BRITISH SIMULIID GROUP BULLETIN

Number 1

May 1992

Contents

EDITORIAL

The Newsletter of the British Simuliid Group appeared from 1979 until its 13th number in 1987. At subsequent Annual Meetings it was suggested that it should be retitled as 'Bulletin' and that its presentation could be improved through the medium of wordprocessing. Unfortunately, achieving the latter aim has considerably delayed the Bulletin's production - for which my apologies, in particular to the contributors to this first number. I am also glad to acknowledge the suggestions and assistance received from colleagues over the choice of hard and software options, and the continued support of my Department in meeting the costs of printing and distributing the Bulletin.

Accounts of the Meetings held from 1988 to 1991 will be given in the next Bulletin. Subsequent issues will continue to report the Annual Meetings, but perhaps I can remind the readership of the original aims of the Newsletter -"to maintain and develop contacts between those interested in simuliids and to provide for the exchange of news, information, requests and ideas concerning all aspects of simuliid biology" (Gavin Gatehouse, Newsletter **1**). It is to be hoped that the Bulletin will serve a similar purpose and to this end articles and news items will always be welcome.

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10th ANNUAL MEETING OF THE BRITISH SIMULIID GROUP

J.A. Bass : *Eastern Rivers Group, Monkswood Experimental Station, Abbots Ripton, Huntingdon PE17 2LS*

About 20 people attended a very successful 10th Simulium Group Meeting on 29th September, 1987, held at the Freshwater Biological Association's River Laboratory in Dorset. Dr. Mike Ladle (F.B.A.) chaired the meeting. Six talks were given and some poster exhibits displayed. Authors' summaries are given below; in addition, Colin Fairhurst and Margaret Curtis (Salford) reviewed the environmental monitoring of the Onchocerciasis Control Programme.

Bob Cheke (Tropical Development and Research Institute) provided a video on Onchocerciasis in West Africa and this was followed by a general discussion on recent developments in the Control Programme.

Thanks go to Lilian Ladle for the excellent buffet lunch and to John Bass for a taxi service for participants (and the food!).

TALKS GIVEN AT THE 10th ANNUAL MEETING

Addresses are those at the time of the 10th Annual Meeting - Editor

Provisional Study of Simuliids in Speyside, Scotland

James Coupland : *Department of Zoology, University of Aberdeen, Tillydrone Avenue, Aberdeen AB9 2TN*

The Kincraig region of the Spey Valley is subject to serious infestations of 'birchflies' (Simuliidae). While the pest species have been tentatively identified (*S. reptans* and *S. tuberosum*) their ecology is very poorly known. Consequently, since October 1986 research has been conducted into the ecology and biology of the simuliids of this region with the aim of developing safe control measures.

This talk discussed the various methods used to collect larvae and adults and their various shortcomings. One of the major problems faced was the difficulty in obtaining quantitative estimates of simuliid larval density. This is due to the nature of the rivers themselves, which tend to be extremely 'flashy', with very unstable substrate. Adult sampling was done with sticky traps, suction traps and silhouette traps. The silhouette traps were the most effective at catching large numbers of simuliids especially if baited with carbon dioxide. Emergence patterns of the most common species (*S. reptans*, *S. variegatum*, *Prosimulium hirtipes*) were shown along with their larval and adult distributions. While there were occasional reports of biting this year the frequency was quite low compared with previous years. This may have been due to the adverse weather conditions.

Haemolymph Attenuation of Microfilarial Motility (HAMM): An in vitro assay of simuliid immunity to Onchocerca

P.J. Ham : *Department of Medical Entomology, Liverpool School of Tropical Medicine, Pembroke Place, Liverpool L3 5QA*

A marked variation in the susceptibility of simuliids to *Onchocerca* infections has been observed, both for British blackflies and *O. lienalis*, and for West African *Simulium damnosum* cytospecies to *O. volvulus* of differing strains. As well as innate variation in susceptibility, an aquired immunity has been demonstrated in which haemolymph from *Onchocerca*-infected *Simulium* confers resistance to susceptible naive recipient flies, following passive transfer. This study describes methods used to look at the in vitro haemolymph properties, in particular by looking at the microfilaricidal properties of haemolymph (a) from different uninfected species of British and West African simuliids (innate immunity), (b) from infected simuliids (acquired immunity). The method used was to bleed simuliids of their haemolymph using fine glass needles, and to deposit the fluid from each fly (1µl approx) in a single well of mini microtitre trays (Terasaki plates). To this haemolymph was added a suspension of fresh living microfilariae. Between 20_30 flies were used for each group. The plates were kept at 21°C in a humid chamber and the motility of the microfilariae monitored at regular intervals.

Innate immunity

A series of experiments revealed significant attenuation of microfilarial motility in certain British species of *Simulium* haemolymph, when compared to others. *S. equinum* and *S. erythrocephalum* both significantly reduced motility in comparison to *S. ornatum*. This correlates with in vivo susceptibility. More interestingly, *S. yahense* haemolymph, a highly susceptible form of the *S. damnosum* complex was relatively non-attenuating to *Onchocerca volvulus*, whereas *S. soubrense* haemolymph was highly microfilaricidal, again correlating with in vivo studies.

Acquired immunity

O. lienalis infected *S. ornatum* haemolymph was found to attenuate *O. lienalis* microfilariae motility to a much greater degree than uninfected groups. Attenuation was not dependent on age of infection. Furthermore nonspecific trauma did not bring on such a response in the haemolymph. The response was however able to attenuate *Brugia pahangi* microfilariae
in vitro. Both types of immunity can be demonstrated, in vitro, to be haemolymph related, but biochemical and physiological causes are probably different.

Thanks go to the Wellcome Trust for a Tropical Lectureship, and to Dr. R. Garms and the staff of the Liberian Tropical Institute for their valuable assistance.

Attachment and Germination of Trichospores in the Digestive Tracts of Simuliidae Larvae

S.T. Moss : *School of Biological Sciences, Portsmouth Polytechnic, Portsmouth, Hampshire PO1 2DY*

Two aspects of Trichomycetes/Simuliidae relationships were presented:

Germination and attachment of trichospores

The digestive tracts of Simuliidae larvae may be inhabited by up to 14 species of the Harpellales (Trichomycetes). Species of *Harpella* occur attached to the peritrophic membrane lining the midgut whereas species of the Legeriomycetaceae occur attached to the cuticle lining the hindgut. Survival and growth of thalli depend upon the germination and attachment of their trichospores to specific regions of the digestive tract. The mechanisms of trichospore germination and attachment have been studied at the electron microscope level. This has shown the presence of an initial but ephemeral adhesive 'pad' and a subsequently produced persistent holdfast. The initial adhesive 'pad' is produced by secretion of adhesive material through pit fields in the terminal region of the sporangiospore wall. The adhesive accumulates between the sporangio-spore and sporangium walls prior to germination within the gut. The stimulus for germination within a specific region of the host gut has not been determined. However, germinated trichospores adhere immediately to the host cuticle by means of the accumulated adhesive. Basal growth of germinated and attached trichospores produces a basal, persistent holdfast and the initial adhesive 'pad' is lost.

The presence of harpellid-like hyphae in ovary tissue

Transmission electron microscopy of ovary tissue from *Simulium yahense* (collected by R. Garms in Liberia) has indicated the presence of fungal thalli. The septal structure of these hyphae is similar to that characteristic of the Harpellales. If these initial observations are confirmed it will be the first report of a harpellid growing within host tissues.

Predation of larval blackflies by larvae of *Limnophora riparia*

R.S. Wotton and R.W. Merritt : *Department of Biological Sciences, Goldsmiths' College, University of London, London SE14 6NW*

Larvae of *Limnophora riparia* (Diptera: Muscidae) are often found in mosses, especially those which have a thin film of water passing over, or through them. They are thus associated with lake outlets where they can be the commonest predator of oligochaetes, and larval chironomids, simuliids and psychodids. In experiments we have shown that larval midges (chironomids) and blackflies (simuliids) are preferred prey. They are attacked by means of the mouth hooks of the muscid which subsequently invades the prey's body and removed much of the contents. As larval blackflies were the most abundant prey available in the lake outlets which we studied, we tested the relationship of predator and prey numbers and showed that survivorship of blackfly larvae was always reduced when the ratio of predator to prey was increased. *L. riparia* larvae had a preference for small blackfly larvae when those of a range of sizes were presented, and small prey always sustained higher damage than larger ones.

Oviposition sites of *Simulium posticatum* Meigen

M. Ladle : *Freshwater Biological Association River Laboratory, East Stoke, Wareham, Dorset BH20 6BB*

The eggs of *S. posticatum* have been found in bankside soil above the water surface of the River Stour. The distribution of oviposition sites has been studied in relation to a local medical problem caused by the bites of the female flies. Sites with a vertical bank profile and loamy soil in the shade of trees were favoured for oviposition. The eggs have a diapause which may be broken by four week's exposure to temperatures of less than 5oC. Eggs are not very resistant to desiccation despite the relatively exposed position in which they are deposited.

POSTER PRESENTATIONS AT THE 10th ANNUAL MEETING

Towards a new method for plotting migration routes in *Simulium damnosum* s.l.

R.J. Post and D.P. Surtees : *Department of Medical Entomology, Liverpool School of Tropical Medicine*

Presently available techniques for plotting migration routes in *S. damnosum* all involve making direct observations on the migrant flies themselves. An alternative method is to determine the genetic similarity between populations, thus making use of the fact that genetic similarity is very strongly influenced by migration.

The example of *S. soubrense* in western Guinea was presented, using a minimum spanning tree linking populations plotted on a map.

Onchocerca development in blackflies: Surface changes in lectin binding characteristics.

P.J. Ham and A.J. Smail : *Department of Medical Entomology, Liverpool School of Tropical Medicine and Winches Farm Laboratories, London School of Hygiene and Tropical Medicine*

Among the natural functions that lectins have in insects are those of protecting the organism against non-self invaders. These proteins specifically bind to carbohydrate moieties and can be used as biochemical tools. In this study we used FITC labelled lectins to study the surface of developing *Onchocerca lienalis* larvae recovered from infected blackflies, *Simulium ornatum* sl. Live parasites were incubated with 0.005% solutions of 7 lectins (con A, lentil, peanut, helix, wheat germ agglutinin (WGA), Asparagus pea and kidney bean). These lectins have different sugar binding specificities. By examining the larvae after incubation and washing, it was possible to observe patterns of fluorescence on their surfaces, as they develop within the fly. No lectins bound to living microfilariae, but con A, lentil and WGA increased in binding as the worms developed through to the second stage, and thereafter decreased. A second group, helix and peanut agglutinins, increasingly bound only to the third-stage larvae as they progressed from preinfective thoracic to infective head stages. Asparagus, pea and kidney bean lectins failed to bind to any of the developing stages. It appears, therefore that there is changeover in the carbohydrates presented to the fly on the parasite surface as it develops, particularly as the microfilariae start developing and as the larvae moult from the 2nd to the 3rd stage. This correlates with the presence of mannose and N-acetyl-D-galactosamine specific lectins within the haemolymph of infected flies, whose relative concentrations apparently fluctuate with the presence of such moieties on the parasite surface. Sugar inhibition studies demonstrated that lectin binding in this study was indeed specific. This turnover may be an evasion mechanism by the parasite, thus contributing to its successful development in the fly, and has clear implications in the transmission of *Onchocerca volvulus* by members of the *S. damnosum* complex. (We are grateful to the Wellcome Trust for financial support).

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THE NEWSLETTER AND THE ZOOLOGICAL RECORD

R.W. Crosskey : *Department of Entomology, The Natural History Museum, Cromwell Road, London SW7 5BD*

At the 10th Annual Simuliid Group meeting (September 1987) it emerged that group members were unaware that the Newsletter of the British Simuliid Group is routinely scanned for its scientific content by the indexing staff of Biosis U.K. so that anything of material interest can appear in the Zoological Record. Papers are included in the ZR 'Author Index' (i.e. bibliography) and their content recorded in the appropriate technical index(es), usually the 'Subject Index' or the 'Systematic Index'. The same computerized data base is used to produce the printed version of Zoological Record as to provide ZR on-line, and there is therefore ready public access to Newsletter data both in electronic and hard copy form; the data base is updated bimonthly, and on-line searches provide more up to date information than that obtainable by awaiting the printed record - though ZR has achieved its currency and the printed record is now distributed within four months of closure of annual indexing. The Newsletter started about the time when ZR first became available on-line, and recorded items from all the issues have been loaded; this will continue, except in the event that ZR has to abandon its present policy of covering all forms of biological newsletter as too costly an undertaking. No ZR-recordable material was included in the first issue of the Newsletter, nor has there been since issue 11 (1985).

Matter entered by the indexers into the data base consists of all authored items in each Newsletter issue that have a zoological content and therefore fall within the very wide indexing scope of ZR. The attached list shows the items so far indexed, printed and published in the Record. The Newsletter items are READ by the indexers so that they can reliably pigeonhole the scientific data into the topic classification of the Subject Index - i.e. they do not rely solely on heading titles to gauge content; for instance, Roger Wotton's passing mention of a blackbird feeding on *S. noelleri* larvae was picked up and indexed in Aves (ZR Section 18) under *Turdus merula* - even though Roger's note was very informal and did not give the bird's Latin name. When appropriate, a contribution is recorded in several places in the Diptera Subject Index, for example Rory Post's note on sexing blackfly larvae (Newsletter No. 8) is entered three times in the Subject Index, viz. under 'Sexual dimorphism', 'Sexing techniques' and 'Histological techniques: Staining'. Minor items such as the transfer of the Lewis Davies collection to the BMNH and a short obituary of Baranov have been indexed - because such information is virtually impossible to find unless 'gathered' by Zoological Record.

The ZR is not, of course, an abstracting journal, but even so the fact that contributions with any scientific content will be picked up and included in the data base - and become available in bibliographic title and synoptic records - might hopefully induce more group members to provide the Editor with copy!

The Diptera are an independent part of each volume of ZR, viz. Section 13 (Insecta), Part C (Diptera).

A general intoduction to electronic databases in entomology can be found in Gilbert, P. and Hamilton, C. J. (1990) 'Entomology: a Guide to Information Sources', 2nd edition, Mansell Publishing Limited (Chapter 5). The Zoological Record database is stored on the Lockheed DIALOG system at Palo Alto, and information on access procedure can be found on pp. 188_189 of Gilbert & Hamilton, or obtained from the General Manager, BIOSIS U.K., Garforth House, 54 Micklegate, York YO1 lLF.

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ZOOLOGICAL RECORD COVERAGE OF NEWSLETTER ITEMS

Coverage extends up to issue 11 (1985). Later issues included no ZR recordable material.

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Newsletter Number	Author	Topic	ZR Reference
2 (1979)	Crosskey	Larval identification	Vol.117, p.22 (biblio.), p.353 (syst. index)
3 (1980)	Crosskey	Ardnamurchan records	Vol.117, p.22 (biblio.), p.233 (geog. index)
3 (1980)	Curran	Nematode / Protozoan parasites	Vol.117, p.22 (biblio.), pp.204, 206 (subject index: parasites)

3 (1980)	Post	*S.ornatum* s.l. chromosomes	Vol.117, p.85 (biblio.), p.182 (subject index: cytogenetics), p.355 (syst. index)
4 (1980)	Moss	Trichomycetes in *Simulium*	Vol.117, p.74 (biblio.), p.204 (subject index: commensalism)
4 (1980)	Williams	Larval microsculpture	Vol.117, p.119 (biblio.), p.138 (subject index: integument), p.174 (subject index: larva)
5 (1981)	Crosskey	Nomenclature of British simuliids	Vol.118, p.24 (biblio.), p.321 (syst. index)
6 (1981)	Biggs	Larval feeding behaviour	Vol.118, p.12 (biblio.), p.159 (subject index: filter feeding)
6 (1981)	Crosskey	Death of Baranov	Vol.118, p.24 (biblio.), p.145 (subject index: obituaries)
6 (1981)	Descals	Simuliid fungal parasite	Vol.118, p.30 (biblio.), p.232 (subject index: fungal diseases)
6 (1981)	Raastad	Norwegian weir project	Vol.118, p.99 (biblio.), p.210 (subject index: freshwater habitat rivers)
8 (1982)	Golini	Collecting method for chromosome study	Vol.120, p.45 (biblio.), p.152 (subject index: histol. techniques fixation)

continued

8 (l982)	Post	Sex of blackfly larvae	Vol.120, p.100 (biblio.), p.152 (subject index: histol. techniques staining), p.154 (subject index: sexing techniques), p.198 (subject index: sexual dimorphism)
8 (l982)	Wotton	Predation of *S.noelleri*	Vol.120, p.141 (biblio.), p.168 (subject index: predators)
10 (l984)	Crosskey	Lewis Davies collection	Vol.121, p.27 (biblio.), p.158 (subject index: museums, collections)
10 (l984)	M.White	Onchocerciasis/ *S.damnosum*, Sierra Leone	Vol.121, p.149 (biblio.), p.216 (subject index: breeding places), p.287 (subject index: transmission of parasites), p. 312 (geog. index)
11 (l985)	Bass	'Eusimuliums', keys and pH relationships	Vol.122, p.9 (biblio.), p.186 (subject index: Chemical environment - hydrogen ion conc.), p.387 (syst. index).

[The above graphics duplicated as text below]

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10 (1984)	Crosskey	Lewls Davies collection	Vol.121, p.27 (biblio.), p.158 (subject index: museums, collections)
10 (1984)	M.White	Onchocerclasis/ *S. damnosum,* Sierra Leone	Vol.121, p.149 (biblio.), p.216 (subject index: breeding places), p.287 (subject index: transmission of parasites), p. 312 (geog. Index)
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RIVER REGULATION AND *SIMULIUM CHUTTERI*, LEWIS 1965

R.W. Palmer and J.H. O'Keeffe : *Institute for Freshwater Studies, Rhodes University, Grahamstown 6140, South Africa*

Since the completion of the Orange/Fish water transfer tunnel in 1975, the pest species *Simulium chutteri* has become the dominant simuliid in the Great Fish River, South Africa. It has largely displaced non-pest species such as *S. adersi* and *S. nigritarse*, except below one of the dams, where *S. chutteri* is scarce, and the simuliid community composition is similar to the pre-transfer community. This condition persists for 36km below the dam, after which *S. chutteri* becomes the most numerous again.

We suspect that the change from a seasonal to a permanent flow caused by the water transfer tunnel has favoured *S. chutteri*. The intermittent flow below the dam, and the fact that adult *S. chutteri* (unlike the other simuliid species present) disperse their eggs into the drift, could mean that the dam is acting as a barrier to downstream distribution of *S. chutteri* eggs. A considerable ammount of work remains to be done, but this could explain why the river immediately below the dam favours pre-transfer simuliid species rather than *S. chutteri*.

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'MOSQUITO ECOLOGY: FIELD SAMPLING METHODS'

M.W. Service : *Vector Biology and Control Group, Liverpool School of Tropical*

Medicine, Pembroke Place, Liverpool L3 5QA

Mike Service writes that he has recently completed writing a revised and updated second edition of the book *Mosquito Ecology: Field Sampling Methods* which first appeared in 1976. The new edition, which contains some 1800 new references, is to be published in January 1993 by Elsevier, London.

As in the first edition, the book contains descriptions of traps and sampling methods for all stages of the life-history of mosquitoes, as well as techniques and procedures for studying the population dynamics of vectors,including survival rates of adults and immature stages, population estimates, dispersal and identification of predators. In addition there are accounts of vectorial capacity, parasite inoculation rates, remote sensing techniques, and methods for identifying blood-meals from engorged mosquitoes. There are also a number of black and white photographs in the new edition.

Every attempt has been made to give worldwide coverage and not to have missed interesting papers in the lesser known journals. Although aimed at mosquito workers, some of the sampling methods, such as for adults, are applicable to other blood-sucking insects including blackflies.

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Preliminary Notice of the 15th Annual Meeting, 1992

The 15th Annual Meeting of the British Simuliid Group will be held at the University of Keele on Wednesday, September 23rd, 1992. Further details will be circulated in due course, but Peter Ham, who is organising the meeeting, would appreciate hearing from anyone wishing to volunteer a talk or poster presentation as soon as may be convenient.

Peter's address is *Professor P.J. Ham, Department of Biological Sciences, University of Keele, Keele, Staffordshire ST5 5BG* and the University's phone number (0782) 621111.

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BRITISH SIMULIID GROUP BULLETIN

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EDITOR'S NOTE

This second number of the Bulletin brings up to date accounts of the British Simuliid Group's annual meetings held between the demise of the Newsletter and the birth of the Bulletin. Participants' addresses are given as they were at the date of each meeting.

Accounts of the 1992 and 1993 meetings will be included in issue 3. The editor would, as ever, welcome additional copy for the Bulletin!

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THE 11TH ANNUAL MEETING (1988) OF THE BRITISH SIMULIID GROUP

Margaret Curtis : *Department of Biological Sciences, University of Salford, Salford M5 4WT*

The 11th meeting of the British Simuliid Group was held in the Department of Biological Sciences at the University of Salford on September 29th, 1988. It was chaired by Professor D.H. Molyneux and attended by some 30 BSG members, staff and students. The meeting was preceded by a festive dinner on the previous evening, which was also well attended.

Six talks were given at the meeting. In addition Professor Molyneux's group demonstrated cuticular hydrocarbon analysis in gas-liquid chromatography and Alice Millest presented a poster on larval morphology in the *S.metallicum* complex.

TALKS GIVEN AT THE 11TH ANNUAL MEETING

The Onchocerciasis Control Programme

Colin Fairhurst : *Department of Biological Sciences, University of Salford, Salford M5 4WT*

The Onchocerciasis Control Programme, organised by the World Health Organisation in West Africa, has been running for some fifteen years. The use of larvicides to control *Simulium damnosum* has required extensive environmental monitoring to ensure that non-target taxa, both invertebrates and fish, are not affected by the treatment. Data on invertebrate and fish monitoring at selected sites in the treatment zone have been analysed at Salford since the start of the Programme.

Some insect groups besides Simuliidae have been reduced, but it has been shown that other taxa have increased to fill the available niches. As a result, insectivorous fish have not suffered from a lack of food. Other studies have shown little effect of larvicides on fish populations.

There have been great variations in fish numbers and occurrences, which were initially feared to be due to treatment. However, over the lengthy monitoring period these effects, which have also been found in untreated rivers, have been linked to hydrological changes. The prolonged drought in the mid-1980's caused the disappearance of many species, through poor recruitment or migration, and numbers are now recovering, if not yet to the original abundance.

Ageing Populations of Different Members of the *Simulium damnosum*

Complex by Pteridine Concentrations

R.A. Cheke : *Overseas Development National Resources Institute, College House, Wrights Lane, London W8 5SJ*

The results of using fluorescence spectrometry to measure the pteridine concentrations in adult flies (the head and thorax only, the wings and abdomen having been removed) of different members of the *Simulium damnosum* complex were described. Pteridines were detected in all cytotypes examined (*S.damnosum* s.str., *S.sirbanum*, *S.squamosum*, the Djodji form of *S.sanctipauli* and the Beffa form of *S.soubrense*).

The samples included flies of both sexes of known age reared from pupae and femal flies of unknown age separated into nulliparous and parous classes. Male flies had significantly higher pteridine concentrations than females of the same age and species. Samples of nulliparous flies had significantly smaller amounts of pteridines than parous samples for each species except *S.soubrense*. For female flies of known age the pteridine concentrations were size dependent.

Significant multiple linear regressions between fluorescence, age and size were found for female *S.damnosum* s.str., *S.sirbanum* and *S.squamosum*. The ages of samples of unknown age were estimated from the regressions. The maximum estimate, 27 days, was for a female *S.damnosum* s.str.

Onchocerca ochengi in Cattle

P.J. McCall and A.J. Trees : *Department of Veterinary Parasitology, Liverpool School of Tropical Medicine, Pembroke Place, Liverpool L3 5QA*

Laboratory reared nulliparous female flies of six temperate species of Simuliidae were examined for their susceptibility to infection with *Onchocerca ochengi* by intrathoracic injection of cryopreserved skin microfilariae obtained from cattle in Mali. Three species (*S.equinum*, *S.ornatum* and *S.erythrocephalum*) supported development to the infective stage, one species (*S.variegatum*) allowed partial development and the two remaining species (*S.reptans* and *S.aureum*) were insusceptible to infection. The most suitable surrogate vectors were *S.equinum* and *S.ornatum,* which had survival rates of 44% and 49%, proportions of microfilariae developing to third stage larvae of 6.4% and 3%, and infection rates with infective larvae of 13.5% and 14% respectively. *O.volvulus* infective larvae, produced by intrathoracic microfilarial injection in *S.ornatum*, were 586-760μm (mean 687μm) long and were significantly shorter ($p < 0.02$) than *O.ochengi* infective larvae (645-880μm, mean 756μm). No constant differences in the posterior or anterior morphology, or in the acid phosphatase staining patterns between *O.ochengi* and *O.volvulus*, were seen. These results raise the possibility that the presence of *O.ochengi* in a population of infective larvae from vector flies in endemic onchocerciasis zones might be identified on the basis of their length alone.

Reference: P.J. McCall and A.J. Trees (1989). The development of *Onchocerca ochengi* in surrogate temperate Simuliidae, with a note on the infective larva. *Trop.Med.Parasit.* 40: 295-298.

The Cytotaxonomy of *Onchocerca*

R.J. Post, P.J. McCall, A.J. Trees, C.J. Delves and B. Kouyate
Departments of Medical Entomology and Veterinary Parasitology, Liverpool School of Tropical Medicine, Pembroke Place, Liverpool L3 5QA

Examination of ovaries and testes from adult *Onchocerca ochengi*, *O.gutturosa*, *O.armillata* and *O.lienalis* revealed five pairs of chromosomes, but in contrast *O.volvulus* and *O.gibsoni* had only four pairs. The number of nuclei increases from approximately 280 in intra-uterine microfilariae to approximately 900 in infective L3 larvae of *O.volvulus*, which suggests that it should be possible to observe mitosis and count the number of chromosomes in the developing stages of the parasite in the vector.

Recent Developments in the Use of Isoenzyme Electrophoresis

J.B. Davies : *Department of Medical Entomology, Liverpool School of Tropical Medicine, Pembroke Place, Liverpool L3 5QA*

The talk described some recent developments in the techniques of isoenzyme electrophoresis in the separation of the sibling species of *Simulium* complexes, and is the result of collaboration with M.C. Thomson and M._G. Basanez.

The classical method used by Meredith and Townson (1981) using the enzymes trehalase and phosophoglucomutase in starch gels although excellent, had serious practical limitations under tropical field conditions. The gels had to be made up a few days before use, and required up to two hours to run, hence refrigeration equipment was required to keep the gels cool to prevent degradation of the enzymes. The system was thus laboratory based, and the flies had to be brought to the laboratory and stored in liquid nitrogen if they could not be processed immediately.
The recent use of cellulose acetate as a substrate by Fryauff and Trpis (1986) prompted us to try using it in Sierra Leone. This substrate reduced the run time to 10 or 20 minutes only, and as a result it was found that cooling was not necessary. This immediately opened up the possibility of assembling a field kit which might be independent of an advanced laboratory and mains electricity.

In Liverpool, Madelaine Thomson experimented with different membranes and buffer systems and at the same time we were most fortunate to find a microchip integrated circuit which would convert 12 VDC to 250 VDC. This enabled us to build a small power pack that would work off a car battery and thus made the system truly portable.

Since then, Madelaine has spent four months in Sierra Leone testing the system with OCP teams trying to identify *S.squamosum* amongst the flies originating from the supposed invasion source area. I have visited Puerto Ayacucho in Venezuela where with Maria-Gloria Basanez we have looked at the enzymes of the suspected vectors of onchocerciasis in the Amazonas Region.

In Venezuela it was immediately obvious that there was a great deal of variation in PGM and TRE within most of the species complexes that we looked at, and this supports the evidence from behaviour and cytotaxonomy that these are species complexes. Unfortunately there was not time to process enough flies to begin to resolve the situation. It is quite clear that what is now required is a larger scale study combining the techniques of morphology, cytotaxonomy and electrophoresis.

The new portable kits performed well in both field situations, and we are confident that they are now operational, and will be useful to a much wider range of disciplines that of Medical Entomology alone.

References:

Fryauff D.J. and Trpis M. (1986). *Am.J.Trop.Med.Hyg.* 35: 1218-1230.
Meredith S.E.O. and Townson H. (1981). *Tropenmed.Parasit.* 32: 123-129.

The Present Status of the *Simulium neavei* Group in Kenya -Some Preliminary Notes

J.N. Raybould : *13 Rownham Mead, Hotwells, Bristol, Avon BS8 4YA*

The *Simulium neavei* group was introduced with slides showing a range of habitats and larvae and pupae attached to various riverine crabs.

A recent collecting trip to western Kenya was described. Three *S.neavei* group species are known from the area: *S.neavei* s.s., *S.goinyi* and *S.hightoni*. *S.neavei* s.s., the sole onchocerciasis vector, was virtually eradicated by 1956 except in a very small area on Mount Elgon (McMahon et al, 1958). The other two species returned to their former habitats after control operations ceased. In view of this unique historical background, the area was visited in August-September 1988 to obtain up-to-date distribution data and material for morphological and cytotaxonomic study. Some observations were made on the immature stages and their associated crabs and specimens from different parts of the crab (including the exhalent branchial chambers in which *S.goinyi* occurs) were tubed separately.

The *S.neavei* group has been little studied recently and methods of catching crabs are not widely known. An illustrated account was therefore given of crab trapping techniques.

The collections will be investigated by Mrs Phoebe A.O. Josiah, a Kenyan Ph.D. student working under the supervision of Dr. R.P. Lane at the London School of Hygiene and Tropical Medicine. They will also provide reference material for Drs. A.J. Shelley and W. Procunier at the Natural History Museum in their proposed reclassifiation of the *S.neavei* group as a whole. Mr. T.R. Williams, Liverpool University, will identify the crabs.

Reference:

McMahon J.P., Highton R.B. and Goiny H. (1958). The eradication of *Simulium neavei* from Kenya. *Bull.Wld.Hlth.Org.* 19: 75-107.

[Dr. Josiah was awarded her Ph.D. by the University of London in 1991 for her thesis titled 'Biological and taxonomic studies of Simuliidae from Kenya, with emphasis on the *Simulium neavei* complex'. Ed.]

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THE 12TH ANNUAL MEETING (1989) OF THE BRITISH SIMULIID GROUP

The meeting was held at the Liverpool School of Tropical Medicine on November 7th, 1989, and organised by staff from the School's Department of Medical Entomology. Participants were welcomed by R.J. Post before J.B. Davies gave an introductory talk to present the extent of the School's involvement in *Simulium* research.

John Davies has provided the following account of his introduction:

At the present time the School is probably more heavily involved in *Simulium* related research than at any other time.

There are five groups working full time comprising six members of staff and eight PhD students. Two other staff members pursue an active interest. Thus we have here sixteen Simulidologists. The members were introduced in turn by John Davies who said a few words about each project.

The interests of the groups and individual members are summarised as follows:-

R.J. Post - Cytotaxonomy and DNA taxonomy of *S.damnosum*

P. Flook	DNA variation and migration in W. African *S. damnosum*
L. Gomulski	Development and testing morphometric identification techniques
M. Wilson	Identification of *S. damnosum* in the OCP area

P.J. Ham - Vector Immunity to Parasite Infections

A. Baxter	Molecular, biological & biochemical aspects of immune proteins
E. Winbolt	Production of monoclonal antibodies to *Simulium* immune proteins

M.J. Roberts - Identity and Biology of Onchocerciasis vectors in Malawi

J.B. Davies - Dynamics of Onchocerciasis transmission in areas of low endemicity

M.C. Thomson	Use of Isoenzyme Electrophoresis for identifying cytospecies of *S. damnosum* s.l.
M.J. Bockarie	Vectors and transmission levels around a forest village in Sierra Leone
D.C. Chavasse	Effect of ivermectin on the uptake and development of microfilariae in *S.damnosum*

A.J.Trees and P. McCall - *Simulium* oviposition pheromones

Other interested workers are M. Service (trapping methods for *Simulium*) and H. Townson who keeps an active interest in all aspects of *Simulium* and onchocerciasis.

TALKS GIVEN AT THE 12TH ANNUAL MEETING

A Fossil Simuliid from the Middle Jurassic Period

R.W. Crosskey : *Department of Entomology, The Natural History Museum, Cromwell Road, London SW7 5BD*

I was recently able to borrow from the Palaeontological Institute in Moscow the dipteran fossil pupa described by Kaligina under the name *Simulimima grandis* and assigned tentatively to the extinct family Eoptychopteridae. The fossil comes from the Mongolian border area of the Soviet Union and is of Middle Jurassic age (i.e. about 165-170 million years ago). Close examination and photography of the fossil while under alcohol clearly shows that it possesses the basic diagnostic features of simuliid pupae, i.e. presence of a unique groundplan of pupal abdominal hooks found in no other family and large prothoracic gills. Furthermore, the abdomen has long sinuous terminal hooks exactly like those of *Prosimulium* pupae. The conclusion is inescapable that *Simulimima* is a true simuliid and that the origin of the family can now be dated back at least as far as the Middle Jurassic period (a time much earlier than any other known simuliid fossils).

[Further information on the fossil can be found in Roger Crosskey's book *The Natural History of Blackflies* (pp. 59-60), and a complete account in his 1991 paper in *Systematic Entomology* 16: 401-406. Ed.]

Gene Expression in Larvae of *Onchocerca* in Blackflies

A.E. Bianco : *Department of Pure and Applied Biology, Imperial College, London*

Onchocerca parasites typically require 12-24 months to complete their life-cycles, yet three out of the four moults that occur during development take place within approximately two weeks. Compressed into this early period of larval differentiation and growth are both crucial points of parasite transmission between the invertebrate and vertebrate hosts. In order to identify molecules with specialized functions permitting larvae to make the major transition between hosts, we set out to identify genes expressed in infective larvae immediately prior to transmission. To do this it was necessary to devise a novel method for labelling proteins synthesised by developing stages within the vectors, involving the micro-injection of [^{35}S] methionine into the thorax of infected blackflies. Pulse labellings of *Onchocerca lienalis* larvae within *Simulium ornatum* s.l. have revealed a major acidic protein of 23kD which is developmentally expressed almost exclusively by infective, third-stage larvae. Homologous proteins occur in *O.lienalis* and *O.volvulus*, but these exhibit size polymorphisms both among species and individual organisms. The 23kD molecule continues to be elaborated after terminal differentiation of the parasite in flies, but not by post-infective larvae entering the phase of development in the vertebrate host. A shift in temperature from 26$_o$C to 37$_o$C triggers secretion of the 23kD molecule as a discrete event 24-72 hours after transmission. The labelling technique has been successfully employed with filarial species that develop in mosquitoes, and in principle should be widely applicable to the study of endoparasite gene expression within arthropods.

Invasions by Savanna *Simulium damnosum* s.l. into Forest Habitats and by Forest Forms into Savannas in West Africa

R.A. Cheke : *Overseas Development Natural Resources Institute, Central Avenue, Chatham Maritime, Kent ME4 4TB*

The occurrence and possible epidemiological significance of movements of savanna forms of *Simulium damnosum* s.l. (*S.sirbanum* and *S.damnosum* s.str.) into forest zones were described and discussed. Examples include:

(a) populations of savanna forms breeding and biting man at Bong Mine, Liberia, where mining activities have created artificial conditions that have been exploited by the invading flies. The phenomenon is apparently seasonal and it it thought the invaders arrived with the harmattan winds during the dry season. Until recently only *S.yahense* and *S.sanctipauli* were known from the area.

and (b) *S.damnosum* s.str. breeding in forested stretches of rivers in Togo and Ghana, such as the Asuakawkaw, Amou and Dayi, where only forest forms used to occur. This was attributed to habitat changes, mainly de-forestation.

Examples of forest forms moving into the savanna were also discussed. The Djodi form of *S.sanctipauli* and, to a lesser extent *S.yahense*, have been found to migrate out of their forest strongholds, in southwest Togo and southeast Ghana, into savannas during wet seasons. This phenomemon was attributed, partly, to reduced competition from other cytospecies consequent upon the latter's being controlled with insecticides.

Talks were also given at the 12th annual meeting by:

I. Cameron Development of iridescent virus' as potential control agents for *Simulium*

M. Ladle Trials of Bt.I. for blackfly control in the south of England

M. Wood Homologies of labral fans and other structures between simuliids and other Nematocera

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THE 13TH ANNUAL MEETING (1990) OF THE BRITISH SIMULIID GROUP

C.A. Lowry : *Medical and Veterinary Division, Entomology Department, The Natural History Museum, Cromwell Road, London SW7 5BD*

Some 30 people attended the 13th Simuliid Group meeting held at the Natural History Museum, South Kensington, on September 25th, 1990.
Many of those present had attended an informal meal on the previous evening.

Dr Tony Shelley introduced the meeting at which five talks were presented. In addition R.A. Cheke showed a video made by Evergreen Helicopters describing their operations for the WHO Onchocerciasis Control Programme in West Africa.

The meeting concluded with a small cheese and wine party to commemorate the retirement of Dr Roger Crosskey from the Natural History Museum earlier in the year.

TALKS GIVEN AT THE 13TH ANNUAL MEETING

Cytology of the *S.exiguum* Complex in Ecuador

M. Charalambous, A.J. Shelley and M. Arzube : *Department of Entomology, The Natural History Museum, Cromwell Road, London SW7 5BD*.

Onchocerciasis was discovered in Ecuador in 1980. An epidemiological survey showed that it was restricted to a number of foci in Esmeraldas Province. A follow up survey in 1986 showed that the average prevelance of onchocerciasis had risen from 28 to 47.3% in the population, representing an increase of 74% since 1980 and blatently indicating the enormity of the public health problem.

The main vector of onchocerciasis in the foci is *Simulium exiguum* which is in fact a species complex. In Ecuador there are four members of the *Simulium exiguum* species complex. The method by which they were identified, polytene chromosome analysis, and their cytotaxonomy were described.

Only two of the four members of the complex occur in Esmeraldas Province and so are likely vectors. However, a worry of the epidemiology is the fact that widespread migration of people is occuring. If infected migrants settle in areas where there are high biting densities of *S.exiguum*, new foci of infection may be set up if the cytospecies present in these areas can act as efficient hosts. The results of experimental infection of adults of all four members of the complex with *Onchocerca volvulus* suggest that all of them can host the parasite efficiently.

Is the Simuliid Pupal Gill a Plastron?

T.R. Williams, C.E. Denley and H.M. Wain : *Department of Environmental and Evolutionary Biology, Liverpool University*

A plastron, or permanent physical gill, is a superficial film of 'air' which, when submerged, allows gases to be exchanged across an extensive air_water interface. These air films, which typically have interface spaces of at least 0.5 µm, are held by hydrofuge structures and can be displaced by wetting agents or by increased water pressure without damage to their supports.

Undoubted plastron surfaces occur on the spiracular pupal gills of many insects (Hinton 1968), but the nature of the simuliid gill is more contentious. Originally described as having an unbroken surface (Pulikovsky, 1927) it was considered to be a plastron by Hinton (1964) who showed that it could be wetted by pressure and by an alcohol of low surface tension, and by Messner and Grafner (1983) from its appearance in the scanning EM. Our work at Liverpool leads us to disagree with these later conclusions.

We have used scanning and transmission electron microscopy to examine the gills of a number of British and African simuliids. In no case has it been possible to resolve a typical plastron surface with the

SEM, although some perforations are almost always to be found. However, the irregular nature of these pores, and their being especially common on the gills of pupae from the field, suggests that they are the result of mechanical damage. Examination of pupae reared and carefully prepared in the laboratory shows the gill surface to be essentially unbroken, at least within the SEM's limit of resolution.

The transmission EM, used with magnifications of up to 150K, provides even stronger evidence of the absence of plastron pores on the simuliid gill. Our results (mainly from *Simulium ornatum* and *S.spinosum*) are similar to those of Hinton (1976) and show that between its supporting filaments the gill surface is a continuous three-layered (at least) membrane, some 70-100 nm in thickness and with its outer margin produced into minute papillae. Hinton (1976) conjectured that this membrane is perforated by small (2_5nm) air-filled pores, though these were not visible in his TEM micrographs. We have found that slightly larger (7nm) channels, similar in size and staining properties to structures in insect cuticle, do occur in the membrane, but have no evidence (and do not think it necessary to suggest) that they open to the surface or are air-filled.

The experimental evidence for the simuliid gill's being a plastron also appears to be inconclusive. Wetting agents, for example, might penetrate through tears in the surface rather than through plastron pores. By repeating Hinton's (1964) experiments on the effects of pressure, but with laboratory reared pupae, we have found that pressures sufficient to wet the base of the gill, its weakest point, also disrupt the surface and its supporting filaments in the area where water penetrates.

References:

Hinton H.E. (1964). *J.Ins.Physiol.* 10: 73-80.
Hinton H.E. (1968). *Adv. Insect Physiol.* 15: 65-162.
Hinton H.E. (1976). *J.Ins.Physiol.* 22: 1061-1070.
Messner B. & Grafner G. (1983). *Zool.Jb.Anat.* 110: 373-380.
Pulikovsky N. (1927). *Z.Morph.Okol. Tiere* 7: 384-433.

Talks were also given at the 13th annual meeting by:

Richard Baker	Onchocerciasis vectors in Sierra Leone
Desmond Chavasse	Effect of ivermectin treatments on the uptake and development of microfilariae by *Simulium*

damnosum s.l.

Angus McCrae — Host selection by *Simulium posticatum* at Blandford, Dorset

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THE 14TH ANNUAL MEETING (1991) OF THE BRITISH SIMULIID GROUP

The Simuliid Group met for the 14th time at Portsmouth Polytechnic on September 25th, 1991. Steve Moss organised and hosted the meeting which started with an informal dinner on the previous evening.

The 25 members who attended were joined by 5 local entomologists. Six papers were presented in addition to an entertaining talk entitled 'Onchomania' given by John Davies from the Liverpool School of Tropical Medicine.

The meeting was drawn to a close by Roger Crosskey. Informal discussions then continued in the Yorkshire Grey .....

TALKS GIVEN AT THE 14TH ANNUAL MEETING

Humoral Immunity to *Onchocerca* in British *Simulium* Species

A.J. Baxter and P.J. Ham : *Department of Medical Entomology, Liverpool School of Tropical Medicine, Pembroke Place, L3 5QA*

Parasites and other pathogens transmitted by insects are subject to the vector's own defence mechanisms. We are looking at different levels of the response of British *Simulium* species to *Onchocerca lienalis* infection, including effects on biological function, e.g. pupal emergence and haemolymph protein production.

Haemolymph proteins present in *O.lienalis* infected, but not in untreated *Simulium*, have been demonstrated by SDS-PAGE and further characterised by proteinase gels, Western blots and 2D-NEPHGE (non-equilibrium pH gel electrophoresis) analysis. Radioactive pulse experiments have indicated the time scale of their production.

At the genomic level, DNA sequences homologous to a *Drosophila* cDNA probe coding for the immune protein cecropin, have been detected in *Simulium* species by Southern hybridisation. Three candidate cecropin clones have been isolated from the genomic library of *S.ornatum* using this heterologous probe and their sequences partially determined.

Using British *Simulium* species and *O.lienalis* as a model system it is hoped to gain information of the mechanisms controlling susceptability to infection in *Simulium*.

Humoral Immunity in African Blackflies

Hans-E. Hagen : *Department of Medical Entomology, School of Tropical Medicine, Pembroke Place, Liverpool L3 5QA*

Acquired and innate immunity in temperate blackflies is now a well documented fact. In order to carry out comparative trials with African blackflies various cytospecies of the *Simulium damnosum* complex in the rain forest and savanna of Cameroon were intrathoracically injected with microfilariae of *Onchocerca ochengi*, *O.dukei* and *O.volvulus*. Moreover wild-caught flies were collected after taking a bloodmeal on infected cattle. So far the results reveal that:

1. The haemolymph of blackflies in Cameroon reacted in a similar way to infection as European species by showing a distinct band at about 66kD after 24 hours, however without featuring a trauma protein due to the injection itself.

2. This 66kD band is stronger in those flies that were injected with microfilariae of *O.ochengi* than in those that received *O.dukei*. This compares favourably with the different susceptibility of these blackflies towards the two *Onchocerca* species: microfilariae of *O.dukei* do not develop well in *S.damnosum* s.l. even following injection (Wahl *et al*, 1991).

3. Only wild caught, blood fed flies that harboured microfilariae showed this 66kD band.

All trials indicated that this change in the protein pattern of the haemolymph is caused by the infection as such. This reponse might be due to an increase of the phenoloxidase-activity in the haemolymph following the infection with pathogens.

Differentiation of *Simulium damnosum* s.l. Larvae and Pupae from Nigeria by Cuticular Hydrocarbon Analysis

H.B. Mafuyai : *Department of Biological Sciences, University of Salford, Salford M5 4WT*

Larvae and pupae of three blackfly species in the *S.damnosum* complex from Nigeria were analysed, using a Gas Chromatograph, for their differences in cuticular hydrocarbons and with a view to their classification. Up to 75% correct classification was achieved for larvae, and 73.3% of the pupae of the same species (*S.damnosum* s.s., *S.squamosum* and *S.yahense*) were correctly classified into their three groups. The cuticular hydrocarbon profiles of larvae and pupae showed remarkable similarities in the occurence of common peaks. Evidence for within group cohesion and for differences between the groups showed in scattergrams derived from discriminant function statistics. The possibilities for further exploratory studies into the nature of cuticular hydrocarbons in sibling species complexes of *S.damnosum* s.l. and their value for identification, are highlighted.

Some Thoughts on Larval Feeding

R.S. Wotton : *Department of Biology, University College London, Gower Street, London WC1E 6BT*

Most blackfly larvae feed by holding their cephalic fans into the current of water which passes over their bodies. Materials trapped by the fans by sieving, impaction and adsorption are then removed by the mouthparts and the food passed into the gut.

When viewed under a microscope the gut contents are seen to consist of particles of easily-identified structure (e.g. diatoms and bacteria) and apparently amorphous material. What is this amorphous material, and what is the basis of larval nutrition?

A Phase in the Life-Cycle of the Harpellales (Trichomycetes) Pathogenic to Simuliidae

M. Taylor and S.T. Moss : *School of Biological Sciences, Portsmouth Polytechnic, Portsmouth, Hampshire PO1 2DY*

The Harpellales is an order of fungi obligately associated with the digestive tracts of aquatic insect larvae and nymphs, including Simuliidae. Horizontal transmission of infection is achieved by the production of asexual trichospores. However, few spores are produced by each fungal thallus and spores are released into a lotic environment.

Ingestion of a released trichospore must occur prior to infestation, each spore giving rise to a single determinate thallus. Evidence is presented to support the occurrence of a stage in the life-cycle of the Harpellales that infects and is pathogenic to adult Simuliidae. This stage also enables upstream transport of the fungus, colonisation of ephemeral habitats and an increase in fungal inoculum.

The Rise and Fall of the Blandford Fly

M. Ladle : *Institute of Freshwater Ecology, The River Laboratory, East Stoke, Wareham, Dorset BH20 6BB*

In the late 1960's a problem arose of people being bitten by insects in the valley of the Dorset River Stour. Extensive biological investigations identified the cause of the biting as *Simulium austeni* (now *Simulium posticatum*) and established most of the basic ecological parameters of the species. Efforts to find a satisfactory method of control for the species were rendered ineffective by environmental, economic and political considerations. Hope of a new avenue, with control potential, arose when the peculiar oviposition behaviour of the species was described, but it was only with the availability of *Bacillus thuringiensis israelensis* that control of *S.posticatum* became a real possibility. Following a small scale trial in 1989 the North Dorset District Council was given permission to treat four main river sites on an experimental basis in 1991. It seems probable that the end is in sight for the notorious 'Blandford Fly'.

Blackflies and Iridescent Viruses

Trevor Williams, Cathy Doyle and Jenny Cory : *NERC Institute of Virology and Environmental Microbiology, Oxford OX1 3SR*

Viral pathogens of Diptera have been much neglected, and host virus interactions in aquatic systems remain almost completely unstudied. Blackflies make good candidates for viral ecology studies in riverine systems for a number of reasons:

- i) geographical ubiquity and abundance
- ii) they harbour known viral pathogens, with the potential for intriguing transmission routes involving aerial and aquatic phases
- iii) their vector status makes them a target for biocontrol measures.

Iridescent viruses (IV's) are icosahedral particles, some 120nm in diameter, containing double stranded DNA, and unlike the better known baculovirus pathogens, are not occluded in a protective protein matrix. The particles form crystalline arrays in host tissues producing a distinct opalescent blue, green or lilac hue, which makes diagnosis of patent infections simple. IV's are typically isolated from the larval stages of invertebrate hosts inhabiting moist or aquatic environments (Kelly 1985, *Current Topics in Microbiology and Immunology* 116: 23-35).

These viruses have been recorded as simuliid pathogens on seven occasions world-wide, but only two isolates have been kept for study. One, named IV22, was found in extremely low abundance (1 in 10^5-10^6 larvae) in mid-Wales (Bateson *et al*. 1976, *J. Invertebrate Pathology* 27: 133-135). Cameron (*Virology* 178: 35-42, 1990) characterised the gene of IV22 coding for the major structural protein (MSP) which itself accounts for some 40% of the protein of a virion. This gene, some 1400 base pairs in length, was used to detect the presence of IV22 DNA in field samples from the rivers Cherwell, Evenlode and Windrush around Oxford.

In the laboratory, field-collected larvae were individually blotted onto a nylon membrane which binds any DNA present in the sample. The MSP gene fragment was then radiolabelled using ^{32}P and allowed to hybridise to simuliid and control DNA on the membrane. Unfortunately, no larvae were identified as positive for IV22 DNA despite a sample size approaching 5000. Likewise, no patently infected larvae were observed in the samples. Probably there is no detectable level of IV22 infection in simuliids from these rivers.

Greater success was achieved in assessing the host range of different iridescent viruses. Several distinct IV's (as shown by restriction enzyme analysis of DNA) were grown in a permissive lepidopteran host, *Galleria mellonella*, and frozen until required. Individual field-collected simuliid egg masses were reared in the laboratory. When egg hatching was near completion, first instar larvae were challenged for 72 hours with high titres (c. 10^6 pfu/ml) of different IV's in the form of macerated *G.mellonella* cadavers. No attempt was made to quantify the relative infectivity of each IV to each simuliid species challenged - a simple yes or no answer was sought as to whether the virus would cause patent infections in simuliid larvae. In this manner, overt infections were observed in each and every combination tested:

Heliothis IV (IV21) against *S.erythrocephalum, S.pseudequinum* and *S.equinum*
Simulium IV (IV22) against *S.ornatum*
Tenebrio IV (IV29) against *S.erythrocephalum*
Isopod IV (IV31) against *S.erythrocephalum*

The frequency of patent infection was consistently low, never rising above 8%, but these results clearly indicate the host range of IV's to be broad (IV21 was tested against a greater number of species simply due to availability). In addition, when larvae exposed to IV21 were squash blotted and probed using IV21 DNA, all showed up as positive - indicating symptomless infection had occurred.

These studies have triggered further work looking at the possibilities of wide scale covert infection in populations of blackfly larvae from elsewhere in the UK.

POSTER PRESENTATION AT THE 14TH ANNUAL MEETING

Sample Size in Parasitological and Vector Surveys

R.J. Post and A.L. Millest : *Department of Biological Sciences, Salford University*

The interpretation of geographic survey data inevitably involves a great deal of subjectivity. Post and Millest (*Parasitology Today* 7: 141) show one way of assessing the adequacy of sample size. They ask for any given sample size, what would be the maximum likely frequency of a species that had actually not been found in the sample. This is in fact a simple binomial problem and is equivalent to asking, given a sample size x and an estimated frequency of the species as zero (because it is absent from the sample), what is the upper 95% confidence limit on that estimate. It is interesting that for sample sizes of 20, 100 and 500, the maximum likely frequency of undiscovered species is 13.9%, 3.0% and 0.6% respectively. The weakness of this approach is that it assumes an adequate sampling method, and does not take into accoung prior probabilities. Hence, no matter what our sample size, we have virtually zero expectation of finding *Simulium damnosum* breeding in Surrey!

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BRITISH SIMULIID GROUP BULLETIN

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From the Editor

The Bulletin has finally caught up with the BSG's annual meetings (and the editorial conscience is at last eased). Although it will now appear annually to report the meetings of the Group, it's hoped this is not seen to be its only function. The editor will gladly accept notes, news and articles at any time. Contributions on disk would be particularly welcome!

Trefor Williams : *Department of Environmental and Evolutionary Biology, University of Liverpool, P.O. Box 147, Liverpool L69 3BX*

Phone: 051 794 5021 Fax: 051 794 5094

THE 15TH ANNUAL MEETING (1992) OF THE BRITISH SIMULIID GROUP

The 15th Annual Meeting of the British Simuliid Group was held at Keele University on Wednesday, September 23rd, 1992. The Centre for Applied Entomology and Parasitology was host to the meeting, which was organised and chaired by Professor Peter Ham. The 60 or so participants were warmly appreciative of Peter's arrangements, which included the customary informal meal on the evening before the meeting.

Speakers included Colin Fairhurst (Salford University) whose talk was titled 'Disturbing News For Blackfly Larvae'.

TALKS GIVEN AT THE 15TH ANNUAL MEETING

Analysis of two cytotypes of ***Simulium exiguum*** **in Ecuador**

M. Charalambous, P.D. Ready, A.J. Shelley, M. Arzube and C.A. Lowry : *Department of Entomology, The Natural History Museum, Cromwell Road, London SW7 5BD*

Sex chromosome evolution is thought to be important in the speciation of simuliids. For example, in the *S.exiguum* species complex the Cayapa cytospecies does not have differentiated sex chromosomes, whereas the Aguarico cytospecies possesses two types of Y-chromosomes which are differentiated by the linkage of inversions.

The Bucay and Quevedo cytotypes of the *S.exiguum* species complex are closely related as they share the same fixed paracentric inversions. However, Quevedo differs from Bucay in having differentiated X_chromosomes. The question this raises is: what degree of reproductive isolation is the X-linked inversion associated with?

A number of populations were sampled in southern and central Ecuador. Larval polytene chromosome analysis confirmed the existence of two chromosomal forms. The cytological results are discussed in relation to isoenzyme analysis of pure populations of each variant collected at the same time.

Onchocerca **and blackfly reproduction**

Melanie Renshaw : *Centre for Applied Entomology and Parasitology, Keele University, Keele, Staffordshire ST5 5BG*

A reduction in reproductive output has been observed with *Onchocerca* infected *Simulium damnosum* in the wild (Checke *et al.* 1982) and with *O.lienalis* infected *S.lineatum* and *S.ornatum* in the laboratory (Ham & Banya 1984). When blood-fed *S.ornatum* were infected with 20 microfilariae by intrathoracic injection, there was a significant reduction in ovarian protein sequestration at 24, 34 and 50 hours post blood-feeding in comparison with a sham injected group. There was no significant difference in ovarian protein content between sham injected and control groups, indicating that the physical process of injection does not affect sequestration. Ovarian protein profiles showed that *S.ornatum* vitellin consisted of two main subunits, at 200 and 60 kDa, corresponding well to those found in *Aedes aegypti* at 200 and 65 kDa (Raikhel 1992). Microfilariae may affect synthesis of vitellogenin in the fat body, circulation in the haemolymph and/or ovarian sequestration.

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Mite induced protease activity in *Simulium* haemolymph

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Simulium spp. adults infested with ectoparasitic mites of the genus *Sperchon* were investigated. The mites were predominantly attached to the soft intersegmental membranes between the head and thorax. Rates of infestation varied between *Simulium* species. Infestation rates were much higher on *S.ornatum* when compared with *S.equinum* from the same collection site. Differences in infestation are thought to be due to differences in pupal gill structure between *S.ornatum* and *S.equinum*.

SDS substrate gel electrophoresis was carried out on haemolymph from *S.ornatum* infested with mites. Results indicated protease activity consistent with that previously found in *S.ornatum* in response to infection with *Onchocerca lienalis* microfilariae. Protease activity in haemolymph from uninfested *S.ornatum* (controls) generally showed lower protease activity. Some controls, however, showed similar protease activity to infested flies. This may be explained by previous mite infestation, since mites are known to detach once fully engorged.

Infections in *Simulium neavei* before and during a mass campaign using Ivermectin in Uganda

Rolf Garms[1], John Yocha[2] and Walter Kipp[3] : [1]*Bernhard Nocht Institute for Tropical Medicine, Hamburg*; [2]*Vector Control Unit, Ministry of Health, Fort Portal, Uganda*; [3]*Deutsche Gesellschaft für Technische Zusammenarbeit, GTZ, Basic Health Services, Fort Portal, Uganda*

Onchocerciasis is a major public health problem in the Kabarole district of Western Uganda where two vectors, *Simulium neavei* and *S.damnosum* s.l., occur. Investigations of the dynamics of the transmission of *Onchocerca volvulus* were begun in 1991 to examine possibilities of vector control and to monitor the effects of a mass treatement campaign with ivermectin launched in 1991 to treat the human population. Distribution of ivermectin was mostly annual, but semi-annual in one area. Onchocerciasis transmission was found to be very intense prior to and at the start of the campaign in two foci where *S.neavei* is the vector. At three catching sites in a hyperendemic focus northeast of Fort Portal, where regular full day catches were carried out by vector collectors, annual transmission potentials were estimated to be 4500 to 6500 infective larvae per person per year. Of 709 parous flies which were examined 40% were harbouring first or second stage larvae (L1/L2). After the first distribution of ivermectin infection rates of the fly population showed a significant drop, but increased again a few months later. From January to August, 1992, 33% of the parous females carried L1/L2 larvae, significantly less than in 1991. After the second round of treatments, which began in July 1992, infection rates of the flies dropped further to 21%, but 100 infective larvae of *O.volvulus* were still found in the heads of 1000 parous flies. Investigations will be continued to assess whether transmission in this limited and isolated onchocerciasis focus can be further reduced, or even interrupted, after repeated dosages and an improved coverage of the human population.

Simulium and river blindness in South West Arabia

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Between November 13th and December 11th, 1991, I paid a visit to SW Arabia to investigate whether human onchocerciasis was indigenous to Saudi Arabia. The first half of the visit was spent in the known onchocerciasis focus of North Yemen. Onchocerciasis was first reported from Arabia in 1957 by Fawdry who reported cases from South Yemen (the former Aden Protectorate). A member of the *Simulium damnsosum* complex was reported from North Yemen by Merighi *et al.* (1969). Detailed entomological studies were made by Garms and Kerner (1982) and the vector *S.rasyani* was described by Garms *et al.* (1988).

Unfortunately my visit coincided with a very poor rainy season, indeed over much of SW Arabia no rain fell in 1991, and this followed at least seven years of poor rainfall. Many of the sites in North Yemen studied by Garms and Kerner (1982) were not flowing in 1991, and these included places where flow had been perennial until very recently. *S.rasyani* was found only in the Wadi Surdud. However, there it was found in large numbers encrusting the stones which formed the river bed, in the absence of suitable vegetable substrate. Garms and Kerner (1982) had only found it attached to vegetation. The other species collected proved to be *S.ruficorne*, *S.hargreavesi* and *S.yemenense*.

In Saudi Arabia I visited Abha in the Asir Region and was helped by Professor Mohamed Omar who is based there. The drought had been even more severe than in Yemen and I did not see any flowing water which looked suitable for the *S.damnosum* complex. The only species collected were *S.ruficorne* and *S.yemenense*. Much of the time in Saudi Arabia was spent investigating the provenance of cases of human onchocerciasis reported from various hospitals and clinics. In all cases bar one it seemed likely that the disease had been contracted in Yemen. However, one undoubted case (examined parasitologically by Professor Omar) concerned a nine year old boy from the Asir Region who had never left the Kingdom of Saudi Arabia. Thus it seems certain that in wetter periods in the past there has been some transmission of onchocerciasis within Saudi Arabia. Presumably the vector was *S.rasyani* which, however, has yet to be detected in that country.

Postscript: 1992 proved to be the wettest for about eight years, but a return visit to Asir could not be sanctioned.

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Most iridovirus infected blackflies do not iridesce

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Iridescent viruses are icosahedral DNA viruses which assemble in a crystalline arrangement in heavily infected host tissues. Light striking these viral arrays is subject to interference causing an obvious and characteristic iridescent coloration - usually blue. This has traditionally been the criterion for diagnosing iridescent virus infection, and because of the rarity of the phenomenon in most insect populations, iridescent viruses have usually been considered of low infectivity. There exist two genera of the family Iridoviridae which infect invertebrates: the larger *Chloridovirus* (c. 180nm) isolated from mosquitoes, and the smaller *Iridovirus* (c. 130nm) which have
a broader host range (Diptera, Coleoptera, Hemiptera, Lepidoptera, and even terrestrial crustaceans).

In the early 1970's blackfly larvae infected with an iridovirus were reported as rare occurrences in the River Ystwyth, Wales. Virtually nothing is known about the ecology of these viruses or of the nature of their host relations, or even of their route of transmission; mainly because iridescence has been used as the diagnostic criterion. During monthly sampling from the Ystwyth, a total of eight patently infected *Simulium* larvae were discovered. The virus from each of these larvae was extracted, bulked-up in a permissive lepidopteran (*Galleria mellonella*), and the DNA characterized by restriction endonuclease analysis. The restriction profiles showed obvious variation in the frequency and position of Hind III restriction sites: no two isolates were identical (Williams & Cory, *Med. and Vet. Entomol*. in press). When individual extracts from 30 randomly selected apparently healthy larvae were injected into *G. mellonella*, eight caused patent iridovirus infection in the lepidopteran. Restriction profiles produced from these covertly infected *Simulium* larvae showed a very similar pattern of isolate variability to that seen in isolates causing patent infections. Apparently healthy larvae pooled into groups of 10, injected into *G. mellonella* produced patent infections in all the lepidopteran larvae, the restriction profiles of which contained many sub-molar bands - indicative of mixed infection by more than one genotype.

The covert nature of the infection was confirmed by Polymerase Chain Reaction (PCR) targeted at the major structural protein (MSP) gene. This gene codes for the major capsid polypeptide and should be highly conserved despite the obvious genetic variation in isolates. By carrying out a two-step PCR reaction involving repeated specific amplification of an 816 base fragment from within the MSP gene, followed by a second amplification of a 719 base fragment (from within the initial 816 base product), the presence of iridovirus DNA within simuliid tissues was demonstrated.

The most common species present in larval samples from the Ystwyth was *S. variegatum*. For both the *G. mellonella* bioassay and the PCR work, uninfected control larvae taken from rivers around Oxford were used. The level of covert infection in simuliid populations from the Ystwyth appears to vary both spatially and temporally, but rates approaching 50% infection may be observed. Current work is taking three approaches:

- i) using these techniques to elucidate the ecology of this host-virus system
- ii) using labelled DNA probes to investigate the exact location of iridovirus in sections of covertly infected larvae and adults
- iii) confirmation of the presence of iridovirus particles in host tissues using electron microscopy.

Ivermectin intervention and transmission of onchocerciasis in Sierra Leone

J. Whitworth : *THEU, London School of Hygiene and Tropical Medicine*

The main aims of wide-scale ivermectin distribution are to decrease clinical morbidity and reduce transmission of *Onchocerca volvulus* infection. Previous studies in Ghana, Guatemala and Liberia have all shown that entomological measures of transmission can be reduced in optimal situations of high coverage of a large human population with a single dose of ivermectin over a short period of time. Our studies in southern Sierra Leone of the effects of 5 six-monthly doses of ivermectin have shown that even with coverage as low as 30% of a small population, there is a highly significant reduction($p < 0.0001$) in the mean number of larvae per infected fly (mainly *Simulium soubrense B*). Other indices: annual biting rate, annual transmission potential, infected and infective parous rates, and mean number of L3 larvae per infective fly, did not alter significantly. We conclude that the mean number of larvae per infected fly is probably the best measure of the effectiveness of ivermectin distribution schemes if the vector has a high parasite carrying capacity. This index is sensitive, changes rapidly after treatment and is relatively simple to carry out in the field.

Estimation of *Simulium damnosum* gonotrophic cycle lengths by time series analysis

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Data on 13 continuous sequences of the numbers of *Simulium damnosum* s.l. caught per day at six different sites in West Africa were analysed by time series analysis. ThePdata were de_trended by differencing according to the number of significant lags, from 1 to 5, identified from partial autocorrelation functions. Spectral analysis of the differenced data showed evidence of cyclic behaviour significantly different from white noise ($p < 0.05$) in every case. The major peaks in the periodograms corresponded to cycles of between 2.04 and 2.77 days. The possibility that these represent gonotrophic cycle lengths, given their similarity to estimates obtained by other methods, was considered.

POSTER PRESENTATION AT THE 15TH ANNUAL MEETING

Seventeen years of the identification and distribution of cytospecies of the ***Simulium damnosum*** **complex in Nigeria**

H.B. Mafuyai[1], R.J. Post[2], D.H. Molyneux[3] and D.H. Davies[1] : [1]*Department of Biological Sciences, University of Salford, Salford M5 4WT*; [2]*University of Wageningen, Netherlands*; [3]*Liverpool School of Tropical Medicine*

Since the description of 8 cytospecies included in the *Simulium damnosum* complex in West Africa (Vajime & Dunbar 1975) it has become known that there are at least 15 cytospecies/cytoforms in the region. It was in this same study that the first cytospecies from Nigeria (*S.damnosum* s.s. and *S.sirbanum*) were reported. More than a decade and a half later, the following cytospecies/forms of the *S.damnosum* complex have been recorded from the country by various authors (Akoh *et al.* 1987; Crosskey 1981; Vajime & Gregory 1990): *S.damnosum* s.s., *S.sirbanum*, *S.sudanense*, *S.squamosum*, *S.soubrense*, *S.soubrense* B, *S.yahense*, and Volta, Beffa and Nile forms.

Cytotaxonomic identifications of the members of this complex routinely utilise the larvae for their salivary-gland polytene chromosomes. By finding differences in the chromosome sequences in relation to the arbitrarily chosen standard (*S.soubrense*) unknown cytospecies may be typed.

New identifications undertaken between 1990-91 from 13 sites across the Nigerian Sudan, Guinea and derived Guinea Savanna, and from 2 other sites from the rainforest, revealed the presence of *S.damnosum* s.s., *S.sirbanum*, *S.sudanense*, *S.squamosum* and *S.yahense*. *Simulium damnosum* s.s., *S.sirbanum* and *S.sudanense* were restricted in distribution to the Savanna zones and *S.yahense* to the forest area, but *S.squamosum* occupied both forest and Savanna areas. This pattern of cytospecies distribution in Nigeria is similar to that reported in the O.C.P. area in West Africa (Vajime & Dunbar 1975).

Acknowledgements: this study received financial support from the UNDP/World Bank/WHO Special Programme for Research and Training in Tropical Diseases (TDR). The authors also wish to thank Professor C.G. Vajime, ABU Zaria Nigeria, for information on some cytospecies' breeding sites.

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THE 16th ANNUAL MEETING (1993) OF THE BRITISH SIMULIID GROUP

The meeting was held at the Natural History Museum, London, on Wednesday, November 17th, 1993. Participants were welcomed by Dr R.P. Lane, Keeper of the Entomology Department.

Dr Magda Charalambous chaired the meeting, which was attended during the day by about 50 members, Museum staff and students. It was a pleasure to see a larger than usual contingent of overseas members of the group. Seven talks were presented at the meeting, four of which were given by speakers from Germany, the Netherlands and Portugal.

Unfortunately, the afternoon session was interrupted by an emergency evacuation of the Museum due to a bomb alert. Happily, it was a false alarm and the meeting was able to be resumed after about an hour without too much disruption.

The meeting was preceded the previous evening by an informal meal at a local restaurant.

TALKS GIVEN AT THE 16TH ANNUAL MEETING

Dispersal of onchocerciasis in Brazil and its significance to studies on simuliid taxonomy

Tony Shelley : *The Natural History Museum, London*

Since its discovery in Brazil over 20 years ago the distribution, prevalence and dispersal of onchocerciasis are still poorly known. Renewed efforts using these parameters are now being made to assess the public health importance of the disease with the increasing development of rural areas in this country. Studies made in the 1970's showed the disease to be confined to an area in the Brazilian and Venezualan Amazon; about 1400 of the Yanomami Indians in the area were infected. Ten years later a new focus of the disease at Minaçu, 2500 km to the south of the Amazon focus, was discovered. Surveys are again being carried out in the Amazon focus to determine the epidemiology of the disease and to formulate control measures.

Transmission of *Onchocerca volvulus* in the Amazon focus is by three or four vector species: *Simulium guianense*, *S.oyapockense/roraimense* and *S.yarzabali*. In the highland, mainly hyperendemic areas of the focus, *S.guianense* is the primary and

S.yarzabali the secondary vector, while in the lowland, mainly hypoendemic areas, *S.oyapockense/roraimense* is the vector. Experimental infection of these species showed only *S.guianense* to be a very efficient host to *O.volvulus* while the other species are probably only efficient vectors when skin microfilaria densities and prevalence rates are high. These vector species and *S.exiguum*, the primary vector in Ecuador, also occur in the Minaçu focus.

Distribution of these vectors in Brazil is apparently wide and they also occur in other countries in South America. Development of the Amazon brings with it the danger that individuals infected with onchocerciasis could carry the disease to non-endemic areas and set up new transmission foci if the appropriate simuliid species are present. Identification of each of these vector species is not straightforward. *S.guianense* occurs in both anthropophilic and zoophilic populations, which are indistinguishable morphologically. Chromosome preparations from larvae are currently being studied in an effort to establish whether female biting behaviour is cytospecies linked. *S.yarzabali* is closely related to *S.incrustatum* and may be a form of it. The latter species is highly variable in morphology and behaviour. Again, cytological studies are necessary in order to link female behaviour and vectorial capacity to the possible existence of cytospecies. *S.oyapockense* may be distinguished from *S.roraimense* by morphology in the male, hydrocarbons in the female and chromosomes in the larvae. The lack of a simple method to distinguish females is the major constraint on establishing whether both species are vectors in the Amazon onchocerciasis focus. Work in the Natural History Museum, London, in collaboration with the Oswaldo Cruz and Evandro Chagas Institutes, INPA and the Ministry of Health in Brazil is aimed at clarifying the taxonomy of these species and facilitating their identification so that onchocerciasis transmission may be qunatified and its dispersal assessed.

Decline of *Simulium neavei* and its associated crabs in the onchocerciasis foci of the Ruwenzori Area, West Uganda, during the past 20 years

Rolf Garms[1], John Yocha[2] and Walter Kipp[3] : [1]*Bernhard Nocht Intitute for Tropical Medicine, Hamburg*; [2]*Vector Control Unit, Ministry of Health, Fort Portal, Uganda*; [3]*Deutsche Gesellschaft für Technische Zusammenarbeit, GTZ, Basic Health Services, Fort Portal, Uganda*

The man-biting members of the *Simulium neavei* group are restricted to forested areas and depend on a dense vegetational cover over their breeding sites. It has been reported, e.g. from Tanzania and Malawi, that deforestation has resulted in a decrease of fly population densities and transmission of onchocerciasis. Selective bush clearing was successfully employed to eradicate *S.neavei* from one of the former foci in Kenya (reviewed by Walsh *et al.* 1993).

Since *S.neavei* is the main vector of onchocerciasis in Kabarole district east of the Ruwenzori mountains in Western Uganda, it was of interest to examine whether recent ecological changes have had an effect on the occurrence of the species. Considerable research work and successful control measures against *S.damnosum* s.l. were carried out in this area during the sixties and seventies (reviewed by Raybould & White 1979) until all activities came to a standstill due to the civil war in

1977. Most of the early data were never published, but records still kept by the Vector Control Unit of the Ministry of Health, Fort Portal, have been used for a comparison of the situations in the periods 1971 to 1975 and 1990 to 1993.

Onchocerciasis is still hyperendemic in two foci in Kabarole district. One is located around the Itwara forest reserve north-east of the district capital Fort Portal, and the other lies to the east of Lake George bordering the Kasioha_Kitomi forest reserve. *S.neavei* is the only vector in both foci and is associated with the river crab *Potamonautes aloysiisabaudiae*, which is the phoretic host of its immature stages. In the northern Itwara focus *S.neavei* is no longer found in some rivers draining westward into the Rift Valley, where crabs have also become rare. Although no control measures were carried out, *S.neavei* has completely disappeared from a third focus (Ruteete area, south of Fort Portal), where onchocerciasis was hyperendemic in 1971 and is now hypoendemic. This change has been accompanied by the establishment of a population of *S.damnosum* s.l. (probably the Nkusi form), which possibly is a poor vector, but may maintain a low level transmission of onchocerciasis. The disappearance of *S.neavei* from this focus could be the result of the destruction of a forest reserve along the Mahoma river. However, the reasons may be more complex, because the crab host has also disappeared. Furthermore, crabs and *S.neavei* are no longer to be found in the nearby Kibale forest reserve, which is still intact. *S.neavei* has also disappeared from at least one river (the Sebwe, Bugoye district) in the foothills of the Ruwenzori, where it was not a vector.

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Prospects for the eradication of *Simulium damnosum* from the island of Bioko (Fernando Po)

R.J. Post : *Wageningen Agricultural University, The Netherlands*

Actual eradication of *Simulium* vectors of onchocerciasis has been achieved on a few occasions. The important factors which have made this possible have been the isolation of the target populations from vector immigration and the accessibility of breeding sites. These factors are both indicated for Bioko, by the endemic nature of the cytotype, prevailing wind pattern, and highly seasonal nature of most of the streams (which possibly restricts dry-season breeding to just five or six perennial rivers).

Recent advances in the identification of adult female *Simulium damnosum* s.l. from West Africa

Mike Wilson : *Wageningen Agricultural University, The Netherlands*

The need to identify reliably the adult female *Simulium damnosum* s.l. has led to the application of a wide range of techniques including morphological studies, cuticular hydrocarbon analysis, DNA probes, etc. We have developed a technique for morphological identification based on multivariate statistical analysis of 15 characters. This morphological scheme can identify *S.damnosum* subcomplex, *S.sanctipauli* subcomplex, *S.squamosum* and *S.yahense* with an overall correct identification of over 98%. However, to achieve the separation of individual members of the *S.damnosum* and *S.sanctipauli* subcomplexes we have been examining DNA sequence variation for species-specific differences, and some have been found between *S.sirbanum* and *S.damnosum* s.str. We are currently screening specimens to confirm the broad applicability of these traits. A non-radioactive detection system was developed specifically to enable large scale use for identifications in both laboratory and field situations.

The blackflies (Diptera: Simuliidae) of Portugal. Taxonomy, distribution and bioecological data

A.J. dos Santos Grácio : *Instituto de Higiene e Medicina Tropical, Lisbon*

The author presents the results obtained during a survey carried out in Portugal from 1980 to the present time. Based on the material studied (14048 larvae, 10424 pupae and 2646 adults) and bioecological data the
author presents a list of the genera and 30 species obtained and their distributions.

The genera, subgenera and species collected were as follows:

Genera *Prosimulium*1, *Metacnephia*2 and *Simulium*

Subgenera *Prosimulium*2, *Nevermannia*2, *Eusimulium*, *Wilhelmia*, *Simulium* s.str.2, *Obuchovia*1 and *Boophthora*2

Species *P.latimucro*2, *P.tomosvaryi*1, *M.blanci*2, *M.nuragica*2, *S.vernum*, *S.naturale*1, *S.cryophilum*1, *S.armoricanum*1, *S.ruficorne*, *S.pinhaoi* sp.nov.2, *S.latinum*3, *S.aureum* s.l., *S.angustipes*2, *S.equinum*1, *S.pseudequinum*, *S.sergenti*, *S.lineatum*, *S.ornatum* s.l.1, *S.nitidifrons*, *S.spinosum*1, *S.reptans*1, *S.hispaniola*1, *S.variegatum*1, *S.monticola*1, *S.argyreatum*1, *S.tuberosum*1, *Simulium* sp.2, *S.ibericum*2, *S.auricoma* s.l.1, *S.erythrocephalum*1

1New to Portugal 2New to the Iberian Peninsula
3Confirmed for Portugal (c.f. Beaucournu-Saguez, 1972)

Data on filariae in cattle and horses in southern Portugal are also presented.

The talk ends with a summary of simuliid breeding grounds found in Portugal.

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Blood meal identifications from *Simulium posticatum*

Angus McCrae and Nigel Hill : *Warborough, Oxon. and London School of Hygiene and Tropical Medicine*

Previous findings relevant to host selection by *S.posticatum* in Dorset are briefly reviewed. These together with host identifications obtained in 1993 through ELISA tests on blood-meals from 3 flies from Dorset and 28 from Oxfordshire hint that in Dorset *S.posticatum* is primarily ornithophilic, whereas in Oxfordshire *S.posticatum* (identifications need confirmation) seems primarily boviphilic with horse and canine hosts also. Implications and prospects for further work are discussed.

[An extended account of this talk appears on page 23. Ed]

The predator_prey relationship between adult watermites and *Simulium* larvae

John Mwango[1], Roy Wiles[1] and Trevor Williams[2] : [1]*University of Buckingham*, [2]*NERC Institute of Virology and Environmental Microbiology, Oxford*

Aquatic mites of the family Hydrachnidia are usually present in abundance across the spectrum of freshwater habitats; both lentic and lotic. However, because of their small size and because of problems of identification (taxonomy) they have often been neglected in studies of aquatic ecology. Watermites have a 7_stage lifecycle of which only the larva, deutonymph and adult are active. The ectoparasitic relationship between larval watermites and adult *Simulium* has been well described by Gledhill *et al.* (1982) and Gledhill (1985). Larval watermites enter the pupal cocoon, crawl onto the adult during emergence and feed by piercing the inter_segmental membranes. Specially adapted piercing and cutting appendages, the chelicerae, are carried on the infracapitulum for this purpose. Having engorged, the larval watermites drop off the adult, back into the water to continue the lifecycle. The predator_prey relationship between watermites and *Simulium* larvae, however, has not been previously recognised (Mwango, Wiles & Williams 1993). Adult watermites feed by puncturing the blackfly larval integument and probably inject a proteinaceous toxin to paralyse or subdue their victim. In other mite species, this toxin has been identified as ca. 250 amino acids in length, with neurotoxic activity.

By direct observation of adults in the laboratory, we identified 3 species of watermite from a typical lowland river habitat which showed clear predatory behaviour towards late instar *Simulium* larvae, including the two most abundant species in the river: *Hygrobates fluviatilis* and *Lebertia porosa*. These species were adopted as the model species for the study. Patterns of adult watermite predation were studied by confining mites and *Simulium* larvae together in cells, in flowing water, in the laboratory. No alternative prey items were available to the watermites. Both species showed similar rates of predation of (mostly) *Simulium equinum* larvae at ca. 1.4 larvae/mite/day for 2nd+3rd instar larvae and ca. 0.5 larvae/mite/day for 6th instar larvae. When offered a simultaneous choice between early and late instar *Simulium* larvae, *H.fluviatilis* showed a distinct preference to attack smaller larvae. The reasons for this are uncertain, but may be related to the problems associated with handling and subduing larger larvae; which may be better able to defend themselves against the mite attacks. By direct observation, and by sampling from the upper part of *Ranunculus* weedbeds, watermites and *Simulium* larvae were observed in the same microhabitat.

Repeated mid_season samples from the *Ranunculus* beds in the River Ouse at Buckingham, demonstrated that *Simulium* larvae were by far the most abundant prey items available for watermites in the river, by an order of magnitude.

The impact of watermite predation on chironomid populations in lakes (in the Netherlands) has been carefully examined by Ten Winkel (1985). Exclusion experiments showed watermites were as important as cyprinid fish (mainly bream) in terms of chironomid predation. Using the adult watermite densitites from 16 weeks of core sampling, the published generation times of *Simulium* spp. in UK rivers, and the laboratory rates of predation in this study, we have tentatively estimated the possible impact which mites may have on populations of *Simulium* larvae. We recognize the criticisms which can be levelled at these data (e.g. availability of alternative prey, elevated temperatures, flow rates, ability of the prey to utilize escape responses such as drift, etc.) but we believe that watermites may represent one of the most influential, yet one of the most neglected of *Simulium* natural enemies.

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POSTER PRESENTATIONS AT THE 16TH ANNUAL MEETING

P.J. McCall, A.J. Trees and D.H. Molyneux (*Liverpool School of Tropical Medicine*) exhibited a poster with the title 'Chemical mediation of communal oviposition in the river blindness vector *Simulium damnosum* s.l. in Sierra Leone'.

The development of habitat preference curves for blackfly larvae and their use in assessing in-stream flow needs

M.A. Bickerton and M.T. Greenwood : *Freshwater Environments Group,* *Department of Geography, Loughborough University of Technology*

1. Introduction

Recent concerns about the ecological impacts on rivers of over-abstraction, drought, regulation and augmentation have led to a 'spate' of new studies on the responses of river fauna to flows. Attempts to quantify habitat preferences and relate these to flows are quite new, and form the subject of this poster.

Habitat suitability can be predicted by integrating information on taxa preferences for flow-related variables (water depth, current velocity, shear stress, substrate characteristics) and how these variables change at a site under different flows.

Selection of appropriate 'target' species for analysing in-stream flow needs is a critical step (Orth 1987), with those having the narrowest range of habitat preferences being most sensitive to flow alterations. The Simuliidae are a classic example of this group.

2. Construction of Preference Curves

Three methods of constructing habitat preference curves which have been compared using Simuliidae by Morin et al (1986) and Skinsley (1993) are:

i) The Incremental Method (Gore and Judy, 1981).

ii) The Polynomial Regression Method (Orth and Maughan, 1983).

iii) The Multiple Regression Method (Gore and Judy, 1981).

In all of these methods a composite habitat suitability can be calculated for a number of variables by multiplying the individually calculated suitabilities.

3. Examples From Two English Streams

Figure 1 shows Skinley's depth and velocity preference curves for Simuliidae using the three methods, using data from field collections from the Wood Brook, Leicestershire. The Multiple Regression method was found to be the most accurate, with the Polynomial Method next best.

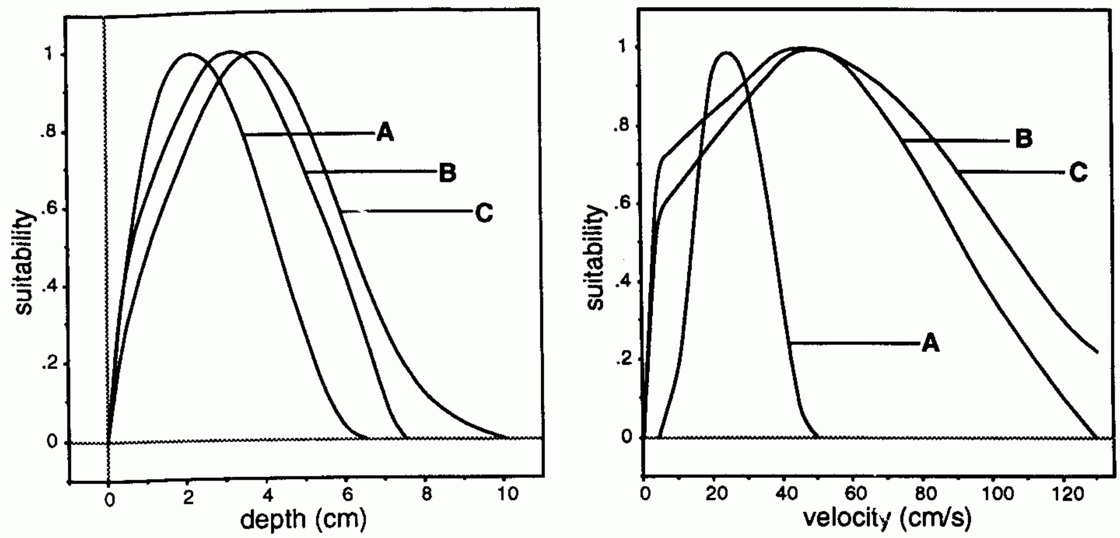

Figure 1. Comparison of methods of preference curve construction for Simuliidae from the Wood Brook, Leicestershire: depth and current velocity preferences: A - Incremental method; B - Polynomial regression method; C - Multiple regression method.

Fig. 1 Comparison of methods of preference curve construction for Simuliidae from the Wood Brook, Leicertershire: depth and current velocity preferences: A – Incremental method: B – Polynomal regression method: C – Multiple regression method.

Figure 2 illustrates preference curves for Simuliidae from the River Wissey, Norfolk (Petts and Bickerton, 1993), together with a plot of the original abundance data against composite suitability calculated from the individual preferences.

Figure 3 shows the uses of these habitat preference curves to predict composite habitat suitability for three sites on the River Wissey under different flows. Chalk Hill Farm is a coarse gravel, asymmetric riffle with areas of relatively high current velocity even under low flows, providing good habitat for Simuliidae. Didlington (sand) is a deep sand- and gravel-bed run of uniform cross-section which requires higher flows to provide reasonable habitat. Didlington (gravel) is intermediate in character.

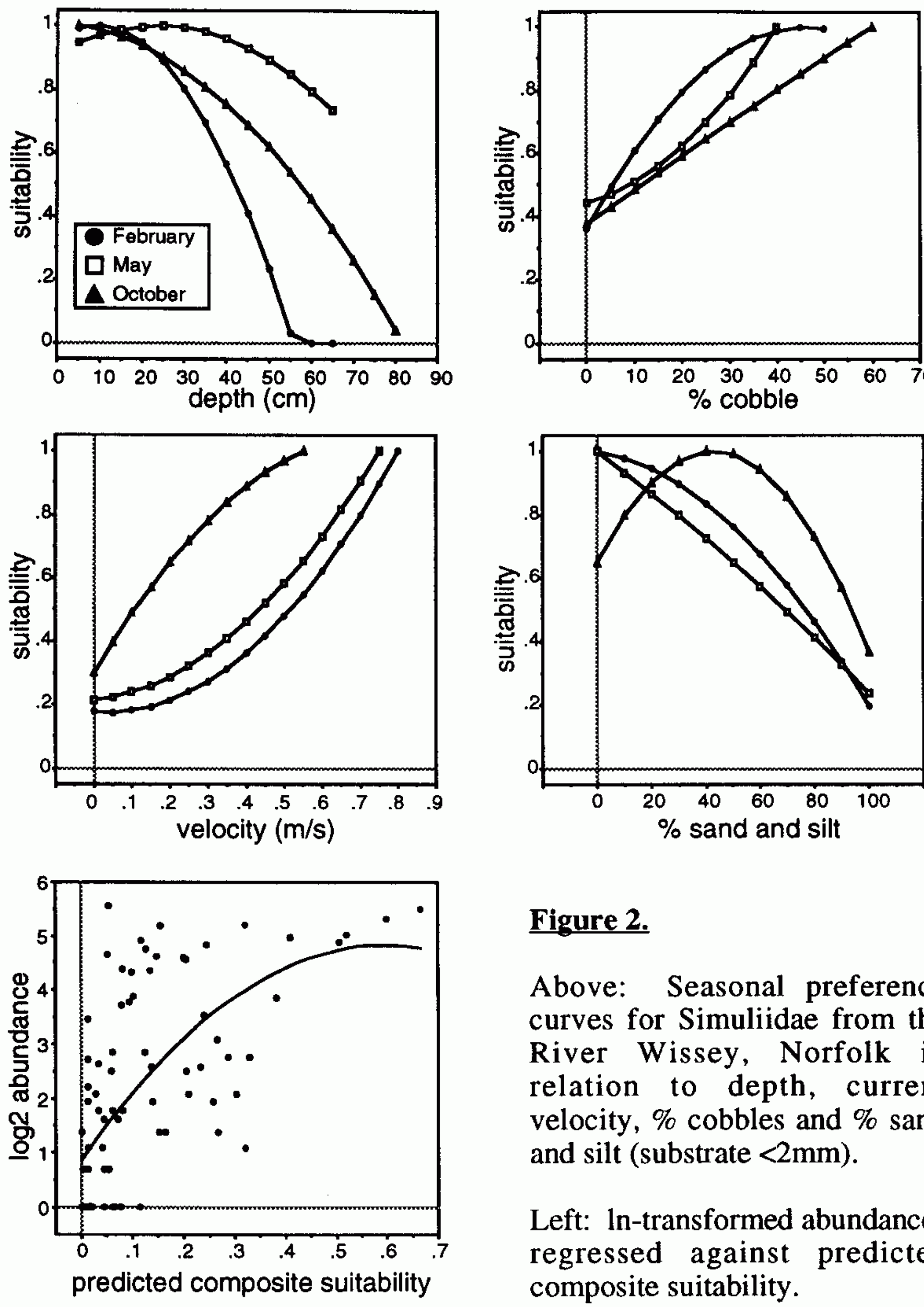

Figure 2.

Above: Seasonal preference curves for Simuliidae from the River Wissey, Norfolk in relation to depth, current velocity, % cobbles and % sand and silt (substrate <2mm).

Left: ln-transformed abundances regressed against predicted composite suitability.

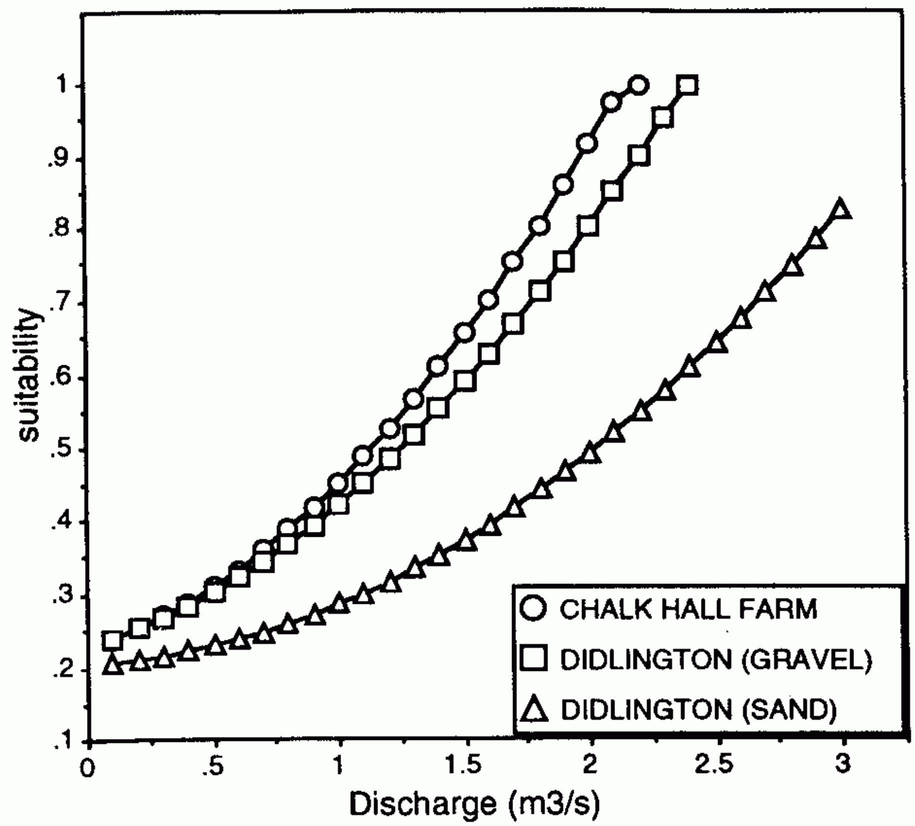

Figure 3. Predicted habitat suitability for Simuliidae with increasing discharge at three sites on the River Wissey, Norfolk, in May.

Fig. 3 Predicted habitat suitability for Simuliidae with increasing discharge at three sites on the River Wissey, Norfolk, in May

4. Conclusions

Table 1 gives the optimum current velocity and depth values for Simuliidae found in a range of studies using comparable methods. Gore (1978) and Orth and Maughan (1983) used a method of weighted habitat means to establish the conditions supporting most larvae at their study sites. Morin et al (1986), Skinsley (1993) and Petts and Bickerton (1993) employed preference curves to predict optimum conditions.

Variability in estimates of optima from different studies probably reflect differences in the methods of calculation, seasonal and, most importantly, species differences. This highlights the need for more species level studies in order to understand the habitat preferences of this important family more fully.

	Velocity (cms-1)	Depth (cm)
Gore (1978) (Montana) *Simulium* sp.	77	27
Orth & Maughan (1983) (Oklahoma) *Simulium* sp.	82	20
Yamagata & Kanayama (1985) (Guatamala) *Simulium ochraceum*	41-66 (max)	0.2-2 (min)
Yamagata (1986) (artificial stream) *S.ochraceum* & *S.horacioi*	40	0.25
Morin et al (1986) (Quebec) *S.aureum*	70 (max)	3 (min)
Skinsley (1993) (Leicestershire) *Simulium* sp.	30	2.8
Petts & Bickerton (1993) (Norfolk) *Simulium* sp.		
February	80 (max)	10
May	75 (max)	25
October	55 (max)	5 (min)

Table 1. Velocity and depth preferences for *Simulium* spp. from published and unpublished studies. Max/min = maximum or minimum observed value.

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Host Selection by the Blandford Fly (*Simulium posticatum* Meigen), with Blood-Meal Identifications

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Despite the severe hypersensitivity that its bites sometime provoke in humans and the adverse public opinions consequently engendered (Hansford & Ladle 1979; Crosskey 1990), field observations (by AM) show clearly that *Simulium posticatum* is actually a 'nervous' or 'dilettante' blood-feeder (see Crosskey 1990 p. 431) on man. Simple calculations based on available data also show that only a minute proportion of the female flies emerging from the River Stour in Dorset actually bite man. Laboratory studies (by AM) have indicated that female *S.posticatum* in Dorset are not autogenous, and this together with the sometimes high parous rates of those coming to man (including those few biting) combine to tell us that other host species must be much more severely attacked. So far, however, field observations have not shown what this (these) host(s) might be: in Dorset such attempted observations have invlolved donkeys (totally negative: Hansford 1977; AM pers. obs.), dogs (occasionally bitten: M. Ladle, pers. comm.; only large, dark and short-haired dogs: AM pers. obs) and cattle (negative: carefully checked by AM because boviphilic simuliids are often also anthropophilic: see Crosskey 1990 for context and examples). Further hosts checked with
negative results in the Stour Valley, though only cursorily, or else merely from a distance when they have shown no indication of disturbance in the presence of abundant females of *S.posticatum*, have been horses, red deer, rabbits and (at Merley Tropical Bird Park near Broadstone) a goat and a wide range of bird species. Certain deer species other than red deer had seemed likely on empirical grounds to be primary hosts, but attempts to secure these for close observation were unsuccessful.

Blood Meals

In a dissected subsample of 30 flies from among abundant *S.posticatum* around man at Broadstone, Dorset, in May 1992, one was found to contain a small but fresh blood-meal. This fly had oocytes of a size typical for a freshly emerged fly and was even unfertilised (though its crop contained an apparent sugar meal), whereas of 6 nullipars captured in the act of biting man, all had been fertilised and had oocytes appropriate to flies 2.5 to >7 days old. This blood-meal was therefore perceived to hold promise of the first fragment of direct evidence as to the elusive identity of a primary host and so was stored on filter paper until host identification could be attempted.

In May-June 1993, 1242 more flies collected by means of a man-baited table trap (which without bait took virtually no Simuliidae) were dissected,
yielding 2 more blood-meals from 164 flies at Broadstone (where *S.posticatum* is only too well known as the 'Blandford Fly') and 28 from 1078 at Stonesfield in Oxfordshire (where *S.posticatum* breeds widely (Williams 1991) and where females of what is presumed to be this species are known variously as the 'Stonesfield Stinger' - R.H.A. Baker, pers. comm. - or the 'Woodstock Fly'). Blood-meals of smallest size (classed as +/-) and/or blackest colour (BB) (see Table for other classes) were not used; thus, 31 (2.4%) of all dissected flies yielded blood-meals judged by size and colour as usable, as later justified by results (Table). Of these 31 flies, 15 were fully engorged (blood-meals +++ or ++++), 14 with BR blood. The bodies less abdomens of most of these 31 flies were retained for confirmation of their identifications, but were inevitably too damaged by wet dissection for *S.posticatum* then to be distinguishable from other minutely similar species.

Table: Blood-meals and host identifications.

Colour / Size	DB	RB	DR	BR	Total
++++	0	1 (1B)	0	2 (2B)	3
+++	0	0	0	10 (6B) (1H) (3N)	10
++	3 (1H) (2N)	1 (1N)	4 (1Ax) (3N)	4 (3B) (1N)	12
+	2 (1B) (1N)	2 (1D) (1Nx)	1 (1N)	1 (1A*)	6
Total	5	4	5	17	31

Blood-meal colour classes: DB = dark brown, RB= red-brown, DR = dark red, BR = bright red.

Blood-meal size classes: + = small, ++ = medium, +++ = large (engorged), ++++ = very large (hyper-engorged).

Host identifications: A = avian, B = bovine, D = dog, H = horse, N = negative. Note none positive for human or sheep/goat.

Locality/Year: * = Broadstone (Dorset), 1992; x = Broadstone 1993. All others - Stonesfield (Oxfordshire) 1993.

Whereas flies with partial (interrupted?) blood-meals too small to induce oogenesis could be expected to be host-attracted, it is inexplicable why any fully blood-fed flies could be captured through the method used. Highest blood-meal rates came towards the end of the biting season: a sample of 52 flies from Stonesfield on 5.vi.93 (very few flies behaving typically for *S.posticatum* were evident there by 10.vi.93) included 9 (17%) with usable feeds, plus a further 14 (27%) with unusable feeds (+/- BB); none of these 23 flies was obviously undergoing oogenesis (following Cupp & Collins 1979). (Nor were any of the total of 1272 dissected flies gravid). Although 42 (81%) of these 52 late-season flies were parous, the idea that the attraction of blood-fed flies to the man-baited trap might be thought an aberrant function of fly senescence was contradicted by finding that 2 of the 5 flies with +++/++++ blood-meals were nulliparous.

ELISA Tests

One of us (NH) tested all 31 usable blood-meals by ELISA in November-December 1993 against human, sheep/goat, bovine, horse, dog and avian antisera, and obtained the following results (and see Table) as confirmed by repeat tests:

(i) No blood-meals were positive for human or for sheep/goat.

(ii) 2 blood-meals from Broadstone (including the one obtained in 1992) were positive for avian and the 3rd was negative.

(iii) 13 blood-meals from Stonesfield were strongly positive for bovine and 2 for horse, 1 was weakly positive for dog and 12 (3 of which had been large and bright red on dissection) were negative.

(iv) No multiple feed from more than one host species was evident, but see (f) below.

Among the implications of these results are:

(a) Paucity of actual anthropophily is supported. This view in no way detracts from the seriousness of the public healsth problem posed by hypersensitised bite reactions in humans. Such hypersensitivity, incidentally, has not been observed in dogs, according to statements from veterinarians in the Blandford area.

(b) Evidence of ornithophily from Dorset is astonishing, all the more so since *S.posticatum* females possess the untoothed tarsal claws characteristic of mammalophilic Simuliidae (Crosskey 1990).

(c) If the bovine-positive feeds from Stonesfield were from cattle (none of which were kept near the catching site), then a marked difference in host selection between the Oxfordshire and Dorset populations is indicated.

(d) Although every bovine-positive blood sample tested strongly, we cannot yet exclude the possibility of some cross-reaction with deer, using this particular technique.

(e) The single dog-positive Stonesfield feed reacted quite weakly, probably owing to its being small (+) and partly digested (RB). It is possible, however, that some cross-reaction with fox blood may occur using this method.

(f) In that 3 of the 12 negative Stonesfield blood-meals had been +++BR (Table), at least one species of non-cross-reactive host is indicated. Thus, multiple feeds (see (iv) and (d), above) remain possible.

(g) In combination with other results, the 2 horse-positive results suggest that the Stonesfield flies represent a population of generalist feeders on large mammals including canines ((e) above) and humans (occasionally: direct observations, R.H.A. Baker, pers. comm.), a view subject to future identifications ((3) below) confirming the flies' conspecificity.

Future Needs and Prospects

1. Considerably more blood-meals need to be tested against more hosts, particularly from Dorset. Control operations in Dorset (Ladle 1993) might make this unfeasible there in future, but not so to date.

2. Sufficient has been retained from most if not every blood-meal for several further tests to be run, dependent on ELISA plates for appropriate hosts being obtainable. Especially needed are tests for muntjac and roe deer.

3. In view of the surprising nature of these preliminary findings (notably (b), (c) and (g) above), the flies' identifications should be double-checked in future studies. Dissection procedures particularly need modification to allow this.

Summary: Only a minute proportion of female *S.posticatum* actually bite humans, despite their notoriety for provoking severe hypersensitive bite reactions in man. In Dorset, dogs are also slightly attacked, but cattle are unattractive. Blood-meals from 31 (2.4%) of 1272 female flies attracted to man (mostly sampled by man-baited table trap) were tested by ELISA against human, sheep/goat, bovine, horse, dog and avian antisera. Of the 3 blood-meals from Dorset, 2 were positive for avian and the other negative, whereas of the 28 from Oxfordshire, 14 were positive for bovine, 2 for horse and 1 for dog. Some of the negatives indicated further hosts untested for. Implications and prospects for future studies are discussed.

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Dense Aggregations of Blackfly Larvae in Lake Outlets

Roger Wotton : *Department of Biology, Darwin Building, University College London, Gower Street, London WC1E 6BT*

Streams are frequently impounded by weirs and dams to create pools, or larger bodies of water. When water flows as an outlet stream from the surface of an impoundment, conditions are ideal for the development of high densities of suspension-feeding animals. In summer, when lakes become thermally stratified, the outlet stream water is constantly warm and contains large numbers of nutritious particles - zooplankton, phytoplankton, bacterioplankton and particles of detritus, all of which are swept from the lake.

Some outlets, especially larger ones with higher discharge, support high densities of net-spinning caddisfly larvae which selectively ingest the most nutritious particles captured on their secreted nets. Where the stream bed consists of sediment, many bivalves will be buried and these capture particles brought in by feeding currents. Where, in contrast, the substratum is better consolidated, and where discharge is low, the fauna will be dominated by midges of the genus *Rheotanytarsus* and/or by blackfly larvae. Both use passive feeding techniques although the midges must move to ingest the silk strands that are attached to their tubes, and which are used to capture particles. Sometimes, the densities of blackfly larvae are so high that their aggregations appear like a carpet, with larval bodies apparently crowded in upon each other.

Aggregations of blackfly larvae in impounded lake outlets are often dominated by *Simulium noelleri* Friederichs, and may be exclusively of this species. They can form tight masses on the surface of dams and spillways, and rows where the substratum is near horizontal and where flow does not undergo any marked acceleration. On the horizontal surfaces of dams made of planks it is usual to find larvae clumped into aggregations and this may be a result of the hydrodynamic conditions present just before water plunges vertically. Interestingly, while larvae of *S.noelleri* can dominate impoundment outlets in the Palaearctic this habitat is characteristic of *Simulium decorum* Walker in the United States and in Canada. As the two species are impossible to tell apart morphologically as larvae (at least by me), and are closely related cytotaxonomically, it suggests that this habit is one which developed a long time ago, and that living in thin films of water pre-adapted these species for life in impoundment outlets.

I would be most interested to hear from anyone who has records of dense aggregations of *S.noelleri* at impoundment outlets, especially in the south of England. Roger Crosskey has kindly provided me with a list of sites where he collected this species, but I would welcome information from other blackfly workers.

Preliminary Notice of the 17th Annual Meeting, 1994

The 17th Annual Meeting of the British Simuliid Group will be held at the Liverpool School of Tropical Medicine and the Department of Environmental and Evolutionary Biology, Liverpool University, on Wednesday, September 21st, 1994. Further details will be circulated in due course, but John Davies, who is organising the meeeting, would appreciate hearing from anyone wishing to volunteer a talk or poster presentation.

John's address is *Dr. J.B. Davies, Division of Parasite and Vector Biology, Liverpool School of Tropical Medicine, Pembroke Place, Liverpool L3 5QA*. The School's phone and Fax numbers are (051) 708 9393 (phone) and (051) 708 8733 (Fax).

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SYSTEMATIC INDEX

Simuliidae (*Simulium* omitted)

Other Taxa

BRITISH SIMULIID GROUP BULLETIN

Number 4 December 1994

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From the Editor

Trefor Williams has been both the secretary of the British Simuliid Group and the editor of the Newsletter and the Bulletin since the Group was formed in 1979. At our last meeting Trefor expressed the wish to hand over the editorship and so I find myself the new editor.

The transition from a cyclostyled newsletter to Bulletin, a more polished production, has not been an easy one. I am fortunate that Trefor overcame the production problems before handing over, so I have the relatively easy task of continuing where he has left off.

We all owe Trefor a sincere vote of thanks for his editorship over the past 15 years. So, Trefor, from all of us - thanks for your unstinted efforts in keeping the Newsletters and Bulletin going - we really appreciate it!

I suppose it is inevitable that a new editor will be fired with enthusiasm and want to make changes, but we should remember the objectives of the Group as expressed by Gavin Gatehouse in the first issue of the Newsletter

"to maintain and develop contacts between those interested in simuliids and to provide for the exchange of news, information, requests and ideas concerning all aspects of simuliid biology".

Now that the production problems are over I think we have in the Bulletin an opportunity to widen the range of interests that it covers. You will notice that I have opened a "News and Correspondence" section to which I invite all members to submit short contributions - anything that might be of interest that other members may have missed or should know about, and that might stimulate some correspondence. This could also include any personal experiences of an anecdotal nature, or simuliid related extracts from newspapers or books.

Past Bulletins have been predominantly concerned with reporting the proceedings of our meetings. I would like to get some reaction from the membership as whether we should try to bring out a second number each year which would be made up of submitted or invited papers and correspondence. I believe that two issues a year, say in December and June, will keep interest going better, and would provide a vehicle for rapid publication. At present we can accept papers up to about 6 weeks before the puplication date. But this depends on **YOU**. If you send in the material I will do my best to get it published. I already have offers for about 12 pages for an additional number, so we only need another 4 or 5 pages to make it worth while.

As organiser of the 17th Meeting, I placed a notice of the meeting on an entomlogical electronic bulletin board (entomo-l) run by the University of Guelph through the Internet (see *Antenna* 18 (3): 102, July 1994 for details). This resulted in a number of requests for membership from Canada, U.S.A., Australia, and I am very pleased to say, from South Africa. Because we have to keep costs down I hope that those overseas members that joined via e-mail will agree to accept their copy of the Bulletin via e-mail. Unfortunately the e-mail version will lack illustrations and figures which we cannot at the moment transmit this way. But should you wish to receive the figures by conventional mail, please let me know. How about a page or two from our new overseas members telling us what is going on in your country?

We must move with the times. Electronic data transference via the Internet is becoming widely accepted and used. Trefor has opened a news list called **simuliidae** which anyone with access to the Internet can join (see his note). Both he and I are concerned that those members to whom this service is not available may feel left out, so we will publish in the Bulletin items that we think are of general interest and may generate some correspondence.

John Davies : *Liverpool School of Tropical Medicine, Pembroke Place, Liverpool L3 5QA.*

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THE 17th ANNUAL MEETING (1994) OF THE BRITISH SIMULIID GROUP

The 17th Annual Meeting of the British Simuliid Group was held at Liverpool University on 21 September 1994. It was hosted jointly by the Department of Environmental and Evolutionary Biology and the Liverpool School of Tropical Medicine. About 45 persons participated in the meeting. The customary dinner, held the evening before, was attended by 35 members, spouses and friends.

In the discussions that followed the meeting a number of members expressed concern that the content of the last few meetings had been strongly parasite orientated and feared that this was discouraging those members who were interested in other disciplines such as freshwater biology. This bias is understandable since the majority of funding available to simuliidologists these days is onchocerciasis or filariasis motivated.

It was felt that one way to attract a wider membership might be to invite someone to present a review paper on a specific subject at each meeting, and to widen the scope of the Bulletin, which might then appear twice a year, with the second number containing submitted papers. We should also consider holding our meetings jointly with other groups.

TALKS GIVEN AT THE 17TH ANNUAL MEETING

The meeting was opened by Professor Brian Moss, Head of the Department of Environmental and Evolutionary Biology, who gave a short and entertaining address of welcome which ended with a reading of a poem which had come to light during a recent renovation of his department. This is reproduced under "Notes and Correspondence".

"Going through the mill" A further look at the effect of the cibarial armature on ingested microfilariae

J.B.Davies: *Liverpool School of Tropical Medicine*
R. Luján: *Centre for Health Studies, Universidad del Valle de Guatemala.*

The cibarium is a structure found at the posterior end of the pharynx, which in some species of *Simulium* bears a cluster of sharp pointed teeth which project into the lumen of the food canal. The effect of these teeth in damaging microfilariae (mf.) of *Onchocerca volvulus* during blood feeding is well known and has been described by Omar and Garms (1975, 1977) and Collins et al. (1977) amongst others. It has been stated that less than 2% of ingested mf. may develop to the infective stage in the fly because of this damage Shelly (1994).

During our attempts to monitor the effect of a nationwide ivermectin distribution campaign by the Guatemalan National Onchocerciasis Elimination Campaign on the continued transmission of the disease, we have been counting the numbers of mf. ingested by the principle vector *Simulium ochraceum* when feeding on treated and untreated volunteers. After feeding to repletion, flies were immediately preserved in 100% ethanol. Later, blood meals were dissected out, then stained and cleared in lactoproprionic orcein using the technique described by Arzube and Shelly (1989).

The preliminary results indicate that when flies were allowed to feed as they would in nature, that is anywhere above the waist, the numbers of mf. ingested from the same person varied widely, and the proportion that appeared to be undamaged varied fron 0% to 30%. Two examples are given in detail. On a moderately infected volunteer with a mean skin mf. density of 18.5 mf./snip, 6 out of 10 flies ingested 37 mf. between them, only one of which was undamaged (Table 1). At the other extreme, from a very heavily infected volunteer with 463.5 mf./snip, all 9 out of 10 flies ingested between 98 and 980 mf. and numbers of undamaged mf. varied between 0 and 277. The 10th fly ingested a surprising 980 mf. of which 277 (28.3%) appeared to be undamaged.

Table 1 - Numbers of undamaged, damaged and portions of microfilariae counted in the blood meal of *S. ochraceum* that had fed on two volunteers with different levels of skin microfilariae.

Fly No.	Entire Undam.	Entire Dam.	No. of Portions	Est. Total
Volunteer No. 1 - 18.5 microfilariae/snip				
1	0	0	0	0
2	0	0	1	1
3	0	0	0	0
4	1	5	17	12
5	0	0	0	0
6	0	1	3	2
7	0	1	5	3
8	0	0	42	14
9	0	0	0	0
10	0	3	4	5
Volunteer No. 2 - 463.5 microfilariae/snip				
1	5	39	417	183
2	20	214	829	511
3	4	32	184	98
4	5	69	400	208
5	42	144	849	469
6	1	41	350	159
7	42	173	395	347
8	24	249	1213	678
9	0	30	242	111
10	277	352	1053	980

It is considered that the wide variation in uptake is a function of the variety of sites on which the flies fed, in comparison to the restricted sites employed in experiments by other workers. There is also the possibility that in some flies the cibarial mechanism may be less efficient at destroying mf. than in others. Statistical analyses to reveal any trends or density dependency will be carried out when a greater volume of data has been assembled.

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Density-dependent processes in the transmission of human onchocerciasis. Entomological aspects.

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The transmission success of *Onchocerca volvulus* is thought to be influenced by several regulatory or density-dependent mechanisms that act at various points in the two-host life cycle. We examine here the evidence for density-dependence in the *Simulium* host, namely, in the processes of microfilarial uptake by the flies, the development of the ingested parasites to the infective stage, and the fate of infected vectors. Analyses are based on published and unpublished data from three endemic areas: Guatemala, where the main vector is *S. ochraceum s.l.* -with a well developed cibarial armature-, West and Central Africa (*S. damnosum s.l.*), and South Venezuela (*S. guianense*) -the latter two vector species with unarmed cibaria-. The ultimate goal is to construct an analytical mathematical model to explore the relative contribution of the various biological processess regulating the population dynamics of human onchocerciasis. In particular, we want to test the assumption that the most important density-dependent mechanism in the transmission of this infection takes place within the simuliid host[1], and to explore its consequences for onchocerciasis control programmes.

The results indicate that in the three *Onchocerca-Simulium* combinations studied and range of parasite loads examined, the intake of dermal mff by the blackflies is essentially proportional to the intensity of the skin burden[2], and that mff ingestion by the vector may not be as strongly density-dependent as previously thought[3]. However, the relationship between the numbers of ingested mff and the numbers of parasites that successfully reach the haemocoele of the flies and develop to L3 larvae in the thoracic muscles is markedly non-linear, suggesting that density-dependence does operate at some point of this stage in the life-cycle. In the three parasite-vector combinations explored, the average number of successful parasites per fly increases initially with mff intake to level off at about 1-3 L3/fly at higher intakes. This phenomenon, known as 'limitation'[4] is confirmed for *S. damnosum s.l.* and found to apply equally to *S. guianense* (the two vectors without prominent cibarial teeth), whilst a pattern of initial 'facilitation'[5] is required to better describe the relationship between mff intake and L3 development in the range of low to moderate parasite loads in *S. ochraceum*. It is possible to explain this initial pattern in terms of density-dependent damage to the ingested mff by the cibarial armature exhibited by this species[6]. A marked difference between armed and unarmed blackflies is again found when the evidence for parasite-induced vector mortality is investigated. Mean survival times and life expectancies, measured at the beginning of survival experiments, decrease significantly with mff load in the three vectors, the decrease being more pronounced in those species without the protection afforded by the cibarial teeth. Mortality rates are well described by non-linear functions of time post-engorgement, in which increasingly higher death rates are experienced during the first 24 hr PE by those groups of flies fed on more heavily infected subjects. However, the amount of density-dependent parasite regulation in the simuliid host which really takes place in the field, will depend on how frequent is the acquisition of high parasite intakes by vectors in endemic areas. Frequency distributions of skin mff per person are usually highly overdispersed, with most people harbouring low to moderate mff loads[7].

The functional relationships thus found and the parameter values estimated from above have been included in a deterministic mathematical model describing pre-control equilibrium mean worm burdens per human and per fly host. Preliminary results suggest that density-dependence in the vector only may not be sufficient to explain the trends of Community Microfilarial Load (CMFL) vs Annual Transmission Potential (ATP) observed in the field[8,9]. Any speculation on the existence of a transmission threshold, or breakdown point, for epidemiological settings where the main vector has a cibarial armature, must be based on formal stability analysis of dynamic models. These models ought to incorporate the features described for the relationhip between *Onchocerca* and *Simulium*, as well as reasonable assumptions about the processes affecting the parasite in the human host. In the case of highly overdispersed distributions, the parasite intensities at which unstable equilibria occur, may be too low to have meaningful epidemiological relevance[7].

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Aggregated oviposition in the blackfly S*imulium damnosum* s.l. is mediated by a pheromone.

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Although many blackfly species are known to aggregate during oviposition, the nature of the phenomenon has not been studied, since the experiments of Walsh with *S. damnosum s.l.* in 1984 (Aspects of the biology and control of *S. damnosum s.l.* in West Africa, PhD thesis, Univ. Salford). Here, data are presented from a series of studies carried out using wild-caught *Simulium damnosum* s.l. in Sierra Leone, an important vector species which exhibits strong communal oviposition behaviour. Wild-caught flies were blood-fed on pigs and maintained for 3 days until gravid, when they were tested in a specifically designed behavioural bioassay. A series of two-choice bioassays showed that gravid flies preferred and responded more quickly to substrates already containing eggs over the relevant control, and that this response was related to the number of eggs present. The volatiles collected from freshly-laid eggs elicited similar behavioural responses but volatiles from eggs aged 12 hours post oviposition failed to elicit any response, in the same bioassay.

Gas chromatographic profiles of the egg volatiles showed 2 compounds which consistently emanated from fresh eggs, but which were significantly lowered after 12 hours. The same compounds were also found only in the ovaries of flies at 2 and 3 days post blood-feeding, and never in any other body region, at any other age, or in males. The possibility of either or both of these compounds being responsible for the behavioural responses is therefore very likely. A unique closed purified air system was designed to collect volatiles from actively laying blackflies in running water, and showed that only the same 2 compounds were occurring, indicating the probable absence of any compounds emanating from adult flies being involved in this aggregation behaviour.

Results showing the bioassay data, the gas chromatographic profiles of the extracts and volatile collections will be presented. The proposed advantages of an aggregated oviposition strategy for blackflies are considered. The possible use of such a pheromone is also discussed.

A novel method for age_grading blackflies by egg_sac relic enumeration

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The described method for physiological age determination in black flies is a modification of the age_grading method suggested by M.I.Sokolova for use in mosquitoes (Sokolova, 1983; Sokolova, 1994). The method is based on specific staining with neutral red of the morphological structures in ovarioles which indicate preceding gonotrophic cycles. It is used to distinguish the gonotrophic dilatations (follicular relics) and zones of granulation which result from egg_sac resorption. The presence or absence in ovarioles of these structures or their combinations allows identification of blackflies which have completed 1, 2 or 3 (or more) gonotrophic cycles. The first publication devoted to applying this method in blackflies was in Russian (Gryaznov, 1993).

Methods

Ovariolar structure was investigated in newly emerged females as well as in females captured from hosts. The formation of gonotrophic dilatations was studied in facultatively autogenous females *Simulium (Wilhelmia) equinum* L. maintained in the laboratory. Morphology of egg_sac and zones of granulation were studied in parous females kept in the laboratory after oviposition and in the obligatory autogenous blood_sucking species *Simulium (Psilozia) vittatum* Zett. maintained in the laboratory after oviposition.

The dissecting technique is presented in scheme in Fig.1. Females were dissected in a drop of isotonic solution to extract the ovaries. The wall of the ovary was cut and the ovary was stretched with needles. In a drop of isotonic solution, neutral red was added at a concentration 1:7000. Then, the ovary was transferred to neutral red solution for staining for 30_40 s. After turning over the ovary calyx side up and additional stretching with the needles, a small drop of mineral oil was put on the ovary and the preparation was additionally stretched with needles. Then a cover slip with paraphinum legs was put on the preparation. Microscopic examination of the preparations was done under a magnification of x70 to x400.

Results

Ovarioles of blackflies (the same way as in mosquitoes) are located between the ovarian wall and calyx surface (Fig.2). In nulliparous females, a terminal follicle is connected the to calyx surface by a pedicel. The internal tip of the pedicel is located approximately in the centre of a tiny ring that is the place where the ovariole sheath attaches to the calyx surface. The resorbing egg_sac forms a zone of granulation that is presented in the form of a cluster of brightly stained granules of various sizes, bound to the ovariolar sheath at the place where it is attached to calyx. The follicular relic looks like a small ball surrounded by a transparent cover. On the stained preparation, red and yellow granules are inside a follicular relic. The follicular relic is always located inside the ovariolar sheath and connected with connecting stalks (or pedicel) both to the terminal follicle and to the calyx surface.

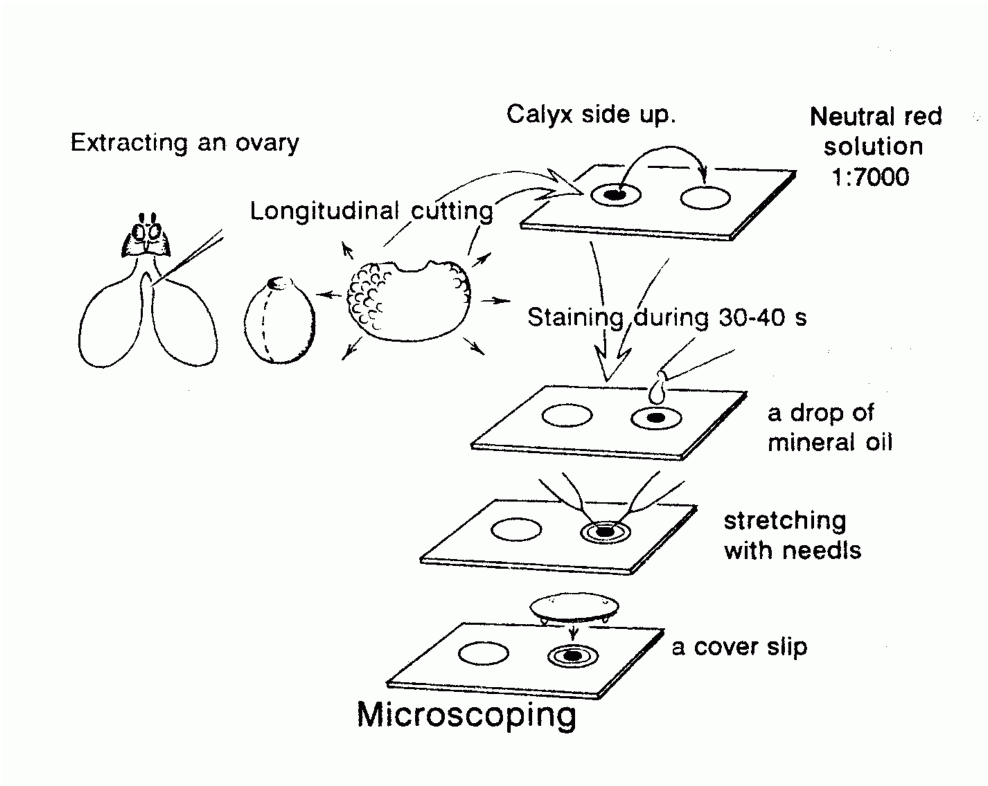


Fig. 1 Dissecting technique

Two different processes can occur in the ovariole during the gonotrophic cycle: either egg development with ovulation or degeneration of a terminal follicle. Egg_sacs are resorbed and form zones of granulation which accumulate in the ovariole with each gonotrophic cycle. After degeneration of the terminal follicle, a follicular relic (=gonotrophic dilatation) is formed. Number of zones of granulation and their combinations with follicular relics indicate the number of completed gonotrophic cycles. However, number of follicular relics in ovarioles does not correspond to parity of female.

It was shown that zones of granulation in the ovarioles of parous females are usually in the form of clusters of brightly stained granules of various sizes bound to the ovariolar sheath. They form a fragmented ring, while the calyx wall is stretched. It is possible to distinguish two zones of granulation in the each of the ovarioles in females after 2 (or more) ovipositions.

Females collected in nature were arranged in three categories: (a) nulliparous; (b) 1_parous; (c) multi_parous. In investigated multi_parous females, most of the ovarioles have no more than two zones of granulation, or a combination of one zone of granulation plus a follicular relic. The females of this category were suggested to be 2_parous. 568 host_seeking females were investigated at the Center of Eastern Europe. Among *Simulium (Odagmia) ornatum* Mg., *S. (Boophthora) erythrocephalum* De Geer and *S. (Schoenbaueria) nigrum* Mg. females 3.8%, 4.3% and 2.3% respectively were 2_parous (in the 3rd gonotrophic cycle). 6.5% of females in *S. verecundum_venustum* complex were found on the 3rd (or possibly older) gonotrophic cycle.

In parous females, some ovarioles drop germarium and terminal follicle and cannot be used for physiological age determination. The different variants of ovarioles were found in wild females of *Simulium verecundum_venustum* complex are shown in Fig.3.

Fig.2. Morphology of blackfly ovariole.

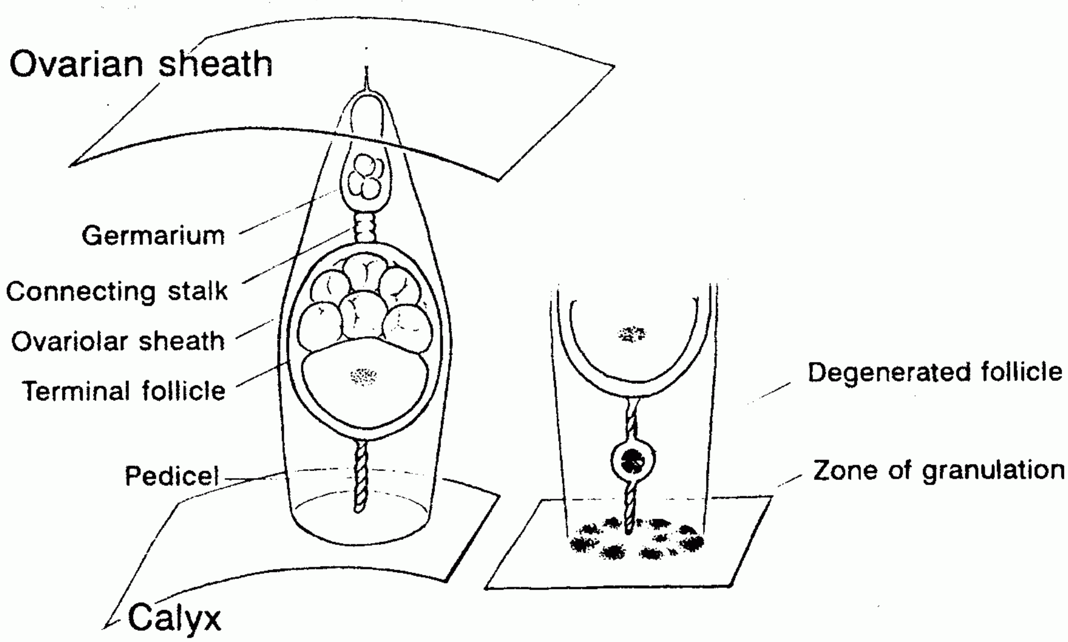
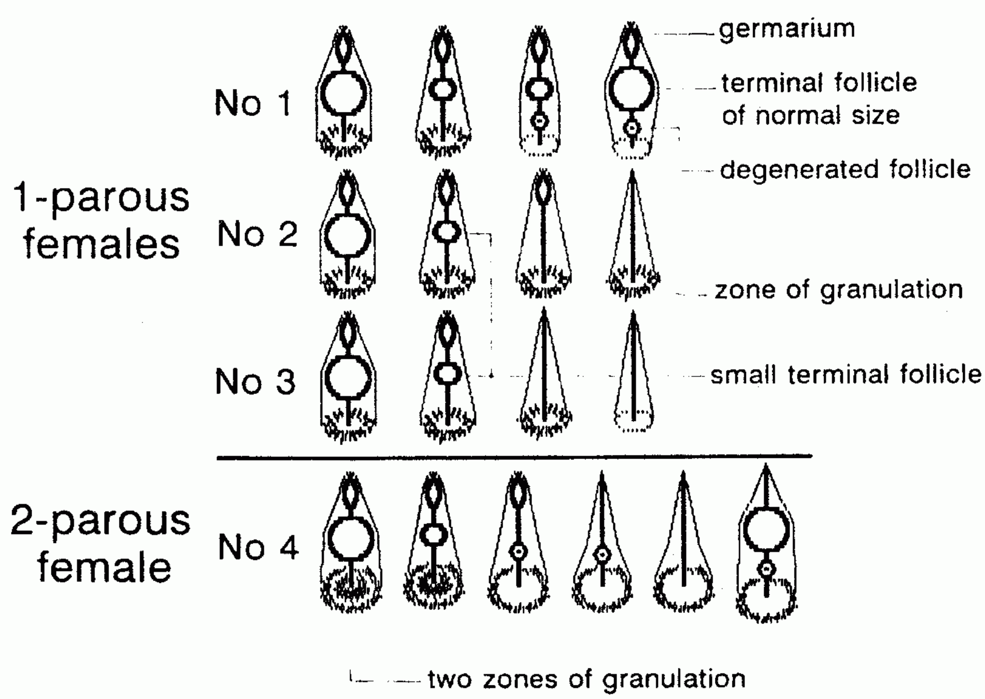


Fig.3. Variability of ovarioles in four females of *Simulium verecundum-venustum* complex attracted to the host.



The main principles of the age_grading method are as follows:

1. In black fly females, normal ovarioles respond to each gonotrophic cycle.

Therefore, either a granular zone or a degenerated follicle form in the ovariole with each gonotrophic cycle.

2. In an ovariole, the egg_sac is continuously reabsorbed and forms a granular zone.

3. A granular zone (as well as degenerated follicles) may be stained with neutral red and counted for parity determination in vital preparation.

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Characterisation and purification of immune peptides and proteins produced by simuliids in response to infection.

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Insects have been found to mount a strong humoral response to infection, this reaction includes the rapid release of antibacterial peptides and proteins into the haemocoel, where they act directly on potential pathogens (see review by Cociancich *et al.*, 1994). We are trying to identify the substances produced by blackflies and to elucidate their role in immunity (Ham, 1992).

We have isolated a lysozyme which is present in the haemolymph of *Simulium equinum*. This has the same molecular weight as hen egg white lysozyme and cross reacts with antiserum to silk moth lysozyme (Hultmark *et al*., 1980) Native polyacrylamide gels overlaid with bacteria have shown that, like other lysozymes, this molecule lyses the gram-positive indicator bacteria *Micrococcus luteus* (both when viable and when lyophilized) but does not lyse the gram-negative *Escherischia coli*. In addition to this role of protection against infection with gram-positive bacteria, this molecule is thought to be responsible for enhancing haemolymph antibacterial activity against *E. coli*.

In addition to *S. equinum* lysozyme, we have also identified two small, inducible peptides with anti-*M. luteus* activity. Native-PAGE indicates that one of these molecules has the same mobility as synthetic cecropin B (3.8kDa), the other has a lower gel mobility. HPLC purification followed by antibacterial assays have revealed three inducible peaks with anti-*M. luteus* activity. Two of these peaks contain molecules ranging from 8 to 14kDa (as determined by Mass spectrometry and SDS-PAGE). The peak with the highest activity contains a major peptide of 4.5kDa (determined by SDS-PAGE), this coincides with a 4.5kDa inducible peptide as determined by SDS-PAGE of whole haemolymph.

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Effect of zooprophylaxis on *Onchocerca* transmission by *Simulium* spp. In Cameroon.

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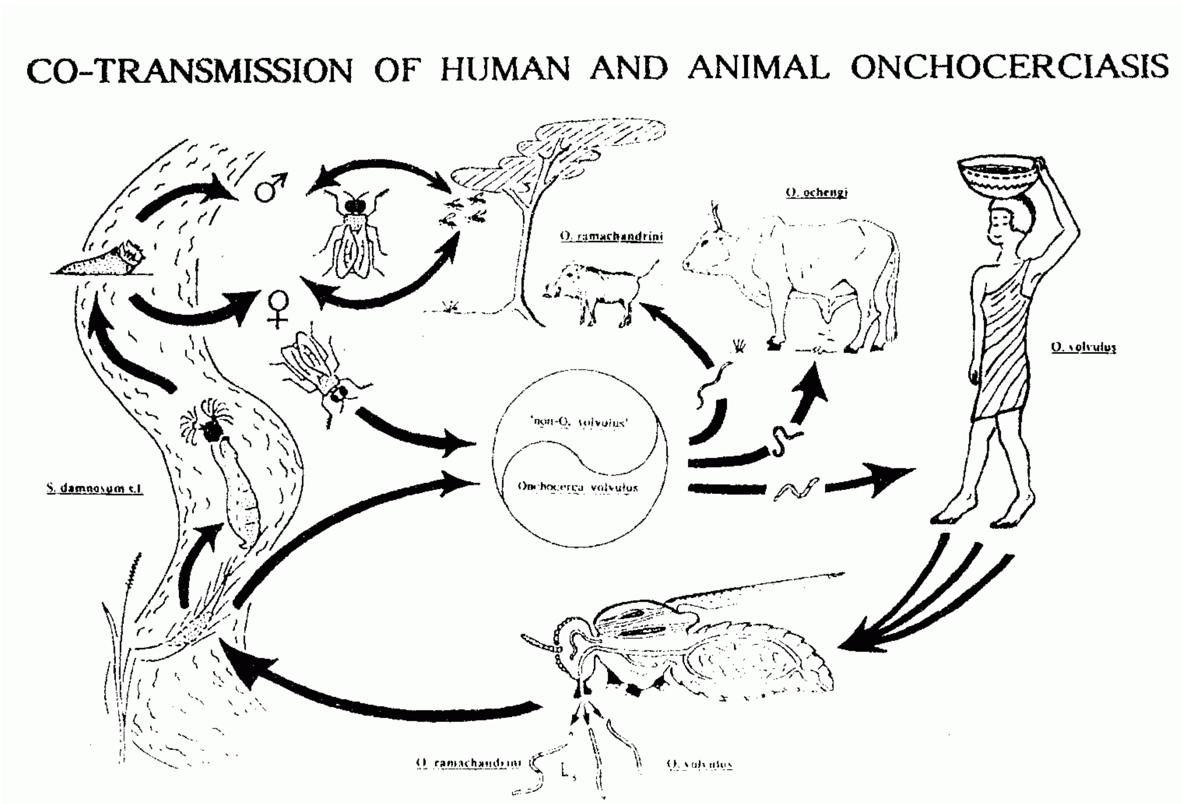
The microepidemiology of human onchocerciasis in the various bioclimatic zones of Cameroon depends on the biology of the local *Simulium damnosum* s.l. vector populations and on the species and strains of *Onchocerca* larvae they transmit.

In the grass highlands, the Sudan savanna, and in the rain forest areas of Cameroon, the prevailing species, namely *S. squamosum, S. damnosum s.s., S. sirbanum* and *S. mengense* exhibit different degrees of zoophagy (i.e. proportion of bloodmeals taken from non_human hosts): In cattle raizing areas like the Adamawa highland, the local *S. squamosum* population feeds predominantly on cattle and transmits mainly a bovine filarial species, *O. ochengi* (WAHL et al. 1994)

If compared to the standard human fly collector, cattle attract twice as many flies. Taking into account that cattle are five times more frequent than the human population in the Adamaoua highlands, this divertion of vector flies strongly reduces the vectorial capacity of the local fly population (zooprophylaxis, RENZ et al. 1987). Despite an extremely large *Simulium squamosum* vector population (ABR 120.ooo flies/man year at the river) the prevalence of human onchocerciasis is low (WAHL et al. 1994). In addition to the beneficial effects of this reduction of the vectorial capacity of the flies, the infective larvae of *O. ochengi,* which constitute over 90 % of all larvae in the estimate Annual Transmission Potential (25.ooo L3/man,year) may stimulate, when transmitted on man, an immune response which then reduces the chance of development of the forthcoming infective larvae of *O. volvulus* (crossreactive 'concomitant' immunity, RENZ et al. 1994, HOCH et al. 1993).

In the Sudan savanna, on average half of all infective larvae found in man_biting flies belong to *O. volvulus* (DUKE, 1967, RENZ, 1987), one third to *O. ochengi* and the rest to *O. ramachandrini*, a newly described species from the warthog (BAIN et al. 1993, WAHL et al. 1994). *S. bovis* occasionally comes to land on man in large numbers, but only rarely takes a bloodmeal. The frequent infections found in this vector stem from cattle (*O. dukei*, WAHL & RENZ, 1991) or from the warthog (*O. ramachandrini* ?). A third filarial transmission cycle in *S. griseicolle* is yet to be described.

In the rain_forest, only very few autochthonous cattle are kept nowadays. Thus, local *Simulium squamosum* and *S. mengense* populations presumably take the large majority of bloodmeals on the human population. They are nevertheless capable of transmitting *O. ochengi*. The on_going deforestation and the recent immigration of savanna *S. damnosum* s.s. into this forest area will certainly influence the future of forest onchocerciasis. Ornithofilariae are occasionaly observed (mainly in *S. kenyae*) but seem not to be of epidemiological importance.



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POSTER PRESENTATION AT THE 17th MEETING

Black fly control through vegetation management in the Thyolo Highlands of Southern Malawi

M. J. Roberts: *Liverpool School of Tropical Medicine*

Onchocerciasis affects some 150,000 of 750,000 people living in the 2,500 square km of the economically important tea_growing area of the Thyolo Highlands (Roberts, 1990).

The Vector Biology and Control section of the Malawi Onchocerciasis Control Project instituted a control programme in July 1992 aimed at reducing biting caused by *Simulium damnosum* cytospecies in the Highlands and this is run in conjunction with mass distribution of ivermectin.

The main component of the control programme is a scheme for management of stream vegetation associated with black fly larvae and pupae, to be supplemented by limited use of insecticides.

The vegetation management programme presently consists of a repeated schedule of manual removal of the aquatic plant *Hydrostachys polymorpha* from 126 black fly breeding sites along a 14 km stretch of the Nswadzi River. Removal of the plant is carried out by five teams of five men, each team being assigned a 2 to 3 km stretch of the river. A cycle of weed removal is carried out at 4 week intervals and each cycle normally lasts 4 to 6 days.

In the first two years, July 1992 to June 1994, vegetation management has been used exclusively, and has been accompanied by a significant reduction both in the size of immature black fly populations and in the intensity of black fly biting . Over the twelve month period, July 1993 to June 1994, black fly biting has stabilised at about 8% of pre_control levels and immature black fly populations at 5 to 6% of pre_control levels. Daily Biting Rates are down from a mean of 51 over the Highlands for the six_year period July 1986 to June 1992, to a mean of 4 for the twelve_month period July 1993 to June 1994.

In the 1994_95 season, the Project plans to introduce supplementary larviciding with BtH14 or temephos to control black fly populations at sites that are difficult of access including waterfalls and stretches of deeper water.

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NOTES AND CORRESPONDENCE

An Electronic News List For Simuliidologists

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Although it seems that most members don't have access to e-mail, my recent suggestion of an electronic news list for the BSG met with enough support to make this feasible. Let me say straightaway (and before you skip to the next article) that electronic news won't replace the Bulletin and, if it gives the BSG a higher profile and increased membership, should be to everyone's benefit. Items of general or long-term interest sent as e-mail will be published later in the Bulletin and, who knows, this might even lead to the Bulletin's appearing more often.

The list, with the listname **simuliidae**, is established on Mailbase, 'the UK's major electronic mailing list service' at Newcastle University. In fact, Mailbase does more than this suggests and provides archiving, file retrieval and a number of other services. It is funded by the Joint Information Systems Committee (JISC) of the Higher Education Funding Councils for England, Scotland and Wales, and is effectively free to the academic community. Although it stipulates that its lists are UK-based, Mailbase welcomes users from throughout the world.

You can join the list without further ado by sending this command as the text of an e-mail message to **mailbase@mailbase.ac.uk**

> **join simuliidae** *your-firstname(s) lastname*
> **stop**

Your usual e-mail address should be given in the 'From:' field of your message. Mailbase won't recognise you if you subsequently send mail from another address. 'Stop' must be entered as a separate line, but can be omitted if your e-mail has no automatic signature.

Information on how to use Mailbase is sent on joining the list. However, if you'd prefer to know more about Mailbase before taking the plunge I suggest you obtain the fully detailed User Guide by e_mailing to **mailbase@mailbase.ac.uk**

send mailbase user-guide
stop

Mailbase's documentation can also be viewed by gopher (server **mailbase.ac.uk**), the World Wide Web (URL **http://mailbase.ac.uk/**) and anonymous FTP (details in the User Guide).

To contribute to the list you must send your message to the listname, i.e.

To: **simuliidae@mailbase.ac.uk**

Please include a descriptive 'Subject:' field when mailing to the list - this will assist anyone browsing through the list's archives. Messages are distributed to all list users, though it's possible to suspend mail for a time. Replies are directed to the sender of a message by default, but this can be overridden if so wished.

I hope this will turn out to be a worthwhile venture - please join the list as and when you can and send in your news, requests, or indeed anything that might be of interest to other members of the BSG!

Spot the Deliberate Mistake

Roger Wotton: *Dept. of Biology, University College London.*

In a court case in the U.S.A a husband was put on trial for the murder of his wife, her body having been found in a car dumped in a river. As the water was cold it was not possible to date the time of death accurately and the husband claimed that his wife had disappeared in June. It was noted that there were blackfly cocoons on the front bumper of the car and Richard Merritt of Michigan State University was called in to identify them. His findings were used in the prosecution case as the pupal cocoons and exuviae of overwintering blackflies showed that the car must have entered the river in April or May. This evidence was partly responsible for a murder conviction being brought by the jury.

The BBC used this story as part of their programme "The Witness Was A Fly" broadcast earlier this year. The filming of the blackfly sequences was by Sinclair Stammers and he used a periscope for tracking shots of larvae and pupae along a car bumper placed in a laboratory aquarium tank. But how to get film of pupation? A prepupa was located spinning initial strands of silk for its cocoon and the camera focused on it until the cocoon had been completed and ecdysis had occurred. It sounds easy but there were anxious moments of waiting to see if we had the results required by the producer. After several failures we managed to get enough film of pupation for the short sequence in the programme.

Which brings me to the subject of the deliberate mistake. Sharp-eyed readers of the

Bulletin who watched the programme will have noticed that the blackflies used in the filming were not from North America but were of *Simulium noelleri* (collected in Kent).

Poem

Found during renovations and read to the meeting by Professor Brian Moss.

Advice from the Guardian Angel of University Heads of Department based on observations of the Lower Creatures

The blackfly is a nasty beast,
which bites you where you 'spect it least.
In shorts, by bubbling streams and rills,
Upon your tender bum it mills.

A pity that it's reprehnsible,
when its young is quite so sensible,
providing morals plain to see
for any watching H o D.

The larva's head fans catch each mote,
like hints of gossip you should note.
And ultimately should enquire
if they're just smoke or really fire.
It hangs quite tightly on with wads
of silk in which its hooks it prods.
Thus surviving currents fleeting
not unlike each term's staff meeting.

And when it has to, loops its girth
to more congenial bits of Earth,
where its head fans won't be hit
by flying lumps of words unfit.

However, there's a bad prognosis
if you achieve metamorphosis,
and then at times of grating stress
you get yourself into a mess.

No matter what your senior state,
the canvas straitjacket's your fate,
if, feeling in the darkest dumps,
you start to bite your colleagues' rumps!

Anon.

Specimens wanted

I am a black fly systematist currently engaged in doctoral research. My project is a genus_level phylogenetic reconstruction of the Simuliidae using rDNA sequence data. I also have morphologically_based revisions underway involving *Ectemnia* (with Peter Adler) and *Simulium (Psilopelmia)* sensu Coscaron. Soon to be submitted is a paper encompassing my Master's research, a revision of the *S. jenningsi* group, which was done in Peter Adler's lab.

My current DNA research is aimed towards identifying the major clades within the Simuliini sensu Currie 1988. If my phylogenetic analysis gives a well_supported tree, I will perhaps propose a classification scheme. Resolution of the groupings at the tips of the tree is critical for the latter. I am also interested in superimposing morphological characters onto the phylogeny in order to answer questions about character evolution in the family.

I am lacking suitable material of a few critical taxa, namely Paracnephia, Procnephia, and the Australian "Cnephia". Inclusion of these taxa is especially important since they have been cited as some of the most primitive taxa within the Simuliini sensu Currie. Any assistance in the acquisition of 95_100% ethanol_preserved material of these taxa for DNA analysis would be very appreciated.

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Request for comments on apparent residual activity of *Bacillus thuringensis*

I have spent 3 years examining the rate of blackfly larval development following single_site field applications of larvicides. The data were used to determine the timing of successive larvicide applications for large_scale control purposes. Although there was considerable variability in development rate, water temperature was the strongest determinant. I then went ahead and booked a helicopter well in advance to ensure successful control. Imagine my surprise to find larval development much slower after large_scale field applications. It seems that there is some sort of residual toxicity following Bti applications. In addition, it seems that the downstream carry of larvicides is enhanced by multiple_site applications. The preliminary single_site trials seem to underestimate things a bit, and I was wondering if anyone else has experienced similar responses, or has ideas of how to correct for multiple_site applications.

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[These last two items have been filtered out of the Internet - Ed]

A Turn-up for the Book: Blackflies in the Galapagos

Roger W. Crosskey and Anthony J. Shelley: The Natural History Museum, Cromwell Rd., London, SW7 5BD, U.K.

Received truth is that there is no running water in the Galapagos Islands. The encyclopedias, the geographies, the expedition reports have said so at least since Darwin's time: thirst-maddened sailors quaffed the urine of the giant tortoises in these 'frying pan hot' islands. Given this, and the fact that simuliids had never been found in such an exhaustively researched archipelago, one of us ventured the comment in his book (Crosskey, 1990) that "these islands are streamless and have no blackflies". Against the odds, however, one species *Simulium bipunctatum*, has recently been found breeding on San Cristobal, the easternmost island - and not only that, biting humans too (Abedraabo et al., 1993).

Darwin and Fitzroy gave San Cristobal (=Chatham Island) a pretty poor press. The interior was like the 'iron furnaces near Wolverhampton', a wasteland of volcanic chimneys and bare and naked lava flows, rough and uncolonized. There were no swarming insects so the birds were seed-eaters. Still, it turns out that blackflies, in their resourceful way, have a toehold even in this inhospitable place where the lava (as on the other islands) is mainly too porous for flowing water. No streams reach the sea, but precipitation at higher altitudes on the southeasterly part of the island produces running water sufficient (at least in the last few years) to permit the development of *S. bipunctatum* and the fly is now well established in the uplands above 300 m. Here it troubles the inhabitants on the banana farms, who associate the appearance of the flies with banana cultivation. Angus McCrae (1968) noticed in Uganda that *S. damnosum* s.l. females swarmed in places where banana beer was brewed - so we like to think that something similar could be going on with *bipunctatum* in San Cristobal. Attraction to humans is 'out of character' given that this species is markedly zoophilic in the coastal parts of mainland South America.

References

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Tepuis, Sundews and Simuliids

J.B. Davies: *Liverpool School of Tropical Medicine.*

Tepuis are rocky plateaux which rise a sheer 1000 feet or more out of the Amazonian rain forest of southern Venezuela. They are thought to have provided the inspiration for Conan Doyle's "The Lost World".

On a recent collecting trip to Guatemala I was trapped in my hotel room by a thunder storm and whiled away the time by skipping through the 54 channels on the cable television. One of them "The Discovery Channel" happened to feature an interesting account of a helicopter expedition to a tepui named Kukanam which is close to mount Roraima which itself forms the point at which the borders of Venezuela, Guyana and Brazil meet.

Apparently there is very little soil on the tepuis as any humus that forms is washed off by the frequent heavy rain. this has led to an abundance and great variety of insectivorous plants. One shot showed species of *Drocera*, a sundew-like plant capturing a small flying insect. There was no doubt that this was a species of *Simulium*, and a female at that. Furthermore, from what I could see from the few seconds the shot was on the screen, it looked uncommonly like *S. guianense*, but I could be wrong since in this area the females of many species are similar in appearance.

S. guianense is one of the suspected vectors of onchocerciasis in S. Venezuela, and it is usually found breeding on the lip and face of waterfalls and the rapids below them. Could it be breeding in the dramatic waterfalls which fall off the edge of tepuis, and does it actually breed in the rocky rivers which flow across these plateaux?

Source: *"Terra-X - Tepuis - Kukanam"* produced by John Borst for the Discovery Channel.

BRITISH SIMULIID GROUP BULLETIN

Number 5 June 1995

CONTENTS

<u>From the Editor</u>

At the last meeting of the British Simuliid Group, it was suggested that it might be a good idea to try to issue the Bulletin twice a year, in order to maintain interest. As a result, this current number is the first which is not dependent on abstracts of presentations for its content.

I would like to thank those who have provided material for this number, and repeat my earlier request for any snippets of news that readers may come across during their activities in the field or in the library.

This publication is issued in numerous simultaneously obtainable copies for permanent scientific record.

It is with great sadness that this Bulletin has to record the death of Colin Fairhurst. He was always a very supportive member of the British Simuliid Group from its inception in 1979 and took an active part in organising the meetings of the Group that took place in Salford.

I would like to remind readers that details of an e-mail list service for simuliidologists can be obtained from Trefor Williams sp36@liv.ac.uk

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AN APPRECIATION OF COLIN FAIRHURST

Stan Frost, *Environmental Resources Unit, University of Salford.*

Those who knew Colin have their own memories and reminiscences. He had a capacity to relate at different levels and adapted quickly to different circumstances. He was always ready with a laugh and a joke.

We first met when he was teaching in Stockport. He was a guest lecturer sharing ecological insights with our MSc in Environmental Resources. It was no surprise when he moved over to Salford to take an active part in coordinating the programme. The academic challanges of the mid- to late '70s, coupled with financial disruptions of the early '80s, gave Colin opportunities to consolidate his position in the new Biological Sciences Department and to develop his research interests in Dutch Elm Disease, soil ecology and aquatic monitoring.

There always seemed to be a group of research assistants in his office and Colin proved to be loyal and supportive both to his students and to staff colleagues. His teaching reflected his personality. His interests ranged from old fast cars to millipedes. He was able to couple the data gathered by the pedestrian biologist with his statistical vision. His predictive analysis had significant potential for the impact assessment of the Onchocerciasis Control Programme.

Changes during the last ten years of Colin's life affected his family, his work and his colleagues. We were watching an indefinable shift which none seemed able to prevent. His death on Boxing Day 1994 marked the passing of a much loved colleague and friend who had so much further to travel.

MEETINGS

The 18th Annual British Simuliid Group Meeting: 1995

The meeting this year is being held at the University of Birmingham on Wednesday, 13th September.

Kindly treat this preliminary notice as a 'call for papers' and poster contributions. If the more 'established' workers in University departments and in Institutes have students just entering Simuliid work, then please encourage them to attend and to offer a poster or contribution.

Overnight accommodation is available at Lucus House (Conference Centre): Bed and Breakfast @ £35 to £40 per night. For those arriving on the Tuesday evening it has been suggested that our usual informal dinner be held in a local, highly recommended Balti House. The Birmingham 'Balti' is something of a culinary delight!

Please get in touch with us as soon as possible, letting us know your requirements, together with a submission (title/abstract) of any presentation.

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The 1995 Annual Meeting of NE118.

Douglas A. Craig, *Department of Biological Sciences, University of Alberta, Alberta, CANADA T6G 2E9*

The annual meeting of the North Eastern Regional Project (NE118) was held between 23_25th, February, at the Rancho de la Osa, Sasabe, Southern Arizona. These meetings which have been convened since 1977, have essentially become the annual meeting for North American workers on Black Flies.

Curious about why an oddly named "project" should attract an international group of some 30 entomologists, or why it should be meeting at a place half a mile north of the Mexican border and distinctly isolated to say the least? Well, the United States Department of Agriculture, Agricultural Reseach Service, via the Deans of the land grant universities, establishes "Technical Advisory Boards", or working groups, to help deal with agricultural problems.

Nine Northeastern States joined together in 1977 to form what was termed

"NE118", with the five year mandate to work on "Black Fly Damage Threshold, Biology and Control". The mandate has changed over the years and is not likely to be renewed at the end of the present term, which is next year. Black Flies are not viewed with as much concern as they were in 1977 _ in large part because of the work of this group. A satisfactory reason to be disbanded _ maybe?

Right from the beginning, at the Dixville Notch, New Hampshire meeting, there has always been an interesting mix of people who travel to the NE118 meetings. Importantly there is a good mix of graduate students, university professors, government employees, company representatives, and even occasionally self_employed people. Canadians have always been present, often in considerable numbers, and have held "office" in NE118. Over the years, it has become expected that most attendees will present something of their work, or comment on that of others. One can never tell when a useful piece of information will turn up from an unexpected scource. This had made these meetings extremely useful for keeping up with the current state of Black Fly work in North America, and occasionally elsewhere _ this year Dr. Roger Crosskey, London, England attended. Talks ranged all the way from a US$3,000.00 control programme in Pennsylvania, to a video presentation of pharate pupae cocoon_spinning behaviour, to the most arcane molecular biology. Everyone stayed awake and listened, even after a fine lunch! Yes, food was one of the reasons NE118 was held at the Rancho de la Osa.

Of great value at NE118 is that there is always time for talking in detail after the more formal presentations. So, over the years there have been a number of firm friendships formed and very productive research collaborations.

This time after the formal sessions and at the "Business Meeting", held in the 200 year old cantina (= bar) on the ranch, it was clear that NE118 was coming to the end of its final mandate. This leaves one more year to go and there was considerable discussion about what should be done in 1997. One suggestion was to see if a more international black fly meeting could be held somewhere. Otherwise, it was felt that the group could probably keep going on an informal basis. Time will tell.

Part of wanting to keep the group going is that in the last few years the meetings have been held in warmer venues _ perhaps one of the reason why Canadians attend. Last year in central Florida at the Archbold Biological Station, there wasn't a black fly larva to be found within hundreds of miles. So even inveterate collectors had to concentrate on the formal sessions. Not so at the Rancho de la Osa, for larvae were collected some 22 miles away. Quite interesting, since Sasabe is in the middle of a desert and most of the waterways in the vicinity are highly eroded and subject to flash floods.

So, in 1996, give some thought to attending what will probably be the last meeting of NE118. Where will it be held? Well, that is not settled, but Texas is top of the list, then the Florida Everglades, then Archbold Station again. For further information about this meeting and to get yourself on the mailing list, contact the new Secretary, Dr. Jim Sutcliffe, Department of Biology, Trent University, Peterborough, Ontario, Canada. K9J 7B8. PHONE (403) 748_1424. FAX (403) 748_1205. E_mail_ "jsutcliffe@trentu.ca".

NOTES, NEWS, VIEWS AND CORRESPONDENCE

Birchflies and Bothys

James Coupland *CSIRO Biological Control Unit, Campus international de Baillarguet, Montferrier sur Lez, 34982, France*.

Canadian colleagues who study blackflies occasionally ask me (a Canadian) why I worked on these beasts in Scotland when obviously Canada has an overabundance of them. Which is exactly the reason with which I usually answer them. While the blackflies in Scotland may not be quite as ferocious as their colonial brethren, Scotland offers in its own way unique experiences for the intrepid simuliidologist. Of which I was following in the footsteps of C.B. Williams, A.E.R. Downe (my Professor at Queens in Canada),and L. Davies (though perhaps he has a different view!).

My abode during my studies in the Highlands was a small bothy on the property of Brigadier Curtis just below the "big house". The Brigadier was a slightly eccentric fellow owning several miles of the Spey and Feshie rivers which he was forever patrolling in his war against canoeists and poachers. He greatly despised canoeists and since poachers were only hypothetical, directed most of his energies against the former. He could often be seen in animated discussion with paddlers as they made their way down the river. Since I worked on the river daily, I was immediately deputised as "bailiff" and basic foot soldier. Sundays meant I was woken at 4:30 a.m. to patrol against possible Glaswegian poachers and early morning canoeists I was given a two_way walkie-talkie and code named "blackfly" (very clever). The only saving grace in all this was that the Brigadier also dragged in other estate owners and gave them ludicrous code names (cock_robin, pinecone etc..).

My sampling techniques for biting blackflies often raised a few eyebrows both among the locals and tourists. I would often borrow children for a morning to catch attacking blackflies. My presence in various woods brandishing a large white sweepnet, while circling the children gave rise to the rumour that ancient pictish sacrificial rites were being carried out in the region. The kids didn't mind as they always got their bag (sack) of candy. One tourist couple from Italy I'm sure returned home with an odd story. On this day I was taking samples off an adult in as many habitats as possible. At our first stop, this Italian couple caught me on my knees trying to poot several landing flies off the lower back of my subject. An embarrassed silence followed, and the couple beat a hasty retreat. At our second site (4 kms away!) the same couple again came across us in an even more embarrassing situation (off the lower leg) and again beat a hasty retreat. To top it off 5 hours later at a site high in the Cairngorms this same couple strides over the hill and there we are again! An expletive in Italian was heard and that was the last we saw of them.

While the Scottish weather was not very accommodating, I was afraid that the locals were going to be similarly inclined especially as my first visit to the "local" pub was similar to the famous scene in "An American Werewolf in London". However, after assuring them that I had nothing to do with either the RSPB or NCC I was grudgingly accepted and indeed made some lasting friends. In my first field season (the wettest summer on record) I wondered often why I ever chose to come to Scotland (as I sat shivering in the drizzle in mid_August). I collected few flies that season and was pretty depressed. The most interesting affair during that year was my attendance at the BSG meeting in Wareham, Dorset where the reverse on my ancient Volvo failed. I had to be pushed out of the parking lot and pointed towards Scotland (I made it too!). As luck would have it the next summer was warm and sunny and I was able to collect some flies and even had visitors including Mike Service who gave me the benefit of their wisdom.

I look back fondly on my time in Scotland (from the warmth of southern France!). There are still a lot of interesting questions to be answered there and perhaps there will be yet another brave simuliidologist to follow in my tracks. If so, beware of the highland cattle!

[My Collins English Dictionary gives: "Bothy. Scot. a small roughly built shelter or outhouse esp. a hut on a mountain slope" - Ed.]

SCIENTIFIC COMMUNICATIONS

On the European blackfly *Simulium lundstromi* and inclusion of *S. latigonium* as a new synonym within this species

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Roger W. Crosskey: *Department of Entomology, Natural History Museum, Cromwell Road, London SW7 5BD, UK*
Doreen Werner: *Museum für Naturkunde, Humboldt Universität, Invalidenstrasse 43, 10115 Berlin, Germany*

A problem that has had to be decided before finalizing new keys to the larvae and pupae of British blackflies (JABB, in preparation) has been whether or not *Simulium latigonium* (Rubtsov) and *S. lundstromi* (Enderlein) are one and the same species. Lewis Davies thought not, and in his coverage for Britain (Davies, 1966, 1968) treated them as separate valid species (the latter under the misapplied name *angustitarse* Lundström): he recorded '*angustitarse*' (= *lundstromi*) as widespread in Britain but *latigonium* from only one site (Sunbiggin Tarn outlet in Cumbria). Our investigations have led us to the opposite conclusion, viz. that only one species is involved and that *latigonium* should be treated as a (new) synonym of *lundstromi*. The story is complicated, so we think it proper for establishing the synonymy to detail the facts underlying the decision and to give a short general account of *Simulium lundstromi* now that it subsumes *S. latigonium*. (We had hoped to dispose of the matter much sooner but were stalled until this year by being unable to obtain the loan of the holotype and topotypic material of *latigonium* from Russia. This has now been resolved through the courtesy of Dr A.V. Yankovsky.)

Apart from the scientific aspect of how to assess variability, the *lundstromi/latigonium* issue has the elements of classical taxonomic muddle - irregular but available proposal of a specific name, misidentification, problems with types and a large but relevant faunotaxonomic literature of varying quality (163 literature items bearing on *lundstromi* have been found and considered). We need not enter into detail, but as background to the faulty use of names by Davies the following explanation is pertinent. Edwards (1920), in the first account of the immatures of British blackflies, described a species with 4-filament pupal gill and 'horned' cocoon under the name *angustitarse*; Enderlein (1921), however, correctly considered that this was a misidentification and (there being no other applicable name) proposed *lundstromi* as a name for *angustitarse* sensu Edwards. Enderlein's citation was the soul of brevity - "N. Lundströmi Enderl. 1921 [angustitarsi Edw. 1920, nec Lundstr.] England" - but his name (now correctly rendered *lundstromi* under the rules of nomenclature) is available because of the back-reference to Edwards' description as *angustitarse*. Unfortunately, Puri (1925), Smart

(1944) and Davies (1966, 1968), in their influential key works, omitted any mention of *lundstromi*and continued with the old Edwards misidentification of *angustitarse*.

Simulium lundstromi/latigonium, though widely distributed in lowland England, is not common at any site and this makes it impossible to obtain material 'to order'. However, over the last twenty or so years two of us (JABB and RWC) have collected specimens from various sites, and this material, combined with new material from Germany (collected by DW), the loan to us of Russian material, re-examination of Davies' collection (now part of the NHM collection in London), and copies of old but very relevant correspondence between our colleagues Heide Zwick and Lewis Davies, has enabled us to assess the likely significance of morphological variation within *lundstromi/latigonium*. The upshot is that we attribute no interspecific significance to the ostensible specific differences indicated by Davies (see later) and have found no other characters to suggest the existence of two distinct species; such variation as exists we consider intraspecific. This view is shared by Heide Zwick, who (in litt. to RWC, 29.9.93) has written "I fully agree and support your establishment of synonymy between *lundstromi* and *latigonium*".

Type localities and type specimens

The type locality of *lundstromi* is the Lark river, Mildenhall, Suffolk, England, in accordance with the designation by Zwick (1974) of an original specimen of *angustitarse* sensu Edwards from the specimens that under the rules of nomenclature constitute the *lundstromi* type material, i.e. all English specimens recorded as *angustitarse* by Edwards (1920). The lectotype is an adult male in alcohol (genitalia missing, ? reason) with its pupal skin. It was collected by Edwards on 25.iv.1916. Several paralectotypes, some from the same sample as the lectotype, are in NHM, London (one also in Berlin Museum). These have been listed by Zwick (1974). Three of them, non-reared females from Bovisand (Devon), Corfe Castle (Dorset) and Stokenchurch (Oxford), are technically paralectotypes of *lundstromi* but actually (as shown by the subcostal hairing character mentioned later) specimens of the true *angustitarse*.

Whether *lundstromi* still exists at its type locality is questionable. Attempts to find it in the Lark river (by RWC on 17.iv.93 and 10.v.94) were unsuccessful, though *S. equinum*, *S. erythrocephalum* and *S. ornatum* were present at and near Mildenhall. The river, though, has been much changed in regard to habitat by flood control measures since 1916.

The type locality of *latigonium* is the Sitenka river in Luga District, St Petersburg (ex Leningrad) Region. The holotype was collected here by Rubtsov on 22.viii.l955. It consists of larval parts (head and mouthparts, anal sclerite and circlet, pharate pupal gills) on one slide; this bears the red 'Holotypus' label of the St Petersburg Academy of Sciences and the name 'Eusimulium latigonium', the number '8812' and the collecting data in Rubtsov's hand. We have also seen a similar larval paratype slide with the same data (except number '8760') and seven pinned adult flies (3 _, 4 _). The latter were collected by Rubtsov at the Sitenka river type locality on 8.vii.1960 and each has its dry pupal skin. These topotypic adults have no type status but they have enabled us to form a correct understanding of *latigonium*. Examination of these specimens has confirmed - as we long suspected - that Rubtsov's (1956, 1962) figures of the pupal gill and the ventral plate of the male genitalia are somewhat misleading. Unfortunately, Rubtsov's original slide of *latigonium* male genitalia is lost or apparently so (Yankovsky in litt. to RWC, 23.2.1993).

Simulium (Nevermannia) lundstromi (Enderlein)

lundstromi Enderlein, 1921: 200 (*Nevermannia*) [no description, name available by back-reference to description by Edwards (1920) as *angustitarsis* Lundström]. LECTOTYPE _, with pupal skin (designation Zwick, 1974: 94), ENGLAND: in Natural History Museum, London [examined].

kerteszi Enderlein, 1922: 68 (*Nevermannia*). LECTOTYPE _ (designation Zwick, 1974: 96), HUNGARY: in Museum für Naturkunde, Berlin [examined and synonymized with *lundstromi* by

Zwick (1974)].
latigonium Rubtsov, 1956: 830 (*Eusimulium*). HOLOTYPE larva (parts only), RUSSIA: in Academy of Sciences, St Petersburg [examined]. **Syn. n.**
[*angustitarse*: authors, not Lundström (misidentification): Edwards (1920), Puri (1925), Smart (1944), Grenier (1953), Carlsson (1962), Davies (1966, 1968) and in many minor pre-1970s works.]

Recognition

Member of *Simulium (Nevermannia) ruficorne* species-group for which principal characters are: __ radius fully haired, fore tarsi slender, postnotum bare: _ genitalia with strongly keeled lamellate ventral plate, one main parameral spine, long truncate styles and rod-like median sclerite: _, claws toothed, hind tibia with sub-basal dark band, abdomen fully haired: *pupa*, 4-filament pupal gill and non-collared cocoon: *larva*, head spots positive, postgenal cleft extending forwards not more than half way to hypostomial base, abdomen with ventral papillae. *Simulium lundstromi* is distinguished from other western Palaearctic species of the group by (1) cocoon with well developed anteromedian projection ('horn') and closely woven, (2) pupal gill with uppermost filament strongly arched basally (angle 75°-95° with base of filament 2: Fig. 3), (3) larval postgenal cleft well developed, extending about one-fifth of distance to base of hypostomium, usually more or less square (Figs 1 and 2), (4) head venter nearly always with saddle-like or slightly H-like pigmented mark anterior to and around postgenal cleft (Figs. 1 and 2).

Distribution

Palaearctic species widely but locally distributed from western Europe (including British Isles) to eastern Siberia and northern China. Absent in Mediterranean and Atlantic islands. Reported* from: Algeria[c], Austria [c], Belgium[d], Britain[a,c,d], Bulgaria[d], China[c], Czech Republic[c], Denmark[a,c,d], France[a,c], Germany[a,b,c,d], Hungary[b], Ireland[c,], Italy[a,c,d?], Morocco[c], Norway[a], Poland[a], Portugal[a], Romania[a,c], Russia[a,b,c,d], Serbia[a,d], Slovakia[c], Spain[c,d], Sweden[a], Switzerland[c], Turkey[c], Ukraine[a,b,c]. [North African reports dubious, perhaps involving allied species.]

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* Superscripts show *lundstromi* has been reported under the name(s): a, *angustitarse* (in misidentified sense); b, *kerteszi*; c, *latigonium*; d, *lundstromi*, [Contact RWC if country references required.]

In Europe *S. lundstromi* is not uncommon in the plains of Denmark and northern Germany. From Germany we have seen numerous adults with pupal skins (in Berlin Museum) obtained in Havelland by Enderlein and identified by him as *lundstromi*, and in the last three years one of us (DW) has collected material from many sites throughout Brandenburg; Seitz (1992) has found the species widespread in Bavaria. In Britain *S. lundstromi* occurs in lowland areas from Dorset and Wiltshire northwards at least to Yorkshire. It has been collected in all counties of South East England (47 known sites in RWC survey records) and East Anglia; Post (1981) records *lundstromi* from several sites in Norfolk. One of us (JABB) recently confirmed that it is still present at the Sunbiggin Tarn exit stream in Cumbria whence Davies recorded *latigonium*. This is a curious site since occurrence in a generally acid moorland environment is unexpected; the site lies, however, on Carboniferous limestone and both the water-plants and streamside vegetation of the habitat are more typical of alkaline areas (JABB, personal observation). (Distribution in southwest England, Wales and Scotland is unclear: some record spots on Davies' (1968: 109) map for '*angustitarse*' are apparently based on old records of wild-caught flies probably misidentified.)

Descriptive notes and variation

The most useful illustrated taxonomic descriptions of the larva, pupa and adults are those of Davies (1966, as *ang.* + *lat.*, in English), Grenier (1953, as *ang.*, in French) and Rivosecchi (1978a, as *lat.*, in Italian). Knoz (1965, as *lat.*), and Davies (1968, as *ang.* + *lat.*) give illustrated coverage in English-language keys. The following works are also useful for their illustrations of significant features (some reproduced in this article). (1) postgenal cleft - Beaucournu-Saguez (1975, *lat.*), Clergue-Gazeau (1991, *lat.*), Jensen (1984, *lat.* + *lund.*), Jensen & Jensen (1973, *lat.*), Knoz (1980, *lat.*), Rivosecchi (1966, ? *lund.*, 1967, 1978b, *lat.*), Zwolski (1959, *ang.*); (2) pupal gill - Adler & Wang (1994, *lat.*), Beaucournu-Saguez (1975, *lat.*), Clergue-Gazeau (1991, *lat.*), Jensen (1984, *lat.* + *lund.*), Jensen & Jensen (1973, *lat.*), Rivosecchi (1966, ? *lund.*, 1978b, *lat.*), Rubtsov (1962, *lund.*), Zwick (1974, *lund.*); (3) cocoon (showing 'horn') - Adler & Wang (1994, *lat.*), Clergue-Gazeau (1991, *lat.*), Jensen (1984, *lat.* + *lund.*), Rivosecchi (1966, ? *lund.*, 1967, 1978b, *lat.*), Zwick (1974, *lund.*); (4) _ genitalia - Beaucournu-Saguez (1975, *lat.*), Clergue-Gazeau (1991, *lat.*), Knoz (1980, *lat.*), Rivosecchi (1966, ? *lund.*).

Most larval characters, including the positive head-spot pattern with its elongate posteromedian mark, are very constant, but the shape of the postgenal cleft and the intensity of the pigmented area on the head capsule venter show some variation (Fig. 1). Some authors have attributed interspecific significance to this, but we consider this variation as all intraspecific. The cleft usually has parallel sides and is approximately square (Fig.1c,d,i) or slightly wider than deep (Fig.1b,f,g,k); sometimes, however, the sides diverge slightly towards the rear, so giving the cleft a more trapezoidal (Fig. 1l) or even subtriangular form. Davies (1968) and Jensen (1984) distinguished *latigonium* from *lundstromi* (*angustitarse* sensu Davies) on this basis, the former having the deeper and more square cleft (cf. figs 1i,j and 1k,l);

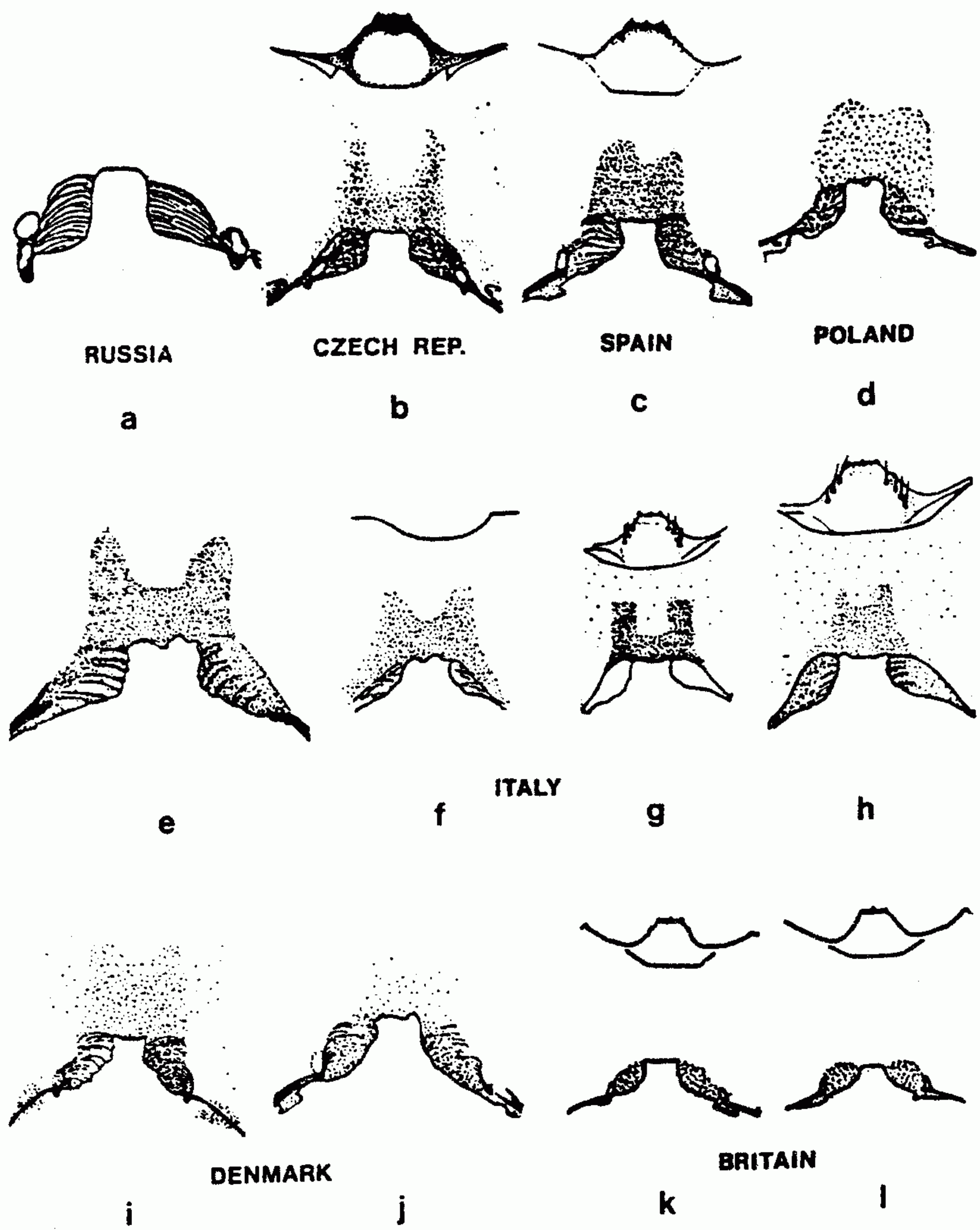

Fig. 1. Larval postgenal cleft and part of head venter, from various authors, countries as shown: a, Rubtsov (1956, *lat.*); b, Knoz (1980, *lat.*); c, Beaucournu-Saguez, 1975, *lat.*); d, Zwolski (1959, *ang.*); e, Rivosecchi (1966, '? *lund*'.); f, Rivosecchi (1967, *lat.*); g, Rivosecchi (1978b, *lat.*); h, Rivosecchi (1978a, *lat.*); i, Jensen (1984, *lat.*); j, Jensen (1984, *lund.*); k, Davies (1968, *lat.*); l, Davies (1968, *ang.*).

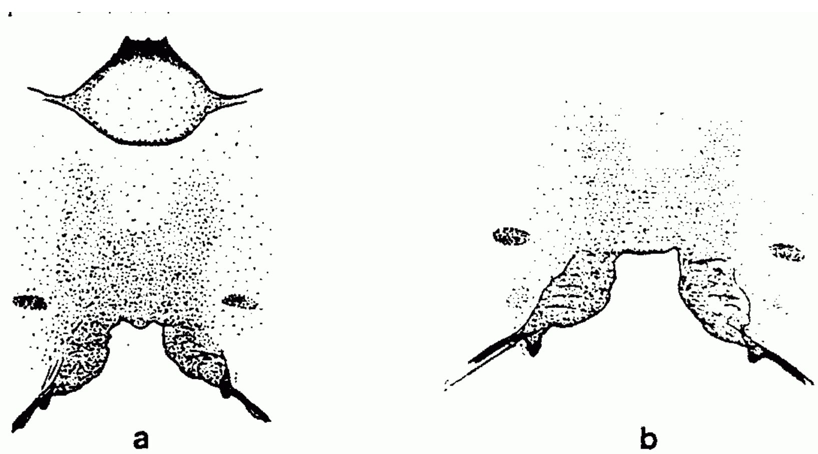

Fig. 2. Larval postgenal cleft and pigment mark of head venter: a, from *latigonium* holotype slide preparation; b, from Sunbiggin Tarn specimen (*latigonium* of Davies). Drawings original (RWC).

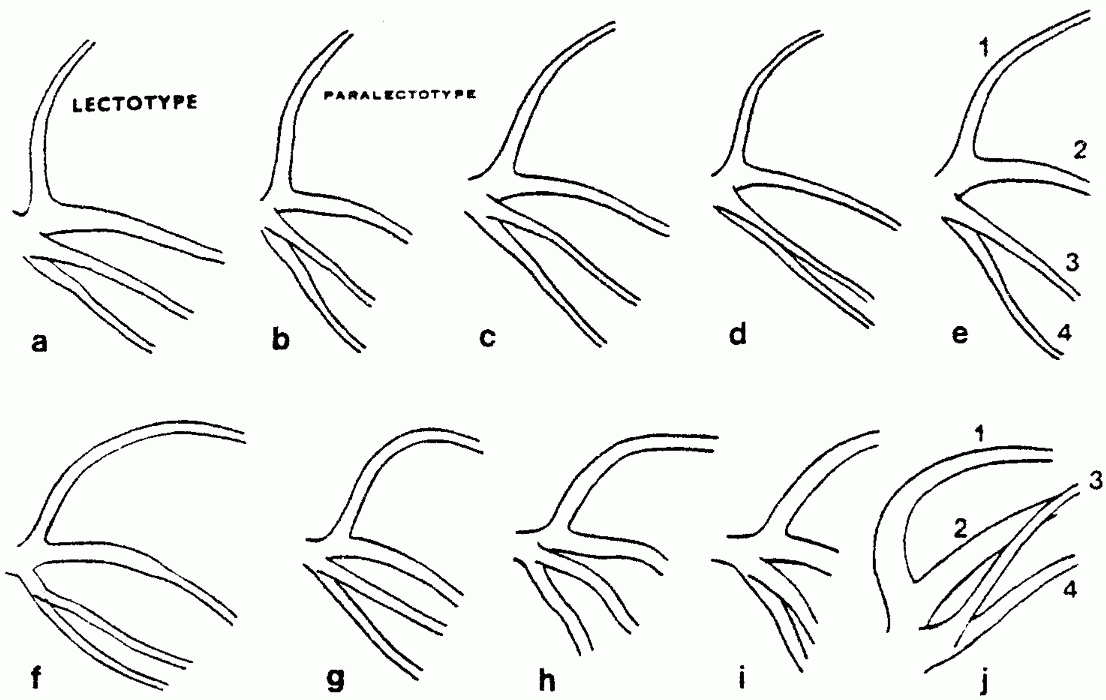

Fig. 3. Pupal gill base: a and b, from lectotype and a paralectotype of *lundstromi* (Britain); c, pupa from China (near Beijing); d, pupa from Britain (Herts, R. Rib); e, pupa from Germany (Brandenburg, Burg, Sudumflüter); f, Zwick (1974, *lund.*, Germany); g, Rubtsov (1962, *lund.*); h, Jensen (1984, *lat.*, Denmark); i, from Jensen (*lund.*, Denmark); j, pharate pupal gill of a larva from Sunbiggin Tarn, Cumbria, England. Drawings a-e and j original (RWC).

connectant states exist, though, even among larvae in the same sample and we see no significance in this feature. Rubtsov's (1956) figure of the
cleft in the original description of *latigonium* is poor (Fig. 1a) so we give a new drawing here (by RWC) showing the cleft in the *latigonium* holotype larva (Fig. 2a). (Fig. 2b shows the similar cleft in a larva from Davies' Sunbiggin Tarn material identified as *latigonium*.) The pigmented mark on the undersurface of the head is quite variable in its size, shape and intensity (Fig. 1b-j) and we do not think that its development is a taxonomically significant feature. The same sample can show larvae with varying degrees of pigmentation, some in which the mark is essentially absent. (We do not exclude the possibility of some correlation with annual generation or larval age.)

The pupal stage varies in the length of the cocoon 'horn' and in the relative diameters of the upper pair of gill filaments compared to the lower pair (Fig. 3a-i). Filament 2 in all pupae is fatter at the extreme base than filaments 3 and 4 but in some pupae the basal thickening extends for some distance along filament 2 (Fig. 3,a,b,f) and thickening is apparent also on the upwardly arching filament 1 (Fig. 3a,h). When filament 2 is thickened in this way it either tapers more or less evenly along its length (as in *lundstromi* lectotype) or narrows rather abruptly after some distance (Fig. 3f); the latter condition is rather unusual in British pupae but not uncommon in Germany and Denmark (as illustrated by Zwick (1974) and Jensen (1984)). Davies (1968) and Jensen (1984) have used the difference between 'thick' and 'thin' upper filaments as a key character separating *lundstromi* (thick) and *latigonium* (thin) but our observations do not suggest that this is a specific difference. All states exist from conspicuously thin to rather thick, sometimes in pupae of the same sample, and we see no essential difference in pupae collected as far apart as China (Fig. 3c) and the English *lundstromi* type locality. Gill filament variation is such, even among the *lundstromi* paralectotype pupal skins, that it is impossible to categorize the individuals one way or the other on the Davies/Jensen criteria. A pharate pupal gill we prepared from a larva in Davies' material from Sunbiggin Tarn (his 'thin-filament' *latigonium*) has in fact much thickened upper filaments (Fig. 3j) and some of the pupal skins we have seen from the Russian type locality of *latigonium* have indistinguishable gills from those of some of the *lundstromi* paralectotype pupal skins. We conclude that this minor variation in the thickness of the upper gill filaments is intraspecific.

In the adult stage there is some variation in the male genitalia that deserves comment. Rivosecchi (1966) noticed that the profile shape of the ventral plate in what he called '*? lundstromi*' is somewhat variable, particularly in the outline of the haired blade which varies in its curvature; he observed that winter-emerging males seemed to have a less rotund blade profile (Fig. 4h) than spring-emerging males (Fig.4j). We have not detected such a correlation but have noticed some variation in plate shape. We have compared the male genitalia of *latigonium* with those of *lundstromi*, using specimens from the respective type localities (cf. Figs 4a and 4c) and observing the dissected parts of the genitalia both while freely movable in mountant (to ensure comparable orientation) and after permanent slide preparation, and have also examined the genitalia of males from Britain (including *latigonium* from Sunbiggin Tarn) and

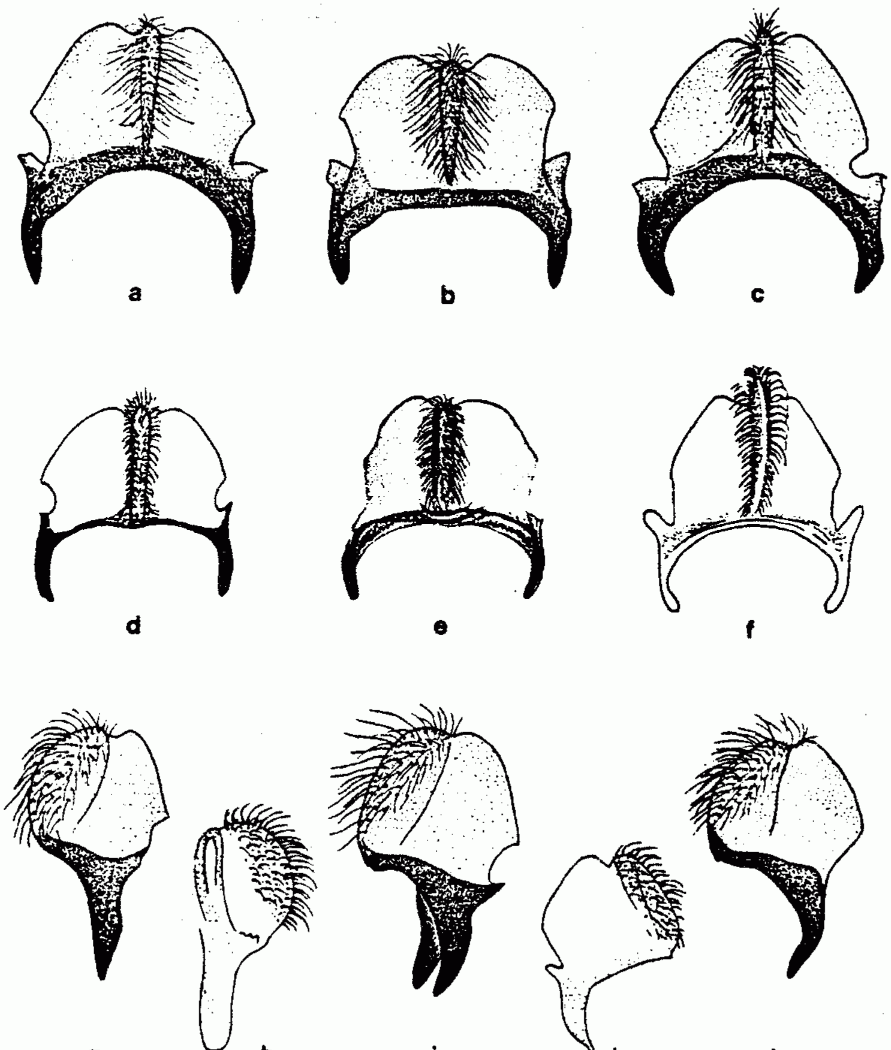

Fig. 4. Ventral plate of ♂ genitalia of *S. lundstromi*, a-f in ventral view and g-k in profile: a, in *lundstromi* paralectotype from Mildenhall, Suffolk; b and c, in specimens from *latigonium* type locality (R. Sitenka, Russia) (see legend note below); d, from Knoz (1965, Czechoslovakia, as *latigonium*); e and f, from Rivosecchi (1966, Italy, as *? lundstromi*); g, in specimen from R. Stor, Pulborough, Sussex; h and j, from Rivosecchi (1966, Italy, as *? lundstromi*, respectively 'winter' and 'spring'); i, in specimen from R. Meon, Hants; k, in specimen from Sunbiggin Tarn outflow stream, Cumbria (*latigonium* of Davies). In b and c the orientation is different, the plate apex tilting upwards in b (giving a relatively broader appearance) and slightly downwards in c. In the Rivosecchi sketches (h and j) the haired keel is reversed compared to the other profiles. Drawings a-c, g, i and k, original (RWC).

Germany that have been reared from pupae with 'thick' and 'thin' filament types. We have found the same sort of variation in ventral plate
profile as Rivosecchi mentioned but cannot correlate it with pupal gill calibre or any other features and we do not attribute interspecific importance to it. Comparison in particular of male genitalia from the type locality samples shows nothing contra-indicating the proposed synonymy of *latigonium** with *lundstromi*. Fig. 4 shows some examples of ventral plates. Interestingly, in ventral plates from Davies' Sunbiggin Tarn samples (seven preparations) the basal arms are more slender and strongly curved than usual (Fig. 4k); in this respect the ventral plate profile seems to differ slightly from that in true *latigonium* from the type locality and from males of other English populations (Figs. 4g and 4i show plate profile in specimens from two southern English sites). Davies (1966, 1968) thought he detected a specific difference between *latigonium* and *lundstromi* in the shape of the gonostyles and dorsal plate and used this as a key character. However, it does not hold and Lewis Davies himself later concluded (see below under comparison with *angustitarse*) that the putative specific differences are unsound.

In adult females the only notable variation is that of the colour of the scutal vestiture varying from pale silvery or greyish yellow to golden and the fact that while the subcosta is totally bare ventrally in most specimens the occasional female possesses a very few (up to three or four) tiny subcostal hairs near the base (at most on the basal third).

Biology

The aquatic stages of *Simulium lundstromi* occur principally in weedy larger streams and rivers that flow smoothly and steadily over muddy or gravelly beds in agricultural areas, marshlands and fens, usually within the velocity range 30-50 cm/sec and the size width range 1-15 metres. However, the species also occurs quite commonly in very small streams: for example, one of us found larvae in Ireland in a stream only 15-30 cm wide that was draining from a bog (Bass, 1990, as *latigonium*). In Britain, breeding often occurs in streams and rivers of the chalk, including the winterbournes of southern England. The outflows of fish-ponds are a habitat reported from Slovakia (Illésová, 1992). Larvae and pupae attach to vegetational substrates, particularly bed-rooted linear water-plants such as the bur-reed *Sparganium erectum* and to a lesser extent *Sparganium emersum*; interestingly, the type material from Suffolk was collected from *Sparganium* (Edwards, 1920, as *angustitarse*); other

[*Rubtsov did not state the meaning of his name *latigonium* but we presume it to refer to a wide male ventral plate. This would accord with the wide appearance of the plate as illustrated by Rubtsov (1956) in the original description and repeated in Rubtsov (1962). We believe this appearance to be artefactual, due to the plate not being orientated horizontally (we cannot prove this because, as mentioned above, Rubtsov's original slide of male genitalia is missing from the St Petersburg slide collection.) The shape shown by Rubtsov does not accord with that of ventral plates from other males from the type locality; however, a somewhat similarly broad appearance results when the plate is drawn with its apex tilted upwards (as in a preparation by RWC, see Fig. 4b).]

substrates include reed-grass (*Phalaris arundinacea*) and *Glyceria fluitans*. Immatures are rarely abundant, usually occurring at rather low density, often in association with more abundant riverine species such as *S. lineatum*, *S. erythrocephalum* and *S. ornatum*; in the small-stream habitats the early stages are sometimes associated with *S. angustipes* and *S. velutinum* (members of the *S. aureum* group).

Pupae and emerging adults can be found through much of the year and *S. lundstromi* appears to be multivoltine almost everywhere that it occurs in western Europe. We have seen wild-caught and reared British specimens that have been collected in all months from April to November. One of us (DW) has found in Brandenburg area of Germany that there are pupation peaks in April and August/September, strongly suggestive of at least two annual generations; Seitz (1992), in Bavaria, reports pupation in all months from March (water temperature 8°C) to October with a triple-peak pupation regime (phanology diagram given) and over-wintering in the larval stage. Up to three annual generations occur in Italy, where there is winter emergence (Rivosecchi, 1978a, under *latigonia*). Davies (1966) thought that '*latigonium*' at the Sunbiggin Tarn locality probably had "a univoltine cycle", but we find this puzzling because his extensive material from this site (in NHM, London) includes many reared adult flies that emerged on 11 May, 12 and 17 July and 19 August [1963]; to our minds this date spread is indicative more of a multivoltine than a univoltine regime. It should be added that spring-emerging adults were obtained by one of us (JABB) in late April/May 1984 during a special re-sampling of Davies' Sunbiggin Tarn site (O.S. grid reference NY675073). Illésová (1992) records from one to three generations at various sites in Slovakia and that at one site in one particular year there was apparently only an 'autumnal generation'.

The bloodsucking toothed-claw females feed on birds. Baker (1970), under the name *angustitarse* (identified for Baker as such by Davies) has shown that *lundstromi* is a vector among rooks (*Corvus frugilegus*) of the protozoan blood parasite *Leucocytozoon sakharoffi*. (Fourteen female flies from Baker's research are in the NHM collection: we have confirmed their identity as *lundstromi*on the basis of the subcostal character mentioned in the next section.) Unlike the females of *angustitarse*, those of *lundstromi* are strongly attracted to carbon dioxide and can be readily caught in traps baited with carbon dioxide, especially when there is no wind and the sky is overcast (Rivosecchi, 1978a, under *latigonia*).

Comparison between *Simulium lundstromi* and *Simulium angustitarse*

As a consequence of our conclusion that *lundstromi* and *latigonium* are conspecific there are only two species of the *S. ruficorne* group in Britain and northwestern Europe, *S. lundstromi* (Enderlein) and *S. angustitarse* (Lundström) (some others occur in southern Europe, including *ruficorne* in Spain and Portugal). The habitats differ, *S. angustitarse* almost always occupying much smaller (usually first-order) streams than the more 'riverine' *S. lundstromi*. This is well shown by Crosskey's survey records for South East England in which (as confirmed by their very different pupae) the two species have only been found together at two sites among 47 sites recorded for *lundstromi* and 41 sites for *angustitarse*.

The two species are best distinguished as follows: pupal cocoon with loose net-like weave and without anteromedian 'horn' in *angustitarse* (closely woven and with 'horn' in *lundstromi*); larval postgenal cleft virtually absent, at most only a tiny notch in the head hind margin, in *angustitarse* (well developed in *lundstromi*, Figs 1 and 2); adult female subcosta with fine hairs ventrally along at least half its length in *angustitarse* (female subcosta completely bare ventrally or with at most only a very few hairs on the basal part in *lundstromi*).

The subcostal character of the female just mentioned was discovered by Zwick (1974). Though seemingly an improbable difference between such closely allied species we have found the same difference among females reared from pupae of known identity. The fine hairs are not as easily rubbed off as would be imagined and we think the subcostal character is reliable enough that it can be used for distinguishing between wild-caught females of the two species. Wild-caught males, on the other hand, cannot be reliably differentiated. The subcostal character does not apply (male *angustitarse* having similarly bare or virtually bare subcosta as in *lundstromi*). Davies (1968) suggested in his key (where *angustitarse* = *lundstromi* and *cambriense* = *angustitarse*) that differentiation is possible on the shape of the genital styles and dorsal plate but other workers have been unable to confirm this. Davies later (1970, in litt. to Zwick) agreed that "the 3 species [the third '*latigonium*'] show very little difference in male genitalia". Zwick (1974) illustrated the variability of the dorsal plate. We agree with Davies' later view, with Zwick, and with Rivosecchi's (1978a) comment (given under *latigonium*) that "Quaesta specie che allo stadio adulto è molto difficile distinguere de *angustitarsis*". (It is noteworthy that Rivosecchi nevertheless illustrates a difference between females in the shape and attachment of the ovipositor lobes: we have not studied this character.)

Cytologically *S. angustitarse* and *S. lundstromi* are extremely similar. Chubareva (1977) studied *angustitarse* from Lithuania and *lundstromi* (as *latigonium*) from the St Petersburg area and reported that karyotypes of both species show 2n = 6 chromosomes (as in almost all Simuliidae), weak pairing of homologues, very strongly differentiated centromeres and a connection zone on chromosome I to the nucleolus: specific differences lie in two homologous inversions, and in the stronger homologue pairing and weaker chromosome puffs occurring in *angustitarse*. [Note: larvae of both species collected in England were communicated at various times by Davies, Crosskey and Bass to the late K.H. Rothfels for chromosome study but findings (if any) were never published and the material has disappeared since dissolution of the Toronto cytotaxonomic 'school'.]

Acknowledgements

We thank Dr A.V. Yankovsky for lending us the *latigonium* holotype and other specimens from the Academy of Sciences collection at St Petersburg and Dr H. Schumann for loan of Enderlein's specimens of *lundstromi* from the Berlin Museum. Heide Zwick kindly provided us with copies of her old but still pertinent correspondence with Lewis Davies and we thank her for this and for communicating her views on a number of points. Lewis Davies kindly confirmed that his identification of *latigonium* from the Sunbiggin Tarn site was based on literature and not upon comparison with Rubtsov material. A visit to England by Frank Jensen when he was beginning a study of the Danish blackfly fauna was a stimulus to our investigations, since he was having similar problems with *latigonium/lundstromi* when comparing British and Danish material. We thank Theresa Howard for great help with the computer type-setting.

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Appendix

Correctly identified *lundstromi* type specimens in NHM, London:

Lectotype _, SUFFOLK: Mildenhall, R. Lark, 25.iv.1916 (*Edwards*) (in alcohol, with pupal skin). [Genitalia missing, specimen accompanied by Zwick's red determination label.]

4 _, 2 _ (pinned), 13 pupal skins (alcohol), data as lectotype. [Two _ with genitalia in Edwards' balsam preparations on celluloid mounts, one _ with genitalia in micro-vial, one _ with genitalia on slide (_ number 5): two _ and one _ with Zwick's red determination labels.]

1 _, SUFFOLK: Mildenhall, 13.v.1909 (*Yerbury*) [genitalia on slide].

1 _, SUFFOLK: Timworth, 17.v.1913 (*Nurse*).

2 _, BEDS: Shefford, x.1917 (*Edwards*).

1 _, BEDS: Shefford, 17.xi.1917 (*Edwards*).

1 _ (with dried pupal skin), CAMBS: Stapleford, 28.iv.1916 (*Edwards*).

2 _ (with dried pupal skins), HERTS: Hatfield, R. Lea, v.1916 (*Edwards*)

2 _, HERTS: Radwell, 15.vi.1917 (*Edwards*).

BRITISH SIMULIID GROUP BULLETIN

Number 6 **December 1995**

CONTENTS

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FROM THE EDITOR

The time for compiling the biannual Bulletin has come round again with this the second number in 1995. Once more we report on the latest meeting of the British Simuliid Group which was held for the first time at Birmingham University.

Everyone that I have spoken to has been full of praise for the way the meeting was organised, and for its content. It was refreshing to hear more presentations with an ecological theme, as some of us were concerned that past meetings contained too much molecular biology. It is very hard to obtain a good balance of subjects in a one day meeting when so many disciplines are involved, but our hosts Malcolm Greenwood and Melanie Bickerton achieved it very well. Those of us who came down the night before experienced a "Balti" dinner which was memorable for spice and quantity, while the accommodation provided in the University was most luxurious. We are most grateful to Professor Geoff Petts for allowing us to invade his department, and to Malcolm and Melanie for organising everything.

How many of you read books on travel or exploration? I am not an avid reader and tend to read such books only when they are given to me as presents. Nevertheless I have come across some interesting snippets relating to nuisances caused by blackflies. I think it would add light-hearted interest to have a "Travellers' Tales" section in future numbers of the Bulletin. In the next issue I will kick off with an excerpt culled from one of the late Gerald Durrell's amusing accounts of his collecting trips, and hope that members will also send in their discoveries.

Let me remind you that I hope to bring out Number 7 in June or July 1996, so if there is anything you would like included - send it in NOW - don't wait until it is too late!

Finally, thanks to Roger Crosskey and Trefor Williams who commented on and proof-read the draft of this Bulletin.

John B. Davies: Liverpool School of Tropical Medicine, Pembroke Place, Liverpool L3 5QA, UK.

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THE 18th ANNUAL MEETING AT BIRMINGHAM UNIVERSITY

The 18th Annual Meeting of the British Simuliid Group was held in the Department of Geography, University of Birmingham on Wednesday 13th. September 1995. The meeting was organised by Malcolm Greenwood and Melanie Bickerton, and opened with an address by Professor Geoff Petts, Director of Environmental Science.

About 45 members and students were present. Titles and short accounts of the papers are given below, and I am grateful to Malcolm Greenwood for help with the following summary of the discussion.

As usual, the later session of the afternoon was given over to a most lively and stimulating debate covering two main issues. The first of these was how best to bring together those members whose field experience was driven by taxonomic and vector control needs with those of the ecologist/geographer who, as a function of working at a larger spatial scale, sees the blackfly as an important but not the only component of the much broader picture. It became clear (to no body's great surprise!) that sound taxonomic appraisal is essential underpinning to these applied studies but all agreed that the available expertise was there to be shared.

This opened the way for a very positive attempt to adjoin these views in collective action and many offers of help were expressed, from taxonomist to geographer and vice versa. An example was well illustrated by the expression of interest as to the effects of River Regulation on blackfly populations. Changes in flow condition as the result of dam construction 'modify' the available habitat and with it the blackfly fauna and any associated health risk. If, a collaborative effort could be made to control the insect, surely this must be the most productive way forward. I was very much reminded, whilst listening to the overall debate, of the old adage which says that, "one plus one equals two and a half". For me the great wealth of experience embedded in 18 BSG meetings is and indeed must be tapped, by those with expertise elswhere. I hope this positive and enthusiastic response was shared by others attending the day in Birmingham.

The second issue was raised by Roger Wotton who reminded us of Doug Craig's note in Bulletin No. 5 when he put forward the idea of holding an international simuliid meeting in 1997. This stimulated a wide ranging discussion as a result of which the consensus favoured a meeting in either Africa (to make it easier for the many African simuliid workers to attend) or Europe. For Africa, South Africa was suggested, but it was appreciated that most participants would require funding for part of their expenses at least. Roger Crosskey informed us that he had discussed the possibility with Ferdy DeMoor, and agreed to follow it up.

[I have since received a note from Ferdy DeMoor saying that both he and Rob Palmer are keen to have a meeting in South Africa. They are at present tentatively looking at ways of forming an organising committee with a view to investigating how they can enlist sources of funding etc. He now needs to hear from people whether in principle they would want to attend. I suggest that anyone interested should contact Ferdy directly by e-mail at amfd@warthog.ru.ac.za, or let me know and I will pass on the message to him. - Ed.].

ARTICLES BASED ON ORAL PRESENTATIONS

Introduction to the Meeting

Professor Geoff Petts: Director of Environmental Science, School of Geography, University of Birmingham, Birmingham, B15 2TT, UK.

Early studies of the distribution of aquatic invertebrates along rivers focused on longitudinal zonations with temperature and 'distance from source' as the primary environmental variables. Research over the past thirty years has not only elucidated the roles of a wide range of environmental variables but has also demonstrated different relationships over a range of spatial scales, including the river, sector, and meso-habitat. The role of flow hydraulics on the distribution of aquatic invertebrates has been clearly established. Other studies have demonstrated the influence of substratum type, variations of channel form, water quality and the riparian zone upon the distribution of biota. Research is now focusing on the influence of short-term (one to a few days), seasonal, and annual variations of these dynamic environmental variables on species distributions.

Research at the University of Birmingham seeks to integrate hydrological and geomorphological studies as a basis for understanding the dynamics of river ecosystems (an approach that has been advanced as the study of 'fluvial hydrosystems' by Amoros and Petts, 1993; Petts and Amoros, 1996). Current research focuses on the effects of different flow regimes on (i) river-floodplain interactions and (ii) aquatic macroinvertebrate communities.
The second is concerned with species and community responses to (a) drought, (b) water abstraction, (c) flow regulation below dams, and with community succession in response to environmental changes, especially in cold streams. With regard to the latter, the University is a partner in a European network studying streams in Iceland, Spitzbergen, Norway, the Alps and the Pyrenees.

Simuliids are highly sensitive to flow hydraulics and the availability of specific meso-habitat types. The effects of flow regulation below dams on blackflies have been described (see Petts, 1984), most demonstrating a marked increase in the abundance of simuliids, but since founding the interdisciplinary journal Regulated Rivers in 1987 (we are now publishing volume 11), there have been only 2 papers that have focused specifically on blackfly problems. Little progress seems to have been made in modelling flow-habitat relationships for simuliid species, and for their different life stages, with a view to predicting the consequences of natural and artificial hydrological changes on their distribution and abundance. Our research seeks both pure and strategic objectives: to advance ecosystem-level models of invertebrate community dynamics to aid river management (e.g. by determining minimum acceptable flows and recommending physical habitat management). The approaches could be developed to aid the management of specific problem species, such as some simuliids.

We were delighted to host the 18th annual meeting of the British Simuliid Group and to help to foster a wider environmental interest in simuliid studies.
We look forward to continuing our association with the Group in the future.

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Blackflies in amber - what can they tell us?

Roger W. Crosskey: Department of Entomology, Natural History Museum, Cromwell Rd., London SW7 5BD, UK.

Blackflies in amber are rare. Only four specimens exist, for example, among 25,000 pieces of fossiliferous amber in the Natural History Museum in London (BMNH), which has one of the top scientific amber collections. These specimens are all in Baltic amber, the only type of amber in which until recently blackfly fossils had been found (excluding an ancient and unconfirmable record of Simulium from Sicilian amber); they are therefore about 35-40 million years old, Baltic amber being geologically dated as Upper Eocene to Lower Oligocene. Recently, one specimen has been found in Cretaceous amber from coastal New Jersey, and several in Tertiary ambers rather younger than the Baltic amber, namely in Saxonian (Bitterfeld) amber from Germany of Miocene age (Schumann & Wendt, 1989) and Dominican amber from Hispaniola of mainly Oligocene/Lower Miocene age (Poinar, 1992). The Saxonian and Dominican specimens await specialist study, but Canadian specialists are currently examining the specimen from New Jersey amber - which is the oldest amber blackfly yet found.

The only named amber blackflies are from the Baltic amber: Ectemnia cerberus Enderlein (see Crosskey, 1994), Simulium oligocenicum Rubtsov (see Rubtsov, 1936), and three Simulium species described by Meunier (1904). The last (S. affine, S. importunum and S. pulchellum) are at present uninterpretable because the types, originally in the Royal Amber Collection at Königsberg (now Kaliningrad), have not yet been located; they might not still exist.

Study of amber blackflies is frustrating. Only rarely can specimens be confidently assigned to a genus or subgenus (let alone a species group), for two reasons: (1) simuliid taxonomy depends more than that of other Diptera on combination adult and early stage characters and in amber studies only adult characters are available; (2) specimen preservation is rarely good enough to reveal sufficient characters adequately (most specimens could fit any one of several supraspecific taxa). The 'workability' of specimens depends not only on their orientation in the amber pieces (often they lie in such a way that polishing can do little to reveal important features) but on the quality and origin of the amber. Old exposed amber darkens and readily fractures, and features are often obscured by cloudiness or finely streamed air bubbles; this is particularly true of Baltic amber. In general, the antennae and legs are fairly readily visible, but the leading wing veins and the terminalia are usually very much obscured; the katepisternal sulcus, a major character for distinguishing the primitive prosimuliines from simuliines, is rarely well displayed, tending to be covered by the positions of the leg bases or invisible because of the general body orientation.

Although amber blackflies reveal little in a direct sense - they bear such indefinite taxonomic 'signatures' - some telling points emerge when we summarize what is known from specimens so far studied. The principal shared characters, i.e. basal section of the radial vein haired, fore tarsi slender, scutum without pattern, and females with strong claw tooth, form a combination suggestive that the amber blackflies were rather primitive bird-biting forms. Interestingly, several specimens have antennae with only 10 segments (8 flagellar segments), a feature among modern blackflies almost confined to Greniera and Austrosimulium. Lastly it is worth emphasizing that the Simulium sensu stricto blackfly 'model', typically characterised by bare radial vein base, dilated fore tarsi, patterned scutum (one sex or both), toothless female claws (of 'mammalophilic' type) and long and heavy male gonostyles, has yet to be found in amber - does the Baltic amber pre-date the evolution of such forms?[Transparencies of three of the BMNH unnamed Baltic amber specimens and of Ectemnia cerberus were shown as part of the presentation. My thanks to Peter York, of the Natural History Museum, for the photography.]

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The latest in the Simulium damnosum oviposition/aggregation pheromone story

Philip J. McCall: Parasite & Vector Biology Division, Liverpool School of Tropical Medicine, Pembroke Place, Liverpool L3 5QA, UK.

At the last BSG meeting in Liverpool 1994, I reported on work carried out in Sierra Leone in 1993/ 1994, demonstrating that volatiles collected from freshly laid eggs of Simulium leonense were effective in attracting gravid flies to oviposit, in a laboratory bioassay. Those studies also showed that in gas chromatography 2 major peaks were associated with attractiveness. These peaks, labelled A & B, were present in fresh egg volatiles, but were significantly reduced in volatiles from 12 hr old eggs, which had no attractiveness in bioassay (McCall, 1995). The studies reported here, carried out in 1995, set out to confirm the role of the volatiles represented by these peaks as attractants. A series of chemical fractions was prepared by Bob Heath and Barbara Dueben at the Insect Attractants, Behavior & Basic Biology Research Laboratory, Gainesville, Florida, from mass dissections of gravid ovaries of S. leonense collected in 1994 in Sierra Leone. Four fractions were prepared with fraction 3 containing peaks A and B. As a result of the escalating civil war in Sierra Leone, the study relocated to Ghana where with the support of Dr. Mike Wilson at the Noguchi Institute in Accra, and the Onchocerciasis Control Programme, I set up a field laboratory at the OCP subsector office in Hohoe, Volta Region. Bloodfed flies (identified by Mike Wilson using adult fly morphometrics as S. yahense) were collected from Tsasadu Falls, about 10km southwest of Hohoe (I am extremely grateful to OCP who ceased their irregular insecticidal treatment of this site for the duration of the study) and maintained in the lab for 4-5 days until gravid. The bioassay procedure was essentially the same as that previously described (McCall, et al, 1994), but modified to allow multiple choice rather than simple two-choice tests. In an initial test the recombinant mixture of all four fractions attracted significantly more ovipositions than a control. Thus no significant activity had been lost in preparing the fractions. Furthermore, this demonstrated that the material isolated from the ovaries of S. leonense in Sierra Leone was attractive to S. yahense in Ghana.

A series of multiple choice bioassays showed that fraction 3 was the most attractive of the fractions tested, indicating that peaks A and B are important in mediating aggregation, though fraction 4 also showed some attraction. However, fraction 3 did not attract significantly more ovipositions than a control substrate in a two-choice bioassay. In fact fraction 3 was active only when fraction 4 (containing a number of compounds which had higher retention times on gas chromatography than peaks A or B, but which are present at very low concentrations) was also present, though in these cases the ovipositions occurred preferentially on substrates baited with fraction 3.

This suggests that although peaks A and/ or B are the major peaks involved, and therefore can be considered to be the likely main constituents of the aggregation pheromone, certain compounds present in fraction 4 are also necessary for attraction. This suggests that two stages of attraction might be occurring, possibly in a sequence of events leading up to final oviposition site choice. My own observations on oviposition behaviour in the laboratory suggest that other sensory factors may also be involved in attraction - contact physical or chemical cues and visual cues are likely to be involved (of interest here is the fact that we [Gryaznov, McCall & Trees] have not detected volatile compounds from dissected gravid ovaries of S. erythrocephalum in Britain, although this species exhibits aggregated oviposition in a laboratory bioassay).Peaks A and B have now been detected in S. leonense from Sierra Leone, S. yahense, S. sanctipauli and S. damnosum/ sirbanum from Ghana (identified by Mike WIlson), and from S. squamosum (identity to be confirmed) from Ngaoundere, Cameroon. Thus it is possible that all the species within the S. damnosum complex share the same pheromone system, though differences in the lesser constituents cannot yet be ruled out. If so, this would not be surprising; as we have suggested, that some of the advantages conferred by oviposition aggregation may not be species specific (McCall & Cameron, 1995).

Currently, spectrometric studies are underway to identify peaks A and B, for which the molecular weights and basic structures are known, and to determine the content of fraction 4. Future work will attempt to elucidate the sequence of events which may be involved in aggregation with a view to an increased understanding of blackfly oviposition, and to the development of a pheromone-baited trap system for S. damnosum s.l.

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A report from Brazil

A.J. Shelley: Natural History Museum, Cromwell Rd. London

Onchocerciasis has long been known to occur in an isolated area of tropical rain forest in northern Brazil inhabited by Yanomami indians. During the last couple of decades the discovery of minerals in the area has led to the invasion of Yanomami territory by miners, many of whom will have become infected with onchocerciasis. Many of these miners have subsequently moved to other parts of Brazil and their presence in Minaçu, a town some 2000kms from the Amazon focus and a few hundred kms to the north of the country's capital Brasilia, has probably provided the source of infection for local people which serological tests have shown to have been in contact with the parasite. Minaçu is also the site of a new hydroelectric dam on the R.Tocantins, a southern tributary of the Amazon.

The project for Minaçu sets out as its main objective to assess the effects of the dam on simuliid populations and future onchocerciasis transmission in the area. In the first year collections of simuliids from all rivers in the area and from biting catches will be used to indicate the species present and and to provide identification keys. Collecting sites at the R.Tocantins and three of its tributaries have been set up and larval and adult collections are being made on a monthly basis to assess population size in relation to season. Results of this work will be presented at next year's meeting.

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Recent advances in Simulium control with regard to the Onchocerciasis Control Programme in West Africa

David Partridge: Aerial Operations Officer, OMS-Oncho, BP 504, Odienné, Côte d'Ivoire

The Onchocerciasis Control Programme first started large scale aerial spraying against Simulium larvae in the river systems of West Africa in 1975. Pioneering treatments started with one larvicide, temephos, which was applied using a simple drop-release system from either a fixed-wing aircraft or a rather large and clumsy helicopter. Since then, numerous advances in spray technology, treatment technique and data collection have been made, allowing the aerial operations teams to improve their ability to deliver a variety of chemicals, in the right place, at the right time, and at the precise dose required. This has resulted in less chemical wasted, fewer overdosing "accidents", fewer treatment failures, and a continuous and dependable break in transmission. Current operations are conducted by 8 helicopters flying from two bases, one in Côte d'Ivoire, the other in Togo. In a typical week, mission planning and pilot briefing occur on Monday. Helicopters depart on Tuesday and follow a two to four day treatment circuit, refuelling at remote caches and spending the night at hotels and guest houses in the field. Technical advances affecting vector control operations include:

1. Choice of helicopter - Hughes 500D and E: compact, manoeuverable, short rotor diameter, autonomy 1h45, 250 litre larvicide weight capacity. In spray mode carries pilot and observer. In prospection mode, carries pilot and three entomologists.
2. Spray system - custom design by Simplex/Micronair: streamlined external tank, 8 nozzles: 6 spray and 2 dribble for canopy penetration, computerized control and recording, accuracy of 1%.
3. Larvicides - 7 approved larvicides from 4 chemical families, chosen for their efficacy, softness on non-targets, safety and economy of use. Formulated for quick dispersal in water. Each has characteristics of toxicity and "carry" that favour use at different discharges and river conditions. Used in rotation to prevent resistance.
4. Hydrological surveillance by satellite - 80 satellite beacons deployed on important and inaccessible rivers. Three French Argos satellites pass overhead 10 times per day. SRDA reception stations at each airbase collect river heights in real time. Dosage updates are sent to helicopters by HF radio.
5. GPS satellite navigation - enabling positioning to within 20 m. Increased navigational confidence leads to lower flight hours, better treatment coverage and fewer lost or bewildered pilots.
6. "Combined operations" with ivermectin distribution. In addition to immediate relief for sufferers of the disease, there is increasing evidence of reduced transmission and reduced adult longevity. May possibly reduce number of years of spraying.
7. Vector and parasite identification by DNA probe - allowing rapid differentiation of Simulium vectors and separation of Onchocerca ochengi, and O. volvulus blinding and non-blinding forms.

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Recent events in Guatemala

John B. Davies: Liverpool School of Tropical Medicine, Pembroke Place, Liverpool L3 5QA, UK.

Members may be interested to know about a Workshop "On the Transmission Cycle of Onchocerca volvulus by Simulium ochraceum" whichwas held at the Universidad del Valle de Guatemala between 6 and 9 June 1995 and sponsored by the Onchocerciasis Elimination Program for the Americas (OEPA). The sessions were led by Richard Collins (Arizona), and the entomologist participants apart from myself were: M-G Basáñez (Oxford & Venezuela), O. Ochoa (Guatemala), C. Porter (CDC Atlanta), V. Py-Daniel (Brazil), J. Ricardez-Esquina and M. Ridríguez (Mexico), and J.C. Viera (Ecuador & Arizona). Objectives were to examine the role of entomological assessment in the ivermectin treatment campaigns with particular regard to the very low proportion of S. ochraceum that is usually found carrying infective Onchocerca larvae (about 0.2%), and to examine the role of epidemiological models in planning and assessing campaigns.

The most important conclusions were that, in future, transmission indices should be based on a modification of the classical Annual Transmission Potential which is restricted to third stage larvae, by including total

numbers
of all Onchocerca larval stages (because this gives higher numbers, requiring fewer dissections); limit entomological activity to the 3 months of highest transmission; catch in the afternoon when parous rates are highest; and continue research into methods of mass screening flies for infections, eg. PCR and DNA probes.

Other points that arose during the course of the workshop were that Dr. Ochoa reported that the vector control programme that had started as a joint Guatemala/Japanese project in 1979 had been continued for another five years after the departure of the Japanese team in 1983-84. A careful check in 1988-89 showed that all catching sites in the controlled area were negative for S. ochraceum, while a skin-snip survey in 1990 showed that there were no infected children in the 0-9 age group, compared to about 50% before control. A paper describing the activities 1984-89 period is being prepared by Dr. J. Onofre Ochoa.

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PESENTATIONS RECORDED AS TITLES

Simuliids as habitat indicators - setting minimum acceptable flow in UK rivers

M.A. Bickerton: Department of Environmental Science, School of Geography, University of Birmingham, Birmingham, B15 2TT, UK.

The role of Simuliidae in the colonisation of streams in Alaska

A.M. Milner Department of Environmental Science, School of Geography, University of Birmingham, Birmingham, B15 2TT, UK.

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ARTICLES BASED ON POSTERS

Chromosomal variation in the onchocerciasis vector blackfly
Simulium guianense in Brazil

M. Charalambous, A.J. Shelley, M. Maia Herzog* and A. P. A Luna Dias*
Department of Entomology, Natural History Museum, London, U.K.
*Departamento de Entomologia, Instituto Oswaldo Cruz, Rio de Janeiro, Brazil.

Simulium guianense is the primary vector of human onchocerciasis in highland areas of the Amazonian focus on the Brazil/Venezuela border (Fig. 1). Variation in female biting habits of S. guianense populations in different areas has led to the suggestion that a species complex occurs consisting of allopatric anthropophilic and zoophilic populations. The high vector capacity of some anthropophilic S. guianense populations is believed to be responsible for the current distribution of onchocerciasis in the Amazon and its dispersal to Minaçu, 2500 km to the south, and potentially to other parts of Brazil (Shelley et al., in press).

In order the analyse the species composition of the putative S. guianense complex, this cytogenetical study describes the polytene chromosomal banding pattern and interprets 3 other cytotypes. Particular attention was paid to investigating any evolution in the sex-determining systems as the accumulation of sex-linked inversions is often related to speciation in simuliids.

Larvae were collected (and put into Carnoy's fixative) from five sites where this species is known to bite humans, including rivers from the Minaçu focus of onchocerciasis in Goiás State (sites 1 and 2; Fig. 1). No material was collected from the Amazonian focus, as the breeding grounds of this species have not yet been located. Polytene chromosome preparations were made using the Feulgen method (see Charalambous et al., 1995) and compared to the banding pattern of S. guianense cytotype A, which was arbitrarily chosen as the "standard sequence".

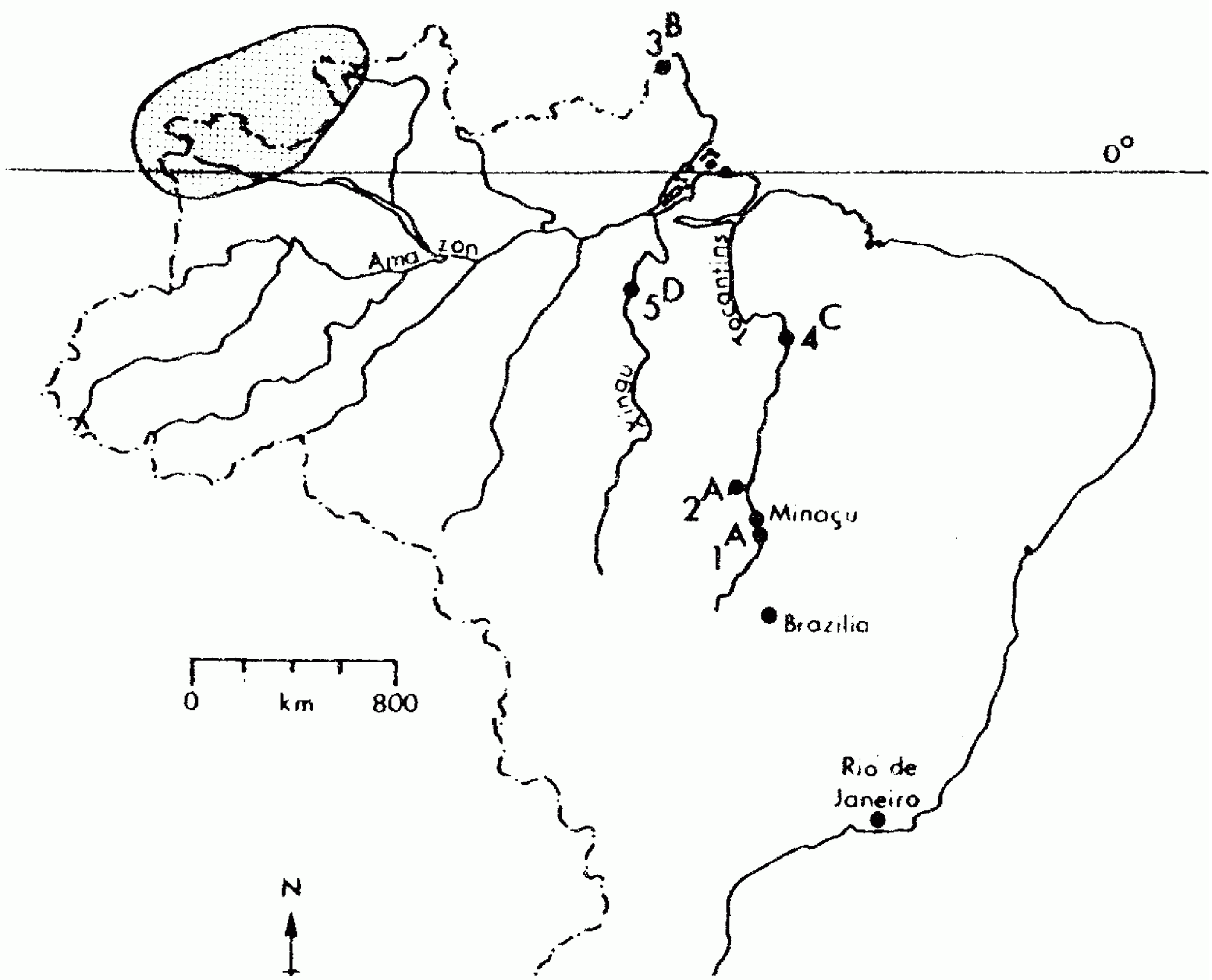

Fig.1
The collection sites of S. guianense s.l. in Brazil (numbers 1-5) used in this study in relation to the Amazonia focus of onchocerciasis (dotted area) and Minaçu. The locality details of each site are given in Table I. Superscripts denote which cytotypes are present at each site.

The results confirmed the presence in Brazil of a S. guianense species complex of at least four segregates, designated A, B, C and D. The fixed chromosome differences that distinguish the cytotypes, and which do not involve novel sex-determining systems, are shown on the idiograms (Fig. 2). These segregates have only been found allopatrically, so without evidence of their assortative mating, we cannot yet infer whether they are distinct species. They have therefore been given the taxonomic status of 'cytotype' as each represents a cohesive group that differs from the other groups. Evidence for sibling species status will be dependent on reproductive isolation between cytotypes from areas of sympatry, which will be evident if heterozygotes for the fixed paracentric inversions are absent. A potential area of sympatry occurs along the middle reaches of the Rio Tocantins, as cytotype A occurs up-river towards Brasilia and cytotype C occurs further down river (Fig. 1).

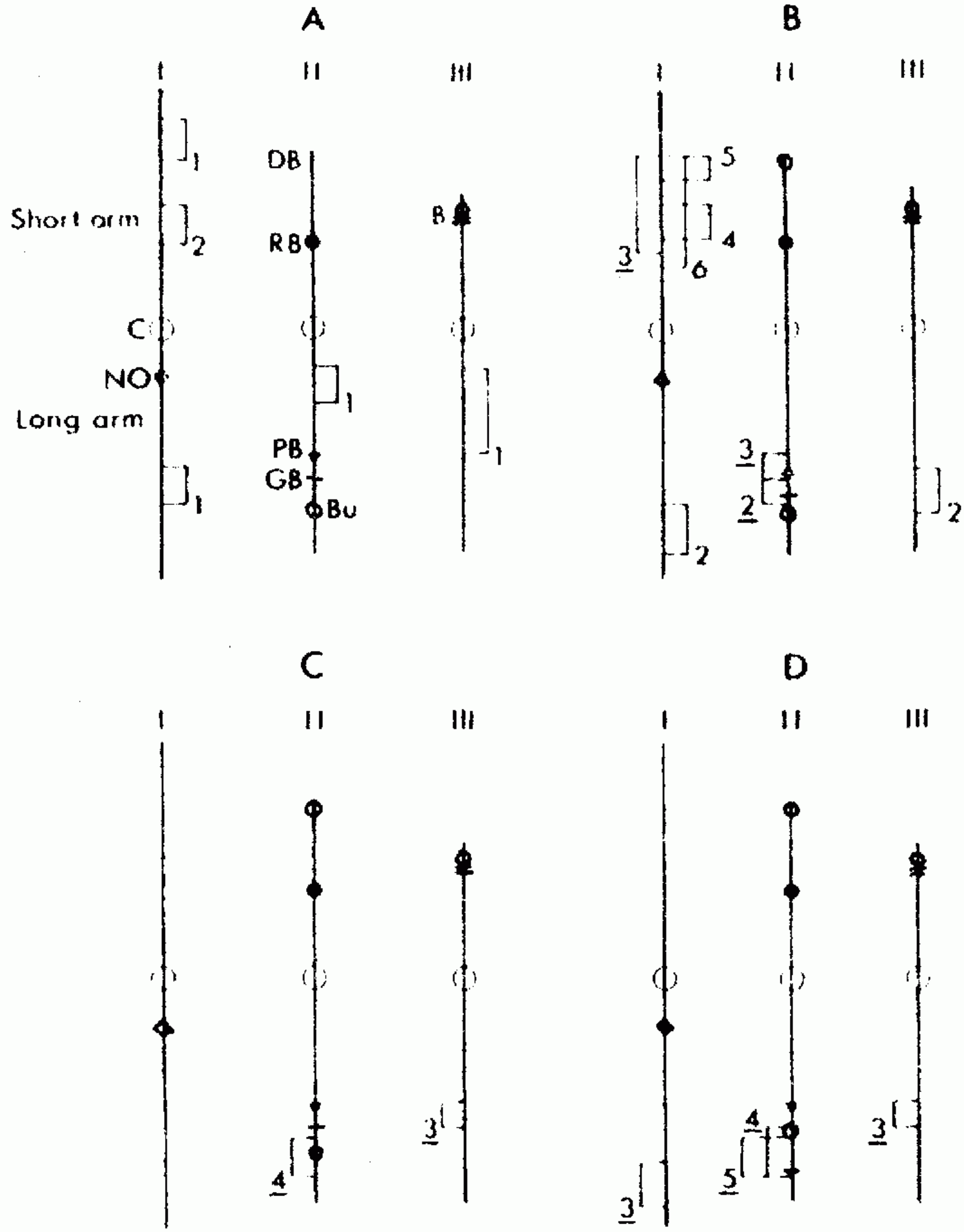

Fig. 2
Idiograms of the four cytotypes (A-D) of S. guianense in Brazil. The relative positions of markers are: C, centromere; NO, nucleolar organiser;

DB, double bubble; RB, Ring of Balbiani; GB, grey band; Bu, bubble; B, blister. Solid brackets on the left and right hand sides indicate fixed and polymorphic inversions, respectively. The length of the chromosome that each inversion occupies is drawn to scale.

References

Charalambous, M., Shelley, A.J., Dos Santos Grácio, A.J. & Raybould, J.N. (1995). Cytogenetical analysis of the Simulium damnosum complex (Diptera:Simuliidae) in Guinea Bissau. Med. Vet. Entomol. 9: 34-42.

Shelley, A.J., Lowry, C.A., Maia-Herzog, M., Luna Dias, A.P.A. & Moraes, M.A.P. in press. Biosystematic studies on the Simuliidae (Diptera) of the Amazonia onchocerciasis focus of Brazil. Bull. Brit. Mus. Nat. Hist. (Entomol.)

Low flows and recovery of Simuliidae in the Little Stour, Kent

P.J. Wood: School of Geography, The University of Birmingham, Birmingham, B15 2TT UK.

The 29 month period between February 1990 and July 1992 represents the driest period in England and Wales since the 1850's with a cumulative rainfall deficit ranging from 450-550mm for much of Central and Southern England.

The recovery of Simuliidae after a protracted drought (1989-1992), exacerbated by groundwater abstractions, was recorded in the Little Stour, a small regulated English chalk stream. Groundwater levels in the area declined to the extent that two dry reaches developed. Prior to 1989, simuliidae (primarily Simulium ornatum) were recorded in 38 of 93 (41%) of samples from the river, although this rose to 58% for

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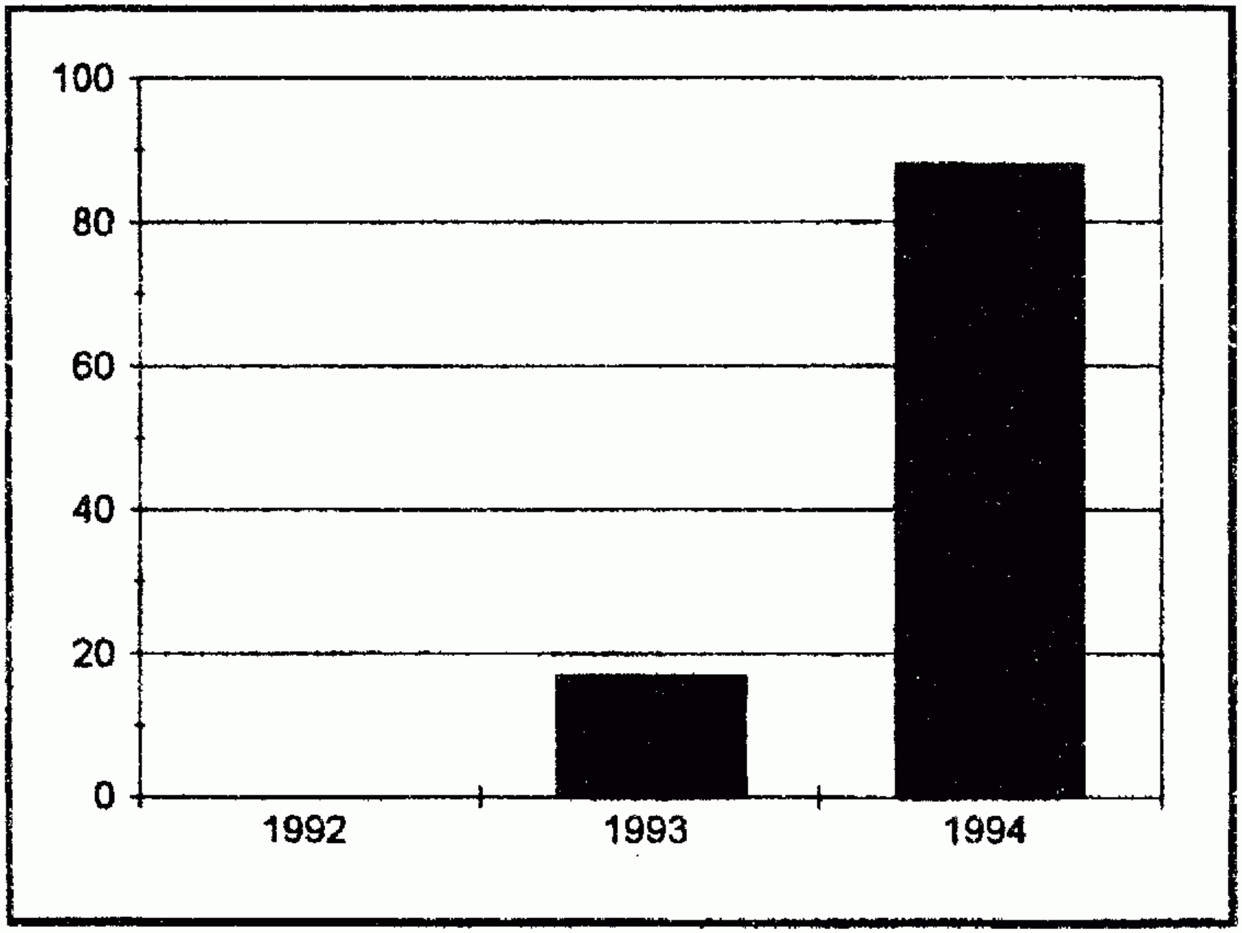

Figure 1. Total number of Simuliidae recorded on the Little Stour 1992 - 1994.

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riffle sites where these were historically dominant or sub-dominant (32 of 55 samples) (Source: NRA routine sampling record). However in the current study there was only one record of Simuliidae between 1989-1992, reflecting reduced flow velocities and an increase in the deposition of fine sediment within the channel.

In 1993 low numbers of Simuliidae were recorded at 3 sites, suggesting that recovery was underway. In 1994 there was further recovery extending to the riffle sites which had been dry during the drought, though this was relatively low compared to other taxa such as Gammarus pulex (Figs. 1 and 2).

The recovery of Simuliidae reflects both an increase in flow and a reduction in surface silts along the river. The rapid increase of Gammarus pulex may relate to an increase in the availability of detrital food material with the resumption of flow. The varied response of taxa suggests a need to understand specific faunal responses to the effects of drought and low flows.

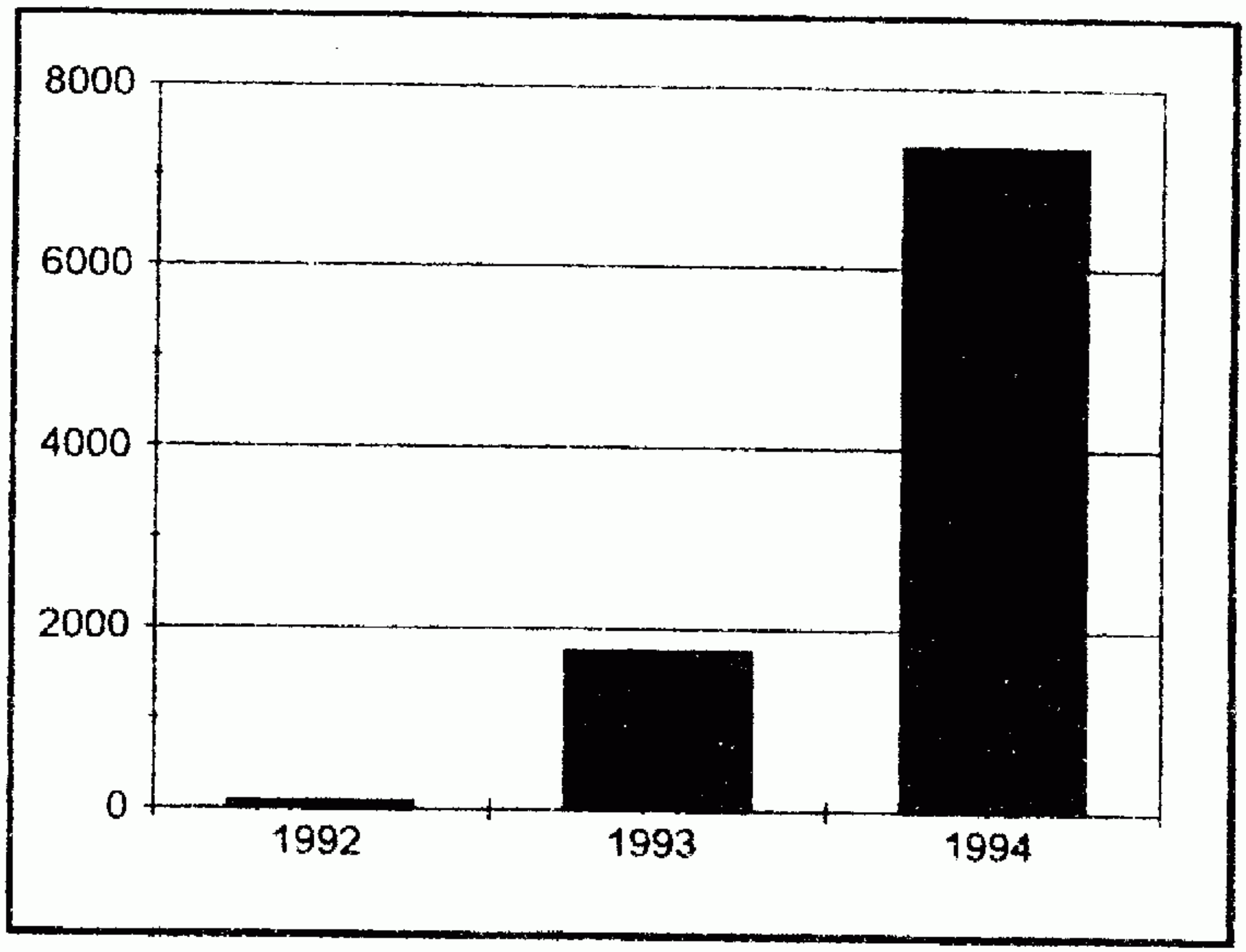

Figure 2. Total number of Gammarus pulex recorded on the Little Stour 1992 ‑1994.

SCIENTIFIC CONTRIBUTIONS

Simulium guimari and Simulium tenerificum: a correction.

R.W.Crosskey: Department of Entomology, Natural History Museum, Cromwell Road, London SW7 5BD, UK.

Simulium guimari Becker and S. tenerificum Crosskey are two species of the Simulium aureum group (= subgenus Eusimulium s.str.) endemic in the Canary Islands. Both are present in Tenerife but only S. guimari occurs in Gran Canaria. The latter island has been thought devoid of running water but investigations since 1987 have resulted in the collection of material from several small streams in Gran Canaria that survive 'against the odds'. (Water capture for human use is so efficient that the number of flowing streams has declined this century from 200 or more to almost nil.)

Study of the new Gran Canaria material has revealed an error in my paper on the Canaries Simuliidae (Crosskey, 1988) which I now correct. The larvae of guimari and tenerificum are easily distinguished by the postgenal cleft: this is a quadrate notch (typical of the aureum group) in tenerificum but is a shallow crescentic excavation in guimari. Figure 9 of my paper shows the guimari (not tenerificum) cleft and Figure 18 shows the tenerificum (not guimari) cleft. It seems that at some stage in MS production the typescripts for the larvae were inadvertently transposed. Information given in my Canaries paper for the larval stage of guimari pertains to tenerificum and vice versa. (Other life stages are unaffected.)

Reference

Crosskey, R.W. (1988). Taxonomy and geography of the blackflies of the Canary Islands (Diptera: Simuliidae). J. nat. Hist. 22: 321-355.

MEETING NOTICES

The 19th Annual Meeting of the British Simuliid Group

At the 18th. Annual Meeting, Jon Bass offered to host the 1996 meeting at Monks Wood. This proposal was accepted by acclamation. We are all grateful for this offer and the date will be announced in the next Bulletin.

NE-118, Florida, 22/23 February 1996

Possibly the last annual meeting of the North Eastern Regional Project which has become the annual meeting for North American workers on blackflies will be held in Everglades, Florida, 22nd. to 23rd. February 1996. The history of this meeting was told by Doug Craig in Brit. Simuliid Grp. Bull. 5 (1995). Anyone interested in attending should contact the meeting secretary Dr. Jim Sutcliffe, Department of Biology, Trent University, Peterborough, Ontario, Canada. K9J 7B8. [Phone (403) 748 1424, FAX (403) 748 1205, e-mail jsutcliffe@trentu.ca]

Ninth German Simulium Symposium, Vienna, 27/29 September 1996

It is understood that plans are underway to hold the Ninth German Simulium Symposium in Vienna between 27th. and 29th. September 1996. The organiser is Dr. Manfred Car, A. Hruzastr. 3, A-2345 Brunn am Gebirge, Austria.

NOTES, NEWS, VIEWS AND CORRESPONDENCE

Ivan Antonovich Rubtsov

The Russian blackfly specialist I.A. Rubtsov (= Rubzov) died in September 1993 at the age of 91. His obituary and bibliography have now been published (in Russian) in the Entomologicheskoe Obozrenie (1995, volume 74, pp. 239-253). It is aimed to prepare an English translation of the obituary (pp. 239-242) and to make a further announcement on our Group E-mail bulletin board when the translation becomes available.
[Contributed by R.W. Crosskey Natural History Museum, Cromwell Rd. London SW7 5BD UK.]

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A fourth Simulium species found in the Channel Islands

Three species have been known to occur in the Channel Islands, viz. Simulium angustipes Edwards, S. ornatum Meigen and S. trifasciatum Curtis (syn. spinosum Doby & Deblock). There are, however, at least four. A pinned male specimen recently found among unworked material in the BMNH belongs to the familiar lake-outfall species Simulium noelleri Friederichs, as shown by genital slide preparation. Its data are: Jersey, Osier St. Catherine,
9.8.1972 (W.J. Le Quesne).

[Contributed by R.W.Crosskey, Natural History Museum, Cromwell Rd. London SW7 5BD UK.]

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Simulium symposium in Santiago, Chile

The day long onchocerciasis symposium chaired by Tony Shelley at the 12th meeting of the Latin American Federation of Parasitologists in Santiago, Chile, in October was a great success with several long discussions generated by the diverse topics presented.
The following talks were given:

Tony Shelley (Natural History Museum, London) - Introduction and recent developments in research on simuliids and onchocerciasis.
Marilza Maia Herzog (Oswaldo Cruz Institute, Brazil) - Oncocercose e sua dispersao no Brasil.
Sixto Coscarón (Museu La Plata, Argentina) - Factores que afectan la distribución de los vectores de oncocercosis en Latino-America.
Sergio Luz (Natural History Museum, London)- Complexos de espécies vectoras de simulideos e sua importância na transmissao de oncocercose na America Latina.
Ron Guderian (Vozandes Hospital, Ecuador) - Estrategias para el control de la oncocercosis en el Ecuador.
Carlos Coutinho (SUCEN, Brazil) - O potencial para controle de simulideos na America Latina.
Philip McCall (Liverpool School of Tropical Medicine, UK) - Oviposition pheromones: a new aspect of blackfly behaviour for monitoring and control.

Following the meeting Tony Shelley, Sergio Luz and Marilza Maia Herzog visited two oases in the Atacama desert of northern Chile in an attempt to

obtain Simulium llutense, a locally prolific man-biting species of the subgenus Notolepria to which the vector of onchocerciasis S.exiguum belongs. Although unsuccessful in obtaining S.llutense they did collect a possibly undescribed species as well as the orange form of the man-biting species S.escomeli. Hopefully, Magda Charalambous will be able to obtain polytene chromosome preparations from this material for comparison with the Pacific lowland orange form and Andean black form of this species from Ecuador.
[Contributed by A.J.Shelley, Natural History Museum, Cromwell Rd., London SW7 5BD]

BSG Bulletin No. 7, July 1996

FROM THE EDITOR

Several members have made suggestions for improving the layout and appearance of the *Bulletin,* which I have tried to incorporate into this number. You will note that the *Contents* have moved to the back cover, and the style of the cover and headings has changed. I hope that you will find this an improvement.

Trefor Williams has provided an up-to-date list of 105 members and 7 libraries who receive the *Bulletin*. E-Mail addresses, where known, have been included. If you spot any errors or omissions, please let Trefor or myself know.

Those with access to the internet should note a change in the address of the archives of the *Simuliidae* Mail List., and comments on separate membership of BSG and *Simuliidae* on page 7.

Jon Bass has kindly agreed to organise the next meeting of the group which will be held at Monkswood in September. Details are given below.

Our membership keeps growing. This is a healthy sign, but I estimate that the cost of preparing, printing and posting 130 copies of the *Bulletin* in its present form comes out at about £80 to £90 per issue, depending on the number of pages. Most of this cost is provided by Liverpool University. Printing and paper costs about £30 per issue, which I consider to be very modest, while most of the rest is postage. With the present reorganisation of departments, and tighter curbs on expenditure, we may find someday that we will have to find alternative sources of funds for producing the *Bulletin*. I think that it is time to investigate other options, so that we will not be caught unprepared.

I was very fortunate to be able to attend the NE-118 blackfly meeting in Florida last February, where I gave a short account of the organisation of our Group, the way in which we arrange our meetings, and produce the *Bulletin.* I was most impressed by the amount of fundamental research that is being done by students in the United States, as you will see from the programme contributed by Jim Sutcliffe.

John B. Davies *Liverpool School of Tropical Medicine, Pembroke Place, Liverpool, L3 5QA, UK.*

MEETINGS

19th. Annual Meeting at Monkswood

The 19th. Annual Meeting of the British Simuliid Group will be held at the Institute of Terrestrial Ecology, Monkswood Experimental Station, Abbots Ripton, Huntingdon, on Tuesday 17th September 1996, starting at around 10.30am. The Meeting will be organised and hosted by Jon Bass. It is proposed to have the customary meal on the evening of Monday 16th. at the Pike and Eel Inn, Needlingworth which is 12 miles from Monkswood, for those who arrive the day before the meeting. This will allow most members time to return home on the Tuesday evening.

Jon will be sending out a detailed announcement soon. But to help with your foreward planning, the nearest rail stations are at Huntingdon and Peterborough 15 min and 25 min drive respectively from Monkswood. There are three trains leaving Kings Cross for each destination between 08.15 and 09.30 in the morning which should arrive in time for the meeting. Hotels are located at Godmanchester, Huntingdon, St. Ives, and Needlingworth, prices range between £35 to £57 single or £54 to £70 double.

Remember that the success of the meeting depends a on the number and quality of papers or posters presented, so Jon would like to hear from anyone who would like to give a presentation. Don't wait for the formal announcement! As before, papers will be published in the December number of the *Bulletin*, so here's a chance to get something into print.

NE-118

The following posting is the programme from the latest meeting of the NE-118 black fly group. This group, in existence for several years, is composed of a core of technical committee members some of whom receive funding through agricultural research stations (ARS) connected with certain U.S. Land Grant Universities and some of whom are self-funded. (The "NE- 118" refers to the grant number under which ARS funding is made available.) Several others pariticipate in NE-118 meetings informally and out of interest. This includes black fly researchers from the U.S. and Canada as well as other countries. Meetings of the group are informal and stimulating and usually held in warmer parts of the continent. Although this is the last year for which ARS funding is available through the NE-118 grant, the group has agreed to continue to meet annually. Next year's venue is probably Vero Beach in Florida - international attendees are most welcome!

If you have any questions about the group, please feel free to ask me

Jim Sutcliffe NE-118 Secretary, Dept. Biology, Trent University

NE-118 Annual Meeting 1996 Programme

Flamingo Lodge Marina and Outpost Resor Everglades National Park,
Florida February 22-24, 1996
Chair: Fiona Hunter, Vice-Chair: John McCreadie, Secretary: Jim Sutcliffe

Friday, 23 February 1996
9:00-9:15am Welcome, Introductory Comments & Announcements
Fiona Hunter (Chair) ; **Jim Sutcliffe** (Secretary)

NE-118 Technical Committee Reports

9:15-10:15am
Peter Adler and John McCreadie (Clemson University): Perspectives on the North American black fly fauna. (15 minutes)
John F. Burger (Univ. New Hampshire): Habitat change and black fly management at the Dixville study site. (15)
Kenneth Pruess (University of Nebraska): Selecting molecular markers. (15)
Rich. Merritt (Michigan State University): Update on Michigan black flies. (15)

Research reports from other workers

<u>10:45-12:0</u> am

Neusa Hamada (Clemson University): Cytotaxonomy and ecology of the Simulium perflavum group in Amazonia, Brazil. (15)

Doug Craig (University of Alberta): Polynesian Simuliidae: reconstructed phylogeny and zoogeography. (15)

Jan Conn (University of Vermont): Interspecific variation in polynesian black flies. (15)

Alison Stuart (University of Toronto): Why behavioural characters are so misunderstood: A case study using black fly cocoon-spinning behaviour. (15)

<u>1:30-3:00pm</u>

Fiona Hunter (Brock University): Sugar-feeding in black fly adults. (10)

Charles Beard (Clemson University): Fungus fun in flies or gut filling. (10)

Doug Currie (University of Toronto): Evolution of blood-feeding behavior in black flies (Diptera: Simuliidae). (20)

Jim Sutcliffe (Trent University): What attracts female *Simulium euryadminiculum* to the common loon? An educated guess. (15)

Elmer Gray (Clemson University): Economic impact of black flies in South Carolina. (15)

John Davies (Liverpool School of Tropical Medicine): The British Simuliid Group. (10)

<u>3.30-4.30pm</u>

John McCreadie & Peter Adler (Clemson University): Spatial consideration of species assemblage patterns. (15)

Jennifer Zettler (Clemson University): The relationships between substrate colour and larval pigmentation. (15)

Fiona Hunter (Brock University): Filter-feeding in black fly larvae. (10)

Elmer Gray (Clemson University): Update on the Clemson University orbital shaker bioassay. (10)

Dan Arbogast (State of Pennsylvania): Noted failures of Bti to effectively control black flies in Pennsylvania. (15)

<u>4:30-5:00pm</u> NE-118 Business Meeting

<u>Saturday, February 24</u>
<u>9:00am</u> Overflow and unscheduled papers.
NE-118 Business Meeting (continued)
Adjournment

<u>6:00pm</u> Closing Barbecue

International Meeting

While at the NE-118 Meeting I canvassed opinion about the possibility of holding an International Simulium Meeting in South Africa.as we discussed last year As with our group, there was a mood of cautious optimism, provided sponsorship could be provided for the majority of the 20 - 25 scientists that might travel from North America. The real problem lay with finding a suitable time. Everyone agreed that the meeting should be held during the northern winter, and that February was the preferred month as most Universities held a short recess then. Obviously there was insufficient time to organise anything for February 1997, leaving February 1998 as the earliest possible date.

When I put this to Ferdy de Moor, he replied that after discussion with Rob Palmer, they are still interested in holding the meeting in South Africa. Unfortunately, Ferdy will be out of the country during January and February 1998, which moves us on to 1999 as the earliest available February. This might be an advantage as Rhodes University, where the meeting would probably be held, has new Vice Chancellor who will need time to settle in before being approached, and the new government and independent funding agencies are at the moment finding a lot of new priorities which were not addressed previously. Hopefully, the situation will be clearer by early 1997, and Ferdy feels that he may be in a better position to assess the viability of a blackfly meeting in SA then. - Ed

NOTES, VIEWS & CORRESPONDENCE

Natural History Museum, London: New Serials List

Bulletin readers might like to know that the Natural History Museum in London has just issued a new list of the periodicals represented in its extensive natural science libraries. This supersedes the last such list of twenty years ago. That was used a fair bit among blackfly workers - for instance, Doug Craig took a set to Edmonton

The following information might be helpful if anyone wants to urge their library to get a copy:

Title: "The Natural History Museum: Serial Titles held in the Department of Library and Information Sources, 4th edition, 1995"
Basis: printout from Museum's electronic library serials catalogue
Scope: lists 25,000 serials held in the museum, of which 7,000 titles are additional
to the last serials list of 1975. Fields covered are all natural history and natural sciences, biomedicine, botany, entomology, geology, palaeontology, zoology.
Format: 1844 double-column pages issued in five ring-bound volumes. Serials listed alphabetically in full title with year span of publication and Museum holding, place of publication, in-house details of whereabouts and shelf-marks etc.
International reference: ISBN 0-565-09014-3
Price: £70 pounds (packing and postage extra)
Orders or further information: apply to Head, Department of Library and Information
Services, Natural History Museum, Cromwell Road, London SW7 5BD, UK.
E-mail address: c.mills@nhm.ac.uk

The Museum's library resources can be accessed through the photocopy service. It is not cheap, but application to the Museum can often short-circuit long delays in getting literature by other means such as inter-library loans.

Photocopy Price: £0.40 (40 pence) per spread + postage (+VAT on UK orders)
Photocopy Orders: FAX - 44 (England) (0) 171 938 9290.
E-Mail: genlib@nhm.ac.uk

Names of British Simuliids

Bulletin readers might like to have a list for easy reference of the name changes for British simuliids since the F.B.A. Handbook was published in 1968.Taxonomic investigations based on more material (including types) have led to better correlation with the Continental European fauna and to weeding out of synonyms and misidentifications.
Here are the changes (*P. = Prosimulium, S. = Simulium*):

FBA Handbook Name	Present Name
P. arvernense	*P. tomosvaryi* Enderlein
P. inflatum	*P. latimucro* Enderlein
S. angustitarse	*S. lundstromi* Enderlein
S. argyreatum	*S. noelleri* Friederichs
S. aureum group sp. (unnamed)	*S. velutinum* Santos Abreu
S. austeni	*S. posticatum* Meigen
S. brevicaule	*S. cryophilum* Rubtsov
S. cambriense (celticum)	*S. angustitarse* Lundström
S. latigonium	*S. lundstromi* Enderlein
S. latipes	*S. vernum* Macquart
S. monticola	*S. argyreatum* Meigen
S. nitidifrons	*S. intermedium* Roubaud
S. salopiense	*S. lineatum* Meigen
S. spinosum	*S. trifasciatum* Curtis
S. subexcisum	*S. latipes* Meigen
S. sublacustre	*S. rostratum* Lundström
S. tuberosum	*S. tuberosum* s.l. *
S. yerburyi	*S. latipes* Meigen
S. zetlandense	*S. equinum* Linnaeus

* Anyone using the name *tuberosum* for British specimens should add 's.l.'. Peter Adler's studies on Holarctic *tuberosum* show it to be a species complex. Our *'tuberosum*' in Britain is not *tuberosum* s.str. (from Finland) but could be one of the other named species that come within the morphospecies *tuberosum*.

Besides name changes there are a few additions and deletions of species to and from the British list:

Additions	Deletions
Metacnephia amphora Ladle & Bass	*Cnephia tredecimata*
S. juxtacrenobium Bass & Brockhouse	*S. britannicum*
S. pseudequinum Séguy	

[List provided by Roger Crosskey who should be contacted if you need the background to any of the changes - Ed]

Membership of the *British Simuliid Group* and the Mail List *Simuliidae*

A number of complaints have been received from BSG members who claim that they have not been getting any of the correspondence from the *Simuliidae* electronic list, and from members of the list who have not received copies of the *Bulletin*.

The explanation is that the two memberships are separate, and not linked. Membership of one does not automatically confer membership of the other. Please refer to the inside of the front cover for information on joining.

MAILBASE of Newcastle University who administer the *Simuliidae* list have just informed us that they no longer support the *Gopher* system. This means that from now on the *Simuliidae* archives can only be viewed via the WWW at URL: *mailbase@www.mailbase.ac.uk/lists-p-t/simuliidae* This is unfortunate for those members who do not have access to a web browser.

On the Internet

Searching the World Wide Web for the word 'simuliid' produced 45 references, most of these related to our *Simuliidae* mail list, but two other sites of potential interest to British simuliidologists turned up. They are:

Pictures of Simuliidae Twenty-two images collected by Doug Craig are available for viewing or downloading at URL:

http://gause.biology.ualberta.ca/craig.hp/simuliid/simul.hp

Warning! Viewing this site may seriously increase your telephone bill!

Checklist of Belgian Simuliidae prepared by Dominique Van Den Neucker in 1991 can be found at URL:

http://alt-www.via.ac.be/u/intpanis/simulis.html

TRAVELLERS' TALES

Kabowra Flies

In 1950, Gerald Durrell visited Guyana on one of his animal collecting trips. This extract is from pages 91 to 92 of his book "Three Singles to Adventure" He describes how, accompanied by Robert Lowes, he visited the McTurk ranch at Karanambo (3° 33' N, 59° 10" W) in the Rupununi Savannah in the South of the country.

> When we had finished the meal, McTurk suggested, to lighten our gloom, that we might like to accompany him on a fishing trip he was making down the river. It would give us a chance to spy out the land and work out some sort of a plan. We made our way down through the trees to the river, and there, in a tiny bay, we found an odd collection of boats. Some were native canoes, some resembled ships' lifeboats, and one of them was a small tubby dinghy with an outboard engine. McTurk climbed into the dinghy and was carrying out some kind of adjustments to the engine, and Bob and I reclined on the bank above to have a smoke. No sooner had we settled ourselves than we were fiercely attacked by great numbers of tiny black flies a little larger than a pin-head but with a bite that was out of all proportion to their size. You felt as though you were being stabbed all over with thousands of cigarette ends, and Bob and I were soon leaping about the bank cursing and slapping and hurriedly rolling down the sleeves of our shirts. McTurk watched our antics with amusement.
>
> "They're kaboura flies", he explained, "but they're not so bad now. You should see them in the rains, millions of them".
>
> The kabouras continued their assault on us until the dinghy was pushed out into mid-stream and the engine started. A few of them flew after us, but we soon left them behind. McTurk explained that they only lived in moist places, and so during the dry season they inhabited only the margin of the river. During the rains, when vast areas of the savannah were covered with water, the flies had a greatly increased range which they took full advantage of, settling on you in clouds if you ventured out unprotected.
>
> The river was not very wide, but the tawny waters were deep and the current fast. Where the river curved, the rippling waters had piled up great banks of golden sand, dotted with the rotting trunks of fallen trees or great slabs of smooth grey rock.

"Three Singles to Adventure" Heineman, London 1962 (First published 1954).

[John Smart (Simuliidae (Dipt.) from British Guiana and the Lesser Antilles; Transactions of the Royal Entomological Society of London 90 (1): 1-11.) writes that the name 'Cabowra flies' refers to *Simulium haematopotum* Malloch. However, when I visited the Rupunini near the Guyana/Brazil border in 1973-5 I found that the term was applied to any species of biting *Simulium,* including *S. guianense* and members of the *S. amazonicum* group. Ed.]

Pests of the Pushal

In 1956 Eric Newby accompanied by Hugh Carless set out to attempt to climb the mountain of Mir Samir in Nuristan which lies NE of Kabul and N of Jalalabad. On their way back they stopped at Pushal, capital of the Ramgul Katirs and located on the Pushal River in the Ramgul valley. (approx. 30° 30' N , 70° 20' E) He writes:

p. 211
"There was no main street in Pushal because no two houses were at the same level. The way through it was like a gully, far too steep even for our horses, which had to cross the river and ford it again lower down beyond the town. There were no shops, no *chaie-khana* but, as in Panjshir, the roofs were covered with apricots and mulberries. Among the fruit, watching us go by, stood wraithlike figures in white so muffled up that it was impossible to say whether they were men or women......."

p. 221
"The children were covered with sores, but then so was every-one else, and as time passed so were we: attacked by an abominable fly, a small yellow-backed variety that drilled holes in us, making a sort of bridgehead for larger filthier flies. This fly had the facility, like a fighter attacking out of the sun, of being able to pick a blind spot and alight on one's nose without being observed. For some reason known only to themselves they were particularly attracted to Hugh's. Soon it was covered with craters that gave him a particularly dissipated appearance of which he was acutely conscious."

Extracted with the author's permission from: "A short walk in the Hindu Kush" by Eric Newby, Secker and Warburg, London 1958 247 pp.

[Note: Elsewhere in the book Newby mentions mosquitoes, so these insects were different, It is unlikely that the colour of *Culicoides* would have been noticed, and *Culicoides* are usually described as "minute", and most species are crepuscular. The presence of a nearby mountain river suggests simuliidae, but could they perhaps have been a yellow species of Stomoxyinae? Can anyone hazard an identification? Ed.]

British Simuliid Group Bulletin

Number 8, December 1996

FROM THE EDITOR

Another *Bulletin* is about to come out, and I would like to thank all contributors for sending in their pieces so promptly.

Trefor Williams, who was the editor of the first numbers of the Bulletin, and of all the Newsletters that preceeded it, retired in October. Since Trefor could not attend the September meeting the opportunity was taken for everyone to sign a card of congratulation (if that is the right sentiment). Trefor tells me that he will continue his teaching commitments for the next two years, and will be happy to continue as secretary of the group. He will still occupy his office in the University, and his address remains unchanged.

John Brooks has looked at the pros and cons of registering the *Bulletin* for an ISSN number. To have a number would help librarians in ordering and cataloguing the *Bulletin* but since we send to only 7 libraries and have a relatively small circulation, it hardly seems worthwhile, so I will not apply unless enough members have other views.

We have received quite a few amendments to the address list published in the last *Bulletin*. The changes and additions are given at the end.

THE 19th ANNUAL MEETING AT MONKS WOOD

The 19th Annual Meeting was held at the Eastern Rivers Laboratory of the Institute of Freshwater Ecology, Monks Wood Experimental Station, Abbots Ripton, Huntingdon on 17th September 1966. The meeting was organised by Jon Bass .

As is with previous meetings, those who managed to arrive the evening before, met for an informal dinner which this year took place at the Pike and Eel Inn, Needlingworth. Fourteen members and friends were assembled and some were brave enough to sample the "Wild Boar" (if an animal that has been reared in captivity can be called "wild").

The meeting itself was attended by 21 members and was opened by Dr. Clive Pinder who introduced the work of the Eastern River Laboratories. He explained that there had been a major decline in freshwater fisheries since 1970. This was mostly attributed to the management of the rivers for navigation and to reduce flooding. Dredging reduced the reaction between the river and the flood plain and the occasional high floods now flushed out the pools and backwaters which served as refuges for young fish. The NRA only censor large fish so MW is concentrating on habitat selection and survival by young fish using Beam as the indicator species.

Copies of newspapers carrying inaccurate accounts of an outbreak of the "Blanford Fly" in the Oxford area in the summer of 1996 and featuring a photograph of a prominant member of the Group on the front page were put on show. Titilating headlines such as "SUPERBUG - Sucking blackfly strikes - Experts baffled" indicated the tone of the articles. For those who might wish to follow up this story, the papers were the *Oxford Mail* of August 29, and the *Oxford Times* of August 30 1996, both articles by Chris Dignan.

Five papers and one poster were presented during the morning and early afternoon.

After tea, there followed a lively discussion on a number of topics. Tony Shelley, on behalf of the Natural History Museum, offered to host the 20th (1997) Meeting, an offer which was accepted by acclaim. The question of future funding of the *Bulletin* was raised. Preparation, printing and postage currently costs about £80.00 per issue. At present this cost is borne by Departments of Liverpool University the Liverpool School of Tropical Medicine, and a research grant. However, the research grant will end in 1997, and reorganisation of University Departments and

their financial structure may make future funding uncertain. The discussion which followed showed that the membership favoured continuing with two issues of the *Bulletin* each year, and alternative sources of funds were discussed. A suggestion that a membership fee or attendance fee be charged at meetings was considered impractible because this would mean keeping accounts etc. A final decision was postponed until the next meeting when the financilal situation would be clearer. In the meantime members would investigate
other alternatives

Members were asked for their views on compiling a register of collections made by members, starting with those that did not figure in any publication. Feelings were mixed. There was the problem of errors in identification becoming perpetuated. However a suggestion that a map should be compiled showing areas where collections had been made so that members would know where the records were lacking won general approval and Roger Crosskey was asked whether he could try to do this.

There was no further information to report concerning the proposal to hold an international meeting in South Africa.

The meeting ended with a vote of thanks to Jon Bass for organising such a successful meeting

ARTICLES BASED ON PRESENTATIONS GIVEN TO THE MEETING

Effect of vector control and community based distribution of ivermectin on the transmission of *Onchocerca volvulus* by *Simulium neavei* in western Uganda

Rolf Garms[1], James Katamanywa[2], John Yocha[3], Tom Rubaale[3]
[1] *Bernhard Nocht Institute for Tropical Medicine, Hamburg, Germany*
[2] *Vector Control Unit, Ministry of Health, Fort Portal, Uganda*
[3] *GTZ Basic Health Services, Fort Portal, Uganda*

In Uganda 1.2 million people are believed to be infected with *Onchocerca volvulus* (World Health Organization, 1995). About 800.000 of them now receive annual treatments with ivermectin, which has become the means of choice for the control of onchocerciasis. In Kabarole district in western Uganda community based distribution of ivermectin began in the second half of 1991. The effect of these treatments on the transmission of *Onchocerca volvulus* by the vector *Simulium neavei* has been studied in the northern of the two onchocerciasis foci in the district from 1991 to 1995.

The focus is located around the Itwara forest reserve about 25 km north-east of Fort Portal, the headquarters of Kabarole district. The reserve covers 87 km^2 of steeply undulating terrain. It is bordered to the west, south and east by large tea estates which are highly important economically, and to the north by subsistence farms with some large cattle ranches. The area is densely populated and onchocerciasis is highly endemic. The vector is *S. neavei* which has its breeding sites in the Sogohi system which bisects the forest. The Itwara focus is not completely isolated from a smaller secondary focus along the lower Sisa and Kyasa rivers and parts of the Muzizi where it flows through forest. Altogether, at least 40,000 people are infected with *0. volvulus* in northern Kabarole out of a population of about 800,000 in the whole district.

In order to monitor the effect of the ivermectin treatments on the transmission of onchocerciasis, flies were routinely caught by vector collectors at four catching sites and examined for infections with *O.volvulus*. In general, immediately after the treatments infection rates declined significantly but started to increase again two to four months later. In 1991, of a total of 1553 parous flies which were dissected 27.8% carried 1st and/or 2nd stages (L1/L2) of *O. volvulus* and 2.6% carried third stage larvae (L3) in the head. Corresponding figures for the following years were 6841/31.0/5.6 in 1992; 3990/26.8/3.5% in 1993; 3162/21.6/3.8 in 1994; and 1672/15.7/2.9 in 1995. Infection rates of the flies became significantly lower than was observed before the treatments when more than 40% of the flies were infected. However, it became clear that over the first four years of the programme the transmission was not being reduced sufficiently to halt transmission. It was estimated that 1000 parous flies carried 124 infective larvae of *O. volvulus* in their heads in 1991, 276 in 1992, 169 in 1993, 176 in 1994 and 151 in 1995. A similar pattern was shown when the individual parasitic loads of the infected flies with L1/L2 or L3(in the heads) were compared (Fig. 1). There was a decline of the numbers of L1/L2 per infected fly but, interestingly, not of the numbers of L3. The reason for this could be a limitation of the numbers of infective larvae tolerated by the flies. Results suggested that ivermectin treatments would have to be continued over many years unless carried out at other intervals or dosages or combined with other measures, such as vector control.

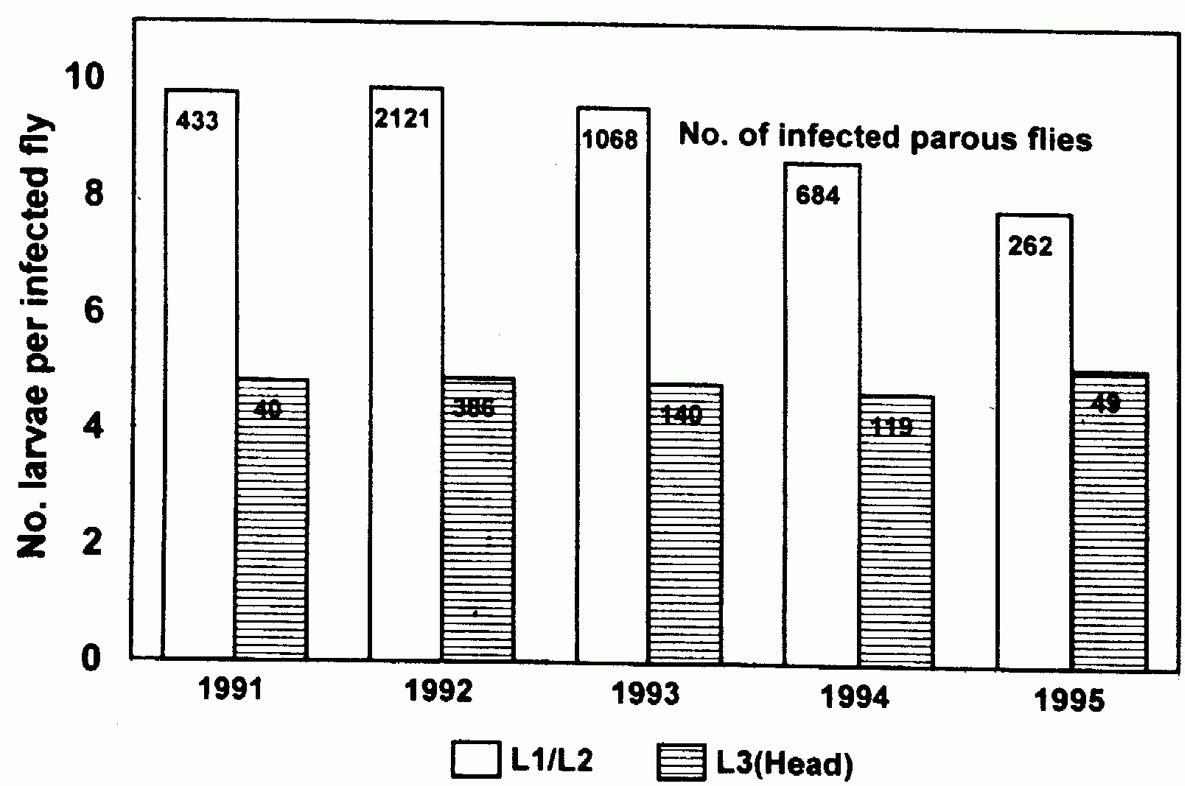

Figure 1: Parasitic loads with L1/L2 or L3(head) of *Onchocerca volvulus* in *Simulium neavei* infected with L1/L2 or L3(head). Northern onchocerciasis focus of Kabarole district (1991 to 1995).

Figure 1: Parasitic loads with L1/L2 or L3(head) of *Onchocerca volvulus* in *Simulium neavei* infected with L1/L2 or L3(head). Northern onchocerciasis focus of Kabarole district (1991 to 1995).

An attempt was therefore made to investigate the feasibility of vector control in the sufficiently isolated northern focus of Kabarole district using the organophosphorous larvicide temephos (Abate<) which is regarded as safe for the environment. First experimental treatments were carried out at two sites on the Sogohi river in 1994. Concentrations of 0.2 to 0.3 mg/l temephos (calculated for a river discharge of 10 minutes) were sufficient to kill the larvae of *S. neavei* over a distance of more than 3 km. No adverse effects were noted on the river crabs (*Potamonautes aloysiisabaudiae*), which are the phoretic hosts of the immature stages of the vector. The first treatments were followed by an immediate reduction of biting densities of *S. neavei* at a nearby catching site, where only 65 flies were caught in 1995, in comparison with an average of more than 3600 flies during the three previous years.

Following these promising results, Abate treatments were gradually extended to all rivers of the focus, where *S. neavei* was known to breed. They were repeated at 1 or 2 months intervals. Finally, 29 dosing points were utilised. The extension soon led to a virtual disappearance of flies from the catching sites around the Itwara forest and the last fly was caught on 3 August 1995 at the Sogohi catching site.

It appears that, at present, there is no longer any substantial transmission in large parts of the focus. The effect of the treatments was also checked and confirmed by the routine examination of river crabs, which became almost free of immature *S. neavei*. Plans are now being made for a routine project aiming at an eradication of the vector and the disease, from the focus. By a combination of vector control and ongoing ivermectin treatments

Blackfly larvae and bioengineering

Roger Wotton, *Dept. of Biology, University College London*, *Gower St., London WC1E 6BT*

Bioengineering is a "buzzword" used to describe the way animals modify their environment. Blackfly larvae have an effect on the streams in which they live but they are also elegantly engineered. I will therefore use two sub-headings: 1. Engineering *of* blackfly larvae and 2. Engineering *by* blackfly larvae

1. Engineering of blackfly larvae

(a) Silk is produced from prominent glands that run almost the length of the larval body. Silk is used by larvae in several ways. For attachment to the substratum; a thread of silk serves as a life-line when larvae are dislodged; and pre-pupae spin a silk cocoon in which the pupa is attached. Although no measurements have been made, observation suggests that blackfly silk is a very strong material indeed.

(b) The body shape of blackfly larvae, with the widest part of the abdomen about one third from the posterior of the body, provides a streamlined profile as larvae trail in the water current.

(c) Anyone viewing the head fans present in most blackfly larvae cannot but be impressed by their engineering. Not only are rays delicate yet strong, but rays can be folded and extended with what appears to be a minimum of energy. The head fans are effective trapping devices and many materials will become impacted on to the microtrichia, larger particles being trapped by sieving.

(d) One of the advantages of the living engineering shown by larvae is that growth, and replacement, of the exoskeleton are achieved by moulting. Inorganic engineering has a lot of catching up to do.

2. Engineering by blackfly larvae

(a) We know from the studies of Doug Craig and his students that complex currents pass over the blackfly larval body and also over/through the head fans. There is a hydrodynamic effect of these currents downstream and this is the explanation for the presence of rows of larvae often seen over horizontal surfaces. The larvae clearly engineer an effect on the pattern of water flow.

(b) Some species (e.g. *Simulium noelleri* in the palaearctic and the closely related *S. decorum* in the New World) form dense aggregations and their effect on the water flowing over them must be considerable. Aggregations are often formed in shallow water and the numbers of large particles (> 40 mm in diameter) being carried by the water are reduced in just a few centimetres of stream length. In thin films of water the tips of the larval head fans are seen to distort the surface film and the effect of larvae on current patterns must be complex and involve much turbulence.

(c) We know that blackfly larvae ingest a wide range of matter, both organic and inorganic, from the water column.

Suspension feeding is not the only strategy and larvae of some species graze exclusively by scraping the substratum, others using this strategy occasionally. We are still a long way from understanding what are the main foods of larvae and sophisticated techniques will be required to see whether exudates and the adsorbed coatings of ingested mucopolysaccharide fibrils play a significant part in nutrition. I suspect that they do.

(d) Blackfly larvae have a low assimilation efficiency and feed continuously. The result is that large numbers of faecal pellets are produced by each larva. In June and July of this year I joined Björn Malmqvist of Umeå University to study the abundance of blackfly faecal pellets in a stream that flowed 500 m from a lake to the Baltic. We monitored the number of faecal pellets in transport and used sedimentation traps to record numbers depositing on the substratum. Blackfly larvae were present in the upper part of the stream at densities of 1 million per m^2 and these larvae produced huge numbers of pellets, having ingested a very wide range of particulate and dissolved materials from the water. They are thus important bioengineers in capturing materials from suspension, packaging them into much larger aggregates, and then causing these large particles to be transported downstream. Our study showed that some pellets were ingested by blackfly larvae and others were sedimented and used by other members of the benthic community. This is probably an important process in the stream we studied and may well be in many stream and river systems.

The Blandford Fly - Absolutely the last word.

Mike Ladle and Stewart Welton. *IFE River Laboratory, East Stoke, Wareham, Dorset, BH20 6BB.*

The "human-biting" Blandford Fly (*Simulium posticatum* Meigen), abundant in the valley of the Dorset River Stour, has been the subject of ecological investigation since the late 1960's. In this period it has been the topic of a PhD thesis, numerous scientific papers, countless newspaper articles, several poor cartoons, a love story and a detective novel. In the course of studies aimed at the ultimate control of the biting problem several fascinating features of the biology of this species have emerged.

The fly has a single annual generation involving the choice of a unique oviposition site in the cracked soil of the river banks, a prolonged egg diapause, huge populations of larvae in the fast flowing reaches of the river in springtime, pupation and emergence over a short period in late April to mid-June and a predeliction for human blood. The latter is associated with biting of the lower legs of humans and often severe reactions to the bites resulting in oedema, irritation, blistering and ulceration.

Following a long campaign, involving NRA, Bournemouth Water Company and HSE, North Dorset District Council were given an experimental permit in 1989 for treatment of the Blandford Fly larvae with the bacterial insecticide Bti. The IFE have since carried out pilot treatments with this material and now, in four successive years, full treatments of the River Stour. Over this period the numbers of people reporting bites at monitored local health centres has been reduced, by two orders of magnitude, to single figures in 1996.

Simulium damnosum s.l.: Identification of inducible immune molecules and their possible implications for the transmission of *Onchocerca* spp. in an endemic area of human onchocerciasis in North Cameroon.

H.E.Hagen, S.L.Kläger, D.V.Barrault, P.J.Ham[1], J.H.McKerrow[2] & D. Hultmark[3] [1]. *Keele University, Staffordshire, UK.;* [2]. *VAM/UCSF, San Francisco, USA;* [3]. *University of Stockholm, Sweden.*

A variety of inducible immune molecules have been observed in *Simulium damnosum* s.l. following an infection with the bovine parasite *Onchocerca ochengi*. Amongst these haemolymph components are phenoloxidase, serine proteases, lectins, lysozyme and at least one defensin-like antibacterial peptide that has not been fully characterised.

For some of these components direct evidence is available that they are potentially lethal to microfilariae and the infective third stage larvae of *Onchocerca* spp. *In vitro* assays could demonstrate that haemolymph of infected blackflies kills the parasite more effectively than control haemolymph. Serine protease inhibitors, when co-injected with microfilariae of *O. ochengi*, were the most effective type of protease inhibitor to increase parasitic survival. This indicates the role of this type of protease in the defense against parasites either directly or via the activation of prophenoloxidase. Co-injection of certain sugars together with the parasites again led to the enhancement of parasitic survival. This is most likely due to their successful blocking of the respective type of haemolymph lectin.

In summary, from our knowledge of the blackfly's immune apparatus it can be concluded that it constitutes some of the important intrinsic factors that determine the vector capacity of a given cytospecies or population of *S. damnosum* s.l.

On blackflies from Tierra del Fuego and Patagonia

Roger W. Crosskey: *Department of Entomology, Natural History Museum, Cromwell Rd., London SW7 5BD, UK.*

The informal contribution comprised a transparency-assisted ramble in parts of Tierra del Fuego and Patagonia where, in January-February 1994, I collected blackflies in company with Monty Wood (Ottawa). Some of the key facts highlighted by way of an introduction to the southern Andean fauna (not hitherto touched on in a Group meeting) were these:

The dominant Andean genus is *Gigantodax* (68 species, Tierra del Fuego to Mexico, one new species in press from Arizona [Kevin Moulton, pers. comm.]). The genus is unique in Simuliidae because of the straight instead of sinuous wing vein Cu1A. Just half of the species occur in southern Andes (Peru southwards). *Simulium* is represented in the southern Andes almost solely by subgenus *Pternaspatha* (29 species, Peru to Tierra del Fuego, one species in Ecuador). The affinities are unclear. Member species lack the calcipala (rounded lobe on inner tip of hind basitarsus) nearly always present in *Simulium*. Additionally, *Paraustrosimulium* (1 species), *Cnesia* (3 species) and two (not mentioned) monospecific genera occur in southern Chile and Argentina. Sites on both sides of the Beagle Channel and in Isla de los Estados, easternmost fragment of the Tierra del Fuego archipelago, are the most southerly point in world range of the Simuliidae (approximately 54°50' South). Thirteen species are known from the archipelago

A collecting trip by F.W. Edwards (a Natural History Museum dipterist) to the southern Andes in 1926 resulted in the collection of 20,000 Diptera, most written up in later years in a series entitled "Diptera of Patagonia South Chile". Edwards collected mainly in the area of Bariloche (Argentina), so this is of special interest because it is the type locality for many southern Andean Diptera. Edwards, being a Nematocera specialist, wrote up the simuliids himself and made the first significant contribution to knowledge of *Gigantodax*; only the original type species was known before, and Edwards (1931) described eight new species (his good series of adults are in the Museum). Edwards (1927) wrote a little known account of the entomological expedition.

References

Edwards, F. W. (1927). Insect collecting in the southern Andes *Natural History Magazine* **1**, 111-125

Edwards, F. W. (1931). Simuliidae. Pp. 121-154 in *Diptera of Patagonia and .South Chile*, Part II Nematocera (excluding crane-flies and Mycetophilidae) 331 pp. British Museum (Natural History), London.

ARTICLES BASED ON POSTER PRESENTATIONS

The use of image analysis systems in simuliid taxonomy

C.A. Lowry, A.J. Shelley, S. Luz and M. Maia-Herzog*
Medical and Veterinary Division, Department of Entomology, The Natural History Museum, London, U.K.
**Departmento e Entomologia, Instituto Oswaldo Cruz, Rio de Janeiro, Brazil*

Recent work on Neotropical simuliid vectors of human onchocerciasis, has shown that behavioural and vectoral differences can be attributed to the existence of sympatric populations of closely related species or of species complexes defined by cytological and molecular methods. A search for fine morphological characters for rapid field identification of members of species groups and complexes involves the need for simultaneous comparisons.

*Synoptics** developed an image composition system, "Montage", within their image analysis software, *Semper*. Images captured and composed using this system can be archived using their image database software, *Treasury*. Multiple images can then be compared simultaneously on screen allowing numerous features to be scrutinised in detail.

Integral within the system is a compound microscope. The range of objectives available allows images of both whole specimens or parts of specimens on slides mounts to be viewed and captured. The composite computer image is constructed from various focal plains of specimens viewed through the microscope. The montage of images to form a single picture is unlimited, thus allowing a precisely focused image of the specimen to be produced. This has surmounted previous problems of micro photographic reproductions that have precluded the full definition of morphological features in a single photograph because of depth of field problems.

The composed image together with any relevant data associated with that image e.g. determination, stage, sex, locality, etc. can be added to the database systems Treasury. The system then allows searches to be done for any words within the text for quick retrieval of images, which can be viewed simultaneously for comparison.

This technique has been effectivly used in differentiating *Simulium oyapockense* Floch & Abonnenc from *S. roraimense* Nunes de Mello, both vectors of onchocerciasis in the Brazilian Amazon, and from the morphololgically similar non vector *S. minusculum* Lutz. On close inspection under standardised lighting *S. minusculum* can be identified by the length of the triangular intervital marks which are short in comparison to those of *S. oyapockense* and *S. roraimense*. Separation of females of *S. oyapockense* amd *S. roraimense* has proved more difficult and the valididy of these two species questioned. However, recent cytological study has show that they are good taxa, with a major fixed inversion in the short arm of chromosome II. Using the above equipment to compare simultaneously on screen numerous features, an area highlighted for further study is the number of cibarial teeth present in these species. However, these comparisons have also indicated that *S. oyapockense* is probably a species complex and further investigation is required.

* *Synoptics* is the name of a commercial organisation - Ed

SCIENTIFIC CONTRIBUTIONS

New records of Simuliidae from Tierra del Fuego and the southern Andes

Roger W. Crosskey: *Department of Entomology, Natural History Museum, Cromwell Road., London SW7 5BD, UK*

In January-February 1994, during a visit to Tierra del Fuego and the southern Andes with Dr. M. Wood, I made a collection intended to augment the somewhat meagre holding of southern Neotropical blackflies in the Natural History Museum. The material obtained is now in the NHM and the following is a succinct account of the new records, the species list given first followed by the list of sites represented by the appended numbers.

Cnesia dissimilis (Edwards).......................................7, 8, 15
Gigantodax antarcticus (Bigot)..................................10, 17, 22
Gigantodax brophyi (Edwards)..................................3, 4, 16, 18, 19
Gigantodax chilensis (Philippi)...................................7, 8, 9, 10, 17, 24
Gigantodax fulvescens (Blanchard)...........................7, 8, 9, 10, 11, 14, 20, 22, 23, 24
Gigantodax igniculus (Wygodzinsky & Coscarón).....2, 5, 6, 7, 13
Gigantodax marginalis (Edwards).............................13, 20, 21, 22
Gigantodax rufescens (Edwards)...............................13, 21
Paraustrosimulium anthracinum (Bigot).....................1, 16
Simulium (Pternaspatha) ? nemorale Edwards..........1, 12, 17

Site data:

Argentina

1. Tierra del Fuego Province, Tierra del Fuego, Rio Olivia, 14 km E of Ushuaia, on Rio Grande road, 25.i.1994
2. Tierra del Fuego Province, Tierra del Fuego, stream 33 km E of Ushuaia just before road junction to Harberton, 25.i.1994
3. Tierra del Fuego Province, Tierra del Fuego, stream into Lake Fagnano, 11.4 km S of Kaikén, 25.i.1994
4. Tierra del Fuego Province, Tierra del Fuego, stream 16.5 km S of Kaikén, on Rio Grande to Ushuaia road, 25.i.1994
5. Tierra del Fuego Province, Tierra del Fuego, mountain cascade on Garibaldi Pass 50 km from Kaikén on road to Ushuaia (above Hosteria El Petrel and Lago Escondida), 25.i.1994
6. Tierra del Fuego Province, Tierra del Fuego, river 25 km E of Ushuaia at Las Catorras ski centre, 25.i.1994
7. Neuquen Province, Rio Tromen on Mamuil Malal Pass (Pucín to Jun¡n de los Andes road, 4.ii.1994
8. Neuquen Province, San Martín de los Andes area, stream 6 km N of Rio Quilquehue bridge, on road to Carirrine Pass, 5.ii.1994
9. Neuquen Province, San Mart¡n de los Andes area, stream on north shore of Lago Lolog 4 km NW of Rio Quilquehue bridge, 5.ii.1994
10. Neuquen Province, San Martín de los Andes area, stream at end of track along north shore of Lago Lolog 5 km NW of Rio Quilquehue bridge, 5.ii.1994
11. Neuquen Province, San Martín de los Andes area, runnel under track along north shore of Lago Lolog 2.5 km NW of Rio Quilquehue bridge, 5.ii.1994
12. Neuquen Province, San Martín de los Andes area, Rio Quilquehue below bridge at outlet of Lago Lolog on road to Carirrine Pass, 6.ii.1994
13. Neuquen Province, stony brook flowing west to Lago Hermoso on 'Seven Lakes' road between San Martín de los Andes and Correntoso, 6.ii.1994
14. Neuquen Province, Nahuel Huapi National Park, forest seepage just south of Lake Falkner, 6.ii.1994
15. Neuquen Province, Nahuel Huapi National Park, Arroyo de la Estacada, at crossing of Correntoso to Bariloche road, 14 km SE of Villa La Angostura, 8.ii.1994

Chile

16. Magallanes Region, north-flowing stream on Punta Arenas to Puerto Natales road, 2.5 km N of Morro Chico near Estancia Morro Chico, 27 and 30.i.1994
17. Magallanes Region, Torres del Paine National Park, stream draining Laguna Margarita into Rio Grey near S end of Lago Grey 1.5 km E of Guarderia Lago

Grey, 28.i.1994
18. Magallanes Region, west-flowing stream to Lago Figueroa, 45 km N of Puerto Natales on Torres del Paine road (near 290 km distance marker from Punta Arenas), 29.i.1994
19. Magallanes Region, Estero Creek, on Punta Arenas to Puerto Natales 5 km E of Renoval, near Estancia Eliana Maria, 30.i.1994
20. Biobio Region, Nuble Province, Estero Renegado 2 km E of Las Trancas, on road to Termas de Chillan, 1.ii.1994
21. Biobio Region, Nuble Province, Termas de Chillan, stream in valley SE of main fumeroles, 2.ii.1994
22. Biobio Region, Nuble Province, Termas de Chillan, stream 1 km SSW of ski centre, 2.ii.1994
23. Biobio Region, Nuble Province, river at Puente Torrealba about 5 km ENE of Las Trancas on Termas de Chillan road, 2.ii.1994
24. Araucania Region, Cautín Province, Rio Momolluco near Chilean customs post at Puesco on Pucón (Chile) to Junín de los Andes (Argentina) road, 4.ii.1994

Acknowledgement

I thank Dr Sixto Coscarón for confirming my identification of Gigantodax marginalis.

First report of Simuliidae in Fuerteventura, Canary Islands

Marcos Baez: *Dep. de Biologia Animal, Universidad de La Laguna, 38206 La Laguna, Tenerife, Canary Islands*

Blackflies are quite well known in Gran Canaria, La Gomera, La Palma and Tenerife, though they have a very restricted distribution in these Canarian islands because of the scarcity of running water. Until lately, however, they have been undiscovered in the highly arid easternmost islands of the archipelago, viz. Fuerteventura and Lanzarote, where lotic habitat is almost non-existent. They are still unknown (and seem unlikely to occur) in Lanzarote but I have found two breeding sites in Fuerteventura and can now report the occurrence of at least one species in the island. Its identity has been verified by Roger Crosskey as *Simulium (Nevermannia) ruficorne* Macquart, a species widespread in Africa and fairly common in sun-warmed lotic habitats in Gran Canaria, La Gomera and Tenerife. I collected pupae and obtained reared adults in February 1990 from the barranco (ravine) to the Embalse de las Peñitas near Vega de Rio Palmas (UTM grid ref. ES9940) and in April 1996 I collected early stages and adults from a trickle near Llanos de la Concepción (UTM grid ref. ES9149). Both places are on the west side of Fuerteventura island, near the road from Puerto de Rosario (the island capital on the east coast) to Pájara (in the southwest). Specimens from both sites are deposited in my collection and in the Natural History Museum in London.

MEETINGS

Fourth International Congress of Dipterology

The Fourth International Congress of Dipterology will be held in Oxford, U.K., 6-13 September 1998. Chairman: Dr. R.P.Lane, Department of Entomology, The Natural History Museum, Cromwell Road, London SW7 5BD, UK. (fax: 44 171 938 8937; e-mail R.Lane@nhm.ac.uk). Secretary: Dr. A.C.Pont, hope Entomological Collections, University Museum, Parks Road, Oxford OX1, 3PW, UK. (fax: 44 1491 873749).

To register your interest or for further information, please contact: Oxford International, ICD4, Summertown Pavillion, Middle Way, Oxford OX2 7LG, UK. (fax: +44 1865 511570; e-mail:

101475@compuserv.com).

[At the 3rd. International Congress of Dipterology, which was held in Guelph, there was a special blackfly workshop. Do we want to want to have one at the next?]

TRAVELLERS' TALES

Pallas and the Moshkis

Roger W. Crosskey: *Department of Entomology, Natural History Museum Cromwell Road., London SW7 5BD, UK.*

By the late eighteenth century the Russian empire had been expanded southwards to the Caspian and eastwards across Asia to the Pacific. There was, however, profound ignorance of what these vast lands contained in the scientific sense until the Empress Catherine the Great, stung by western criticism of Russian academic backwardness and scientific ignorance of her vast territories, set about putting things right. Educated travellers were sent hither and thither on journeys of scientific exploration. One of these men, and perhaps the most eminent, was Peter Simon Pallas, a German graduate in medicine who spent 42 years in the service of the Russian government, adding enormously to knowledge of the natural history, geology and geography of the Empress's domains (ornithologists know his name well from Pallas's Sandgrouse). He must have given satisfaction since late on in life Catherine gave him an estate in the Crimea, the area he loved best. Pallas ultimately returned to Berlin, where he had been born (1741) and where he died (1811)
Pallas's travels, especially in the six years 1768-1774 when he was in the regions of the lower Volga, Tartary, the Urals and the Altai, brought him into contact with blackflies and in 1781 he wrote some paragraphs about these biting pests that I think qualify for our "Travellers' Tales" section of the Bulletin.

At the time Pallas wrote about blackflies the name *Simulium* had not been coined (that was 1802) so he had to make the insects he was talking about comprehensible by comparing them to the famous Golubatz fly of Banat on the Middle Danube. Here are some interesting passages (from the German).

"I turned to the excellent Mr von Born* ... and thanks to his intervention I recently received a small plate full of the correct Golubatz midges, every one of which I was able to recognize immediately as the Russian moshkara**, although somewhat larger, and also as the same insect that I had frequently cursed whilst collecting plants and insects on the river Volga and in the Altai mountains... [Description] ... This is how I have found the Golubatz midge, and I have also seen the Volga and Siberian moshkara to be in perfect agreement with this, except that they are rather smaller and do not have such broad white rings on the legs, and so I no longer have the slightest doubt that both belong to one kind. I am equally completely convinced that Linn,'s *Culex reptans* is nothing but this insect, rather smaller and not quite so abundant in the northern regions".

Later:

"This biting fly, as it could appropriately be called, is found in the northern forests of Russia ... and for the most part it runs around amongst the hairs of cattle. On the Volga below Kazan, where the river begins to flow between forested hills and approaches a warmer region, and especially in the area from Simbirsk to Saratov and Kamyshin, ... the same species is found from the beginning of May to the middle of June ... in such unimaginable numbers in low, sheltered, bushy areas and on the forested hills that midges seem to fill the air like hailstones; they fall blindly and with force into one's face, as if someone was throwing sand at you, they fly into the eyes, nose and mouth, and they settle stubbornly on the skin; with their blunt proboscis they pierce the skin (often painfully), so that on each occasion a bloody spot is left, although it does not itch. Fishermen, hunters and anyone else who has business in the open or who is travelling provides himself at this time with a spacious gauze hood, impregnated with birch oil ... because it has been observed that the moschka, though it throws itself blindly against everything else, does not dare fly through a gauze veil soaked in this strong-smelling oil, no matter how broad the netting. Without this protection it is often hardly possible to open the eyes. If the insect has the chance to alight unnoticed on the skin and to suck robustly the abdomen fills up with blood like a balloon and there is no way of removing it except by crushing it to death. As it is impossible to open the mouth without several of them inside all at once, it often happens that they are crushed or bitten as they are spat out, and one then learns involuntarily that their innards have the sweet flavour of honey".

"These biting flies are no less abundant in the more southern part of the Ural mountains; but still more abundant when one approaches the forested mountains of southern Siberia and also beyond Lake Baikal. Even in the mountains one is pursued by these pests in June, right up to the cold elevations where there is no longer any forest. However, they are not to be found here in late summer. If one travels from Yakutsk to the Sea of Okhotsk [edge of the Pacific], indescribable numbers of the flies are again encountered once the Aldan river is crossed; and presumably they also occur in North America [!]".

"There are also reports from the mountains of Siberia and the Urals that these little insects, together with the cattle-warbles which are common at the same time, are able to worry horses and cattle to death if they wander into the forest and find no refuge in open spaces or around a smoky fire ... I have also noticed in Siberia that the bite sometimes produces large swellings in man which have still barely subsided after 48 hours".

"Mr von Born ... confirmed in his letters to me the great damage caused by the pest [in Banat] ... they attack cattle, creep through the anal orifice, the nasal openings and the ears into the inside, and kill the animal within four or five hours. If one cuts the animal open, they are found in clusters in the lungs and viscera, both of which are completely inflamed. The plague lasts for three or four weeks, and then vast numbers of dragonflies arrive (*Libellula grandis* and *aerea*) and devour them all, and then again they are consumed by swallows which also appear in flocks. At the end of July or the beginning of August the second generation hatches and the circumstances are the same".

[Is this perhaps the earliest reference to predators of blackflies ?]

Reference

Pallas, P.S. (1781). Ueber die kolumbachischen oder bannatischen, viehtödtenden Mücken [On the Golubatz or Banat, cattle-killing midges]. Pp. 349-354 *in* Pallas, P S. (Ed.), *Neue Nordische Beyträge zur physikalischen und geographischen Erd-und Völkerbeschreibung, Naturgeschichte und Oekonomie* **2**, 375 pp. St Petersburg and Leipzig.

* Von Born was an eminent polymath scientist, born in Bohemia, who studied in Vienna. He was a freemason and Grand Master of the lodge of which Mozart was a member. He is thought to be the basis of Sarastro in "The Magic Flute". (Information from Adrian Pont, 8/1/1991.)

** The usual Russian word for blackfly, transliterated from Cyrillic, is moshka (plural: moshki). Pallas said that moshkara was the name along the Volga and that mokriza was in use in Siberia.

AMENDMENTS TO MEMBERS' ADDRESSES

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Deletion

Mr. Kevin Darling, has written to say that he is leaving science shortly, and will no longer continue his interest in the Simuliidae.

British Simuliid Group Bulletin Number 9, July 1997.

FROM THE EDITOR

Wonders will never cease! Most of the pages of this Bulletin were spoken for three months before the deadline. In Bulletin No. 6 of December 1995 it was announced that an obituary to I.A. Rubtsov had been published in Russian and that when an English version was produced it would be made available to members. The translation now appears on page 2.

At the Monks Wood meeting of the British Simuliid Group in September 1996, it was suggested that in order that members could know where records were lacking, a map should be compiled to show all areas where Simuliids had been collected. Thanks to considerable effort by Jon Bass and Roger Crosskey, this has been done, and it is included in this Bulletin as detachable supplement. It is quite remarkable how much of the country has now been covered. But there are still many spaces, particularly in the midlands. Even in areas where collections have been made the records may be old or not completely representative. So there is no excuse, next time you go for a picnic, *pick up a pupa!*

We have a review of Simuliid control in Brazil from Victor Py-Daniel which reveals how widespread the nuisance problem is in that country, and how seriously it is regarded. I confess that I had no idea of the extent of the problem until I read his article.

Lastly we have an index compiled by Roger Crosskey of the numerous Simuliid related items that appeared in the early *Newsletters of the British Simuliid Group* between 1979 to 1987 . While *Bulletins* 1 to 4 were indexed by Trefor Williams, I confess that I have not indexed the numbers under my editorship, but will see if I can produce an index for inclusion in Bulletin No. 10.

Trefor Williams tells me that he was amazed and amused to receive the retirement card following the Monks Wood meeting even though it was a little premature as he is only semi-retired. He warns anyone contemplating semi-retirement that it involves 90% of the work for only 30% of the salary!

Corrections to *Bulletin* No. 8

Please correct the following errors in Bulletin No. 8 of December 1996.

Page 1, paragraph 6: the Pike and Eel Inn is at "Needingworth" .
Page 2, second line should read "using bream as the indicator species"
Page 6, paragraph 6, line 5: error in units, replace "mm" with "μm"

MEETING NOTICE

Preliminary Notice of the 20th Annual Meeting of the British Simuliid Group, 25 November 1997

The 20th Annual Meeting will be held at the Natural History Museum in London on Tuesday 25 November, 1997. Further details will be circulated in due course. However, the organisers would welcome hearing from anybody wishing to volunteer a talk or poster presentation.

Correspondence to BSGM c/o Mrs. Carolyn Lowry or Dr. Tony Shelley, Medical and Veterinary Division, Department of Entomology, The Natural History Museum, Cromwell Road, London SW7, 5BD (e-mails: cael@nhm.ac.uk and ajs@nhm.ac.uk respectively)

IN MEMORY OF I. A. RUBTSOV (1902-1993)

V. N. Tanasychuk and V. A. Tryapitsin

Translated from *Entomologicheskoe Obozrenie* **74**: 239-242 (1995)

Ivan Antonovich Rubtsov, eminent entomologist, professor and doctor of biological sciences, died on 22 September 1993, in his ninety-second year.

His path into science was neither easy nor simple. I.A.R. was born on 16 January 1902, in the village of Novolitovskoe in the Maritime Territory [Primorsky, eastern Siberia], in a peasant family with many children. He attended the village school and subsequently worked in a post-office while preparing external exams for middle school. Having completed his school education in this way, he worked for several years as a primary school teacher, and, in 1924, entered the Biological-Geographical Faculty of the Irkutsk State University, from which he was to graduate in 1928. At the University, as well as at the Station for Plant Protection (STAZRA), where I.A.R. worked while still a student, his scientific interests began to emerge. His first studies, published immediately after graduation, dealt with the Siberian planarian fauna, but after these first works he began an in-depth research into the locusts of Siberia, focusing mainly on problems related to their mass-scale breeding outbreaks and the means of combating them. His early works on this topic were noticed, refereed and approved by B.P. Uvarov. After graduation, I.A.R. remained as a postgraduate research student at the Department of Zoology of Invertebrates, completing his postgraduate study in 1932; he then began work at the Irkutsk Station for Plant Protection (STAZRA) as a scientific researcher, subsequently becoming the head of its entomological section. At this time he began to be interested in the systematics and faunistics of the family Simuliidae, which at that time had hardly been examined at all in the territory of the USSR (only two species had been known). In 1934 I.A.R. became a doctoral candidate at the Zoological Institute of the Academy of Sciences of the USSR in Leningrad [now St Petersburg]. In 1935 he successfully defended his candidature-dissertation on locusts, and - already by 1936 - his doctoral thesis, entitled "The Simuliidae of the USSR, their Systematics, Geographical Distribution, Biology and Ecology". In the two subsequent years I.A.R. headed the zoological laboratory of the All-Soviet Institute for Plant Protection (VIZR), while simultaneously editing the Plant Protection Journal. In 1938 he joined the staff of the Zoological Institute, where he was to work for forty-one years - up to his retirement in March 1979.

In 1940, I.A.R. published a monograph on blackflies (Simuliidae) in the "Fauna of the USSR" monograph series. In it he made much use of such progressive taxonomic methods as the examination of the genitalia and the analysis of the morphological characteristics of the pre-imaginal stages. Eighty species of blackflies were recognized in the territory of the USSR, and this number rapidly increased. By 1956, in a new edition of the same book, the simuliid fauna of the USSR already included 280 species. I.A.R.'s tome, under the title Simuliidae, appeared in 1959-1964 in Lindner's series "The Flies of the Palaearctic Region" and contained descriptions of more than 300 species. In our own time, as a result of research by I.A.R. and his students, we know of around 650 species of blackflies in the Palaearctic region, more than 350 of which were described by I.A.R. himself.

Together with other employees of the Zoological Institute, faced with the outbreak of the Second World War, I.A.R. took part in defence activities and the protection of the Institute, surviving the first and most terrible winter of the blockade of Leningrad. In 1942, together with a large group of employees of the Institute, he was evacuated to Dushanbe (called Stalinabad at the time), and there, while continuing with his research into blackflies, he also started a new study conceived before the war and related to the biological control of harmful insects. In Tajikistan, in the environs of Kurgan-Tjube, I.A.R. set up an entomological station where he studied parasites of the shield-bug *Eurygaster integriceps* Put. (Heteroptera). This research, alongside his study of blackflies, became a new direction of his work. Returning to Leningrad in 1945, I.A.R. devoted a lot of time to an examination of the theoretical foundations of biological control and published numerous studies related to the problems of introduction and acclimatization of entomophages. His monograph "The Biological Method of Combat Against Harmful Insects" (1948), combining vast amounts of foreign and national material, provided a strong stimulus for developments in this direction both in the USSR and beyond its borders: abroad it has been translated more than once. In this volume, for the first time in the national literature, I.A.R. dealt with many theoretical aspects of the 'biomethod'. The book has not lost its importance to the present day. The title was submitted to the publisher at the beginning of 1948, and soon after the painful and infamous session of the All-Soviet Academy of Agricultural Sciences (in August 1948), was subjected to harsh criticism at a special sitting of the Academy. I.A.R. was charged with an inclination towards "formal genetics" and, in particular, rebuked for citing the works of I.I. Shmal'gauzen [Schmalhausen]. Luckily for I.A.R. he also referred in his book to some works of T.D. Lysenko and this somewhat weakened the position of his accusers. Nonetheless, at the time of his trial, I.A.R. had to "justify himself" in all seriousness and own up to his "errors".

An important part of the book was its fifth chapter devoted to the aims of the biological method in the USSR, which included lists of entomophages of the more important harmful insects and recommendations about the introduction of parasites and predators from abroad. However, this section was written hastily and contained some unchecked information, so provoked many critical remarks from the experimental specialists in biomethods.

I.A.R. played a part in the introduction of several parasitic Hymenoptera into the USSR. In 1947, while on a duty trip to Italy, he visited the Laboratory for General and Agricultural Zoology in Portici (near Naples), where Professor Filippo Silvestri, one of the living patriarchs of the biomethod, was still at work. From Italy, I.A.R. despatched to Batumi [Georgia] some twigs of mulberry, with the mulberry scale *Pseudaulacaspis pentagona* Targ.-Tozz., infected by the ichneumon fly *Encarsia berlesei* How. This scale-parasite acclimatized itself in the Caucasus. Accidentally, the same package contained a male and a female specimen of the ladybird

Lindorus lophanthae Blaisd., from which was initiated the population of this scale predator in Georgia.

Because of his outstanding talent as a researcher, applied with enormous erudition, an exceptional love of work and capability, I.A.R. became a most eminent specialist in all fields of knowledge in which he chose to immerse himself. This was the case with the fourth direction of his research, the examination of the mermithid worms, which represented a logical development in his study of biological control. An enormous experience of morphological work accumulated in his study of insects enabled him to produce a major contribution to knowledge of this group. He published one hundred studies dealing with this topic, including "The Freshwater Mermithids of Estonia" (1973), the two tomes on "Aquatic Mermithids" (1972 and 1974), the first monographic study on this subject in world science "Mermithids" (1977 and 1978), and "Parasites and Enemies of Fleas" (1981). He described more than four hundred and fifty species of mermithids, and considered in detail the questions of origin, taxonomy, distribution and biocenotic relations of these animals. He examined their role in nature and the possibilities for their practical application. He also described a new order of parasitic worms - Marimermithida - discovered on the Asteroidea from the seas of the Antarctic.

In total, I.A.R. produced more than four hundred scientific studies, including several dozen monographs, devoted to blackflies, mermithids and biological control. He executed himself tens of thousands of extraordinary drawings illustrating these studies. However, an excessive hastiness, characteristic of I.A.R. and reflected in his works, not unrarely provoked justified objections from his colleagues.
The works of I.A.R. were highly praised by zoologists - both at home and abroad - and this is reflected in his many invitations to foreign institutes and the translations of his books into foreign languages (about which he sometimes learnt purely by accident).

I.A.R.'s contribution to science was recognized through a number of awards at home, as well as an Italian medal named after Mario Bezzi which was awarded for his study of the Italian blackflies (1947-1961). He took part in numerous scientific congresses and conferences at home and abroad.

I.A.R.'s productivity as a scholar caused amazement among his colleagues. Thus, a correspondent-member of the Academy of Sciences of the USSR, V.V. Popov, the head of the Department of Land Invertebrata at the Zoological Institute (now the Laboratory for the Systematics of Insects), spoke of the "powerful work force" I.A.R. possessed. In one of the review reports of the department, V.V. Popov underlined the fact that "approximately one third of the entire published production of the department in the past year was written by I.A. Rubtsov".

I.A.R.'s scientific thinking was characterized by considerable independence and in some cases oddity. On occasion he would express ideas which were not accepted unconditionally and on trust by his colleagues, and this led to discussions which were not infrequently rather sharp. Nonetheless, I.A.R. defended his ideas gently and tactfully. To one of his scientific opponents, for example, he gave a present - an offprint of his study - with the following dedication: "To the opponent of the ideas expressed herein, with the hope of mutual understanding". Among his ideas of this kind is certainly the concept of mutualist relationships (i.e. relationships of mutual benefit) between the parasite and its host, as well as his exaggeration of the role of heterosis in the biomethod. As a systematist I.A.R. sometimes expressed criticism of what he called a purely "museum" tradition in the study of species, and spoke in favour of a multi-faceted study (biology, ecology, genetics, etc.), to which nobody objected. I.A.R., however, maintained that each "museum" species would finally be shown to consist of dozens of "true, natural" species, so bypassing the hierarchical classification of species into subordinate taxa. As the years passed, I.A.R. keenly followed the development of new scientific directions in the USSR, supporting the establishment of a laboratory devoted to karyosystematics. He became a consultant on research into the karyosystematics [cytotaxonomy] of blackflies undertaken by L.A. Chubareva and N.A. Petrova.

I.A.R. was an able teacher to many now famous scientists. It will suffice to mention such specialists in the study of Simuliidae as Z.V. Usova, A.E. Terteryan, Sh.M. Djafarov, E.O. Konurbaev, V.D. Patrusheva and A.V. Yankovsky. His students now work in all the republics of the former USSR, and many foreign scholars also consider themselves to be his disciples. One of the authors of this obituary (V.N. Tanasychuk) himself began research under the supervision of I.A.R.

It should also be said that the results of I.A.R.'s work would not have been so enormous, and this is a prevailing belief among his colleagues, without the help he received over many years from his devoted co-worker A.A. Il'ina, with her extraordinary love of work, self-sacrifice and application.

I.A.R. was a very versatile man. He loved classical literature and knew it intimately, he was not a bad painter, and his flat, although not very large, was furnished with magnificent furniture and sculpture, resembling a small corner of the Hermitage. When I.A.R. moved to the Home for Veterans of Science he donated all that treasure to the Priyutino Museum.

The chief passion of Ivan Antonovich, nevertheless, was always science. To it he gave more than sixty years of his long life. In it and in its history he will remain.

SCIENTIFIC CONTRIBUTION

Simuliid “Borrachudo/Pium” control in Brazil

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The control of simuliids (Diptera, Culicomorpha, Simuliidae) in Brazil has never been associated with species that transmit pathogens, but with species present in the southeastern and southern regions that adversely affect human activity such as tourism, agriculture, and housing development etc.). In these areas biting simuliids are known by the common name of “borrachudo” and control has been undertaken and techniques developed in the states of Rio Grande do Sul, Santa Catarina, Paraná, São Paulo and Espírito Santo. The main target species for the control activities, in all the states is *Chirostilbia pertinax* [1](Kollar,1862).

1*Editor's Note: Readers who are unfamilliar with the simuliid fauna of Brazil may not recognise the generic name *Chirostilbia*. In this paper the authors have elevated some subgenera of the widely accepted genus *Simulium* to generic status. This is not the place to enter into a discussion on taxonomic hierarchical systems, so I have decided to allow the names to stand. All the "generic" names in this paper may be referred to in other works as subgenera of *Simulium* Latreille, 1802. More details are given in Py-Daniel and de Moreira Sampaio (1994a, 1995).

Rio Grande do Sul

In the mountain-range region of this state, where most of the tourist activity occurs, these insects may constitute a plague affecting the economic exploitation of the scenic landscapes, and limiting agricultural activity.

Before 1972, it is understood that control activities were initially the responsibility of the Agriculture and Tourism Secretaries and some highly toxic pesticides such as the organochloride DDT were used. From 1972 until 1982 the State Health and Environmental Secretary (SSMA) became responsible for control and started to use the organophosphate larvicide temephos to reduce the action of the simuliids. The SSMA also providing training so that control

could be carried out by the administrations of the municipal areas involved.

Between 1982 and 1983 the treatments with this organophosphate were interrupted because it was suspected that resistance to temephos dad developed. Trials were conducted that confirmed the low efficiency of the product against the target species. The use of temephos was abandoned and replaced by mechanical control activities in which the walls of dams and sluices were brushed to remove the immature stages of the target species, and action was taken to and deviate the water flow to kill larvae.

In 1984 a pilot biocide control project based on the use of *Bacillus thuringensis* var. *israelensis* (Bti, H14.) was initiated in five municipal areas: Gramado, Feliz, Dois Irmãos, Sapiranga and Nova Petropolis. To set up this project trials and hydrological studies were first carried out with the objective of obtaining a suitable methodology for determining the discharge measurements necessary for calculating the dosages required for Bti. treatments.

Special modified Pashall troughs were constructed in different dimensions relating to the topography of each creek. At the same time trials were carried out by the Technical Assistance and Rural Enterprise (EMATER) prefectures and municipal schools in the communities involved to involve and inform the population about this type of biological control, and enlist help from the communities. Many imported formulations of Bti. from different manufactures have been tested since 1984), Now, even after 12 years of use, Bti. is still effective and today about 80 municipal areas are using Bti. to control simuliids in an area of 37.855,5 Km2, with about 2,358,000 people benefiting

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We wish to emphasise that Rio Grande do Sul is important because it was the first Brazilian state to set up Simuliidae control using Bti. . This State now has a technical and methodological structure that conducts annual training sessions for personnel from other States, as well as expanding its own control areas.

A short bibliography of papers relating to Simuliid control in the State of Rio Grande do Sul is appended to the References section.

Santa Catarina

According to Prando (1995) the State Simuliid Research Program was begun in 1984, following a request from rural and political leaders, mainly in the mountainous region of Joinville. Although the initial assumption was that the major problem would be in the Joinville region, a later survey revealed that more than 80% of Santa Catarina municipal areas also needed solutions related to simuliid control.

In the years of 1984 and 1985 the Santa Catarina Agriculture Research Enterprise (EMPASC), (now Santa Catarina Research and Technology Diffusion Enterprise: EPAGRI) undertook the following work:

1. Simuliid species survey: 25 simuliid species were identified in the Santa Catarina area.
2. Studies on the seasonal abundance of different simuliid species in which larvae and pupae densities were estimated, and observations made on the oviposition and host preferences of the adults.
3. A survey of fish predatory on aquatic stages of simuliids. Although 35 species of fish were examined, the presence of simuliid immatures was found the gut of only five species;
4. Studies related to the biology of the anthropophilic simuliids to confirm the life cycle, the egg stage duration, larvae, pupae and adults of the target species, *Chirostilbia pertinax.*
5. Simuliid control: Different larvicide formulations of Bti. were tested in a variety of concentrations.

The EPAGRI is developing training courses to pass on the Bti. control methodology, through technical co-operation agreements with a number of prefectures. In addition to the control work and the diffusion of the technology, campaigns are being organised to assist the preservation and management of the springs and water sources which are also simuliid breeding sites. In 1992 more than 160 technicians were trained to identify the “borrachudos” breeding sites, measure the water flow and apply Bti. At present, the simuliid control work in Santa Catarina is a result of the control technology transference by EPAGRI to local interested technicians in many municipal areas, where “Vectobac” and “Teknar” are applied by private or prefectural initiative.

Paraná

According to Guimarães (1990), the Simuliid Control Program at that time mncluded all state regions (coast, first, second and third plateaux), covering approximately 70% of the municipal areas, The work is coordinated by the State Environmental Agency (SUREMA), guiding and passing on the control methodology to the prefectures, communities, industries, schools and other governmental agencies. As a control measure they adopted in an integrated approach to obtain a high effectively in which the chemical methods (temephos (Abate®) larvicide), mechanical (cleaning), sanitation and environmental improvement (pollution control, forest recuperation and fish re-colonization).

São Paulo

According to Araújo-Coutinho (1995), the Health Secretariat of São Paulo State started the Simuliid Control Program in 1957, initially using the organochlorides DDT and BHC and in 1971 changing to the organophosphate temephos. The program covered an area of 893 Km^2 throughout Serra do Mar.

A decision that alternative uses of nonchemical control techniques should be studied was taken in 1984 and in 1986 a pilot project was set up to develop a Bti. application methodology. Following the satisfactory results obtained in the pilot project, a complete cover of the selected area was initiated in 1990 using Bti. and in 1994 a study was started with the purpose of evaluating cost/benefits, mainly in the sense of assessing the direct and indirect impact of the continuous use of Bti.

Espírito Santo

This state, has been using the Bti. control method, In 1991 an experimental production of Bti. was organised through a collaboration between EPAGRI and EMCAPA (Espírito Santo) in Itajaí Experimental Station (EPAGRI). (Prando, 1995)

Amazonia

This region, where biting simuliids are commonly named “pium”, is characterized by its extensive area, its lack of road systems that increase the operational cost, the great river discharges and an aquatic trophic chain in which the basic source of food for most Amazonian fishes is concentrated on chironomids, over which Bti. has accentuated action, hence a large scale simuliid control programme is not relevant. Studies related to the control could be feasible only in small areas, where the biological, chemical and physical parameters are already known for some certain species.

<u>Amazonas / Roraima</u> - *Onchocerca volvulus*

The onchocerciasis focus occurs in the Yanomami/Ye’kuana Indian areas of these two states, in the north of Amazonas and in the west of Roraima.

Four species are suspected of being involved in the transmission of this filaria: *Thyrsopelma guianense* (Wise,1911), *Psaroniocompsa incrustata* (Lutz,1910), *Cerqueirellum oyapockense* (Floch & Abonnenc,1946) and *Notolepria exiguua* (Roubaud,1906). Each species presents a different degree of involvement in the transmission such as abundance, diurnal activity, and physiological and morphological differences that may hinder the development of the parasite. It seems likely that the main species involved in the transmission is *Thyrsopelma guianense*.

According to Py-Daniel (1994) and earlier workers the immature stages of species of the genus

Thyrsopelma Enderlein,1934, have an close association with plants of the Podostomaceae family, which are restricted to rock surfaces in or near to waterfalls and rapids . Based on this specificity of *Thyrsopelma* with Podostomaceae, the authors suggest that as part of integrated management for onchocerciasis elimination an auxiliary method of control might be achieved by removal of the plants from the breeding sites in a 5-kilometre radius of each community being treated with Ivermectin.

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THE SIMULIIDAE OF GREAT BRITAIN

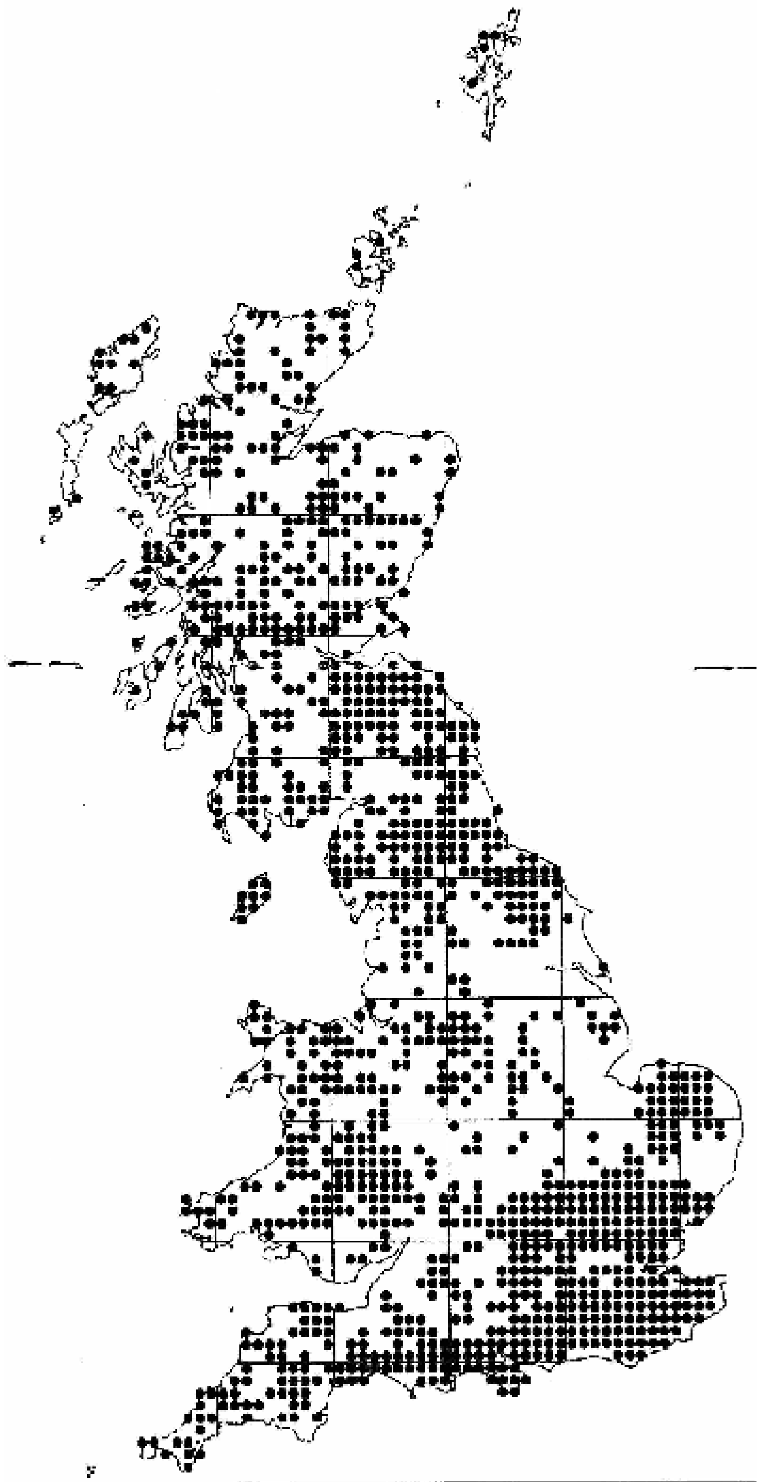
A SITUATION MAP SHOWING THE DISTRIBUTION OF COLLECTIONS ON RECORD JANUARY 1997

The map overleaf shows the distribution of existing records of Simuliids compiled by Jon Bass and Roger Crosskey using data held at the Biological Records Center, Institute of Terrestial Ecology, Monks Wood, and the Natural History Museum, London. The main sources are: Natural History Museum (R.W.Crosskey - SE England and the Lewis Davies collection), the Institute of Freshwater Ecology River Communities Survey (Kay Syme), and additional occasional records from Jon Bass, Mark Taylor, Melanie Bickerton, Malcolm Greenwood and John Davies.

The map is intended to highlight gaps where simuliid records are lacking and to stimulate visits to particular areas to check whether simuliids are present. It is probable that discrete distributions for certain species have changed since the 1960's when Lewis Davies published maps with his key to the British species.

On the map the large grid represents the 100Km squares of the National Grid Reference System which are identified by letters (for example, Anglesey and NW Wales lie within square SH). Each black dot on the map is located at the center of any 10 Km square in which specimens from one or more collections exist. White areas indicate no knowledge mainly because no sampling has been done, but may also indicate a genuine absence of simuliids as in Central London. The white areas are priority areas for future collections.

Situation Map of Collections of Simuliidae in Great Britain



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The map was produced by Henry Arnold of the Biological Records Centre, Monks Wood using the DMap Computer Mapping Programme.

Indexes to the 'Newsletters of the British Simuliid Group'

The *Newsletter*, forerunner of the present *Bulletin*, ran from 1979 to 1987. There were thirteen issues, the dates and number of pages as follows: No. 1, April 1979, 9 pp.; No. 2, November 1979, 6 pp.; No. 3, April 1980, 10 pp.; No. 4, November 1980, 4 pp.; No. 5, May 1981, 11 pp; No. 6, November 1981, 7 pp.; May 1982, 2 pp. [+ 4 pp. mailing list separately paginated]; No. 8, December 1982, 6 pp. [+ 1 unnumbered p. mailing list addition]; No. 9, August 1983, 2 pp.; No. 10, May 1984, 10 pp.; No. 11, April 1985, 8 pp. [+ 3 unnumbered pp. of figures]; No. 12, May 1986, 7 pp.; No. 13, June 1987, 10 pp. [Note: in issues 2-6 *Simulium* was used in the title and not Simuliid.]

There is a complete hard-cover bound set of the *Newsletter* kept at shelf-mark ES 104 in the Diptera floor divisional library of the Department of Entomology in the Natural History Museum, London. Working with this complete set, Roger Crosskey has compiled the indexes given here, following the principle that any item of scientific information attributable to an author-contributor might be helpful. Thus individuals and topics are not indexed when they appear (for example) only in a list of talks given at a meeting. Another complete set is kept by Trefor Williams.

To make the information most easily accessible there are separate indexes to authors (contributors), organisms and topics. For location the Newsletter number is given first, followed by a colon and the page(s). A stroke (slash) between page numbers shows that the subject appears in a separate context in multiple places within the issue. Brackets in the author index show when there are unrelated items by the same author appearing on the same page.

[Originally printed in two columns – Ed.]

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British Simuliid Group Bulletin
Number 10, January 1998

FROM THE EDITOR

This Bulletin No. 10 is a little late due to the combined effects of holding the Annual Meeting later than usual in November, and my involvement in the Onchocerciasis Control Programme and Mectizan meetings which were held in Liverpool during the first two weeks of December. In addition, I waited for delivery of some new software which is designed to help with arranging the pagination of booklets. The problem with most word processors is that pages are normally printed in sequence, while in the case where two A5 pages are printed on a single A4 sheet, as with the Bulletin, the center sheet pages would be numbered 10 and 11, for example, while the other side of the same sheet would carry pages 9 and 12. The new software rearranges the pages to suit the pagination and scales the type to fit, but as usual has taken me time to get used to it.

In the past, I have raised doubts about the continued funding of the Bulletin, so it is with great relief and gratitude that I can announce that due to the representations of Trefor Williams and Professor Brian Moss, it has been agreed by Professor Julian Crampton, Head, School of Biological Sciences, and Professor David Molyneux, Director, Liverpool School of Tropical Medicine that the costs of producing and distributing the Bulletin will be divided between their respective departments. I am sure that all members are grateful for this generosity.
John B. Davies, Editor

THE 20TH ANNUAL MEETING AT THE NATURAL HISTORY MUSEUM, LONDON

The 20th. Annual Meeting was held on Tuesday 25th. November 1997 at the Natural History Museum, London. The Meeting was convened by Dr. Tony Shelley, who was in the chair, and organised by Dr. Carolyn Lowry and helpers, to whom we are grateful. Tony Shelley opened the meeting with words of welcome, and went on to describe the recent re-organisation of the departments within the Entomology section of the museum. He then continued with his talk on the recent findings in Brazil.

Six scheduled papers and four posters were presented. In addition, Roger Crosskey gave an unscheduled entertaining talk on a trip that Peter Adler and he had recently made to St. Petersburg to examine I.A.Rubtsov's simuliid collection. An account of this trip is promised for the next issue.

Discussion: As usual the meeting concluded with an informal discussion during which the following points were raised:

British Distribution Map: Having published in Bulletin No. 9 a map showing the areas where collections of simullids had been made, the question was raised as to what should be done next. It was asked whether it would now be possible to use the database behind the map to display the distribution of individual species. To this the answer was no, because so far the data only records the presence of a positive collection with no details, and there was also the problem of accuracy of identification. In this connection, the meeting noted the imminent publication of Jon Bass' key to the larvae and pupae of British Simuliids (see Announcement p. 15). Obviously, the next activity should be to try to fill in the gaps in the map. Angus McRae suggested that perhaps the Group should mount an expedition to a specific area at the best time of year, and was promptly "volunteered" to organise a prospection of the area north of Oxford within a rectangle bounded by Birmingham, Oundle, Bedford and Evesham during the first half of April 1998.

Where what to collect: Roger Crosskey advised that because the identification of adults and early instars of larvae of many species was very difficult, collections should be restricted to late instar (gill-spot) larvae and pupae (particularly older, black pupae). They should be preserved in 80% ethanol. Collections should be made in any blank 10km square on our map, selecting the following habitats, if present, after reference to an Ordnance Survey Map: 1) A main named river. 2) At least one moderate sized river or stream. 3) A lake outlet. 4) The first 200-300m of a spring-fed stream. This last habitat is characteristic of limestone/chalk areas, and is the unique habitat of *S. costatum* (4 filamented pupa, no horn to cocoon).

Next Meeting: John Davies offered to see whether the next meeting could be held in Liverpool. It might be advantageous to arrange the meeting to coincide with the Liverpool School of Tropical Medicine's centenary celebrations and/or the 2nd European Conference on Tropical Medicine, Liverpool, 14-18 September (and incidentally, the 4th International Congress of Dipterology, Oxford, 6-13 September) so that some of our overseas members might be able to attend. However, this would probably mean that the meeting would have to be held on a Saturday. John would like some feed-back from the membership on this suggestion before making any official enquiries.

ARTICLES BASED ON PRESENTATIONS GIVEN TO THE MEETING

Six scheduled papers and 4 posters were presented to the meeting, from which 4 papers and 3 posters are reproduced in this Bulletin. Due to lack of space the remainder (listed below), together with a version of Roger Crosskey's talk, are scheduled to appear in Bulletin No. 11.

P. McCall The "Invitation Effect" in *Simulium damnosum* s.l.
R. J. Post The potential reinvasion of the Island of Bioko after the eradication of *S. damnosum* s.l.
J. B. Davies *et al.* The effect of ivermectin treatments in Guatemala on the uptake of *O.volvulus* microfilariae by *S. ochraceum*. [Poster]

Confirmation of a new focus of onchocerciasis in Brazil

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The talk was based on results from the following collaborators - Magda Charalambous (NHM) [cytotaxonomy], Jan Bradley (Salford University) and Marilza Maia-Herzog (Oswaldo Cruz Institute) [serology and taxonomy]; Rory Post (NHM) and Jose Rubio (Madrid University) [molecular biology] and Tony Shelley and Carolyn Lowry (NHM) and Paulino Luna Dias (Oswaldo Cruz Institute) [taxonomy, biology and infection studies].

Following the discovery some 10 or so years ago of an autochthonous case of human onchocerciasis in the town of Minaçu, central Brazil some 2500 kms south of the Amazonia focus of the disease, biopsies of 2500 local citizens were all found to be negative for microfilariae. The objective of our work was to make an attempt at finding other cases of onchocerciasis using more sensitive detection measures, assess the simuliid species present in the area, study the basic biology of anthropophilic species and investigate their potential to act as hosts to *Onchocerca volvulus*.

Blood samples were taken from over 700 people of whom about 2% reacted positively to the serodiagnostic test developed by Jan Bradley. This showed that these people had been in contact with the disease but not that they necessarily were microfilaria carriers. Skin snips taken from several seropositives reacted positively to the DNA probe of Meredith and some of these also showed a positive Mazzotti reaction. It was concluded that microfilaria carriers were present in Minaçu and the neighbouring town of Formoso and the Buracao gold mine. It appeared that positive cases are probably associated with small rivers in the area. The serodiagnostic test, DNA probes and Mazzotti test will be used in the future to determine the extent of this new onchocerciasis focus and the prevalence rate of the disease.

Nine species of simuliid were collected in the area and of these *Simulium minusculum, S.nigrimanum, S.guianense* (probably cytotype A) and *Simulium (Psaroniocompsa)* sp. were anthropophilic. The first two species bit man throughout the year with biting peaks occurring in the dry season. The latter two species were less common and were more apparent during the dry season.

Simulium minusculum occurred in all river types in the area but was found in greatest numbers in the largest river (Tocantins) while *S.guianense* occurred only rarely in smaller rivers being more common in the medium size rivers and the R.Tocantins. The other two species were small river breeders.

Experimental infection of the four anthropophilic species with *Onchocerca volvulus* showed that microfilariae developed to infective larvae in all four.

Future work in the area will focus on defining parasite distribution and prevalence, discovering the natural vector of onchocerciasis and determining the effect of the newly constructed dam on the R.Tocantins on simuliid populations in the area.

These data will be published fully in the Memorias do Instituto Oswaldo Cruz.

Modelling human Onchocerciasis with particular reference to the *Simulium - Onchocerca* interaction

María Gloria Basáñez *Wellcome Trust Centre for Epidemiology of Infectious Disease, University of Oxford, and Centro Amazónico para Investigación y Control de Enfermedades Tropicales, Amazonas, Venezuela*

This talk used the information presented in Basáñez *et al.* (1994, 1995, 1996) with the objective of presenting simple analytical models of the population biology of human onchocerciasis. Currently available mathematical frameworks for the transmission dynamics of *Onchocerca volvulus* were briefly reviewed. Few consider inclusion of regulatory assumptions within the human host and none addresses the issue of facilitation in simuliids with toothed fore-guts. Current views regarding transmission breakdown points in filarial host-parasite systems were discussed. Data suggestive of the operation of checks on parasite abundance within humans were presented. Two possible functional relationships between the mean microfilarial load per person in the village and the intensity of transmission (measured as the annual transmission potential) were introduced. The former assumes severe limitation of parasite establishment within the definitive host with increasing annual exposure to L3 larvae; the latter considers that this limitation is incomplete and that a small fraction of infective larvae succeeds in maturing to the adult stage (Dietz, 1982). The model describes, within a deterministic framework, the rate of change with respect to time of the mean number of adult worms and mff/mg per person and of the mean number of L3 per fly. Regulatory assumptions include constraints on parasite establishment within humans and flies and excess mortality of infected vectors. The model does not incorporate age-structure, latency, or heterogeneities in human, vector, or parasite populations. Expressions for the basic and the maximum reproductive ratio, respectively, R_0 and R_{max} were presented and related to the minimum vector density required for parasite persistence in localities where vectors lack or possess well-developed cibarial armatures. The values thus calculated for West African savanna villages (*S. damnosum s.s.*/*S. sirbanum*) and Central American settings (*S. ochraceum s.l.*) are in agreement with previous estimates and indicate that much higher biting rates are necessary for onchocerciasis to be endemic in those areas where the main vector exhibits initial facilitation. In the absence of non-linearities concerning mating probabilities of adult worms, the *Onchocerca* - *Simulium* systems in which the flies are unarmed exhibit a single, stable endemic equilibrium for $R_0 > 1$ (West Africa), whilst unstable equilibria may arise in those parasite - vector combinations characterised by armed flies (Central America). However, the epidemiological significance of these transmission breakdown points does depend on vector abundance, becoming practically negligible for the high annual biting rates observed in Guatemala and Mexico. In addition to statics considerations, some dynamic projections under a scenario of mass annual ivermectin distribution were discussed. Best results were obtained when it was assumed that ivermectin irreversibly reduces fecundity of adult female worms in agreement with Plaisier *et al.* (1995).

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British Simuliid Group Bulletin Number 10, January 1998

Simulium damnosum s.l.: Innate Immunity and Transmission of *Onchocerca*

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In spite of the lack of cellular encapsulation and melanisation blackflies have the ability to kill *Onchocerca* parasites in a rapid and species specific manner. Some of the humoral components of the innate immune system have been demonstrated to be involved in this process. Co-injection of *O. ochengi* microfilariae and inhibitors for serine proteases, a type of protease involved in the activation of prophenoloxidase (PPO), led to an increased survival of the parasites. Subsequent analysis of the haemolymph of *S. damnosum* s.l. revealed that this effect was partially due to the diminished activation of PPO. Enhanced parasite survival could be observed for haemolymph lectins following co-injection of D(+)-galactose and methyl-D-mannopyranoside. Thus the innate immune system is at least to some extend determining the vectorial capacity of the vector by controlling the number and species of parasites successfully developing. However, as most of these immune molecules described so far have to be induced and/or activated some other immune components must be involved during the initial phase of the immune reaction. Haemocytes are prime candidates to mediate the immune response as they are mobile, have the ability to phagocytose, mediate site-specific immune responses that target foreign surfaces, produce some antimicrobial peptides and probably mediate the main production of peptides in the fat body via the release of stimulatory factors. Therefore future work will focus on the role of haemocytes of blackflies during the early phase of an *Onchocerca* infection, the recognition of non-self.

Recent studies of the *Simulium damnosum* complex in western Uganda

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Almost 40 cytotypes and cytospecies are currently recognised in the *S. damnosum* complex. Four of them occur in our study area in western Uganda located east of the Rwenzori mountains between Lake Albert in the north and Lakes Edward and George in the south. This was the area, from where Dunbar (1966), in the sixties, received the material for the description of the first cytological segregates of the complex. At that time man-biting *S. damnosum* s.l. were widely distributed south and east of the Rwenzori mountains. Nowadays *S. damnosum* s.l. still occupies the same area, but anthropophilic *S. damnosum* s.l. are restricted to two rather small and limited foci, one in the south on the border with Congo (Kasese district), and one further north along the rivers Mahoma and Nsonge (Kabarole district south of Fort Portal). One possible reason of this change could be the control programme carried out in the sixties and early seventies designed to alleviate the biting nuisance caused by the flies. Looking into old data (Vector Control Unit, Fort Portal, unpublished) the northern focus of man biting *S. damnosum* s.l. apparently did not exist at that time. The area was forested and *S. neavei* was the anthropophilic blackfly. Meanwhile the forest and *S. neavei* have disappeared. *S. damnosum* s.l. moved in and became a nuisance. Biting densities are extremely high now in both areas and can easily exceed 1000 flies/man/day. Interestingly onchocerciasis is only hyperendemic in the southern focus, but almost absent in the northern one.

Surveys of breeding sites and cytological identifications of *S. damnosum* s.l. larvae revealed that four cytotypes of the complex occur in the study area. These are ‘Nyamagasani’, which is assumed to be identical with *S. kilibanum*, ‘Nkusi’, ‘Sebwe’ and a new form, preliminary named ‘Sogohi’. From the epidemiological point of view it was important to find out which cytotypes are the highly anthropophilic ones and potential vectors of onchocerciasis.

In the southern focus 'Nyamagasani' could be incriminated as the sole man-biting form and vector of *Onchocerca volvulus*. The situation in the northern focus along the rivers Mahoma and Nsonge was more complicated. Results of first surveys had suggested that this was a ‘Nkusi’ population. Since ‘Nkusi’ is generally regarded as non-anthropophilic more detailed studies were carried out, which resulted in the detection of 'Nyamagasani'. However, cytologically the frequent occurrence of heterozygous loops on the long arm of chromosome II was a striking feature. Exactly in this region ‘Nkusi’ has its diagnostic inversion IIL-5, which also appears on one of the loop cords, whereas the non-inverted cord is typical for ‘Nyamagasani’. This was the first indication for a hybridisation of the two cytotypes in this river system. Therefore it was not clear, which form was the anthropophilic one and source of the nuisance. The man-biting females, which cannot be distinguished by using cytological methods, had to be identified. Morphologically the adults of ‘Nkusi’ and ‘Nyamagasani’ turned out to be very similar. Also a multivariate analysis applying the criteria of Wilson et al. (1993) for the West African species, revealed that females of ‘Nkusi’ and ‘Nyamagasani’ only slightly differed from each other and that the Mahoma population had an intermediate status. However, it remained difficult to identify single specimens.

Attempts were therefore made to identify the females by using molecular approaches proposed by Brockhouse et al. (1993) and Tang et al. (1996). Their methods were based on the PCR amplification of a fragment from nuclear DNA, which encodes the ribosomal 18S, 5,8S and 28S RNA genes including the internal transcribed spacer (ITS). DNA was extracted from complete flies or larvae, the fragment amplified and the products separated by gel electrophoresis. The digestion of the entire ITS fragment with the restriction enzyme Rsa I produced several specific sub-fragments. But still ‘Nkusi’ and ‘Nyamagasani’ were very similar. The amplification of the first half of the ITS, the ITS1 region with an approximate length of 300 bp, of specimens from Mahoma/Nsonge showed that some of them had only one band, which was identical with that of ‘Nyamagasani’ specimens, others had double bands typical for ‘Nkusi’ or multiple bands, which assumingly indicated the hybrids. All tested females caught on man or cattle showed the single ‘Nyamagasani’ band. A sequence analysis of the ITS 1 fragment confirmed that ‘Nkusi’ differs from ‘Nyamagasani’ by carrying at least two alleles for this region. All together the West Ugandan cytotypes share some mutations different from West African species.

Results of cytotaxonomical, morphological and molecular methods agreed with each other. The close relationship among the three forms ‘Nyamagasani’, ‘Nkusi’ and ‘Sebwe’, which belong to the ‘Sanje group’, often makes it difficult to distinguish them by using just one method. The systematic position of 'Sogohi', which is morphologically different, is not clear. So far only ‘Nyamagasani’ could be incriminated as a voracious man-biting species and vector of *O.volvulus* in western Uganda. ‘Sebwe’ and ‘Sogohi’ are certainly non-anthropophilic. Concerning ‘Nkusi’ the situation is not clear. In general it seems to be non-anthropophilic, but in case of geographical overlapping hybrids may behave like ‘Nyamagasani’. The situation in the Mahoma-Nsonge area should be carefully monitored.

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POSTERS DISPLAYED AT THE MEETING

Relationship Between Onchocerciasis Endemicity, Altitude, and Blackfly Composition along Two Fluvial Axes of the Upper Orinoco Region, South Venezuela

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The Amazonian focus of human onchocerciasis, affecting Yanomami Amerindians, comprises areas situated between Venezuela and Brazil. Yarzábal et al. 1983 described the infection in the highland areas of Sierra Parima, southern Venezuela. In this area (high endemicity), the main vector *S. guianense*, whilst in the lowland areas (lower prevalence), *S. oyapockense* prevailed (Basáñez et al. 1988). Ivermectin delivery programmes require detailed knowledge on the extent and severity of onchocerciasis in areas not studied previously. The working hypothesis was the existence of a relationship between altitude, simuliid species composition and onchocerciasis endemicity that could provide guidelines for designing regional control schemes. Two fluvial axes of the Upper Orinoco basin were studied. These were the rivers Ocamo - Putaco (9 communities), and Orinoco - Orinoquito (8), covering a range of altitude between 50 and 1,000 m. Endemicity was calculated by measuring in the whole population the age-standardised prevalence and intensity of dermal microfilariae (mf/mg) identified as *Onchocerca volvulus* (Botto et al. 1997). Entomological indicators were species composition (percentage of total no. of biting flies captured on human bait during 3-5 consecutive days during rainy and dry seasons at each locality); daily biting rates (no. of bites per person/day during 12 hr of exposure), and hourly parity rates (average proportion of parous flies in each hourly sample). Species were identified according to Ramírez-Pérez et al. 1982 and Shelley et al. 1997.

Prevalence varied between 0.0% and 86.3%; it was positively correlated with altitude (r = 0.68), and non-linearly related to intensity. A total of 97,151 adult female blackflies were collected and identified. Species were *Simulium oyapockense* s.l., *S. incrustatum* s.l., *S. guianense* s.l., *S. bipunctatum*, and *S. exiguum* s.l. Up to 200 m *S. oyapockense* was predominant and onchocerciasis ranged from hypo- to mesoendemic according to the biting rate (r = 0.54). Above 200 m, onchocerciasis was hyperendemic; the abundance of *S. incrustatum* increased followed by *S. guianense*, and beyond 700 m *S. guianense* was the dominant species followed by *S. bipunctatum*. Parity rates of *S. oyapockense* ranged between 41% and 80%; those of *S. incrustatum* between 47% and 53%, and for *S. guianense* between 22% and 52%. The vector competence of *S. guianense* (a species lacking cibarial armature) is generally higher than that of *S. oyapockense* (an 'armed' species), perhaps requiring lower biting rates to ensure onchocerciasis endemic persistence; this has been shown for *S. damnosum* s.l. (unarmed) and *S. ochraceum* s.l. (armed) (Basáñez, 1996). The vector competence of *S. incrustatum* is presently being investigated. Communities at high risk of onchocerciasis are those in which the main anthropophilic simuliids are *S. incrustatum* s.l. and *S. guianense* s.l. In these localities, mass treatment with ivermectin is recommended as a priority. *S. oyapockense* s.l. is capable of maintaining mesoendemic transmission when daily biting rates are very high. In such cases mass chemotherapy is also suggested. In hypoendemic areas target treatment should be implemented.

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Sample Sizes of *Simulium ochraceum s.l.* for the Estimation of *Onchocerca volvulus* Infection under Ivermectin Control Programmes

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Pre- and post-ivermectin *Simulium ochraceum* s.l. monthly samples from southern Mexico were analysed for *Onchocerca volvulus* infection rates, infection intensity, and the characteristics of larval distribution among the flies (see Rodríguez-Pérez et al. 1995). The variance over mean ratio (VMR) indicated that in all cases this distribution departed from Poisson and was strongly aggregated (VMR > 1; Anderson & May, 1995). The negative binomial was found to be an adequate model (Grenfell et al. 1990) with a small value of the aggregation parameter k but the degree of larval overdispersion increased as the mean larval load decreased, invalidating the use of a common k_c value (Elliot, 1977; Ludwig & Reynolds, 1988). A linear relation between k and the mean (m) was then established ($k(m) = k_1 m$) which permitted exploration of the relationship between the observed proportion of infected flies, p, and the estimated mean larval burden per fly, m (all larval stages in parous flies, see also Basáñez et al. 1995). This would allow mean numbers of larvae per parous fly to be predicted from presence-absence data (Gerrard & Chiang, 1970); e.g. from infection rates provided by PCR methods applied to pools of flies (Toe et al. 1994; Oskam et al. 1996). The method requires, however, an assumption that k_1 is known. Given that both p and m are naturally low in *S. ochraceum*, their relationship was practically linear in the range of observed values. Predictions were tested with the Mexican data from which the clumping parameter was estimated as well as for Guatemalan data for which this information was not available (Cupp et al. 1992). Results showed a highly satisfactory degree of agreement between predictions and observations. The sample sizes required to estimate mean larval loads from prevalence data for fixed levels of precision (defined as the ratio between SE(m) and m) were calculated for realistic *S. ochraceum* infection rates (those found in published pre- and post-control field surveys as well as in this work). For the special case in which the relationship between k and the mean is linear and goes through the origin, $k(m) = k_1 m$, the number of flies to be checked for *O. volvulus* infections does not explicitly depend on the aggregation parameter but does depend on the unknown proportion of infected flies. Practical recommendations for the calculation of sample sizes are discussed. The linearity between onchocercal infection rate and infection intensity in the fly population suggests that relationships between the former and onchocerciasis patterns in the human population should be further explored for the purposes of monitoring the impact of ivermectin control programmes through entomological evaluations.

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The detection of *O. volvulus* DNA in wild-caught *S. ochraceum* before and after ivermectin treatments in Guatemala.

J.B.Davies: *Liverpool School of Tropical Medicine, Liverpool, UK.,*

L. Oskam: *Royal Tropical Institute (KIT), Amsterdam, The Netherlands*.

R. Luján: *Universidad del Valle de Guatemala, Guatemala. C.A. and Comité Prociegos y Sordos de Guatemala.*

It has been shown by Oskam *et al*. (1997) and Katholi *et al.* (1995) that the detection of *Onchocerca volvulus* DNA in single infected blackflies in pools of uninfected flies can be carried out with considerable sensitivity using the polymerase chain reaction (PCR) screening technique. In our preliminary trials a single *Simulium* inoculated with 1 microfilaria was detected in a pool of 80 uninfected flies.

Because the prevalence of *O. volvulus* larvae in *S. ochraceum* is normally of the order of 1% their detection by dissection requires many hundreds of flies to be painstakingly dissected in order to obtain a reasonable estimate. We therefore tested pools of wild-caught biting *S. ochraceum* collected in 1994 before and after ivermectin treatments at the hyperendemic Finca of El Brote to see whether we could detect *O. volvulus* DNA and detect any change in the proportion of positive pools following the treatments. Flies which had been collected biting in February 1994, 13 weeks before the first treatment (97% of eligibles treated on 16/5/94), were compared with flies collected in July 1994, 7 weeks post-treatment. The flies had been stored in 95% commercial ethanol since collection. Flies containing visible blood were discarded and not tested. Negative controls comprised 10 pools containing 10 *S. ornatum* from England in each. They were randomly distributed amongst the others and all were negative.

In February 1997 we tested 360 flies in 18 pools (Table 1) using the techniques described in Oskam *et al*. (1997). The proportion positive was higher than expected. Nine out of 10 pre-treatment pools were positive for *O. volvulus* DNA, while at 50 days post-treatment 3 of 8 pools (37.5%) were positive. This difference is significant (p= 0.04). It appears that the treatment suppressed the level of infection in the vector by about 60%.

This project was supported by the European Economic Community

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Table 1 Results of PCR Tests on pools of *S. ochraceum* from El Brote, pre- and post-ivermectin treatment.

Collection &Date	Days before/after Treatment	(Weeks)	No. Flies per Pool	No. of Pools	Pools PCR +ve	% +ve Pools
Pre- 8 Feb 94	-97	(-13)	20	10	9	90.0*
Post- 5 July 94	+50	(+7)	20	8	3	37.5*

⓾Differences between proportions significant ($p = 0.04$; Chi2 ,Fisher's Exact Test).

British Simuliid Group Bulletin Number 10, January 1998

ANNOUNCEMENTS

Identification Key to the Last Instar Larvae and Pupae of the Simuliidae of Britain and Ireland.

Jon Bass: *Eastern Rivers Group, Institute of Terrestial Ecology, Monkswood Experimental Station, Abbots Ripton, Huntingdon, PE17 2LS*

Publication of the revised key is anticipated around about Easter (1998). It includes short notes on collecting, preserving, examining larvae and pupae, together with the seasonality and preferred habitats of each species. Name changes and faunal additions/deletions since Lewis Davies' 1968 key are also provided. The key will be published by the Freshwater Biological Association (based at -The Ferry House, Far Sawrey, Ambleside, Cumbria LA22 0LP). At present, the price of the new key is not known.

I will be very interested to hear of any collecting or identifications you may embark on - and I would like to see some specimens.

North American Black Fly Meeting

The annual North American black fly meeting (previously NE-118) will be held this year in Vero Beach, Florida, beginning at 8:30 AM on Sunday, 8 February and running through 12:00 noon on Monday, 9 February 1998.

Plan to travel on Saturday (7 February). Vero Beach is the home of the Florida Medical Entomology Laboratory. The setting consists of 300 acres of pristine Oak Hammock with walking and canoe trails and excellent bird watching. You can fly into one of three airports and then rent a car: Orlando (2 hours by car), West Palm Beach (1.5 hours by car), or Melbourne (40 minutes by car). Lodging will be in a bunkhouse ($10.00 per night) or a trailer ($15.00 per night).You will need to bring sheets or a sleeping bag and a towel. Blankets will be furnished for a minimal charge. A tour of the facility and a canoe trip are planned. Registration will be approximately $25.00 to cover beverages, snacks, and a lunch on Sunday. Individuals wishing to stay longer may do so. For further information, please contact Co-Chairs P. H. Adler (864-656-5044, adler@clemson.edu) or R. W. Merritt (517-355-8309, merrittr@pilot.msu.edu).

NOTES, VIEWS AND CORRESPONDENCE

Note on the *Simulium damnosum* complex in Zambia

Roger W. Crosskey: *Department of Entomology, Natural History Museum, Cromwell Road, London SW7 5BD, UK.*

I have been asked from time to time whether *Simulium damnosum* s.l. occurs in Zambia. The answer is yes, though this is only scantily evident from the literature. Such few references as have existed until now derive from two female flies in the Natural History Museum in London. These are the basis upon which Zambia (as 'N. Rhodesia') was listed by Freeman & de Meillon (1953) in their synopsis of *S. damnosum* distribution, the first reference for the country. These authors gave no other data, but Raybould & White (1979) fleshed out Freeman & de Meillon's statement slightly by writing that specimens of *S. woodi* are "in the British Museum (Natural History), together with females of *S. damnosum* s.l. from Kaomba - one of which was caught biting man". The same two specimens are the basis upon which a record spot is shown for Zambia on the distribution maps for *S. damnosum* s.l. given in de Meillon (1957) and those prepared by me at various times and published in Smith (1973) and World Health Organization (1976, 1978).

Since the information about *S. damnosum* in Zambia has been vague up to now, and no adults (to my knowledge) have been collected there since 1952, it is worth providing here some more detail about the two known female adults, and worth recording a new record based on a sample obtained in 1979 by David Baldry in a quite different part of Zambia and found among some samples of Zambian simuliids sent to me for identification.

Of the two females in the Natural History Museum, one is labelled "N. Rhodesia:/Kaomba R./Serenje Boma./4,200 ft. April 1930./Dr. R.E. Lloyd" (printed Label) and the other is labelled "N. Rhodesia:/Serenji,/Kaombi R./Biting man." (hand-written label). Both flies are clearly from the same locality, although the place name on the labels is differently spelt. Each fly also bears a printed Museum accession label, these reading respectively "Brit. Mus. 1930-292" and "J.J.C. Buckley. B.M. 1952-151". The fly caught by Buckley while biting man is in excellent condition but the other is in poor state (antennae missing, proboscis damaged, right fore leg missing, most of left fore tarsus missing, right wing torn). The co-ordinates of Serenji are 13º 12'/30º 15E

The immatures received from Baldry comprise 5 larvae and 1 pupa with the data "Central Province, Mumbwa Game Management Area, Nansenga river, 19.vi,1979" (Natural History Museum, London). Interestingly, the larvae in this sample possess enormous abdominal tubercles and two sizes of posterior abdominal scales like the larva of *S. luadiense* from Zaire illustrated by Elsen *et al*. (1983) and rather like the larvae occurring in certain forest-related cytospecies of the *S. damnosum* complex in West Africa. The Nansenga river flows southwards to join the Kafue and the collecting site was near its northern end at 15º 00'S/26º 34'E.

Other species of *Simulium* present in the same general stretch of the Nansenga, as shown by material that I identified for Baldry and also for Dr. John E. Davies (no connection with Bulletin editor John B. Davies), were *S. adersi, S. alcock*i group sp (10 filamented pupal gill, ? *impukane*), *S. bequaerti, S. hargreavesi, S. medusaeforme* and *S. nigritarse.*

The situation in Zimbabwe is not a lot clearer than in Zambia. Meeser (1942) reported *Simulium damnosum* from several sites in "Southern Rhodesia" (everywhere non-anthropophilic), but not from the Zambezi river, the border with Zambia. Still, the occurrence of the complex in the Zambezi is confirmed by the presence of a reared male in the Natural History Museum collection bearing a hand-written label "Rhodesia./R. Zambesi,/Victoria Falls/From pupae". There is no label giving the collector's name or the collection date but the collection label is in the identical hand to that on the "Serenji" man-biting female from Zambia and I am confident that the Zambezi specimen was also collected by J.J.C.Buckley, in or a little before 1952. Meeser's paper is the basis of all subsequent reports of *S. damnosum* s.l. in Zimbabwe (the erstwhile Rhodesia or Southern Rhodesia).

Information about onchocerciasis in Zambia is even more scanty than for *Simulium damnosum* complex. The country is neither mentioned in the text nor included in the disease-range maps given in any of the various WHO Expert Committee Reports on Onchocerciasis (1954, 1966, 1976, 1987, 1995). However, a note by Beaver et al. (1993) - which has not rated a notice in the Expert Committee Reports that post-date it - records an infection with *Onchocerca volvulus* in a young girl living in the village of Macha (26º 16'S/26º 48'E). So far as I know, this is the only published reference to human onchocerciasis in Zambia. I recall that the late Frank Budden (pers. comm.) found no indication of ocular onchocerciasis when he undertook a consultancy on eye disease in Zambia in the 1970s. It seems that a serious attempt at prospection for the disease and its potential vectors would be worthwhile and that the Zambesi river border region with Zimbabwe should be included in the coverage.

[Note: Zambia was accidentally omitted from the distribution for *S. damnosum* complex in the recently published inventory of World blackflies (Crosskey & Howard, 1997) - a case of *mea culpa,* the country name having been 'lost' at a late production stage while I was re-jigging the relevant part of the text!]

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MEMBERSHIP NOTICES

Changes to e-mail addresses

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Prof. R.J.Post: *rorp@nhm.ac.uk*
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Change of address

Dr. Rob Palmer, AfriDev Consultants, P.O.Box 4349, White River, 1240, South Africa. *Afridevr@iafrica.com*

New Members

We welcome the following new members to the Group (*e-mail addresses given in italics*)

Matthew Hopkins, 446 Manchester Rd., Walkden, Manchester, M28 3WJ. *matthew.hopkins@virgin.net*
Wayne Jarvis, Department of Entomology, Natural History Museum, Cromwell Road, London SW7 5BD, UK.
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BRITISH SIMULIID GROUP
BULLETIN NO. 11, JUNE 1998

Contents **Number 11, June 1998**

FROM THE EDITOR

The most significant event so far this year has been the publication of Jon Bass's "Key to the Simuliidae of Britain and Ireland" details of which are given on page 2. Also in this number are the presentations from the 20th Annual Meeting which could not be included in Bulletin No. 10, including an account of Peter Adler and Roger Crosskey's trip to St. Petersberg to see Rubtsov's collection. There is also a summary of the papers presented to the Annual North American Black Fly Meeting.

It has been decided to hold the 21th. Meeting of the Group in conjunction with the *Simulium* Workshop incorporated in the Fourth International Congress of Dipterology in Oxford, England, 6-13 September, 1998, details are given in the next article.

It has been a great sorrow to report the death on March 20th. 1998, of Professor W.E. Kershaw at the age of 87. "Willy" Kershaw was one of the "characters" of tropical medicine and a great supporter of the Group, and attended most of our meetings up until the Salford meeting of 1988. Although primarily a parasitologist, he was involved in aspects of the 1950's work on the biting habits of *Simulium damnosum* in studies on the dynamics of the transmission of onchocerciasis in West Africa.

John Davies

THE 21ST. ANNUAL MEETING

At the 20th Annual Meeting held at the Natural History Museum, London last year, it was proposed to hold this year's meeting in Liverpool before or after the anniversary celebrations of the Liverpool School of Tropical Medicine, and the Second European Congress on Tropical Medicine, on 14-18 September, 1998. On later consideration it was thought that there was little point in following the *Simulium* Workshop destined to be included in the Fourth International Congress of Dipterology in Oxford on the morning of 9th. September 1998 with a second *Simulium* meeting a week or two later. We have been fortunate that the organisers of the Oxford meeting have been favourably disposed to combine the two meetings, and to waive the congress registration fee for BSG members attending a combined meeting.

One hundred and twenty members were canvassed by e-mail, letter and telephone, one third responded and all but one were in favour of having the combined meeting in Oxford on 9th September 1998.

We have therefore decided to go ahead with organising a combined meeting with the *Simulium* Workshop. Since the workshop will occupy the morning only and a number overseas members will be present, we plan to organise a get-together for lunch somewhere in Oxford during the afternoon where there would be plenty of opportunity to make new friends or meet old ones and to continue discussions. (It has been suggested that a field trip could be arranged). Some members from further afield may find it easier to arrive in Oxford the day before, and for them we may also organise the customary evening meal.

Please note the date **9th September 1998** in your diary. Notices giving more details will be sent out later. There may be a chance for BSG members to contribute short presentations or posters at the workshop, so please start thinking about them now. Any queries should be addressed to myself or to Carolyn Lowry at the Natural History Museum, London.

John Davies, Liverpool School of Tropical Medicine, Pembroke Place, Liverpool L3 5QA, Uk. (e-mail: daviesjb@liv.ac.uk, home phone: (44) 151 632 4031)

KEY TO THE SIMULIIDAE OF BRITAIN AND IRELAND

Last Instar Larvae and Pupae of the Simuliidae of Britain and Ireland: A Key with brief Ecological Notes.

by Jon Bass Freshwater Biological Association. Scientific Publication No. 55, (1998), 102pp.

This long-awaited successor to Lewis Davies's Key to the British Species of Simuliidae is now available from The Freshwater Biological Association, Dept. DWS, The Ferry House, Far Sawrey, Ambleside, Cumbria, LA22 0LP, UK. Price £14.00 (including postage). Members of the FBA can claim a 25% discount.

PRESENTATIONS GIVEN AT THE 20TH ANNUAL MEETING

The 'Invitation Effect' in *Simulium damnosum* s.l.

Philip J. McCall: *Tropical Parasitic Disease Unit, International Institute for Parasitology, CAB International, St. Albans . (current address: Division of Parasite & Vector Biology, Liverpool School of Tropical Medicine, Pembroke Place, Liverpool L3 5QA. UK.*

In certain haematophagous Diptera, the presence of an initial group of individuals bloodfeeding on a host can attract other host seeking individuals of the same species. This phenomenon was first demonstrated by Alekseev *et al.* (1977) in *Aedes communis* and was termed the 'invitation effect'. Subsequent studies have shown similar behaviour in *Aedes aegypti*, *Phlebotomus papatasi* (Psychodidae) and *Culicoides impunctatus* (Ceratopogonidae). The behaviour appears to be an olfactory response to the feeding insects, and evidence from the studies on *P. papatasi* and *C. impunctatus* suggest it is probably mediated by a pheromone emitted by the actively feeding insect.

No intraspecific communication of any kind has been recorded during host-seeking or feeding in any blackfly species. However, during studies on behaviour of *S. damnosum* s.l. in Sierra Leone the author observed that greater fly densities stimulated higher rates of bloodfeeding, an effect which may be analogous to this 'invitation effect'.

The study involved feeding flies in chambers applied to the ears of a pig, with 4 chambers used simultaneously in each feeding trial. Each chamber received flies at densities of either <10, 10-14, 15-19 or $\geq$20 individuals. On completion, all blackflies were aspirated from the chambers and the numbers of fed and unfed individuals counted.

A total of 934 blackflies were tested in 72 chambers, in 18 trials. Of these, 431 (46%) fed on blood. The results clearly demonstrated that chambers containing higher numbers of flies resulted in higher feeding rates. A comparison of the four groups tested showed an increase in feeding rates with chamber density, with the most pronounced increase occurring at densities of 20 or more flies per chamber. There was also a strong correlation between the density in each chamber and the proportion of flies that fed (r^2=0.74).

In demonstrating that the number of flies assembled at the host influences the proportion which subsequently begin feeding, the data provides evidence for intraspecific communication during bloodfeeding in *S. damnosum s.l.*. It is possible that this behaviour may represent a later event in a sequence of interactive events involved in host location and bloodfeeding by *S. damnosum s.l.*; a sequence that could begin with the attraction of blackflies over distance in a manner similar to that described in other Diptera.

Since neither the mediator nor the evolutionary significance of such behaviour are known, the author invited suggestions and discussion from the audience. There ensued a lively debate on the significance of the findings, the possible origins of such behaviour and its relationship to host selection and disease transmission.

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McCall, P.J. & Lemoh, P.A. (1997) Evidence for the "Invitation Effect" during Bloodfeeding by Blackflies of the Simulium damnosum complex (Diptera: Simuliidae). *Journal of Insect Behavior*, **10**, 299-303.

The Simuliid Collection in the Zoological Institute, St. Petersburg, Russia

Peter H. Adler: *Department of Entomology, Clemson University, Clemson, SC 293634-0365 USA*
Roger W. Crosskey: *Department of Entomology, The Natural History Museum, London, England SW7 5BD*

This paper is an expanded version of a short, unscheduled presentation given by one of us (RWC) at the 20th Annual Meeting of the British Simuliid Group and foreshadowed (British Simuliid Group Bulletin 10: 1, January 1998) by the editor for the current issue of the Bulletin. The Zoological Institute in St. Petersburg, Russia, houses one of the world's three major collections of Simuliidae, the others being in London and Washington. From 27 to 31 October 1997, we were able to study the collection, graciously hosted and assisted by A. A. Ilyina, V. A. Krivokhatsky, O. G. Ovtshinnikova, V. Richter, V. N. Tanasychuk, A. V. Yankovsky, and the Deputy Director V. F. Zaitzev.

The simuliid collection was amassed under the direction of Ivan Antonovich Rubtsov. When Rubtsov began his work on simuliids in 1934 the published literature had recorded only three species from the former Soviet Union. Under Rubtsov's tenure at the Institute, which began in 1938 and continued even beyond his retirement 41 years later, the number of species recognized by him from the area increased to roughly 400. Although formed particularly of material from Russia and the former Soviet republics, the collection also has a wealth of material from Mongolia and northern China. The collection contains nearly 400 primary types of simuliids, of which approximately one third are lectotypes.

The collection is in excellent condition, owing largely to the dedication and loyalty of Anna A. Ilyina, Rubtsov's assistant, who has served the collection since 1949 and continues to work on an ad hoc basis. No pesticides are used to deter dermestid beetles and similar pests; however, we saw no evidence of pest problems. The slide and pinned material is housed in a single, narrow room on the second floor of the Institute, the slides along the left wall and the pinned material along the right wall. Desk space, although at a premium, can accommodate four workers. One compound and two dissecting microscopes were available in the room for our use. We did not have the opportunity to view the alcohol collection.

The majority of species in the collection are represented by both pinned and slide- mounted examples. Slides prepared by Anna are in very fine condition, mounted in Canada balsam and well labelled. Some slides, particularly those of 1970s vintage that were prepared by other workers, are made with a different mounting medium and these have become uninterpretable because of shrinkage of the medium and encroachment of air bubbles. These slides include type specimens and eventually will need to be broken down and the parts remounted. Fortunately, the Anna Ilyina preparations form the bulk of the slide collection. The slide mounts include larvae, pupae, and adults. Larval mounts from about 1949 to the present include only the head capsule and terminal portion; the intervening larval cuticle, often with diagnostic setae and scales, evidently was discarded. Slides are held in double-wide cardboard trays which, in turn, are held in boxes (up to 10 per box) arranged in fine-wood cabinets, following Rubtsov's classification scheme for the family. The edge of each tray shows, in typescript, the names of the contained species and is marked with a red dot against the species name if slides of types are included.

Nearly all of Rubtsov's illustrations in his taxonomic papers were drawn from slides in the collection, and one can often determine precisely which specimen was drawn by the peculiarities of the particular preparation. Although Rubtsov's drawings are true to the slides, they sometimes incorporate distortions caused by damage or poor orientation during preparation of the mount.

The pinned material is organized, according to Rubtsov's classification, in wooden drawers stored in wooden cabinets. Specimens of each species are arranged in rows with ample space between taxa to accommodate new material and new species. The dry pupal exuviae are sometimes associated with the adult on the pin. Many species are represented by good series from multiple localities.

Each slide mount and pinned specimen has been logged into a series of record books maintained since the early days of the collection. Entries for each specimen include a preparation number, species name, and collection data. A card index is maintained by Anna, and from this index a catalogue of the types of about 385 taxa was generated by A. V. Yankovsky (Yankovsky, A. V. & K. N. Ulyanov. 1995. Catalogue of type specimens in the collection of the Zoological Institute, Russian Academy of Sciences, Diptera. No. 5.

Simuliidae, Culicidae. Zoological Institute, St. Petersburg). A useful feature of this publication is the citation of label data on the type specimens, but the relevant data in the catalogue are best associated with the type specimens by means of the preparation numbers. At the time of our visit, the 137 lectotypes that were designated in the catalogue were not indicated on the actual specimens; however, we understand that since our visit, the task of applying the labels has begun. In relatively few cases, types have gone unrecognized and others have labels of dubious authenticity.

Careful study of this impressive and valuable collection by the international community of simuliid specialists is likely to reveal numerous synonymies between and within zoogeographical regions. During our short visit, we gained much insight into Rubtsov's approach to simuliidology and to the riches of the collection. Unfortunately, one week was woefully inadequate for mining the vast treasures of what has come to be known informally as the 'Rubtsov Collection'.

POSTER PRESENTED AT THE 20TH ANNUAL MEETING

The effect of Mectizan® treatments in Guatemala on the uptake of *O. volvulus* microfilariae by the vector *S. ochraceum*

J.B.Davies *Liverpool School of Tropical Medicine, UK.*
R.Luján *Universidad del Valle de Guatemala, Guatemala, CA*.

The following three examples are taken from our studies on the transmission of onchocerciasis by *Simulium ochraceum* Walker in Guatemala

1. Vector Microfilarial Uptake VmfU) vs. Skin-Snips as a measure of infection.

We have coined the term *vector microfilarial uptake* (VmfU) for use when microfilaria loads are estimated by feeding flies (in our case *Simulium ochraceum*) on volunteers. This parameter is obtained from the estimated numbers of mf in the fly's blood meal as determined by staining and dissection. Ten flies were usually fully engorged on the bare back each volunteer, and the geometric mean (GMean) calculated to give the VmfU for each person. For a community or cohort of volunteers, the GMean of all members' VmfU is used. (Davies et al. Trop. Med. Int. Hlth. 1997, 2 (4):348-355)

Apart from indicating skin mf. densities, VmfU provides a measure of the infectiousness of subjects to the vector, and can be used to show the effect of the campaign on the availability of mf to the vectors. We have also found that this technique is more acceptable to the study communities than taking skin-snips.

Figs. 1 and 2 show the VmfU as mf/fly compared with the GMean skin-snip mf densities and dates of the ivermectin treatments in 2 sets of adjacent coffee plantations (fincas). Arrows indicate treatment dates. Fig. 3 shows the rate of recovery up to 2½ years post-treatment.

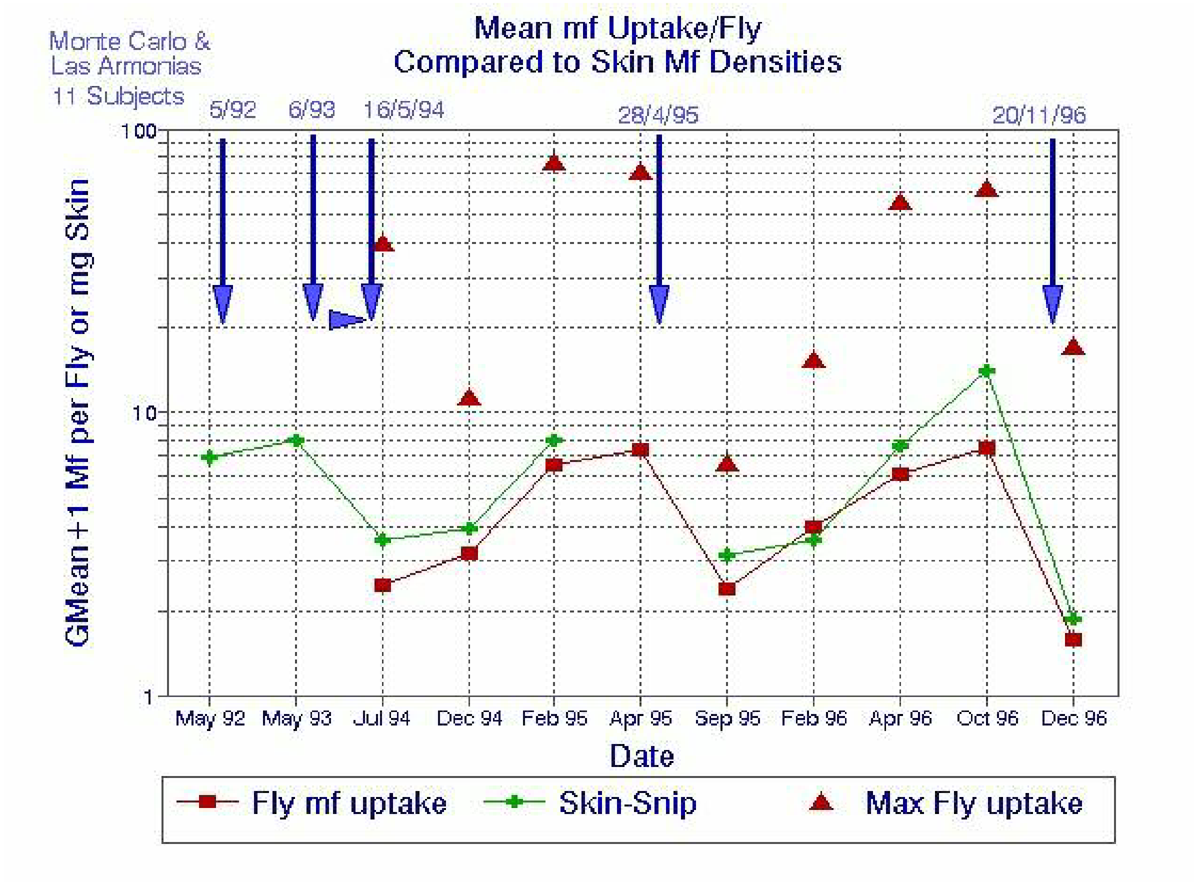

Fig. 1 The effect of 5 annual treatments (arrows) at two adjacent fincas. Demonstrating the annual fall in both skin-snip densities and VmfU which follow the ivermectin treatments and their subsequent recovery. Both parameters are of the same magnitude.

Values of VmfU in Figs. 1 and 2 are geometric means from all persons in the sample. Because infectivity varies greatly between individuals the maximum individual VmfU obtained at each visit is also plotted (as Max. Fly uptake) for comparison. For example, in Fig. 1 in July 1994 the VmfU for the 11 subjects was about 2.5, but for one individual it was 40, and since this value is itself a mean of 10 flies, single flies must have ingested considerably more. We suspect from this that intermittent transmission is still taking place.

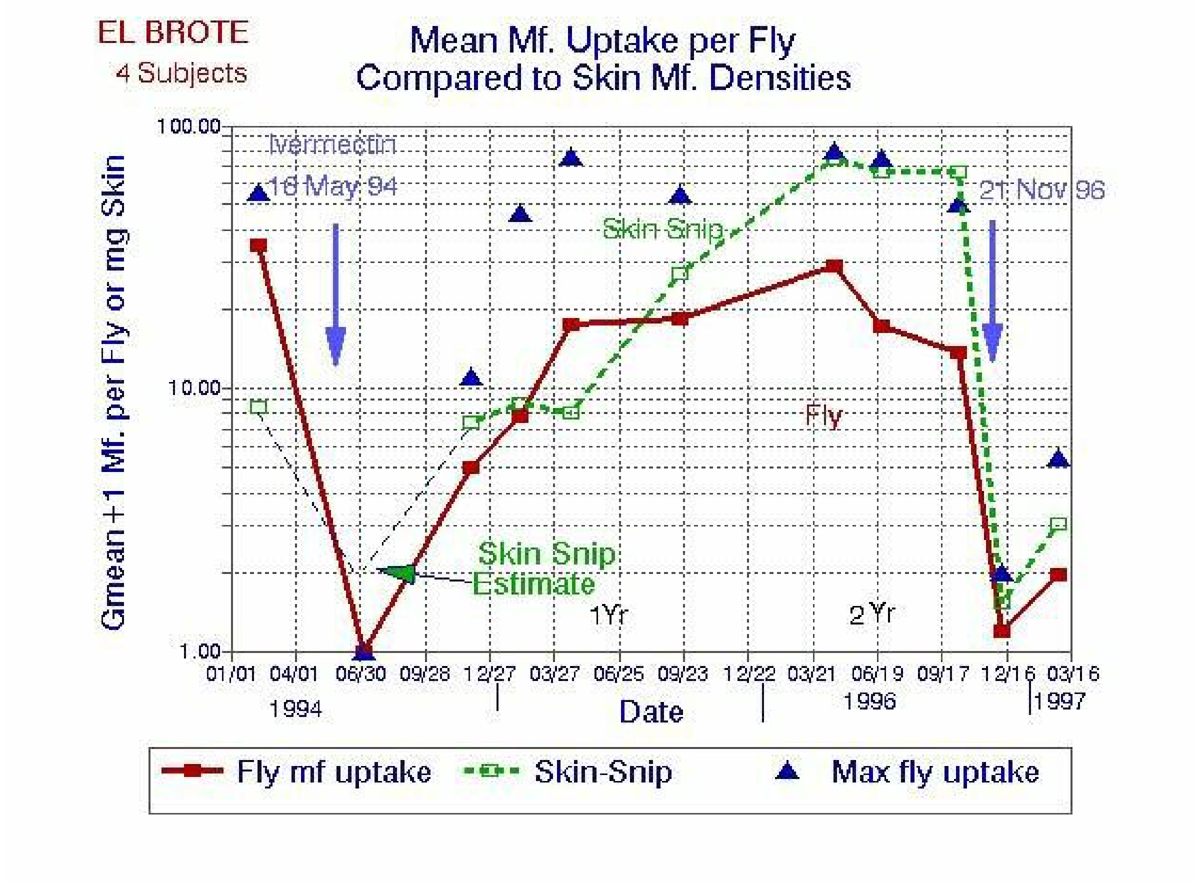

Fig. 2 In this finca there was almost a 2½ years gap between treatments during which skin-snip mf. levels recovered to almost ten times the pre-treatment level. (We suspect that this may be the result of the abandonment of the long running nodulectomy campaign.). VmfU showed a post-treatment climb to a maximum at about 2 years post-treatment.

2. Collection of *S. ochraceum* on fully clothed and partially clothed human attractants

To examine the occurrence of blood in *S. ochraceum* coming to bite, flies were caught on either of two 30 to 40 year old male volunteer attractants who were known to be infected with onchocerciasis. The two baits (A and B) were seated 5 m apart on either side of a bridge . The bait, collector and location were kept constant throughout the experiment to provide a single site/collector/bait variable.

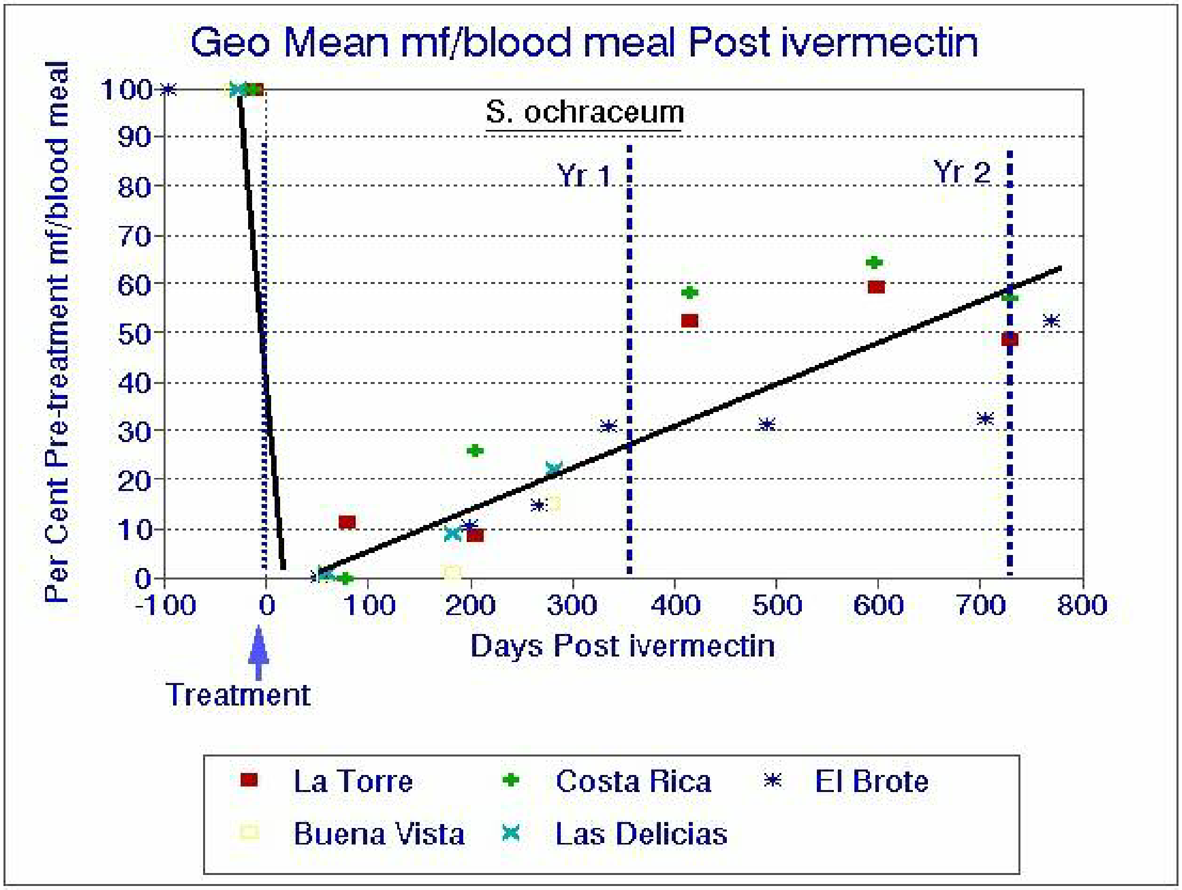

Fig. 3 Combined results from 5 communities which demonstrate the rate of recovery of community VmfU up to 2½ years after a single treatment with ivermectin expressed as a percentage of the pre-treatment level. (Slope lines fitted by eye)

Collections were made during four consecutive 20-minute sessions between 11.30 am and 12.50 pm. During each session one of the baits wore a bright blue shirt with long sleeves buttoned at the neck, whilst the other was bare above the waist. Flies were recorded as containing no blood, old blood or recent blood. Later, the abdomens of all flies were opened up to confirm the original classification and to detect any minute traces of blood invisible from the outside. Results are in Table 1

We found that the fully clothed human bait attracted about 41% of the number of *S. ochraceum* that would be attracted to an partially clothed bait. At high biting densities this would still attract enough flies for transmission studies.

Less than 2% of *S. ochraceum* caught at covered bait contained traces of fresh blood compared to 17% of those caught at bare bait.

About 5% of *S. ochraceum* caught at both baits contained traces of blood from a previous meal.

About 36% of blooded *S. ochraceum* could be detected only by internal examination.

Table 1. Numbers of *S. ochraceum* collected at each bait/cover/time combination at Finca Las Armonias 31 July 1996.

	BAITS					
	A		**B**			Diff.
Time	Covered	Bare	Covered	Bare	Total	Sig. Level
11.3-11.50		62	29		91	a
11.50-12.10	10			35	45	a
12.10-12.30		25	10		35	b
12.30-12.50	8			17	25	ns
Totals	18	87	39	52	196	
Cover Totals		**139**	**57**			a
Bait Totals	**105**		**91**			ns

a $p<0.001$
b $p>0.1, <0.02$
ns $p>0.05$, not significant

3. PCR tests on Single *S. ochraceum* with and without visible blood

Using PCR we individually tested 195 *S. ochraceum* caught at baits for the presence of *O. volvulus* DNA . Details of the tests are in Table 2.

8.8% of flies with no externally visible blood contained *O. volvulus* DNA.
7.5% of flies with no detectable blood contained *O. volvulus* DNA.
10.8% of all flies contained *O. volvulus* DNA.

Because the site of the DNA is not known, interpretation of these results is uncertain.

Acknowledgements
This work was supported by a grant from the European Economic Community.

Table 2 Results of PCR tests for *O.volvulus* DNA on single *S. ochraceum* from Las Armonias collected when coming to bite and classified by presence or absence of internally or externally visible blood.

S. ochraceum	Number	No. PCR +ve	% PCR +ve	Significance
Total tested	195	21	10.8	
With externally visible blood	25	6	24	Yes
No externally. visible blood	170	15	8.8	p = 0.022
With int. or ext. visible blood	35	9	25.7	Yes
No ext. or int. visible blood	160	12	7.5	p = 0.002
With new blood	24	7	29.17	No
With old blood	11	2	18.18	p = 0.49

TRAVELLER'S TALES

Two accounts from North-eastern North America

The sources of both of the following excerpts were suggested by Roger Crosskey.

A Contemporary Traveller

The Appalachian Trail stretches over 2000 miles along the East Coast of the United States of America from Georgia to Maine. With his friend Stephen Katz, Bill Bryson recently attempted to walk the 2000 or more miles of the trail and wrote about his experiences in his book "A Walk in the Woods" (Doubleday, 1997, 320pp.). The following extract from page 244 describes events on a section of the Appalachian Trail through the Berkshire Mountains south of Cheshire, Massachusetts, in June.

> "I spent the night in a motel and the next day hiked on to Cheshire. It was only nine miles over easy terrain, but the black-fly made it a torment. I have never seen a scientific name for these tiny, vile, winged specks, so I don't know what they are other than a hovering mass that goes with you wherever you go and are forever in your ears and mouth and nostrils. Human sweat transports them into a realm of orgasmic ecstasy, and insect repellent only seems to excite them further. They are particularly relentless when you stop to rest or take a drink - so relentless that eventually you drink while moving and then spit out a tongueful of them. It's a kind of living hell. So it was with some relief that I stepped from their woodland domain in early afternoon and strolled into the sunny, dozing straggle that was the little community of Cheshire."

[I asked Peter Adler his opinion on the identity of these "vile specks" and he consideres that most of them are undoubtedly *Simulium venustum* s.s. **Ed**.]

Newfoundland in the 1880s

The next extract is one of many to be found in Marshall Laird's annotated book on the Natural History of Newfoundland (Laird, M. 1980. *Bibliography of the Natural History of Newfoundland and Labrador*. lxxi+376 pp. Academic Press)

Marshall Laird explains that a Captain Kennedy was in command of HMS "Druid" from 1879 to 1882 protecting the English fisheries on the coast of Newfoundland. He was evidently a dedicated hunter and fisherman and described his exploits in a series of letters to the *Field* under the nom-de-plume "Mariner" as well as in a book; (Kennedy, Captain W.R. (1885) "*Sport, Travel and Adventure in Newfoundland and the West Indies*" Edinburgh and London, Wm. Blackwood & Sons. x+399 pp.).

> "Returning to our camp [*on the Exploits River*], we found the tent pitched, fire lighted, and tea ready, and we looked foreward to refreshment and repose; but alas! there was was none of it, for the blackflies were masters of the situation. They were in millions, and attacked us from all quarters, notwithstanding repeated applications of tar and oil, until we had to take refuge in the smoke of our fire, where we passed a miserable time, with our eyes running with water, mingled with grease and tar. We endeavoured in vain to make ourselves comfortable for the night; but the flies got into our eyes, ears and mouth.... Darkness set in, and we flattered ourselves we should have peace but there was no peace for the wicked. The flies disappeared, but the mosquitoes took their place."

Further on Captain Kennedy comments:

> "it would be simply impossible for anyone to settle on the banks of that or any other river in the island, with any degree of comfort unless the bush be first cleared away. Some of the old settlers of thirty and forty years' standing told us that they were bitten just as badly as when they first came into the country, and their bleeding hands and faces testified to the fact. The wretched women and children could not leave their houses to work in the garden unless it was blowing a gale or raining in torrents; and these pests last from June until October, the best months in the year."

Nevertheless, Captain Kennedy's enthusiasm for fishing triumphed as he later remarked:

> "although undoubtedly a great drawback they are not sufficient to deter a keen angler from enjoying his

favourite pastime. We found the best remedy to be Stockholm tar and oil, or carbolic and oil - twenty parts of the latter to one of the former - the flies buzz round, but they don't hanker after it. As to veils, I wouldn't be bothered with them. They are all very well for loch-fishing, but when as in Newfoundland, you have often to walk for miles to reach the water, or wade up the river to reach the pools - climbing over boulders, with an occasional header into the river - a veil would be worse than useless; besides, it is uncomfortably hot and interferes with smoking..."

[Captain Kennedy was fortunate - he could always escape to his ship when the torment became unbearable, unlike the long-suffering residents! **Ed**.]

MEETING NOTICES AND REPORTS

Forthcoming Meetings

Fourth International Congress of Dipterology in Oxford, England, 6-13 September, 1998 (includes a Simulium Workshop on the morning of 9 September).

Second European Congress on Tropical Medicine, Liverpool, England, 14-18 September, 1998

X1th European Meeting of the Society for Vector Ecology, Lisbon, Portugal, 13-17 October 1998

Entomology '98, September 9-11 1998, Ex

eter University, UK.
Convenor: Robin Wootton, Biological Sciences Dept., Hatherly Laboratories, Prince of Wales Rd., Exeter, Devon, EX4 4PS, UK. *(r.j.wootton@exeter.ac.uk)*

10th German/ 2nd European Simuliid Symposium will be held on the 18.-20.September 1998. in Aarhus, Denmark. Organiser: Dr. F. Jensen Naturhistorisk Museum Århus, Universitetsparken, Bygning 210, DK-8000, Århus C, Denmark.

The XXI International Congress of Entomology will be held at Iguassu Falls (Brazil), August 20-26, 2000. You can find all updated information about the ICE. on the WWW at http://www.embrapa.br/ice.

Meeting Report
Annual North American Black Fly Meeting

Peter H. Adler & John W. McCreadie: *Department of Entomology, Clemson University, Clemson, SC 29634-0365 USA*

The 21st annual meeting of North American black fly workers was held 8-9 February 1998 at the Florida Medical Entomology Laboratory in Vero Beach, Florida. The meeting was held for the first time as a Southern Extension and Research Activities-Information Exchange Group, the replacement vehicle for the now-defunct Northeast Regional Black Fly Technical Committee or NE-118. Peter Adler and Richard Merritt served as Co-Chairs and John McCreadie was the Program Organizer. Twenty-six people attended the meeting. Eighteen research reports were presented, following introductory comments by the Co-Chairs and a presentation about the Florida Medical Entomology Laboratory by its director, Dick Baker, who also provided a tour of the Laboratory's facilities.

Next year's meeting will be held 7-8 February 1999 at the Flamingo Lodge in the Everglades National Park, Florida.

The following presentations were made:

Algae and Bti failures on the Susquehanna River (**D. Arbegast**)

Involvement of citizen groups in the Delaware River black fly program
(**J. Fitzpatrick**)
Initial steps towards black fly management in the Negro Valley of
Argentina **(E. Gray)**
Bioindicator studies with black flies: new toxicology testing methods
(**A. Hyder**)
Update on Michigan black fly program (**R. Merritt)**
There's a SOOP (*Smittium* or other partner) in my fly (**C. Beard**)
Do black flies pollinate ericaceous shrubs (**F. Hunter**)
Oviposition sites of black flies (**C. Hazzard**)
Black fly parasites and pathogens (**J. McCreadie & P. Adler**)
Structuring mechanisms in a black fly community in southern California
(**T. Pachon**)
Simulium jenningsi research in New Jersey **(D. Bidlack**)
Evolution of the mitochondrial CO-II gene in black flies (**K. Pruess**)
Autogeny in black flies: a new marker (**C. Brockhouse**)
Finally a phylogeny for *Inseliellum* (**D. Craig**)
Significance of spermathecal structure in black flies (**C. Evans & P. Adler**)
Simulium parnassum - is it a complex? (**E. Paysen & P. Adler**)
Black flies of northwestern North America (**D. Currie**)
The black flies of North America (**P. Adler**)

[Anyone wishing for more details on these presentations should contact Jim Sutcliffe or Peter Adler for addresses – **Ed**.]

List of the Inaugural and Annual Meetings of the British Simuliid Group, 1979 - 1996

Listed By: Date; Venue; Organiser(s); Account in Newsletter or Bulletin

Inaugural Meeting. February 1979
British Museum (Natural History), London
Drs RW Crosskey (NHM) &
AG Gatehouse(University College of North Wales)
Newsletter 1 (1979)

Annual Meetings

1. July 1979
Liverpool School of Tropical Medicine
Dr H Townson
Newsletter 2 (1979)

2. July 1980
Department of Biology, Salford University
Dr S Frost
Newsletter 4 (1980)

3. November 1981
Freshwater Biological Association River Laboratory
Mr JAB Bass
Newsletter 6 (1981)

4. November 1982
Winches Farm Field Station, London School of Hygiene and Tropical Medicine
Dr PS Ham
Newsletter 8 (1982)

5. September 1983

Department of Biological Sciences, Exeter University
Dr NL Hywel-Jones
Newsletter 10 (1984)

6. November 1984
British Museum (Natural History), London
Dr RW Crosskey
Newsletter 11 (1985)

8. November 1985
Liverpool School of Tropical Medicine
Dr RJ Post
Newsletter 12 (1986)

9. September 1986
School of Biological Sciences, Portsmouth Polytechnic
Dr ST Moss
Newsletter 13 (1987)

10. September 1987
Freshwater Biological Association River Laboratory
Mr JAB Bass
Bulletin 1 (1982)

11. September 1988
Department of Biology, Salford University
Dr M Curtis
Bulletin 2 (1993)

12. November 1989
Liverpool School of Tropical Medicine
Dr PS Ham
Bulletin 2 (1993)

13. September 1990
The Natural History Museum, London
Mrs CA Lowry
Bulletin 2 (1993)

14. September 1991
School of Biological Sciences, Portsmouth Polytechnic
Dr ST Moss
Bulletin 2 (1993)

15. September 1992
Centre for Applied Entomology and Parasitology, Keele University
Prof PS Ham
Bulletin 3 (1994)

16. November 1993
The Natural History Museum, London
Dr M Charalambous
Bulletin 3 (1994)

17. September 1994
Liverpool School of Tropical Medicine & Department of Environmental and Evolutionary Biology, Liverpool University
Dr JB Davies
Bulletin 4 (1994)

18. September 1995
Department of Geography, Birmingham University
Dr M Greenwood (Loughborough University) & Miss MA Bickerton (Birmingham University)
Bulletin 5 (1995)

19. September 1996
Monkswood Experimental Station, Institute of Terrestrial Ecology
Dr JAB Bass
Bulletin 8 (1996)

20. November 1997
The Natural History Museum,
London
Dr. A.J.Shelley, Mrs. C.A.Lowry.
Bulletin 10 (1997)

T.R. Williams *School of Biological Sciences Liverpool University*
PO Box 147, Liverpool L69 3BX UK

MEMBERSHIP NOTICES

Death

We regret to report the deaths of the following members:

Professor W. E. Kershaw CMG, VRD, MD, DSc, in UK. on March 20 1998
Dr. T. Timm, Essen, March 1996

New member

We welcome as a new member (e-mail address in italics):

Dr. Ladislav Jedlinka, Department of Zoology, Comenius University, Mlynska Dolina B-1, SK-842 15 Bratiskava, Slovakia. *JEDLINKA@fns.uniba.sk*

New Addresses for Existing Members

Dr D. A. Boakye, 206 Vale Avenue, Brmingham, Alabama, AL 35209, U.S.A.

Professor R.A.Cheke, Pest Management Dept., Natural Resources Institute, University of Greenwich Central Avenue Chatham Maritime, Chatham, Kent ME4 4TB, UK. *r.a.cheke@greenwich.ac.uk*

Professor Marshall Laird, 193 Wharawhara Rd., RD2, Katikati, 3063 New Zealand

New e-mail Addresses

Dr. Jörg Grunewald joerg.grunewald@tuebingen.de

BRITISH SIMULIID GROUP BULLETIN - Number 12, December 1998

Contents   Number 12, December 1998

FROM THE EDITOR

I happened to be searching the British Library catalogue for a journal when I thought it would be interesting to see whether our Bulletin was listed - and there it was under ISSN Number 136 33376, DSC Shelfmark 2424.100000n. So we do have a number after all, can't think why I didn't check before.

As usual, the second Bulletin of the year carries an account of the Annual Meeting. This year it was held in conjunction with the 4th. International Congress of Dipterology, and I am indebted to the organizer, Adrian Pont, and his colleagues for providing the texts of the abstracts of talks and posters presented to the meeting, and for permitting them to be published in the Bulletin.
John Davies

COMBINED 21ST. ANNUAL MEETING OF THE BRITISH SIMULIID GROUP AND THE SIMULIIDAE WORKSHOP OF THE 4TH. INTERNATIONAL CONGRESS OF DIPTEROLOGY

The 21st. Meeting was unusual in that it was held in conjunction with the Simuliidae Workshop in the 4th. International Congress of Dipterology Keble College, Oxford, on Wednesday 9 September 1998, because this would enable overseas members attending the Congress to take part, and avoid conflict between the two meetings. We are most grateful to Adrian Pont and the organizers of the Congress for allowing us to join them.

The pre-meeting supper got off to a bad start. The management of the Chang Mai Restaurant had initially told us that there would be no need to book, but when we checked two days before they said they were filling up, so I booked for 20 as 17 had indicated they would be attending. In the event, 30 members and friends turned up, and we only just squeezed everyone in. However, the food was good, and conversation spirited, so I think it was enjoyed by all.

The formal part of the meeting opened at 9.30. am under the chairmanship of Tony Shelley, when 4 papers were presented to an audience of about 45. There then followed a short informal discussion of the BSG's business before the lunch interval. After lunch members gathered around the poster displays for informal discussions on matters raised by the posters and other subjects.

The informal discussions were opened by John Davies who for the benefit of visitors gave a brief outline of the objectives and activities of the Group and details of the biannual *Bulletin* and the electronic mail list *Simuliidae*. This gave rise to a suggestion that we should look into the possibility of linking *Simuliidae* with the neotropical mail-list *SimNeo-L* so that messages sent to one list would be automatically sent to the other. A request was made by Dr. Coscarón that he and his colleagues would appreciate the compilation of a reading list of papers relating to the agricultural and economic consequences of blackfly biting, *e.g*. loss of milk yield in cattle. Perhaps these could be posted on the *Simuliidae* list. These possibilities will be discussed with the Hon. Secretary who is the *Simuliidae* list owner.

In the afternoon, Roger Crosskey announced that Neal Evenhuis of Bishop's Museum, Hawaii was compiling a World Catalogue of Diptera Systematists as an extension of the Afrotropical List published in Roger's *Catalogue of the Diptera of the Afrotropical Region* (1980). This was being published on the WWW, and everyone was invited to peruse it and offer amendments or additions. The catalogue can be found at: http://www.bishop.hawaii.org/bishop/ento/dipterists.

PRESENTATION ABSTRACTS

Effect of human activity and environmental change on vector/host/parasite distribution and epidemiology of onchocerciasis

R.J.Post: *Natural History Museum, Cromwell Rd., London, SW7 5BD, UK.*

In this paper we examine the possible role of parasite migration in changing the epidemiology of onchocerciasis. Parasite migration can occur with the human host or Simuliid vector. The role of human activity (such as deforestation) in the migrations is examined using examples from Brazil, Malawi, Sierra Leone and Ghana. (The Simuliidologists listed for each study are those primarily responsible for the work reported, but are not necessarily responsible for the opinions and interpretations expressed in this abstract).

Brazil
(M. Maia Hertzog, A.J.Shelley, A.PA.Luna Dias, & R.J.Post)

A new focus of onchocerciasis was recently confirmed (in 1997) at Minaçu, in central Brazil where endemic transmission was found to be taking place to residents who have never left the area. Of the 10 species of *Simulium* in the area, 4 are anthropophilic and presumed capable of transmitting *O. volvulus,* they are; *minisculum, guianense, pseudoincrustatum* and *nigrimanum.* This focus is believed to have been caused by an immigration of gold miners, who had been previously infected when working in the onchocerciasis focus of the Brazil/Venezuelan border area. At Minaçu there just happened to be a population of vectors capable of transmitting the disease.

Malawi
(C.G.Vajime, P.J.Tambala, J.B.Davies, A.Krüger & R.J.Post)

The Thyolo focus of Malawi is the southernmost focus of onchocerciasis in Africa. The disease has been known there since 1939, but about 10 years ago it was noticed that biting by *Simulium* was spreading and increasing, and this has been associated with an increase in deforestation, which is itself a result of an increase in human population from 18,000 in 1900 to a present ½ million. The area is the type locality of *S. woodi* which breeds on crabs in small forested streams, and which was common in 1950's but now comprises less than 1% of biting flies, the rest being 5 or 6 cytospecies of the *S. damnosum* complex which prefer open country. The increase in the latter species has been followed by an increase in the spread and intensity of onchocerciasis.

Sierra Leone
(M.Thomson, J.B.Davies & R.J.Post)

The original extent of true forest is controversial due to long term degradation. At present forest exists mostly only in forest reserves. Most of the forest was destroyed long before the first detailed *Simulium* surveys of 1980 and 1981. These showed the expected distribution of *S. damnosum* cytospecies, with the "forest" forms found mainly in the forest and the "savanna" forms which carry the severe blinding form of onchocerciasis in the savanna. Later studies described a new cytospecies, *S. leonense*, which became associated with blinding onchocerciasis in central areas.

However, surveys by OCP in 1988 reported that savanna flies were widespread throughout the wooded southern part of the country. To try to explain this apparent contradiction pre-1988 records were searched by Madeline. She found 1272 identifications from wooded areas made between 1983 and 1987 at the end of the dry and during the wet seasons, amongst which only 1% were savanna flies.

Therefore, in 1988 something (probably not deforestation) induced savanna flies to suddenly invade the south of the country and the area previously occupied by *S. leonense*. Unfortunately, due to the prolonged civil unrest in Sierra Leone, it has not been possible to carry out any follow-up studies.

Ghana
(M.Wilson, R.A.Cheke, M.Osei, & R.J.Post)

Southern Ghana west of the Volta Lake is an area of moist deciduous forest lying between montaine forest to the north and tropical rain forest to the south. The rivers flow from north to south across these zones. The objective was to see if there was, **a)** a southward spread of "savanna" cytospecies of *S. damnosum,* and, **b)** deforestation as shown by remote sensing data. The latter data shows first of all that the original forest reserves as established in the first half of the century to conserve water catchment still largely exist, but have been nibbled away around the periphery by human encroachment. However, it is not yet clear whether farming intensity has increased outside the tropical forest areas. The overall impression given by the NDVI (a measure of vegetation cover) is that this has been little changed over the period 1984-1991, except for a small drop in 1991.

An analysis of savanna/forest ratios in 21,294 cytospecies identifications over the last 25 years show that forest species are present all the year round, but savanna species are concentrated into the period between the end of the dry season and beginning of the rains. So far, data analysis has shown a small but consistent increase in the population of savanna cytospecies, taking all sites together. However, this has not been demonstrated for individual rivers and the data show strong seasonal and geographical bias, to counteract which statistical approaches are being explored.

Cladistic analysis of Neotropical/Afrotropical *Simulium* Latreille subgenera (Simuliidae) - a preliminary scenario

D.R. Miranda-Esquivel: *Escuela de Biología, UIS, AA678, Bucaramanga, Santander, Colombia. Email:dmiranda@uis.edu.co*
S. Coscarón: *Museo de la Plata, Paseo del Bosque, s/n, 1900 La Plata, Argentina.*

The Neotropical/Afrotropical *Simulium* Latreille fauna is one of the richest in the world, comprising 25 out of 42 subgeneric taxa and two species-groups of subgeneric rank. Traditionally both faunas have been seen as two separated groups and the Neotropical Region alone has been considered a monophyletic taxon.

A preliminary cladistic analysis of Neotropical/Afrotropical *Simulium* subgenera based on morphological characters from the larva, pupa and adults shows that the Neotropical subgenera are not a monophyletic taxon. *Thyrsopelma* Enderlein + *Trichodagmia* Enderlein are more closely related to *Xenosimulium* Crosskey + *Freemanellum* Crosskey + *Anasolen* Enderlein than to any other subgenera. The other Neotropical subgenera form a clade with those taxa and the other Afrotropical subgenera another separated subclade. The position of the *blancasi* species group is controversial since the present analysis shows that it may be the sister-group of all Neotropical + Afrotropical taxa or the sister-group of some Neotropical clades.

Taxonomic status of *Simulium* Latreille subgenus *Simulium* in the Neotropical Region (Simuliidae)

S. Coscarón: *Fac. Ciencias Naturales y Museo, Paseo del Bosque s/n, 1900 La Plata, Bs. As. Argentina*.
S. Ibañez-Bernal: *INDRE. Prol. Carpio 470, 11340 D. F. Mexico*.
C. L. Coscarón-Arias: *Facultad de Ciencias Agrarias, Universidad del Comahue, 8324 Cinco Saltos, R. Nn. Argentina.*

The subgenus *Simulium* (*Simulium*) Latreille s.str. is a very well represented taxon in the Neotropical realm with 25 recognised species distributed from SW of the USA and northern Mexico to the north of Chile. The revision led to the discovery of two new species from Mexico and the synonymy of another two species. A phylogenetic approach based on analysis of 25 Neotropical species plus the type species of the 20 non-Neotropical species groups using 29 morphological characters gave a strict consensus tree that grouped the New World species independently of the remainder.

Fennoscandian black flies (Simuliidae); a progress report

J.E. Raastad: *University of Oslo, Zoological Museum, Sarsgt.1, N-0562 Oslo, Norway.*

The black fly fauna of Fennoscandia and Denmark comprises about 70 assumed valid nominal species. There are six *Prosimulium* Roubaud spp. (s.g. *Helodon* Enderlein and *Prosimulium*), eight or more species of *Cnephia* Enderlein (*Metacnephia* Crosskey, *Cnephia*, and *Stegopterna* Enderlein), 30 species of *Eusimulium* Roubaud (*Hellichiella* Rivosecchi & Cardinali, *Nevermannia* Enderlein, *Eusimulium*, and *Schoenbaueria* Enderlein), and 25 or more species of *Simulium* Latreille (*Wilhelmia* Enderlein, *Parabyssodon* Rubzov, *Boophthora* Enderlein, *Gnus* Rubzov, *Odagmia* Enderlein, and *Simulium*).

POSTER ABSTRACTS

The autumn aspect of black flies (Simuliidae) of the spring areas in the highest mountains of Spain and Andorra

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In October 1997, detailed collections of black fly preimaginal stages were made in the Esera River valley (Cobierno de Aragon), which originates beneath the highest mountain of the Pyrenees - Pico de Anetto, and in the alpine stream originating beneath the peak of Pico de Veletta in the Sierra Nevada mountains. In the upper part of the Esera River (1,900 m a.s.l.), samples were taken from four localities. The Esera River has the character of an alpine stream in this part (it is 0.5 - 2m wide and the water temperature is 7°C). The water in the stream very often disappears in moraine deposits and appears subsequently as springs in several places. In addition, a sample from the right-side tributary was taken. This stream runs out from the alpine mountain lake at an altitude of about 2,500m and it descends steeply. The sample from the Esera River contained the following species: *Simulium cryophilum* Rubzov, *S. oligotuberculatum* Knoz, *S. vernum* Macquart, *S. monticola* Friederichs, *S. variegatum* Meigen, *S. ornatum* Meigen, *S. trifasciatum* Curtis. In the alpine stream under the peak of Pico de Veletta the following species were found: *S. monticola* and *S. carthusiense* Grenier & Dorier. In the mountain river Rio Gran Valira under the capital of Andorra (Andorra la Vella) two species were obtained: *S. bezzii* Corti, *S. ornatum* Meigen. Detailed data on the ecology and distribution of each species were presented.

The morphometric variability of pupal gills and respiratory surface area in the *Simulium ornatum* Meigen species-group (Simuliidae)

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The number, form and branching of pupal gills are widely used in the taxonomy and identification of black flies. In the *Simulium ornatum* Meigen species-group their number is constantly eight, paired on four basal trunks on each side of the body. The length and width of basal trunks, their ratio and the sum of the trunks' length were used by some authors in the differentiation of taxa at species and infraspecies level in this group (e.g. *S. apenninicum* Rivosecchi, *S. baracorne* Smart, *S. flaveolum* Rubzov, *S. frigidum* Rubzov, *S. hibernale* Rubzov, *S. pratorum* Friederichs, *S. rotundatum* Rubzov, forms of *S. ornatum* and *S. caucasicum* Rubzov, many of them synonomised by later authors). The morphometry of pupal gills was analysed in *S. ornatum* and *S. trifasciatum* Curtis from the West Carpathians and Pannonian lowlands, to show the overall variability, individual variability and variability between different generations of the same species. While the variation of the length of first, second and third basal trunk between generations is not significant, the length of the second basal trunk, the width of all basal trunks and the length:width ratio of all trunks vary significantly.

Significant differences were also found in the sum of trunk lengths. All characters under study show a high individual variability (coefficient of variation over 10%); the width of all basal trunks, and the length:width ratio of second and third basal trunks are ecologically very variable with 20-80% of variation explained as due to differences between generations and/or local populations.
The length of basal trunks and the length:width ratio increase with increasing temperature during the larval development, while the width of basal trunks decreases with increasing temperature. The highest variability was found in measurements of the second basal trunk which were most frequently used in differentiation of taxa.

The respiratory surface area varies between 6.63 mm^2 (spring generation) and 4.25 and 4.52 (in the summer and autumn generations respectively). The differences are significant between the spring generation on the one hand, and summer and autumn generations on the other hand ($F=16.809$, $P<0.001$).

Spatial and temporal variations in biting activity of the *Simulium* Latreille vectors in the Amazonian onchocerciasis focus, southern Venezuela

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Previous studies of onchocerciasis in southern Venezuela, which affects the Yanomami people, have shown that it is located in the highland areas where *S. guianense* Wise is the main vector. More recently, this range was extended to the lowland areas and the extent to which other blackfly species may be involved in *Onchocerca volvulus* transmission is presently being evaluated. Since vector density partially determines the transmission, the biting activity of the anthropophilic blackflies at 18 Yanomami villages found along two river systems of the Upper Orinoco river basin was evaluated. Gradients of altitude and onchocerciasis prevalence (low altitude - low prevalence to high altitude - high prevalence) were covered. Blackfly catches were made on local volunteers during 3 - 5 days, over three years (dry: DS, and rainy: RS, seasons). Simuliid species richness increased with altitude and during the RS. *S. oyapockense* Floch & Abonnenc predominated at low altitude, and their monthly parous females biting rate (MPBR) and parity rate (PR) reached a peak in the RS. *S. incrustatum* Lutz dominated at moderate altitude, showing MPBR and PR values higher during the RS. *S.guianense* occurred at highest altitude, mainly during the RS. *S.exiguum* Roubaud and *S. bipunctatum* Malloch bit in small numbers at high altitude, mainly during the RS.

These results suggest that the pattern of onchocerciasis endemicity in the area coincides with the differential distribution of three main blackfly species showing different biting activities and vectorial efficiencies. *S. oyapockense* (low vector competence) is the main vector in the hypo- and mesoendemic lowland areas of the Amazonian focus, mainly because of its high parous biting activity. *S. guianense* (highly efficient vector) is the main vector in the hyperendemic highland areas despite its low biting activity. The vectorial role of *S. incrustatum* remains to be elucidated.

Parasite and vector survival in the blackflies (Simuliidae) of the Amazonian onchocerciasis focus of southern Venezuela in relation to the implementation of ivermectin control programmes

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Density-dependent mechanisms are assumed to regulate *Onchocerca volvulus* populations. Within *Simulium* Latreille, parasite survival and development, as well as parasite-induced mortality play an important role. Among the former, the patterns of limitation and initial facilitation have been associated, respectively, with vectors lacking or possessing well-developed cibarial armatures.

Of the anthropophilic simuliids present in the Amazonian onchocerciasis focus of Brazil-Venezuela, only *S. guianense* Wise s.l. (an unarmed species) has been studied in detail. This work presents, for *S. oyapockense* Floch & Abonnenc s.l. (with armed fore-gut), the relationship between parasite intake, parasite damage inflicted by the armature, and vector survival before and after treatment of onchocerciasis carriers with the microfilaricidal drug ivermectin (IVM). Pre-IVM microfilarial (mf) intakes ranged from 3.9 to 70.9 mf/fly whereas post-IVM average intakes after 48 h, 96 h, 4 months, and 6 months, ranged from 0.0 to 3.4 mf/fly. The proportion of undamaged mf in the blood-meal varied between 0.0 and 0.5, exhibiting a nonlinear relationship with total ingested: for low intakes most mf were scathed by the cibarium, whilst for higher intakes the proportion of surviving parasites increased and levelled off. There was, however, more heterogeneity for lower intakes. A density-dependent effect of the armature upon ingested mf is a prerequisite for this mechanism to be responsible for the initial non-linearity characteristic of facilitation in armed vectors. In turn, this implies that mf depression through IVM treatment is likely to have a greater impact in locations where these flies prevail (*e.g*. lowlands of the Amazonian focus). Although overall survivorship of wild *S. oyapockense* in captivity was low (perhaps due to its high parous rate), there was a positive relationship between early mortality (within 24 h post-engorgement) and mf uptake. Discussion focuses on the theoretical implications for parasite transmission dynamics and practical criteria for IVM distribution in southern Venezuela.

Microalgae as food of *Simulium perflavum* Roubaud (Simuliidae) larvae in streams of Central Amazonia, Brazil

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The stomach contents of *Simulium perflavum* Roubaud larvae were analyzed to identify the phycoflora present in the feeding process of this species, and to compare these with the species present in the plankton and periphyton. The collections were made in five streams in Central Amazonia (Manaus and Presidente Figueiredo counties), in September-October 1996 (dry season) and February-March 1997 (rainy season). We dissected 1,400 larvae to analyze the stomach contents using two different methods: fresh and after oxidation. In the stomach contents we identified 43 species of Bacillariophyta, 38 of Chlorophyta, two of Cyanophyta, one of Euglenophyta and one of Pyrrhophyta. In each stream, qualitative and quantitative samples of plankton and periphyton were collected. These were mounted between slides and cover glass and the specimens were counted in a Sedgwick-Rafter chamber. In the qualitative samples of the plankton we identified 29 species of Bacillariophyta, 53 of Chlorophyta, seven of Cyanophyta, two of Euglenophyta, two of Rhodophyta and one of Pyrrhophyta.

In the samples of the periphyton we identified 21 species of Bacillariophyta, 32 of Chlorophyta and one of Rhodophyta. One species of Rotifera was present in all the samples. Cluster analysis, based on the species composition of the organisms present in the stomach contents, grouped the streams into two major groups. Correlation, based on presence/absence of species of microalgae in the stomach contents, plankton and periphyton indicated significant association ($p<0.05$) between stomach contents and plankton and between plankton and periphyton (significance test based on z test); the Sorensen similarity coefficient and Cluster analysis agreed with these results.

Black fly (Simuliidae) species distribution, co-occurrence and richness among streams in Central Amazonia, Brazil

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Distribution, co-occurrence and species richness of the black fly fauna collected in five counties in the state of Amazonas, Brazil are evaluated. Previously, six species were known from streams of this region; five species are added to this list, bringing the total to 11 species. We sampled 82 sites between March and August 1996; at each sampled site, 11 parameters were measured: temperature, water velocity, depth, width, discharge, stream bed particle size, riparian vegetation, canopy cover, pH, presence of impoundment, vegetation type (forest, campina, agriculture). Principal component analysis (PCA) and stepwise logistic regression were used to determine significant associations between stream site conditions and the larval distribution of each species.

Based on stream site characters, the occurrence (presence/absence) of larvae of the different species of black fly in the area were highly predictable (76-90%), indicating that the distributions of black fly larvae are not random. The predictive value of stream size and presence of impoundments agrees with the results of similar work in the Nearctic Region, suggesting that the general responses of black fly distribution to environmental parameters might be universal in nature. Cluster Analysis (UPGMA, Jaccard distance) based on species occurrence indicated three groups that reflect the physical characteristics of the habitats of the species; presence of impoundments, riparian vegetation and landscape type were especially important. Co-occurrences were assessed by Spearman correlation; species grouped in the Cluster Analysis showed positive correlations, while species in different groups were negatively correlated. Species richness was negatively associated with presence of impoundments and was lower than the values reported for the temperate zone, with a maximum of four species per stream; 36% of the streams had only two species, indicating that the black fly fauna in the studied area is less rich than several places in the temperate zone.

Studies on bioacoustic behaviour in blackflies (Simuliidae)

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In blackflies, swarming behaviour typically occurs before mating. So far, only optical and chemical signals have been discussed in species identification and recognition between males and females. Blackflies of both sexes can also produce sounds, by vibrating either their wings or their abdomen. Wing and abdomen vibration is a very common method of sound production in these insects. The sounds are characteristically of lower frequency in contrast to those produced by stridulation and percussion.

The songs of males and females of different genera are described, together with methods for observing behaviour in the presence of conspecific songs and songs of other species. These vibrations fall into different categories: flight songs, positive responses to other songs, and body reactions. Bioacoustic patterns have characteristics that are correlated to male and female size. Song parameters, such as inter-pulse interval, burst length, number of pulses per burst and intra-pulse frequency, were measured and differences are given.

Onchocerciasis in the Amazonian focus of southern Venezuela: altitude and blackfly (Simuliidae) composition as predictors of endemicity in the selection of communities for ivermectin control programmes

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The pre-ivermectin prevalence and intensity of infection due to *Onchocerca volvulus* as well as the species composition and abundance of *Simulium* Latreille vectors were investigated in 22 Yanomami communities situated along two altitudinal transects in the southern Venezuelan onchocerciasis focus. These transects corresponded to the Ocamo-Putaco and Orinoco-Orinoquito river systems, covering a range of elevation between 50 and 1,050 m above sea level (asl). A total of 836 people underwent parasitological examination in this survey and an additional 196 patients from a previous study in Parima-B were included in the analysis. A total of 92,659 man-biting blackflies were collected and identified to morphospecies. *S. oyapockense* Floch & Abonnenc s.l. was the predominant simuliid up to 150 m asl, whereas *S. guianense* Wise s.l. and *S. incrustatum* Lutz s.l. prevailed above 150 m. Communities located below 150 m were found to range from hypo- to mesoendemic; all villages above 150 m proved to be hyperendemic (> 60% microfilarial prevalence). Age above 10-14 yr, altitude of the village and biting rate of *S. guianense* s.l. up to 200 m asl were found to be statistically significant independent predictors of infection by multivariate logistic regression using a spline model. There were no differences in infection status according to sex. Above 200 m, microfilarial rate and density remained approximately constant, prevalence reaching an average of 79% regardless of blackfly abundance. Altitude and blackfly composition might be adopted as useful indicators aiding selection of most affected communities for the implementation of ivermectin-based onchocerciasis control programmes in the Amazonian focus.

NOTES, VIEWS & CORRESPONDENCE

The meanings of the scientific epithets of British blackflies

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Recognizing the classical or other origins of the scientific names of organisms can help to make them more easily remembered. Here is a list of the specific epithets of blackflies present in our fauna and what they mean, with valid epithets alphabetical in the genus and their synonyms indented beneath them. The meanings of the 50 epithets fall into five categories: 30 morphological (related to structure possessed or compared, colour or pattern); 7 geographical (related to original locality); 4 environmental (related to habitat or season); 3 behavioural (related to host); 6 personal (based on names of people). Most derive from Latin (L.) but a few from Greek (Gr.) or latinized Greek. The epithets in the personal category are nouns in the genitive case and have the '-*i* ' suffix appropriate to a name based on one male person. There are no epithets in the British fauna applying to the name of a woman (when '-*ae*' suffix is requisite) or to persons in the plural (when '-*arum*' or '-*orum*' suffix is requisite depending on gender combination). [Examples are *sommermanae*, named for Kathryn Sommerman, and *woodorum* named for Monty and Grace Wood (both in *Prosimulium*).]

Simulium and *Prosimulium* are neuter generic names, therefore adjectival epithets combined with them must take neuter suffixes (-*e*, -*um*). Where relevant the adjectival -*us* (masculine) and -*a* (feminine) endings are shown that apply when the species is placed (as still occasionally in European literature) in a non-neuter genus: e.g. *Boophthora erythrocephala* and *Odagmia ornata* (feminine) and *Gnus rostratus* (masculine). The geographical suffix denoting place is -*ensis* in the masculine and the feminine but -*ense* in the neuter, therefore -*ense* is required for *Simulium* (and for any generic name suffixed -*simulium*); names in the list with an -*ense* suffix denote the provenance of the original specimens.

Metacnephia

amphora Ladle & Bass - wine-vase or pitcher (L. *amphora*, pitcher, wine jar). Refers to the amphora-like outline shape of the larval postgenal cleft.

Prosimulium

hirtipes Fries - haired legs (L. *hirtus*, hairy or shaggy + L. *pes*, foot). Refers to the hairy legs in *Prosimulium*.
latimucro Enderlein - broad point (L. *latus*, broad + L. *mucro*, thorn, point). Refers to the shape in the female of the basal tooth of the claws, noted by Enderlein with the statement "Klaue halb so lang wie das letzte Tarsenglied, fast die Basalhälfte stark verbreitert".
  inflatum Davies - bulbous (L. *inflatus*, -*a*, -*um*, puffed up, swollen). Refers to the female clypeus, more bulbous in profile than in the *P. hirtipes* female.
tomosvaryi Enderlein - named for Dr Tömösvary (Hungary).
  arvernense Grenier - of the Auvergne (L. -*ense*, suffix denoting place). Refers to the geographical provenance of the original specimens (Clermont-Ferrand, France).

Simulium

angustipes Edwards - slender-legged (L. *angustus*, narrow + L. *pes*, foot). Refers to the undilated fore tarsi.
angustitarse Lundström - slender-footed (L. *angustus*, narrow + Gr. *tarsos* latinized to *tarsus*, foot from heel to toes). Refers to the undilated tarsi of both sexes.

argyreatum Meigen - silvery (Gr. *argyreos*, of silver). Refers to the silvery pattern of the female scutum.

armoricanum Doby & David - of Armorica (L. *Armoricae*, *-arum*, Roman name for the northwestern part of Gaul equivalent now to Brittany peninsula and part of Normandy). Refers to the original specimens being from Brittany.

aureum Fries - golden (L. *aurum*, gold). Refers to the golden appearance of the fly, especially the scutum.

costatum Friederichs - ribbed (L. *costa*, rib, *costatum*, *-a*, *-um*, ribbed). Refers to strong wing venation in this large species, emphasised by Friederichs in his species key with the words "Flügelgeäder etwas kräftiger als gewöhnlich" (= wing-veins rather stronger than usual).

cryophilum Rubtsov - cold-loving (Gr. *kryos*, frost + Gr. *philos*, friend or affection). Presumably refers generally to the Russian original provenance since temperatures of the aquatic habitat are not notably low.

brevicaulis Dorier & Grenier (legitimized Davies) - short stalk (L. *brevis*, short + L. *caulis*, stalk, stem). Refers to the (two) short common stalks of the four-filamented pupal gill.

dunfellense Davies - of Dun Fell (L. *-ense*, suffix denoting place). Refers to Great Dun Fell in the northern Pennine Mountains of Cumbria, source of the Knock Ore Gill type locality stream.

equinum Linnaeus - of horses (L. *equus*, horse, *equinus*, *-a*, *-um*, of horses). Refers to the equine host of the female fly.

brunettii Enderlein - named for Enrico Adelelmo Brunetti (1862-1927), bandmaster, amateur dipterist and collector of the type specimen.

zetlandense Davies - of Shetland (L. *-ense*, suffix denoting place). Refers to the Shetland Islands type locality.

erythrocephalum De Geer - red-headed (Gr. *erythros*, red + Gr. *kephale*, head, Latinized *cephalus*, *-a*, *um*). Refers to red appearance of the male head caused by the red-coloured eyes. [Species described in 1776 from a male swarm.]

sericatum Meigen - silky (L. *sericatus*, *-a*, *-um*, clothed in silk). The reason for the name is obscure. Meigen described the species from a male fly that had already lost its abdomen. The name perhaps alludes in some way to the bright silvery parts of the scutal pattern.

intermedium Roubaud - intermediate (L. *intermedius*, *-a*, *-um*, that which is between). Refers to the small claw tooth in the female, intermediate between the toothless condition and the heavily toothed condition of various species. Reason clear from Roubaud's statement in original description "les griffes de cette intéressante espèce constituent un terme de passage entre les griffes simples et les griffes à talon basilaire".

nitidifrons Edwards - shiny frons (L. *nitidus*, *-a*, *-um*, shining + L. *frons*, forehead). Refers to the shining black frons of the female, which contrasts with the dull grey frons in *S. ornatum*. [*S. nitidifrons* was originally described as a variety of *ornatum*.]

juxtacrenobium Bass & Brockhouse - near *crenobium* (L. *juxta*, near + *crenobium* species epithet). Refers to close kinship with the Central European species *S. crenobium* (its name derived from Gr. *krene*, spring).

latipes Meigen - wide foot (L. *latus*, broad + L. *pes*, foot). Refers to the enlarged hind basitarsi of the male.

subexcisum Edwards - feebly excavated (L. *sub*, in sense of somewhat or less than + L. *excidere*, to cut out, *excisum*, *-a*, *-um*, excavated). Refers to the very shallow pedisulcus of the hind leg in both sexes of this species, a contrast to the deep pediculcus of most *Simulium* species.

yerburyi Edwards - named for John William Yerbury (1847-1927), British army officer and amateur dipterist.

lineatum Meigen - striped (L. *linea*, thread or line, *lineatus*, *-a*, *-um*, of a line). Refers to the three narrow dark stripes that form a somewhat lyre-shaped pattern on the scutum of the female.

salopiense Edwards - of Salop (L. *-ense*, suffix denoting place). Refers to the type locality being in the English county of Shropshire (= Salop).

lundstromi Enderlein - named for Carl August Lundström (1844-1914), Finnish entomologist.

latigonium Rubtsov - wide ventral plate (L. *latus*, broad + Gr. *gonos*, that which produces seed). Refers to the wide ventral plate (adminiculum) of the male genitalia.

morsitans Edwards - biter (L. *morsus*, bite). Refers to the bloodsucking habit of the female.

naturale Davies - of nature (L. *naturalis*, *-e*, pertaining to or having the quality of nature). Refers to the type locality stream being in the Moor House National Nature Reserve in Cumbria.

noelleri Friederichs - named for the German parasitologist Dr W. Nöller (Hamburg).

subornatum Edwards - somewhat ornate (L. *sub*, in less than or somewhat sense + *ornatum* species epithet). Refers to the resemblance, because of an essentially similar *ornatum*-like scutal pattern, to *S. ornatum* (next).

ornatum Meigen - decorated or adorned (L. *ornare*, to adorn or furnish), *ornatum*, -*a*, -*um*, adorned). Refers to the conspicuous pattern of the scutum of the female.

posticatum Meigen - meaning uncertain (L. *post*, after, behind, *posticus*, -*a*, *um*, that is behind). The reason why Meigen chose this (apparently malformed) epithet is unclear. It evidently derives from *posticus* (to the back) and presumably was meant to indicate something about the abdomen of the original female specimen.

austeni Edwards - named for Ernest Edward Austen (1867-1938), Natural History Museum dipterist and collector of the holotype.

pseudequinum - false equinum (Gr. *pseudos*, fallacy + *equinum* species epithet). Refers to deceiving similarity between the species and *S. equinum* (above); adults of the two species are alike externally.

reptans Linnaeus - crawler (L. *reptare*, to creep or crawl). The reason for the name is not fully certain. Macquart (1826, *Insectes Diptères du Nord de la France*, p. 21-22) noted how the simuliid's fore tarsi are constantly patting when on a surface and presumed this to be the explanation for the name *reptans* ("C'est cette habitude qui a fait donner par Linnée le nom de *Culex reptans* à l'espèce la plus connue"). The habit applies when the fly is on a host and Linneaus knew his *reptans* to be a pest.

galeratum Edwards - capped (L. *galea*, helmet or cap, *galeratus*, -*a*, -*um*, capped). Refers to the pigmentation pattern of the larval head, as stated in the original description "The name has reference to the cap-like black patch on the head of the larva".

rostratum Lundström - having a beak (L. *rostratus*, -*a*, -*um*, beaked). Refers to the beak-like ventrally directed process of the ventral plate in the male genitalia (the shape of which provided the diagnostic character in the description).

sublacustre Davies - (L. *sub*, in sense of from or beneath + L. *lacus*, lake, *lacustrinus*, *lacustris*,-*e*, of lakes. Refers to the lake outlet habitat of the aquatic stages.

trifasciatum Curtis - three-banded (L. *tres*, three + L. *fascia*, band, *fasciatus*, -*a*, -*um*, banded). The reason for the name is obscure. The one original specimen (holotype) is a female of the *ornatum*-group and the name perhaps refers to the black tergites of the basal half of the female abdomen and the manner in which they stand out against the general grey background. [Note: the species was described in 1839 and is the only one described from Britain before Edwards's work of 1915. I have seen the holotype: it is in the National Museum of Victoria, Melbourne.]

spinosum Doby & Deblock - thorny (L. *spina*, thorn, *spinosus*, -*a*, -*um*, thorny). Refers to the thorny tubercles of the pupal thorax.

tuberosum Lundström - protuberant (L. *tuber*, a swelling or protuberance, *tuberosus*, -*a*, -*um*, lumpy). Refers to the conspicuous tubercle present on the inner surface of the style in the male genitalia.

urbanum Davies - urban (L. *urbs*, town, city, *urbanus*, -*a*, -*um*, of the city). Refers to the original provenance being near London. The type locality is on the northern edge of Greater London but is a tiny rill on the undisturbed heathland of Stanmore Common and not actually urban.

variegatum Meigen - parti-coloured (L. *variegatus*, -*a*, -*um*, of varied sorts, particularly in coloration). Refers to the multicoloured yellow and brownish black legs of the female.

velutinum Santos Abreu - velvety (New Latin, *velutinus*, -*a*, -*um*, derivative from classical *villus*, a tuft). Refers to the velvety appearance of the male scutum.

latinum Rubtsov - of Rome area of Italy (L. *Latinus*, -*a*, -*um*, classical *Latium* district of central Italy). Refers to type locality near Rome.

vernum Macquart - of the spring (vernal) season (L. *vernus*, -*a*, -*um*, of springtime). Refers to the month of May when the original adult fly was captured. Macquart dubbed the species with the French vernacular 'Simulie printanière' and gave the date as 'Au commencement de Mai'.

Acknowledgement: I was not sure why Lewis Davies had chosen the names *inflatum* and *naturale* and thank him for putting me wise on this. (He commented in reply that the Moor House Nature Reserve and its buildings are now in ruins.)

TRAVELLERS' TALES

The *NAMU* of New Zealand

Marshall Laird writes to say that since "retiring" back to New Zealand in 1983, he has been assembling data for a publication the genesis of which was his *Bibliography of the Natural History of Newfoundland and Labrador* (see *Bulletin* No. 11). It is to appear as a CD-rom entitled *New Zealand's Natural History - Synopsis and Recommended Reading** around the dawn of the third millennium. The following accounts and comments are taken from the TOPIC concerning blackflies.

In early April 1773, George Forster (1777) of Captain James Cook's second voyage to NZ reported that when HMS *Resolution* was in Dusky Sound (Lat. 45° 47' S, Long. 166° 26' E.) "a sort of little crane-flies... became remarkably troublesome during the bad weather. They were numerous in the skirts of the woods, not half so large as gnats or musketoes, and our sailors called them sandflies." This understandable association of the pests with the sandy shore of the landing place was probably, as Crosby (1973) wrote, "the earliest authentic reference to Simuliidae as 'sandflies'", the name still in common usage in NZ (and Australia too) for blackflies (Laird 1981)[1]. The earliest reference that I've found to the use of the latter name in this country for what could only have been a simuliid is that of MacKenzie (1893). Writing of his early November 1853 trip along the Waipa River not far from Ngaruawahia (37 ° 40' S, 175° 09' E) in the North Island's King Country, he complained that "The mosquitoes are very annoying here, as also a kind of small black fly which bites as badly as a flea."

While praising the wealth of fish, birds and timber at Dusky Sound in 1791, Captain George Vancouver (1798) declared that "... no sooner did we get our feet on shore than we were covered with these flys, and their sting is as painful as that of a Musquitto, and made us scratch as if we had got the itch."

Almost a century later Andreas Reischek spent April to October of 1884 searching for birds in Fiordland, SW South Island, notably at Dusky Sound and Chalky Inlet (46° 04' S, 166° 30' E). By then the special abundance of simuliids in that region and northward along the South Island's west coast had become proverbial thanks to the rapids of so many rivers and streams discharging from the mountains of NZ's wettest area. Reischek's (1930) reminiscences spoke of his being "... so pestered with sand-flies that I was frequently compelled to run away from them and bathe my eyes. They were sometimes so bad as to kill penguins on the beach, while three young ground-parrots (the now critically endangered Kakapo *...ML*) I captured were so badly attacked that a few hours after capture ... I found one dead and the others covered with these insects." More recently Fallis *et al.* (1976) described the haematozoan, *Leucocytozoon tawaki*, from the Fiordland Crested Penguin, identifying early stages of its sporogonic cycle from the midgut of *Austrosimulium* spp.; while Allison *et al.* (1978) elucidated the complete sporogonic cycle and the parasite's transmission to chicks of the same penguin by *A. ungulatum,* which their springtime (September to October) data established as the primary vector of *L. tawaki*. The latter authors observed "heavy mortality among *A. ungulatum* that had fed on a heavily infected penguin chick, as compared to flies that had fed on a lightly infected bird...."

Back to earlier days at Chalky Inlet, from which McNab (1913) refers to a mid-December 1836 opinion from the papers of John Balleny of a visiting schooner. This man wrote that "I do not think either natives or settlers could live any great time in this part from the myriads of poisonous flies in the summer", and that they "fasten on us with such fury and fly into the nose mouth and ears; the itching they leave is positively enough to drive one mad."

As we all know, there was little that could be done to alleviate the biting. At Sealer's Bay (46° 46' S, 167° 39' E), Codfish Island, Poppelwell (1912) had found at Easter of the previous year that the most abundant adventitious plants were Mint and Fennel planted for their flavouring virtues by sealers of the early 19th century. Wilson (1959), noted that *Mentha spicata* had long been believed to discourage simuliids. When at Sealer's Bay in 1935 he and another ornithologist camped in a large bed of *M. spicata* near the remains of a trying-out station which had been disused for a century or so, Wilson remarking that "though there were a good number of sandflies on the island, we did not suffer from them on our bed of mint."

Long before the arrival of Europeans, Maori had countered the attacks of *Namu* (sandflies) by eating outdoors under the shelter of smoke from a circle of fires (Brunner, 1848). In ancient times these occasioned bushfires and a more lasting solution to simuliid problems via habitat destruction, which continued apace after European settlement led to draconian forest clearance to open up land for farming. Little short of 80 years ago Thomson (1922) linked habitat destruction with the disappearance of both simuliids and mosquitoes from districts where they were formally very common.

A pre-European contribution to combatting *Namu* (a word which means mosquitoes throughout the tropical Polynesian atolls that lack streams offering blackfly larval habitat) was the use of the oily liquid from an indigenous myoporacean tree, the *Ngaio* (*Myoporum laetum*); which occurs from NZ's subtropical Dependency of the Kermadec Islands, nearly 1000 km NE of Aukland, to the vicinity of Dunedin. The oily liquid from this tree served as a repellent to blackflies and mosquitoes, crushed leaves or an infusion of the bark being rubbed into the skin (see Riley, 1997 for references). Perhaps *Ngaio* juices merit modern investigation as the basis of a commercially viable blackfly repellent?

As regards the natural enemies of NZ simuliids, any contribution any contribution to the destruction of their adults by insectivorous birds seems slight, even though it was said by Reischek (1930) that at lake Brunner (42° 37' S, 171° 27' E) on 28 December 1877 Fantails "were flitting about like butterflies and catching gnats and sandflies which were here in myriads. Whenever they caught anything they would snap their beaks together in a satisfied way." And turning to freshwater fish, while the Torrentfish presumably includes immature blackflies in its diet when feeding on larval insects among the rocks of rapids, it is one of NZ's rarest and least seen species. (McDowall, 1973, 1992)

From his vast reserves of Maori lore, Elsdon Best (1942) provides an appropriate note to conclude on. For tribal elders had assured him that although great numbers of *Namu* perish in their onslaught, "they'll gladly loose a thousand, or two thousand, disdaining death as long as Maori blood wells forth... a saying of the sand-fly folk is 'What matter if I perish, if only his blood flows'."

[* To be published by PolyMEDIA of Nelson New Zealand. To register an interest in acquiring a copy when issued send an e-mail to Richard Clark, at mail@polymedia.co.nz.]

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FORTHCOMING MEETINGS

Annual North American Black Fly Meeting

The 1999 meeting is planned for 7-8 February at the Flamingo Lodge, Everglades National Park, Florida. Contact Jim Sutcliffe or Peter Adler for details.

International black fly researchers' meeting in year 2000?

There has not been a major international meeting of black fly workers since the one held at the Pennsylvania State University in May of 1985.
I have recently surveyed some of the black fly researchers in North America about their interest in an INTERNATIONAL MEETING IN YEAR 2000 and the response was very favourable.

The proposed meeting site is the campus of Brock University in St. Catharines, Ontario, Canada for spring/summer year 2000. This would mean that accommodation (single or double rooms) would be available in University residences at prices well below those of hotels in the area. St. Catharines is in the heart of the wine-growing region of Ontario. It is approximately 1-1.5 hours from both the Toronto Airport (Canada) and the Buffalo Airport (USA).

Trips that could be arranged include visits to Niagara Falls (20 minutes away), Niagara Parks Butterfly Conservatory (15 minutes away), Winery Tours, Royal Ontario Museum (1.5 hours away), Algonquin Provincial Park
(with an overnight stay at the Wildlife Research Station there), etc.

I would like to know whether British simuliid workers would be interested or able to attend such a meeting. Are there any blocks of time in spring or summer 2000 that are already booked for scientific meetings and would preclude participation in the St. Catharines Black Fly Meetings?

Please let me know YOUR views so that I can proceed with the plans!

Fiona F. Hunter, Dept. of Biological Sciences, Brock University,
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MEMBERSHIP NOTICES

Change of Address

Jon Bass, River Laboratory, East Stoke, Wareham, Dorset, BH20 6BB
j.bass@ife.ac.uk
J.Whitworth, Research Programme on Aids in Uganda, c/o Uganda Virus Research Institute, P.O.Box 49, Entebbe, Uganda. *mrc@starcom.co.ug*

New Members

Gene Brown, 84 Lambeth Rd., Mt. Albert, Aukland 3, New Zealand.
Neusa Hamada, I.N.P.A., Caixa Postal 478**, CEP** 69011-970, Manaus AM, Brazil, *nhamada@inpa.gov.br*
Miranda Esquivel, Escuela de Biologia, UIS, AA 678, Bucaramanga, Santander, Colombia. *dmiranda@uis.edu.co*
Bjorn Malmquist, Dept. of Animal Ecology, University of Umea, S-90187 Umea, Sweden. *Bjorn.Malmquist@animecol.umu.se*

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BRITISH SIMULIID GROUP BULLETIN Number 13, June 1999

Contents Number 13, June 1999

FROM THE EDITOR

We have quite a varied selection in this issue. Accounts of two recent blackfly meetings, and announcements about another three forthcoming. There are reports of work being carried out in Italy, and the extension of man-biting *Simulium damnosum s.l.* into South Africa. The Travellers' Tales section carries a description of a South Seas "paradise", and there are details of two recent publications of general interest.

The flow of material continues, and I wish to thank all those who have contributed text or ideas for articles - please keep them coming in.

John Davies

MEETING ANNOUNCEMENTS

22nd ANNUAL MEETING

We are hoping to hold the 22nd Annual Meeting of the British Simuliid Group at Liverpool University sometime between the middle of October and the middle of November 1999. The date cannot be announced until the time-table of lecture theatre usage for the autumn term has been finalised and we can find a convenient vacant slot.

The 25th Nordic-Baltic Congress of Entomology VESTFOLD, NORWAY 28th June to 2nd July, Year 2000

The meeting is organized by the Norwegian Entomological Society and the University of Oslo (Zoological Museum) And will be held at Melsomvik School of Agriculture in beautiful surroundings between Tønsberg and Sandefjord.

Topics of the symposia:
Section 1. NORDIC-BALTIC ENTOMOLOGY

1. General entomology
2. Special sections and workshops (Lepidoptera, Coleoptera, Diptera, Hymenoptera, Aquatic insects,

etc.)

Section 2. NORDIC-BALTIC FAUNISTICS, COLLECTION MANAGEMENT AND USE OF DATABASES

Section 3. THREATENED INSECTS AND CONSERVATION STRATEGIES IN THE NORDIC-BALTIC COUNTRIES

At the opening of the congress there will be a plenary session with selected topics of entomology presented by invited speakers. Plenary sessions, symposia, poster presentations and excursions will be organised. The language of the Congress is English. Participants are invited to present their contribution as lectures/posters on the sections as suggested above. Each lecture should be 15 min (+ 5 min for discussion). The main sections will be held with as little overlapping as possible, while sections on special taxonomic groups may be run simultaneously. Besides insects, the Congress covers also other terrestrial arthropods.

Excursions to interesting places for the collector:

Tjøme (seashore meadows and dry meadows) –localities for rare Lepidoptera and Hymenoptera etc.
Larvik (old pine and deciduous forests) – Coleoptera localities
Drangedal (forest) – rare Coleoptera

For preliminary registration of participants for further information, please send your name and address by letter or by e-mail to:

Organising Committee of the XXV Nordic-Baltic Congress of Entomology c/o Zoological Museum, University of Oslo, Sarsgt. 1, N-0562 Oslo, Norway

E-mail address: **j.e.raastad@toyen.uio.no**
WEB SITE: http://www.toyen.uio.no/NBCE2000/

BLACK FLIES IN THE NEW MILLENNIUM

An International Meeting of Black Fly Workers will be held at Brock University, St. Catharines, Ontario, Canada from June 17-21, 2000.

The tentative schedule is as follows:

Sat. June 17
Arrival, Registration and Welcome Reception
Sun. June 18
Theme I: Systematics and Taxonomy of Black Flies
Theme II: Ecology and Behaviour of Immatures
Mon. June 19
Theme III: Ecology and Behaviour of Adults
Special: Student Papers and Poster Competition
BANQUET
Tues. June 20
Theme IV: Disease Transmission
Theme V: Biological Control
Wed. June 21
Departure Day
Optional (Overnight) Field Collecting Trip to Algonquin Provincial Park (sleeping bags required)

If you are interested in being a Symposium or Workshop leader, please contact Fiona F. Hunter.
To be put on an e-mail list for updates about this conference, please send your request to **hunterf@spartan.ac.brocku.ca**
Please note that a Web Site for Conference Information is currently under construction!

Fiona F. Hunter, Conference Organizer, Dept. of Biological Sciences, Brock University, St. Catharines, Ontario, CANADA L2S 3A1. Tel. 905-688-5550 ext. 3394 or 3388 Fax. 905-688-1855 e-mail: hunterf@spartan.ac.brocku.ca.

MEETING REPORTS

Report from a blackfly workshop 6-7 December 1998 in Sweden

Björn Malmqvist: *Department of Ecology and Environmental Science, Umeå University, SE-90187 Umea, Sweden*

Recent studies of blackfly ecology in northern Sweden have shown that these insects are highly significant members of the communities of streams and rivers in this region. Their importance is related to the large numbers in which they occur. In addition to the significant effect on transported material in the rivers, they can be expected to influence other processes in the system as well as human activities and those of domestic animals. With this background, sixteen invited participants met at the Umeå University field station at Kronlund to discuss future research possibilities. The meeting was funded by FRN (The Swedish Council for Planning and Coordination of Research) and the theme for the workshop was: 'Blackflies – ecologically important animals in North Sweden. Planning of a work program'.

In addition to myself, participants were from North America (Peter H. Adler, Jan Ciborowski, Richard W. Merritt), UK (Roger Wotton), Germany (Ellen Kiel), Iceland (Gïsli Mär Gïslason), Finland (Kalevi Kuusela, Timo Muotka) and Sweden (Jan Chirico, Åsa Eriksson, Tim Hipkiss, Micael Jonsson, Jean Lacoursière, Christian Otto, Yixin Zhang).

The first day, the participants reported from their own, current research. The presentations served to update and inform about their research directions and interests. In addition to oral presentations, an inspiring and professional-quality clip from a video film about predation on blackfly larvae was shown by Timo Muotka. Christian Otto presented North Sweden in terms of geography, climate and ecology. Among many interesting contributions, the elegant long-term (21 years) study by G'sli Mär Gïslason on blackflies in Iceland and the strong regulatory effects of these insects on their predators (salmon, birds) boosted an intense discussion. Rich Merritt advocated for the use of Bti to control blackflies, a technique which unusually enough seems to be safer the more studies on their side effects are carried out. Ellen Kiel, Roger Wotton and Jan Ciborowski all gave very stimulating talks on sophisticated aspects of larval activities such as the ageing of larval silk and its influence on subsequent colonisers, the food and faeces of the larvae, and the uptake of dissolved organic matter from the water. Peter Adler presented, among other things, an overview of his work on the North American blackfly fauna illustrated with beautiful drawings of blackflies. Jean Lacoursi re gave a timely account on the blackflies' capacity to detect UV-B light and avoidance behaviour (dispersal, drift) in response to this. Timo Muotka showed that blackfly larvae might be more important prey to invertebrate predators than is usually believed, and Kalevi Kuusela discussed fluctuating asymmetry in blackfly female genitalia. Jan Chirico reviewed the veterinarian importance, as far as it is known, of blackfly biting in Sweden. An information-saturated talk was given by Yixin Zhang, who successfully defended his PhD thesis only two weeks after the meeting. Three other PhD students, Åsa Eriksson, Tim Hipkiss and Micael Jonsson, presented interesting information on blackfly distributions in lake outlet streams, relationships between blackflies and Tengmalm's owl, and ecosystem process rates in relation to species diversity, respectively. My own contribution was a summary of recent blackfly work in Sweden leading up this workshop.

The second day, the participants were divided into two groups with the aim of discussing possible research directions. The two subjects were: (1) Blackflies as an economic factor in northern countries (including tourism, pollination by blackflies, blackflies as vectors of disease, blackfly effects on wild and domestic animals, control programs, use of Bti, blackflies in environmental research), and (2) Blackflies and ecosystems (blackflies as test animals in ecological theory, material engineering, blackflies as prey - aquatic and terrestrial, possible fertilisation of river banks through sedimentation of larval faecal material, blackflies as habitat modifiers for other organisms, behaviour).

The group arrived at three main research areas that would be particularly fruitful for future studies in Swedish rivers. These were: 1) Larval dynamics, including the importance of blackfly larval biomass to aquatic predators, what role aquatic predators play for the populations of blackflies, and the significance of blackfly-produced materials (silk, polysaccharides and flocculated material); 2) Faecal matter. Recent studies have shown that blackflies are quantitatively important transformers of riverine particles influencing the transport and utilisation of such particles. However, there remain many questions, including how durable this material is and how it is used by the biota; 3) Feeding biology and dispersal of adults. The knowledge about blackflies as parasites on wildlife and livestock in Sweden is very limited. Given the massive populations of blackflies it would be an urgent task to map their importance. Of economic interest is also the potential effects blackflies may have on tourism in northern Sweden. Plans for an evaluation of negative effects and possible strategies for the mitigation of such effects were discussed. Altogether, these aspects form an excellent basis for a large cross-disciplinary research programme.

Kronlund offered a fine atmosphere for informal discussions. Many participants enjoyed long walks in the snowy and cold (-15°C) late nights, and the generous and tasty meals, including reindeer meat, salmon and ostrich, served in the yellow house made strong impressions.

Third Annual SERA-IEG Meeting (Flamingo, Fla. 1999)

John R. Wallace *Department of Biology Millersville University Millersville, PA 17551*
Alison H. Hyder *South Carolina Army National Guard,Columbia, SC*

Flamingo Lodge, nestled in the heart of Everglades National Park, Florida was the location for the third annual Southern Extension and Research Activities - Information Exchange Group meeting on Black Fly biology, economic problems and management. This year's meeting was co-organized by John R. Wallace (Millersville University, Millersville, PA) and Alison H. Hyder (South Carolina Army National Guard, Columbia, SC). Mr. Eric Naguski, (Millersville University, student) managed the audio-visual equipment during all sessions. There were approximately 29 registrants representing three continents and six countries including Sweden, England, Canada, Columbia, Brazil, and the United States. The meeting included three subsections: Population Management and Water Quality; Ecology and Behavior and; Genetics and Systematics. The meeting culminated with a business discussion on Monday, February 15.

Those present were: Peter Adler, Dan Arbegast, Doug Currie, Doug Craig, Ken Cummins, Peter Dechant, Joe Fitzpatrick, Bob Fusco, Elmer Gray, Robin Gray, Neusa Hamada, Ozzie Hernandez, Michael Higgins, Christie-Lee Hazard, Fiona Hunter, Alison Hyder, John McCreadie, Bjorn Malmquist ,Richard Merritt. Ken Minson, Eric Naguski, Ray Noblet, Jay Overmyer, Ken Pruess, Will Reeves, Jim Robinson, Alison Stuart, Claudia Velasques, John Wallace, and Roger Wotton.

Population Management and Water Quality (Feb. 14, 10 am. - 12 pm):

Dan Arbegast (PA DEP) discussed black fly suppression programs in Pennsylvania. Approximately 1700 stream miles in PA are treated with Bti. The focus of his talk was on small stream (Yellow Breeches) treatment with cooperation of fly-fishing groups enabling PA Fish & Game to use Bti in future projects. Elmer Gray (Clemson University) presented a paper on projected costs of black fly management in Argentina. Elmer mentioned several factors that may affect cost, e.g., frequency of larvicide applications, flight range, larval habitat and whether vector or nuisance pest. Alison Hyder (South Carolina Army National Guard) presented her research on bioindicator studies with black flies and new toxicology testing methods. Alison examined 24 and 48h LC50 of chlorpyrifos with three species of black flies and found 1) older larvae may be less susceptible and sensitive to chlorpyrifos than younger larvae and; 2) none of the species examined were more susceptible than any other in her trials. Jay Overmyer (University of Georgia) presented a preliminary information using black flies as biomonitors of environmental contamination. Rich Merritt (Michigan State University) concluded the first session with a presentation on the Black Fly International Workshop held recently in Sweden and the current status of black fly control programs in Michigan. The workshop in Sweden focused on the generation of funding opportunities and possible collaborations for future black fly research. Michigan black fly programs e.g., Copper Harbor and Betsie River are still active.

Ecology and Behavior (Feb. 14, 1:30 pm. - 4:30 pm):

Roger S. Wotton (University College, London, UK) presented a paper on the processing of organic matter by black fly larvae. The fate of organic material from labral fans to faecal pellets was discussed as well as the importance of faecal pellets in streams and rivers. Christie-Lee Hazard (Brock University) examined four diets for engorged female flies and discussed the effects of sugar meals on the development and transmission of *Leucocytozoan* sp. Fiona F. Hunter (Brock University) presented research on black fly saliva, blood-feeding and sugar-feeding. Salivary gland protein differences among species and their recycling were discussed. In addition, Fiona discussed on-going plans to hold an International Black Fly meeting at Brock University, June 17-21, 2000 (tentatively). Any thoughts or comments regarding this meeting should be directed to Fiona Hunter (Brock University, Ontario, Canada). Björn Malmquist (Sweden) presented a talk on the importance of black flies in North Sweden ecosystems. He discussed the importance of engineering of faecal pellets and increases in carbon output and included studies on lake outlet streams, large free-flowing rivers and chalk streams. John McCreadie (Clemson University) presented a talk (co-authored with Maria Grillet and Neusa Hamada) on the effects of El Niño on black fly communities. Using Monte Carlo simulations, John discussed the species richness of black flies during wet and dry seasons in Venezuela. Will Reeves (Clemson University) discussed new records of black flies in unique cave habitats. Two species of simuliids were found in his cave systems, *S. parnassum* and *Prosimulium saltus*. Claudia Velasques (Brazil) presented a talk on the microhabitat of *S. goeldi* and *Simulium* "6B1" in Central Amazonia, Brazil. Claudia discussed differences in head capsule width among black fly larvae inhabiting five streams differing in substrate type. To conclude this session, Doug Craig (University of Alberta) waxed hydrologic commenting on one of Björn's recent papers regarding "why a river ends up the way it is!"

Genetics and Systematics (February 15, 9:00 am. - 11:30 pm):

Peter Adler (Clemson University) presented a compilation of recent advances in black fly systematics. Peter provided data from North America Black Fly fauna on polytene chromosome mapping, species numbers, new natural enemies of black flies, as well as blood-feeding strategies. Doug Craig (University of Alberta) presented an update on Polynesian/Pacific black flies. Several new species were collected on Doug's most recent visit which have contributed interesting aspects to the Polynesian clades. Doug Currie (Royal Ontario Museum) co-authored a presentation with Art Borkent on the discovery of the female of *Parasimulium (Astoneomyia) melanderi* with discussion of the phylogenetic position of *Astoneomyia*. This species of black fly was discovered in a cave on Vancouver Island. Doug stated that *Astoneomyia* may be more closely related to other black flies, both *Astoneomyia* and *Parasimulium* were monophyletic but that the former may have similar a habitat as the latter. Alison Stuart (University of Toronto) presented a paper on the phylogenetic placement of *Ectemnia* based on cocoon spinning behavior. Based on data collected on six spinning stages and the following behavioral synapomorphies 1) the method of spinning structures and; 2) lack of pull front/back stages, Alison concluded that *Ectemnia* is a sister group to the *Simulium* and *Eusimulium* clade. Neusa Hamada (Brazil) co-authored a talk with Peter Adler and Maria Grillet on news on the chromosomes of black flies in the *S. perflavum* Group. Neusa provided new cytological and geographical information on this group emphasizing the gill pattern similarities as well as chromosomal arrangement. Ken Cummins (South Florida Water Management District) was invited as a guest speaker to conclude this year's meeting. Ken presented a summary of the WHO black fly control program in West Africa. Ken highlighted the ecological aspects of the *S. damnosum* complex relative to onchocerciasis (river blindness), control strategies, medical treatment strategies for onchocerciasis, and future directions and impacts of humans on these systems.

Business Meeting (February 15, 11:30 am - 12:00 pm):

Fiona Hunter discussed the format of the international black fly meeting to be held in June, 2000 at Brock University, Ontario. She stated that the meeting will cover the population management, ecology/behavior, and genetics/systematics themes with plans to publish the proceedings. It was suggested that the 2000 SERA-IEG meeting should be rescheduled for 2001 in lieu of the international meeting to be held at Brock University. The work group unanimously decided that the 2001 meeting will be held the first week in February at the Archbold Field Station in central Florida. Dan Arbegast and Elmer Gray volunteered to co-organize the meeting.

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TRAVELLERS' TALES

The Horrors of Hatiheu

Jimmy Whitworth, now in Uganda, has suggested passages written by Gavin Bell in *In search of Tusitala* in which he describes his adventures in 1992-3 while attempting to retrace the travels of Robert Luis Stevenson who sailed around the South Seas in 1888-89. One place visited by Stevenson is the Bay of Hatiheu on the island of Nuku-Hiva in the Marquesas Islands. In Stevenson's time it was a thriving community of about 10,000 people, but since then a cholera epidemic introduced by a visiting ship and later a tidal wave on 1st April 1946 wiped out almost everybody. Gavin Bell writes...

> "There is a savage beauty about the, place which is almost intimidating. The usual cluster of bungalows with ubiquitous corrugated-iron roofs lines the shore, beneath a wall of mountains; at the western end rises a series of fantastic needles of rock swathed in dark green vegetation; in the absence of a reef the bay is a restless expanse of grey. water with strong currents. Less than two hundred people were making a living from fishing and copra when I was there, and the population over the ridge was a mere fifteen."

Gavin Bell continues ..

> "I turned away and looked out to sea, feeling lonely. I reflected that Stevenson had been fortunate in having the company of his family and the crew of his yacht in this wild place.
>
> I had another problem. My arms and legs had come to resemble the volcanic topography of the island, being a mass of infected sores. The culprits were microscopic vampires known to scientists as *Simulium buissoni* , to other interested parties as blackflies, and to Marquesans as *no-nos* . They rank among the world's worst blood-sucking pests and carriers of disease - in Africa they are responsible for 'river blindness' - and Nuku-Hiva is infested with countless millions of them. The good news is they are not found on beaches. The bad news is the beaches are the domain of their white cousins, *Styloconops albiventris*, which are equally voracious. During my visit, a team of French entomologists was waiting patiently for the rain to stop so they could pour chemicals into mountain streams to eradicate blackflies.

They had been waiting for three months

One of them explained to me the difference between the *modus\ operandi* of mosquitoes and blackflies. The former are like flying hypodermic needles, inserting suckers and withdrawing blood with surgical precision; the latter chew and tear at flesh to drink the blood, leaving ragged wounds susceptible to infection. Marquesans eventually become immune to the insect saliva that causes irritation, but there is no respite for the unsuspecting traveller. In 1904, a severe infestation forced French administrators to move lock, stock, and wine-barrel from Nuku-Hiva to Hiva-0a. To be on the safe side, they stayed there for forty years. The French expert obligingly showed me a reference work on the subject by a member of the Natural History department at the British Museum. Referring to social and economic disruption caused by these vermin, the author notes: '*The experience of being continually bitten, unable to step outside without soon oozing blood from countless bites, is a demoralizer with few equals*.'

I heartily endorse this view. On my first night at Hatiheu, I had a beautiful dream. I was lying in a darkened room, between crisp, clean white sheets. Every so often a nurse would come to my bed and silently bathe my arms and legs in a cooling solution. I was awakened from this reverie by the infernal screeching of a cock outside my window in the middle of the night, to find myself scratching a profusion of insect bites behind my right knee. A thin trickle of blood was staining the sweat-soaked sheets."

The above quotation comes from page 7, of Roger Crosskey's *The Natural History of Blackflies.* In Chapter 18, Roger also quotes the experiences of the late Evelyn Cheesman who visited the same valley in 1924. He writes...

"With the exception of the Marquesas, the Pacific islands are virtually free from man-biting. *Simulium jolyi* in Vanuatu, and *S. laciniatum* in Fiji, occasionally make their presence felt, but only *Simulium buissoni* is ever an intolerable pest. This blackfly is endemic in the Marquesas archipelago, where it is innocuous on most islands but attacks man in a valley on Nuka-Hira with a ferocity unequalled anywhere else in the Pacific. It is the dreaded *no-no* (or *nau-nau*), of which the late Evelyn Cheesman wrote vividly, but without exaggeration, in her autobiographical accounts of the insect collecting in the Pacific to which she devoted her life. A passage in *Hunting insects in the South Seas* (Cheesman, 1932) describes matters perfectly:

"There is a famous valley of the Marquesas which is so plagued with one species of sandflies [Simulium] that it is practically uninhabitable. ...The scenery is superb and its beauty not exaggerated ... but no natural beauties can make up for the torture inflicted by these small flies. When I visited it with the Saint George Expedition in 1924, none of us had any idea of what was waiting on shore. The sandflies did not even wait for us, but, eager to suck the blood of the newcomers, came out to the yacht as she anchored at sundown. I noticed that bites of some sort of insect had raised blains on my arms and neck that night. ... Next day the whole party suffered to a lesser or greater degree when we went ashore; but I came out worst because I was collecting until sundown in cottonfields at the mouth of the valley and was attacked by dense clouds of sandflies. Wherever any of my flesh was visible it was literally black with the insects, and at intervals one swept them off, killing hundreds each time and in a very few minutes more had taken their place ... For a whole day afterwards I could not walk but had to spend hours in bathing swollen limbs; and some of our party had bad sores for weeks afterwards ... These little insects have made one of the most lovely valleys in the world unfit for human habitation ... there might have been a thriving colony for all that land is very fertile"

"Later, in *Things worth while* (1957), when it was known to her that the flies were simuliids, she wrote "I got a guide and went up the valley to where a grand view showed the Tai-pi Vai, the River Tal-pi, winding to the sea. But always the Simuleum flies [sic] were relentless; only death can stop them and it is difficult to kill such large numbers". Miss Cheesman's memory of the flies was so vivid that when, in her eighties, she told blackfly specialists about them she seemed to be recounting something which happened only yesterday."

In his taxonomic revision of the simuliids of the Marquesas, Doug. Craig (Craig et al, 1995) gives more on the historical background to these pests from the writings of Herman Melville (author of Moby Dick) in 1847 to the present. He also gives more information on the control activities.

"Under the auspices of ORSTOM and ITRMLM*, an attempt was made during January to April, 1993, to eradicate *S. buissoni* from Nuku Hiva. Temephos (Abate®) was added to all flowing rivers every two weeks. After the first two applications of insecticide, populations of biting females were reduced to 4% of previous levels. However, heavy rain in March, 1993 precluded further reductions of the populations. By October, 1993, populations of *S. buissoni* had increased to pretreatment densities (Fossati & Séchan 1993, Séchan *et al*. 1993). "

[* I understand that the control was carried out by persons some of whose names will be familiar to followers of onchocerciasis control: O. Fossati, P. Guillet, P. Martin, J. Roux & Y. Séchan]

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J.B.Davies

RECENT PUBLICATIONS

First Update to the New Taxonomic and Geographical Inventory of World Blackflies
by **R.W. Crosskey** *Natural History Museum, London*

Included with this issue of the *Bulletin* is a supplement to *The New Taxonomic and Geographical Inventory of World Blackflies* by R.W.Crosskey and T.M.Howard recently published by the Department of Entomology, Natural History Museum, London. Together with the original inventory this *First Update* collates information available up to the end of 1998.

For those who are not aware of the original inventory there follow details of the work and how to order it.

Title: Crosskey, R.W. and Howard, T.M., *1997, The New Taxonomic and Geographical Inventory of World Blackflies* (Diptera: Simuliidae) ISBN0-565-09021-6. Soft cover, 144pp.
<u>Main Contents</u>

3 • All world species listed in their current genera, sub-genera and species groups (with authors, dates and synonyms)
4 • Countries of the distribution of each species are individually listed and included in a country index (enabling a checklist for any country to be easily extracted)
5 • A bibliography of works that include identification keys (entries arranged by region, country and life-stage)

<u>To order:</u> Orders should be addressed to:
Departmental Administrator
Department of Entomology
Natural History Museum
Cromwell Rd, London SW7 5BD, UK.
e-mail: mps@nhm.ac.uk (or m.scott@nhm.ac.uk)

Price: 25 pounds sterling (postage and packing included)
Usual credit cards are accepted

Diptera Simuliidae
by **Frank Jensen** *Natural History Museum Århus, Denmark*

in *Aquatic Insects of North Europe - A Taxonomic Handbook*. Vol. 2 pp209-241 *Ed*. Anders N. Nilsson, 1997. Apollo Books, Kirkeby Sand 19, DK-5771, Stenstrup, Denmark

This work deals with the Simuliidae to be found in Denmark, Norway, Sweden, Finland, Fennoscandian Russia, Estonia, Latvia, Lithuania, Northern Poland & Germany, Iceland and the Faroes. There is an excellent brief summary of the biology and morphology, followed by well illustrated keys to the genera of adults, and to the species of pupae and mature larvae. In all, 18 species of Prosimuliini and 61 species of Simuliini are referred to, many of which can also be found in the British Isles.

NOTES, VIEWS AND CORRESPONDENCE

Blackflies at the Honeypot

The recent clutch of very interesting papers by Steve Burgin and Fiona Hunter (1997a-c) on homopteran honeydew as a sugar source for blackflies which supplements, or perhaps in some circumstances even substitutes for, floral nectar brings to mind the old adage that there is nothing new under the sun. Observation and anecdotal reference to honeydew-feeding is amazingly old, going back to the work in which Macquart (1826) described *Simulium vernum*. Macquart classified simuliids as 'Tipulaires rampantes' and discussing them wrote a rather remarkable passage in very idiomatic and slightly old-fashioned French "Comme ces insectes habitent ordinairement les buissons situés sous les arbres, et qu'ils y recueiiient avec la trompe les sucs répandus sur les plantes, et particulièrement ceux produits par les Pucerons, leurs tarses font les functions de palpes; ils servent à reconnaître ces aliment, et on les croirait l'organe d'un sens supérieur au toucher" - for which an English rendering would be "As these insects usually live among bushes situated beneath trees, and collect with their proboscis the sugars which are scattered on the plants, especially those which have been produced by aphids, their tarsi function as palps; they serve to recognize this food, and one could believe that they are superior tactile organs".

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Roger W. Crosskey

Anthropophilly and Autogeny in *S. damnosum* in South Africa

In a recent publication R. Palmer and F. de Moor (1998) report on the occurrence of man-biting *Simulium damnosum s.l.* in South Africa, On page 231 they write:

> "members of the *S. damnosum* complex are anthropophilic along the Orange and Vaal Rivers and in the vicinity of Johannesburg (Begemann 1986; Jupp and Palmer, in press). They appear to be non-anthropophilic elsewhere in southern Africa. Steenkamp (1972) reported *S. damnosum s.l*. as a pest of livestock, causing loss of condition in cattle in the vecinity of Parys, Vaal River. In the Vaal River about 7% of the *S. damnosum* population was autogenous"

This and similar recent reports extend the known distribution of the anthropophilic forms further south than the generally accepted limit of southern Malawi (as shown in Fig. 3 of W.H.O., 1987 for example). The latest W.H.O. Technical Report *Onchocerciasis and Its Control* (W.H.O. 1995) states on page 6 "In Africa, wherever anthropophilic members of the two vector complexes [i.e. *S. damnosum* or *S. neavei*] occur, the human population suffers from some degree of onchocerciasis". Let us hope that this will prove to be an inaccurate statement rather than a prophecy. Is the cytospecies of these biters known? Where have they come from?

The report of autogeny is extremely interesting. Is it the first for *S.damnosum*? Does anyone know of other reports, and what are the possible implications? Could this form be another candidate for colonisation? Please send your comments to the Editor for publication in the next Bulletin.

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J.B.Davies

Bulletins on the Internet

Many members who have access to the Internet have also joined the Simuliidae mail-list which is operated by "Mailbase" at the University of Newcastle. This list also incorporates a Web Site. Whether you have registered with Simuliidae or not, information about the Simuliidae list and its membership is available to anyone with a web browser at the URL :

http://www.mailbase.ac.uk/lists/simuliidae

Once at this site, go to List Resources, then Read, then Other Files. Here will be found public files posted by the list owners. These include a general description of the British Simuliid Group, a complete listing of the Contents pages of *Bulletins* Nos. 1 to 10, and the entire text of *Bulletins* Nos. 11, 12 and eventually this one.

If you find this site interesting, or have any suggestions for improvement, or ideas for additional information files, please contact the list owners at the addresses inside the front cover of this *Bulletin*

Animation of black fly larvae

The Department of Biological Sciences, University of Alberta, has a digital imaging facility and an industrial intern, who is learning to do all the arcane stuff associated with multimedia presentations. As part of his work, he digitized and animated the flow patterns around a black fly larva. Although apparently rather simple in nature, it required him to make the labral fans flick open and closed, quite remarkable in that he began with a digitized image of a drawing of the larva. The animation can be viewed on the WWW at the URL:

http://www.biology.ualberta.ca/multimedia/entomology/blackfly.htm

To view the various flow paths, click on the button on the right-hand side of the screen and enjoy

Doug. Craig

Black flies (Diptera: Simuliidae) in Friuli Venezia Giulia, Italy.

Ghetti P.F., Losso C., Pedron M., Tagliapietra D., Volpi Ghirardini A. *Università degli Studi Ca' Foscari di Venezia - Dipartimento di Scienze Ambientali, Calle Larga S. Marta 2137, Venice, Italy*

During the last two decades black flies have bothered the population of Friuli Venezia Giulia Region (NE Italy) Lower Plain. At the beginning, the affected area was restricted to the Stella River basin, a little tributary of the Marano lagoon but, more recently, frequent complaints indicate that the situation has worsened.

These facts prompted Friuli Venezia Giulia local government to ask for a investigation by the Department of Environmental Sciences of the University of Venice.

The aim of the study was to substantiate the knowledge about Simuliid autoecology and to determine the current black fly distribution.

The study concentrated on the aquatic stages (eggs, *larvae* and *pupae*) and consisted of two parts:

1. A monitoring phase conducted on three sites, characterised by a different degree of artificiality, over one year from July 1997 to August 1998. During this phase artificial substrata were used.
2. A survey carried out along a series of thirty stations representing different channel typologies and degree of human impact such as distance from built-up areas, arable lands and pisciculture plants.

The investigated sites were located in the flood-plain along a line approximately parallel to the coast consisting of a sequence of springs (Italian: "Linea delle Risorgive"). The natural emergence of ground water occurs at the boundary between layers of the permeable gravelly soils and the impermeable ones.

6 In summary, the result achieved were the following:

7 The species found during the whole study were *Simulium ornatum* Meigen, *S. angustitarse* Lundstrom, *S. paraequinum* Puri and *S.erytrocephalum* De Geer.

8 Study 1) The three stations displayed different population dynamics ranging from the most natural site which showed the lower black fly presence to the canalised one which in turn presented a stronger and more variable colonisation. *S. paraequinum*, a species known as bothering for humans was present only at this last station.

9 Study 2) Simuliids were present along the whole transect showing that black flies had spread, from the original foci, through the lower Friuli Venezia Giulia plain. A positive correlation was found between *S.paraequinum* presence and flow rate.

10 Detailed papers on the subject are in preparation.

11 ---

MEMBERSHIP NOTICES

New Members

(e-mail addresses given in italics)

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BRITISH SIMULIID GROUP BULLETIN - Number 14, December 1999

Contents Number 14, December 1999

FROM THE EDITOR

This, the last number before the millennium, is again packed with items of interest. There is a report on the 22nd Annual Meeting held in Liverpool in October, and an announcement for the 23rd Meeting which is to be held at the unusually early date of April 2000, and which will include a workshop on collecting and identifying British simuliids. In this connection a sample Field Data Collection Form has been included. We also have papers from contributors as far afield as Japan and South Africa.

John B. Davies, Editor.

THE 23rd ANNUAL MEETING - ANNOUNCEMENT

The next meeting of the Group will probably be held at Salford University on Wednesday 12 April 2000

Please mark your diary now!

THE 22nd ANNUAL MEETING OF THE BRITISH SIMULIID GROUP

The meeting was held in the Lord Pilkington Lecture Theatre of the Liverpool School of Tropical Medicine on Wednesday 20th October, and was attended by eleven members and one visitor, Prof. M.N. Madhyastha from Mangalore University, India, who was introduced by Stan Frost.

As in the past, those who had traveled to Liverpool the previous day, met for an informal dinner at the Yuet Ben Chinese Restaurant on Tuesday evening.

The meeting was opened by **Harold Townson**, Selwyn-Lloyd Professor of Medical Entomology, and was followed by three formal presentations, abstracts of which are published below, and two posters.

Professor **R.A. Cheke** ended the lectures with talk on the on-going studies on “Deforestation and *S. damnosum s.l.* in Ghana and Western Togo”. This was an update on the information given by Professor **R.J. Post** at last year’s meeting. By re-analysing the cytotaxonomic data collected over the years 1975 to 1997 by grouping into 5-year time intervals with four annual seasons instead of the 3 seasons used previously, the increases in proportion of savanna type flies with time was found to be statistically significant. However, this result could have been caused by seasonal sampling bias, so the data was reorganized by eliminating all zero or single instances of savanna flies. Only 8 rivers met this criterion, and only in the January - March season. Nevertheless the increasing trend in proportion of savanna flies taking into account the degree of heterogeneity of the rivers was still relevant. In addition, dissections of savanna and forest flies from the Tano River show the presence of savanna flies with infective *O. volvulus* larvae in the head, and important monthly biting rates.

The job now is to try to link the presence of savanna flies with deforestation. This is being done by classifying satellite images of the area into areas of vegetative cover. They show that the edges of forest reserves along the Tano River are being eroded, and in most areas there is a general increase in the urban/village/cleared ground category. The analysis continues.

General Discussion

The talks were followed by a lively discussion which covered the following topics.

The Bulletin: A suggestion that we try to reduce the cost of printing and posting the Bulletin by sending printed copies only to U.K. residents and overseas members without e-mail addresses, everyone else to receive theirs by e-mail, was not well received. It was decided that we should continue to post copies to all members for as long as possible.

Change in Meeting Format: There was agreement that the main function of our meetings was the opportunity to meet colleagues and have informal discussions. The format of the present meeting with four half-hour talks was thought to be about right, as this gave time for a lengthy lunch break, and long general discussion period.

Group Project: It was considered that the only feasible group project would be to try to increase the coverage of the British Simuliid distribution surveys. To this end, it was proposed that part of the next meeting should be devoted to a practical workshop on collecting and identifying British simuliids. Jon Bass offered to produce a standard collection data form (published on page 19). It was hoped that the next meeting might be held earlier in the year, so that members could bring material for identification. Sabine Kläger offered to see if the meeting could be held at Salford.

The meeting ended with a vote of thanks to the organisers, John Davies and Philip McCall, with particular praise for Lisa Bluett who had arranged the excellent sandwich lunch.

ABSTRACTS OF MEETING PRESENTATIONS

Plasticity of blackfly distributions: what are the key factors?

Jon Bass *Institute of Freshwater Ecology, River Laboratory East Stoke, Wareham Dorset, BH20 6BB [j.bass@nerc.ac.uk]*

This short talk considers the various scales at which we observe blackfly species distributions - from a single rock or grass blade to the broader scale of country/region and from daily to year-by-year changes. The overview was stimulated by the increasing availability of analytical 'packages' for data analysis and the thought that some critical variables determining distribution patterns may be easily overlooked, i.e. - perhaps statistically valid conclusions may not always provide us with the correct interpretation?

The precise ecological characteristics/requirements of all life stages is known for very few species. (Slides were shown illustrating some UK blackfly habitat types and life cycle patterns). Information available suggests, not unexpectedly, that for some species the life cycle characteristics vary across geographic ranges and through the year. At the other extreme, the species niche can be very narrow and easily defined (if not fully understood!).

Species distributions are most conveniently monitored during the larval stages. Though these distributions are real they are constrained. They reflect the scope for adult oviposition combined with the effects of variable conditions for larval growth, survival and development. These constraints may be associated with adequately maintained water flow, water/food quality, habitat quality and interactions with other fauna. None of these factors are robustly described by the 'spot sampling' of larval site characteristics - which are conveniently used to analyse and interpret species distribution.

To summarise -

Relating presence/absence/abundance to environmental variables is now technically easy.
We must take on board:

- The spatial/temporal context - how complete are the data?
- Relating presence/absence to environmental/ecological constraints - is there a limited knowledge base?
- Do we consider the appropriate constraining variables?

Natural born killer: the *Simulium*'s innate immune system.

Hans-E Hägen. *The Wellcome Trust, 183 Euston Rd., London NW1 2BE*
Onchocerca microfilariae upon entering the haemocoel of *S. damnosum* are killed and removed in a swift and species-specific manner. This process does not involve any encapsulation or humoral melanisation reactions. Using caspase inhibitors and an *in situ* cell death detection assay (TUNEL) it was possible to show that the microfilariae die due to elevated levels of apoptosis. Moreover it seems that this induction of apoptosis is mediated by serine proteases. Additional *in vivo* experiments using the peptide RGDS as an inhibitor for putative integrin-like receptors have revealed that in the presence of this peptide survival of microfilariae in its vector *S. damnosum* is enhanced. This is the first indication that haemocytes are involved in the killing of the parasite, and that this killing is receptor-driven. These finding have led to the hypothesis that microfilariae might be killed by Natural Killer-like haemocytes which patrol the haemocoel.

Phosphoglucomutase and trehalase isoenzymes of *Simulium ochraceum s.l.* in Guatemala.

J.B. Davies, *Liverpool School of Tropical Medicine, Liverpool, L3 5QA, U.K.*
R. Mendizabál Solé de Cabrera, A.J. Paniagua-Alvarez, and **R. Luján,** *Center for Health Studies, Universidad del Valle de Guatemala, Guatemala, C.A.*

In Guatemala, onchocerciasis and its vectors, particularly *Simulium ochraceum s.l.,* have been known and studied since 1915. Detailed investigations into the behaviour and transmission dynamics have suggested that *S. ochraceum* is probably a species complex. It is surprising, therefore to find that relatively little attention has been paid to the cytotaxonomy of this species. Hirai and Uemoto (1983) confirmed this prediction by recognising 3 cytotypes within *S. ochraceum*, but this was not followed up until Hirai et al. (1994) recognised 3 taxa which they called A, B and C. Taxon A was highly anthropophilic in the Guatemalan onchocerciasis foci,. Taxon B was only found in the onchocerciasis focus of Oaxaca, Mexico, while taxon C was limited to the dry non-endemic savannahs of SE Guatemala. these identifications were based on material collected from 2 localities in Mexico and 11 in Guatemala, one of which was the hyperendemic Finca (Coffee estate) of El Brote, Solola.

As part of our studies into the effect of ivermectin based onchocerciasis control in Guatemala, *S. ochraceum s.l.* were collected when attracted to human bait in 6 fincas in two localities. The Chicacao area with fincas El Brote, Monte Carlo and Las Armonias, and Pochuta area with fincas Costa Rica, Las Delicias and Buena Vista. The greatest horizontal distance between fincas within each group was 10km, while the distance between the two groups was about 30km. Flies were collected between 2 November and 4 December 1994. Each fly was ground up in 4µl of water and tested for the two enzyme systems by electrophoresis on cellulose acetate membranes using the techniques of Thomsom et al. (1989).

In the 542 *S. ochraceum s.l.* processed, only one trehalase band was found, compared to 3 bands with phosphoglucomutase (PGM). The bands were labelled C, D and E, and all possible heterozygote pairs were found. Analysis of observed and expected Hardy-Weinberg band frequencies showed that at all fincas there was a significant scarcity of heterozygotes, particularly between the E and D bands. Examination of the band frequencies showed that the population at El Brote (taxon A of Hirai *et al.*) was similar to the others in the Chicacao group, but differed significantly from the fincas in the Pochuta group.

We conclude that in the area studied there are probably at least two populations within *S. ochraceum s.l.* (Taxon A) which are not freely interbreeding, and the proportions of these populations differ between localities. The cytotaxonomy of this species complex requires much greater study.

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Posters

R. Morales Hojas, R.J. Post, A.J. Shelley and M. Mia-Hertzog:
The Natural History Museum, London
Molecular tools for identification of *O. volvulus* and *M. ozzardi* in Brazil

Fiona Hunter, *Brock University, Ontario, Canada*. Black Flies in the New Millennium: An International Meeting of Black Fly Workers, June 17-21 2000 at Brock University, Canada.

SCIENTIFIC CONTRIBUTIONS

Discovery of a blackfly species with three spermathecae

Hiroyuki Takaoka *Department of Infectious Disease Control, Oita Medical University, Hasama, Oita 879-5593, Japan, [takaoka@oita-med.ac.jp]* and
Chaliow Kuvangkadilok *Department of Biology, Faculty of Science, Mahidol University, Rama VI Road, Bangkok 10400, Thailand*

Our recent faunistic survey on Simuliidae in northern Thailand revealed an intriguing new species which has three spermathecae in place of a single, typical one. This species is represented by only two female adults reared from pupae collected from a small stream 0.5-1.0 m wide, with a water temperature of 19'C, at Tontong waterfall (altitude 500 m), Doi Phuka National Park, Nan Province, northern Thailand, on December 9, 1998. Both female adult specimens examined had three spermathecae (one principal and two accessory), as shown in Fig.1. The principal spermatheca is large, pear-shaped, and is connected with a typically long major spermathecal duct, while the two accessory ones are of equal small size, oblong, curved, and are connected with somewhat shorter spermathecal ducts arising from the main duct near its base. All are well sclerotized and dark brown, and show internal setae. Since there is no difference in the size, shape, and disposition of the three spermathecae between these two apparently-normal females, we think it unlikely that they were aberrant and that the two additional spermathecae, as an outcome of teratogenesis, happened to occur coincidentally. Possession of multiple spermathecae must be a normally inherited character of this new species, though this inference should be verified by examining extra female specimens.

The new species concerned is placed in the *multistriatum*-group of the subgenus *Simulium* (*Simulium*), defined by Takaoka and Davies (1996), and is easily distinguished from the other known species of the same species-group by its corbicular cocoon and by the wide forwardly directed projection on each arm of the genital fork.

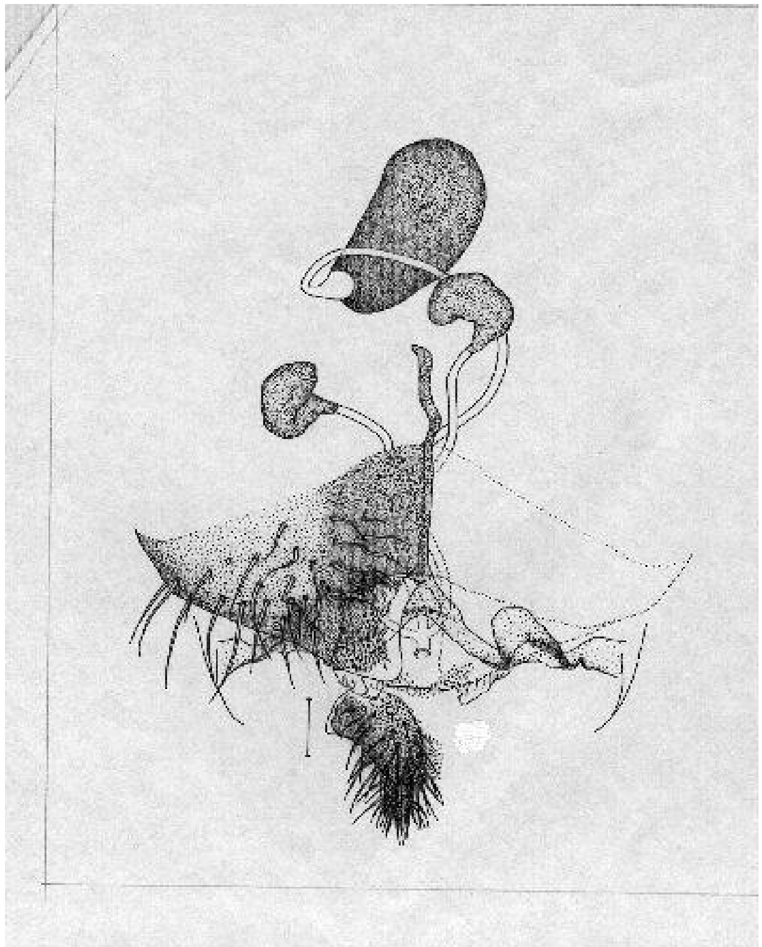

Fig.1. Female genitalia *in situ* (ventral view) showing three spermathecae. Scale Bar = 0.05mm.

The presence of a single spermatheca is usual in Simuliidae and normally diagnostic for the family (Crosskey, 1990). However, females retain two additional spermathecal ducts arising from the main spermathecal duct near its base. both of which are typically much shorter than the main one. Three spermathecae are considered to be the evolutionarily basic complement for the Diptera (Downes, 1968). In other nematocerous insects, such as mosquitoes and biting midges, the number of spermathecae varies from one to three in different taxa (Crosskey, 1993). Therefore, it is perhaps not unexpected to encounter a species carrying two or three spermathecae even in the small family Simuliidae. Our finding is the first to record a species with three spermathecae in the Simuliidae. Bernard (1974) reported two spermathecae of almost the same size in a freak specimen of *Simulium erythrocephalum*. Hunter and Adler (pers. comm) also found aberrant females with two spermathecae of different size in colony-reared *S. vittatum*.

The new species will be described in a separate paper, together with three other new species (Takaoka and Kuvangkadilok, 1999).

Acknowledgements
We thank Dr. R.W. Crosskey, the Natural History Museum, U.K., for reading the manuscript and giving valuable suggestions. Thanks are also due to Dr. D.A. Craig, Professor emeritus, University of Alberta, Canada, Prof. P.H. Adler, Clemson University, USA, and Dr. D.C. Currie, Royal Ontario Museum, Canada, for their useful information on multiple spermathecae of dipteran insects. This work was supported by the Grant-in Aid of Ministry of Education, Science and Culture, Japan (no. 11670246) to HT, and also by the TRF/BIOTEC Special Program for Biodiversity Research and Training grant BRT 139007 to CK.

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Simulium damnosum s.l. complex widespread in Southern Africa

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A recent study has shown that the *Simulium damnosum s.l.* complex in southern Africa is far more widespread than previously known (Palmer & de Moor 1998). Indeed, *S. damnosum s.l.* is now considered among the most common and widespread of blackflies in southern Africa (Figure1). Furthermore, some *S. damnosum* members in South Africa are anthrophophilic, which changes the long-held belief that the *S. damnosum s.l.* complex in southern Africa is strictly zoophilic (Jupp and Palmer 1999). This article discusses some of the recent records of *S. damnosum s.l.* in southern Africa, and suggests that, besides more in- depth sampling, increased distribution records of *S. damnosum s.l.* in southern Africa are the result of greater river regulation and catchment development.

The most recently published distribution map of *Simulium damnosum s.l.* in Africa shows that the complex is patchily distributed in southern Africa, with most records collected along the eastern side of the subcontinent (Crosskey 1990). The complex was considered absent from the southwestern Cape, as it was not recorded during a detailed study of the Berg River in the 1950's (Harrison & Elsworth 1958). In 1996 the complex was recorded for the first time from the Berg River at Sonkwasdrift (33°20'S; 18°58'E). In the same year it was also recorded from the middle Olifants River near Citrusdal (32°35'S; 19°00'E), the Bree River near Ceres (33°22'52"S; 19°18'10"E), and the Klein Berg River at Nuwekloofpas (33°18'41"S; 19°04'31"E). The discovery of *S. damnosum s.l.* in four major river systems in the south-western Cape Province suggests that their distribution and abundance has increased in recent years.

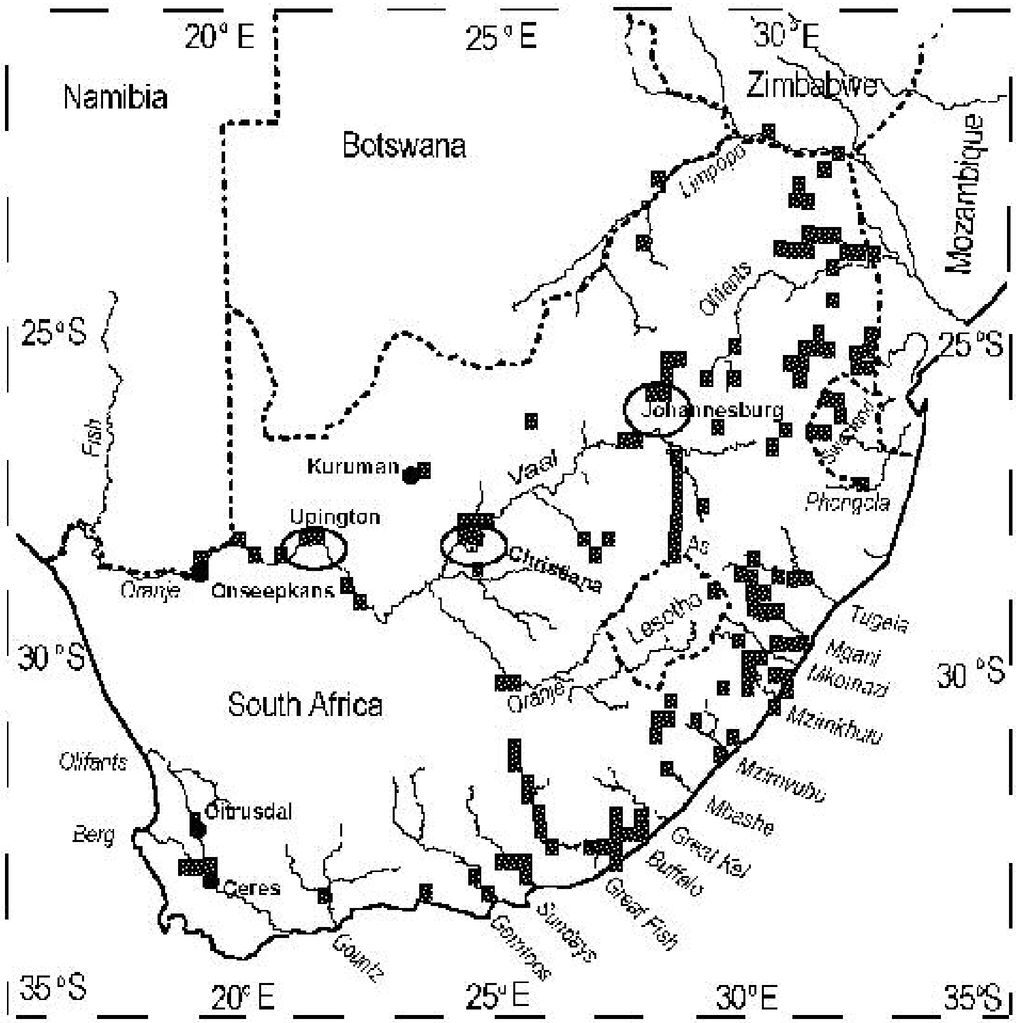

Figure 1. The distribution of the *S. damnosum s.l.* complex in southern Africa (squares), showing major rivers and key towns mentioned in the text. Large circles indicate where *S. damnosum* has been known to bite humans [Adapted from Palmer & de Moor 1998, with permission from African Entomology.]

Simulium damnosum s.l. has a preference for conditions downstream of impoundment outlets. In May 1981 it was recorded by Begemann in the Pienaars River downstream of Roodeplaat Dam (2528CB). In August 1989 it was found in the Phongolo River downstream of Jozini Dam during low-level release (27°23'S; 31°49'E), and in the Mgeni River downstream of the Albert Falls Dam (29°27'S; 30°28'E). In 1996 it was recorded in the Mgeni River downstream of Midmar Dam, when the water was slightly green and mildly turbid (29°29'S; 30°14'E). During a three-year study of the Buffalo River, Eastern Cape Province, it was common throughout the year, particularly near impoundment outlets during low-level releases (32°59'30"S; 27°43'45"E). In 1990 it was recorded from the Orange River, about 5 km downstream of Gariep Dam (30°37'S; 25°27'E). In 1997 it was recorded in the Komati River downstream of the Vygeboom Dam (25°53'S; 30°37'E), and in 1998 it was recorded in the Olifants River (Northern Province) downstream of Loskop Dam (25°24'08.3"S; 29°22'18.2"E) and Arabie Dam (24°44.4'S; 29°24.2'E).

A survey of 33, mostly un-impounded rivers in the former Transkei region of the Eastern Cape Province, recorded the presence of *S. damnosum s.l.* in the Mngazi River only (31°36'39"S; 29°24'16"E). Likewise, a survey of eight rivers in the south-western part of the Eastern Cape Province did not record any *S. damnosum s.l.* Some rivers influenced by agricultural development and small weirs in the north-eastern regions of the Eastern Cape Province did, however, reveal low numbers of *S. damnosum s.l.* These records suggest that the building of dams has significantly increased the distribution of the Simulium damnosum *s.l.* complex in southern Africa.

Simulium damnosum s.l. was considered absent from Namibia (Crosskey and Howard 1996), but the omission was later corrected (Crosskey 1999). It is now known from the extreme north and south of the country. In 1985 it was collected by Shirley Bethune in the Mkena Channel, Kavango (Okavango) River (1820BB), and in 1986 on the same river at Popa Falls, at the western end of the Caprivi Strip (1821BA) (Curtis, 1991). In 1994 Dr Mark Chutter collected *S. damnosum s.l.* from the Kavango River at Andara, upsteam of Popa Falls. It is therefore likely that *S. damnosum s.l.* also occurs in the Kavango River within Botswana and Angola. An intensive survey of the lower Kunene River in Namibia in 1997 and 1998, however, revealed that *S. damnosum s.l.* was absent, with *Simulium fragai* the only species recorded. *Simulium damnosum s.l.* is also known in the Orange River as far downstream as Onseepkans (28°44'12"S; 19°18'25"E), and it is highly likely that it occurs further downstream during clear conditions.

Simulium damnosum s.l. occurs in a wide range of water-quality conditions, but is often present in medium to large sized rivers, particularly when the water is visibly green owing to the presence of planktonic algae. During a five year study of the middle reaches of the Orange River, *S. damnosum s.l.* was abundant during clear water conditions only, when flows were moderate to low. Developments in the upper and middle Orange River are likely to reduce flows in the river, and convert the river from a flashy, turbid system, to a more stable, clear-water system. These changes are likely to favour *S. damnosum s.l.*

The adaptability of *Simulium damnosum s.l.* is illustrated by its presence, in high numbers, in a clear, isolated dolomitic spring on the edge of the Kalahari Desert at Kuruman (27°27S; 23°27'E). It is also known from the centre of Johannesburg, one of the most urbanised areas in Africa (26°08'S; 28°08'E). *Simulium damnosum s.l*. was also recorded in very cold water (4°C), in the upper reaches of the As River (Free State Province) at an altitude of 1640m (28°22'45"S; 28°21'54"E), and in the Great Fish River at Middelton (Eastern Cape Province) (32°57'S; 25°48'E).

Simulium damnosum has been recorded biting humans in the vicinity of Johannesburg (26°08'S; 28°08'E), Upington (28°28'S; 21°13'E) and Christiana (27°50'S; 25°14'E) (Jupp and Palmer 1999). It is likely that *S. damnosum s.l.* in southern Africa comprises several sibling species. Larvae collected from the lower Vaal River show distinct morphological differences to those from Swaziland (pers. obs F.C. de Moor). The fact that certain populations show distinct zoophilic, ornithophilic or anthropophilic host preferences further corroborate these observations. Detailed studies on different populations of *S. damnosum s.l.* in southern Africa are required to verify these observations.

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Editor's Note:

For completeness, it should be noted that unpublished chromosome studies carried out by Manfred Carr in about 1980 revealed three sibling species in S.A. and a fourth in Swaziland, all of which differed from any previously known inversion patterns. See Crosskey, R.W. (1987) Ann. trop. Med. Parasit. 81 (2) p. 188

NOTES, VIEWS & CORRESPONDENCE

The new International Code of Zoological Nomenclature

The new (4th) edition of the *International Code of Zoological Nomenclature*, in combined English and French versions, was published in August 1999 and comes into force on 1 January 2000. Here are details of the work:
Title: *International Code of Zoological Nomenclature*: *fourth edition*.
Publisher: International Commission on Zoological Nomenclature.
Supplier: International Trust for Zoological Nomenclature, The Natural History Museum, Cromwell Road, London SW7 SBD, U.K. (e-mail: iczn@nhm.ac.uk).
Specification: ISBN 0 85301 006 4; Hardback, xxix + 305 pp.
Price: £40 or $65, including surface postage (air supplement £2 or $3).
Discounts: available for members of scientific societies and students. (e-mail as above for details or see ICZN Web site 'www.iczn.org', *Bulletin of Zoological Nomenclature*, volume 56, page 107).

This new edition is quite considerably revised as compared to the 3rd edition (1985). It contains several new provisions, removes some former ambiguities, contains many more examples which demonstrate the purport of mandatory Articles, and contains many more helpful Recommendations (i.e. guidelines that are advised for good practice). An example of tightening up is the proviso, now mandatory but previously only a recommendation, that a new species name must be accompanied by designation of a holotype or syntypes and a statement of the type depository.

There are no adverse effects of the new Code to worry simuliidologists because present-day blackfly taxonomy is procedurally good, already in the main observing the technicalities of zoological nomenclature. Whether zoological judgement is always sound is another question!

If anyone has queries of a nomenclatural ill be happy to help
(e-mail: rwc@nhm.ac.uk).

Roger W. Crosskey

A novel form of *Simulium* control

The following excerpt from NATURE: January 1st 1880 is interesting, not only because the efforts were wildly misdirected, but also because of the variety of names used for the pest fly *Simulium colombaschense* (Fabricius, 1787).

Hungarian Earthquakes and the Kolumbács Flies

A NOTE in NATURE, Vol. xxi. p. 89, speaking of the recent Hungarian earthquakes, contains, amongst others, the following, passage:- "Near Weisskirchen, the old ruins of the Castle of Golubacz have fallen in completely, and in the vicinity several caves were rendered inaccessible. These caves were the breeding places of the dreaded Kolumbács mosquitos, and if this insect is thus exterminated the earthquake may, with all the damage it did, have yet been of some use."

This report is based on obvious error, for it is a well-known fact that the small (3-4 miilim. long) Kolumbács flies (*Simulia golumbacensis*, Fabr.), which, in the southern part of Hungary, especially in the old Banat and the county of Hunyad, cause considerable damage among the pasturing cattle (especially among horned cattle, horses, swine, and sheep), breed by no means in those caves which are to be found around the ancient Galambócz (known nowadays under the name of Golubácz or Kolumbács, on the Servian territory), but in the shallower parts of the waters extending in great quantities in that country. The course of life of the Kolumbács fly is, for the most part, in conformity with that of many families of the Nemocera, or Tipulariae group, as are the Culicidae, - many species of flies (Brachycera), the Phryganidae, &c. The mature and fecundated mother-fly lays her eggs upon the plants vegetating on the water-borders, whence they get on the stones under the water, and other objects, there living through their larva and nymph states until they arrive at their full development.

But, in the first years after 1850, under the rule of the Austrian military system of that time, there did occur the curious fact that - upon the advice of a military officer of the frontier-districts, who, as it was supposed, had made out that the breeding-nests of these flies are in the caves around Galambócz, Old Moldavia, and their environs - the Government of Vienna officially decreed the walling up of the openings of the caves. And actually they were walled up. But in the next mild spring, the conditions of development being favourable a gain, the Kolumbács fly appeared and ravaged once more. The Viennese Government, on learning this unpleasant and disappointing news, hastened to amend the blunder, and sent to the place a Hungarian *savant*, Vincent Kollár, and a German entomologist, Joseph Mann, to take the question under examination. These, in a brief space of time succeeded in clearing up the true state of things, and in gathering such a series, as contained all the stages of the development of the Kolumbács fly in numerous specimens. This collection is to be seen now in the entomological section of the Naturalien Cabinet of Vienna, grouped in the best order.

The imputation, therefore, as if it were the Hungarians who had walled up the orifices of the caves in the vicinity of Galambócz, in order to exterminate the Koluinbács flies by that means - an opinion which, as I, this year, happened to hear at the lecture of an eminent German *savant*, is propagated even in Germany - is entirely erroneous and without any foundation.

Budapest, December 2 JULIUS LETHÖ

Blackflies on the World Wide Web

A Web site devoted entirely to Blackflies has been opened on the World Wide Web, with the URL: **www.blackflies.org.uk.**

These pages are intended to act as a hub with links to information pages and other web sites of similar interest. They will be updated periodically as more information becomes available. Please visit the site, and if you have any suggestions as to content, or useful links, or wish to contribute, please e-mail me at

author@blackflies.org.uk

John Davies

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APPENDIX

British Blackfly Records

County

Collector:

Sample date:

Address:

National Grid Reference Number:

Site/river/stream name:

Occupied Substrate (tick):	weed	stones	trailing grass	trapped debris	Other (specify)
larvae					
pupae					

Identity checked: **(Yes / No)**
Sent for checking to: **(Date:)**
Material returned: **(Date:)**

Species or species group present:

indicate stage: larvae (lar) / pupae (pup) + associated adult (ad) and D - dominant; C - co-dominant or P - present

eg: ornatum gp		lar/pup	D/C/P	Notes
	1			
	2			
	3			
	4			
	5			
	6			

Contents Number 15, June 2000

From the Editor

As this is the first number to be published in the year 2000, I suppose we should follow the trend and call it our “millennium number”. The content differs from previous issues in that the June number has never before contained reports of our Annual Meeting, but much more significantly, it contains the first ever contribution in the French language offered to us by a new member from Morocco. So here is a challenge to all members - no more can you hide behind the excuse that your English is not good enough. Contributions in any EEC accepted language will now be considered. Finally, my thanks to Frank Walsh for his report on the afternoon session of our Annual Meeting.
John Davies

The 23rd annual meeting of the British simuliid group

In a break with tradition, the meeting was held in the spring instead of in the second half of the year, so that members would have a chance to collect specimens to bring along to the simuliid identification workshop. It took place on 12 April 2000 at the Division of Biological Sciences, University of Salford, and was organised by Sabine Kläger assisted by Stan Frost. The evening before, those of us who were near to Salford, met at the Kailash Nepalese Restaurant for a most pleasant social get-together.

The meeting began with coffee at 10.00am and was then formally opened by Professor P. Craig, Head of the Division of Biological Sciences, who congratulated us on achieving 23 consecutive meetings, and greeted some familiar faces from his days at Liverpool. Twelve members were present. The serious part of the meeting began with an update on the numbers of taxa and names of Simuliidae in the year 2000 by Roger Crosskey, a description of the possibilities of plotting species and collection distributions by means of computer programs such as Dmap by John Davies, followed by a talk on modelling vector dynamics and onchocerciasis by Maria-Gloria Basáñez.

In the short business session which followed, it was proposed that because the 1995 joint meeting with the freshwater biologists at Birmingham University had been so successful, the Hon. Secretary should approach Malcolm Greenwood at Loughborough or Melanie Bickerton at Birmingham to see whether a similar joint meeting could be set up for next year.

Following a pleasant lunch break in the bar of the Staff House several of us visited the small exhibition of Lowry works in the Salford Art Gallery before returning for coffee and tea and in the lecture theatre. There Jon Bass, expertly using the over-head projector, gave a brief introduction to simuliid larval morphology. Among items covered were the cervical sclerites characteristic of *Prosimulium* species, the use of the name *rectal organ* in preference to *anal gill*, and the shrinkage of rectal organs and anal papillae which can occur in preserved material.

We then moved to a laboratory equipped with Wild dissecting microscopes where Jon had provided a collection of larvae and pupae of about 20 species/species groups, together with some undetermined material. In addition, several people had brought recently collected material for determination. The pointed microtubercles on the thoracic cuticle of *Simulium triifasciatum* were shown on screen via a micro projection apparatus. Some of us then proceeded, with varying degrees of success, to use Jon's recently published key to larvae and pupae, on sale at the meeting, beautifully produced and a snip at £14,50 from the Freshwater Biological Association. Those of us seriously out of touch had the advantage of Jon's guiding hand, while the sages chatted to one another. This laboratory session was very helpful and gave further evidence that the members of the BSG could make a valuable input to mapping simuliid distribution in the British Isles. Shortly after 4.00 p.m. we retired for cups of coffee and tea before departing on our various journeys home refreshed, not only by the drinks, but also by a pleasant day spent in the company of fellow enthusiasts.

We are most grateful to Sabine Kläger, Stan Frost who arranged the meeting and the several technicians who made equipment available. Thanks also go to Professor Craig for hosting the meeting in his department at Salford.

Abstracts of Meeting Presentations

How many blackfly species on reaching the year 2000?

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In 1985 I succumbed to a request from the organizers of the international blackfly meeting held in May that year at Pennsylvania State University to provide a talk on "The future of blackfly taxonomy". The upshot was a chapter of this title in the Kim & Merritt book, published on lst March 1988, in which (inter alia) I charted the cumulative growth of blackfly species description and formal naming - and tried my hand at soothsaying by extrapolating the line from 1450 species listed as valid in 1984 to “? 1950!” as the number of species that might pertain by 2000. Was this a reasonable estimate? To answer this, here is a revised cumulative chart (Figure 1) and some updating statistics. (The original chart attempted to include recognized but unnamed cytospecies: these are not considered here but it can be said that the dotted line for these has certainly dipped well below the projected take off because of the relative demise of cytotaxonomy in the past dozen years or so.)

The number of species listed valid rose from 1450 in 1984 to 1670 by the end of 1996 and 1720 by the end of 1998 (sources: Crosskey & Howard 1997; Crosskey 1999). It is now 1740 at the start of year 2000 (Crosskey ongoing database). Currently, anyone wanting to state how many species of the Simuliidae there are should take 1750 as the ballpark figure.

A quick eyeballing of the chart suggests that the projected possible figure of 1950 species at year 2000 was close to the mark, because adding the new species described in the 1980s (272) and 1990s (209) to the 1450 figure in the Kim & Merritt book gives a total of 1931 species. However, there is a profit and loss account and this total does not actually apply because many species names that had previously to be listed as valid have proved to be synonyms. Hence there is a considerable discrepancy between the 1740 valid species figure pertaining now and the 1900+ figure that would have applied if no new synonyms had been established in the past fifteen years. This is the reason for most of the gap between the projected line (broken) and the actual line.

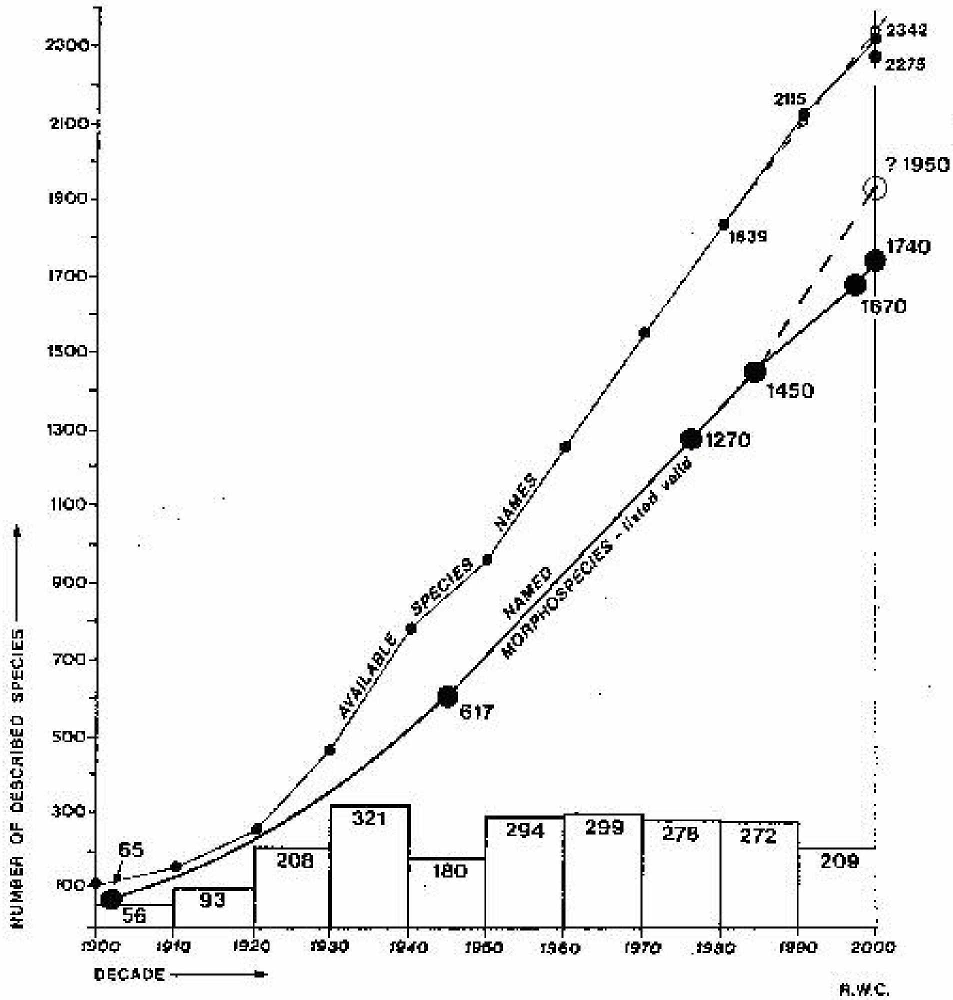

Figure 1. Chart showing the cumulative growth in the description and formal naming of species of blackflies (Simuliidae). Numerals by large black dots on the thick line show the number of species listed as valid at the date concerned. Sources: Kerteszls Diptera catalogue 1902 (65); Smart's simuliid catalogue 1945 (617); Crosskey's chapter in Laird book 1981 (1270); Crosskey's checklist in Kim & Merritt book 1988 (1450); Crosskey & Howard's world inventory, 1997 (1670); world database at Natural History Museum, London as at 1 January 2000 (1740).

Since all properly proposed new species names are available, i.e. can be legitimately used for species irrespective of their accepted validity at any particular time, the line showing the total number of species names has risen along with the valid species total. In all, 2275 nominal species* have been described from Linnaeus onwards to the start of year 2000, as can be seen by summing from the chart the 65 species total applying up to year 1900 and the ten individual decade totals. The total of all available species names is 2432; the difference between this figure and the described species total represents substitute names published for junior homonyms.

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* Technically coordinate 'species-group taxa' in the sense of the *International Code of Zoological Nomenclature* as subsumed as if species are the few subspecies and pre-1961 varieties.

Plotting *Simulium* distributions with Dmap

John Davies *Liverpool School of Tropical Medicine, Pembroke Place, Liverpool L3 5QA, UK. daviesjb@liv.ac.uk*

The situation map of collections of Simuliidae in Great Britain published in Bulletin No 9 (July 1997) was compiled by Henry Arnold of the Biological Records Centre at Monks Wood using the Dmap computer mapping program from data provided by Jon Bass, using personal and Institute of Freshwater Ecology records, and those supplied by Roger Crosskey, which included records at the BM. Dmap accepts data in the form of a list of National Grid references or Latitude and Longitude co-ordinates and will plot a symbol at the corresponding location or grid square on an outline map of the country. The data is simply a list in the form of a word processor document with the grid references listed thus: HU39 HY33 NB00 NB03 .... for 10Km grid squares, or SU5273 SU4778 SU3586 ... for 1 Km squares.

Some examples were shown of the IFE and Crosskey records plotted separately using different symbols for each. By means of other commonly available graphics programs such maps may be overlaid to show two or more sets of records on the same map. This was demonstrated for the IFE/Crosskey data sets and for 4 species taken from the maps in Lewis Davies's 1968 Keys. (A Key to the British Species of Simuliidae (Diptera) in the Larval, Pupal and Adult Stages. Freshwater Publication No. 24, 1986).

Modelling onchocerciasis in settings where vectors have a cibarial armature: a research problem

M.G. Basáñez *Wellcome Trust Centre for Epidemiology of Infectious Disease (WTCEID), Department of Zoology, University of Oxford, Oxford OX1 3FY, UK, and Centro Amazónico para Investigación y Control de Enfermedades Tropicales (CAICET), Puerto Ayacucho, Amazonas, Venezuela.* [*E-mail: maria-gloria.basanez@ceid.ox.ac.uk*]

This talk discussed a simple analytical model for the population biology of *Onchocerca volvulus* when the vectors lack or possess a well-developed cibarial armature. The main regulatory constraints to parasite population abundance were: a) parasite establishment in the simuliid vector (limitation or initial facilitation); b) parasite-induced vector mortality, and c) parasite establishment in the human host (limitation or asymptotic proportionality) depending on the annual transmission potential (ATP). The model was parameterised for West Africa and Guatemala/ Mexico using experimental results (flies) and epidemiological data in endemic communities (humans) in settings where, respectively, main vectors were savanna *Simulium damnosum* s.l. (unarmed) and *S. ochraceum* s.l. (armed).

For West African settings, the model satisfactorily described pre-control infection intensity and prevalence when density-dependence was assumed to operate both in simuliids and humans, although best results were obtained when constraints within the human host were weak (suggesting absence of solid protective immunity, see Basáñez & Boussinesq, 1999). In these settings, the proportion of blood-meals taken on humans (h) was considered to range from 0.10 to 0.99 (being lower for Cameroon and higher for Burkina Faso and Côte d'Ivoire). By contrast, results for Central American settings required a dramatic reduction of the parameters describing vector competence given the very high biting rates recorded in Guatemalan and Mexican localities. The model-derived parameters showed little agreement with vector competence estimates obtained from fly-feeding experiments. When the relationship was analysed between mean microfilarial load in the village and ATP, there was a good non-linear fit for all villages regardless of vector species, whereas when the relationship between the former and annual biting rate was explored, villages segregated into two clusters (Figure 1). West African savanna localities required a lower threshold biting rate for stable endemicity (roughly 1,000 bites/person.yr, depending on anthropophily) than their Central American counterparts (roughly 10,000 bites/person.yr, with human-blood index varying between 0.25 and 0.99). The experimental data had suggested a 10-fold difference in vector competence between *S. damnosum* s.l. and *S. ochraceum* s.l. .

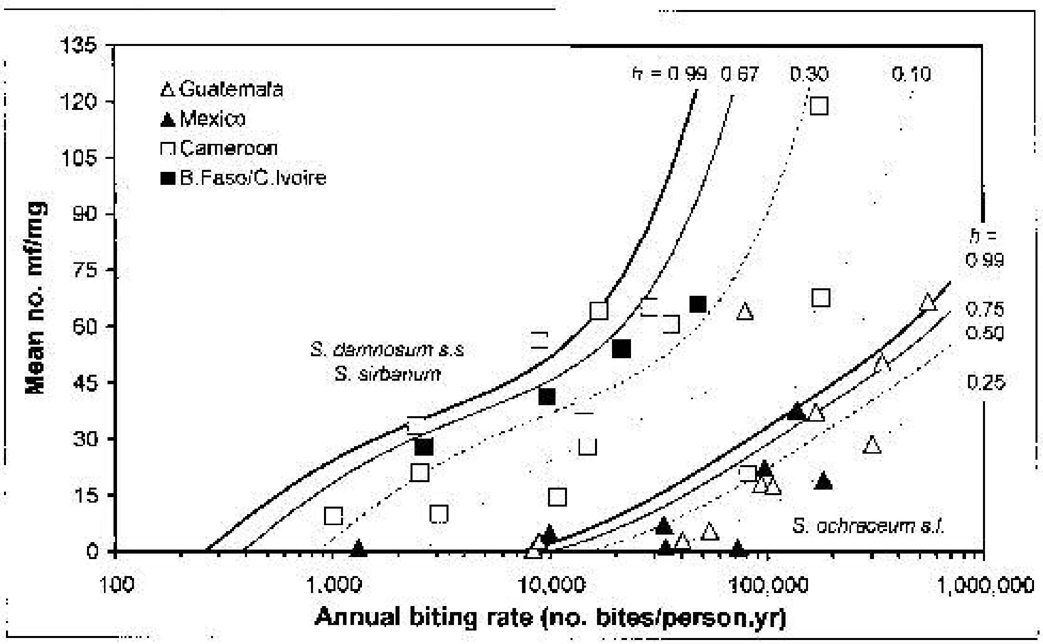

Figure 1. Relationship between pre-control community microfilarial load and annual biting rate in settings where vectors are unarmed (*S. damnosum* s.l. = squares), and armed (*S. ochraceum* s.l. = triangles). The lines represent model outputs with varying h = human-blood index

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This research problem was presented to the attendants of the meeting who suggested the following explanations: a) greater uncertainty in Central America with respect to biting rate estimates due to very high vector densities; b) possible existence of various cytotypes in the biting populations of *S. ochraceum* s.l. with varying degrees of vector efficiency; c) higher than estimated mortality rates in the field; d) density-dependent feeding success, and e) lack of updated estimates for the origin of vector blood-meals. These aspects will be taken into account in future versions of the model This research problem was presented to the attendants of the meeting who suggested the following explanations: a) greater uncertainty in Central America with respect to biting rate estimates due to very high vector densities; b) possible existence of various cytotypes in the biting populations of *S. ochraceum* s.l. with varying degrees of vector efficiency; c) higher than estimated mortality rates in the field; d) density-dependent feeding success, and e) lack of updated estimates for the origin of vector blood-meals. These aspects will be taken into account in future versions of the model

MGB acknowledges the Wellcome Trust for financial support.

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Basáñez, M.G. & Boussinesq, M. (1999). Population biology of human onchocerciasis. *Phil. Trans. R. Soc. Lond.* **B** 354, 809-826.

Abstracts of Posters Presented at the Meeting

Aspects of the Vectorial Competence of Onchocerciasis Vectors in the Amazonian Focus of Southern Venezuela before and during Ivermectin Distribution

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A positive association between altitude and microfilarial prevalence has been reported in the Amazonian onchocerciasis focus of southern Venezuela (Vivas-Martínez et al. 1998). This association could be partially explained by clinal variation in the *Simulium* species composition, abundance, and vectorial efficiency along the altitudinal gradient (Grillet et al. 1998). *Simulium oyapockense* s.l. prevails in the lowlands (<150 m asl) whilst *S. incrustatum* and efficient vector *S. guianense* s.l. occur above this altitude (Basáñez et al. 1988, 1995).

To provide entomological support in favour of the clinal hypothesis of prevalence, the susceptibility of these 3 species to experimental infection with microfilariae (mf) of *Onchocerca volvulus* was investigated. Four meso- to hyperendemic Yanomami sentinel communities (Maweti, Mahekoto, Aweitheri and Pashopeka) of the ongoing control programme in southern Venezuela were selected. Flies were collected before and 1 to 6 mo. after the first dose of mass ivermectin treatment. The location of the communities can be found in Vivas-Martínez et al. (1998).

In each community, flies were fed on *O. volvulus* carriers whose Mf loads were classified into Type I (2-20 mf/mg), Type II (21-60), and Type III (61-140). A tenth of the total no. of flies fed on each carrier were dissected 8-10 hr post-engorgement to assess mf intake, damage by the cibarial armature, and establishment in the thoracic muscles. Remaining insects were maintained alive for about one week until completion of the extrinsic incubation period (EIP) They were then fixed in alcohol, stained with Mayer's haemalum and dissected in glycerine. Successful larval development at the end of EIP is shown as percentage of flies with L3 larvae (Pinfective, Table 1).

Endemicity (+ ↓)

Community	mf	sp	Pre-ivermectin No. flies	Pre-ivermectin Mean no. mf/fly (range)	Pre-ivermectin $P_{infective}$ (%)	Post-ivermectin[a] No. flies	Post-ivermectin[a] Mean no. mf/fly (range)	Post-ivermectin[a] $P_{infective}$ (%)
Maweti	I	*So*	262	6 (0-49)	0	568	0.4 (0-9)	0.2
Mahekoto	I	*So*	212	5 (0-27)	0	-	-	-
"	II	*So*	157	17 (0-162)	1	184	5 (0-53)	0
"	III	*So*	394	63 (1-274)	0	331	0	0
Aweitheri	I	*So*	24	-	0	-	-	-
"	I	*Si*	146	2 (0-26)	1	-	-	-
"	II	*So*	56	58(14-136)	4	91	0	0
"	II	*Si*	167	21 (0-101)	4	94	0	0
"	III	*So*	170	65(10-236)	2	131	64(0-238)	2
"	III	Si	159	50 (2-165)	3	24	31 (0-151)	1
"	III	*Sg*	15	-	0	8	-	10
Pashopeka	I	*So*	72	6 (0-9)	1	188	0.04 (0-1)	0
"	I	*Si*	143	20 (0-130)	1	116	-	0
"	I	*Sg*	30	34 (6-62)	7	-	-	-
"	III	*So*	43	44(35-52)	5	76	0	0
"	III	*Si*	70	58 (3-377)	6	52	-	0
"	III	*Sg*	25	-	12	54	-	1

[a] In Maweti and Mahekoto: 6 mo. post-ivermectin; in Pashopeka and Aweitheri: 1 mo. post-ivermectin
(-) Not determined

The mean no. of mf/fly was positively associated with the mean no. mf/mg of the carriers, with Spearman rank correlation coefficient, rS = 0.83 (P <0.05) for *S. oyapockense* s.l. and rS = 0.60 (P =0.04) for *S. incrustatum*. The proportion of mf damaged by the cibarial armature of *S. oyapockense* in mesoendemic communities (Maweti and Mahekoto) was higher than that in the hyperendemic localities (Aweitheri and Pashopeka), and the former values were also higher than those recorded for *S. incrustatum*. Larval development was successful in the 3 simuliid species, with higher Pinfective in *S. guianense* than in *S. oyapockense* and *S. incrustatum* (sample sizes of *S. guianense* were too small to analyse). Also, Pinfective increased with endemicity level and individual mf load. The ability of patients to infect feeding flies 1 and 6 mo. after the first dose of ivermectin treatment was reduced, as post-ivermectin experimental infections were mostly, but not all, negative.

Conclusions: *S. oyapockense* s.l. and *S. incrustatum* may contribute to onchocerciasis transmission in the Amazonian onchocerciasis focus of southern Venezuela. Their vector competence is lower than that of *S. guianense* s.l. However, there is a trade-off between the low vector competence of *S. oyapockense* s.l. and its high biting rate at lower altitudes (Grillet et al. 1998) that determines its role in hypo- and mesoendemic levels in the focus. In those hyperendemic areas located between 150 and ~200 m asl, both *S. guianense* and *S. incrustatum* play a vectorial role. The former because of its high vector competence albeit lower abundance; the latter because of moderate abundance but possibly higher survival rates (Basáñez et al. 1998). As these species are themselves distributed along the altitude gradient described earlier, our results provide entomological support to the clinal hypothesis of onchocerciasis prevalence. The data also corroborate the efficiency of ivermectin in reducing levels of *O. volvulus* mf available to the blackfly biting population, although issues of coverage, compliance, and treatment failure cannot be overlooked.

This study was supported by the World Bank, PAHO, and the Wellcome Trust.

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Pre-ivermectin Entomological Indices in the Onchocerciasis Amazonian Focus of Southern Venezuela

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In onchocerciasis, the degree of human-vector contact (measured by biting rate on humans) and the transmission intensity (measured by annual transmission potential or ATP) are important factors determining endemicity, intensity of infection, and morbidity in affected communities. Mass distribution of ivermectin, by reducing the skin microfilarial (mf) reservoir of *Onchocerca volvulus* in treated populations, should produce progressive decrease of entomological infection indices. Impact of ivermectin in the Amazonian focus of southern Venezuela has been measured through experimental infection of flies fed on mf carriers before and after 1 treatment dose (Grillet et al. this volume). This permits estimation of the ability of treated individuals to provide infecting blood-meals to vectors. Here we present preliminary data on natural infection rates of such vectors before the start of control which will provide a baseline against which to monitor treatment impact.

Flies that landed to bite on humans were collected in 6 sentinel communities of the southern Venezuela onchocerciasis control programme, comprising the 4 villages of the previous communication plus Niyayowë and Coyowë. In each community, and during 3-8 consecutive days covering dry -D- or rainy -R-seasons. Blackflies were caught during the first half hour of each hour from 7:00 to 18:30 hr. Parity was evaluated in the field. The remains of the flies were preserved in alcohol for further staining, dissection, and assessment of infection with

Locality (altitude)	Year (Season)	*sp*[*]	Total flies	Parity	P_i (%)	ABR	No. L3 / fly	ATP	Mf / mg	Prevalence (%)
Altamira (800 m)	1990 (all yr)	*S m* *S e*	6,230 1,444	ND[¶] ND	0.03 -	265,096 44,074	0.0003 -	85 -	8.3	18.9
Maweti (140 m)	May 1995 (D → R)	*S o*	8,878	0.76	0.05	648,240	0.0016	259	3.3	28.0
Pashopeka (240 m)	June 1995 (R)	*S i*	471	0.55	0.00	71,248	-	-	25.4	79.8
"	Jan 1997 (D)	"	943	0.47	0.21	136,145	0.0021	289	"	"
Aweitheri (162 m)	June 1995 (R)	"	461	ND	0.00	250,025	-	-	64.7	66.8
"	July 1997 (R)	"	1,137	0.68	0.00	144,905	-	-	"	"
Pashopeka (240 m)	June 1995 (R)	*S o*	71	0.61	1.41	9,052	0.0100	91	25.4	79.8
Aweitheri (162 m)	June 1995 (R)	"	58	ND	0.00	20,057	-	-	64.7	66.8
"	July 1997 (R)	"	515	0.61	0.00	112,420	-	-	"	"
Pashopeka (240 m)	June 1995 (R)	*S g*	67	0.57	0.00	9,709	-	-	25.4	79.8
Aweitheri (162 m)	June 1995 (R)	"	29	ND	0.00	13,870			64.7	66.8
"	July 1997 (R)	"	207	0.56	0.00	31,390	-	-	"	"
Niyayowë (950 m)	1985-1987 (D + R)	*S g*	4,368	-	0.62	128,480	0.0105	1,349	66.5	77.5
Coyowë (250 m)	1985-1993 (D + R)	*S g*	7,697	0.62	0.48	294,592	0.0138	3,888	63.6	77.1

[*]*S m* = *S. metallicum s.l.*; *S e* = *S. exiguum*; *S o* = *S. oyapockense s.l.*; *S i* = *S. incrustatum*; *S g* = *S guianense s.l.*
[¶]ND = not determined

Table 1. Pre-ivermectin entomological indices in the Amazonian onchocerciasis focus of southern Venezuela (Altamira is in the northern focus) D: dry season, R: rainy season D→R transition between dry and rainy seasons.

O. volvulus larvae. These are compared with 1990 data from the Altamira locality of the Venezuelan northern focus. Age- and sex-adjusted prevalence of irreversible ocular lesions (sklerosing keratitis, choroidoretinitis, iritis, and optic nerve damage) and their relation to ATP were calculated from reports of ophthalmological consultancies (Onchocerciasis Elimination Programme for the Americas) and published records.

For each locality, collection season or year, and blackfly species the following entomological indices were quantified for the total no. of flies (not just the parous flies),

$$\text{Parity rate} = \frac{\text{No. parous flies}}{\text{Total No. flies}} \qquad (1)$$

$$P_I = P_{infective}\,(\%) = \frac{\text{No. infective flies x 100}}{\text{Total No. flies}} \qquad (2)$$

ABR = Annual biting rate = No. bites/person . yr

$$\text{Mean No. } L_3\text{/fly} = \frac{\text{Total No. infective larvae } (L_3)}{\text{Total No. flies}} \qquad (3)$$

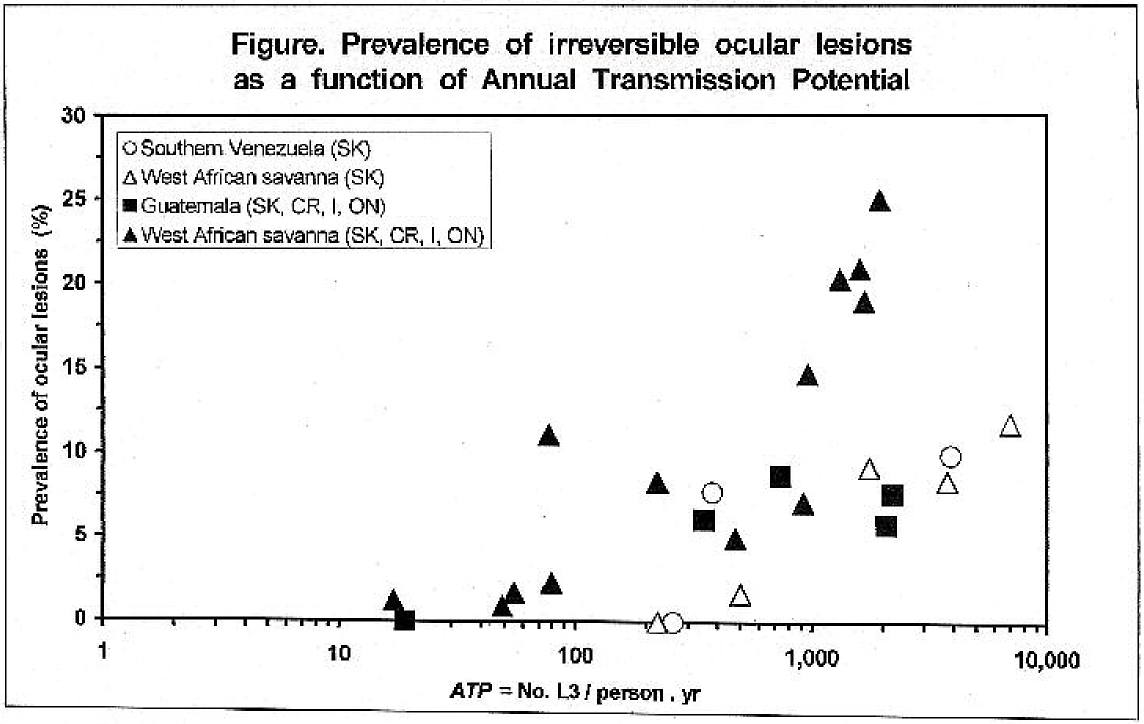
ATP = Annual transmission potential = No. L_3/person . yr

$$\text{ATP} = \text{ABR x Mean no. } L_3 \text{ larvae/fly} \qquad (4)$$

Results are summarised in Table 1. In the Amazonian focus, the number of. L_3/fly in species with a well-developed cibarial armature (*S. oyapockense* s.l. and *S. incrustatum* s.l.) was, of an order of magnitude lower than that of species lacking such an armature (*S. guianense* s.l.). *S. metallicum* s.l. and *S. exiguum* s.l., also with unarmed cibarium, but from Altamira showed low infection rates

The results agree with data from Guatemala/Mexico (*S. ochraceum* s.l. / *S. metallicum* s.l.) and West Africa (*S. damnosum* s.l.). The pre-control ATP's recorded for the Amazonian focus are comparable to West African savanna pre vector control levels. The higher ATP's corresponded to *S. guianense* (high vector competence). But the high biting rates of blackflies with lower vector competence (*S. oyapockense*, *S. incrustatum*, and *S. metallicum*), may compensate for the low L_3/fly, and generate levels of transmission compatible with recorded endemicity.

The Figure below shows the prevalence of irreversible ocular lesions against ATP for localities in West African savanna, Guatemala, and southern Venezuela, and confirms the threshold of ~100 L3/person.yr for severe ocular onchocerciasis. In the Amazonian focus, where >70% of villages are hyperendemic, this level of ocular severity corresponds to a community mean of 20 mf/mg and mf prevalence >60%. These results may provide a starting point for the identification of transmission and morbidity thresholds to be considered in the regional guidelines for elimination criteria.



SK = sclerosing keratitis; CR = choroidoretinitis; I = iritis; ON = optic nerve atrophy

This study was supported by the Wellcome Trust, the British Council Academic Link Programme, the World Bank, and PAHO.

Simulium's innate immune system: involvement of cytotonic haemocytes?

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Recorded by title only

Scientific Contributions

Découverte de *Simulium (Obuchovia) galloprovinciale* et *Simulium (Obuchovia) auricoma*: deux nouvelles espèces pour le Nord de l'Afrique

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Le sous-genre *Obuchovia* Rubtsov est un taxon caractéristique de la faune Simulidienne des massifs montagneux dont les limites de distributions s'étendent du Sud-Ouest d'Europe jusqu'en Asie centrale.
Les espèces d'*Obuchovia* affectionnent les cours d'eau violents. Ainsi, à l'état pré-imaginal elles sont cantonnées dans les cascades. Les nymphes possédant 6 filaments respiratoires sont enfouies dans un cocon caractéristique à talon très prononcé et solidement accrochées à la surface des roches où elles donnent l'impression d'une masse argentée.

Les larves et les adultes sont très difficiles à différencier tellement ils se ressemblent. Néanmoins, les principaux caractères discriminatifs sont fournis par les caractères nymphaux tels que, la forme du cocon, la structure (rugosité) du tégument de la face dorsale du thorax et du capuchon céphalique et enfin, de la disposition et de l'aspect des filaments respiratoires.
A l'état actuel de nos connaissances, une seule espèce, *Simulium (Obuchovia) marocanum* Bouzidi et Giudicelli 1988 est connue dans le Nord de l'Afrique (principalement, dans le haut Atlas Marocain). Elle a été récoltée au Maroc dans deux localités :

7. Dans le Massif du Rif : oued Bou Adel, affluent de la rive gauche de l'Oued Ouerha.
8. Dans le massif du Haut Atlas : un petit affluent temporaire du Rdat, près de la route qui conduit de Marrakech au col de Tischka.

Au cours de nos prospections entomologiques effectuées dans le massif Rifain Nord marocain, nous avons trouvé deux autres espèces appartenant au sous-genre *Obuchovia*: *Simulium (Obuchovia) galloprovinciale* Giudicelli 1963 et *Simulium (Obuchovia) auricoma* Meigen 1818 élevant à trois le nombre d'espèces du sous-genre *Obuchovia* au Maroc.

Ainsi, ces deux nouvelles citations élargissent considérablement l'aire de distribution jusqu'en Afrique du Nord d'espèces qui n'étaient connues jusqu'à présent qu'en Europe continentale et que je détaille dans cette note.

Répartition au Maroc

Simulium (O.) auricoma:

Cette espèce a été récoltée en quatre stations situées sur la côte méditérranéenne, dans la province de Chaouen (Figure).

9. Oued Aarkôb,100m, localité Arherarose, 35°16'22''N;4°50'12''W le 17-XI-1997: 1 nymphe. le 27-IV-1998: 44 nymphes. le 15-IV-1999: 11 nymphes
10. Oued Sidi Yahya Aârab, 80m, localité Sidi Yahya Aârab, 35°17'33''N;4°53'25''W le 5-III-1998: 2 nymphes. le 27-IV-1998: 1 nymphe
11. Oued Jenane en Nich, 60m, localité Jenane en Nich,35°16'29''N;4°52'01''W le 27-IV-1998: 1 nymphe. le 15-IV-1999: 1 nymphe
12. Oued Amazithen, 80m, localité El Ouesteyine,35°18'33''N;4°54'36''W le 27-IV-1998: 1 nymphe. le 15-IV-1999: 4 nymphes

Simulium (O.) galloprovinciale:

Les récoltes de cette espèce ont eu lieu dans l'une des stations côtières pré - citées (Oued Aarkôb) et dans une petite cascade de la rivière Nakhla située dans la péninsule tingitane (fig.1).

13. Oued Aarkôb le 27-IV-1998: 5 nymphes. le 15-IV-1999: 2 nymphes
14. Oued Nakhla, 80m, localité koudiet Krikra, province de Tétouan, 35°27'09''N ;5°25'29''W le 12-XI-1998: 4 nymphes. le 3-V-1999: 7 nymphes

Répartition ailleurs

La répartition du sous genre *Obuchovia* dans les pays voisins d' Europe se présente comme suit :

Simulium (Obuchovia) galloprovinciale,

En **France** : Elle a été trouvée dans un petit cours d'eau, le Baillon, qui se jette dans l'Arc, dans la région d'Aix-en-Provence (Bouches -du -Rhône). Et dans le ruisseau du Gaudin qui se jette dans la rivière de Caramy. En **Espagne,** cette espèce a été recensée dans la rivière Guadalquivir, en Andalousie. En **Italie**, elle a été trouvée dans diverses localités telles que la rivière Tronto dans la vallée de Gole di Arquata (Marche), dans le torrent Castellano et son affluent, et dans les torrents Salinello et Chiarino.

Simulium (Obuchovia) auricoma

Quant à elle a été décrite d'**Autriche** puis trouvée en **France** (Vosges et Pyrénées et Corse (la vallée de Restonica) . En **Italie** cette espèce a été récoltée dans différentes localités aussi : dans un torrent situé dans la province de Latina, dans la rivière Tronto (gole di Arquata), dans les vallées Staffora et Trebbia et enfin dans le Mont Sibillini (cascade gole di Pioraco). L'espèce a aussi été signalée en **Yougoslavie.** Elle a été trouvée aussi dans le nord du **Portugal** et en **Espagne** (Catalonie),

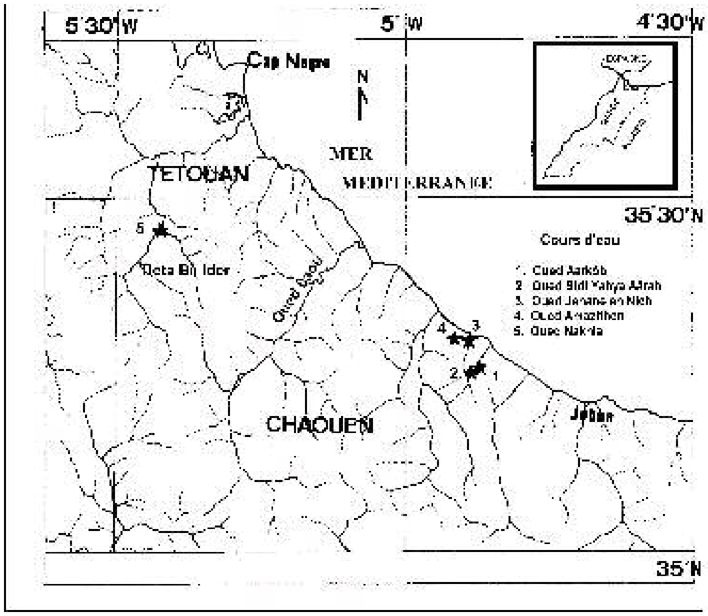

Figure 1. Répartition de *Simulium (Obuchovia) galloprovinciale* Giudicelli et *Simulium (Obuchovia) auricoma* Meigen dans le Rif. (Maroc) (★).

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la **Tchécoslovaquie**, la **Bulgarie**, l'**Allemagne**, du **Liban**, les Isles de **Grèce** et l'ile de **Chypre**.

Remerciements:

J'adresse mes remerciements au Dr. R. W. Crosskey pour avoir examiné mes spécimens et pour m'aider dans mes déterminations.

Références:

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Giudicelli J.1963. *Simulium galloprovinciale* n. sp. (Diptera, Simuliidae), une Simulie nouvelle du groupe *auricoma*. Comparaisons avec les espèces du genre *Obuchovia* Rubzov, 1951. *Bulletin de la Société de Parasitologie exotique.* 55 (5) (1962): 882-892.

NOTES, VIEWS AND CORRESPONDENCE

A curious abnormality of the male genitalia in *Simulium* s. str.

Simulium s. str., the largest subgenus of *Simulium* s.l., is a northern hemisphere taxon in which the male genitalia have long heavy styles that exceed the coxites in length and that lie horizontally and parallel to one another. Style shape, especially the sinuosity of its outline and the degree of development of an inner basal swelling or tooth, varies between species but the bluntly rounded form of the style tip is very uniform; a typical style is shown in Figure lc. Given the well known constancy of apical form shown by the styles in the many species of *Simulium* s str it was a surprise to come upon a specimen of the subgenus in which the ends of the styles are malformed, slightly inflated and flared out in the dorsoventral plane to two moderately sharp points (Figure la and ib); another aspect of the abnormality is that the left and right styles are not fully symmetrical, the left one as the hypopygium is orientated on the fly (right one in the illustration) being more drawn out to the tip and less strongly splayed into definite points. The usual apical spinule of each style is more or less aborted. All structures of the hypopygium other than the styles are entirely normal. The specimen concerned is a pharate adult male of *Simulium (Simulium) monticola* that I found whilst identifying my material from the Sierra Nevada in Andalusia. The collecting data are: Spain, Granada Province, RÍo Trevélez at Trevélez, 1400 m, UTM Grid 10 km square VF7696, 22.iii.1996 (Crosskey), male pupa/pharate with separate removed and undissected hypopygium in alcohol microvial (Natural History Museum, London).

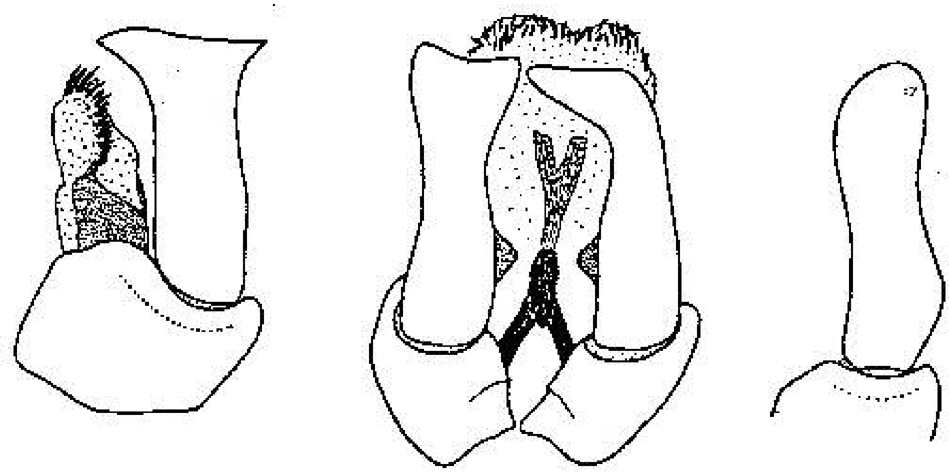

Figure 1. Male hypopygium of a specimen of *Simulium (Simulium) monticola* with aberrant styles, in right lateral view (**a**) and ventral view (**b**), and, for comparison, a typical style (**c**) in the subgenus *Simulium* s. str. (**c**).

The aberrant hypopygium was sent to Peter Adler to be seen by a second pair of experienced eyes and I am grateful to him for his comments. Neither of us has seen such an abnormality before or knows of a literature reference to anything similar.

Roger W. Crosskey

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BRITISH SIMULIID GROUP BULLETIN NO. 16, DECEMBER 2000

Contents **Number 16, December 2000**

FROM THE EDITOR

Because our last meeting was held in the first half of the year and was reported in Bulletin No. 15 (June 2000), this December number contains only one meeting poster report which could not be included with the others due to lack of space. Instead we have a mixed bag of articles including probably the last published work of Edward Newman, originator of the order name 'Simuliidae', a Travellers' Tale from Iceland, and sadly, a memorial note to Mmme Françoise Beaucornu-Saguez. Lastly, a new development in the Blanford Fly saga. Again my thanks to those who have sent in contributions - keep them coming!

John Davies

NEXT MEETING

Trefor Williams reports that he has approached Melanie Bickerton who has responded that they would definitely like to hold the next BSG Meeting at Birmingham. Dates etc. not yet decided.

POSTER PRESENTED AT THE 23rd ANNUAL MEETING

S*imulium*'s innate immune system: Involvement of cytotoxic haemocytes?

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Onchocerca microfilariae upon entering the haemocoel of *S. damnosum* are killed and cleared in an effective and species-specific manner. Interestingly, unlike other insects, blackflies do encapsulate and/or melanise the parasites during their initial immune response. This fast removal of vast amounts of cells, i.e. microfilariae, without any signs of an “inflammatory” reaction, are the hallmark of apoptosis. Experiments have been carried out using caspase inhibitors and an *in situ* cell death detection assay (TUNEL) which demonstrates that microfilariae die due to elevated levels of apoptosis. Moreover it seems that this induction of apoptosis is mediated by serine proteases of the blackfly. Additional *in vivo* experiments using the peptide RGDS as an inhibitor for putative integrin-like receptors have revealed that in the presence of this peptide survival of microfilariae in its vector *S. damnosum* is enhanced. This is the first indication that haemocytes are involved in the killing of the parasite, and that this killing is receptor-driven. These findings have led to the hypothesis that microfilariae might be killed by Natural Killer-like haemocytes which patrol the haemocoel.

NOTES, VIEWS AND CORRESPONDENCE

Edward Newman on *Simulium* in 1876

The article which follows was, I understand, unearthed by the Librarian at the Natural History Museum and passed to Roger Crosskey who forwarded it to me. Edward Newman is of interest to simuliidologists as he was the originator of the name Simuliidae (1834) (as order Simuliites) in his "Attempted division of British insects into natural orders" (*Entomological Magazine* 2: 379-431, 1843), while he had discussed blackflies in his "Grammar of Entomology" of 1841. This article is taken from "*The Field, The Country Gentleman's Newspaper*" of May 13th, 1876 and was stimulated by a response to a query in the Correspondence columns. I find it a fascinating read with some wonderful English. It sets out the perceived knowledge of blackfly biology at the time with some interesting inaccuracies, but the narrative frequently digresses into criticisms of his contemporaries with phrases such as "our leaders and teachers often turn us aside when in the earnest pursuit of knowledge" and "[the works of] older naturalists in their careful and elaborate folios and quartos, which find no parallel among the hasty and superficial productions of the present day". There is also the random use of the terms 'gnats', 'sandflies' and 'mosquitoes' while the name blackfly was apparently not yet in use.

Sadly, Newman died on 12 June 1876, just 4 weeks after this article was published, and *The Field* of June 17th 1879 carried his obituary.

The article is reproduced with the original spelling and formatting.

LIFE-HISTORY OF THE SANDFLY OR SIMULIUM
By EDWARD NEWMAN

The occurrence of the sandflies or Simulium reptans in Britain, recently noticed in an answer to a correspondent in Scotland (A.B.H.), is not new. From time to time members of this genus of flies have cropped up in different parts of Great Britain and Ireland, have crawled over our skins by day, and have produced an intolerable sensation of titillation. The gnats or Culices have done the same on many a sultry summer night, and have added injury to insult by piercing our eyelids and inserting a siphon with which to extract a drop of blood, often leaving a swelling that lasts for several days, sometimes to such an extent as even to close the eye and produce an effect anything but pleasant to the proprietor, and eliciting observations from the spectator that are always uncomplementary if not offensive. The culprit is not unfrequently captured in the act, and taken red-handed to some very scientific man, who pronounces it a "true mosquito" an insect with which he is perfectly familiar, having suffered from its bites in the West Indies or Australia, in Cape Colony, or some other far distant locality, where he has perchance sojourned, or of which he has unquestionably heard: he will forthwith write to the local paper, and record the phenomenon in all its sensational details. Thus originates a little panic, which is fanned into flame by being copied from paper to paper, the culprit often being multiplied into "immense swarms" and the narrative being always accompanied by some advice for their extermination; consequently everyone is anxious to exhibit a true mosquito, and all "clever people" are eager to master this branch of scientific law.

Now a mosquito is a myth, a ghost, an idea, the chameleon, a bugbear, and yet it must be shown, in order to substantiate all the allegations that have been made respecting it; so gnats and flies, of all kinds, sizes, shapes, and colours, are impounded, crushed, and exhibited as the real Simon Pure, to the edification of the learned, the confusion of the ignorant, and the great comfort of the exhibitors. The particular insect which your correspondent has sent participates in this persecution, and may possibly acquire a popularity rivalling that of the "potato bug", or even that of Phylloxera itself. I have received specimens from Ireland, and others from Devonshire, thus supporting the notion that warmth and moisture are favourable to its development, but by no means implying the probability of its increase to any injurious or even annoying extent. In fact, I cannot readily believe that an insect which remains dormant or unnoticed for so long a period is likely to affect an ultimate settlement as a denizen among us. Moreover, we have the highest natural history authority for not deciding that such and such conditions are exclusively favourable to the increase of the gnats, which are so great an annoyance in less favoured countries than our own. Humboldt observes with respect to the Simulia and Culices of South America that "their geographical distribution does not depend solely on the heat of climate or the excess of humidity, but on causes difficult to characterise" - a profound and truthful observation, self-evident to everyone who will think of it, for we find these insects quite as abundant about the poles as under the equator. That mosquitoes, sandflies, gnats or midges may become, and do become, an intolerable nuisance in some countries, is absolutely certain. Between the little harbour of Higuerote and the mouth of the Rio Unare in South America, Humboldt informs us that "the wretched inhabitants are compelled to stretch themselves on the ground, and to pass the night buried in the sand three or four inches deep, leaving out the head only, which they cover with a handkerchief". You will find it also in Mouffet's most amusing and instructive "Theatrum" -and far more precious it is to me with its quaint Latin and homely woodcuts, than the most costly tome on my entomological bookshelf* you will find I say, to what on extent these insects abound in the West Indies, Peru, and Italy, and that they are *crudeles et venenati,triplices caligas imo ocreas item perjorantes*. Only think of their biting through three pair of stockings and one pair of boots! In Dr Harris's "Treatise on the injurious insects in the United States", a great number of truly appalling statements are made respecting these sandflies.

It has been asserted during recent times that their attacks on cattle, horses, and swine are often fatal: but this may safely be attributed to numbers, and not to individual poison. "In Hungary they frequently swarm to such an extent as to suffocate sheep and cows, by entering the throat and windpipe. It is even said that the ponderous elephant has succumbed to these insignificant insects", since in the pages of Kirby and Spence we read, after details of their doings, "It is not therefore incredible that Sapor, King of Persia, should have been compelled to raise the siege of Nisibis by a plague of gnats, which, attacking his elephants and beasts of burthen, so caused the rout of his army:" ("Introduction to Entomology", vol. i., p. 118)

Not be having the means of verification at hand, I allude to this record with hesitation, and simply as an unauthenticated report. But, returning to the more immediate subject of this paper, Simulium reptans, Linnaeus informs us it is so incredibly numerous in Lapland as entirely to cover a man's body, turning a white dress into a black one, occupying the whole atmosphere. In the north of Europe their numbers are so great that they have been compared to snow when falling thickest. "The Lapps cannot take a mouthful of food, or lie down in their cabins, without having their mouth and nostrils filled with them".

I believe the first scientific account of this pest was published at Stockholm by Professor Freis in 1824, and the translation or rather an abstract, appeared in the first edition of my "Grammar of Entomology" in 1835: this, as well as the second edition, not published until 1841, supplies nearly the whole of the information we yet possess respecting it: and, as these works have been out of print very many years, I think that the readers of *The Field* will scarcely object to its repetition, especially now that an inquiry respecting its name has been instituted, showing that itself and its doings are somewhat unfamiliar. Happy indeed is this unfamiliarity; happy indeed is the comparative immunity which in this land we enjoy from the persecution, the irritation, inflicted on man and beast by these seemingly insignificant insects.

The eggs of the sandfly appear to be at present unknown, but the larvae are found on the stems of the Oenanthe Phellandrium, the fine-leaved water dropwort, on that portion of the stem only which is generally submerged; they are long, cylindrical, considerably thicker posteriorly, and almost perfectly transparent. The head is united to the body by a very short neck - so short, indeed, that the head appears continuous with the body, but is certainly not so. It has four jaws, which move horizontally; these are the mandibles and maxillae - their offices being entirely changed on their conversion into a siphon by a process that is worthy of study by all entomologists, but I cannot stop to describe it now. The structure of the mouth in the diptera is totally unknown to our leading the entomologists; nor is this the most lamentable feature in our science, since those who ought to be our leaders and teachers often turn us aside when in the earnest pursuit of knowledge. To use the familiar but not very elegant expression, they shunt us into a siding instead of keeping us on the mainline to the knowledge of truth. During the past summer infinite pains were taken to convince the neophyte that the species of Syrphus and Eristalis fed exclusively on liquid honey, whereas their food consists entirely of dry and hard pollen granules, as proved by the immense quantity of these productions always to be found stowed away in their stomachs.

The second segment of the larva is thickened, and provided with a conical foot, retractile within the body, and thus capable of being withdrawn from observation. At the other extremity, of the maggot are two prehensile claspers, which are also retractile within the body, and thus alike also capable of concealment; indeed, in this respect they almost exactly resemble the claspers of moths. Entomologists formerly called these claspers legs, and very excusibly so, because they saw that the claspers performed all the functions of legs. Well, in walking - subaqueous walking - the foot is firmly fixed on some immovable object, as the stem of a water plant, and then the claspers and the other end of the maggot are brought up and firmly fixed, the back arched during the operation: the foot then relaxes its hold, the body is again stretched to its full extent, and the claspers brought up to the fore foot as before, and attached further on; thus the maggot progresses by a series of strides, like a geometer caterpillar. The food of this curious larva is unknown; some entomologists have suggested that it feeds on the rind of the dropwort, others that it preys on microscopical animalcules which are floating or sporting in water. When full grown it spins a little purse-like sheath - indeed, something rather like a silken watch pocket - which is hung up on the stems or among the subaqueous leaves of the dropwort, and in this purse it changes to a chrysalis in an upright position: the head and shoulders are kept well above the rim of the purse, and probably it is thus made sure of the supply of atmospheric air necessary for the preservation of life. The chrysalis is very like that of a small moth; it is motionless, of a transparent brown colour, and distinctly exhibits the various parts of the perfect insect through the skin.

Attached to the back, or rather to each side of the back of the head, are four slender, almost hair-like cilliated appendages; and these doubtless serve as respiratory organs. They are very similar to those observable in the larvae of gnats, which are adapted for *breathing* water, in a manner analogous to the gills of fishes. Such a provision for aquatic respiration is by no means uncommon among those larvae - and they are many - which pass the earlier part of their existence in the water, and are represented by several of the older naturalists in their careful and elaborate folios and quartos which find no parallel among the hasty and superficial productions of the present day. Early in July the chrysalis, encircled in a bubble of the air brilliant as quicksilver, rises to the surface of the water, and there floats for a moment; then it opens by a straight fissure down the back, and the Simulium emerges a perfect fly. Another moment she rests in her bubble, like Anaduomene in her shell, and then the bubble bursts and vanishes, and the fly remains standing on the water, with so delicate a touch that it makes no impression on the liquid surface. Entirely satisfied with the perfect safety of her apparently perilous position, she walks the water a thing of life.

Edward Newman.

*The date of Mouffet's "Theatrum" is 1634

Mme Françoise Beaucournu-Saguez: memorial note

Françoise Beaucournu-Saguez died on the llth August 2000. Over two decades (1972-1992) she published many valuable studies on the simuliids of western Europe, North Africa and the Middle East. Several of these papers resulted from personal fieldwork that she undertook in France, Spain, Portugal and Morocco. It is to her that we owe the first discovery that the female of *Simulium velutinum* can be distinguished from that of other European species of the *S. aureum* group (= *Eusimulium* s. str.) by lacking the usual pigmented "nipple" on the spermatheca at the base of the duct[1] - a character that has proved constant and very reliable for recognizing this species among otherwise inseparable females. The firsts among her faunistic findings include the discovery that *Simulium ruficorne* - best known as an Afrotropical species[2,3] - has a toehold on the European continent, in Portugal and Spain . Most notable in her oeuvre of formal taxonomy for the Palaearctic region is her description (with Dr Yehuda Braverman who collected the material) of *Levitinia freidbergi*[4] from ephemeral streams on the Golan Heights (Syria under Israeli Military Administration): like the other two species of this genus, both from Central Asia, this Middle Eastern simuliid is highly aberrant and its larva has no filtering head-fans. Also deserving to be highlighted is Françoise B.-S.'s one paper relating to the extra-Palaearctic fauna. This describes another weirdly aberrant blackfly, *Crozetia seguyi*[5]. The strange genus *Crozetia* was first made generally known to simuliidologists by Lewis Davies[6] who visited the Crozet archipelago in 1969 and 1972/3 and redescribed in detail the only species then known, *C. crozetensis*.

On the non-taxonomic side of Beaucournu-Saguez's output should be mentioned the investigations on anthropophily by blackflies in France to which (with her husband and other colleagues) she turned her attention most recently. Of special interest for specialists in Britain are papers showing that there is some man-biting problem with *Simulium posticatum* in northwest France[7] and summarizing and mapping the history and distribution of simuliid-anthropophily in France as a whole[8]. (In the latter article it is good to see in French: the "Mouche de Blandford"!)

Mme Beaucournu-Saguez was associated with the Department of Parasitology and Applied Zoology at the University of Rennes in northwest France; she is survived by her husband, Professor Jean-Claude Beaucournu, a specialist mainly on fleas (Siphonaptera) in that department and co-author for some of her simuliid contributions.

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R. W. Crosskey

Common or vernacular names for Simuliids

Some time ago I sent out via the Simuliidae Mail List a request for contributions towards an inventory of common names for simuliids that I have been compiling. Thanks to those who took the trouble to respond, the number of names that I have now stands at about 180. However, the geographical distribution is very patchy as you will see from the list below; classified by rough geographical areas. The list does not include the 'international' names such as 'blackflies', 'simulies' 'simulidos' etc. which are associated with the large language groups.

Africa: 38
America, North: 2
America, Central & South: 98
Asia (inc. Burma, India, Pakistan, former USSR): 22
Australia, New Zealand, Pacific Islands: 2
Europe (inc. Fennoscandia): 14
Iceland: 10

If anyone knows of any names belonging to local languages, whether in common use or obsolete, whether published or not, that they would like to pass on, I would be grateful to receive them. In particular, from Africa (about 80% of the names I have are from Nigeria, the rest of West, Central and Eastern Africa are poorly represented), and North America (did the native North American Indians have words for blackflies as they still do in S. America?).
To give an idea as to what I am looking for, here are a few

examples:

mawi (sing), ***morwesia*** (pl); Mende language, Sierra Leone; *S*. *damnosum*

pium (sing), ***piuns*** (pl); several Amerindian languages, Amazonia; *S. amazonicum* group

potû ; Hindustani, W. Himalayas, India; *S. indicum*

If the name has been published, a reference would be helpful.

Please send your contributions to me by e-mail at **daviesjb@liv.ac.uk**, or by mail at Liverpool School of Tropical Medicine, Pembroke Place, Liverpool L3 5QA, U.K.. If the list ever gets published, all contributors will be acknowledged.

John Davies

Blackfly Web Sites

Two Sites have been set up on the World Wide Web which are dedicated to simuliids. The first at **www.blackflies.org.uk** gives general information regarding blackflies and their life history and has links to other sites of a similar nature. A new addition is the inclusion of a picture gallery of images of all blackfly stages which are available for downloading free of charge.

A second site **www.simulium.org.uk** is intended to contain information of more interest to specialists. At present it contains the complete text of the last *Bulletin*, No 15. but I am considering whether we could include a list of recent and forthcoming publications (i.e. those that have been accepted by a journal). What do you think?

Anyone is welcome to contribute material or ideas to either site and can do so by e-mailing me at **John@blackflies.org.uk**

John DaviesAn antidote for Blackfly bites

Bulletin No. 8, December 1996 contained a piece by Mike Ladle and Stewart Welton entitled “The Blandford Fly - Absolutely the last word”. It seems that this was premature, we should have known that this story was going to run and run. One of our ardent and dedicated researchers has reported finding an interesting new product which is claimed to alleviate the effects of The Blandford Fly. As most members will know, the Blandford Fly is *Simulium posticatum* Meigen. The makers of this product, Badger Brewery, have kindly provided specimens of their labels, and details of local suppliers can be found on their web site at **www.badger-brewery.co.uk**


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ALC 5.2% VOL
Serve Chilled
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An unusually
refreshing premium ale
subtly spiced with ginger for
EXTRA BITE

[Your Editor is considering calling for volunteers to assist in carrying out a controlled experiment to determine the optimum frequency of application required to achieve the maximum effect.]

TRAVELLERS' TALES

Great Balls of Blackflies

I am indebted to Gisli Mar Gislason for pointing me in the direction of a paper written by B. V. Peterson, concerning a collecting trip he and Mr. E.F.Bond made to Iceland in 1962. Although primarily a taxonomic work, the species descriptions are also accompanied by biological notes. The piece which follows is taken from the description of *Simulium vittatum*. It is evident that although having experienced the infamous attacks by blackflies in parts of Canada, in Iceland, Bob had been confronted by something quite extraordinary, as it is unusual to find such an eloquent description embedded in a formal taxonomic paper. Read on....

> *Simulium vittatum* is the most abundant and widespread of Icelandic black flies. The author collected it all across the island from many different types of streams ranging from large, fast, cold rivers to tiny trickles of warm, sulphurous water originating from the condensation of volcanic steam. As mentioned above, this species varies considerably in size. Specimens reared from the colder water streams tended to be larger than those reared from warm water streams of volcanic origin. It was specimens from the latter type stream that first led me to think there was an undescribed species in Iceland (Peterson 1965, p. 17).
>
> Early travellers in Iceland (e.g. Mohr 1786, Pálsson 1791-97 (published 1945), Thienemann 1827) often mentioned the nuisance caused by black flies. Probably all of these early accounts refer to *S. vittatum*. This species traditionally has been very abundant in the vicinity of lake Mývatn, and according to Nielsen *et al*. (1954), the name of the lake is derived from these pestiferous flies.

Simulium vittatum primarily feeds on horses and, to a lesser extent, on cattle and other animals. Occasionally it bites man but more often is a nuisance because of its habit of hovering around the head and darting into the eyes, ears, nostrils, and even the mouth.

Females of this species were bothersome to the author in several localities but never as they were near Vogar and Reykjahlídh along the northeast shore of lake Mývatn. In the late evening (9:00 p.m.) of 3 July 1962, huge swarms of *S. vittatum* almost totally engulfed my companion and me. Never have I seen so many black flies at one time. They were all over us, crawling into every conceivable opening they could find in our clothing and on our person. They covered my glasses so I could not see through them nor could I see clearly without them. It was difficult to breathe and about all I remember hearing was the faint humming of millions of tiny wings. I had to swing my collecting net back and forth in front of my face to make it possible to see and breathe without swallowing large numbers of flies. The net filled very quickly with large balls of moving flies which continually had to be dumped. Hundreds of flies had crawled inside my clothes which became sticky with their mashed bodies. This hoard of flies continued swarming until the sun dropped nearly to the horizon after which they rapidly dissipated. Through all this, neither my companion nor I received a single bite. An Englishman who was fishing in the lake at the time was forced to retire to the lodge. He received only one bite high on his bald forehead.

In the late afternoon (5:30 p.m.) of 7 July 1962, at Hof. near Vopnafjördhur in northeast Iceland, I had the opportunity to observe large mating swarms of *S. vittatum*. The males formed large, loose swarms, flying with their abdomens at an angle of about 45° and the legs hanging straight down. The flight pattern was essentially the same as reported by Peterson (1962). As females entered the swarm, males would vie for them. Successfully coupled pairs left the swarm, many of them falling to the ground. In most instances the male took a position on top of the female with his abdomen curved underneath her. Sometimes the female would drag her coupled mate on his back along the ground, and in some cases small balls of copulating pairs were formed. Many mating pairs landed on our white automobile where they were easily and clearly observed. In most instances the mating process lasted only a few seconds. Often several males tried to mate with a single female at the same time, and males were continually testing the sex of other males in their quest for a suitable partner.

B.V.Peterson. (1977) The Black Flies of Iceland. *Can. Ent*. 109: 449-472.

MEMBERSHIP NOTICES

Geographical Distribution of Members

We have at present 132 members, distributed world-wide as follows:

United Kingdom	68	North America	22
Europe	14	Cent. & S. America	9

Africa S. of Sahara 8 Australia & New Zealand 4
and 1 member each in Denmark, Iceland, Jordan, Morocco, Slovakia, Sweden and Turkey.

New Members

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BRITISH SIMULIID GROUP BULLETIN NO. 17, JUNE 2001

CONTENTS Number 17, July 2001

FROM THE EDITOR

So, another *Bulletin* is ready for publication. As Editor, it is most gratifying to be supplied with more material than can be squeezed into one number, although this has its accompanying problems regarding what to postpone (so far, nothing has been rejected). There are already a couple of articles lined up for the December number. As I have said before, many thanks to those of you who have sent in contributions or suggestions for articles.

In this number, I am particularly sad to include an Obituary to Botha De Meillon who passed away at the end of 2000. He will always be remembered for his contribution to the "African Simuliid Bible" familiarly known as "Freeman and De Meillon", without which those of us who worked in Africa would have been all at sea.

John B. Davies, Editor

NEXT MEETING

The **24th Annual Meeting** of the British Simuliid Group is planned to be held in conjunction with Birmingham University during **18th to 19th October 2001**. It is being organised by Melanie Bickerton and Malcolm Greenwood.

Please start thinking about your talk or poster. Presentations on the theme of UK or aquatic ecology would be preferred.

Members will be contacted by mail with further details nearer the time, but in the meantime, if you have any queries contact **Melanie Bickerton, Department of Geography, University of Birmingham, Edgbaston, Birmingham, B15**

2TT UK. [e-mail: M.A.Bickerton@bham.ac.uk]. It is anticipated that overnight accomodation will be available within the University.

Correction

----OBITUARY

Botha De Meillon

Simuliidologists in general, and Africa hands in particular, will have been saddened to learn of the passing of Botha De Meillon who died in his sleep on 6 December 2000 in Philadelphia, aged 98. In *Simulium* circles he was probably best known for his co-authorship of the 1953 monograph generally referred to as "Freeman and De Meillon", and which is still very much the starting point for any newcomer to the African Simuliid fauna.

In honour of his 90th birthday his colleagues published (in 1993) a Festschrift summarizing the life and scientific achievements of this remarkable man. The following summary has been compiled very largely from this document

He was born on 15th October 1902 in Prieska on the Orange River in Cape Colony where he was educated at home or in farm schools until going to Pretoria Boys School at the age of 14. From 1921-26 he attended the University of Witwatersrand where he obtain his BSc and MSc. In 1926 he found employment at the South African Institute for Medical Research (SAIMR) in the departments of Parasitology and Entomology, becoming head of Entomology in 1930.

In 1931 he established the malaria research station at Tzaneen in the northern Transvaal, and while there he developed the indoor insecticide spraying method of mosquito control using pyrethroids, which all but eradicated malaria in South Africa. At the same time he started work on the Simuliidae, Siphonaptera and Ceratopogonidae of South Africa.

Even though the simuliidae were not his main occupation, between 1930 and 1959 he authored or co-authored 16 taxonomic works, containing descriptions of 37 new nominal species from Africa south of the Sahara and Madagascar. Of these, two works are of particular importance to simuliidologists, the first “On the Ethiopian Simuliidae” in the Bulletin of Entomological Research (1930), and his monograph “Simuliidae of the Ethiopian Region” which he co-authored with Paul Freeman of the British Museum (Natural History) and published in 1953.

The 1930 paper was called "On the Ethiopian Simuliidae" but actually provided rather more than its simple title suggested: it included an identification key to females and provided illustrations of the gills for all those species in which the pupil stage was by then known. The latter was important, because in practice the pupa was then (and remains) the most useful life stage for everyday species recognition, particularly when dealing with a previously unworked or little-known fauna. However, De Meillon was careful to point out a fact he had recognised pretty much at the start of his simuliid studies: that different species sometimes have virtually identical pupal gills, so rearing of adults from pupae and studying associated adult characters has fundamental importance in taxonomy.

For nearly a quarter of the century the 1930 paper provided the only practical starting point for studying the Afrotropical blackfly fauna. One of its side-effects was to stimulate E. G. Gibbins, a health inspector in Uganda, into studying the

Simuliids of eastern Africa and the Congo basin. Between them, Gibbins and De Meillon described virtually all the regional *Simulium* species recognised and newly named during the 1930's. The discovery by J.P.McMahon in 1949-50 that the early stages of *Simulium neavei* exist only in obligate phoretic relationship with river crabs, the appeals for help in identifying the Kenyan and other East African species, coupled with the realisation that onchocerciasis was far more widespread in tropical Africa than anyone had envisaged, prompted Paul Freeman at the British Museum to attempt a review of the African simuliid fauna. He soon found that many of the type specimens were in the SAIMR in Johannesburg, the product of De Meillon's research. Thus was the collaboration established, and the "Simuliidae of the Ethiopian Region" was finally published in 1953, without the authors ever meeting.

De Meillon's main contribution to entomology and public health, however was in the field of mosquito (both Anopheline and Culicine) taxonomy, behaviour and control. From 1936 onwards, he became increasingly in demand as a consultant to other African countries, such as Swaziland, Mozambique and Zambia (then Northern Rhodesia), and his work on the Culicines of South Africa was one of the reasons the Rockefeller Foundation chose to established an Arbovirus Research Station at Rietfontein in the 1950's.

In 1960 he was seconded to WHO as Advisor on Malaria to the Regional Director, Brazzaville, and two years later resigned from SAIMR to join WHO, Geneva, as Acting Director, Division of Parasitic Diseases. Soon after (1963-65), he became Project Leader, WHO Filariasis Unit in Rangoon, then moved to Washington DC as head of the South-East Asia Mosquito Project from 1966 to 1973. Hes activities during these latter years led to the award in 1973 of the U.S. Department of Defense Certificate for Meritorious Service and the U.S. Department of the Army Citation “for selfless dedication and professional competence”. In South Africa and elsewhere he received many other awards, including the South African Medical Association Silver Medal in 1975, and the Elsdon-Dew Medal of the Parasitological Society of South Africa.

During his lifetime he published a total of 189 papers (including the 16 mentioned above), 142 as senior or sole author. Anyone wishing to consult the full list of publications or read more about this remarkable man should consult the Festschrift quoted below.

I met Botha on several occasions, the first being in 1 to 8 July 1968 at the historical OCCGE, USAID and WHO sponsored meeting in Tunis, on “The Feasibility of Onchocerciasis Control” which kick-started what was to later become the Onchocerciasis Control Programme in the Volta River Basin. We were members of a small entomological working group charged with the impossible task (given our general lack of knowledge of the ground and paucity of information) of estimating the cost of controlling *S. damnosum* s.l. in Upper Volta (now Burkina Faso), northern Ivory Coast and northern Ghana, using ground application of DDT to the breeding rivers. If I remember correctly, other members were René LeBerre, Rolf Garms, J. P. McMahon, Douglas Marr, and Hugo Jamnback. After two long sessions, which went well into the night and involved copious quantities of beer and coffee, we concluded that this could not be done for less than one million US dollars per year. The meeting greeted this estimate with shocked disbelief, but I think it had the effect of making the planners more receptive to the possibilities of aerial application. Little did we know at the time that it would transpire to be a gross underestimate! Latterly, Botha must have wondered at the behemoth of a control scheme he had helped to launch.

De Meillon had a somewhat gruff manner which at first was rather off-putting. However, his sense of humour and constant stream of anecdotes soon put one at ease, and his enthusiasm, down to earth good sense and breadth of knowledge soon endeared him to all his associates. He is greatly missed.

John B. Davies, Editor.

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MEETING REPORT

Annual North American Meeting of Simuliid Workers

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The annual North American meeting of simuliid workers was held 10-12 March 2001 at the Archbold Biological Station in Lake Placid, Florida. This meeting was the fourth held under the auspices of the Southern Extension and Research Activities Information Exchange Group. The meeting was organized by E. W. Gray and chaired by D. H. Arbegast. Thirty workers attended, including 24 from the United States, 5 from Canada, and 1 from the Galapagos Islands.

The following 18 presentations were given:

Black flies and non-targets at the Branch River Country Club, Wisconsin (**R. W. Merritt,** Department of Entomology, Michigan State University, East Lansing, MI)

Military experience with black flies (**C. A. Stoops & P. H. Adler**, Department of Entomology, Clemson University, Clemson, SC)

Simulium bipunctatum in Galapagos — what control is feasible? (**T. Poulsom & C. E. Causton**, Charles Darwin Research Station, Galapagos Islands)

Journeys through black flies: pathogens we've met along the way (**C. E. Beard, P. H. Adler & C. A. Stoops**, Department of Entomology, Clemson University, Clemson, SC)

The Metropolitan Mosquito Control District's Black Fly Control Program (**J. Walz & K. R. Simmons,** Metropolitan Mosquito Control District, St. Paul, Minnesota)

Algal effects on the efficacy of *Bti* in an orbital shaker bioassay system (**M. S. Stephens, E. W. Gray, J. P. Overmyer & R. Noblet**, Department of Entomology, University of Georgia, Athens, GA)

Insecticide toxicity evaluations with *Simulium vittatum* IS-7 colony: mixture assessments and food influence (**J. P. Overmyer, E. W. Gray, M. S. Stephens & R. Noblet**, Department of Entomology, University of Georgia, Athens, GA)

The Archbold Biological Station and the ecology of the Lake Wales Ridge (**M. Deyrup**, Archbold Station, Florida)

What's so special about honeydew anyway? (**T. Stanfield**, Department of Biological Sciences, Brock University, St. Catharines, Ontario)

Update on the Polynesian project (**D. A. Craig**, Department of Biological Science, University of Alberta, Edmonton, Alberta)

New species found last summer in Pennsylvania (**D. I. Rebuck**, Black Fly Suppression Program, Harrisonburg, Pennsylvania)

Involvement of county personnel in the New Jersey black fly program (**A. Crans, T. Rainey, F. Carle & C. Musa**, Rutgers University, East Brunswick, NJ [presented by D. H. Arbegast, Black Fly Suppression Program, Harrisonburg, Pennsylvania])

North to the Horton: black fly diversity and biogeography in the Northwest Territories (**D. C. Currie**, Centre for Biodiversity & Conservation Biology, Royal Ontario Museum, Toronto, Ontario & **P. H. Adler**, Department of Entomology, Clemson University, Clemson, SC)

The continuing cytological study of *Inseliellum* (**M. Spironello**, Department of Biological Sciences, Brock University, St. Catharines, Ontario)

A preliminary survey of the distribution and cytogenetics of *Simulium arcticum* in westcentral Montana (**G. F. Shields**, Department of Natural Sciences, Carroll College, Helena, Montana)

Sibling speciation in the *Leucocytozoon* vector *Simulium slossonae* (**C. L. Evans & P. H. Adler**, Department of Entomology, Clemson University, Clemson, SC)

A phylogenetic analysis of Nearctic *Simulium* s. str. (Diptera: Simuliidae) using two mitochondrial genes (**M. Smith**, Centre for Biodiversity & Conservation Biology, Royal Ontario Museum, Toronto, Ontario)

Simulium pictipes is not, and other taxonomic discoveries (**P. H. Adler**, Department of Entomology, Clemson University, Clemson, SC)

SCIENTIFIC CONTRIBUTIONS

Deux Simulies nouvelles pour le Nord de l'Afrique : *Simulium (Nevermannia) angustitarse* et *Simulium (Simulium) trifasciatum*

B. Belqat*, M. Dakki et M. Errami***
*: *Université Abdelmalek Essaadi, Faculté des Sciences, Tétouan*
***: Institut Scientifique de Rabat*

Au Maroc le genre *SIMULIUM* est présenté par sept sous-genres : *Crosskeyellum, Eusimulium, Nevermannia, Obuchovia, Rubzovia, Simulium* et *Wilhelmia*. Les deux sous-genres *Nevermannia* et *Simulium* sont sans doute les plus représentés avec, respectivement, deux groupes *(S. (N.) ruficorne* et *S. (N.) vernum)* et trois groupes *(S. (S.) bezzii, S. (S.) ornatum et S. (S.) variegatum)*.

Durant l'étude menée sur les Simulies du Rif, deux espèces, jusqu'à présent de distribution Eurosibérienne *(Simulium (Nevermannia) angustitarse)* et Européenne *(Simulium (Simulium) trifasciatum)* sont recensées pour la première fois au Nord de l'Afrique. Cette découverte nous a permis d'élargir considérablement leur aire de répartition jusqu'au sud de la paléarctique occidentale.

Sous-genre NEVERMANNIA Enderlein
groupe *Simulium (Nevermannia) ruficorne*
Simulium (Nevermannia) angustitarse **(Lundström)**

Localités et matériel étudié :
1. Aïn Sidi Brahim Ben Arrif, 500m, Province de Larache, Localité Bâb

Hachef-Aïssa, 35°18'22" N ; 5°36'57" W. Le 09-III-1998 : 1 larve.
2. Oued Bou îch, 1200m, Province de Chaouen, Localité Bou Rhaît, 35°00'56" N ; 4°57'30" W. Le 25-II-2000 : 1 larve.
3. Aïn Bab Tariouente, 1405m, Province de Chaouen, Localité Jbel beni salah, 35°01'04" N ; 5°00'27" W. Le 23-II-1998 : 2 larves. Le 22-VI-1998 : 4 nymphes.
4. Oued Kétama , 1480m, Province de Al Hoceima, Localité Koudiat Ech chiba, 34°59'03" N ; 4°34'34" W. Le 30-IV-1998 : 1 nymphe. Le 12-XI-1998 : 1 larve. Le 22-VI-1998 : 1 larve, 3 nymphes. Le 20-IV-1999 : 1 larve.

L'espèce a été signalée en Angleterre (Bass, 1998) dans des biotopes de ruisseaux herbeuses. Dans la péninsule Ibérique, Crosskey et Crosskey (2000) la récoltent en Andalousie et au Nord de l'Espagne. González (1997) la signale dans les cours d'eau de moyenne altitude à eaux modérément froides. L'espèce est aussi bien représentée dans d'autres pays d'Europe tels que, le Portugal (Santos Grácio, 1985), l'Allemagne, la Suède, le Norvège et le Danemark (Crosskey et Howard, 1997).

Au Rif, l'espèce a été capturée dans 4 localités rattachées à trois provinces Rifaines (Larache, Chaouen et Al Hoceima). Elle paraît être liée essentiellement aux cours d'eau de moyenne et haute altitude (500-1480m), mais semble plutôt préférer les plus hautes altitudes (1405 et 1480m). Les biotopes où elle se tient sont une petite rivière (Oued Ketama) à fond limoneux, à végétation abondante, à température oscillant entre 11 et 16°C et au courant modéré. Les autres gîtes qu'elle affectionne correspondent à des ruisseaux encombrés par la végétation aquatique et caractérisés par une température moyenne de 12°C, un cours lent et un lit formé essentiellement de limon. Nos renseignements écologiques paraissent concorder avec ceux de Crosskey et Crosskey (2000) puisqu'en Espagne ils signalent l'espèce entre 580 et 1200m et ceux de González et al. (1986) qui la récoltent en amont de la rivière Yeguas.

Avec ces nouveaux points de capture au Rif, nous élargissons donc jusqu'en Afrique du Nord, l'aire de répartition de *Simulium angustitarse*.

Sous-genre *SIMULIUM* Latreille s.str.
groupe *Simulium (Simulium) ornatum*
Simulium (Simulium) trifasciatum **Curtis**

Localités et matériel étudié :
5. Oued Sgara, 1300m, Localité Tleta Ketama, 34°52'29" N ; 4°37'07" W. Le 30-IV-1998 : 3 larves, 5 nymphes. le 20-IV-1999 : 12 larves, 8 nymphes.
6. Oued ketama, 1283m, Localité Tleta Ketama, 34°52'29" N ; 4°37'07" W, 20-IV-1999 : 4 larves, 6 nymphes.
7. Oued Ketama , 1340m, Localité El Mouzarâr, 34°52'42" N ; 4°36'57" W. Le 12-XI-1998 : 6 nymphes.

L'espèce a été signalée en divers pays d'Europe tels que, l'Espagne, la France, la Grande Bretagne, l'Italie, l'Autriche et la Tchécoslovaquie (Crosskey et Howard, 1997). Cette forme paraît cantonnée, en Espagne, dans de petits ruisseaux de faible altitude (150-520m), à fond de pierres, à courant lent et à végétation abondante (Beaucournu-Saguez, 1975). González-Peña (1990), la signale dans divers petits cours d'eau appartenant au bassin versant Llobregat à des altitudes comprises entre 90 et 700m, dans des eaux généralement limpides bien oxygénées et présentant un grand écart thermique (5-23°C).

Au Rif cette espèce apparaît comme une forme strictement montagnarde puisqu'elle n'a été recueillie que dans trois rivières arborisées de haute altitude (1300-1340m). Dans ces gîtes, le biotope se caractérise par un lit le plus souvent pierreux, riche en végétation aquatique, un cours modéré à rapide en certains points et par une température allant de 13.3°C à 16.8°C.

Au point de vue de sa distribution verticale, nos observations concordent avec celles de González-Peña (1990) qui indique que dans les Pyrénées, l'espèce occupe le même type de biotopes signalés par elle mais à plus haute altitude (1260-1890m). De même les caractéristiques des biotopes que nous donnons sont comparables à ceux signalés en littérature, sauf que, au Rif, *Simulium (Simulium) trifasciatum* affectionne plutôt des rivières plus ou moins larges. L'espèce se tient alors en divers bras où le cours est ralenti par la végétation.

Taxonomiquement, cette espèce ne peut être identifiée avec certitude qu'à partir du genitalia. Par conséquent, sa plaque ventrale, très caractéristique par son processus nasiforme large, à extrémité arrondie et la présence de tubercules épineux sur la capsule céphalique et le thorax (Knoz, 1965), sont deux preuves irréfutables de l'existence de cette espèce au Rif.

Son aire d'extension donc, avec le point de capture (Rif Central Marocain) que nous signalons pour la première fois s'étend maintenant jusqu'en Afrique du Nord.

Remerciements:

Nous remercions vivement le Dr. R. W. Crosskey pour l'identification d'une partie du matériel.

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Distribution Summary of the Simuliidae of Morocco with New Data for the Rif Mountains

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Abstract

Forty-two species of simuliids are now known from Morocco;

including 13 from the Rif Mountains recorded here for the first time, of which two are also new to N. Africa.

Introduction

The following checklist summarises the species presently known from Morocco. Sites where we provide the first record of a species in either North Africa or the Rif Mountains are indicated by the word "**new**". Sampling sites in the Rif Mountains (details in Table 1) are listed within square brackets. The occurrence of a species in other regions of the country is also given. Taxa are listed as in the World Inventory of Crosskey & Howard (1997).

Simulium species recorded from Morocco

Genus **GRENIERA** Doby & David, 1959
fabri Doby & David, 1959.
Middle Atlas, **new** for the Rif [Rif:27; 31; 34]

Genus **METACNEPHIA** Crosskey, 1969
blanci (Grenier & Theodorides, 1953)
High Atlas, Middle Atlas, Anti Atlas, Rif
? **nuragica** Rivosecchi, Raastad & Contini, 1975
tredecimata: Grenier et al., 1957
(misident)
Coastal Méséta (region of Rabat)

Genus **PROSIMULIUM** Roubaud, 1906
Subgenus *PROSIMULIUM* Roubaud s. str.
P. (P.) aculeatum species-group
faurei Bernard, Grenier & Bailly-Choumara, 1972.
Middle Atlas, **new** for the Rif [Rif:4; 5; 15;30; 31]

P. (P.) hirtipes species-group
laamii Beaucournu-Saguez & Bailly-Choumara, 1981
Central Rif Mountains (Jbel Tidighine)
latimucro (Enderlein, 1925).
High Atlas, **new** for the Rif [Rif:1; 4; 6]
rufipes (Meigen, 1830).
new record for North Africa [Rif: 2; 4; 6; 8; 9; 11; 13; 14; 17; 25; 26; 27; 28]
tomosvaryi (Enderlein, 1921).
new record for North Africa [Rif:3; 4; 5; 6; 22; 25; 27; 28; 30]

Genus **SIMULIUM** Latreille, 1802
Subgenus *CROSSKEYELLUM* Grenier & Bailly-Choumara, 1970
gracilipes Edwards, 1921
Western Middle Atlas (plain of Saïs)

Subgenus *EUSIMULIUM* Roubaud, 1906
angustipes Edwards, 1915
High Atlas, Middle Atlas
mellah Giudicelli & Bouzidi, 2000
High Atlas
petricolum (Rivosecchi, 1963).
latizonum: Bailly-Choumara & Beaucournu-Saguez (misident.)
High Atlas, **new** for the Rif [Rif: 3; 4; 6; 7; 11; 12; 15; 16; 23; 24]
velutinum (Santos Abreu, 1922)
latinum (Rubtsov, 1962)
High Atlas, Middle Atlas, Anti Atlas, Rif

<u>*S. (N.) ruficorne* species-group</u>
angustitarse (Lundström, 1911)
new record for North Africa. [Rif: 6; 10; 13; 28]
ibleum (Rivosecchi, 1966).
High Atlas, **new** for the Rif [Rif:10; 28]
lundstromi (Enderlein, 1921)
latigonium (Rubtsov, 1956)
High Atlas
ruficorne Macquart, 1838
High Atlas, Anti Atlas, Rif

<u>*S. (N.) vernum* species-group</u>
brevidens (Rubtsov, 1956)
High Atlas (record may be in error, verification needed)
carthusiense Grenier & Dorier, 1959
Rif. [Rif: 11]
costatum Friederichs, 1920.
High Atlas, Middle Atlas, **new** for the Rif [Rif:25; 28]
cryophilum (Rubtsov, 1959) .
pusillum: Séguy, 1930. (misident.)
High Atlas, **new** for the Rif [Rif:1; 2; 3; 4; 5; 6; 8; 10; 13; 15; 16; 23; 25; 26; 27; 28; 29]
(chromosomal confirmation by P. Adler)
toubkal Bouzidi & Giudicelli, 1986
High Atlas
vernum Macquart, 1826 .
latipes: authors pre-1972 (misident)
High Atlas, **new** for the Rif;[Rif:10; 28]
(chromosomal confirmation by P. Adler)

Subgenus *OBUCHOVIA* Rubtsov, 1947
auricoma Meigen, 1818.
Rif. [Rif:18; 19; 20; 21]
galloprovinciale Giudicelli, 1963.
Rif. [Rif:8; 13; 16; 18; 32]
marocanum Bouzidi & Giudicelli, 1988
High Atlas, Rif

Subgenus *RUBZOVIA* Petrova, 1983

CRENOSIMULIUM Giudicelli & Thiery, 1985
knidirii Giudicelli & Thiery, 1985
High Atlas
lamachi Doby & David, 1960
High Atlas, Rif

Subgenus *SIMULIUM* Latreille s.str.
S. (S.) bezzii species-group
bezzii (Corti, 1914)
atlas Séguy, 1930
High Atlas, Middle Atlas, Anti Atlas, Rif
S. (S.) ornatum species-group
egregium Séguy, 1930
High Atlas
intermedium Roubaud, 1906
nitidifrons Edwards, 1920
reptans var. *fasciatum*: Séguy, 1930 (misident)
High Atlas, Middle Atlas, Rif
ornatum Meigen, 1818 (complex)
subornatum: Séguy, 1930 (misident)
High Atlas, Middle Atlas, Anti Atlas, Rif
trifasciatum Curtis, 1839.
new record for North Africa, Rif [Rif: 7; 8; 9]

S. (S.) variegatum species-group
atlasicum Giudicelli & Bouzidi, 1989
High Atlas
berberum Giudicelli & Bouzidi, 1989
High Atlas
variegatum Meigen, 1818
High Atlas, Rif
xanthinum Edwards, 1933
gaudi Grenier & Faure, 1957
High Atlas, Middle Atlas, Rif

? *S. (S.) venustum* species-group
sp. indet.
Rif. [Rif:4; 6; 8] (first record; chromosomal identification by P. Adler)

Subgenus *WILHELMIA* Enderlein, 1921
S. (W.) equinum species-group
equinum (Linnaeus, 1758)
High Atlas, Middle Atlas
pseudequinum Séguy, 1921
mediterraneum Puri, 1925
barbaricum Séguy, 1930
High Atlas, Middle Atlas, Anti Atlas, Rif
quadrifila Grenier, Faure & Laurent, 1957
Rif. [35; 36; 37; 38]
sergenti Edwards, 1923
ariasi Séguy, 1925

Table 1 .List of principal sampling sites harbouring the species recorded in the Rif Mountains, with localities, altitudes and geographical coordinates.

No.	Site	Locality	ALTITUDE	Geographical Co-ordinates.
Al Hoceima Province				
1	Spring K. En Nâsser	Khandek En Nâsser	1640 m.	34°53'04" N ; 4°43'35" W
2	Spring Quanquben	Jbel Bou Bessoui	1600 m.	34°57'45" N ; 4°40'47" W
3	River Ouringa Tamdâ	Sikh	1580 m.	34°55'38" N ; 4°35'56" W
4	River Iouchirene	Tidouine	1540 m.	34°55'06" N ; 4°32'01" W
5	River Mrinet	Ouareg	1500 m.	34°57'07" N ; 4°27'16" W
6	Stream Ketama	Koudiat Ech Chiba	1480 m.	34°59'03" N ; 4°34'34" W
7	River Ketama	El Mouzarâr	1340 m.	34°52'42" N ; 4°36'57" W
8	River Sgara	Tleta Ketama	1300 m.	34°52'29" N ; 4°37'07" W
9	River Ketama	Tleta Ketama	1283 m	34°52'29" N ; 4°37'07" W
Chaouen Province				
10	Spring Bab Tariouente	Jbel Beni salah	1405 m.	35°01'04" N ; 5°00'27" W
11	River after FiFi	Bab El Karne	1280 m.	35°00'24" N ; 5°12'07" W
12	Streamlet lagoon FiFi	Fifi	1200 m.	35°01'29" N ; 5°12'25" W
13	Streamlet Bou îch	Bou Rhaît	1200 m.	35°00'56" N ; 4°57'30" W
14	Streamlet after FiFi	Ahoundar	1000 m.	34°58'03" N ; 5°13'57" W
15	River Biyada	Jbel Setsou	880 m.	35°04'19" N ; 5°09'18" W
16	River Maâmala	Beni Derkoul	840 m.	35°03'35" N ; 5°04'05" W
17	River Tazarine	Beni Oualal	200 m.	35°04'09" N ; 5°20'00" W
18	River Aarkôb	Arherarose	100 m.	35°16'22" N ; 4°50'12" W
19	River Sidi Yahya Aârab	Sidi Yahia Aârab	80 m.	35°17'33" N ; 4°53'25" W
20	River Amazithen	El Ouesteyine	80 m.	35°18'33" N ; 4°54'36" W
21	River Jenane en Nich	Jenane en Nich	60 m.	35°16'29" N ; 4°52'01" W
22	River Ouringa	Jebha	40 m.	35°11'42" N ; 4°41'18" W
Larache Province				
23	Streamlet S . El Mokhfi	Pic de Bou Hachem	1400 m.	35°15'16" N ; 5°30'43" W
24	Streamlet Bou Hachem	Pinède B. Hachem.	1200 m.	35°15'59" N ; 5°30'39" W
25	Spring El Ksour	Es Soukkâne	1200 m.	35°19'03" N ; 5°31'14" W
26	River Taïda	Taïda	590 m.	35°21'12" N ; 5°31'57" W
27	River Tisgris	Hmmadesh	580 m.	35°22'09" N ; 5°31'34" W
28	Spr. S. Brahim B. Arrif	Bâb Hachef-Aïssa	500 m.	35°18'22" N ; 5°36'57" W
29	River Stitou	S. K. Beni Arous	190 m.	35°20'56" N ; 5°33'16" W
30	River Hannacha	Koudiet Ejkhoûr	170 m.	35°19'09" N ; 4°38'12" W

Tétouan Province

31	River Ankouda	Bezouâla	80 m. 35°30'56" N ; 5°41'41" W
32	River Nakhla	Koudiet Krikra	80 m. 35°27'09" N ; 5°25'29" W
33	River kebir	Koudiet Krikra	80 m. 35°27'17" N ; 5°25'50" W
34	River Jbel Habib	Tleta de Jbel Habib	40 m. 35°28'14" N ; 5°48'06" W
35	River El Kebir	Tieta de Jbel Habib	20 m. .35°28'14" N; 5°54'05" W
36	River Rmel amont	Bou Reïhal	46 m.35°52'40" N; 5°28'24" W
37	River Ajrss aval	Aïn el Hsn	80 m.35°33'20" N; 5°31'14" W
38	River Râouz	Zaouia	100 m.35°41'53" N; 5°30'00" W

Acknowledgements

We are very grateful to Dr. R. W. Crosskey of The Natural History Museum, London, for his continuous advice and for examining some of our specimens.

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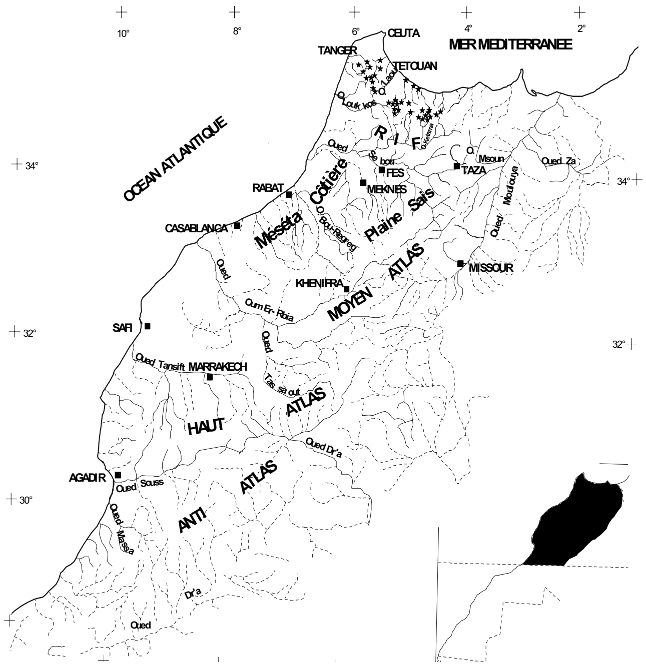

Map of Morocco showing simuliid sampling sites, positions of principal mountain ranges and other regions of previous reports.

★ = Sites providing first Rif records. Haut Atlas = High Atlas; Moyen Atlas = Middle Atlas; Oued = River (Wadi)

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NOTES, VIEWS AND CORRESPONDENCE

A Brief History of Northeast Regional Project NE-118 in the USA

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The Northeast Regional Project entitled Black Fly Damage Thresholds, Biology and Control — or NE-118 as it was both officially and informally christened — was North America's all-time, premiere vehicle for facilitating research, collaboration, and information exchange on the Simuliidae. The project grew out of the First Inter-Regional Conference on North American Black Flies, which was organized and hosted by John F. Burger at Dixville Notch, New Hampshire, from 31 January to 2 February 1977. The conference at Dixville was inspired by the informal gatherings that the Canadian workers held during the 1950s and 1960s. Following the Dixville conference, Edward Piper organized a meeting held on 14 April 1977 in Boston, Massachusetts, during which Jeffrey Granett presented a draft outline of the potential project to the dozen northeastern scientists in attendance. Working from this draft, J. F. Burger, E. W. Cupp, J. D. Edman, R. W. Merritt, and J. Granett formulated the project's formal proposal. The project officially began on 1 October 1977 and expired on 30 September 1996.

Cooperative Regional Projects, such as NE-118, are supported by allotments of research funds under the United States Hatch Act (as amended 11 August 1955). Under this federal legislation, funds are allocated annually to each state for cooperative research in which two or more state agricultural experiment stations cooperate to solve problems that concern the agriculture of more than one state.

The objectives of NE-118, as originally written, were to 1) establish nuisance, economic and pathogenic threshold levels for black flies in relation to human health, human activity, agricultural animals, and wildlife; 2) analyze the population dynamics of pest black flies and factors contributing to their distribution and abundance; 3) initiate the development of safe, efficacious methods to manage pest black fly populations. Through three subsequent project renewals, each providing five additional years beyond the original five-year run, the objectives changed to emphasize systematics, larval and adult behavior, and the improvement of *Bacillus thuringiensis israelensis* (*Bti*) as a biological control agent for black flies.

NE-118 originally consisted of six participating states: Delaware, Maine, Massachusetts, Michigan, New Hampshire, and New York. Pennsylvania, Rhode Island, and West Virginia joined in 1978 and Maryland came aboard in 1979. Most states participated for the remainder of the project, although the institutions or agencies (and their representatives) sometimes changed, while a few states such as Rhode Island and Delaware left the project in the early 1980s. The representative(s) of each participating state were referred to collectively as the Technical Committee. NE-118 rapidly grew into an international forum, with participants informally, but routinely, joining the group from countries such as Canada and England. By the late 1980s, the project officially had expanded beyond the bounds of the northeastern United States to include Technical Committee representation from the participating states of Arizona, California, Florida (1985 only), Nebraska, and South Carolina. Quebec and Ontario became official participants during the final five-year renewal in 1991. The project was served by five administrative advisors: E. H. Piper (1977-1979), D. E. Leonard (1980-1983), W. C. Dunham (1984-1988), D. L. McLean (1989-1990), and R. G. Helgesen (1991-1996). Robert C. Riley served as the Cooperative State Research Service - United States Department of Agriculture (CSRS-USDA)[1] representative for the project's entire duration.

The project required an annual meeting (Table 1) and a yearly progress report from each official participant that would be used to prepare a comprehensive annual report for the CSRS office in Washington, DC. The annual meeting lasted 2-3 days, attracted an average of about 30 attendees, and typically involved 20 or more presentations. Progress reports were given by each member of the Technical Committee (alphabetically by state), followed by presentations from other attendees, a final discussion, and a business meeting to elect officers (Chair, Vice Chair, and Secretary) for a one-year term and establish the specifics for the subsequent year's meeting. In 1988, the meeting format was modified to integrate presentations by Technical Committee members with those of other attendees under the three objectives at that time (systematics, biology, and control). Meetings were run by the elected Chair of the Technical Committee. The Secretary recorded the minutes, which later were distributed to members of the Technical

Committee and to the Directors of the Agricultural Experiment Stations of the participating state universities. The format of the meetings was formal, but the milieu was informal. The meetings fostered collaborations and introduced many graduate students to the community of simuliid workers.

During its 20-year life, NE-118 was one of the most productive Regional Projects in the history of the CSRS. Nearly 20 theses were produced by graduate students who were supported, at least in part, by funds allocated to state universities through the project. More than 100 papers on simuliids were published by personnel of the official participating institutions. The project also spawned an annotated list of black flies in the northeastern United States (Cupp & Gordon 1983), the International Conference on Ecology and Population Management of Black Flies (1985), and an edited volume on black flies (Kim & Merritt 1988) that involved 48 contributors from around the world. In 1981, at the fourth annual meeting of NE-118, an ad hoc subcommittee was established to report on the progress of *Bti* and to recommend standardized laboratory and field protocols for its use against black flies; the result was an edited publication (Molloy 1982).

By the mid 1990s, due partly to the success of *Bti*, the status of black flies as major pests had diminished among the powers that be, and administrative support for a fourth renewal was not forthcoming. One might say that the success of NE-118, in part, ultimately spelled the project's demise. In 1998, NE-118 was replaced with a new five-year project entitled Black Fly Biology, Economic Problems, and Management, or SERA-IEG-29, authored by P. H. Adler and J. W. McCreadie. This project operates in an official, but less formal, configuration under the auspices of the Southern Extension and Research Activities Information Exchange Group (SERA-IEG) of the Southern Association of Agricultural Experiment Station Directors. The Group holds annual meetings, typically in Florida, that generally attract more than 30 attendees from around the world.

[1] Precursor of the Cooperative State Research, Education, and Extension Service - USDA.

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Table 1. Annual meetings of NE-118, including locations, chairs, dates, and numbers of attendees.

Date	Location	Chair	Attendees
5-6 January 1978	University of Massachusetts, Amherst, MA	J. Granett	14
4-5 January 1979	University of Massachusetts, Amherst, MA	J. GRANETT	12
6-7 February 1980	Michigan State University, East Lansing, MI	J. D. Edman	28
10-11 February 1981	Thruway House Hotel, Albany, NY	R. W. Merritt	36
27-28 April 1982	Ramada Inn, Bangor, ME	J. F. Burger	32
26-27 April 1983	Honey in the Rock Motel, Beckley, WV	J. W. Amrine	41
13-14 February 1984	Holiday Inn, Portsmouth, NH	K. C. Kim	32
28-31 May 1985*	Pennsylvania State University, State College, PA	D. P. Molloy	98
14-16 February 1986	Michigan State University, East Lansing, MI	I. N. McDaniel	29
17-18 February 1987	National Museum of Natural History, Washington, DC	J. D. Edman	27
9-11 February 1988	Balsams Hotel, Dixville Notch, NH	J. W. Amrine	37
14-15 February 1989	Loews Le Concorde Hotel, Quebec City,	J. F. Burger	31

	Quebec		
12-13 April 1990	Sheraton Hotel, Charleston , SC	R. W. Merritt	32
14-15 April 1991	California Department of Health, Berkeley, CA	K. E. Gibbs	19
1-3 March 1992	University of Massachusetts, Amherst, MA	P. H. Adler	29
28 February - 2 March 1993	Manoir du Lac Delange, Quebec City, Quebec	K. P. Pruess	32
28 February - 1 March 1994	Archbold Biological Station, Lake Placid, FL	J. F. Burger	27
23-25 February 1995	Rancho de la Osa, Sasabe, AZ	R. W. Merritt	28
23-24 February 1996	Flamingo Lodge, Everglades National Park, FL	F. F. Hunter	29

* The International Conference on Ecology and Population Management of Black Flies was held in lieu of the annual meeting, although the Technical Committee met briefly before the Conference.

MEMBERSHIP NOTICES

Changed Addresses

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THE BRITISH SIMULIID GROUP BULLETIN No. 18, March 2002

CONTENTS

FROM THE EDITOR

Discerning readers will have noticed a change to the cover of *The Bulletin.*

For some time I have been unhappy that the Bulletin has never had a proper financial base, and have expressed this disquiet at a number of our Annual Meetings. Up till now, the printing and distribution costs have been met jointly by the Liverpool School of Tropical Medicine and the School of Biological Sciences, Liverpool University, who had absorbed the costs into their budgets. We are all indebted to the Heads of Departments who have supported *The Bulletin* in this way since 1992, but although continued support has always been implied, there has never been any certainty, and in this climate of tightening fiscal control, I have always feared that the axe might fall at any time.

It was therefore with alacrity that I accepted an offer from Rory Post and Dick Vane-Wright, Keeper of Entomology, Natural History Museum, to publish *The Bulletin* under the umbrella of the Museum. This will obviously give *The Bulletin* a more assured future, and also, when the time comes for me to relinquish the editorship, my successor will not be obliged to hunt for a sponsor.

Honorary Secretary

Trefor Williams, who has given sterling service as Honorary Secretary to the British Simuliid Group since its inception in February 1979, and was also editor of the Newsletters and the first three *Bulletins*, has indicated that he thinks it is time to hand over his duties to someone else. If any member would like to volunteer, or suggest a name, please get in touch with me so that hopefully we can decide on a successor at the next Annual Meeting.

Botha DeMeillon Obituary: a correction

In *Bulletin* No. 17, there was an inaccuracy my account of the historic "Feasability of Onchocerciasis Control" meeting held in Tunis, 1968, which DeMeillon attended, and in which I stated that De Meillon and others in the entomological working group were involved in formulating the first ever budget for OCP. Prof. Rolf Garms has a better recollection of the meeting than I, and has written to me as follows:

> "As far as I remember only three of the entomological working group were condemned to estimate the first budget of the OCP in the Volta River Basin. These were you, Hugo Jamnback and myself. Our estimate was 2.5 million dollars per year, which was a shock for the meeting. So, in the final report, this amount was quoted as an outside limit and it was suggested that it might be possible to reduce the cost to 2 or even 1.5 million. I like to present this story when, in our annual course on Tropical Medicine, I am talking about onchocerciasis control."

Thank you Rolf for putting the record straight.

John B. Davies, Editor

24th BRITISH SIMULIID GROUP MEETING
18th October 2001, University of Birmingham.

At the 23rd. Meeting, held at Salford in the spring of 2000, it was proposed that we should try to hold the next meeting in conjunction with the freshwater biologists at Birmingham

University as we had done in 1995. Thanks to the efforts of Trefor Williams, Malcolm Greenwood and Melanie Bickerton, this came to pass, and the 24th Annual Meeting was held in the new School of Geography and Environmental Sciences, University of Birmingham on 18th October 2001.

As usual, those who arrived the evening before, assembled at the Staff House Bar to meet old acquaintances, and to fortify themselves before tackling a local Balti restaurant. About 20 members, spouses and friends turned up, and the conversation was brisk and animated. We were particularily pleased to welcome three visitors, one from Hamburg and two from Wageningen.

The meeting itself, began at 10.00 am. Unfortunalely, Prof. Geoff Petts, Pro-Vice Chancellor for Research, University of Birmingham, who expected to open the meeting was called away at the last minute, so the chair was taken by Malcolm Greenwood.

The morning session was devoted to a local blackfly biting problem that quite fortuitously had cropped up the previous August near a Water Park to the northeast of Birmingham. Thus making this meeting particularily relevant. The surprising fact is that there appear to be no previous records of blackflies causing a serious problem in this area and everyone was caught unawares, although there had been occasional reports of a mild biting nuisance around the headwaters of the River Cherwell in Oxfordshire earlier in the year. Steven Falk, of the Warwickshire Museum, presented an excellent summary of the situation, which is reproduced below. A local resident, Mrs. Sue Jones, described her personal experiences.

These presentations were followed by a lively discussion, during which the following points were made:

1. The identity of the fly needs to be confirmed. Some adult female specimens were identified as *Simulium lineatum* and *S. variegatum* by Prof. Ian Burgess, whilst another sample was identified by Roger Crosskey as *S. noelleri.*
2. Species taken by sweep-netting riverine vegetation may not necessarily be the same as those biting.
3. In view of the difficulty in identifying adult female simuliids (especially when squashed!), immature stages, particularily pupae, must be collected from the suspect rivers and identified as they are easier to identify. Adults should be reared from the pupae, for comparison with biting specimens.

The meeting concluded with a vote of thanks to Melanie Bickerton for organising the meeting so well.

The 25th Annual Meeting

No date has yet been set for the next annual meeting, however, Jon Bass was asked if he could see whether it could be held in Dorset, possibly at the River Labs.

Presentations made to the Meeting

There were eight verbal presentations, and four posters which are listed in the order of presentation. Where authors have provided abstracts, these are included. Readers wishing to receive details of the other presentations should contact the individual authors. In the case of multiple authors, the presenter's name is underlined.

Simuliidae in British river habitat assessment and water quality monitoring

***Melanie Bickerton**, University of Birmingham*

Anaphylactic Shock probably resulting from multiple Blackfly (Simulium) bites in the English Midlands

***Steven Falk,** Senior Keeper of Natural History, Warwickshire Museum, Market Place, Warwick CV34 4SA*

Between Thursday 23rd and Sunday 26th August 2001, five people were admitted to hospital with severe anaphylaxis shortly following severe biting by biting insects. Three of these had been visitors to Kingsbury Water Park in north Warwickshire, the other cases were from nearby Nuneaton and the Walmley area of north Birmingham. Such a high incidence of anaphylaxis is almost unheard of in this region and one victim (an angina sufferer) nearly died.

The accounts given by two of the victims, plus investigations by local medical experts, seemed to indicate mass *Simulium* biting was the cause, though some of the victims claimed that they had been bitten by mosquitoes. The author carried out surveys of various parts of Kingsbury Water Park on Wednesday 28th in fine weather to determine what sorts of biting insect were present. Mosquitoes were very active in the shaded damp woodland and a sample of about 20 specimens was taken. But they were not encountered in the open situations where one of the anaphylaxis victims claimed to have been subject to biting by small flying insects that did not match the description of mosquitoes. Simuliid flies by contrast were encountered in very large numbers within the open grassland, tall herb and scrub areas towards the River Tame (which passes through the north side of the site). About 100 specimens were taken. Their numbers were particularly large within rank *Deschampsia cespitosa*, *Arrhenatherum elatius* grassland and stinging nettle beds within 50 metres of the river during the morning. They were less evident during the heat of the day, but appeared to become more active again in late afternoon. Whilst specimens could be found up to a 1km from the river, numbers were much reduced. No horseflies were encountered, though it is known that *Haematopota* and *Chrysops* spp. are present at the site.

The samples were sent to Dr Ian Burgess of the Medical Entomology Centre in Cambridge who identified the mosquitoes as *Aedes cantans* Meigen and *A. cinereus* Meigen, both common species. The simuliids were *Simulium lineatum* (Meigen) and *S. variegatum* Meigen. The former simuliid was the more abundant. It probably has three generations per year and breeds in weedy streams and rivers of moderate current. The River Tame, which is fairly shallow, gravel bottomed, of moderate flow and supporting plentiful crowfoot growth seems ideal for this species. *S. variegatum* has three generations per year and favours large swift stony streams. Both species have been recorded attacking larger mammals and presumably also attack humans, though no evidence of anaphylaxis linked to their biting has been found by the author. The presence of the 'Blandford Fly' *S. posticatum*, which became infamous as a serious nuisance in Blandford Forum, Dorset, was not detected and it seems more likely that mass biting resulted from one or both of the two *Simulium* species detected in the samples **(though we are awaiting Mel Bickerton's results of a sample of possible *posticatum* from the Birmingham area)**.

Neither *Simulium* species is rare, or likely to be a new feature of the area, though improved water quality of the River Tame may have increased populations. A possible cause of the problem was the weather at the end of August, which was characterised by very warm, humid, windless conditions. This would have favoured the build up of large, mobile *Simulium* populations in the grassland adjacent to the river. Some of the victims were lightly-dressed individuals who had had been in the vicinity of the River Tame (at least one was a fisherman) away from any grazing stock. It would appear that a combination of fine weather, and access to lightly-dressed individuals where *Simulium* numbers are particularly high can result in mass biting leading to anaphylaxis. Discussion with medical experts suggests that anaphylaxis probably only results from mass biting, not isolated attacks, and different individuals are likely to vary in their degree of susceptibility. Unfortunately two of the victims feel that it was mosquitoes that were responsible. The chances are that these individuals came into contact with both categories of insects during their visit to the Water Park, but attack by a large swarm of tiny *Simulium* is far less noticeable than attack by a much smaller number of more conspicuous mosquitoes. It is thus suspected that *Simulium* flies were the cause of their illness and not mosquitoes.

Anaphylaxis resulting in death of livestock has been suspected as resulting from mass *Simulium* attacks, though no fully documented incidents have been encountered on the world wide web or literature. If any readers are aware of proven links between anaphylaxis and *Simulium*, the author would be keen to receive information. For the time being, this note should be viewed as a notification of a suspected relationship.

Warwickshire County Council, which runs Kingsbury Water

Park, North Warwickshire Borough Council and Warwickshire Health Authority have taken the following measures to reduce the risk of further anaphylaxis cases on its land:

1Placing signs along the riverside paths and leaflets at main entrances, asking people to dress appropriately (trousers, long-sleeved tops and closed shoes) to use insect repellent, and to seek medical attention immediately if they feel unwell (quoting the number of NHS Direct).

Providing ‘Black-fly awareness’ training to the country park rangers to ensure that they know what the flies look like, and where they tend to be most numerous. The author prepared a sample of dead flies within a magnifying ‘bug box’ and accompanying photocopies of illustrations of simuliids and other biting flies, to be kept at the staff quarters at the visitor centre.

⑩Specific training to rangers (who are already qualified first-aiders) on the handling of anaphylaxis victims.

⑩Liaison with accident and emergency units of local hospitals

⑩Dissemination of information to other organisations likely to be affected by the issue e.g. other local authorities within the affected area, other health organisations, GPs, schools, local wildlife trusts, English Nature (West Midlands and Peterborough), plus special study groups such as The British Simuliid Group and Dipterists Forum.

Acknowledgements

The author is grateful to Dr. Huda Mohamed and Debra Khan (Warwickshire Health Authority), the staff of Kingsbury Water Park, Dr. Mel Bickerton (University of Birmingham), Dr Ian Burgess (Medical Entomology Centre) and Paul Williams (North Warwickshire Borough Council) for assistance in the production of this note.

Distribution of Simuliid species downstrearn of the Roadford Reservoir, SW England: Changes recorded over 10 years post-impoundment

Ian Morrissey, *University of Birmingham*

Simuliidae in The Netherlands: first results gathered during an identification course

***Tj.H. van den Hoek* and R. Wiggers,** *Alterra ,- Green World Research Institute, P.O. Box 47, 6700 AA,* Wageningen, The *Netherlands*

In The Netherlands, routine sampling and identification of freshwater macroinvertebrates is mainly carried out by experts of local and regional governmental organisations, like Provincial Environment Agencies and Water Boards.

For years these taxonomists have encountered problems with the identification of Simuliidae due to insufficient knowledge of the taxonomy. Consequently, there are no reliable data available on the distribution and ecology of simuliid species in The Netherlands. Some major causes which have exacerbated the neglection of this group are:

II. the confusing taxonomy and the difficult morphological characteristics;
III. the lack of a reliable reference collection updated to the latest taxonomy and;
IV. the lack of knowledge about species distribution.

The latest updated list of Simuliidae found in The Netherlands was published in 1984 and listed only 12 simuliid species. When comparing this list with lists of other Northern European countries, it became evident that the Dutch list was rather short and probably far from complete.

Table 1 shows the number of Simuliidae species found in some of the Northern European countries:

Table 1: Simuliid species richness in some of the Northern European countries

Country	Number of species	Reference
Britain and Ireland	32	Bass, 1998
Denmark	22	Jenssen, 1984
Eastern Germany	35	Seitz, 1992
The Netherlands	12	Mol, 1984

Despite the loss of potentially suitable habitats due to intensive farming, a variety of running waters can still be found in The Netherlands, so a revision of the list seemed appropriate.

In order to tackle the taxonomic difficulties taxonomists encountered, we decided to organise an identification course prompted by positive feedback from Dutch experts. Jon Bass from the Centre for Ecology and Hydrology (Dorset, UK) was asked to give this course. Besides information on anatomy, morphology and ecology of Simuliidae a substantial part of the course was dedicated to the identification of larvae and pupae found in different regions in our country.

All attending taxonomists were asked to bring along simuliids collected in their region. During the course these specimens were used for identification. This resulted in a list of 21 species based on 75 sites (Table 2). All together, these sites cover all regions where Simuliidae are likely to be found.

Table 2: Comparison of the 1984 species list with the species identified during the course.

Simuliidae species	Mol (1984)	Simuliidae listed during the identification course
1*Prosimulium hirtipes*		X
2*Stegopterna richterii*		X
3*Simulium angustitarse*		X
4*Simulium lundstromi*	X	X
5*Simulium cryophilum*	X	X
6*Simulium vernum* (species complex)	X	X
7*Simulium juxtacrenobium*		X
8*Simulium dunfalense / Simulium urbanum*		X
9*Simulium costatum*	X	X
10*Simulium angustipes*	X	X
11*Simulium aureum*	X	X
12*Simulium lineatum*		X
13*Simulium equinum*	X	X
14*Simulium erythrocephalum*	X	X
15*Simulium intermedium*		X
16*Simulium ornatum* (species complex)	X	X
17*Simulium trifasciatum*	X	X
18*Simulium morsitans*	X	X
19*Simulium posticatum*		X
20*Simulium reptans*		X
21*Simulium noelleri*	X	X

The species *Stegopterna richterii*, *Simulium juxtacrenobium* and *Prosimulium hirtipes* need confirmation through pupae and/or adult identification, as they are based only on larval specimens.

Distribution and ecology

Simulium morsitans was only found in relatively wide lowland streams in the northern part of The Netherlands, all characterised by a low current and scattered patches of vegetation.

Some species/groups appeared more widely distributed over several regions, such as *Simulium ornatum* species complex, *Simulium vernum* species complex and *Simulium noelleri*. *Simulium posticatum* was only found in a fourth order stream near the eastern border with Germany. The species *Simulium aureum*, *Simulium equinum* and *Simulium cryophilum* were found in second and third order lowland streams.

Simulium intermedium and *Simulium costatum* were collected from a few lowland headwater streams. *Simulium costatum*, *Simulium angustitarse* and *Simulium lineatum* were only found in the headwaters of some upland streams in the very south.

Conclusion and further investigation

The identification course on Simuliidae turned out to be of great value. Besides, extending the already existing list with an additional eight species identified during the course, it can be regarded as the first step for Dutch taxonomists to become used to identify Simuliidae.

It is likely that The Netherlands host more species than the current 21 listed. Intensive sampling and increased taxonomical knowledge will contribute to the development of an up-to-date species list. During the course the Dutch experts agreed to send us the results of Simuliidae collected in their region. With these data we will gain a better understanding about the ecology, distribution and ecological significance of Simuliidae in the Netherlands.

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Eradication of the vector *Simulium neavei* from an onchocerciasis focus in western Uganda

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Between-village heterogeneity in the human blood index of *Simulium damnosum s.l.* and onchocerciasis modelling in Northern Cameroon

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Introduction. The role of host choice by onchocerciasis vectors at a particular time and locality, depends on species-specific preferences and probably also on a combination of vector and host density, and availability of preferred and alternative hosts. However, most mathematical models of vector-borne infections encapsulate all these factors under the single (and fixed) umbrella of the parameter representing the proportion of bloodmeals taken on humans (h), also known as the human blood index. In previous onchocerciasis models, h was kept constant for localities in northern Cameroon at 0.3[1] and 0.5.[2] With the development of species-specific DNA probes, populations of the savannah members of *S. damnosum s.l.* in West Africa are now known to harbour a geographically variable proportion of human- and nonhuman-derived *Onchocerca* larvae,[3] suggesting greater variability of the human blood index. Here we modify a previous model[1] to estimate village-specific values of h. We also obtain estimates of absolute vector density and correlate this with both h and distance from the village to vector breeding sites. Finally, we contrast model outputs of the predicted mean no. of L3/biting fly, and the relationship between the basic reproduction number (R_0) and annual biting rate under the assumptions of constant and heterogeneous h.

Model assumptions. Let H_x denote human hosts, H_y non-human (ungulate) hosts, V_x the no. of vectors feeding on humans, V_y the no. of vectors feeding on nonhumans, and g the interval between two consecutive bloodmeals. The proportion of total vectors, V, taking a bloodmeal on humans is $h_x = V_x/(V_x+V_y)$. The annual biting rate (β) can be written as $\beta = (V\,h_x)/(H_x\,g) = V_x/(H_x\,g)$ and the no. of vectors feeding on humans as $V_x = \beta\,H_x\,g$, with values for β and H_x in each village as reported,[4-6] and g equal to 3-4 days. While R_0 represents the maximum (unconstrained) reproductive potential of the parasite (the average no. of mature females produced by a female worm during her reproductive lifespan in the absence of regulatory processes), the effective reproductive number, R, can be expressed as a function of parasite density. At endemic (pre-control) equilibrium, R = 1, as each female worm replaces only herself during her lifetime.

Results and Discussion. We measured parasite density in terms of the pre-control mean microfilarial load (M) in the community, and obtained the values of h_x that satisfied $R(M) = 1$ for each village. Values of h_x ranged from 0.6 to 0.006, and decreased with increasing V. In northern Cameroon, the human blood index had been reported to vary between 0.2 and 0.5.[6] Estimated values of V decreased with increasing distance of the village from breeding sites.[5] We proceeded to use the new h_x values in the equation describing the rate of change with respect to time of the mean no. of L3 larvae/fly, L.[1] Allowing for heterogeneity in the human blood index improved model fit significantly. Finally, we recalculated R_0 and plotted the values against annual biting rate. Under the hypothesis of constant h_x, R_0 varies linearly with β. In contrast, the new values of R_0 are lower than those previously estimated, and the relationship with β becomes nonlinear. This implies that changes in vector density would have to be reduced to very low levels to substantially reduce the basic reproductive number of *O. volvulus* by vector control programmes.

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K Razali was the recipient of a scholarship of Universiti Malayi while doing her MSc at the former Wellcome Trust Centre for Epidemiology of Infectious Disease, Oxford University. M-G Basáñez thanks the Wellcome Trust. We thank C Fraser, G Garnett, and A Renz for helpful discussions.

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Estimating the prevalence and intensity of *Onchocerca volvulus* infection in *Simulium guianense s.l.* using the O-150 polymerase chain reaction assay

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Introduction. Because mass ivermectin distribution depresses *Onchocerca volvulus* infection, traditional dissection methods have become inefficient. Entomomological tools are needed which are both species-specific and highly sensitive for surveillance in controlled areas. The O-150 polymerase chain reaction (PCR) assay for the detection of *O. volvulus* has been tested and validated using *Simulium damnosum s.l.* in the Onchocerciasis Control Programme area in West Africa,[1] and *S. ochraceum* in Mexico.[2] We report its application to *S. guianense* Wise *s.l.*, the main vector in hyperendemic areas of the Amazonian focus between Venezuela and Brazil. This technique would provide estimates of the proportion flies infected (using whole bodies) or infective (using only heads), but not of the no. of larvae/fly. The former, together with biting rates (*BR*), provide a measure of the infective biting rate (*IBR*). The latter, forms part of the transmission potential (*TP*), a component of the force of infection. Knowledge of the relationship between transmission, infection, and morbidity is essential for monitoring control programmes.

Methods.

<u>Prevalence of vector infection and comparison of dissection vs. O-150 PCR pool screening.</u> A total of 5,979 host-seeking *S. guianense* flies were collected using from dawn to dusk during 7 consecutive days in May 2000 (rainy season) at the Yanomami locality of Coyowë-theri. The ivermectin distribution programme commenced in 1994. At the time of this study the community had received 7 rounds of (annual) treatment. After assessing parity status in the field, flies were stored in 100% ethanol, with half being processed by dissection (at CAICET) and the other half using the PCR-assay (at Alabama). Confidence limits (95% CL) for the proportion of infective flies were obtained by the exact method for dissected flies and by PoolScreen™ for PCR-tested flies,[3] with pool size = 50 flies.

<u>Intensity of vector infection: estimating the mean infective larval load</u>

from the proportion of infective flies. We explored the distribution of L3 larvae among pre-control *S. guianense* samples (1982–1993). In 10 out of 14 samples (n = 148–4,325 flies) the distribution was significantly overdispersed, with variance over mean ratio >1. For these samples, parameter k of the negative binomial distribution was estimated. Values of k ranged from 0.002 to 0.02 and increased linearly with the mean. The relationship between proportion of infective flies, P, and mean no. of L3 larvae/fly, m, was fitted (by maximum likelihood) using an underlying negative binomial distribution with $k(m) = k_0 + k_1 m$. Estimates were k_0 = 0.001 and k_1 = 0.249.

Results. *DBR* in May 2000 was 790 flies/person-day. There was no statistically significant difference between the prevalence of infective flies estimated by either method. Dissection of 2,729 flies resulted in 7 with *O. volvulus* L3 larvae (0.26%; 95% CL = 0.10–0.53). Eleven pools out of 63 (3,150 heads) were positive by PCR (0.38%; 95% CL = 0.19–0.69). *MIBR's* were 64 (25–130) and 93 (46–169) infective bites/person-month, respectively. The mean no. of L3/fly was 0.003 (0.001–0.006) by dissection (*MTP* = 73 L3/person-month). The estimated larval load in the PCR-processed flies was, however, 0.009 (0.004–0.016) L3/fly (*MTP* = 220).

Discussion. After 7 rounds of ivermectin (coverage = 46–78% of total population), the arithmetic mean mf load in Coyowë has decreased from 64 to 23 mf/mg and CMFL from 19 to 9 mf/snip. Entomological indicators are not yet reflecting this change. The pre-control percentage of infective flies was 0.21% (0.10%–0.26%) in the rainy months of April–July 1993 (n = 11,442). The pre-ivermectin transmission potential (0.009 L3/fly; *DBR* = 808; *MTP* = 225) is also very similar to that from the PCR-processed flies. We will continue refining statistical methods to obtain accurate estimates of transmission intensity from prevalence in vectors, and exploring the relationship between entomological and epidemiological indices. The use of any larval stage, instead of L3 only, may be more practical (no separation of heads required) and more sensitive for the purposes of entomological surveillance.[4]

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Interspecific hybridisation and potential gene flow in the *Simulium damnosum* complex

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It has been known for more than 25 years that the morphospecies *Simulium damnosum* s.l. exists as a series of chromosomally-defined cytospecies. During this time studies of morphology, proteins, cuticular hydrocarbons and DNA have largely failed to discover additional taxonomic traits by which the adult flies can be identified (except in a few cases). This is in marked contrast to species complexes in some other families such as Drosophilidae and Culicidae.

A possible explanation for this might be that within the *S. damnosum* complex regular interspecific hybridisation has slowed the genetic divergence of sibling species. There is direct evidence for interspecific hybridisation. In cytotaxonomic studies where the total number of specimens examined has been presented 14/12452 (=0.09%) hybrids and 1/12452 (=0.008%) backcross progeny have been found (Post, 1984). A further three backcross progeny have been recorded by Boakye and Meredith (1993). These are high rates of hybridisation. Indirect evidence from molecular phylogeny reconstruction (Morales Hojas, 2001) and the interspecific distribution of insecticide resistance (Boakye and Meredith, 1993) are fully consistent with this idea.

Posters displayed at the meeting

A revision of the systematics of the *Simulium damnosum* complex

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The molecular systematics of a broad selection of samples of the *Simulium damnosum* complex from various parts of Africa was studied by sequence analysis of the ND4 and 16S mtDNA fragments. Some of the samples had been collected in the 1960s and were used then by Dunbar in his early cytogenetic studies. This enabled us to compare both Dunbar's and our own results. It turned out that the *S. damnosum* complex comprises two main branches which by geographical distribution of the species are almost exactly separated by the equator and not, as considered hitherto, divided into an East and a West African clade. The northern branch covers the 'Nile' group including the 'squamosum', 'Nile' and 'sanctipauli' subcomplexes, whereas the southern branch includes the 'Sanje' and 'Kibwezi' groups. Although most of the highly anthropophilic vector species belong to the northern clade the phylogenetic relationships within the complex do not correlate with host preferences or other behavioural/ecological characteristics.

The results suggest changed systematic positions for *S. mengense* and 'Kagera', and *S. rasyani*, *S. latipollex* and *S. machadoi* are placed into the system for the first time. The cytoform 'Kaku' appears to be identical with *S. pandanophilum*.

Simulium damnosum complex in the Gulf of Guinea.

Mabintu Mustapha, RJ.Post, P.K.Flook, A.L.Millest, R.A.Cheke, P.J.McCall, MD.Wilson, S.Somiari, J.B.Davies, R.A.Mank, P. Genen, A.Sima and J.Mas.
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Biting and infection rates of *Simulium exiguum s.l.* and *S. quadrivittatum* in two hyperendemic areas of Ecuador before the initiation of ivermectin control

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Background and Objectives. In Esmeraldas Province in Ecuador there was a high prevalence of onchocerciasis among the Chachi (Amerindian) and the Black populations before the mass ivermectin distribution programme was introduced.[1] The main vectors are *Simulium exiguum* Roubaud s.l. (without cibarial armature) and *S. quadrivittatum* Loew (with armed cibarium). Other species are *S. escomeli* and *S. bipunctatum*.[2] Pre-ivermectin entomological evaluations were conducted in 1995-1996 in two hyperendemic localities of the Cayapas river with the objective of investigating spatial and temporal variation in the biting patterns and rates of infection (with *Onchocerca volvulus* larvae) of *S. exiguum* s.l. and *S. quadrivittatum*. This would provide the Ecuadorian programme for onchocerciasis control with baseline data for entomological monitoring of control progress, and indicate the months and times of the day that would maximise efficiency of entomological sampling for REntA (Rapid Entomological Assessment) methods.

Methods and Data Analysis. The study area comprised the localities of El Tigre (ET) and San Miguel (SM). Fly collection took place every other month between Nov 1995 and Nov 1996 at four sites per locality: two by the river Cayapas and two in the village. Host-seeking simuliids were collected from 08:00 to 12:00 and from 13:00 to 17:00 h for four consecutive days per month using 20 min. collection periods per hour and site. Flies were counted, identified, and divided into two groups, one to be dissected manually and the other to be analysed using O-150 PCR pool screening (results elsewhere).

Determinants of vector density. We multiplied the no. flies in 20' period x 3 to obtain the no. flies per hour. The logarithmic transformation, i.e. Log (no. flies+1) was used to normalise the distribution. A four-factor ANOVA: locality, site, month, hours of the day (and their interactions) was conducted.

Biting and Infection rates. The daily biting rate (*DBR*) was estimated as the geometric mean no. of flies per hour x 12 = No. flies per day = *DBR*. Monthly biting rates (*MBR*) were calculated multiplying *DBR* by the corresponding no. days in each month. Multiplying *MBR* times the proportion of infective flies in the sample gives Monthly Infective Biting Rates (*MIBR*), and *MBR* times the mean no. L3 larvae per dissected fly gives the Monthly Transmission Potential (*MTP*).

Results and Discussion. *S. exiguum* was more abundant in ET

(Geometric mean MBR = 2,077 bites/person-month) than in SM (GM-MBR = 706). In contrast, *S. quadrivittatum* was more abundant in SM (Gm-MBR = 1,898) than in ET (GM-MBR = 755). *S. exiguum* was more frequently collected by the river sites while *S. quadrivittatum* was more frequently collected outside the houses. For both species, biting rates were higher from March through July (end of dry season and rainy season) than during the dry season (September through January). *S. exiguum* showed a clearly bimodal pattern during the day (with peaks of biting activity early morning and late afternoon). *S. quadrivittatum* bites more frequently in the morning. *S. exiguum* had higher overall infective biting rates (MIBR = 16 and 7 in, respectively, ET and SM) than those of *S. quadrivittatum* (MIBR = 2 in both ET and SM). MTP values were higher in ET for both vector species, but while *S. exiguum* exhibited the highest MTP (~ 250) in July (rainy season), *S. quadrivittatum* had its highest MTP (~ 25) in March (end of dry season). This difference in MIBR and MTP (about 1 order of magnitude higher in *S. exiguum* than in *S. quadrivittatum*) is consistent with the results of fly feeding experiments, which demonstrate a higher vector competence of 'unarmed' *S. exiguum* (Cayapas form) in comparison to that of 'armed' *S. quadrivittatum*.[2,3]

Acknowledgements. JC Vieira was a short-term entomological consultant for the Onchocerciasis Elimination Program for the Americas (OEPA) and acknowledges the support of the Ecuadorian programme for Onchocerciasis Control. L Brackenboro conducted data analyses as part of her MSc project at the former Wellcome Trust Centre for Epidemiology of Infectious Disease, Oxford University. M-G Basáñez thanks the Wellcome Trust.

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Spatial and seasonal variation of biting and parity rates of blackfly vectors in the Amazonian onchocerciasis focus

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Introduction and Objectives. The Amazonian onchocerciasis focus encompasses Yanomami populations between Venezuela and Brazil. It has been well characterised for the highland areas, where *Simulium guianense s.l.* is an efficient vector, responsible for hyperendemic transmission[1] but less so for the lowlands. Infection prevalence has been shown to increase with altitude along two river systems.[2] This positive association could be partially explained by clinal variation in the *Simulium* species composition, blackfly abundance, and vector competence along the gradient. A recently implemented ivermectin-based control campaign has demanded investigation of entomological indicators and risk factors along this altitudinal gradient. We present information on spatial and seasonal variation in relative abundance (*RA*), daily biting rates (*DBR*), and proportion of parous flies (*PP*) of *S. oyapockense s.l.*, *S. incrustatum* and *S. guianense s.l.* in 6 sentinel localities up to 240 m above sea level (asl) along the Ocamo/Putaco (A) and Orinoco/Orinoquinto river systems (B) within the control area.

Methods and Data Analysis. The study area comprised the Yanomami villages of Ocamo, Maweti, Awei-theri, Pashopeka, Mahekoto-theri and Hasupiwei-theri. In each village, and during 1 to 5 consecutive days per visit, all blackflies that landed to bite on two human attractants were caught during 30 min. of each hour from 07:00 to 18:30 h. This amounted to 12 half-hour intervals per collecting day. Collections took place between 1995 and 1999 with most communities visited more than once as to cover both dry and rainy seasons for each community. In the field, all hourly-caught flies were identified to species,[3,4] counted, and dissected for parity status. RA was expressed as the percentage represented by each species of the total collected at each locality and season. DBR's were obtained by multiplying each 30 min. collection period by 2 (with the exception of the 18:00-18:30 h), adding the hourly totals and taking the arithmetic mean of the daily totals. DBR's were multiplied by the corresponding no. of days in the month to obtain monthly biting rates (MBR). PP is the percentage of parous flies in the sample. Multiplying MBR times PP gives the monthly parous biting rate (MPBR). Abiotic variables included rainfall and river height (routinely measured at the meteorological station of Ocamo).

Results and Discussion. *S. oyapockense* prevailed below 150 m along both river systems. Above this altitude and up to 240 m, *S. incrustatum* and *S. guianense* become more frequently and evenly collected along river system A, but not along B, where *S. incrustatum* remained absent. The *DBR* of *S. oyopockense* was higher during the dry season along river system A whereas the converse occurred along river system B. The *DBR* of *S. incrustatum* was lowest during early rains, while that of *S. guianense* was highest during this period. Values of *MPBR* suggest that the months contributing most to onchocerciasis transmission are probably the dry season and the transition periods between seasons. This has been confirmed for *S. guianense* in the locality of Coyowë-theri (250 m asl). There was a significant negative cross-correlation between *PP* of *S. oyapockense* and river height (2- and 3-month lagged), whereas river height (1- and 2-mo lagged) was positively correlated with *PP* for *S. incrustatum*. This suggests an interplay between favoured breeding sites, their proximity to villages, breeding site dynamics and survival of immature populations which varies for each species.

Acknowledgements. M-E Grillet and S. Vivas-Martínez acknowledge the financial support of the World Bank. M-G Basáñez thanks the Wellcome Trust and the British Council Academic Links Programme.

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R.C.Muirhead-Thomson (1914-2000)

Born in Kilmaurs, Scotland on 2 May 1914, and graduated in 1936 at Glasgow University with a 1st class honours Bsc degree in Zoology, obtaining his DSc in 1942. Although devoting most of his life to studying the vectors of malaria, he did have an interest in onchocerciasis and blackfly vector control, publishing a paper on "The development of *Onchocerca volvulus* in... *S. damnosum"* in the *Am. J. trop. Med & Hyg*. Vol. 6 In 1957.

Between 1957 to 1966 he was with the World Health Organisation in India, Zimbabwe and Geneva.

In 1966 he obtained a grant from the Medical Research Council to carry out laboratory evaluations of *Simulium* larvicides. This was followed by a series of publications spanning the years 1977 to 1983 on the toxicity of permethrin, temephos, decamethrin, and chlorphoxim to *Simulium* larvae. This was at the time that the Onchocerciasis Control Programme was looking for alternative larvicides to temephos (Abate). In addition to publishing about 54 papers, he wrote seven books, of which two described the impact of insecticides on aquatic fauna, and one on the behaviour pattens of blood-sucking flies.

He was very courteous, but considered something of a loner and eccentric. He was an enthusiastic photographer, and cartoon drawer. His wife pre-deceased him in 1988, and he died on 4th October 2000, leaving no children or close relatives.

Two more detailed obituaries by Mike Service can be found in the *Annals of Tropical Medicine and Parasitology*, 95: 857-858 (2001) and *Antenna* 26 (1): 9-11, from which much of the above information has been gleaned.

John. B. Davies

A memorial note on Anna Ilyina

Anna never wrote a paper on blackflies, nor did her name even once appear on the title page of one, but her death deserves to be remembered in the *BSGBulletin.* It was she who, through her loyalty to the late I. A. Rubtsov and dedication to her work for him, ensured the very high curatorial standard of the simuliid collection in the Zoological Institute of the Soviet (now Russian) Academy of Sciences in Leningrad (now St Petersburg). Anna became Rubtsov's assistant in 1949 and remained in this post until Rubtsov's retirement in 1979 - and informally continued in effect as his assistant for several years afterwards. We met Anna when we visited St Petersburg in 1997 to work on the 'Rubtsov' collection. While we were there Anna came in daily to help us find the types and other specimens that we wanted to see, gamely climbing steps and bringing down weighty slide boxes and specimen drawers - a task that would have taxed many younger than her 75 years.

Anna Alexeevna Ilyina (= Il'ina) was born on 16 November 1924 and died on 14 January 2001. She was an unassuming person, kind and quiet and much loved by the staff of the Zoological Institute - which it would not be wholly true to say of Rubtsov himself. She was meticulous with the collection, even arranging the pinned specimens not only in beautifully neat rows but with those from the same locality in date order of their capture. Anna's work as technician mainly involved slide-making and collection maintenance but she also typed Rubtsov's manuscripts and (sometimes) accompanied him on collecting trips; early on she went with him to Irkutsk Province in Siberia and in 1951 to the Crimea in Ukraine; in 1956 she made the first of several more local trips in Leningrad Province. It was on the 1956 field trip that Anna collected the original material of S*imulium annae* which Rubtsov named for her (as *Eusimulium annae)* in his *Fauna of the USSR* simuliid volume (1956). A photograph of Anna with Rubtsov at the microscope, probably taken about this time, is on page 5 of the English language bibliography of Rubtsov's work on Simuliidae (Crosskey, 1999, *Studia dipterologica* 6: 3-32).

It has been with the help of our dipterist friend Vera Rikhter at the Zoological Institute in St Petersburg that we have been able to provide some of this thumbnail sketch and we thank her warmly.

Roger W. Crosskey and Peter H. Adler

MEMBERSHIP NOTICES

New Members

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THE BRITISH SIMULIID GROUP BULLETIN

No. 19

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CONTENTS

STEVE MOSS

MEMBERSHIP NOTICES

FROM THE EDITOR

Your *Bulletin* continues to florish, as evidenced by this somewhat thicker edition, and already about half of the next is spoken for. As next year will be our 25th jubilee, I am hoping to make the 20th *Bulletin* a special number, and if space permits hope to include an index to all 20 *Bulletins.* Nevertheless, please keep material coming in. One section that I thought we might include is a section of short anecdotes on member's experiences, amusing, interesting or even libellous. Think about it and send in your contributions.

John Davies Editor.

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STEVE MOSS

The totally unexpected death of Dr. S.T. (Steve) Moss on 25 October 2001, came as a shock to all who knew him. Steve had maintained a close relationship with the Group since its inception in 1979. As a mycologist he was one of the first to take in interest in the ecological relationship between the Simuliidae and fungae, at a time when the search for bio control agents was on, contributing in the 5th. *Newsletter,* an illustrated key to the *Trichomycetes* associated with *Simulium* larvae, which I am told still remains the definitive key to this day- in fact a request for a copy was received by the Editor earlier this year. In all, Steve contributed 5 papers, notes or talks in the *Newsletter*, and two more in the *Bulletins* He also organised the memorable 1991 meeting in Postsmouth, which was preceded by a gargantuan 7-course repast at a French restaurant the evening before.

Steve began science as an external student of London University, later obtaining an MSc from Birkbeck College, and a PhD from Reading. His interests encompassed not only freshwater aquatic fungae but the fungi of the Mary Rose wreck, and marine fungi in general.

He was an active member of the British Mycological Society, being on its Council and General Secretary for many years, finally being elected President in 2000. As a person he was gentle, kindly and most helpful to those who requested information or assistance. He was a painstaking and meticulous worker and an excellent lecturer. He has left a gap that will be hard to fill.

John Davies

Editor's Note: Some of the information above has been borrowed from an obituary by Stefan Buczacki which appeared in *The Mycologist* Vol. 16 p 87, May, 2002, kindly supplied to us by Alan Rizzo.

MEETING REPORTS

24th ANNUAL BRITISH SIMULIID GROUP MEETING
18 September 2002 – Center for Hydrology & Ecology, Dorset, U.K.

This year the meeting was held in Dorset, near Wareham at the new Center for Ecology and Hydrology (CEH) located behind a formitable security system, at Winfrith Technology Park. As usual, those members and friends who travelled down early, met for an informal dinner the evening before, this time at the Rajpoot Indian Restaurant, Wareham. Twenty-one persons were present, the numbers possibly reflecting the distance many of us had to travel. We were very pleased to welcome colleagues from Germany and Austria. Overall, it was a lively group generating some heated discussions, possibly fuelled by the cuisine.

The main meeting on the 18th was opened by Professor Alan Gray, Director of the Center for Ecology and Hydrology, Dorset who explained that the Center is a combination of the former IFE River Laboratories at East Stoke and the former Research Station at Furzebrook, and is now situated in splendid new laboratories at Winfrith. CEH is presently involved in launching a new *Atlas of the British Flora*, which shows that, in terms of biodiversity, the richest six square mile square in the United Kingdom is located in Dorset and contains the town of Wareham. This is the reason why the laboratory is sited where it is.

The morning session, attended by 21 members, included four 20-minute presentations, (abstracts below), plus two posters and was followed by a discussion on three matters of business:

1. Post of Honorary Secretary. As stated in Bulletin No. 18, Trefor Williams, who has given sterling service as Honorary Secretary to the Group since its inception in February 1979, and was also editor of the Newsletters and the first three *Bulletins*, has indicated that he thinks it is time to hand over his duties to someone else. Members had been requested to suggest nominations, but the only person proposed felt that although he was interested, his future was so uncertain that he could not accept the post at present. There being no other nominations, it was decided to defer the decision until the next meeting, with your Editor standing in as temporary Hon. Secretary.

Next Meeting The 25th Jubilee Meeting is due to fall in 2003. It was felt that some effort should be made to make the meeting a little special. One proposal was that we should try to combine with the German Simuliid Group, but they hold their meetings every two years, the next being in 2004. There seemed to be a general consensus that it should be held in London, the venue of the first meeting in 1979, with both The Natural History Museum and Imperial College being suggested. It was left to the acting Hon. Sec. to develop this further. We have since received an informal suggestion from Manfred Car and Doreen Werner that we consider joining their next meeting in Berlin, 2004.

In the afternoon, we all travelled the short distance to the old River Laboratory at East Stoke for an opportunity to collect specimens from R. Frome (accompanied by some inaccurate weilding of grappling hooks). Unfortunately, very few pupae could be found – mainly *S. equinum* - although there was an abundance of small larvae. The meeting ended with a vote of thanks to Jon Bass and his colleagues for organising an excellent meeting.

PAPERS PRESENTED AT THE MEETING

Survey of the Blackflies (Diptera: Simuliidae) from Belize

A.J.Shelley, L.M.Hernández and **M. Penn**,
Department of Entomology, The Natural History Museum, London SW7 5BD, U.K.

Five onchocerciasis foci are recorded in Central America (Guatemala and Mexico), but none in Belize. Two cases of human onchocerciasis, probably from Guatemala or Mexico, were previously recorded from

Belize and in 1959 a parasitological survey accompanied by a preliminary survey for possible simuliid vector species. No other cases of onchocerciasis were found, although three simuliid species that transmit *O. volvulus* elsewhere were recorded. It was concluded that the risk of transmission of onchocerciasis in Belize could only be assessed once the epidemiology of the disease was better understood in Guatemala and Mexico.

Forty years on the epidemiology of the disease in Latin America is well documented, Belize has developed significantly as a result of an improved road infrastructure and migration of people from neighbouring countries (especially Guatemala) has significantly increased. The present survey was carried out to provide data on the current distribution and biology of Simuliidae in Belize and an overview of the factors that might influence the dispersal of human onchocerciasis to the country.

Twelve simuliid species were collected in Belize, seven of which are known vectors. The record of *S. veracruzanum* is corrected for Belize. Primary vectors are *S. ochraceum* (in Guatemala and Mexico) and *S. metallicum* (in northern Venezuela). Most of species are widely distributed in Belize, except *S. ganalesense* which was only found in southern Belize in sympatry with *S. haematopotum*. *Heminectha* species were recorded from fast flowing rivers and waterfalls. Other simuliid species were collected in different water courses. The anthropophilic species in Belize can be divided in two groups depending on the presence or absence of cibarial teeth. Other factors that affect the host capacity are discussed. No routine examination for onchocerciasis is carried out in hospital in Belize.

Simuliidae: Key to Larvae and Pupae from Central and Western Europe, CD-ROM Edition

Wolfgang Lechthaler[1],and **Manfred Car**[2]

[1] Technisches Büro für Biologie, Brunneng. 76/22, A-1160 Wien, Austria: wolfgang.lechthaler@chello.at

[2] Institut für wissenschaftliche Analyse, Adolf Hruzastr. 3, A-2345 Brunn am Gebirge, Austria: manfredcar@utanet.at

Material and Methods

Simuliidae larvae and pupae derive from the collection of the junior author (MC), missing species were kindly provided by BASS and CROSSKEY (Britain), KNOZ (Czech Republic), MALMQUIST (Sweden), NIESIOLOWSKY (Poland), RAASTAD (Norway), and SEITZ and WERNER (Germany).

Preparation and photography was made by W.L. using a digital video-camera, which allows the production of high-quality images of objects under microscopes with low or high magnification. Images show an analysis of 752 x 494 per chip, in total, they contain of about 1.3 million picture elements.

Image acquisition, archiving, and processing was carried out by using a special software-program of SIS (Soft Imaging Systems), Analysis, V. 3.1. A various range of applications allows manual or automatical measurements of microscopic structures, to insert editable overlays with text and graphic supports or to edit images by using filters.

To eliminate the limited depth of focus, a restricting problem of light microscopy, images were produced with the software-module EFI (Extended Focal Imaging), which extracts those parts of the image that are in focus. Mounted into a single image, these details result in an image with unlimited depth of focus and maximal information.

The Key

The digital key enables the user to determine larvae and pupae of 70 blackfly species, which represent the Simuliidae fauna of 17 European countries:

Andorra	**Denmark**	**Liechtenstein**	**Slovenia**

Andorra	**Denmark**	**Liechtenstein**	**Slovenia**
Austria	**France**	**Luxembourg**	**Switzerland**
Belgium	**Germany**	**Netherlands**	
Britain **Czech Republic**	**Hungary** **Ireland**	**Poland** **Slovakia**	

It consists of 4 parts:

V. **Faunistic-ecological part:** A checklist for each country containing ecological parameters for each species can be drawn from the database.

VI. **Digital Key:** The user decides between two photos of taxonomic important features which way to follow. For each step 2 – 4 features can be compared.

VII. **Morphological Atlas:** An illustrated description of the larval and pupal morphology. The user may choose from a sequence of photos with exact explanation of taxonomic features or ask for a feature in a search window and find the adequate photo.

VIII. **Gallery:** Larval and pupal stages of each species are represented in the database of 2000 photos with about 15 - 20 pictures. Depending on the size of the screen the user may open an unlimited number of pictures to compare similarities of and differences between blackfly species.

The key covers more than two third of the North- and South-European Simuliidae fauna. Future updates will cover the missing European species.

The Effect of Different *Onchocerca-Simulium* Combinations on the Outcome of Ivermectin-Based Control Programmes

Sharon Kennedy and **María-Gloria Basáñez**

I*mperial College Faculty of Medicine (St. Mary's Campus), Department of Infectious Disease Epidemiology, Norfolk Place, London W2 1PG, UK.*

Rationale. *Simulium* vectors of *Onchocerca* parasites are known to vary geographically in biological, ecological and behavioural traits,[1] underlining a potential to differentially affect the outcome of ivermectin-based control programmes. Two *O. volvulus*-*Simulium* combinations were chosen to represent savannah and forest species of *S. damnosum s.l.* from West Africa (*S. damnosum s.s./ S. sirbanum*, and *S. leonense,* respectively) and a third one from Latin America, with a well-developed cibarial armature (*S. ochraceum s.l.* from Mesoamerica). A pre-existing mathematical model[2] was used to represent different structural assumptions in relation to the three chosen complexes, and various ivermectin-based control strategies were simulated. A sensitivity analysis was conducted to test whether the outcome of these control strategies was sensitive to variations in vector-related parameters. This study provides estimates of the time required to reduce onchocerciasis transmission according to different control strategies and vector species, and provides a foundation for further exploration of the role of inter- and intraspecific vector variation in onchocerciasis transmission and its control.

Methods. Three equations, representing the rates of change with respect to time of mean adult worm and microfilarial burden per person and infective larval load per fly were used.[2] Structural assumptions were defined in the model as limitation of larval development within the vector (savannah species); proportionality (forest), and initial facilitation (Mesoamerica). Exposure-dependent parasite establishment within the human host was assumed throughout. Model solutions were obtained with the Berkeley-Madonna numerical integration package. Two definitions of model sensitivity were used: 1. when choosing the most influential parameters on which to base subsequent analyses, criteria were based both on the absolute difference between the maximum and minimum outcome parasite loads obtained within the parameter range explored (Table 1), and on this difference expressed as a proportion of the maximum [(max-min)/max]; 2. when investigating the effect of the most influential parameters on the outcome of different control strategies, the variable of interest was defined in terms of the no. of years and no. of treatments required to reduce the Annual Transmission Potential (ATP) by 95% and 99% of pre-control endemic equilibrium values. Control strategies were simulated to reflect annual, biannual and triannual ivermectin treatments with low (50%), moderate (65%) and high (80%) coverage (C) of the total host population. Microfilaricidal efficacy (E) was set at 95%. Each treatment was represented in two ways: 1. A PULSE function providing an immediate reduction in microfilarial (M) numbers corresponding to M[1-(E x C)], and 2. A MOD function providing a reduction in female worm fecundity, representing a non-cumulative 30% decrease from pre-control levels over one year.[3]

Table 1: Parameter values and ranges used in study

Parameter representing:	*S. damnosum s.l.* (*S. ochraceum s.l.* when different) Nominal value	Range used in Sensitivity Analysis
Natural vector mortality (uninfected)	1/week	1 every 2 days-1 every 3 months
Linear parasite-induced vector mortality	0.5968 (0.4327)	0.05-5 per microfilaria ingested
Quadratic parasite-induced vector mortality	0.0025 (0.00027)	0.00025-0.025 (0.0003-0.003) per mf^2
Severity of density-dependent limitation*	0.0205 (0.132)	0.00205-1.32 per mf
Interval between 2 consecutive blood-meals	1 every 3 days	4/day-1 every 30 days
Proportion of L3 larvae inoculated into humans	0.5	0-1
Degree of anthropophagy	0.5	0-1
Proportion of parasites establishing successfully	~2% (~0.2%)	<1% - 30% (<0.02% - 3%)
Annual biting rate	15,000	1,000 - 300,000 bites per person per yr

* Parameter value = 0 by definition for forest species of *S. damnosum s.l.* (proportionality)

Table 2: Effect of different structural assumptions associated with each vector-parasite combination on the outcome of selected ivermectin control strategies, ABR = 15,000

Species combination	Years to 95% reduction in ATP (No. treatments)			Years to 99% reduction in ATP (No. treatments)		
	Annual	Biannual	Tri-annual	Annual	Biannual	Tri-annual
S. damnosum s.l. (savannah)	N/A	9.5 (18)	3 (8)	N/A	34 (67)	19 (55)
S. damnosum s.l. (forest)	23	4.5 (8)	3 (7)	N/A	22 (43)	11 (32)
S. ochraceum s.l.	6	3 (5)	2 (5)	14	5 (10)	3 (7)

N/A not attained; Nominal parameter values used with 65% coverage level

Results. Model outputs were most sensitive to variations in parameters representing: a) parasite establishment within the vector; b) Annual Biting Rate (ABR); c) degree of anthropophagy, and d) the proportion of infective (L3) larvae inoculated into humans, per bite. These parameters

were deemed to warrant further investigation. The model was least sensitive to variations in the survival of uninfected flies, and parasite-induced vector mortality. In general, an increase in value of any of the most influential parameters, was associated with longer times to reduce

ATP, and this effect was exacerbated when 2 or more parameters were varied simultaneously. Annual treatments failed to attain a 95% reduction in original ATP when coverage was low. Biannual and triannual treatments, even at low coverage levels, consistently reduced

ATP faster than did annual treatments at high coverage levels. Although triannual treatments reduced ATP faster than biannual treatments this was not always associated with a reduction in the overall number of treatments required (Table 2).

Discussion. Forest species of *S. damnosum s.l.* required longer treatment durations to reduce ATP than did savanna species due to the higher ABR, parasite establishment, and human-blood index assumed for forest species. However, despite a higher degree of anthropophagy and vector density, *S. ochraceum* required shorter programme durations than *S. damnosum s.l.* to attain similar reductions in ATP. This is probably due to stronger constraints on parasite establishment resulting from the presence of a cibarial armature in the former, which translates into a lower vector competence. The results of this study suggest that geographical variations in vector-parasite combinations have the potential to differentially influence the outcome of ivermectin-based control programmes and this should be investigated further.

Acknowledgements. Sharon Kennedy extends her thanks to the Medical Research Council, UK, for financial support during her 'MSc in Modern Epidemiology' at Imperial College. Christophe Fraser, John Williams, Christl Donnelly, Orli Bachall and Geoff Garnett, at the Department of Infectious Disease Epidemiology, provided useful advice for model implementation and execution of the sensitivity analysis. Rory Post, from the Natural History Museum, London, encouraged us to look at the differential impact of different simuliid species on treatment outcome and provided helpful bibliographic references and discussion.

References*:*

1. Shelley AJ (1994) Factors affecting filarial transmission by Simuliids. *Advances in Disease Vector Research* **10**: 183-214
2. Basáñez M-G, Ricardez-Esquinca J (2001) Models for the population biology and control of human onchocerciasis. *Trends in Parasitology* **17**: 430-438

4Plaisier AP, van Oortmarssen G, Habbema JDF, Remme JDF, Alley ES (1990) ONCHOSIM: a model and computer simulation programme for the transmission and control of onchocerciasis. *Comput. Meth. Programs Biomed*. **31**:43-56

A Proposal to make all past BSG publications available in Electronic Format

John B. Davies: Liverpool School of Tropical Medicine, Liverpool, L3 5QA, UK.

Since 1979 the British Simuliid Group has published 13 annual *Newsletters* and 18 *Bulletins*. As editor, I get several requests per year for articles which have been published in both journals. Most often the requests come via the Internet and I send out copies of the papers by the same method.
The *Bulletins* had their beginning at a time when word processors were becoming common, if not quite universal, amongst scientists and over the years they have been prepared using a variety of different programs and formats from Word Perfect to MS Word. The earlier *Newsletters* were issued as mimeographed sheets, which while perfectly readable, are not suitable for scanning and converting into word processor documents using an optical character recognition (OCR) program because the printing is too indistinct. Fortunately, all the *Bulletins* have been saved on diskettes and over the past few years I have been converting their files into the most common current document formats. Each page of the *Newsletters* has been scanned and saved as a facsimile graphics file.

It would seem that the next obvious step would be to make all the data available to members as a complete set. This can now be done easily by writing all the files to CD Rom, (they easily fit on a single CD), for despatch by post. I would need to make a small charge to cover the costs of materials and postage, probably of the order of £5.00 or its equivalent in other currencies. Would anyone interested in receiving a CD Rom, please contact me via e-mail at daviesjb@liv.ac.uk so that I can judge the numbers that might be required.

An alternative would be to post all the files on a Web Page, and I am looking into the feasibility of that. Some back numbers of the Bulletin are already available on the SIMULIIDAE Mail List archives, but here we are severely limited as to the amount of space available.

Posters Shown at the Meeting

Diptera Predators of World Blackflies (Simuliidae)
Doreen Werner: *Humboldt University, Berlin, Germany*

Long-term trends in mortality rates of Simulium posticatum and the persistance of non-target blackfly species in the Dorset Stour, subject to a single annual Bti treatment

Stewart Welton, Mike Ladle and Jon Bass, *CEH Dorset.*

OTHER MEETING REPORTS

Annual North American Meeting of Simuliid Workers

Peter H. Adler and Craig A. Stoops, *Department of Entomology, Clemson University, Clemson, SC 29634-0365 USA*

The 25th annual North American meeting of simuliid workers was held 26-28 January 2002 at the Archbold Biological Station in Lake Placid, Florida. This meeting was the fifth and final annual meeting held under the auspices of the Southern Extension and Research Activities Information Exchange Group. The meeting was organized and chaired by C. A. Stoops of Clemson University. Twenty-five workers attended, including 21 from the United States and four from Canada. The next annual North American meeting of simuliid workers will again be held at the Archbold Biological Station, this time from 1 to 3 February 2003 as an informal gathering with no official umbrella.

The following 16 presentations were given at the 2002 meeting:

Larval feeding behavior and time budgets for the *Simulium tuberosum* group and *Simulium jenningsi* group in the laboratory (**C. A. Stoops & P. H. Adler**, Clemson University, Clemson, SC)

Factors influencing the relative abundance of hindgut trichomycetes in larval black flies (**J. W. McCreadie**, University of South Alabama, Mobile, AL)

Laboratory assessments of potential changes in black fly treatment protocols to mitigate the effects of algae on the efficacy of *Bti* (**J. Overmyer, M. Stephens, E. W. Gray & R. Noblet**, University of Georgia, Athens, GA)

Complex is not always better (**T. Stanfield & F. Hunter** [presented by M. Spironello], Brock University, St. Catharines, Ontario)

Seven years of black fly management at Musgrove Mill Golf Club (**E. W. Gray & J. Overmyer**, University of Georgia, Athens, GA)

The role of Valent BioSciences in black fly control (**C. Royals**, Valent BioSciences , Tampa, FL)

Black flies: the melting pot habitat (**C. E. Beard**, Clemson University, Clemson, SC)

Simuliid symbionts in the Great Smoky Mountains (**W. Reeves**, Clemson University, Clemson, SC)

Genetic responses to stress in black flies (**C. Brockhouse & L. Purcell**, University of South Alabama, Mobile, AL)

How well do we know the black flies of North America (**P. H. Adler**, Clemson University, Clemson, SC **& D. C. Currie**, Royal Ontario Museum, Toronto, Ontario)

Recently discovered black flies in Pennsylvania (**D. I. Rebuck**, Department of Environmental Resources, Harrisburg, PA)

A phylogenetic investigation of *Simulium* s. s. using a total evidence approach (**M. Smith**, University of Toronto, Toronto, Ontario)

A continuing chromosomal study of the Pacific black flies, and an investigation of simuliid polytene chromosomes using FISH (**M. Spironello**, Brock University, St. Catharines, Ontario)

Crozetia – a storm in a tea cup. Or, check the types (**D. A. Craig**, University of Alberta, Edmonton, Alberta)

Whither *Crozetia*: speculation about the phylogenetic position of the

Crozet Island black flies (Diptera: Simuliidae) (**D. C. Currie**, Royal Ontario Museum, Toronto, Ontario **& D. A. Craig**, University of Alberta, Edmonton, Alberta)

Year-end summary of world use of *Bti* (**R. A. Fusco**, Valent Bio-3 Sciences, Mifflintown, PA)

SCIENTIFIC CONTRIBUTIONS

A synoptic list of the named mermithid parasites described from simuliid hosts

Roger W. Crosskey[1] and **George O. Poinar**[2]:
[1] *Department of Entomology, The Natural History Museum, London SW7 5BD, U.K.*
[2] *Department of Entomology, Oregon State University, Corvallis, Oregon 97331, U.S.A.*

When one of us (RWC) was preparing a bibliography of the simuliid works of the late I. A. Rubtsov (1902-1993)[1] it became evident how extensive had been Rubtsov's work on the mermithid nematodes in relation to blackflies. He first took up research on the mermithids fairly late in life, according to Rubtsov (to GOP) in 1959 - when he would have been 57 years old. Thereafter he became so involved with them that 40% of his simuliid publications from 1963 onwards relate also to mermithids and by the time of his death he had (in all) described over 450 nominal species of these parasitic worms[2]. (It is necessary to say 'nominal' species as many parasitologists have misgivings about Rubtsov's readiness to describe purportedly new mermithid species from the in-host larval stage alone and in the long run some of his species may well be invalidated.)

The number of mermithid taxa described or codescribed by Rubtsov from blackfly hosts is relatively small, 39 species and 14 subspecies and varieties, but it is nevertheless not easy for the blackfly worker outside Russia to get a 'handle' on these because almost all were described in Russian and the literature is sometimes difficult and scattered. It seemed useful to us, therefore, to capitalise on information about these mermithids obtained when the bibliography of Rubtsov's simuliid works was being prepared by providing a handy list of the mermithid taxa concerned, the references to their original descriptions, and their blackfly type hosts. However, such a by-product alone would be very much less useful than a complete list of all the species of Mermithidae from simuliid hosts that have been recorded in the world literature. Consequently we have put together the following list in the hope that it could prove of value as a starting point for anyone taking up the study of blackflies vis-à-vis their mermithid nematode parasites. In total we list 88 mermithid species in 10 genera from 21 countries.

Notes. (1) All nominal species, subspecies and varieties of mermithids are listed alphabetically in their originally published binomina or trinomina. (2) Bibliographic references have been checked to source. (3) The simuliid host names are given in presently valid form, as shown in the world inventory of Crosskey & Howard (1997); blackfly authors' names if required can be found in the same work. (4) Where the simuliid name used by the author in the mermithid work is no longer valid this is shown by annotation in parentheses - when enclosure in inverted commas indicates misidentification (e.g. as 'latipes' under vernum) and non-enclosure in inverted commas indicates junior synonymy (e.g. as galeratum under reptans).

Austromermis namis Poinar, 1990
Reference: Revue de Nématologie 13 (4), 395-402.
Type host: Austrosimulium multicorne.
Country: New Zealand (South Island).

Ditremamermis montana Camino, 1998
Reference: Fundamental and Applied Nematology 21 (1), 69-74.
Type host: Simulium rubiginosum.
Country: Argentina (Buenos Aires).

Ditremamermis simuliae Camino & Poinar, 1989
Reference: Neotropica 34 (92) (1988), 93-97. [Note: volume '36' printed on title page of article in error.]
Type host: Simulium bonaerense.
Country: Argentina (Buenos Aires).

Gastromermis bobrovae Rubtsov, 1974
Reference: Aquatic mermithids, Part II. 222 pp. "Nauka", Leningrad [in Russian].
Type host: Prosimulium alpestre.
Country: Russia (Siberia).

Gastromermis boophthorae Welch & Rubtsov, 1965
Reference: Canadian Entomologist 97 (6), 581-596.
Type hosts: Simulium erythrocephalum, S. morsitans, S. rostratum (as 'verecundum'), S. vernum (as 'latipes').
Country: Russia (European).

var. cinerea Welch & Rubtsov, 1965 (invalid name, variety described post-1960).
Reference: Canadian Entomologist 97 (6), 581-596.
Type hosts: Simulium erythrocephalum, S. morsitans, S. noelleri (as 'argyreatum').
Country: Russia (European).

var. coerulescens Welch & Rubtsov, 1965 (invalid name, variety described post-1960).
Type hosts: Simulium erythrocephalum, S. cryophilum.
Country: Russia (European).

var. distoma Welch & Rubtsov, 1965 (invalid name, variety described post-1960).
Reference: Canadian Entomologist 97 (6), 581-596.
Type hosts: Simulium erythrocephalum, S. noelleri (as 'argyreatum'), S. reptans (as galeratum).
Country: Russia (European).

var. glaucescens Welch & Rubtsov, 1965 (invalid name, variety described post-1960).
Reference: Canadian Entomologist 97 (6), 581-596.
Type hosts: Simulium erythrocephalum, S. morsitans, S. noelleri (as 'argyreatum'), S. rostratum (as 'verecundum').
Country: Russia (European).

var. minifrons Rubtsov, 1967 (invalid name, variety described post-1960).
Reference: Trudy Zoologicheskogo Instituta 43, 59-92 [in Russian]
Type host: Simulium morsitans.
Country: Russia (European)

ssp. mutica Rubtsov, 1971
Reference: Scripta Facultatis Scientarum Naturalium Universitatis Purkynianae Brunensis (Biologia) 2 (1), 97-132.
Type host: Simulium ornatum.
Country: Britain (Scotland).

var. vittata Welch & Rubtsov, 1965 (invalid name, variety described

post-1960).
Reference: Canadian Entomologist 97 (6), 581-596.
Type hosts: Simulium morsitans, S. noelleri (as 'argyreatum').
Country: Russia (European).

Gastromermis clinogaster Rubtsov, 1967
Reference: Trudy Zoologicheskogo Instituta 43, 59-92 [in Russian]
Type host: Simulium aureum.
Country: Russia (European).

Gastromermis cloacachilus Poinar & Takaoka, 1981
Reference: Systematic Parasitology 3, 13-19.
Type host: Gigantodax wrighti.
Country: Guatemala.

Gastromermis cordobensis Camino, 1991
Reference: Memorias do Instituto Oswaldo Cruz 86 (2), 223-227.
Type host: Simulium lahillei.
Country: Argentina (Córdoba).

Gastromermis crassicauda Rubtsov, 1967
Reference: Trudy Zoologicheskogo Instituta 43, 59-92 [in Russian]
Type host: Simulium morsitans.
Country: Russia (European).

Gastromermis crassifrons Rubtsov, 1967
Reference: Trudy Zoologicheskogo Instituta 43, 59-92 [in Russian].
Type host: Simulium erythrocephalum.
Country: Russia (European).

Gastromermis doloresi Camino, 1993
Reference: Memorias do Instituto Oswaldo Cruz 88 (4), 571-575.
Type host: Simulium wolffhuegeli.
Country: Argentina (Córdoba).

Gastromermis fidelis Doucet, 1982
Reference: Communicaciones del Museo Argentino de Ciencias Naturales "Bernardino Rivadavia" (Parasitologia) 2, 11-17.
Type host: Simulium wolffhuegeli (as wolffhuengeli, error).
Country: Argentina.

Gastromermis iguazuensis Camino & Villalobos, 1997
Reference: Nematologica mediterranea 25 (1), 105-108.
Type host: Simulium pertinax.
Country: Argentina (Misiones).

Gastromermis leberrei Mondet, Poinar & Bernardou, 1977
Reference: Canadian Journal of Zoology 55 (8), 1275-1283.
Type host: Simulium hargreavesi.
Country: Mali.

Gastromermis likhovosi Rubtsov, 1976
Reference: Zoologichesky Zhurnal 55 (4), 1292-1298 [in Russian].
Type host: Simulium equinum.
Country: Tajikistan.

Gastromermis longispicula Rubtsov, 1967
Reference: Trudy Zoologicheskogo Instituta 43, 59-92 [in Russian].
Type host: Simulium morsitans.
Country: Russia (European).

Gastromermis massei Doucet & Cagnolo, 1997
Reference: Fundamental and Applied Nematology 20 (6), 565-569.
Type host: Simulium wolffhuegeli (as

wolffhuengeli, error).
Country: Argentina (Córdoba).

Gastromermis mesostoma Poinar & Takaoka, 1986
Reference: Systematic Parasitology 8 (1), 51-55.
Type host: Simulium japonicum.
Country: Japan.

Gastromermis metae Curran & Hominick, 1981
Reference: Nematologica 27, 259-274.
Type hosts: Simulium equinum, S. ornatum.
Country: Britain (England).

Gastromermis odagmiae Rubtsov, 1967
Reference: Trudy Zoologicheskogo Instituta 43, 59-92 [in Russian].
Type host: Simulium ornatum.
Country: Russia (European).

Gastromermis philipponi Mondet, Poinar & Bernadou, 1977
Reference: Canadian Journal of Zoology 55 (8), 1275-1283.
Type host: Simulium cervicornutum.
Country: Ivory Coast.

Gastromermis rosalba Rubtsov, 1967
Reference: Trudy Zoologicheskogo Instituta 43, 59-92 [in Russian].
Type hosts: Simulium angustipes (as securiforme), S. rostratum (as 'verecundum').
Country: Russia (European).

Gastromermis simulii Belturganov, Gubaidulin & Dubitsy, 1990
Reference: Izvestiya Akademii Nauk Kazakhskoi SSR (Seriya Biologicheskaya) 6 (162), 39-48 [in Russian].
Type host: simuliid larvae (unidentified).
Country: Kazakhstan.

Gastromermis tschubarevae Rubtsov, 1974
Reference: Aquatic mermithids, Part II. 222 pp. "Nauka", Leningrad [in Russian]
Type host: Simulium variegatum.
Country: Georgia.

Gastromermis vaginiferous Camino, 1986
Reference: Neotropica 31 (86) (1985), 143-147.
Type host: Simulium wolffhuegeli.
Country: Argentina (Buenos Aires).

Gastromermis virescens Rubtsov, 1967
Reference: Trudy Zoologicheskogo Instituta 43, 59-92 [in Russian].
Type host: Simulium erythrocephalum.
Country: Russia (European).

var. acutipenis Rubtsov, 1967 (invalid name, variety described post-1960).
Reference: Trudy Zoologicheskogo Instituta 43, 59-92 [in Russian].
Type host: Simulium erythrocephalum.
Country: Russia (European).

Gastromermis viridis Welch, 1962
Reference: Annals of the Entomological Society of America 55 (5), 535-542.
Type host: Simulium vittatum.
Country: USA (Wisconsin).

Hydromermis doloresi Camino, 1993
Reference: Memorias do Instituto

Oswaldo Cruz 88 (4), 571-575.
Type host: Simulium jujuyense.
Country: Argentina (Córdoba).

Isomermis benevolus Poinar & Takaoka, 1979
Reference: Japanese Journal of Sanitary Zoology 30 (4), 305-307.
Type host: Simulium metallicum.
Country: Guatemala.

Isomermis bipapillata Poinar & Takaoka, 1986 (as bipapillatus)
Reference: Systematic Parasitology 8 (1), 51-55.
Type host: Simulum japonicum.
Country: Japan.

Isomermis brevis Rubtsov, 1972
Reference: Aquatic mermithids, Part I. 254 pp. "Nauka", Leningrad [in Russian].
Type host: Simulium morsitans.
Country: Russia (European).

Isomermis lairdi Mondet, Poinar & Bernadou, 1977
Reference: Canadian Journal of Zoology 55 (12), 2011-2017.
Type host: Simulium damnosum.
Country: Ivory Coast.

Isomermis rossica Rubtsov, 1968
Reference: Zoologichesky Zhurnal 47 (4), 510-524 [in Russian]
Type hosts: Simulium cryophilum, S. erythrocephalum, S. lundstromi (as kerzhneri), S. morsitans, S. rostratum (as 'verecundum'), S. vernum (as 'latipes').
Country: Russia (European).

Isomermis tansaniensis Rubtsov, 1972
Reference: Aquatic mermithids, Part I. 254 pp. "Nauka", Leningrad [in Russian].
Type host: Simulium damnosum.
Country: Tanzania.

Isomermis vulvachila Poinar & Takaoka, 1981.
Reference: Systematic Parasitology 3 (1), 13-19.
Type host: Mayacnephia pachecolunai.
Country: Guatemala.

Isomermis wisconsinensis Welch, 1962
Reference: Annals of the Entomological Society of America 55 (5), 535-542.
Type host: Simulium vittatum.
Country: USA (Wisconsin).

Limnomermis caudata Gafurov, 1982
Reference: Izvestiya Akademii Nauk Tadzhikskoi (Otdelenie Biologicheskik Nauk) 1979 (2), 33-39 [in Russian].
Type host: simuliid larvae (unidentified)
Country: Tajikistan.

Limnomermis cryophili Rubtsov, 1967
Reference: Zoologichesky Zhurnal 46 (1), 24-34.
Type hosts: Simulium cryophilum, S. vernum (as 'latipes').
Country: Russia (European).

Limnomermis europea Rubtsov, 1971
Reference: Scripta Facultatis Scientarum Naturalium Universitatis Purkynianae Brunensis (Biologia) 2 (1), 97-132.
Type host: 'Eusimulium' sp. (Simulium subgenus not

determinable).
Country: Britain (Scotland).

Limnomermis macronuclei Rubtsov, 1967
Reference: Zoologichesky Zhurnal 46 (1), 24-34.
Type hosts: Simulium cryophilum, S. vernum (as 'latipes').
Country: Russia (European).

Limnomermis subtropicalis Villalobos & Camino, 1997
Reference: Memorias do Instituto Oswaldo Cruz 92 (3), 339-341.
Type host: Simulium orbitale.
Country: Argentina (Misiones).

Mesomermis adulta Gafurov, 1979
Reference: Izvestiya Akademii Nauk Tadzhikskoi (Otdelenie Biologicheskik Nauk) 1979 (2), 33-39 [in Russian].
Type host: simuliid larvae (unidentified).
Country: Tajikistan.

Mesomermis alaica Gafurov, 1982
Reference: Izvestiya Akademii Nauk Tadzhikskoi (Otdelenie Biologicheskik Nauk) 1982 (4), 91-93 [in Russian].
Type host: simuliid larvae (unidentified).
Country: Kyrgyzstan.

Mesomermis albicans Rubtsov, 1966
Reference: In - Cherepanov (ed.), New species in the fauna of Siberia and adjoining regions, 109-147 [in Russian].
Type hosts: Simulium cryophilum, S. morsitans, S. noelleri (as 'argyreatum'), S. reptans (as galeratum), S. vernum (as 'latipes').
Country: Russia (European).

Mesomermis arctica Rubtsov, 1972
Reference: Aquatic mermithids, Part I. 254 pp. "Nauka", Leningrad [in Russian].
Type host: Simulium giganteum.
Country: Russia (European).

Mesomermis baicalensis Rubtsov, 1972 (availability date)
Reference: Aquatic mermithids, Part I. 254 pp. "Nauka", Leningrad [in Russian].
melusinae var. baicalensis Rubtsov, 1966 (invalid name, variety described post-1960).
Reference: In - Cherepanov (ed.), New species in the fauna of Siberia and adjoining regions, 109-147 [in Russian].
Type host: Prosimulium alpestre.
Country: Russia (Siberia).

Mesomermis bistrata Rubtsov, 1966
Reference: In - Cherepanov (ed.), New species in the fauna of Siberia and adjoining regions, 109-147 [in Russian].
Type host: Simulium vernum (as 'latipes').
Country: Russia (European).

Mesomermis brevis Rubtsov, 1966
Reference: Doklady Akademii Nauk SSSR 169 (5), 1236-1238 [in Russian].
Type host: Prosimulium isos.
Country: Russia (Siberia).

Mesomermis camdenensis Molloy, 1979
Reference: Journal of Nematology 11 (4), 321-328.
Type host: Simulium tuberosum.

(Other cited host: S. venustum.)
Country: USA (New York).

Mesomermis canescens Rubtsov, 1972 (availability date).
Reference: Aquatic mermithids, Part I. 254 pp. "Nauka", Leningrad [in Russian]. melusinae var. canescens Rubtsov, 1966 (invalid name, variety described post-1960).
Reference: In - Cherepanov (ed.), New species in the fauna of Siberia and adjoining regions, 109-147 [in Russian].
Type host: Simulium noelleri (as 'argyreatum').
Country: Russia (European).

Mesomermis caucasica Rubtsov, 1972
Reference: Aquatic mermithids, Part I. 254 pp. "Nauka", Leningrad [in Russian].
Type host: Simulium variegatum.
Country: Georgia.

Mesomermis crassa Belturganov, Gubaidulin & Dubitsky, 1990
Reference: Izvestiya Akademii Nauk Kazakhskoi SSR (Seriya Biologicheskaya) 6 (162), 39-48 [in Russian]
Type host: simuliid larvae (unidentified).
Country: Kazakhstan.

Mesomermis crassivaginae Camino, 1985
Reference: Revista del Museo de la Plata (Nueva Serie) (Zoologia) 14 (150), 1-19.
Type host: Gigantodax chilensis. (Other cited host: Cnesia dissimilis.)
Country: Argentina (Neuquén).

Mesomermis dissimilis Camino, 1985
Reference: Revista del Museo de la Plata (Nueva Serie) (Zoologia) 14 (150), 1-19.
Type host: Cnesia dissimilis.
Country: Argentina (Neuquén).

Mesomermis ethiopica Rubtsov, 1972
Reference: Aquatic mermithids, Part I. 254 pp. "Nauka", Leningrad [in Russian].
Type host: Simulium damnosum.
Country: Tanzania.

Mesomermis flumenalis Welch, 1962
Reference: Annals of the Entomological Society of America 55 (5), 535-542.
Type host: Simulium venustum.
Country: Canada (Ontario).

Mesomermis gafurovi Belturganov, Gubaidulin & Dubitsky, 1990
Reference: Izvestiya Akademii Nauk Kazakhskoi SSR (Seriya Biologicheskaya) 6 (162), 39-48 [in Russian]
Type host: simuliid larvae (unidentified).
Country: Kazakhstan.

Mesomermis guatemalae Poinar & Takaoka, 1981
Reference: Systematic Parasitology 3 (1), 13-19.
Type host: Simulium metallicum.
Country: Guatemala.

Mesomermis japonica Poinar & Saito, 1979
Reference: Japanese Journal of Sanitary Zoology 30 (2), 147-149.
Type host: Simulium japonicum.
Country: Japan.

Mesomermis khodzhikenti Gafurov & Lebedeva, 1988
Reference: Doklady Akademii Nauk Uzbekskoi SSR 1988 (1), 48-50 [in Russian].
Type hosts: Simulium baracorne, S. desertorum, S. equinum (as avetjania, error for avetjanae), S. ferganicum, S. flaveolum, S. litshkense, S. quattuordecimfilum. (Also S. 'pygmaeum' sensu Rubtsov, as pygma error, ? identity.)
Country: Uzbekistan.

Mesomermis kondarensis Gafurov, 1979
Reference: Izvestiya Akademii Nauk Tadzhikskoi (Otdelenie Biologicheskikh Nauk) 1979 (2), 33-39 [in Russian].
Type host: simuliid larvae (unidentified).
Country: Tajikistan.

Mesomermis longicaudiensis Belturganov, Gubaidulin & Dubitsky, 1990
Reference: Izvestiya Akademii Nauk Kazakhskoi SSR (Seriya Biologicheskaya) 6 (162), 39-48 [in Russian].
Type host: simuliid larvae (unidentified).
Country: Kazakhstan.

Mesomermis macroforameni Gafurov, Belturganov & Gubaidulin, 1989
Reference: Izvestiya Akademii Nauk Kazakhskoi SSR (Seriya Biologicheskaya) 4 (154), 34-39 [in Russian].
Type hosts: Simulium hiemale (as ssp. of alajense), S. caucasicum, S. ornatum-group sp., Sulcicnephia sp.
Country: Kazakhstan.

Mesomermis mediterranea Rubtsov, 1971
Reference: Scripta Facultatis Scientarum Naturalium Universitatis Purknyianae Brunensis (Biologia) 2 (1), 97-132.
Type host: Simulium pseudequinum (as mediterranea).
Country: Morocco.

Mesomermis melusinae Rubtsov, 1966
Reference: In - Cherepanov (ed.), New species in the fauna of Siberia and adjoining regions, 109-147 [in Russian].
Type hosts: Simulium cryophilum, S. erythrocephalum, S. morsitans, S. noelleri (as 'argyreatum'), S. ornatum, S. rostratum (as 'verecundum'), S. vernum (as 'latipes').
Country: Russia (European).
melusinae var. biseriata Rubtsov, 1966 (invalid name, variety described post-1960).
Reference: In - Cherepanov (ed.), New species in the fauna of Siberia and adjoining regions, 109-147 [in Russian].
Type host: Simulium morsitans.
Country: Russia (European).

Mesomermis minuta Rubtsov, 1972
Reference: Aquatic mermithids, Part I. 254 pp. "Nauka", Leningrad [in Russian].
Type host: Simulium morsitans.
Country: Russia (European).

Mesomermis nortensis Camino, 1991.
Reference: Neotropica 37 (97), 3-7.
Type host: Simulium lahillei.

Country: Argentina (Tucumán).

Mesomermis ochrae Camino, 1985
Reference: Revista del Museo de La Plata (Nueva Serie) (Zoologia) 14 (150), 1-19.
Type host: Simulium delponteianum.
Country: Argentina (Buenos Aires).

Mesomermis odeschti Gafurov, 1979
Reference: Izvestiya Akademii Nauk Tadzhikskoi (Otdelenie Biologicheskikh Nauk) 1982 (1), 33-39 [in Russian].
Type host: simuliid larvae (unidentified).
Country: Tajikistan.

Mesomermis ornata Rubtsov, 1966
Reference: In - Cherepanov (ed.), New species in the fauna of Siberia and adjoining regions, 109-147 [in Russian].
Type host: Simulium ornatum.
Country: Russia (European).

Mesomermis ornatissima Camino, 1994
Reference: Research and Reviews in Parasitology 54 (1), 29-31
Type host: Simulium bonaerense.
Country: Argentina (Buenos Aires).

Mesomermis paradisus Poinar & Hess, 1979
Reference: Nematologica 25, 368-372.
Type host: Prosimulium exigens.
Country: USA (California).

Mesomermis paralella Rubtsov, 1972
Reference: Aquatic mermithids, Part I. 254 pp. "Nauka", Leningrad [in Russian].
Type host: Prosimulium alpestre.
Country: Russia (Siberia).

Mesomermis patrushevae Rubtsov, 1972
Reference: Aquatic mermithids, Part I. 254 pp. "Nauka", Leningrad [in Russian].
Type host: simuliid larvae (unidentified).
Country: Russia (Siberia).

Mesomermis pivaniensis Rubtsov, 1980
Reference: In - Sonin (ed.), Helminths of insects, 155 pp. "Nauka", Moscow [in Russian].
Type host: Simulium vulgare.
Country: Russia (European).

Mesomermis prisjaznoi Rubtsov, 1972
Reference: Aquatic mermithids, Part I. 254 pp. "Nauka", Leningrad [in Russian].
Type host: simuliid larvae (unidentified).
Country: Russia (European).

Mesomermis robusta Gafurov, Belturganov & Gubaidulin, 1989
Reference: Izvestiya Akademii Nauk Kazakhskoi SSR (Seriya Biologicheskaya) 4 (154), 34-39 [in Russian].
Type hosts: Simulium hiemale (as ssp. of alajense), S. bezzii-group sp. (as Tetisimulium sp.).
Country: Kazakhstan.

Mesomermis sibirica Rubtsov, 1972
Reference: Aquatic mermithids, Part I. 254 pp. "Nauka", Leningrad [in Russian].
Type host: Simulium murmanum (as relictum).

Country: Russia (Siberia).

Mesomermis simuliae Müller, 1931
Reference: Zeitschrift für Morphologie und Ökologie der Tiere 24: 82-147.
Type host: 'Simulia' (unidentified to species).
Country: Germany.
ssp. acricauda Rubtsov, 1971
Reference: Scripta Facultatis Scientarum Naturalium Universitatis Purkynianae Brunensis (Biologia) 2 (1), 97-132.
Type host: Simulium ornatum, Simulium s. str. sp. (as Odagmia sp.).
Country: Britain (Scotland).
ssp. acutangula Rubtsov, 1971
Reference: Scripta Facultatis Scientarum Naturalium Universitatis Purkynianae Brunensis (Biologia) 2 (1), 97-132.
Type hosts: Simulium argenteostriatum, S. monticola.
Country: Slovakia.
ssp. obtusicauda Rubtsov, 1971
Reference: Scripta Facultatis Scientarum Naturalium Universitatis Purkynianae Brunensis (Biologia) 2 (1), 97-132.
Type host: Prosimulium hirtipes (sensu Rubtsov, applies to allied sp., ? mixtum).
Country: USA (New York State).

ssp. rotunda Rubtsov, 1971
Reference: Scripta Facultatis Scientarum Naturalium Universitatis Purkynianae Brunensis (Biologia) 2 (1), 97-132.
Type host: Simulium s. str. sp. (as Odagmia sp.).
Country: Czech Republic.

Mesomermis subandina Camino, 1985
Reference: Revista del Museo de La Plata (Nueva Serie) (Zoología) 14 (150), 1-19.
Type host: Gigantodax chilensis.
Country: Argentina (Neuquén).

Mesomermis talgarica Belturganov, Gubaidulin & Dubitsky, 1990
Reference: Izvestiya Akademii Nauk Kazakhskoi SSR (Seriya Biologicheskaya) 6 (162), 39-48 [in Russian].
Type host: simuliid larvae (unidentified).
Country: Kazakhstan.

Mesomermis tumenensis Rubtsov & Novitskaya, 1975
Reference: Materialy Nauchnykh Konferentsy Vsesoyuznogo Obshchestva Gel'mintologov 26 (1974), 239-246 [in Russian].
Type host: simuliid larvae, description not relatable to specific hosts among several possible host species from which worms may have emerged (seven simuliid species named as present in the Ob River provenance).
Country: Russia (Siberia).

Mesomermis vashkovii Rubtsov & Novitskaya, 1975
Reference: Materialy Nauchnykh Konferentsy Vsesoyuznogo Obshchestva Gel'mintologov 26 (1974), 239-246 [in Russian].
Type host: simuliid larvae, description not relatable to specific hosts among several possible host species from which worms may have emerged (seven simuliid species named as present in the Ob River provenance).
Country: Russia (Siberia).

Mesomermis vernalis Rubtsov, 1966

Reference: In - Cherepanov (ed.), New species in the fauna of Siberia and adjoining regions, 109-147 [in Russian].
Type hosts: Simulium cryophilum, S. morsitans, S. vernum (as 'latipes').
Country: Russia (European).

Neomesomermis travisi Vargas, Rubtsov & Fallas, 1980
Reference: Revista de Biología Tropical 28 (1), 73-89.
Type hosts: Simulium metallicum, S. panamense.
Country: Costa Rica.

Octomyomermis bonaerensis Camino, 1988
Reference: Revista Ibérica de Parasitologia 48 (2), 183-186.
Type host: Simulium bonaerense.
Country: Argentina (Buenos Aires).

Octomyomermis longispiculae Camino, 1992
Reference: Neotropica 38 (100), 105-109.
Type host: Simulium wolffhuegeli.
Country: Argentina (Buenos Aires).

Spiculimermis fluvialis Rubtsov & Mitrochin, 1973
Reference: In - Cherepanov (ed.), New and little-known species in the fauna of Siberia 7, 5-17 [in Russian].
Type hosts: Simulium erythrocephalum, S. morsitans.
Country: Russia (Siberia).

Rapid cross-reference list by simuliid host species name

Simuliid species names are alphabetical regardless of generic position. Morphospecies known to be aggregates of chromosomal cytoforms are marked '(complex)'; in such cases nothing is known that ties the mermithid parasite records unequivocally to particular cytoforms. Hosts pertaining to the varieties and subspecies of mermithid parasites are listed for simplicity under the appropriate species.

alpestre, Prosimulium - Gastromermis bobrovae, Mesomermis baicalensis, M. paralella
angustipes, Simulium - Gastromermis rosalba
argenteostriatum, Simulium - Mesomermis simuliae
'argyreatum': misidentification, see noelleri
aureum, Simulium - Gastromermis clinogaster
avetjanae: synonym, see equinum
baracorne, Simulium - Mesomermis khodzhikenti
bezzii species-group, Simulium - Mesomermis robusta
bonaerense, Simulium - Ditremamermis simuliae, Mesomermis ornatissima, Octomyomermis bonaerensis
caucasicum, Simulium - Mesomermis macroforameni
cervicornutum, Simulium - Gastromermis philipponi
chilensis, Gigantodax - Mesomermis crassivaginae, M. subandina
cryophilum (complex), Simulium - Gastromermis boophthorae, Isomermis

rossica, Limnomermis cryophili, L. macronuclei, Mesomermis albicans, M. melusinae, M. vernalis
damnosum (complex), Simulium - Isomermis lairdi, I. tansaniensis, Mesomermis ethiopica
delponteianum, Simulium - Mesomermis ochrae
desertorum, Simulium - Mesomermis khodzhikenti
dissimilis, Cnesia - Mesomermis crassivaginae, M. dissimilis
equinum, Simulium - Gastromermis likhovosi, G. metae, Mesomermis khodzhikenti
erythrocephalum, Simulium - Gastromermis boophthorae, G. crassifrons, G. virescens, Isomermis rossica, Mesomermis melusinae, Spiculimermis fluvialis
Eusimulium sp. - Limnomermis europea
exigens, Prosimulium - Mesomermis paradisus
ferganicum, Simulium - Mesomermis khodzhikenti
flaveolum, Simulium - Mesomermis khodzhikenti
galeratum: synonym, see reptans
giganteum, Simulium - Mesomermis arctica
hargreavesi, Simulium - Gastromermis leberrei
hiemale, Simulium - Mesomermis macroforameni, M. robusta
hirtipes (sensu Rubtsov), Prosimulium - Mesomermis simuliae
isos, Prosimulium - Mesomermis brevis
japonicum, Simulium - Gastromermis mesostoma, Isomermis bipapillata, Mesomermis japonica
jujuyense, Simulium - Hydromermis doloresi
kerzhneri: synonym, see lundstromi
lahillei, Simulium - Gastromermis cordobensis, Mesomermis nortensis
'latipes': misidentification, see vernum (complex)
litshkense, Simulium - Mesomermis khodzhikenti
lundstromi, Simulium - Isomermis rossica
mediterranea: synonym, see pseudequinum
metallicum (complex), Simulium - Isomermis benevolus, Mesomermis guatemalae, M. travisi
monticola, Simulium - Mesomermis simuliae
morsitans, Simulium - Gastromermis boophthorae, G. crassicauda, G. longispicula, Isomermis brevis, I. rossica, Mesomermis albicans, M. melusinae, M. minuta, M. vernalis, Spiculimermis fluvialis
multicorne, Austrosimulium - Austromermis namis
murmanum, Simulium - Mesomermis sibirica
noelleri, Simulium - Gastromermis boophthorae, Mesomermis albicans, M. canescens, M. melusinae
orbitale, Simulium - Limnomermis subtropicalis
ornatum (complex), Simulium - Gastromermis boophthorae, G. metae, G. odagmiae, M. melusinae, M. ornata, M. simuliae
ornatum species-group, Simulium - Mesomermis macroforameni
pachecolunai, Mayacnephia - Isomermis vulvachila

panamense, Simulium - Neomesomermis travisi
pertinax, Simulium - Gastromermis iguazuensis
pseudequinum, Simulium - Mesomermis mediterranea
pygmaeum (sensu Rubtsov), Simulium - Mesomermis khodzhikenti
quattuordecimfilum, Simulium - Mesomermis khodzhikenti
relictum: synonym, see murmanum
reptans, Simulium - Gastromermis boophthorae, Mesomermis albicans
rostratum, Simulium - Gastromermis boophthorae, G. rosalba, Isomermis rossica, M. melusinae
rubiginosum, Simulium - Ditremamermis montana
securiforme: synonym, see angustipes
Simulium sensu stricto sp. - Mesomermis simuliae
Sulcicnephia sp. indet. - Mesomermis macroforameni
tuberosum (complex), Simulium - Mesomermis camdenensis
variegatum, Simulium - Gastromermis tschubarevae, Mesomermis caucasica
venustum (complex), Simulium - Mesomermis camdenensis, M. flumenalis
'verecundum': misidentification, see rostratum
vernum (complex), Simulium - Gastromermis boophthorae, Isomermis rossica, Limnomermis cryophili, L. macronuclei, Mesomermis albicans, M. bistrata, M. melusinae, M. vernalis
vittatum (complex), Simulium - Gastromermis viridis, Isomermis wisconsinensis
vulgare, Simulium - Mesomermis pivaniensis
wolffhuegeli, Simulium - Gastromermis doloresi, G. fidelis, G. massei, G. vaginiferous, M. longispiculae
wrighti, Gigantodax - Gastromermis cloacachilus

Unidentified larval hosts (Soviet Union literature) - Gastromermis simulii, Limnomermis caudata, Mesomermis adulta, M. alaica, M. crassa, M. gafurovi, M. kondarensis, M. longicaudiensis, M. odeschti, M. patrushevae, M. prisjaznoi, M. talgarica, M. tumenensis, M. vashkovii

Appendix re Rubtsov & Doby (1971)

Rubtsov, I.A. & Doby, J.M. 1971. Mermithides parasites de Simulies (Diptères) en provenance du nord et de l'ouest de la France. Bulletin de la Société zoologique de France 95 (1970): 803-836. [French with English summary: publication date 5.vii.1971 stated on last page (p. 898) of journal part]

This work describes two purportedly new species and seven new subspecies of mermithids based on free-living adult worms and/or post-parasitic juveniles collected from various rivers in northwestern and northern France. The title of the paper is misleading in its implication that the new taxa are parasitic on Simuliidae. The authors have drawn this inference simply from the fact that simuliids are present in the type locality streams. In all, twelve blackfly species are listed as present in the various streams. The mermithids described in the work are:

Gastromermis ambianensis Rubtsov & Doby, 1971 (p. 810)
? Hydromermis angusta Rubtsov & Doby, 1971 (p. 813)
Isomermis rossica gallica Rubtsov [sole author] in Rubtsov & Doby, 1971 (p. 807)
Mesomermis simuliae avrensis Rubtsov & Doby, 1971 (p. 834)
Mesomermis simuliae brachyamphidis Rubtsov & Doby, 1971 (p. 827)
Mesomermis simuliae brevipenis Rubtsov & Doby, 1971 (p. 821)
Mesomermis simuliae latichordata Rubtsov & Doby, 1971 (p. 822)
Mesomermis simuliae longipenis Rubtsov & Doby, 1971 (p. 821)
Mesomermis simuliae paimponti Rubtsov & Doby, 1971 (p. 829)

Rubtsov in Laird (1981: Blackflies: the future for biological methods in integrated control, p. 176) listed the mermithids "that have so far been reported from blackflies". The list included eight of these nominal taxa (M. s. longipenis misspelt longipes) and omitted '? Hydromermis angusta' (presumably because of doubtful generic affiliation). All the names have to be omitted from the mermithid/simuliid host parasite list in the absence of any concrete proof of association.

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MEMBERSHIP NOTICES

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THE BRITISH SIMULIID GROUP BULLETIN

No. 20

June 2003

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FROM THE EDITOR

As this is the 20th Bulletin it is commerated by the inclusion of an Index to all 20 Bulletins, produced at long last – thanks to Peggy and Roger Crosskey – who took on a task that I had avoided doing ever since I took over the Editorship. The first Editor, Trefor Williams had dutifully indexed Bulletins 1 to 3, but I confess that I balked at the job. I am sure that we are all grateful.

Whilst the Index takes up the greater part of the number, there are also juxtaopposed two Travellers' Tales from the Amazon Basin, written nearly 200 years apart, showing that the *Simulium* biting problem has scarsely changed. There is also a memorial note to Mme Monique Clergue-Gazeau,

John Davies, Editor

25th Jubilee BSG Meeting - September 2003

The next **British Simuliid Group Meeting** will be held on Wednesday 24th September 2003 in the Palaeontology seminar room of the Natural History Museum, South Kensington, London, and will be organised by Tony Shelley. Since this is our 25th meeting, we hope to be able to attract as many members as possible.

If you have not already done so, please inform him of your intention to attend and indicate whether you intend giving a presentation, talk, or show a poster

Details of the programme, lunch arrangements and the pre-meeting dinner will be posted to those who have responded when we have more information. A list of suitable hotels can be obtained from Tony Shelley, or can be found under Important Announcements on the "Blackflies" website at http://www.entomologist.free-online.co.uk .

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NOTES, VIEWS AND CORRESPONDENCE

Mme Monique Clergue-Gazeau: memorial note

The death of Monique Clergue-Gazeau in the year 2000 has brought almost to an end, hopefully only temporarily, a distinguished record of simuliid studies in France since World War 2 - starting with Paul Grenier at the Institut Pasteur in Paris in the 1940s and 1950s, followed by Jean-Marie Doby at the University of Rennes and Auguste Dorier at the University of Grenoble in the 1950s and 1960s, and continuing most recently with Françoise Beaucournu-Saguez of Rennes (died 2000, see Bulletin 16: 8-10) and Monique Clergue-Gazeau of the Paul Sabatier University in Toulouse. Beaucournu-Saguez and Clergue-Gazeau carried the flame for simuliidology in France from the mid-1970s almost to the present time and their loss is a blow to blackfly studies in general; they spread their taxonomic and faunal nets wider than their home territories and published valuable works embracing not only simuliids in France but also North Africa and parts of the Middle East. Luckily, Jean

Giudicelli of Marseille, though formally retired, remains in harness continuing his studies on the blackflies of Morocco and Lebanon.

Monique Gazeau was born on 20th November 1931. In the manner common in France, she added her husband's name Clergue upon her marriage. Throughout her professional life she was associated with the Centre National de la Recherche Scientifique, to which she was affiliated as a research fellow in October 1964. She was not part of the teaching faculty and thus was able to devote her time to biological research, attached to the Laboratoire d'Hydrobiologie of the Paul Sabatier University in Toulouse. Over several years she alternated her life between the out-station laboratory of the C.N.R.S. located in the foothills of the Pyrenees at the village of Moulis, whence her fieldwork in the mountains could be easily undertaken, and her permanent base in Toulouse, where she returned when in need of full-scale university facilities to bring her field studies to publication.

Monique C.-G.'s early biological research was on the urodele Amphibia, her specialist student thesis (1963) providing a comparative study of lake and cave-dwelling species, and her doctoral thesis (1972) being on the reproductive and developmental life of the cavernicolous species of these amphibians in the Pyrenees. These studies were a far cry from her later involvement with the Simuliidae. That came about in 1983 at a time when the laboratory to which she was attached decided upon a change of direction in its research thrust and needed someone to specialise in this family of benthic insects. It was this change which, fortunately for everyone interested in the Simuliidae of the western palaearctic area, brought M. C.-G. into the fold of blackfly research. The Simuliidae, one could say, were wished upon her, but she became deeply committed to this family and between 1985 and 1993 published (sometimes with colleagues) a dozen significant papers. Of these one should highlight her important keys to the simuliids of the Pyrenees[9], a work based largely on her own fieldwork. In another direction, notable works are those resulting from her investigations on the impact of hydro-electric dams on the lotic fauna[3,5] The 1980s was a busy time in France for collaborative projects with students from countries under erstwhile French influence, and Monique C.-G. became drawn to an interest in the circum-Mediterranean simuliid fauna, coauthoring papers on blackflies in Lebanon[1] and North Africa [2,4,10] but not personally collecting in these areas. She did, however, visit Tunisia to be part of the thesis jury for Moncef Boumaiza, a colleague with whom she wrote two of her papers[2,4]. Her last publications, in 1993[1,12] , were with Dr Gilles Vinçon, a close colleague in hydrobiology. Through all these activities her interest in vertebrate biology never waned and we have learned that through her latter years she continued to participate in studies on reptilian embryology!

Monique Clergue-Gazeau was a person of great kindness who was always specially helpful to her younger colleagues, supremely honest in all matters, and never for long discouraged by the setbacks she encountered. She retired on 1st January 1992. Sadly, soon after the death of her husband in a car crash in 1999, she fell victim to bone cancer.

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TRAVELLERS' TALES

Provocation of the pium

Contributed by R.W.Crosskey

It isn't often that blackflies come to the notice of media correspondents so it is novel to see that John Simpson, doyen of BBC foreign correspondents, having been to the Amazon, has something to say about them in his wander down memory lane - disclaimed as an autobiography - *Strange Places, Questionable People, Macmillan 1998.*

"We made a bumpy landing along a grassy patch cut out of the forest. A group of almost naked indians stood and smiled at us, and the doctor who was to be our guide ran forward to shake hands. I hadn't expected a young, attractive woman. Maria turned out to be from a wealthy family on the Atlantic coast, who had decided to give everything up and work here. The heat was overpowering, even at nine in the morning. All around us was the sound of flesh being slapped: I had been warned about the pium [Simulium], the tiny midges which brought up great welts with their stings ..."

"The pium hung round our heads in a small, private, cloud: and not just ours as newcomers but the indians' as well. Each of these detestable little insects was the size of an inverted comma on a printed page, so everywhere we went we seemed to be in quotation marks, like clumsy jokes. I had my own cloud, like the rest, but they didn't sting me. Perhaps it was the roll-on insect repellent I used but it might just have been the way I smelled. The others found my immunity mildly annoying*.

Maria's mother, hot but indefinably glamorous with her golden earrings, was sitting in the cedarwood *fazenda* where they lived fanning Maria's baby. Mother and daughter were both so badly bitten by the pium that their feet seemed to be tattooed. The house was stripped of everything: doors, windows, furniture. Only a few hammocks swing in the breeze, Butterflies the size of my opened hands showed flashes of yellow or orange like petticoats, and a bird with a wonderfully liquid warbling cry spent most of the day in the nearby banana trees."

**Roger Crosskey tells me that he was equally unaffected, having no reaction to bites after being used by Brian Duke and Tony Shelley as their engorgement bait while on an Amazon trip!*

*I like to identify the location of Traveller's Stories as accurately as possible. J.S. Does not say where this village is, but later in his narrative he describes travelling for twelve hours by motor canoe up the Envira (Embira) river to Simpatia which I have found close to the border of Peru at Lat. 9°44'S, Long. 71° 38'W. - **Editor**.*

Humboldt on the Orinoco

In 1799 Alexander von Humboldt set out to explore the little-known world of South America, accompanied by his friend Bonpland. His tribulations have been described by Douglas Botting*, also an explorer, who followed the same route in the late 1960s and presents the experiences as recorded in Humboldt's writings with feeling and added detail.

"Late on the night of the 15 April 1800 the party reached the foot of the Atures and Maipures rapids, the Great Cataracts. These forty miles of shattered rocks and violent water - one of the longest and most perilous sets of rapids in South America - marked the end of navigation for shipping along the Lower Orinoco. For centuries they had sealed off the unexplored interior of Venezuela from the populated coastlands to the north. Only light canoes in the hands of expert local Indian watermen could enter that treacherous labyrinth and hope to reach the calm waters at the other end. Usually the canoes became waterlogged in the process, often they capsized and on occasions were smashed to pieces against the rocks so that the Indians, battered and bleeding, had to swim for their lives. If progress by water became impossible then the canoes had to be manhauled with immense difficulty over land.

Humboldt and Bonpland spent two days at Father Zea's humble house at Atures while the Indians struggled to haul the unladen canoe through the cataracts. They found the small mission, a mile or so from the river, in the most deplorable state. The Indian population was reduced to less than fifty - partly due to the 'guilty practice of preventing pregnancy by the use of deleterious herbs' -

and they lived in wretched conditions and suffered continually from sickness. Father Zea himself had been ill with his *calenturita*, his 'little fever', for eight months and was often attacked with fits of malaria during the journey. Moreover, it was abominably hot and clouds of biting insects filled the air so thickly that Humboldt was unable to see the sky through his astronomical instruments.

From now on, in fact, the insects were to become the dominating factor in their lives. Father Zea, after observing that there were fewer insects above a height of fifteen feet, had built a kind of tree house where it was possible to breathe more freely, and every evening Humboldt and Bonpland used to climb up a ladder to this refuge in order to dry their plants and write up their journals. Even so, they were beginning to suffer visibly from the immense quantity of bites they had received at Atures, and their hands had swollen considerably.

> "People who have not navigated the great rivers of equinoctial America, can scarcely conceive how, at every instant, without intermission, you may be tormented by insects flying in the air; and how the multitude of these little animals may render vast regions almost uninhabitable. It is impossible not to be constantly disturbed by the mosquitoes, zancudos, jejenes, and tempraneros, that cover the face and hands, pierce the clothes with their long needle-formed suckers, and getting into the mouth and nostrils, cause coughing and sneezing whenever any attempt is made to speak in the open air. In the missions of the Orinoco, in the villages on the banks of the river, surrounded by immense forests, the plague of the mosquitoes affords an inexhaustible subject of conversation. When two persons meet in the morning, the first questions they address to each other are: 'How did you find the zancudos during the night? How are we today for the mosquitoes?'
>
> In the Great Cataracts this suffering may be said to attain its maximum. I doubt whether there is a country on earth where man is exposed to more cruel torments in the rainy season. What appeared to us very remarkable is that at different hours of the day you are stung by distinct species. From half past six in the morning till five at night the air is filled with a tiny biting fly called jejen. An hour before sunset the tempraneros, a species of small gnat, take their place. Their presence scarcely lasts an hour and a half; they disappear between six and seven in the evening, or, as they say here, after the Angelus. After a few minutes' repose, you feel yourself stung by zancudos, another species of' gnat with very long legs. The zancudos, the proboscis of which contains a sharp-

> pointed sucker, causes the most acute pain, and a swelling that remains several weeks. The Indians pretend to distinguish the zancudos and the temprancros 'by their song'. At fixed and invariable hours, the air is peopled with new inhabitants, and we might guess blindfold the hour of the day or night by the hum of the insects, and by their stings.
>
> It is neither the dangers of navigating in small boats, nor the savage Indians, nor the serpents, crocodiles, or jaguars, that make Spaniards dread a voyage on the Orinoco; it is as they say with simplicity, *'el sudar y les moscas'* (the sweat and the flies).

Some of the devices for escaping these insect hordes were as ingenious as Father Zca's tree house. Some Indian tribes slept in little clay ovens full of smoke from a wet brushwood fire-Bonpland used to creep into these suffocating places to dry his plants. Others buried themselves up to the neck in sand and covered the face with a cloth. Some daubed themselves with mud or turtle oil, others recommended the insect-repellant qualities of a putrescent crocodile or smouldering cow-dung. In the Great Cataracts the Indians took refuge at night on rocks in the middle of the river, and Humboldt himself suggested that Europeans might travel sealed inside linen bags stiffened with whalebone hoops. But for the most part the only effective thing a man could do during the tortured hours of daylight was wave his arms about and slap himself. "The more you stir yourself," the missionaries would say, "the less you'll be stung.' The Indians, Humboldt noted, automatically slapped each other in their hammocks even in their sleep.

On the evening of' the 16 April, the travellers heard that the canoe had been safely negotiated through the Atures rapids. The next morning they set out along the bank to rejoin it and after two arduous days on the river reached Father Zea's mission at Maipures - a solitary place, full of the distant roar of the cataracts but mercifully free of insects.

The rapids of Maipures were even grander and wilder than the Atures, and Humboldt and Bonpland never tired of gazing down on them from the top of a nearby hill. For several miles the broad bed of the river was filled with an archipelago of islands-massive iron-black rocks covered in luxuriant forest trees and joined together by granite dikes. Through the narrow channels between the islands and over the falls formed by the dikes the river roared and swirled in a series of torrential cataracts. The surface of the water was a sheet of foam, and a thick mist, a whitish fog, hung over it for as far as the eye could see. In the evening the refracted sunlight formed rainbows which appeared and disappeared among the falls like will-o'-the-whisps - an exquisite optical illusion. The noise of this enormous weight of' falling water was deafening, especially at night.

Beyond the Great Cataracts an unknown land began. All that Humboldt knew about it was what he had learnt by hearsay, for nothing had ever been written about it by anyone who had ever been there. Even at the time of his visit, nearly 300 years after Diego de Ordaz first nosed his way into the Orinoco and Sir Walter Raleigh ventured along its lower reaches in search of El Dorado, there were only half a dozen white men living there in the space of 300 miles"

These blackflies have since been extensively studied at the Centro Amazónico para Investigación y Control de Enfermedades Tropicales (CAICET), Puerto Ayacucho, located at the foot of the Atures rapids. I know from personal experience the intensity of biting that can be found along the R. Orinoco, having visited there. The main species involved was most likely *Simulium oyopockense s.l.* Floch & Abonnenc --**Editor**

[Douglas Botting, Humboldt and the Cosmos. Sphere Books Ltd. 1973 295pp.]

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Index to the British Simuliid Group Bulletins

Nos. 1 to 20 (1992-2003)

Compiled by M.E. and R.W.Crosskey
(with additions from Nos. 19 and 20 by J.B.Davies)

[The Index may be separated by loosening the staples between pages 12 and 13]

Index to the British Simuliid Group Bulletins
Nos. 1 to 20 (1992-2003)

The information contained in the first 20 issues of the B.S.G. Bulletin, published between May 1992 and June 2003, is presented in this index in four sub-set indexes, according to the topic (subject matter), the scientific names of Simuliidae, the scientific names of other organisms, and the names of contributing authors. For each entry the issue numbers are given first, followed by the relevant page(s) in parentheses; where the same indexed item occurs in separate articles within an issue the page references are separated by a slash (/). References to 'onchocerciasis' *per se* pertain to the disease in humans. The titles/authors of talks and posters given at B.S.G. meetings but never supplied as full text for publication have been disregarded, left unindexed because of lack of content. In the contributor index each author's name is accompanied by full initials even if not all initials are provided in the article heading; when known the author's usual or preferred full forename is given in parentheses.

Topic Index

Blackfly Scientific Names Index

Index of Other Organism Names

Contributor Index

THE BRITISH SIMULIID GROUP BULLETIN No. 21
December 2003

CONTENTS

FROM THE EDITOR

Another bumper number of your Bulletin is about to go to press. In it we have the report and presentation abstracts from the 25th “Jubilee” meeting of last September together with a report from a new contributor from Ireland – an area from which we have received very little information in the past. Let’s hope that this will start a renewal of interest in that country. There is also an advance notice of the very special joint meeting that we propose to hold next October with the European Simuliidae-Symposium in Berlin – see below.

The year 2003 has been a sad one for simuliidologists. Reports of the deaths of five prominent workers have been received. Memorial notes on three will be found under the “In Memoriam” section at the end of this number. It is hoped to be able to add further notes on the other two, H.T. Dalmat, and J.A. Downes, in the next issue. While none of them were members of the Group, many of us will have met them at conferences, worked or corresponded with them, or had occasion to be grateful for their published works. They will be missed.
John Davies, Editor

26th Annual Meeting – Advance Notice

As was decided at the 25th Annual meeting (see below) the 26th Annual Meeting of the British Simuliid Group will be combined with the **5th European Simuliidae-Symposium, 15 to 18 September 2004** at the Institute of Biology, Humboldt-University of Berlin, Invalidenstrasse 43, 10115 Berlin – Mitte

The main topics of the scientific sessions will be:

- phylogeny and taxonomy of black flies
- physiological research on the larval stages
- adaptation to environmental changes
- ecological background
- influence of feeding/nutrition on the larval stages
- history of black fly research

All presentations (talks and posters) will be in English

Proposed Timetable

Wednesday, 15 September
Arrival – Registration
Welcome evening (6.00 p.m.), Insect Hall of the Museum of Natural History

Thursday, 16 September
Opening (10.00 a.m.): Museum of Natural History, Insect Hall
Lectures
Cultural evening

Friday, 17 September
Lectures
Round table with Social evening

Saturday, 18 September
Excursion to Potsdam or the River Oder region

Members will be kept informed via e-mail or regular mail and should also keep a watch on the websites at www.entomologist.free-online.co.uk and www.biologie.hu-berlin.de for further details

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MEETING REPORT

25th ANNUAL BRITISH SIMULIID GROUP MEETING 24th September 2003 – Natural History Museum, London

The 25th Jubilee meeting of the Group was held in the basement seminar room, Entomology Department of the Natural History Museum, London, on 24th September 2003. The same venue, if not the same room, of the inaugural meeting, chaired by A.G.Gatehouse in February 1978. (For purists, actually 5 months short of the anniversary).

The meeting was Chaired by Tony Shelley, who, after the usual coffee and biscuits, opened the meeting at 11.00am. There then followed three papers before lunch which was taken at a pizza house near South Kensington Station. On returning there followed a discussion as to whether the Group should combine with the 5th European Simuliidae Symposium, to be held in Berlin in October 2004, see separate item below. The afternoon session contained four more papers, before concluding at about 5.00pm. after a vote of thanks to Tony Shelley and Luis Hernandez for a well organised meeting.

The range of topics was particularily broad, covering blackflies from Germany and U.K., Yugoslavia, Guyana, Gulf of Guinea, South America and the Galapagos Islands.

26th Annual Meeting

At the 2002 meeting a proposal had been put forward suggesting that we should combine with one of the meetings of the European Simuliidae Symposium, which are usually held in Germany every two years, and it had been indicated that the possibility should be investigated further.

Doreen Werner proposed that the Symposium's next meeting scheduled to be held in Berlin in October 2004 would be an excellent opportunity for us to combine, and there was general agreement that we should try to bring this about.

PAPERS PRESENTED AT THE MEETING

BSG – a look at the first 25 years

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MEMBERSHIP

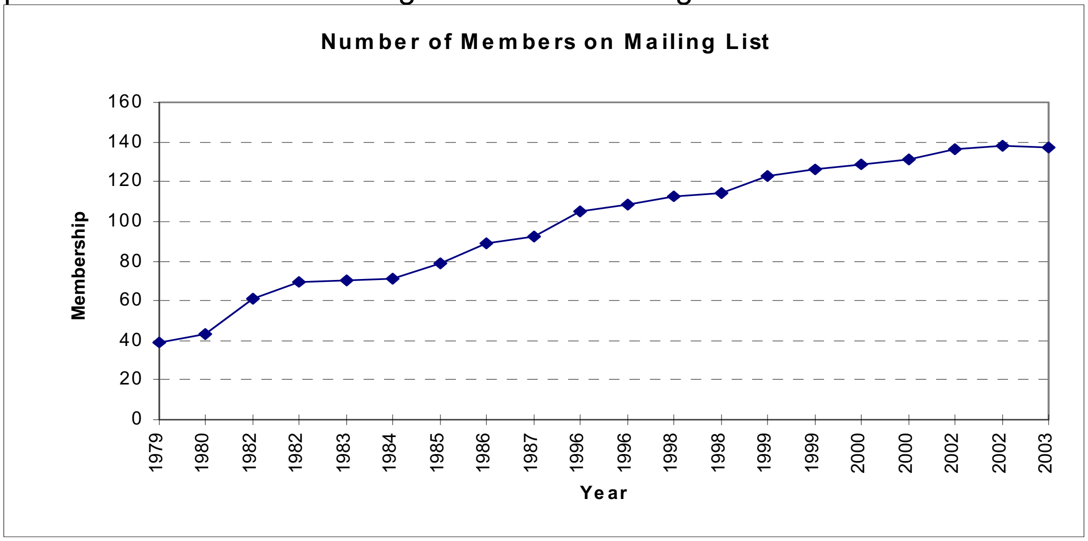
The British Simuliid Group was in effect originally formed in 1979 by 39 persons working on simullids in Britain who provided a note of their names, addresses and special interests to Trefor Williams, editor of the Newsletter of the British Simuliid Group, shortly after the initial meeting to start the Group had been held at the Natural History Museum. Gavin Gatehouse, in the first Newsletter (1979), wrote that the Newsletters, and by extension also the Group, were:

> "... aimed at maintaining and developing contacts between those interested in simuliids and will provide for the exchange of news, information, requests and ideas. concerning all aspects of simuliid biology."

Membership grew rapidly, at an average rate of four new members each year, and by the time of the Group's 25th Annual Meeting in 2003 (the time of its Silver Jubilee), the list stood at 137 members. The membership figures at particular times are shown on the accompanying chart.

Much of the increased membership, particularly in recent years, has been due to the interest in the Group shown by workers outside Britain, and from a range of disciplines. This led to an expanded version of the Group's purpose which was formulated in 1995.

“The British Simuliid Group (BSG) is an informal gathering of scientists of any discipline, from many countries, who have an interest in the Simuliidae. The group's members include entomologists, parasitologists, environmentalists, ecologists and medics, with interests in ecology, bionomics, taxonomy, cytotaxonomy, disease transmission, freshwater biology etc. Our aim is to assemble as diverse a group as possible in order to encourage a wide interchange of ideas and information."



The composition of the membership is currently about 52% from Britain and 48% from overseas (Europe 14%, the Americas 23%, Africa 7%, Asia and Australasia 4%). It seems that the establishment of the Group's Website has provided a stimulus to new membership - together with the fact that membership continues to be free!

Several individuals have left the Group as their interests changed and five members were lost to the Group through death, all notable specialists in their fields: Colin Fairhurst, 'Johnny' Johnson, Willie Kershaw, David Lewis and Steve Moss.

MEETING VENUES AND ATTENDANCE

A BSG meeting has been held every year since the first scientific meeting of the group at the Liverpool School of Tropical Medicine (LSTM) in summer 1979. Meeting venues are sometimes thought of as alternating between the LSTM and the Natural History Museum (NHM) in London but in fact there have over the years been 12 different venues and in toto only 10 of the meetings have been at the LSTM + NHM. The numbers of occasions on which each venue has been used are: Abbots Ripton (Monks Wood Experimental Station), 1; Birmingham University, 2; Exeter University, 1 ; Keele University, 1 ; Liverpool (School of Tropical Medicine), 5; London (Natural History Museum), 5 (including 25th Anniversary meeting 2003); Oxford University, 1 ; Portsmouth Polytechnic, 2; Salford University, 3; St Albans (Winches Farm Field Station), 1; Wareham (River Laboratory), 2; Winfrith Newburgh (Centre for Ecology and Hydrology), 1.

Perhaps surprisingly, given the vicissitudes of employment for those interested in simuliid research, the attendance at meetings has never dropped below a dozen and in bonanza years 45 and more people were present. However, these dizzier numbers were at times when the meetings were held in university departments where many attending were not members of the Group but students and staff looking in on the meeting from the casual interest point of view. One such meeting, that at Keele University in 1992, holds the attendance record. The mean total attendance has been about 29. A mainly recent trend is for attendance by overseas members, and at various times BSG meetings have been able to welcome friends from Argentina, Austria, Belgium, Brazil, Canada, Colombia, Germany, Ghana, Guatemala, India, Italy, Ivory Coast, Netherlands, Nigeria, Norway, Portugal, Russia, Slovakia, Spain, Venezuela and Yugoslavia.

NEWSLETTER and BULLETIN

Since the Group was initiated in 1979 its publications, the Newsletter and the Bulletin, have been - apart from the annual meeting - its mainstay activity. Astonishingly, as shown by a check of the author indexes to the Newsletters and Bulletins (issued in Bulletins 9 and 20), 189 persons with an interest in blackflies have authored or part-authored contributions of one sort or another in the 25 years of the Group's existence. The Newsletter was started in 1979 and became the place in which to publicise the talks given at the annual meetings and in which to provide short original articles of an informal kind. An excellent example, still used today, was Steve Moss's identification key to the trichomycete fungi associated with blackflies. The Newsletters ran for 13 issues and were edited by Trefor Williams.

The coming of the word processor offered the chance for an upgraded type of publication and in 1992 the British Simuliid Group Bulletin began, produced in the smaller A5 format and provided with a stiffened cover, contents list and other improvements - a swankier-looking publication altogether! The changeover was masterminded by Trefor Williams, who continued as the BSG editor until 1994, when John Davies took over the job, beginning with Bulletin 4. So far a total of 21 Bulletin issues have appeared, usually two each year. The Bulletin is taken by several libraries and since the Group's inception its publications have been monitored by the Zoological Record, which references any notable articles.

THE FUTURE

The membership of the Group continues to grow, and each annual meeting seems to stimulate more requests to join. The Group's associated website at www.entomologist.free-online.co.uk and the *Simuliidae* news list at www.jiscmail.ac.uk, both of which carry copies of recent *Bulletins,* are becoming known and more frequently consulted. With these facts in mind, it seems that the Group's future is assured at least for the time being.

Distribution of some blackfly species (Diptera: Simuliidae) in the region of Novi Sad

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Nuisance and more or less serious allergenic consequences caused by severe blackfly bites have been recorded among local inhabitants in the region of Novi Sad. The increase in number of some antropophylic blackfly species has become an apparent problem during the last few years.

After an absence of about 30 years the research of blackfly fauna has been reestablished and intensified in the last three years, with the aim to update references on present species in the region.

The hydrologic map of the region shows a lot of breeding places suitable for development of immature stages of black flies, such as the Danube river, and numerous streams, tributaries of the Danube river coming from Fruska Gora hills. Eight out of nine species present in the region of Novi Sad have been sampled in the immature stages: *Simulium ornatum* Meigen, 1818 (complex), *Simulium erythrocephalum* (De Geer, 1776), *Simulium aureum* Fries, 1824, *Simulium vernum* Macquart, 1826 (complex), *Simulium lundstromi* (Enderlein, 1921), *Simulium balcanicum* (Enderlein, 1924), *Simulium costatum* Friederichs, 1920 and *Simulium pseudequinum*, Séguy 1921.

Dry ice baited traps have been applied for sampling blackfly adult populations in different urban and semirural localities in the region during the period of seasonal activity. Comparison in morphology of adult specimens captured in dry ice baited traps with those reared from the immature stages collected in the breeding sites has been performed to obtain correct identification of species. Apart from the eight species registered in larval and pupal stages *Simulium equinum* (Linnaeus, 1758) has been positively identified in adult stage only. Identification of other trapped adults has not been done with confidence because of extremely similar morphologic characters of *S. balcanicum* and other species of the Wilhelmia subgenus (probably *Simulium lineatum* (Meigen, 1804) for which immature stages have not yet been found). *S. costatum* and *S. pseudequinum* were not captured in traps.

Highly abundant breeding sites of *S.ornatum* were found in majority of surveyed streams, especially in stretches crossing the populated zones where streams were polluted with different organic, plastic or other waste. Immature stages have been found not only on natural substrates (stones, gravel and submersed vegetation), but on plastic, glass and metal waste as well.

Breeding sites of *S. erythrocephalum* were located in the Danube, especially at the banks of numerous islands. Unexpectedly this species has been recorded in larval and pupal stages in one stream during the period of low water level of the Danube river, in the spring 2003. A similar situation was registered for *S. balcanicum*. This species that usually prefers large water flows such as the Danube was found in the same stream in autumn 2001.

Breeding sites of *S. aureum* have been recorded in several streams, sometimes associated with *S. ornatum*. *S.vernum* and *S.lundstromi* have been found together only in one stream with periodical flow during the springtime. *S.costatum* and *S.pseudequinum* were found occasionally only in two streams.

A morphological revision of the Simuliidae of Guyana, South America

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A revision is made of the previously poorly studied blackfly fauna from the south-western border of Guyana with Brazil. Notes on the biosystematics of the species found are provided, together with keys and illustrations (digital images) based on their morphology. Of the 14 species recorded eight are anthropophilic and two of theses *(S. oyapockense s.l*. and *S. guianense* s.l.) are proven vectors of human onchocerciasis in the nearby Amazonia focus of the disease in neighbouring Brazil.

Blackflies and their Diptera predators: a review and some new results

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Blackflies are attacked in all their life stages by a wide variety of organisms, ranging from birds and fishes at one end of the scale to protozoans and nematodes at the other. Some act as internal parasites, attacking mainly the larval stages. Others are predators and scavengers – there is only a fine line between these feeding strategies – and attack egg, larval, pupal and adult stages.

Insects from at least 9 orders are known to feed on blackflies. The most important of these are undoubtedly the caddis flies (Trichoptera). Equally important, but under-estimated and certainly under-investigated, are the Diptera, many of which are obligate predators as larvae or adults or both.

Our literature searches and fieldwork have shown that there are 12 families of Diptera that prey on blackflies. Some of these associations are undoubtedly fortuitous or opportunistic. For example, larvae of the Chaoboridae have been recorded on a few occasions as taking adult and larval blackflies as food. Chaoborid larvae, however, live in standing water, and so can only pick larvae that have drifted in an area of standing water or adults that have fallen on to the water surface. Adult Asilidae, the well-known robber flies, have been recorded on a number of occasions as taking adult blackflies as prey, but in a recently published database of prey records blackflies form only 0.18% of the total number of records listed.

In the course of fieldwork in Europe over the last few years, D.W. has been able to record new predators of the aquatic stages of blackflies in the families Chaoboridae, Chironomidae, Phoridae, Ephydridae and Scathophagidae. Our fieldwork in 2002 and 2003, in Germany and the UK, either individually or collaboratively, has focussed on predators of adult blackflies, and we have new information on Dolichopodidae, Empididae, Hybotidae and Muscidae. These are not simply records of species x catching species y, but also include observations on hunting strategies and also, in the case of the muscid genera Limnophora and Lispe, observations on courtship and mating rituals.

Contrary to what is generally written and accepted about predation, not all predators are promiscuous in their choice of prey. It is clear that there are some very specific associations between certain Diptera predators and blackflies, as larvae feeding on larvae and adults feeding on larvae and/or adults. So far as larvae are concerned, this is evident in the association between certain Hemerodromiinae (Empididae) and blackfly larvae, and, in this country, between Limnophora (Muscidae) and Simulium noelleri. But our observations have also shown that there are behavioural strategies in certain adult Empididae and Muscidae that are specifically adapted for predating on adult blackflies.

Within the broad context of the "management" of blackfly populations, the Diptera predators undoubtedly have a role to play. Our work has shown that this is not an insignificant role, and further investigations of both larval and adult predators are expected to confirm this and to reveal additional associations.

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Blackfly endemism in the Gulf of Guinea

Mabintu Mustapha & Rory Post: *Department of Entomology, The Natural History Museum, London*

The Gulf of Guinea is a general biodiversity hot-spot and hence of great conservation interest with parts of it designated as a UNESCO World Heritage Conservation Site. Blackflies can be considered as a model for the study of the origins of biodiversity in the area. The four Gulf of Guinea islands and Mount Cameroon were formed simultaneously about 15 mybp as volcanic uplifts and extrusions along a "hotline" which extends SW to St Helena.

Annobón is the smallest and most distant of the Gulf of Guinea islands, and a brief survey by Dr Jordi Mas (personal communication) of the University of Barcelona failed to discover any blackflies. They are presumed absent.

Prof Antonio dos Santos Gracio (1999) reported finding *Simulium dentulosum* and *Simulium alcocki* on the island of São Tomé. We confirm these findings, and have also found a new endemic species closely related to *S. alcocki*. Príncipe is the second smallest island, and has only *S. dentulosum*.

There 49 species recorded from Cameroon (Crosskey & Howard, 1997), of which 25 are known from SW Cameroon in the Mount Cameroon area. We have identified eight species from Bioko, all of which are known from Cameroon except the "Bioko" form of *Simulium yahense* (Post *et al*., 2003). However, *S. yahense* is known to breed just over the border in Nigeria, and some cytotaxonomists are of the opinion that the "Bioko" form might warrant distinctive species status.

Simulium cervicornutum from Bioko and Cameroon was found to occur as a distinctive morphotype in comparison with material from the rest of the afrotropical region. The Bioko/Cameroon material was similar to Pomeroy's original species description of *S. cervicornutum*, whereas material examined from other countries was similar to Gibbin's redescription.

The origin and distribution of the three endemics (new species from São Tomé, the "Bioko" form of *S. yahense* and the "Pomeroy" form of *S. cervicornutum*) might be explained variously by cycles of invasion and isolation related to Pleistocene cycles of sea-level changes and southern reach of the harmatton wind (occurring at the same time as the northern latitude cycles of glaciation).

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Patterns of blindness due to human onchocerciasis: a whole new can of worms

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Background: Decisions on the control of human onchocerciasis (river blindness) by antivectorial measures (Onchocerciasis Control Programme, OCP) have been strongly influenced by the hypothesis that in West Africa there are two main vector-parasite complexes: one found in savanna regions and associated with high prevalence of blindness, and the other occurring in forested regions and associated with negligible blindness. However, the blinding/non-blinding strain divide is not consistent with observations of high levels of onchocercal blindness in forest-savanna mosaic areas (Umeh *et al*. 1996; Pion *et al*. 2002). The strain theory has been supported by cross-fly feeding experiments (Duke *et al*. 1966); experimental animal models (Duke & Garner 1973), and molecular techniques identifying savanna- and forest-specific DNA sequences (Meredith *et al.* 1991) which correlate with blindness patterns (Zimmerman *et al*. 1993). However, the specimens used to define typical savanna and forest strains according to their DNA came from different countries (Mali in the north and Liberia in the south of the OCP area, respectively) and there is considerable, yet unquantified variation in the degree of hybridisation to either DNA probe from isolates obtained from non-type localities. The entomological evidence of heterologous incompatibility between vector and parasite has also been disputed (Toé *et al*. 1997). Therefore, the question of whether there are only two parasite strains and two distinct *Onchocerca-Simulium* complexes determining blindness patterns in West Africa requires further scrutiny.

Objectives: To collate and analyse data on blindness prevalence (our outcome variable) across different geographical regions in West Africa in order to test the two-strain hypothesis, and identify other possible risk factors (our explanatory

variables).

Methods: The relationship between the prevalence of blindness (P_B) and a number of potential risk factors was examined using data collated from published and unpublished sources. Data were standardised for parasitological (skin snipping) and entomological (cytotaxonomy) procedures, and bioclimatic zone. Univariate analyses were used initially to examine the relationship between prevalence of blindness and prevalence and intensity of *O. volvulus* microfilariae (mff), annual transmission potential (ATP), annual biting rate (ABR), bioclimatic zone and members of the *Simulium damnosum* complex present. A multivariate logistic regression model was used to assess the contribution and significance of each individual risk factor and their interactions in explaining the variation in blindness prevalence.

Results: When the forest and savanna complexes were defined according to Duke *et al*. (1966) [the forest strain circulating in the forest, forest-savanna mosaic and most of the Guinea-type savanna, in contrast to the Sudan-savanna strain], the difference in blindness prevalence was not statistically significant (*p*-value=0.07). For several risk factors the prevalence of blindness increased rapidly and nonlinearly after a threshold value. For ATP this value was about 100 L3/person/year; for mff prevalence it was approximately 60% for savanna regions but, interestingly, 30% for all non-savanna zones. For mff intensity (measured as the community mff load or CMFL) there was little blindness below 15 mff/snip. This relationship, previously reported for savanna alone (Remme *et al*. 1989) was shown to apply to all bioclimatic zones. In the multivariate analysis, mff prevalence, mff prevalence squared, bioclimatic zone, and country were all significantly associated with blindness prevalence (*p*-values<0.001). The interactions between mff prevalence and country, and mff prevalence and bioclimatic zone were also statistically significant. The increase in the risk of blindness for each unit increase in the mff prevalence was 8% higher in the savanna (odds ratio=1.08, *p*-value=0.02) and 10% higher in the forest-savanna mosaic areas (OR=1.10, *p*-value=0.02) than in the rainforest forest areas (taken as the baseline). When the presence of individual vector species were added to the model, *S. sirbanum, S. damnosum s.s.,* and *S. squamosum* were found to be significantly and positively associated with blindness prevalence (OR=1.04, 1.27 and 4.09, respectively), whereas *S. yahense* and *S. sanctipauli* Djodji form were found to be significantly negatively associated (OR=0.34 and 0.89 respectively).

Conclusions: There is substantial variation in blindness prevalence as indicated by the significant geographical (country) and ecological (bioclime) effects (interacting with mff prevalence) which does not conform neatly to the two-strain hypothesis and points towards either a greater degree of parasite heterogeneity, or to a homogeneous parasite that is affected by a variety of local influences such as the vector form that transmits it. The contribution of individual vector species and locally adapted *Onchocerca-Simulium* complexes should be further explored. The role of host-related, environmental, and nutritional factors, as well as patterns of (pre-ivermectin) chemotherapy should also be investigated.

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Blackflies and their control in the Galapagos Islands (Ecuador)

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The Galapagos Islands, a World Heritage Site and Biosphere Reserve, are famous for their unique ecosystems and endemic biodiversity. Unfortunately, the biodiversity of these islands is under attack by invasive species. The blackfly, *Simulium bipunctatum* Malloch (= *S. ochraceum* Walker *sensu* Shelley et al.) (Diptera, Simuliidae) was found in Galapagos Islands in 1986. The presence of these flies is more prominent on the island of San Cristóbal where they have permanently disrupted the lives of the local farmers and negatively influenced the economy of the island.

Starting in 2000, the Charles Darwin Foundation evaluated several factors to determine the feasibility of eradicating or controlling blackflies such as the bioecology, the importance of *Simulium* as a vector of other alien species, i.e. diseases and parasites, the current area of distribution and the importance of habitat(s) and species conservation affected by this invasive species.

Since July of 2002, monthly monitoring is being carried out at each selected sample site to determine the faunal composition and the periodic changes in physical characteristics of the rivers. A total of 27 invertebrate species in 10 different orders and 24 families were identified from the rivers in San Cristobal. The order Diptera was the most prominent group with 75.5% of the total number. *S. bipunctatum* (=*S. ochraceum)* was present all year long and was the most abundant species in all the rivers. *Gyrinus galapagoensis* (Coleoptera, Gyrinidae) and *Copelatus galapagoensis*, (Coleoptera, Dytiscidae) which are endemic species in San Cristobal's rivers, were found to share the habitat with blackflies. Increase in rainfall negatively influenced the population of blackflies. The population decreased as a result of the torrential rains that acted as natural control by washing away immature stages and substrates through the increase of water turbidity and discharge.

Considering the ecological importance of the unique biodiversity of the Galapagos Islands, a large-scale black fly control program, prior to its implementation, needs to be thoroughly evaluated for potential side effects on the endemic fauna. The decision to use *Bacillus thuringiensis* var. *israelensis* (Bti) in the San Cristobal black fly control project was based on its specific larvicidal effect on blackflies and the relative safety for other non target macro invertebrates of the fresh water ecosystems.

In order to efficiently control the larval stages of blackflies in the field, laboratory tests were carried out to determine the adequate dosages of Bti, the exposure time and the effect on non-target organisms.

A series of tests with various dosages of Bti at 5, 7.5,10,15 and 25 ppm and different exposure times (1, 5, 10, 30 and 60 minutes) were conducted to determine the most effective concentration. A dosage of 10 ppm resulted in an 85% mortality with a 1-minute exposure time under laboratory conditions.

At present, the exact impact of *Simulium bipunctatum* on the native fauna is very difficult to determine, and remains largely unknown. The presence of the blackflies, both adults and larvae, may influence the feeding habitats of other organisms. However, the most significant impact of blackflies is the aggressive attacks of the adults on the farmers as well as on livestock causing great nuisance.

POSTERS

Vector competence of *Simulium exiguum s.l.* in Ecuador: cytospecies or density-dependence?

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Background: The Ecuadorian onchocerciasis focus occurs mainly in the Santiago basin of Esmeraldas Province, bordering with Colombia, where *Simulium exiguum s.l.* is the primary vector. The *S. exiguum* complex consists of at least six known cytotypes: Aguarico, Bucay, Cayapa, Hautarac, Napo and Quevedo forms.[1-4] The Cayapa form is the only known natural vector of onchocerciasis in Ecuador. However, the Aguarico, Bucay and Quevedo forms have been shown to support development of *Onchocerca volvulus*.[5] The variable role of *S. exiguum s.l.* in onchocerciasis transmission has been attributed to differences in biting preferences and vector competences among its constituent siblings.[6]

Objectives: A statistical investigation of the vector competence of *S. exiguum s.l.* was conducted to assess the effects of density-dependence as exhibited by non-linear relationships in parasite uptake and vector survival in the different cytotypes for which fly-feeding experimental data were available. Finally, larval development within the vector was assessed to estimate rates of progression from one larval stage to the next for mathematical modelling purposes. The results of this investigation will be used to parameterize a model for the transmission and control of onchocerciasis in Ecuador.

Methods: Data for the Cayapa form[5,7,8] were analysed regressing the mean of the log-transformed counts of L3/fly against the mean of the log-transformed microfilarial (mff) counts per mg of skin. If the regression coefficient differs statistically from unity there is evidence of non-linearity (in particular if the slope is less than 1 there is limitation of larval load/fly). The mean mff load was adjusted for measurement error using a method of moments estimator.[9] (Measurement error can cause attenuation and give the impression of non-linearity when the relationship is in fact linear.) A (Kaplan-Meier)[10] non-parametric analysis estimated survival curves for all cytospecies combined but grouped according to mff intake. A Peto & Peto modification of the Gehan-Wilcoxon test[11] was used to test for differences in survivorship among mff groups. A parametric analysis of daily fly mortality rates assumed a parabolic function with time (*t*) post-engorgement (p.e.) for each group of flies fed on a mff carrier.[12] Estimates of initial mortality (within the first 24 h p.e.) were regressed on mff load to estimate baseline (uninfected) mortality rate and the extent of excess fly mortality due to increasing mff intake

Results: A limitation relationship between L3 output and mff input was confirmed in the Cayapa form of *S. exiguum s.l.*[7] Data from different cytospecies fell well within the variation displayed by the data and suggest the possibility that observed differences between cytospecies may be a result of density-dependent processes. However, the means for the non-Cayapa forms lay in the low end of the spectrum (Fig. 1).

The survival of those groups of flies fed on different mff loads was statistically significant (*p*-value<0.001) (Fig. 2). The parametric (parabolic) function indicated age-dependent mortality in captive flies. The baseline death rate for ‘uninfected’ or ‘lightly infected’ flies was 0.049/day, translating into an uninfected life-expectancy of 20 days (in captivity). The parasite-induced fly mortality was 0.004/day/mf

The investigation into larval progression (Fig. 3) yielded a minimum time lag of 5 days before the appearance of L3 larvae in *S. exiguum s.l.* The rate of progression between L1 and L2 was estimated as 0.20 per day (average duration of L1 stage= 4.96 days), and between L2 and L3 stages as 0.32 per day (average duration=3.14 days).

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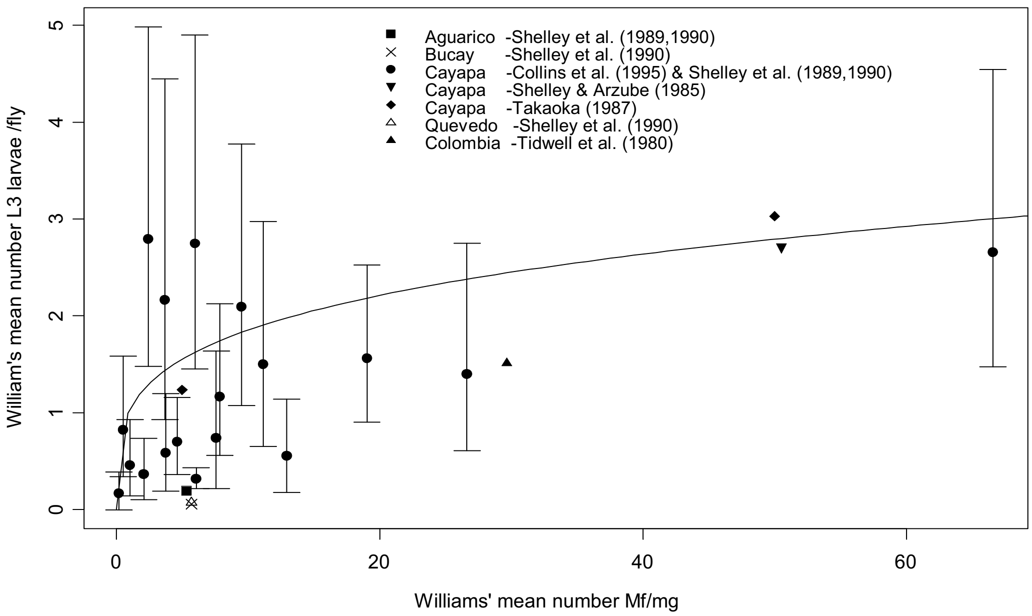

Fig. 1. The relationship between mean no. of L3 and mean Mf load. The data points not accompanied by 95% confidence intervals were obtained from published literature and overlaid on the graph (Refs. 13-15).

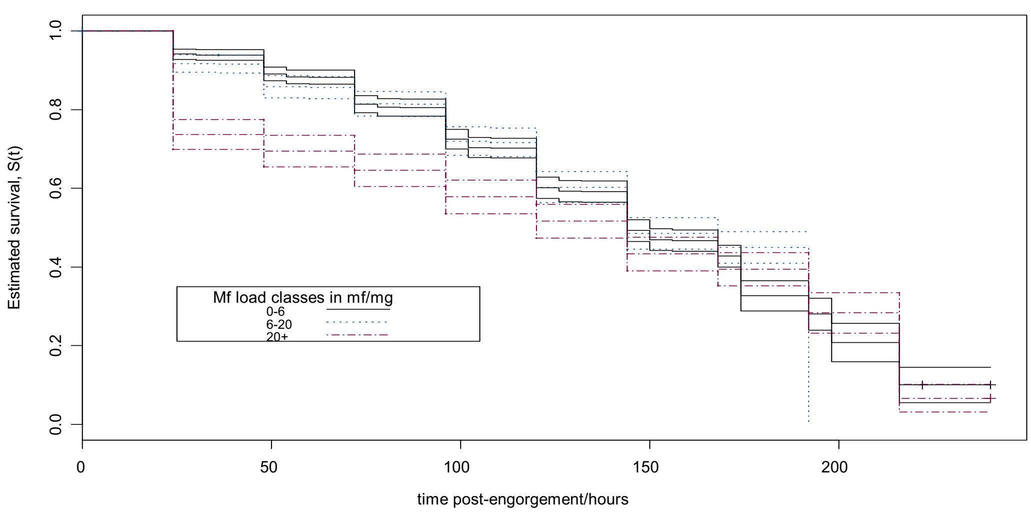

Fig. 2. Kaplan-Meier survivorship curves, *S(t)*, for groups of *S. exiguum s.l.* flies fed on different Mf loads over time p.e. (in hours) with 95% confidence intervals

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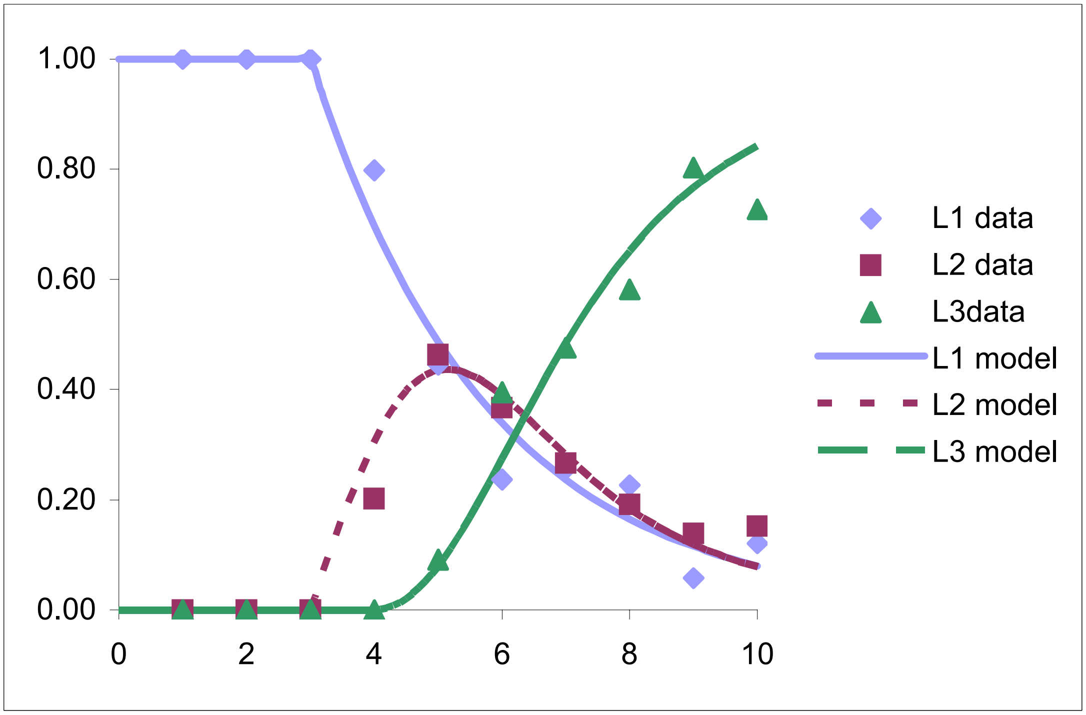

Fig. 3. Proportions of L1, L2 and L3 larvae relative to the total number of larvae at time p.e. (*t*, in days) in *S. exiguum s.l.* maintained in the laboratory for 10 days. Markers are data points; lines are the results of a simple deterministic model using constant rates of progression.

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Aggregated oviposition in *Simulium ochraceum* s.l.

Mario A. Rodríguez-Pérez[1], Norma L. Valdivieso-López[1], and P. J. McCall[2]

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In southern Mexico and Guatemala, members of the *S. ochraceum* complex typically oviposit in tiny rivulets and streams, with minimal flow rates, on the floors of forests on Pacific-mountain slopes, at altitudes of 600-1500 masl. Oviposition occurs during the day, between 11.00 and 15.00 h. Other than these observations, there is not much known about the oviposition behaviour of this vector complex. The objective of the present, laboratory investigation was to determine if the oviposition behaviour of *S.ochraceum* s.l. involved olfactory attractants. Oviposition attractants and pheromones have potential as surveillance-trap baits, for blackflies and other vectors. Wild *S. ochraceum* s.l. were collected in southern Mexico. The wild-caught, female flies were offered bloodmeals. The flies fed to repletion were maintained at insectary conditions and provided with 10% sugar solution until gravid. They were then allowed to oviposit on discs of filter paper W-2 that had been placed in Petri dishes and saturated with d-water. The eggs produced were kept in drops of d-water, on glass slides over ice, until used in the bio-assays. Each bio-assay was conducted in a 12x12x12 cm cage. During each bio-assay, 20 gravid blackflies were placed in the cage and left, for 2 h, to oviposit on the discs, one of which was baited with the attractant being tested –100, 500 or 1000, freshly laid eggs (used within 4 h of their oviposition) or 12h old eggs, in d-water– and the other, as a control, with an egg-free sample of d-water. Each bioassay was replicated 5 times. After the 2-h oviposition period, all the flies were dissected. Flies with empty or partially empty ovaries were considered to have oviposited. The no. of eggs laid on each disc was counted and, based upon the total no. of flies ovipositing and the mean no. of eggs laid/ovipositing flies, the no. of flies choosing to lay on each disc was estimated. The estimated numbers of flies ovipositing on the baited and control substrates were compared using X^2 or Fisher´s exact tests, whereas the mean number of eggs laid were compared using Friedman tests.

Table 1. The oviposition behaviour of gravid *Simulium ochraceum* s.l. offered two substrates, one baited with fresh or 12-h-old eggs and the other left egg-free, as a control.

	Mean no. of eggs laid/bio-assay			Estimated no. of blackflies ovipositing		
Attractant	Baited	Control	**P**	Baited	Control	**P**
1000 fresh eggs	749.2	90.6	0.025	25	3	0.000
500 fresh eggs	537.6	230.8	0.180	18	3	0.001
100 fresh eggs	447.6	109.6	0.025	15	4	0.016
1000 12h old eggs	158.2	78.0	0.046	5	3	0.360
500 12h old eggs	269.0	51.4	0.025	8	2	0.105
100 12h old eggs	120.8	68.0	0.317	3	2	0.500

The results are summarized in Table 1 .where the data demonstrate that gravid females ´preferred´ to oviposit on substrates that already held freshly laid eggs. Substrates baited with aged (12h old) eggs did not elicit such strong responses. The reduced response to aged eggs raises the possibility that the attraction to the presence of eggs on baited substrates could be mediated by a pheromone that is released in larger amounts from fresh eggs than from 12h old ones. This is the first evidence that *S. ochraceum* s.l. exhibits communal oviposition behaviour and that it might be chemically mediated. The latter must be confirmed by demonstrating that egg extracts or volatiles from eggs elicit similar responses to the fresh eggs. The communal oviposition of *S. ochraceum* s.l. has yet to be observed under field conditions, and it remains to be demonstrated whether eggs or their extracts can attract gravid females to potential oviposition sites in the field.

Acknowledgments. We thank CONACyT-34486M, the Mexican Centro de Biotecnología Genómica of IPN, and the Wellcome Trust-031509/2/90/A.

SCIENTIFIC CONTRIBUTIONS

A note on Ongoing Work on Blackfly species (Diptera: Simuliidae) and their distribution in Irish Freshwater Habitats.

Dr. Deirdre Tierney, Mr. Wayne Trodd and Dr. Mary Kelly-Quinn

Limnology Unit, Zoology Dept. University College Dublin, Belfield Dublin 4.

Background

Simuliids are commonly encountered in Irish limnological investigations and are generally recorded as Simuliidae spp. (Bass, 1990). They are rarely identified to species level due to the lack of taxonomic expertise on this group and difficulties encountered in identification. Twenty-five species of simuliids were reported to occur in Ireland Ashe et al (1998). A small number of publications provide species lists for simuliids but these tend to be confined geographically. The present project, funded by the Heritage Council of Ireland, commenced in March 2003 and is due for completion by the end of November 2003. The main aim of the project was to update the current knowledge available on the distribution of simuliid species, enhance taxonomic expertise and assemble voucher collections.

Materials and methods

A literature survey was carried out to locate and extract all references to species of Simuliidae found in Ireland. The collection of adult Simuliidae specimens held in the Natural History Museum was consulted and details noted. Preserved material from projects based at the Limnology Unit at University College Dublin was made available for identification. Field sampling of both larva and pupa was carried out in under-represented national grid squares. Over eighty-three sites have been surveyed covering eighty-two different 10km grids. Furthermore, world expert in simuliids, Dr. Roger Crosskey of the British Natural History Museum provided additional records and Mr. Pascal Sweeney gave additional material for identification.

An informal three-day course was completed under the direction of Mr. Jon Bass. This course resulted in a reference collection of confirmed specimens and aided the identification of specimens. Additional material was subsequently sent to Mr. Bass for confirmation. The standards FBA key (Bass, 1990) was used for identification of specimens. Only last instar larva and pupa were identified. A number of species can only be identified as adults. These were recorded as species pairs and refer to six species. The information collected was compiled into a database which will be used to compile a species list and their distribution.

Results
Eighteen species of simuliid were identified. These included one new species for Ireland and another species listed in published literature was not included in the species list by Ashe et al (1998). In addition 3 species pairs were also encountered. Information is now available to construct distribution maps for each species.

A report of the findings will be forwarded to the Heritage Council Ireland at the end of November 2003. A revised checklist of species along with distribution maps will be submitted to the Bulletin of the Irish Biogeographical Society for publication. A further paper will explore the relationship between simuliids and water quality. A voucher collection will be lodged with the Natural History Museum, Dublin.

Acknowledgements
The authors are grateful to the Heritage Council for providing funding for this project and to the following for their held: Mr. Jon Bass, Dr Roger Crosskey, Dr. Jim O'Connor, Mr. Pascal Sweeney, field assistants and colleagues at the Limnology Unit UCD.

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IN MEMORIAM

Walter Rühm (1926-2003)

It is sad to record that we have lost another outstanding European simullidologist following the death in February 2003 of Walter Rühm. Prof. Dr. Rühm published extensively on simuliid biology, especially that of mammalophilic blackflies such as *Simulium erythrocephalum* and *S. ornatum* complex that occur abundantly in the northern lowland areas of Germany. On these and other taxa his researches embraced adult physiological age, larval dispersion, oviposition, population dynamics and many other topics. At Hanover, and later Hamburg University, he had many blackfly students; to these he was an avuncular figure encouraging and guiding their development. Before taking up the study of simuliids in the 1960s his interests had been many and varied, including for example a spell concerned with forest entomology at the Universidad Austral in Valdivia, southern Chile. For a full obituary the reader is referred to: Zwick,. H. and Zwick, P_ 2003, *Entomologische Mitteilungen aus dem Zoologischen Museum Hamburg* 14 (168): 125-128.

A. Murray Fallis (1907-2003)

Professor Emeritus A. Murray Fallis passed away in his 97th year on July 8 2003 in Harriston, Ontario, Canada. As Head of the Department of Parasitology at the School of Hygiene, University of Toronto he built a flourishing research group which for almost 30 years studied the blood parasites of birds at the Wildlife Research Station, Algonquin Park, He and his research students will be remembered by simuliidologists as the team that discovered the role of simuliids (*Simulium latipes* and *S. aureum)* and ceratopogonidae in the transmission and development of Leucocytozoon and Haemoproteus parasites in their avian hosts in Canada, and other blood parasites in Tanzania and penguins in New Zealand.

A full obituary can be found in the University of Toronto, Zoonews, October 2003.

Frederick John Hartley Fredeen (1920-2003)

Hartley Fredeen died in Saskatoon, Canada, on September 23rd 2003. He began his career as a research scientist for Canada Agriculture, specializing in the study of blackflies and the means of controlling them, specifically *Simulium articum* and *S. luggeri* in Manitoba, Saskatchewan and Alberta. He was actively involved in developing traps for studying attacking behaviour of adults, and sampling methods for aquatic stages as tools to quantifying and managing blackfly populations. Because of his experience in *Simulium* control he was consulted by the World Health Organisation in the set up and expansion of the Onchocerciasis Control Programme. He was extremely active in local affairs and member of many associations including a stint as chair of the Entomological Institute of Canada.

A full obituary can be found in the Saskatchewan issue of the Canadian *Globe and Mail* newspaper of September 15, 2003.

Editor's Note: The more significant publications by all three can be found listed in R.W.Crosskey's *"The Natural History of Blackflies"*; John Wiley & Sons, 1990.

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THE BRITISH SIMULIID GROUP BULLETIN No. 22
July 2004

CONTENTS

FROM THE EDITOR

In this rather slimmer Bulletin we have announcements of our first international meeting in Berlin, which we must thank Doreen Werner for organising. At the time of going to press, there are 32 registrants, and we hope more will join before the deadline of 10 August 2004. After that date, you will still be able to attend, but the list of presentations will be closed. Full details are given on this and the following pages. Although it is expected that most members will register via the web, a registration form will be found on the last page for those who find it more convenient to register by mail.

Other items are announcements of two important books, the long awaited *The Black Flies (Simuliidae) of North America* by Peter Adler, Doug. Currie and Monty Wood., and the latest update on the *Inventory of World Blackflies,* by Roger Crosskey and Teresa Howard. Finally I have included two memorial notices for Antony Downes, and Alan Stone. Although the latter died in 1999, his passing

should have been noted earlier – *mea culpa*
John Davies, Editor

26th Annual Meeting – Berlin 15-18 September 2004
Final Notice

The International Simuliidae-Symposium (5th European Simuliidae-Symposium including the 26th Annual Meeting of the British Simuliid Group) in 2004 will be held between 15 and 18 September 2004 at the Institute of Biology, Humboldt-University of Berlin, Invalidenstrasse 43, 10115 Berlin-Mitte

Full details including a registration form can be consulted on the Symposium's Web Pages at: *http://biologie.hu-berlin.de/ESS*

The main topics of the scientific sessions are:

- phylogeny and taxonomy of black flies
- physiological research on the larval stages
- adaptation to environmental changes
- ecological background
- influence of feeding/nutrition on the larval stages
- history of black fly research

But papers or posters will be accepted on any subject relating to Simuliidae

Provisional Programme

Wednesday, 15 September
Arrival – Registration. Main entrance of the Museum für Naturkunde,
Invalidenstrasse 43, 10115 Berlin.
Welcome evening (6.00 p.m.), Insect Hall of the Museum of Natural History

Thursday, 16 September
Opening (10.00 a.m.): come to the main entrance of the Museum of Natural History and follow directions to the Insect Hall
Lectures
Cultural evening

Friday, 17 September
Lectures
Round table with Social evening

Saturday, 18 September
Excursion to Potsdam or the River Oder region

Abstract Submission

If you intend to make a presentation, please submit an abstract in English up to one page in length, by 10th August 2004 at the latest, by email:to h0662cer@rz.hu-berlin.de, or by FAX or mail to Doreen Werner at the address below.

Use the following layout:

Font:	Times New Roman font (12pt, single spaced)
Margins:	Left 3.0 cm, top, right and bottom 2.0 cm
Title:	Capital letters (all caps), bold, centred
Authors:	First name followed by last name, small capital letters (small caps), centered
Key words:	Please insert up to 8 key words

All presentations (talks and posters) will be in English.

Registration form

Please fill in and submit the registration form on the above web site by 10th August 2004 at the latest, by FAX or e-mail. Later registrations can be accepted, but without presentations.
[*For those who do not have access to the World Wide Web, a registration form for sending by post will be found on the last page of this Bulletin*]

Accommodation

I have reserved an allocation of rooms in some of the hotels near the Institute of Biology. If you prefer, you may make your own hotel reservations, preferably before 10th August 2004, using the key word "Simuliidae Symposium".
Full information together with a list of hotels is available on the website, or from me or John Davies (address below). It has not been possible for us to reserve rooms in all the local hotels because some of them have only a very limited number of rooms available. For this reason, please make your own reservation as soon as possible.
Guesthouses and hotels are very comfortable, and their individual home-pages will show the standard of accommodation and other facilities that they offer.
Please book as early as you can. Berlin-Mitte is a very expensive area, and is frequently overbooked in summer and early autumn.

Registration fee
25 Euro for participants
15 Euro for active participants (presenting a talk or a poster)
10 Euro for students
This can be paid in cash at the Registration desk on the opening day of the Symposium.

Excursions
There are two possibilities for a post-meeting tour.

1. A visit to Frederick the Great's Potsdam Palace and Sanssouci Park. The price of the tour is 35.00 Euro and includes
transport, 2 hours guided tour around the castle and the park, and brunch.

2. A visit to the Oder region, to see the ecological background of populations of *Simulium (Schoenbaueria) nigrum and Simulium (Simulium) reptans*. It is not the best time of the year to collect black flies, but this excursion will enable participants to understand the situation there.

The deadline for a place on the tour is 10th August 2004. Unfortunately, the number of places is limited and I have to book the tour!

Please pass on this announcement to anybody who might be interested in the Symposium.

I would appreciate your response as soon as possible. If you have further questions, please do not hesitate to contact me.

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BOOK NOTICES

The Black Flies (Simuliidae) of North America

by
Peter H. Adler, Douglas C. Currie, and D. Monty Wood
(Illustrated by Ralph M. Idema and Lawrence W. Zettler.
Foreword by Daniel H. Janzen)
Cornell University Press, Ithaca, NY. 941 pp., April 2004

960 pages, 255 maps, 97 halftones, 887 line drawings, 150 color illustrations in a 24-page insert, and 13 tables
Cloth ISBN 0-8014-2498-4 - Price- USD $99.95

You may get more information and view the Contents Pages and order at the Cornell University Press website http://www.cornellpress.cornell.edu
[When the page is open click on “Search our list”, and enter "Adler" in the Author box]

Resumé

This book compiles the authors' previously unpublished research and nearly all of the published information on North American black flies. All aspects of black flies are treated within the context of a worldwide perspective, including natural history and ecology, cytology and morphology, phylogeny and classification, economic impact, pest management, natural enemies, history of research, study methods, and identification. Each of the 255 species known from the continent north of Mexico, including 43 new species, is treated in detail. Each species account summarizes all pertinent information on taxonomy, morphology, cytology, physiology, molecular systematics, and bionomics. The book is copiously illustrated with more than 1,100 figures, including color drawings of larvae and adult thoraxes, by some of the world's foremost scientific illustrators. Additional figures and photographs show chromosomal and morphological features, portraits of important researchers, control efforts, natural enemies, oviposition behavior, and cladograms. Detailed distribution maps show the range of each species.

Inventory of World Blackflies

A Revised Taxonomic and Geographical Inventory of World Blackflies (Diptera: Simuliidae)
by Roger W Crosskey and Theresa M Howard.

Published by The Natural History Museum only on the internet.
13th February 2004

http://www.nhm.ac.uk/entomology/projects/blackflies/index.html

This work, currently only available as a downloadable Adobe Acrobat portable document format (pdf) file, is a revised taxonomic and faunal inventory of world blackflies that updates and supersedes the main text of an earlier such inventory published over six years ago by The Natural History Museum in London (Crosskey & Howard, 1997). That work contained information published before 1 November 1996 and was issued as a print product from the electronic database. The present inventory on the Web is essentially a completely new edition and covers information known to have been published prior to 1 November 2003. The prime purpose of the work remains the same as for the previous printed inventory, i.e. to provide a user-friendly systematic aid to a wide audience involved with almost any aspect of simuliid research, particularly in relation to biodiversity studies. A total of 1809 formally named species are listed as valid on present knowledge (1798 living and 11 fossil). For each species a geographical statement is provided to show the countries from which it has been reported, with specification of the type locality country for synonyms as well as nominal species considered valid; more refined distributional data - region, state, province, island - are given for large countries, especially those covering diverse biomes or having island constituents. Taxonomic information includes the listing of many 'cytoforms', i.e. entities that are informally named in the literature (e.g. by chromosomal inversion formulae, numbers, letters or place names) and might prove to be valid species in nature. Significant misidentifications and some persistent misspellings of names are recorded.

There is no index because it is easy to search electronic documents using the search facilities within the software. For those of you unfamiliar with pdf files, the search facility is accessed by clicking on the binocular icon ("find") on the toolbar near the top of the scrren.

The Natural History Museum, which created the simuliid inventory and has maintained it as a current work for several years, is bowing out from this project - but luckily not without a successor. It is hoped that the project will continue under the wing of Professor Peter Adler at the Department of Entomology, Clemson University, South Carolina.

(e-mail: padler@clemson.edu).

SCIENTIFIC CONTRIBUTIONS

Blackflies in Bougainville: some amplifying notes

Roger W. Crosskey, *Department of Entomology, The Natural History Museum, Cromwell Rd.,London SW7 5BD*

Bougainville is topographically the northernmost major island of the Solomon Islands chain but is linked politically to Papua New Guinea. (Like the showy shrub *Bougainvillea,* it was named after the French navigator Louis Antoine de Bougainville; the plant, though, is not Oriental but a native of sub-tropical South America, as I only learnt rather late in life.) Blackflies were first found in Bougainville in 1965, when I spent a week there whilst collecting Tachinidae in Papua New Guinea for the Natural History Museum. A pristine stream ran through the compound of the cocoa- plantation owners who kindly hosted my stay and, naturally enough, was irresistible: a scrutiny of several boulders soon yielded a fair sample of larvae and pupae. There were fairly obviously three species in the sample, one of which I was fairly sure was the *Simulium (Morops) raunsimnae* Smart & Clifford known from mainland New Guinea. However, my listing of this species from Bougainville later on in the *Catalog of the Diptera of the Australasian and Oceanian Regions* (1989, p. 225) proved to be an error: when friend 'Hiro' Takaoka (1995) studied material from Bougainville in detail he found that my specimens comprised two new species which he named after places near my collecting area, *Simulium (Morops) aropaense* and *S. (M.) kietaense,* and a few specimens of S. *(M.) noroense* Takaoka & Suzuki. Of these three it was *kietaense* sp.n. that I had taken to be *raunsimnae.*

For his study Takaoka was able to take into account aquatic-stage specimens I sent him from material that had been collected in Bougainville in 1987-89 by Catherine (Cathy) Yule for her doctoral research, based at James Cook University in Queensland. She had been in touch with me in mid-1988 seeking help if possible with identifying the simuliids she was finding in the course of her work and had sent material. The material proved to consist of specimens of two species of the subgenus *Morops,* but neither of them the same as any in my material. Both were obviously new species, and as handles we referred to them in correspondence as *Simulium (Morops)* sp. 1 and *S. (M.)* sp. 2. The two species differed obviously in pupal gill form, the *'Morops* 1' gill being a single prong-like structure without terminal filament and the *'Morops* 2' gill being a forked double-pronged structure in which each element was drawn out into a fine terminal filament. The two species have been described by Takaoka (1995), and the gills illustrated, but his publication was being prepared contemporaneously with Cathy Yule's papers derivative from her doctoral thesis; as a result, it has not till now been shown which of Takaoka's formally named species correspond to *'Morops* 1' and *'Morops 2'.* Hence a main purpose of this note is to establish the link between the semi-vernacular names used for the ecological and developmental data on simuliids in the Yule papers and the names applying in formal nomenclature: viz. *Simulium (Morops)* sp. 1 of Yule = *Simulium (Morops) pangunaense* Takaoka; *Simulium (Morops)* sp. 2 of Yule = *Simulium (Morops) yuleae* Takaoka.

Cathy Yule's publications that include information on blackflies are perhaps unknown to many *B.S.G. Bulletin* readers so to conclude I provide some notes from them and a list of the main pertinent references. The bulk of her study was concerned with the benthic invertebrate fauna of a non-seasonal mountain stream (the Konaiano Creek) and has general interest in its potential for comparison with tropical highland streams in Africa or South America, and specific interest inasmuch as it provides the first significant ecological and developmental data for blackflies in New Guinea and the Solomons. In Konaiano Creek nearly 100,000 specimens were collected over a period of 22 months and yielded a total of over 182 taxa (Yule, 1 995; Yule & Pearson, 1996). The two simuliid species together represented only about 1.1% of the fauna in taxa terms but 55% of the fauna in terms of individuals. Pupae of the simuliid species were readily separated (as indicated above) but larvae could only be separated in the final instar (by means of the pharate pupal gill). Mean head capsule lengths showed the size of the two species to be virtually identical (S. *pangunaense,* 0.474 mm and S. *yuleae,* 0.467 mm). For both species collectively, larval size frequency histograms, based on head capsule measurement, indicated seven instars. Other than data on development, Yule (1996a) includes information on the simuliids' spatial distribution, and Yule (1996b) their place in the trophic pathways within the benthic community.

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IN MEMORIAM

J.A. Downes 1914-2003

J. Antony Downes died in his sleep on 24 June 2003 at age 89. Born in 1914 in Wimbleton, England, Antony was a lecturer in entomology at the University of Glasgow from 1940 to 1953. Antony immigrated to Canada in June 1953 to join the Medical and Veterinary Entomological Unit and most of the time until retirement he was associated with the "old" Entomology Research Institute. In 1956, Antony was the general secretary of the 10th International Congress of Entomology (held in Montreal). During 1958 and 1959, he became head of the Medical and Veterinary Entomology Unit, and from 1960 to 1971, he was head of the Experimental Biology Section of the ERI. In the mid-1970s, Antony was instrumental in starting the Biological Survey of Canada (it is still flourishing today). Antony wrote over 50 scientific papers, mostly on the feeding and mating behaviour of biting midges and mosquitoes and on arctic insects. He also studied the feeding habits of some Lepidoptera. In 1976, he was elected a Fellow of the Entomological Society of Canada and in 1977 the Society awarded Antony the prestigious Gold Medal for outstanding achievement in entomology. He was an expert in Ceratopogonidae, Empididae and Lepidoptera and had a broad interest in dipteran behaviour, ecology and evolution. His contributions to the knowledge of Simuliidae were in the field of arctic biting insects and their behaviour including mating and mating flights. He retired in 1978. A few months before his death Antony finished writing a theological treatise entitled "A Genesis of Early Christian Liturgies: the Ember Times."

[Compiled from obituaries by Art Borkent in the Ceratopogonid Information Exchange Newsletter, vol. 72, December 2003, and Edward C. Becker and Colleagues in the Entomological Society of Ontario, Vol. 9, Issue 1, February 2004.]
John Davies

Alan Stone 1904-1999

Alan Stone, died on 4 March, 1999 at the age of 95. He was a life-long member of the Entomological Society of Washington, and served the Society as Editor from 1944 to 1947, and as President in 1951.

Alan was born in Brooklyn. New York, on January 23, 1904. He graduated from Cornell University in 1926 and earned his doctorate there in 1929 with a thesis on North American Tabanidae. He taught one year at Dartmouth University and then on October 21, 1931 began his forty-year long employment as a biting fly specialist with what is now the Systematic Entomology Laboratory of the U.S. Department of Agriculture at the Smithsonian Institution in Washington, DC. He served as the supervisor of the Diptera Unit from its establishment in the 1930s until his retirement on December 31. 1971.

He authored or coauthored about 100 papers, chiefly on mosquitoes, blackflies, and horseflies. His most important contribution was his work on mosquitoes, especially during World War II and the Korean War when there were exceptionally heavy demands on him for identification of specimens from all parts of the world, particularly the Pacific Islands and Southeast Asia. He identified 7,000 to 9,000 samples during each of the WW II years, much of it new to science, and instructed approximately 200 Army, Navy, and Public Health Service officers in mosquito identification. These busy years were the foundation for the innovative *Synoptic Catalog of the Mosquitoes of the World* by Stone, K. L. Knight, and H. Starcke published in 1959, the first catalog of the entire family to appear in 37 years during which time names of mosquitoes had tripled in number.

His epitaph should probably be *A Catalog of the Diptera of America North of Mexico* published in 1965. It was in fact a team effort of the Diptera Unit, but he headed the program, there was no doubt. His correspondence with collaborators for that volume was immense and the care for the punchcard system that was used was a painstaking operation. The catalog, used now by some entomologists not even born when Alan retired, was the catalyst for all the regional Diptera catalogs that have followed.

.Although he published only about 17 papers specifically on simuliids, it was in his capacity as the leading dipterist at the Smithsonian Institute that most simuliidologists will have contacted him for information and advice, drawing on his wide knowledge of the group. He was a conscientious, meticulous worker, a prompt and excellent correspondent. equally responsive to each of the separate tasks of his job: research, curation. and service. His contribution to simulidology is best summed up by the following quotation taken from the recently published *The Black Flies (Simuliidae) of North America* by Aldler et al, (2004) Chapter 2, page 18*

“One of the premiere simuliid workers in the United States was Brooklyn-born Alan Stone (1904-1999), who began employment as an entomologist with the USDA in Washington, D.C., on 21 October 1931, two years after receiving his doctorate on tabanids from Cornell University. Stone's position initially was offered to Raymond Shannon, who declined the offer, choosing instead the adventures of medical entomology in the tropics. Stone spent the next 40 years, his entire professional life working on black flies, as well as culicids, tabanids, and tephritids. He also would earn the distinction of being one of the two longest-lived North American simuliid workers to date (the other being A. M. Fallis), reaching the age of 95. In the late 1940s, he contributed three new species names, plus the generic name *Gymnopais* (Stone 1948 1949b). Although he enjoyed collecting black flies and was fascinated by their pupae, he retired earlier than he might have done otherwise, in part because of the taxonomic difficulties presented by the group. Despite his feeling that the species he described were not always legitimate 25 (almost 90%) of the 28 species names that he authored or coauthored for North American black flies refer to valid species."

This memorial note has been compiled from the much more complete obituary by Raymond J. Gagné published in the *Proceedings of the Entomological Society of Washington*, vol. 101 (4), 1999, pp. 911-913.

* Adler, P.H., Currie, D.C. and Wood, D.M. (2004) *The Black Flies (Simuliidae) of North America.* Cornell University Press, Ithaca, NY. 941 pp

John Davies

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E-mail addresses in italic, underlined

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Change of e-mail address

Professor Doug Currie *dcurrie@zoo.utoronto.ca*

Correction
In Bulletin No. 21, Alain Thomas's Department was given incorrectly. His address is:

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alain3d@cict.fr

Symposium Registration Form

Deadline 10th August, 2004 (Registration with presentation)
International Simuliidae-Symposium - 5th European Simuliidae-Symposium in 2004 including the 26th Annual Meeting of the British Simuliid Group
Berlin 15th - 18th September 2003-11-11
Fax: +49 - 30 - 2093 8491 by post or e-mail to:

Doreen Werner
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Please print in capital letters!

Name
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Country:……………………………………..

Telephone:………………………………….

Title of presentation Lecture/Poster (delete one)

THE BRITISH SIMULIID GROUP BULLETIN No. 23 January 2005

CONTENTS

FROM THE EDITOR

This 23rd Number is almost entirely devoted to reporting on the historic combined meeting of the European Simuliidae Symposium and the British Simulium Group, held in Berlin in September 2004. That this meeting ever happened is entirely due to the persistence of Doreen Werner of Humboldt University who first raised the possibility at our 24th Meeting (2002), and again at the 25th Meeting in 2003. Ten members of our group managed to attend, and it was a unique opportunity to meet many simuliidologists who had been known to us previously only by name. It was also surprising to find so much Simuliid enthusiasm and activity in the former Eastern Block countries. Thank you Doreen and the Cytogenetics group for all your efforts and for a well organised meeting.

John Davies, Editor

Angus McCrae

It is with great sadness that I have to record the untimely death from cancer of Angus W. R. McCrae on 15 August 2004. Angus was associated with our group almost from its inception in 1979, and had a lively interest in the Simuliidae and many other insects and animals, stemming from his days in East Africa from about 1966 onwards. His wide interest in all living things made him one of a dwindling breed - the true naturalist.

It is expected that a formal obituary will be published later, possibly in *Antenna*. Anyone whishing to contribute facts or anecdotes about his life may contact me, and I will pass them on to whoever prepares the obituary.

John Davies

Report on the International Simuliidae Symposium (5th European Simuliidae-Symposium, including the 26th Annual Meeting of the British Simuliid Group) held from 15 to 18 September 2004 at the Institute of Biology of the Humboldt University of Berlin, Germany

The Simuliidae working groups of Central Europe and Great Britain met together to take part in an International Simuliidae Symposium held from 15 to 18 September 2004 at the Humboldt University of Berlin, Germany. The five-day meeting was organised by the Cytogenetics working-group at the Institute of Biology, and was opened with an introductory talk by Prof. Dr. H. Saumweber on the history and future prospects of the Institute..

With 38 delegates from 16 countries (Austria, Belgium, Canada, Czech Republic, Finland, France, Germany, Great Britain, Italy, Lithuania, Norway, Serbia-Montenegro, Russia, Slovakia, Sweden, USA), this was the largest European meeting of its kind to be held. There were 35 scientific presentations in total, with the emphasis predominantly on taxonomy and systematics, history, ecology, disease transmission, medical and veterinary aspects, and control. These stimulated discussions which not only took place during the coffee and lunch breaks and the poster session but also continued into the evenings, with the interesting and lively exchange of ideas within a pleasantly relaxed social framework and after the dinner at the "Die Zwölf Apostel" restaurant and the visit to the German State Opera's performance of Tchaikovsky's ballet "Swan Lake".

Summaries of the presentations are published below. The complete manuscripts will be published in 2005 as a Supplement volume of the *Studia Dipterologica*.

Excursions to Potsdam and to the River Oder generated considerable interest and enthusiasm, which in turn reflected the traditionally informal and friendly atmosphere during the symposium.

To maintain the impetus for scientific exchange and collaboration, it is planned to continue with this type of joint Symposium. Future enquiries and requests for information should be directed to Dr J. B. Davies, (Liverpool School of Tropical Medicine, Liverpool, UK, , daviesjb@liv.ac.uk) or to Dr Doreen Werner (Berlin, Germany, HU Berlin, h0662cer@rz.hu-berlin.de).

The next joint Symposium will take place in 2006. The meeting place has yet to be decided, but offers to host the next meeting have been received from Vilnius in Lithuania and Novi Sad in Serbia and Montenegro..

Doreen Werner

Abstracts of Presentations

RELATIONSHIPS OF THE NEARCTIC AND PALAEARCTIC SIMULIID FAUNAS

[1]PETER H. ADLER, [1]DOUGLAS C. CURRIE, [2]BJÖRN MALMQVIST, [3]EUGENIE A. KACHVORYAN & [4]DOREEN WERNER

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The black fly faunas of the Nearctic and Palaearctic Regions are intimately related. About 33 species are Holarctic, occurring in both regions. By contrast, only 15 Nearctic species are shared with the Neotropical Region. In the Nearctic Region, the number of species shared with the Palaearctic Region increases with latitude: 3 species between 30º and 40º N, 9 between 40º and 50º N, 19 between 50º and 60º N, and 33 between 60º and 70º N. Westernmost Alaska, which is only 88 km from the Palaearctic Region, shares 70% of its 38 species with that region, and the percentage shared is expected to increase as synonymies continue to be recognized. Faunal similarities decrease from west to east across the Nearctic Region, indicating the significance of the Beringian connection; in addition, most Holarctic species become progressively more differentiated chromosomally from west to east in the Nearctic Region. In the cytologically and morphologically well-surveyed country of Sweden, 36% of the 61 species are shared with the Nearctic Region. Non-feeding and ornithophilic species have statistically greater proportional representation among Holarctic black flies than among either Nearctic or Palaearctic black flies. Additional Holarctic species are expected to be revealed as type specimens are reexamined and chromosomal and structural characters are studied. Faunal similarities, rather than minute differences that result in the application of different species names, should continue to be emphasized between the two regions.

Keywords: Simuliidae, Beringia, cytotaxonomy, faunal studies, Holarctic Region, Nearctic Region, Palaearctic Region, systematics

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ON THE DISTRIBUTION OF BLACKFLY LARVAE IN DIFFERENT RIVERS IN LITHUANIA

RASA BERNOTINĖ

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Our study of the blackflies in Lithuania began in the last decade of the 20th century, during which time 27 species of blackflies have been found in this country. The aim of the present work was to assess the characteristic features in the distribution and abundance of blackflies in different rivers in Lithuania.

The studies were carried out during 2001 – 2004 in 14 different rivers, at 16 study sites (in two paired study sites in the two largest rivers, the Neris and the Nemunas), from April to November. The annual water discharge varied from 0.1 to 500 m^3/s at the study sites. Larvae and pupae of blackflies were collected from aquatic plants every month. In the course of the fieldwork, data on the physical and chemical indices (water temperature, dissolved oxygen, phosphates, nitrates, nitrites, water hardness, ph, permanganatic oxidation of organic matter, current velocity) were gathered. Each sample was taken from 3 tufts of aquatic plants, torn from the stream at different depths. The composition of blackfly species and the abundance (ind./dm^2) of larvae and pupae of every species were determined for each sample.

To assess the impact of environmental factors on blackfly distribution and abundance, the correlation between the abundance of different blackfly species in rivers and the physical and chemical indices of the water was repeatedly measured using ANOVAs. The results of the study revealed that the species composition and abundance of each species of blackfly depend on the environmental factors of their habitats. However, individual species of blackflies differ in the impact of the various environmental factors on their occurrence and abundance. For example, the abundance of *Simulium maculatum* (MEIGEN) larvae depends on the river discharge ($R = 0.83$, $p = 0.03$) and the amount of organic matter ($R = 0.74$, $p = 0.014$), while the impact of other physical and chemical caracteristics was weaker or even nonsignificant.

Different species of blackflies thus differ in their reaction to the environmental factors that determine the quality of their habitats.

Keywords: Simuliidae, Lithuania, distribution, hydrochemical indices

INITIAL PRACTICAL EXPERIENCE WITH THE DIGITAL KEY TO THE LARVAE AND PUPAE OF SIMULIIDAE FROM CENTRAL AND WESTERN EUROPE

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[1]Institut für wissenschaftliche Analyse, Adolf Hruzastr. 3, A-2345 Brunn am Gebirge, Austria
[2]Technisches Büro für Biologie, Brunneng. 76/22, A-1160 Wien, Austria.

The digital key for Simuliidae has been available since April 2004 as the first part of the programme "Biological Indicators", which will be continued with keys to the Trichoptera and Culicidae.

Initial experience in the first months of use have proved the advantages of a key based on original photographic images. In a trial, even high school students without any experience with the identification of freshwater organisms were able to identify many species. Because of the Morphological Atlas and the Gallery of 2400 microscopic images, it can easily be used for teaching and can therefore replace a reference collection.

For the specialised taxonomist, a digital key cannot replace books and species descriptions, but it makes the comparison of structures between different species much easier and clearer. This key to Simuliidae enables the non-specialised freshwater biologist to identify blackflies beyond the family or genus level. In this way this medically and ecologically important group of insects can be handled more easily and samples can be identified more frequently down to species level for ecological surveys and the assessment of water quality.

The key enables the user to determine the larvae and pupae of 69 blackfly species, which covers the Simuliidae fauna of 17 European countries: Andorra, Austria, Belgium, Czech Republic, Denmark, France, Germany, Great Britain, Hungary, Ireland, Lichtenstein, Luxembourg, Netherlands, Poland, Slovakia, Slovenia, Switzerland, and it includes more than two-thirds of the North and South European Simuliidae fauna.

The digital key consists of a set of Determination Programs: the Key, the Morphological Atlas, the Gallery, the Ecology, the Query Key.

Opening the Key, the user finds a number of pages on which two images of each relevant taxonomic feature are compared and explained in a text field beneath the images.

The Morphological Atlas provides numerous images of the morphological characteristics of larvae and pupae. Overlays describe the features, with the scientific names used in the key, and in this way the less experienced user can find his way easily.

Opening the Gallery, the whole photo database is available and enables sets of pictures to be compared. In this way, either all the features of one species or one feature in a set of species can be compared. This is an easy way to teach yourself the differences between species. Each database consists of thousands of photos.

In the menu Ecology, the user can find ecological and saprobiological data for each species. In addition, their distribution and a list of synonyms and their authors is given.

By entering the available features in a form, the Query Key enables a determination to be made even if only some body parts are available (e.g. a pupa without a cocoon).

Further information can be found on the Internet. On our homepage, the registered user can enter his password and immediately obtain the latest information and updates.

Keywords: Simuliidae, blackflies, digital key, taxonomy, ecology

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ONCHOCERCIASIS TRANSMISSION BY THE BIOKO FORM OF *SIMULIUM YAHENSE* VAJIME & DUNBAR

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[5]MICHAEL D.WILSON

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This paper will report on investigations of the vectorial abilities of the endemic form of *Simulium yahense* VAJIME & DUNBAR that occurs on the island of Bioko in the Gulf of Guinea in relation to ivermectin treatments. Although ivermectin has been administered in Bioko since 1990, coverage remains low with about half the island's population treated overall. There are no data on levels of parasitism with *Onchocerca volvulus* in *Simulium yahense* prior to the treatments, although one data-set from a site at Sampaca is based on flies collected in 1993. These data on transmission rates were compared with more recent ones at Sampaca, which did not show any evidence of a decrease. Data from other sites collected during the APOC project in 1999-2001 do not show any evidence of declines in transmission rates either. Transmission rates and levels of parasitism in the flies were typical for the West African forest zone.

Keywords: Simuliidae, *Simulium yahense*, onchocerciasis, transmission, Bioko

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ESTIMATING THE BITING RISK TO HUMANS BY THE BLACK FLY SPECIES THAT ARE MOST ABUNDANT IN THE REGION OF NOVI SAD (VOJVODINA PROVINCE, SERBIA AND MONTENEGRO)

ALEKSANDRA IGNJATOVIC CUPINA, DUSAN PETRIC, MARIJA ZGOMBA, ALEKSANDRA KONJEVIC, SONJA GRABOVAC, DUSAN MARINKOVIC

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Black flies were recorded widely and abundantly in Serbia during the last century. Because of its suitable hydrological and climatic conditions, the province of Vojvodina can be considered one of the territories in the country most vulnerable to simuliid problems.

Studies of black flies have intensified in the region of Novi Sad in the last few years because these flies are a permanent nuisance for local inhabitants and are especially problematic in the areas close to the breeding sites: along the Danube river and on the slopes of the Fruska Gora mountain.

Dry-ice baited traps (type NS-2) have been successfully used for monitoring adult black fly populations at regular weekly intervals from March to September during the last four years (2001-2004). Adult captures and larval samples from the breeding sites confirmed that the three most abundant and most frequent species in the region are *Simulium ornatum* MEIGEN, 1818 (complex), *S. balcanicum* (ENDERLEIN, 1924) and *S. erythrocephalum* (DE GEER, 1776). Highly productive breeding sites have been found in the majority of streams flowing down from the Fruska Gora mountain, and in the case of *S. balcanicum* and *S. erythrocephalum* in the Danube river as well. Anthropophilic behaviour has been confirmed for all of these species.

Two methods of sampling adult black flies were employed simultaneously during the spring and summer of 2003 and 2004. Human biting catches were made during a period of five hours before sunset, while the exposure period for dry-ice baited traps was extended until the following morning. The results confirmed a significant correlation between these two methods of adult sampling. The data can be used as a valuable tool for estimating the risks to humans of being bitten by the main species present in the region.

The area identified as being most at risk of attacks by *S. ornatum* is limited to the right bank of the Danube river, formed by the slopes of the Fruska Gora mountain where there is an abundance of streams that provide excellent breeding conditions for black flies. There is no such strict delimitation in the case of *S. erythrocephalum* and *S. balcanicum*. Both banks of the Danube are affected, although localities on the right bank have a higher risk of black fly attacks.

Keywords: Simuliidae, *S. ornatum, S. erythrocephalum, S. balcanicum*, monitoring, traps, biting risks

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DIURNAL BITING PERIODICITY OF AMAZONIAN SIMULIIDAE

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[3]Department of Infectious Disease Epidemiology, Faculty of Medicine (St. Mary's Campus), Imperial College, Norfolk Place, London, UK

We describe the hourly patterns of (parous) biting activity of the three main anthropophilic simuliids in the Amazonian region of southern Venezuela, namely, *Simulium guianense* WISE s.l.; *S. incrustatum* LUTZ; and *S. oyapockense* FLOCH & ABONNENC s.l. The time series of the hourly numbers of host-seeking parous flies caught in five Yanomami villages during the dry and wet seasons and their transition periods were investigated from 1995 to 2001 using harmonic analysis (assuming an underlying circadian rhythm) and periodic correlation (based on SPEARMAN's *r*). Parous *S. guianense* s.l. showed a bimodal activity pattern, with a minor peak in mid-morning and a major (statistically significant) peak at 1600 hours. *S. incrustatum* exhibited mainly unimodal activity either during early morning or around midday, according to locality. *S. oyapockense* s.l. bit humans throughout the day, mainly between 1000 and 1600 hours, but also showed a bimodal periodicity at some localities. Superimposed on these endogenous, species-specific cycles, the daily patterns of biting activity of each species showed variations according to locality, season, air temperature and relative humidity, with biting being promoted by warmer and drier hours during wet seasons/periods and reduced during hotter times in dry seasons or transitions. The results are discussed in terms of their implications for blackfly biology and ecology (e.g. the possible timing of oviposition and the proximity of breeding places to human settlements) as well as for the epidemiology and control of blackfly-transmitted infections.

Keywords: Simuliidae, *Simulium guianense* s.l., *S. incrustatum*, *S. oyapockense* s.l., harmonic analysis, circadian rhythms, host-seeking activity, Amazonas, Venezuela

CHANGES IN BLACKFLY COMMUNITIES CAUSED BY ANTHROPOGENIC INFLUENCE

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Our long-term research into the blackfly fauna of Slovakia has shown that anthropogenic pressure has a profound influence on blackfly communities. The most significant influences are engineering interventions to assist with the management of running waters and changes in the landscape structure on the banks.

The construction of the Gabčíkovo barrage on the River Danube in 1992 enabled us to study how blackflies may be influenced by such a dam. Data on the preimaginal stages of blackflies from this area were almost non-existent before 1991. During 1991-1992, the area of the Gabčíkovo project was studied, and 19 species were found. The most abundant were *S. balcanicum* (ENDERLEIN) and *S. reptans* (LINNAEUS), followed by *S. colombaschense* (FABRICIUS) and *S. lineatum* (MEIGEN). In the period immediately after the damming (1993-1997), several species disappeared (e.g. *Prosimulium* spp., *S. degrangei* DORIER & GRENIER, *S. morsitans* EDWARDS) and the abundance of the remaining species changed (*S. noelleri* FRIEDERICHS and *S. erythrocephalum* DE GEER became very abundant). Subsequently (2001-2004), several species that had disappeared were discovered again (*P. rufipes* (MEIGEN), *S. vernum* MACQUART), *S. erythrocephalum* became less abundant, and *S. balcanicum* and *S. noelleri* were again abundant. After 1992, new communities were formed in the upper parts of the adjacent tributaries, which are characterised by the great abundance of *S. balcanicum, S. noelleri* and *S. erythrocephalum,* but in the lower parts blackflies disappeared because there was no longer any running water.

In the Gidra stream, the influence of various factors on the blackfly communities was studied. This stream is subject to increasing levels of anthropogenic pressure along its course, such as channel modifications, bank vegetation without trees, and pollution. Where the stream channel has been strongly regulated, *S. brevidens* (RUBTSOV), *S. costatum* FRIEDERICHS and *S. cryophilum* (RUBTSOV) have disappeared. The relative abundance of the species also changed: an increase in the abundance of the *S. ornatum* MEIGEN complex, and a decrease of the *S. variegatum* MEIGEN group. We have also studied localities where anthropogenic pressure seems very low. We compared two adjacent mountain streams in the Eastern Carpathian forests, one flowing through primeval forest and the second through managed forests with open areas; more species were found in the second stream, including *S. ornatum, S. vernum,* and *S. auricoma* MEIGEN. Another anthropogenic influence is the construction of small water barrages. The stream sections above the barrages were usually inhabited by *P. tomosvaryi* (ENDERLEIN), *S. brevidens*, *S. cryophilum, S. ornatum*, and *S. vernum*, whereas the sections below the barrages were always inhabited by *S. noelleri* and also by *S. ornatum*. A special type of habitat, the small drainage channel, has been created in agricultural areas. Its features, such as the absence of natural bank vegetation, the simple morphology of the channels and the great concentration of agri-chemicals, have given rise to a specific blackfly community poor in species but with *S. ornatum* very abundant.

Keywords: Simuliidae, anthropogenic influence, blackfly communities, River Danube, Carpathians, water barrages

ON THE MORPHOLOGY OF SEVERAL BLACKFLY SPECIES OF THE *AMAZONICUM*-SPECIES GROUP, SUBGENUS *PSARONIOCOMPSA*, IN LATIN AMERICA

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Species of the *amazonicum*-species group of the subgenus *Psaroniocompsa* (Diptera: Simuliidae) are implicated in the transmission of mansonelliasis and onchocerciasis in the Neotropical region. In both cases, the simuliid vector species involved has been identified as *S. amazonicum* GOELDI, 1905. The redescription of *S. amazonicum* by several authorities (e.g. LUTZ, 1917) has resulted in many misidentifications of morphologically similar species, because of variation in the female and male scutal patterns and a lack of associated, reared material. In this paper, we discuss some morphological characters of the adults and pupae of some species in the *amazonicum* group (*S. amazonicum*, *S. ganalesense* VARGAS, MARTÍNEZ PALACIOS & DÍAZ NÁJERA, *S. minusculum* LUTZ, *S. oyapockense* FLOCH & ABONNENC s.l., *S. roraimense* NUNES DE MELLO and *S. sanguineum* KNAB). The taxonomic characters commonly used for species identification in Neotropical Simuliidae (e.g the structure of the female and male genitalia, cibarium, leg colour) are very similar in all these species. The most reliable taxonomic character is the thoracic pattern of the scutum, and in the pupa the number and configuration of the gill filaments. The females all have a black thorax with a pattern consisting of 1+1 sub-median silver pruinose vittae nearly extending to the posterior margin and 1+1 black cunae anteriorly (light source anterior). The males can be recognised by the black thorax with 1+1 sub-median, silver pruinose vittae ending in tails that may or may not extend to the posterior margin. The number of gill filaments varies from 6 to 8, all branching at different heights. However, variations in the thoracic pattern and the pupal gill configuration throughout the species distribution range make their identification a very difficult exercise. An integrated approach to assess their taxonomic status using molecular and/or cytogenetic techniques linked to morphological variation is discussed.
Keywords: Simuliidae, subgenus *Psaroniocompsa*, Neotropical region, taxonomy

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BLACK FLY STUDIES IN FINLAND: PAST, PRESENT AND FUTURE

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Black flies (Diptera: Simuliidae) are a relatively poorly studied insect family in Finland. Fries described *Simulium (Schoenbaueria) pusillum* in 1824, and LUNDSTRÖM described eight new species in 1911 from Finnish material. LUNDSTRÖM also made a very significant contribution to simuliidology by introducing the use of male genitalia in species identification. The most recent species described from Finnish material is *Metacnephia trigoniformis* YANKOVSKY, 2002. Only a few records of the Finnish black fly fauna were made in the five decades after LUNDSTRÖM. Ecological studies on black flies have been even fewer than faunistic studies in Finland. KUUSELA compiled the first checklist of the Finnish black fly fauna in 1971, giving a total of 31 species. The checklists by JENSEN (1997) and by CROSSKEY & HOWARD (1997) listed 33 and 37 recorded black fly species in Finland, respectively. Several new species have been recorded in Finland in the past three decades, especially in the most recent few years. The author of this paper has undertaken studies of the distribution and habitat use of immature black flies in North Finland, the mating behaviour of adult black flies, and the black fly fauna of spring brooks in southern Finland. Since none of the recent new records have been included in the latest Inventory of World Blackflies, there is clearly a need for a revised checklist of the black flies of Finland. Combining all the recent or unpublished records with the records listed in the Inventory of World Blackflies, more than 50 species are obtained. The black fly fauna consists of more than 60 species in Sweden and more than 50 species in Norway. As almost no cytological studies have been carried out in Finland, contrary to the situation in Scandinavia, probably fewer than 10 new morphospecies can be expected in Finland. However, both morphological and cytological studies dealing with species-specific problems as well as studies on the ecology of all life stages of black flies in Finland are needed in the future.

Key words: black flies, Simuliidae, Finland, faunistics, distribution, behaviour

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DISTRIBUTION PATTERNS OF THREE HIGH ALTITUDE SPECIES OF EUROPEAN BLACKFLIES

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Prosimulium latimucro (ENDERLEIN, 1925), *Twinnia hydroides* (NOVÁK, 1956), and *Simulium* (*Nevermannia*) *oligotuberculatum* (KNOZ, 1965) are distributed in the main European mountain ranges and can be considered true high-mountain blackfly species. *T. hydroides* is found in the montane, subalpine and alpine zones of both the Alpine-Carpathian and the Hercynian systems. *P. latimucro* has a wider range, being distributed in the mountain systems of southern and central Europe and in the British Isles. *S. oligotuberculatum* is a rare high-mountain species currently known from the West Carpathians, Jeseníky Mountains, Alps and Pyrenees. The vertical distribution of all three species is statistically significantly dependent on altitude. The regular occurrence of *T. hydroides* has been reported at altitudes from 900 m up to 1600 m a.s.l. with a relative frequency (F) of occurrence from 0.14 at altitudes of 900-1000 m a.s.l. to 0.8 at altitudes of 1400-1500 m a.s.l. In the West Carpathians, the occurrence of *P. latimucro* below 900 m a.s.l. is exceptional (F<0.01), and in the zone between 900 and 1300 m a.s.l. it is probable (F=0.06) but not frequent, whereas at altitudes of 1300-2000 m a.s.l. its occurrence is very constant (F=0.7). Throughout its entire distribution area it was found at altitudinal ranges from 400 to 2600 m a.s.l., with its centre over 1000 m a.s.l. Its occurrence at lower altitudes was recorded mainly in streams flowing down from the high mountains (Alps, Pirin) and at the northern limit of its distribution (UK). All the known breeding sites of *S. oligotuberculatum* were located at altitudes between 1200 and 2700 m a.s.l. at or above the timberline, in the subalpine and alpine zone.

All three species breed in the crenal and/or the rhithral. According to the thermal conditions of the breeding sites and the water temperatures recorded during the pupal stage, all three species are caltostenothermic. In the West Carpathians, the annual main water temperature in the breeding zone is below 4°C and the temperature during pupation is usually under 10°C. The species were recorded in a zone with a mean annual air temperature below 4°C, and a main air temperature in summer (July) up to 12°C; a mean daily temperature below 0°C lasts for 140 or more days, and a frost-free period lasts for 80-120 days; running waters begin to freeze at the end of November and remain frozen until the beginning of April.

The distribution of all three species is disjunctive oreal/oreoalpine and relict. It may be postulated that the distribution was wider and more contiguous, and that the species were also distributed at lower altitudes with a less differentiated georelief, during the LGM (Vislan/Würm) or early postglacial period (occurring both in springs and in fast currents, and tolerating much harsher climatic conditions). This wider distribution probably continued up to the end of the Younger Dryas and ended not later than the Preboreal (some 8 ky BP), when the present distribution area was formed and the immigration of *P. latimucro* into the British Isles may have taken place. A later immigration is less probable due to the rupture of the land bridge with continental Europe and climate changes during the Boreal and Atlantic periods. The absence of these species from Scandinavia may be because large

parts of Scandinavia were still covered by glaciers during this period. Based on this, it can be suggested that all three species belong to the dinodal biome type.

Keywords: Simuliidae, *Twinnia hydroides*, *Prosimulium latimucro, Simulium* (*Nevermannia*) *oligotuberculatum*, distribution

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THE ANTHROPOPHILIC MEMBERS OF THE *SIMULIUM DAMNOSUM* THEOBALD COMPLEX IN ETHIOPIA, MALAWI AND TANZANIA

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The southernmost foci of onchocerciasis in Africa are found in southern Tanzania and Malawi, and consist of rather isolated and relatively small areas. By contrast, towards northeastern Africa, in western Ethiopia, huge areas are affected by onchocerciasis and resemble the West African situation. Both for the northern and southern foci of eastern Africa, little was previously known about the local *S. damnosum* THEOBALD s.l. cytoform composition and the exact vector identity.

Using recent technical advances in cytotaxonomy and DNA typing, we are now able to detect 10 cytoforms and cytospecies of *S. damnosum* s.l. in and around the southern foci and two (three) additional ones in Ethiopia. A size comparison of the rDNA ITS-1 polymerase chain reaction amplicons derived from cytologically identified larvae with those from adult female flies caught on human bait have revealed that there is only one species/cytoform each in the northern and the southern foci responsible for human-biting, and hence most likely also for transmission.

In Malawi and southern Tanzania, *S. thyolense* VAJIME, TAMBALA, KRUEGER & POST could be identified as the most abundant species within all foci, while outside the foci other species were dominant. Furthermore, all biting female flies from the different areas were identified as *S. thyolense,* which suggests that this species is the only significant vector. Specimens identical chromosomally to *S. kilibanum* GOUTEUX, which is a proven vector in western Uganda and adjacent areas, were also found breeding at some localities, but there was no evidence here for anthropophily. Vice versa, in parts of central Tanzania the vector seems to be the cytoform 'Nkusi', which is otherwise regarded as non-anthropophilic (e.g. in Uganda). Morphological and molecular differences between the Ugandan and Malawian/Tanzanian populations of *S. kilibanum* and 'Nkusi' respectively raise the question of whether identical chromosomal traits have evolved independently or have been conserved for a much longer time than usual.

In central-western Ethiopia, the anthropophilic form of the *S. damnosum* complex is thought to be identical with cytoform 'Jimma', whereas the cytoforms 'Kulfo' and 'Kisiwani E' are probably zoophilic. However, DNA analyses suggest a very close relationship of the 'Jimma' and 'Kulfo' forms and their phylogenetic proximity to the 'Kibwezi' group, although 'Kulfo' was originally assigned to the 'squamosum' subcomplex of the *S. damnosum* complex. 'Jimma' form clearly differs chromosomally from the two northernmost vector species of the complex, cytoform 'Hamedense' from Sudan and *S. rasyani* GARMS, KERNER & MEREDITH from Yemen, but we cannot rule out the occurrence of additional anthropophilic cytoforms in the central-northern parts of Ethiopia, which might be related to these two members of the 'damnosum' subcomplex.

Keywords: Diptera, Simuliidae, *S. damnosum* complex, onchocerciasis, Ethiopia, Malawi, Tanzania

THE IDENTITY, TAXONOMY AND BIONOMICS OF *SIMULIUM MAXIMUM* (KNOZ)

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Simulium maximum (KNOZ, 1961) was described from the Jeseníky Mountains in the Czech Republic (as *Odagmia maxima*). In addition to the Czech Republic, it is known from Spain, France, Switzerland, Germany, Italy, Austria, Slovakia, Poland, Romania, Serbia, Bosnia and Bulgaria; it is found only in mountain streams. In Slovakia, *S. maximum* has been recorded at altitudes between 485 and 1520 m a.s.l., with the localities concentrated in 12 geomorphological units in the highest part of the Western Carpathian Mountains. The closely related *S. monticola* FRIEDERICHS is known from the same countries but also from other areas of Europe (Scandinavia, Russia); in Slovakia it has been recorded at altitudes between 130 and 1650 m a.s.l., with the localities in 33 geomorphological units of differing characters. The emergence of adults of *S. maximum* occurs in late spring, and the existence of a second generation is uncertain.

According to the description, *S. maximum* does not differ from *S. monticola* in most of its morphological characters However, both species are said to differ in body length in all stages (*S. maximum* is said to be considerably larger); the larvae are said to have different colour patterns, and *S. maximum* is said to have more rays in the large labral fan and more branches in the rectal papillae. In the pupa of *S. maximum*, the lower pair of the gill filaments is said to be branched on a common stalk, whereas in *S. monticola* it is said to arise directly from the basal stem. Males of the two species are said to differ in a few details of the genitalia, mainly in the shape of the dorsal plate. Females are said to differ in the shape of the ovipositor. These differences are rather weak, and in view of the variability of many blackfly characters, the validity of the two species is doubtful. We have studied the gill filaments in 135 *S. monticola*/*S.maximum* pupae. The results showed that these individuals could not be divided into two groups and that there is no strict division between a long stalk and a very short or absent stalk. However, these individuals could easily be divided into two groups (*S. monticola* 1 and *S. monticola* 2) according to the distribution of their thoracic tubercles. Further comparison of *S. monticola* 1 and 2 showed that they differ significantly in 53 of the 72 measured characters of the gills and that they were clearly separated from each other in the ISSR DNA analysis. The structure of the male and female terminalia of *S. monticola* 1 and 2 is very similar and does not correspond exactly to *S. monticola* or *S. maximum* sensu Knoz, but the shape of the median sclerite in *S. monticola* 2 was very similar to *S. maximum*. The occurrence of both forms was studied in the mountain stream Varínka (Malá Fatra Mountains, Western Carpathians). The pupation time and the pupation sites overlapped, but *S. monticola* 1 and *S. monticola* 2 were abundant in the upper part of the stream, whereas in the lower part only *S. monticola* 1 occurred. The maximum abundance of *S. monticola* 1 pupae was recorded in late April and early May, whereas the maximum abundance of *S. monticola* 2 pupae was recorded in late May and early June. In August and September, *S. monticola* 1 pupae were abundant again and only two pupae of *S. monticola* 2 were found. It seems probable that two (at least) closely related species really do inhabit the mountain regions of South-west, Central and Eastern Europe. A detailed comparison of *S. monticola* 2 with the type material of *S. maximum* is needed in order to determine whether these two are identical.

Keywords: Simuliidae, *Simulium monticola*, *Simulium maximum*, taxonomy, bionomics, distribution, morphology, variability

ISSR IN TAXONOMY AT THE SPECIES LEVEL

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There has been a continuing need to search for further practical methods for species separation among blackflies, mainly because of persistent problems in the taxonomy at the species level. In addition to traditional morphological methods, cytotaxonomic methods have become increasingly important, and they are very effective in revealing sibling species. Most recently, molecular methods based on the study of nucleic acids or proteins have been tested. DNA analysis has been successfully used to discover the basal divergences within blackflies. ISSR (Inter Simple Sequence Repeats) are widely used in plants but less commonly in vertebrates, and only a few reports have been published on invertebrates. The preliminary results obtained in certain insect groups (Diptera: Culicidae and Tachinidae, Lepidoptera, Hemiptera, Hymenoptera) indicate that different species (including closely related species) show different DNA profiles. The intraspecific variability of the specific insect DNA profiles has never been widely studied but differences between individuals and populations have been found. We have studied 47 individuals of nine blackfly species. Five different primers have been tried: $(GACA)_4$, $(ACAG)_4$, $(ACTG)_4$, $(GATA)_4$, $(CAA)_5$; and the following material from the area of the Western Carpathian Mountains was analysed: *Prosimulium rufipes* (MEIGEN, 1830) – 14 individuals, *Simulium costatum* FRIEDERICHS, 1920 – 1, *Simulium lundstromi* (ENDERLEIN, 1921) – 1, *Simulium ornatum* MEIGEN, 1818 – 1, *Simulium variegatum* MEIGEN, 1818 – 3, *Simulium monticola* FRIEDERICHS, 1920 – 22 (*S. monticola* 1 – 6 and *S. monticola* 2 – 16), *Simulium argyreatum* MEIGEN, 1818 – 3, *Simulium equinum* (LINNAEUS, 1758) – 1, and *Simulium balcanicum* (ENDERLEIN, 1924) – 1. The primer $(CAA)_5$ did not produce clear patterns and was not analysed further. At first, single individuals from the analysed species were compared. Considerable differences were found among the species, and no identical or similar profiles were found. The analyses were then focused on the variability in *P. rufipes* and the *S. variegatum* species group, and considerable individual variability was found. By comparing individuals using the UPGMA method of clustering, similarity trees were constructed. The species of the *S. variegatum* group and also the two morphological forms of *S. monticola* were clearly separated from each other. Two different subgroups were identified within *S. monticola* 2: the first subgroup was represented by the individuals from the Malá Fatra Mountains and the second from the Tatra Mountains, the localities being approximately 100 km distant from each other. Because the existence of sibling species in blackflies is always a probability, further research is needed to determine the sensitivity of this method for differentiating between related species, populations, and intraspecific variability.

Keywords: molecular taxonomy, DNA, ISSR, Simuliidae

BLACKFLIES IN NORTHERN SWEDEN: USING RIVER REGULATION AS A LARGE-SCALE EXPERIMENT TO STUDY THEIR IMPORTANCE

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River regulation alters the flow of rivers. In northern Scandinavia, many rivers have been transformed into series of elongated lakes, providing a minimum of habitat for current-loving invertebrates, such as larval blackflies. Running in parallel, however, there are free-flowing rivers protected from hydropower exploitation. These support huge populations of simuliid larvae. Taking a comparative approach, we have studied the importance of blackflies in this boreal landscape. Trapping flying adults, using a vehicle-mounted net, showed patterns of diel and seasonal

activity and species composition, and provided information on many other aspects of blackflies in this landscape. Large-river species were more numerous than typical stream species, with *Metacnephia lyra* (LUNDSTRÖM) and *Simulium reptans* (LINNAEUS) being the most abundant species. Males of *M. lyra* remained in large numbers near their native rivers, whereas the females dispersed. Blood analyses showed that engorged blackfly females were either mammalophilic or ornithophilic, and that large hosts were preferred. Mammalophilic species were more specialised than ornithophilic ones. Carbon-dioxide baited traps (CDC) captured relatively more small-stream species than car trapping, suggesting a different behaviour among these species. Biting problems in humans were greater along free-flowing rather than along regulated rivers, as reflected in a higher frequency of hospital visits. *Leucocytozoon*, a blood parasite in birds, occurred at a somewhat higher frequency along the free-flowing rivers, but it is not clear at present whether this parasite can affect bird populations. Insectivorous birds might be favoured by the mass occurrence of blackflies, as was suggested by pied flycatcher nestling survival. Our investigations show that blackflies make up a considerable part of the flying insects in the boreal forests of northern Sweden and indicate that they play important roles in terrestrial ecosystems.

Keywords: blackfly hosts, dispersal, phenology, Scandinavia, Simuliidae

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SIMULIUM (EUSIMULIUM) PETRICOLUM RIVOSECCHI IN NORTH-WEST EUROPE

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Simulium petricolum (RIVOSECCHI) is a common member of the *S. aureum* group around the Mediterranean, and is known from Portugal, Spain, France, Italy, Czech Republic, Serbia, Bosnia, Greece, Cyprus, Libya, Morocco, and Madeira. However, there are unauthenticated records from Russia and Ireland, bringing into question the assumed circum-Mediterranean distribution. We report the discovery of this species pupating and emerging from a seasonal muddy ditch in winter-early spring in the south of England.

Keywords: Simuliidae, *Simulium petricolum*, UK, distribution

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ON THE HISTORY OF NORTH EUROPEAN BLACKFLIES (SIMULIIDAE)

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European blackfly nomenclature dates back to the Swedish biologist Carl LINNÉ (1746, 1758, 1767). Though all the Linnaean types appear to be lost, some of his names in Simuliidae are still standing. Shortly after LINNÉ, numerous blackfly species were described by the well known European entomologists of the time, FABRICIUS (1775, 1781, 1787, 1805), MEIGEN (1800, 1803, 1804, 1806, 1818, 1830, 1838), LATREILLE (1802, 1805) and MACQUART (1826). There were also further important contributions from Sweden, e.g. by DE GEER (1776), ZETTERSTEDT (1822, 1833, 1838, 1840, 1850, 1855, 1860), FRIES (1824, 1829), and WAHLBERG (1844). The first and only Norwegian contribution at this time was the brief mention of blackfly records by SIEBKE (1877).

WAHLGREN (1905, 1922) seems to have been the first to make a ‘complete’ list and key to Scandinavian blackfly species. Further important contributions involving Scandinavian species are found in the papers published by LUNDSTRÖM (1910, 1911, 1913). At the same time, EDWARDS (e.g. 1915, 1921, 1924, 1927) and ENDERLEIN (1921, etc.) published many well-known papers, which, together with two papers by PURI (1925, 1926), were of great importance for the understanding of the Scandinavian fauna. Several papers on Danish blackflies were published by PETERSEN (1924) and USSING (1925).

Russian contributions were also appearing at this time, e.g. by DOROGOSTAISKI et al. (1935). RUBTSOV (1940, 1956, 1959-64, 1971) was soon dominating the arena of blackfly taxonomy in Europe, and was gradually succeeded by CROSSKEY (e.g. 1988, 2004). Major changes in blackfly nomenclature have been made by ZWICK (1995), CROSSKEY & DAVIES (1972), and ZWICK & CROSSKEY (1981).

Returning to Scandinavia, we now had important contributions by USOVA (1961), CARLSSON (1962), and RUBTSOV & CARLSSON (1965). Some papers on local faunas have appeared (KUUSELA 1971, RAASTAD 1979, 1981, JENSEN 1984, 1997). The most recent publication is a comprehensive investigation of the Swedish fauna (ADLER et al. 1999).

According to present knowledge, we have some 70 valid blackfly species in Scandinavia. It seems that we must expect the discovery of further new synonyms and name changes in the North European species, resulting from earlier misunderstandings and the incorrect usage of names. Some of these problems will be discussed in this oral presentation.

Keywords: Simuliidae, history, nomenclature, synonymy

THE FEASIBILITY OF ONCHOCERCIASIS ERADICATION? RESULTS FROM A 17-YEAR FOLLOW-UP OF *SIMULIUM* BITING RATES AND *ONCHOCERCA VOLVULUS* TRANSMISSION POTENTIALS IN A MECTIZAN-MASS-TREATED AREA IN NORTH CAMEROON INDICATE THE NEED FOR NEW MACROFILARICIDES

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Follow-up studies of the human-biting rates of *Simulium damnosum* THEOBALD s.l. and the transmission dynamics of *Onchocerca volvulus* before and 17 years after the start of ivermectin mass treatments in the Vina river valley in North Cameroon indicate that transmission still continues at a level sufficient for the survival of the parasite. Annual Transmission Potentials still exceed the tolerable level of 100 infective larvae per human and year, but as long as the individual human microfilarial load is kept low by regular annual retreatments, the risk of developing onchocerciasis eye-lesions is probably low.

In addition to the reduced transmission of *O. volvulus* L3, the proportional increase of bovine *O. ochengi* L3 stimulates cross-reacting immunization of the human population and thereby assists with maintaining onchocerciasis at a tolerably low level. Such zooprophylaxis, as a synergic result of ivermectin mass-chemotherapy, could be combined with other, rather simple means to further minimize the transmission of human onchocerciasis.

However, since the parasite cannot be eradicated, the development of ivermectin-resistance in humans, as has already happened with other nematodes in cattle and sheep, is an increasing threat as long as mectizan remains the only drug available. As an aid to the development of new drugs or vaccines against human onchocerciasis, the bovine filaria *Onchocerca ochengi* has proved to be an excellent model for chemotherapy and immunological studies.

Epidemiological and experimental data also strongly indicate that there is a density-dependent regulation of the *Onchocerca* adult worm load and microfilarial density in the skin, both in humans and in cattle. The possibility of vaccination was successfully demonstrated in calves immunized with a heterologous vaccine, namely live L3 of *O. volvulus*.

Keywords: Simuliidae, Cameroon, *Simulium damnosum*, onchocerciasis, infectivity, control

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THE VARIATION OF PUPAL GILLS IN *PROSIMULIUM RUFIPES* (MEIGEN)

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Many details of pupal gills, such as their form, number, branching etc, are used for the identification of black flies. Previous studies made on the *Simulium ornatum* Meigen, 1818 species group have shown that certain characters of the gills exhibit considerable intraspecific variation.
The respiratory organs of *Prosimulium rufipes* (MEIGEN, 1830) were studied from 9 sites in Slovakia. In total, 91 metric characters of the pupae were measured on each pupal gill in 90 individuals mounted on microscope slides: the length of all filaments and trunks, width of all trunks and filaments on their proximal and distal ends, and the body length of each pupa. The variation in the measured characters was analysed by ANOVA. The termination of each filament (broken, not broken) was noted, in order to compute the actual surface area for each individual, because the filaments of pupae developing under natural conditions are often broken.

P. rufipes generally has 16 filaments on each side of the thorax, growing from three trunks: dorsal trunk (3+2+3), medial trunk (2+2) and ventral trunk (2+2). The most frequent variation in the branching was reported on the dorsal trunk, and some variability was also recorded in the branching of the ventral trunk and of the medial trunk. We also recorded individuals with 14, 15, and 17 respiratory filaments.

In the population of *P. rufipes* from Račková Dolina Valley, we found that no specimens were laterally symmetrical in their gill measurements. Significant differences were found between the right and left side of the body in the case of the fifth metric and one meristic characters. *Prosimulium rufipes* showed a high level of individual variation in the characters analyzed. The lowest variability was found in the body length of pupae (coefficient of variation 9.31%) and in the potential respiratory surface area (coefficient of variation 14.66%). The highest variation was recorded in the length of the sixth base (coefficient of variation 80.10%) and also in the surface area of this base (coefficient of variation 64.40%).

Keywords: Simuliidae, *Prosimulium rufipes*, variation, pupal gills, respiratory surface area

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BLACKFLIES AND THEIR NATURAL PREDATORS: NEW RESULTS ON DIPTERA

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Blackflies have a wide range of natural enemies, and in many instances the insects are the most important invertebrate predators. At least 9 orders are known to feed on blackflies. Caddisflies (Trichoptera), bugs (Heteroptera), and flies (Diptera), which are obligate predators as adults or as larvae or as both, are the most numerous and most effective natural enamies. Our research and fieldwork have shown that at least 12 families of Diptera that actively prey on blackflies. Other families, such as the Sciomyzidae and certain Anthomyiidae, have been seen feeding on the bodies of dead blackflies.

Some of the associations are undoubtedly fortuitous or opportunistic. For example, larvae of the Chaoboridae have been recorded on a few occasions as taking adult and larval blackflies as food, but chaoborid larvae live in standing water and so can only pick larvae that have drifted into an area of standing water or adults that have fallen on to the water surface. Adult Asilidae have been recorded on a number of occasions as taking adult blackflies as prey, but in a recently published database of prey records, blackflies form only 0.18% of the total number of records listed.

In the course of our recent fieldwork, we have been able to record new predators of the aquatic stages of blackflies in the families Chaoboridae, Chironomidae, Phoridae, Ephydridae, and Scathophagidae. In Germany, Armenia, USA, and the UK, we have focused on the predators of adult blackflies and have new information on Empididae, Hybotidae, Dolichopodidae, Scathophagidae, Anthomyiidae, and Muscidae. We have been able to record on camera many of our observations on hunting strategies, details of life cycles, and courtship and mating rituals in the muscid genera *Limnophora* and *Lispe*.

Contrary to what is generally written and accepted about predation, not all predators are promiscuous in their choice of prey. It is clear that there are some very specific associations between certain Diptera predators and blackflies, as larvae feeding on larvae and as adults feeding on larvae and/or adults. So far as larvae are concerned, this is evident in the association between certain Hemerodromiinae (Empididae) and blackfly larvae, and between *Limnophora* (Muscidae) and *Simulium noelleri* FRIEDERICHS. But our observations have also shown that there are behavioural strategies in several adult Empididae and Muscidae that are specifically adapted for preying on adult blackflies.

Within the broad context of the management of blackfly populations, Diptera predators undoubtedly have a role to play. Our work has shown that this is not an insignificant role, and our continuing investigations of both larval and adult predators are confirming this and are revealing additional associations.

Keywords: Diptera, Simuliidae, predation, prey

BLACKFLY LARVAE AND AGGREGATION

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There are three types of aggregation affecting blackfly larvae and the flowing water in which they live:

(i) Formation of dense aggregations by some species
Blackfly larvae attach to substrata and may be spaced, arranged into lines, or form aggregations. The type of dispersion depends on species, current velocity, and the characteristics of water flow. One species, *Simulium noelleri* FRIEDERICHS, often forms dense aggregations at lake outlets and there is evidence that individuals from the most dense parts of aggregations grow more rapidly and produce larger individuals than those from less dense aggregations. What is the explanation?

(ii) Feeding by larvae on aggregations of organic matter and (speculatively) the role of the feeding fans in promoting the formation of aggregates
Blackfly larvae are capable of intercepting and ingesting colloids and other dissolved organic matter. The majority of the particles in their guts (usually > 95%) are < 10 μm in diameter, so the gut contents contain a huge surface area for digestion and for lysis. But how many particles (including those in the dissolved category) are intercepted individually and how many are in the form of naturally-occurring flocs and aggregates? Does the blackfly labral fan play a role in aggregation processes?

(iii) The importance of blackfly larval faeces in the transformation of organic matter

Blackfly larvae are "ecosystem engineers", converting dissolved matter, particles, and flocs into compacted aggregates - faecal pellets. As larvae digest little of the material that they ingest, and as they feed almost continuously, they produce very large numbers (probably hundreds) of faecal pellets per larva each day. When larvae are abundant they transform significant quantities of organic matter into much larger, dense faecal pellets that sink rapidly in calm water. Potential nutrients are therefore transported from the water column to the substratum and we know this to be an important process in both small streams and large rivers. In addition to feeding themselves, blackfly larvae thus help to retain nutrients that are otherwise carried downstream and, eventually, to the sea.

Keywords: Simuliidae, larvae, aggregations, flocs, aggregates, faecal pellets

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THE DISCOVERY OF A FOSSIL BLACKFLY FEMALE (DIPTERA: SIMULIIDAE) IN BALTIC AMBER

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A blackfly female was found in a piece of Baltic amber from the sea coast of Lithuania (35-40 million years b.p., Eocene-Oligocene). According to the modern classification of the family Simuliidae, it belongs to the genus *Ectemnia* ENDERLEIN, 1930. The generic characters are the deep and bulbous katepisternum, the shallow mesepisternal sulcus, vein Rs not forked, costal vein with hairs and spinules, hind legs without calcipala and pedisulcus, claws with a large basal tooth, body length almost 5.5 mm (rare in Simuliidae). This specimen is being described as a new species in the genus *Ectemnia* (YANKOVSKY & BERNOTIENĖ 2004, in litt.). This is only the sixth known species of blackfly in Baltic amber. It differs from all the other known Baltic amber species by the following characters: from *Hellichiella oligocenica* (RUBTSOV, 1936) and *Greniera importuna* (MEUNIER, 1904) – by the 11-segmented antenna (unlike the 10-segmented antenna in these species); from *Greniera pulchella* (MEUNIER, 1904) and *G. affinis* (MEUNIER, 1904) – by the large body length (5.5 mm, unlike the 1.5-2.5 mm in these species); from the related fossil species *Ectemnia cerberus* (ENDERLEIN, 1921) (redescription in CROSSKEY, 1994), *Ectemnia* new species differs by the peculiar length of the wings (twice as long as the body length), whilst in *E. cerberus* the wings are shorter than the body length, and by the peculiar small size of the head (compared to the body size). All the blackfly species found in Baltic amber belong to the archaic subfamily Prosimuliinae (or, according to another classification, at least to the archaic genera of the family Simuliidae – *Greniera* and *Ectemnia*) (CROSSKEY, 2002). The exception is *Hellichiella oligocenica* (RUBTSOV, 1936), but the characters of this genus place it in an intermediate position between the subfamilies Prosimuliinae and Simuliinae. The findings of blackflies in Eocene/Oligocene Baltic amber are very rare and are restricted to one small geographic region, but we can suggest that at that time and in that area the Prosimuliinae formed the main part of the Simuliidae fauna.

Keywords: Simuliidae, black flies, taxonomy, fossils, Baltic amber

Abstracts of Posters

REPEATED MATING IN *SIMULIUM (WILHELMIA) LINEATUM* (MEIGEN) (DIPTERA: SIMULIIDAE)

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Male mating success and the number of offspring strongly depend on the number of copulations as well as on the effectiveness of sperm transfer. Males of blackflies can copulate more than once. However, the effectiveness of multiple matings has not been investigated in polygamous simuliid males. The aim of the present research was to compare the male behaviour in the first and the second matings and also the spermatophore transfer parameters in the stenogamous species *Simulium* (*Wilhelmia) lineatum* (MEIGEN).

Mating behaviour. Under laboratory conditions, from 80 to 92% of *S.* (*W.) lineatum* males copulated for a first and a second time, irrespective of the time that elapsed after the first copulation, an interval that ranged from 1 minute to 24 hours. The duration of the male pre-copulatory period during the first and subsequent matings remained the same. The majority of males (from 70 to 96%) started to copulate during the first minute of meeting with a virgin female. Therefore, during the the second mating, the sensitivity of *S.* (*W.) lineatum* males to signals transmitted by females remains approximately the same as it was before the first mating and that it does not change even 1 minute after copulation.

The duration of the first and second copulations was different. The mean duration of the first copulation of *S.* (*W.) lineatum* individuals was 5.48 ± 2.72 min. The mean duration of the second copulation just 1 minute after the first mating was almost twice that length at 12.98 ± 5.62 min. These results demonstrate that *S.* (*W.) lineatum* males are able to repeat a copulation very quickly (within a minute or less) and that they react to females with the same intensity as when virgin, but that their mating behaviour changes. It was only after 24 hours that the mean duration of the second copulation (4.85 ± 2.11 min) did not significantly differ statistically and equalled the mean duration of the first one. After 24 hours, therefore, the copulatory behaviour of the males is the same as that during the first-time mating.

Spermatophore parameters. The results showed that the length and width of spermatophores from the first copulation are greater than those from the second mating. The spermatophore length from the first copulation was 0.194 ± 0.015 mm, and the width was 0.191 ± 0.015 mm. The spermatophore length from the second copulation (after 1 minute) was 0.183 ± 0.017 mm, and the width was 0.164 ± 0.016 mm. When the second copulation took place 24 hours after the first mating, the spermatophore length was 0.187 ± 0.017 mm, and the width was 0.166 ± 0.018 mm.

The behavioural reactions of *S.* (*W.) lineatum* males return to the normal state more quickly than do the spermatophore-transfer parameters. Smaller spermatophores are likely to contain fewer spermatozoa and smaller quantities of other sperm substances. Our data thus indicate that for females to copulate with an already-mated male is less rewarding than with a virgin male.

Keywords: Simuliidae, mating behaviour, polygamous males, duration of copulation, spermatophore

SIMULIID VERNACULAR NAMES PROJECT – PRESENT STATE OF PROGRESS

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In most countries, languages and cultures, very specific names are usually given to things which cause discomfort. This applies to pestiferous animals and plants and particularly to biting insects which are often perceived as something to be endured. Not least amongst these are the Simuliidae which, as we all know, can at times be present in enormous numbers and can make life miserable and well nigh impossible in some areas of the world.

For some years I have been noting down the names given to simuliids by indigenous peoples in their own languages as well as those found in published reports by explorers, naturalists and entomologists. With help from colleagues I have so far compiled a list of nearly 170 names from 32 countries. A summary of these names will be shown as a poster display and everyone is invited to add to the list.

Keywords: Simuliidae, blackflies, common names, vernacular names, distribution

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ECOLOGICAL CONDITIONS AND SPECIES COMPOSITION OF BLACK FLIES IN THE RIVER HRAZDAN, ARMENIA

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The River Hrazdan is the main waterway in the Republic of Armenia and is of great importance to the country's economy. The Hrazdan is a highly regulated river and is used for many purposes, such as water supply, irrigation, energy, and recreation. Since the break-up of the Soviet Union, the ecological conditions of the River Hrazdan and the biodiversity of invertebrate animals inhabiting it have changed, but little biological information exists on this subject. Because of the close connection between water quality and biodiversity, monitoring of the river by means of these indices will enable its current ecological condition to be determined.

The River Hrazdan begins in Lake Sevan and enters the River Araks in southern Armenia. The length is 146 km, the mean slope is 0.077%, and the average annual discharge is 22 cubic m/sec. The basin of the River Hrazdan runs through different climatic and landscape zones, and has both relatively clean and polluted sections. Before the break-up of the Soviet Union, this river basin was widely used for industry, agriculture, and hydroelectric power. Along the river are a number of settlements and towns, such as Sevan, Hrazdan, Charentsavan, Bjni, Arzni, Yerevan, and Masis, with a total population of 1,130,000 people.

According to A. E. TERTERYAN (1960), 7 species were found in the River Hrazdan before 1953: *Wilhelmia paraequina* PURI*, W. mediterranea* PURI*, W. turgaica* RUBTSOV*, Obuchovia popovae* RUBTSOV*, Simulium variegatum* MEIGEN*, S. caucasicum* RUBTSOV*,* and *S. tarnogradskii* RUBTSOV. Once the Sevan-Hrazdan hydroelectric power station began operating, the hydrological conditions of the river changed. TERTERYAN noted that this change entailed a sharp reduction in the numbers of black fly larvae, followed by their complete elimination along the river in the first year of the hydroelectric power station's operations. TERTERYAN made annual observations of the River Hrazdan from 1953 to 1960, but he recorded no recovery of these populations.

From 2002 to 2004, we investigated the water quality and concentration of heavy metals in the River Hrazdan, from its headwaters to its mouth, including its tributaries, and documented the species of black flies that developed in the river during spring, summer, autumn, and winter. In conjunction with the water analyses, we investigated the species composition of black flies in the river and its tributaries, demonstrating differences in the species diversity in relation to season and anthropogenic impacts.

Analysis of the water quality of the River Hrazdan showed only small concentrations of heavy metals, probably as a result of the partial functioning of the numerous industrial facilities along the river. Only lead and zinc were found, but at concentrations lower than the maximum level permitted. However, within the city limits of Yerevan and at the mouth of the river, we found levels of coliform bacteria that exceeded the accepted standards. This high level of pollution is reflected in the small numbers of black flies and the low species richness in this area. Ten kilometres from the source of the River Hrazdan, we found *Simulium variegatum*, *S. kiritshenkoi* RUBTSOV, *S. bezzii* (CORTI), and *S. lineatum* (MEIGEN). We also found *S. pseudequinum* SÉGUY and *S. australe* (RUBTSOV) in the Middle Hrazdan. These species develop along the river up to its entry into the city of Yerevan. In the city itself, the following species were found at the Kanaker hydroelectric power station and Ahktanak Park: *Simulium aureum* group, *S. australe*, *S. chubarevae* (KACHVORYAN & TERTERYAN), *S. kiritshenkoi*, *S. noelleri* FRIEDERICHS, and *S. pseudequinum*.

A rich simuliid assemblage occurs in the tributaries Marmarik and Jrvezh. Species associated with the forest landscape in the upper Marmarik include *Metacnephia subalpina* (RUBTSOV), *S. delizhanense* (RUBTSOV), *S. fontium* (RUBTSOV), *S. australe*, *S. chubarevae*, *S. vernum* group, *S. variegatum*, and *S. kiritshenkoi*. In the middle Marmarik, where there is only a sparse growth of trees, the following species develop: *Prosimulium tomosvaryi* (ENDERLEIN), *P. rachiliense* DJAFAROV, *S. bezzii*, *S. variegatum*, and *S. kiritshenkoi.* The following species develop in the forest-steppe zone: *S. noelleri*, *S. margaritae* (RUBTSOV), *S. debacli* TERTERYAN, and *S. pseudequinum*. In the Jrvezh tributary, we found *S. akopi* (CHUBAREVA & KACHVORYAN), *S. aureum* group, *S. pseudequinum*, *S. variegatum*, and *S. kiritshenkoi.*

Some changes in biodiversity are also seasonal in nature. For example, in the Marmarik tributary (village Aghavnadzor) in June, we found *P. rachiliense*, *P. tomosvaryi*, *M. subalpina*, and *S. australe*, whereas in July we found *S. australe*, *S. chubarevae*, *S. bezzii*, and *Simulium* sp. By September, the species composition had changed markedly, consisting of *S. bergi* RUBTSOV, *S. debacli*, *S. australe*, and *S. kiritshenkoi.* These seasonal changes in biodiversity emphasize the importance of repeated visits to the same areas over the course of a year to inventory the fauna of the Armenian watersheds.

On leaving the city of Yerevan, we found only *S. pseudequinum*, *S. lineatum*, and *S. paraequinum* PURI in the Hrazdan River. Species richness in the river is thus poorer than in the tributaries. The most tolerant species, *S. kiritshenkoi* and members of the subgenus *Wilhelmia*, were dominant in the river.

Our continuing study of the black flies of the River Hrazdan, from its source to its mouth, including its tributaries, indicates that this catchment area is a hot spot for black fly biodiversity. Our analyses indicate that the water is generally clean. The number of black fly species in the Hrazdan River system is greater now than in recent historical times (ca. 1953-1990), suggesting that the water quality has improved.

This research was made possible by Award No. BI 059 – 02 from the National Foundation of Science and Advanced Technologies (NFSAT) to E.A. KACHVORYAN; Award No. 12005 from the U.S. Civilian Research & Development Foundation for the Independent States of the Former Soviet Union (CRDF) to P.H. ADLER and E.A. KACHVORYAN; and Award No. A676 from the International Science and Technology Center (ISTC) to E.A. KACHVORYAN, K.V. HARUTYUNOVA, and M.V. HARUTYUNOVA.

Keywords: Aquatic habitat, biodiversity, Armenia, Simuliidae, water quality

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Our investigation of the black flies in Armenia, combined with historical records, indicates that the Armenian fauna consists of 5 genera and 50 species. We currently regard about 11 of these species (22%) as endemic to Armenia, although some eventually may be found in neighbouring countries. An additional 16 species (31%) are endemic to the Caucasus. Overall, 27 (53%) of Armenia's species are restricted to the Caucasus, based on current knowledge. About 12 (23%) of the species in Armenia are widespread in the Palaearctic Region. The most widespread and abundant species in Armenia is *Simulium kiritshenkoi* RUBTSOV.

Our discovery of a large breeding population of *Simulium noelleri* FRIEDERICHS in an organically polluted stream in the center of Yerevan (Ahktanak Park) represents the first Armenian record of this anthropogenic species. It has since been eradicated from the Park as the result of development, but in 2004 we rediscovered the species in the River Hrazdan, near the village of Meghradzor. Using a chromosomal approach, we identified *S. angustipes* EDWARDS for the first time from Armenia, including the type locality of *S. reginae* TERTERYAN; the name "reginae", therefore, falls as a synonym of *angustipes*. Similarly, *S. petricolum* (RIVOSECCHI) and *S. cryophilum* (RUBTSOV) were found for the first time in Armenia, representing a significant eastward extension of their ranges. Preliminary analyses from our joint field expedition in mid-June 2004 revealed a number of infrequently collected species, including *Metacnephia persica* (RUBTSOV), *M. subalpina* (RUBTSOV), *Simulium aureofulgens* TERTERYAN, *S. debacli* TERTERYAN, and *S. margaritae* (RUBTSOV). Morphological examination of material of the subgenus *Montisimulium* suggested the presence of an undescribed species in Armenia; chromosomal analyses will be conducted to test this hypothesis.

Using a cytogenetic approach, we have shown that the Armenian black fly fauna has both unique elements and shared relationships with the rest of the Palaearctic Region. These findings suggest that the black fly fauna in Armenia is incompletely known and that additional new species will be discovered in the country in the future.

This research was supported by Award No. BI 059 – 02 from the National Foundation of Science and Advanced Technologies (NFSAT) to E.A. KACHVORYAN; Award No. 12005 from the U.S. Civilian Research & Development Foundation for the Independent States of the Former Soviet Union (CRDF) to P.H. ADLER and E.A. KACHVORYAN; and Award No. A676 from the International Science and Technology Center (ISTC) to E.A. KACHVORYAN, K.V. HARUTYUNOVA, and M.V. HARUTYUNOVA.

Keywords: Armenia, biodiversity, endemism, faunistics, range extensions, Simuliidae

NOTES ON THE DISTRIBUTION OF BLACKFLIES ON THE CANARY ISLAND OF LA GOMERA

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In early February 1988, the aquatic stages of blackflies were sampled by hand at 9 locations along some of the few remaining streams in the northern part of Gomera (Canary Islands, west of Morocco). Adults were reared individually from pupae. *Simulium (E.) guimari* BECKER, *S. (E.) tenerificum* CROSSKEY, *S. (E.) velutinum* (SANTOS ABREU), *S. (N.) ruficorne* MACQUART, *S. (S.) intermedium* ROUBAUD, and *S. (W.) pseudequinum* SÉGUY were identified. In addition, numerous specimens of intermediate forms that combine the characters of different species of the *S. (E.) aureum*-group were found. With these six species, Gomera seems to be the island with the highest number of species among the Canaries. *S. intermedium* was the most abundant species. *S. ruficorne* was also abundant and, like *S. intermedium*, was found at 8 of the 9 stations. At a single stream, the Barranco de Monteforte, 5 samples were taken along a longitudinal (ca. 7 km) and altitudinal (3 - 720 m a.s.l.) gradient. A species endemic to the Canary Islands, *S. guimari*, seems to prefer very small headwaters at elevations above 500 m. The second endemic species, *S. tenerificum*, and associated forms, as well as *S. ruficorne* apparently prefer lower altitudes. No clear preference could be detected for *S. intermedium*. All species were found in the pupal stage and all species-groups in the larval stage at the same time in February.

Keywords: Simuliidae, faunistics, new record, small-scale distribution, zonation, Canary Islands, Gomera

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PARASITIC MITES (ACARI: HYDRACHNIDIA) ON PUPAE AND ADULTS OF SIMULIIDAE (INSECTA: DIPTERA)

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The larvae of various species of water mites (Hydrachnidia) are known as parasites of adult blackflies. Typically, the larvae of these mites are seen in pupal cocoons of Simuliidae, where they wait until the imago hatches. Then they attach to the emerging adult flies, engorge by feeding upon the host's haemolymph, and profit from its upstream movement to compensate for downstream drift and thus repopulate the seasonally fast-flowing breeding sites.

Recently, and in contrast to former results, we frequently observed parasitic water mites on simuliid pupae. In 2003 and again in 2004, extraordinarily high numbers of *Sperchon* cf. *setiger* THOR larvae were seen in the rivers around Tübingen in Southern Germany (e.g. in the moderately polluted perennial river Ammer, populated by *Simulium ornatum* MEIGEN, *Simulium equinum* (LINNAEUS), and in the Schlierbach and its temporary flowing tributary Kirchgraben, both with *Eusimulium vernum* (MEIGEN)). On the other hand, these mites were not observed in a population of *S. ornatum* in a very slightly polluted river draining the protected forest area of Schönbuch in the same river-catchment area. In the parasitized populations, infestation rates were high, 80 to 90 % in over 100 pupae examined, and the average number of larvae was 3-5 mites per *Simulium* pupa, with a typical negative-binomial distribution pattern. Mites were seen crawling eagerly over and into the pupal cocoons, but were not attracted to *Simulium* larvae even when these were situated close to the pupae. Mite larvae of different sizes but of the same species were seen together in the same cocoon, and this might indicate that the mites grow by feeding on the *Simulium* pupae.

Although these mites are commonly considered to be mainly phoretic parasites, their numbers and the fact that they may also suck haemolymph makes them potential regulators of *Simulium* populations. This is also indicated by a low percentage of adult flies that emerge from such infested pupae when kept in emergence cages: only one mite was seen attached to the ventral abdominal surface of a newly-hatched blackfly, together with signs of melanization which probably resulted from the previous feeding of the mite.
These facts suggest that *Sperchon* cf. *setiger* larvae feed on the blackfly pupae and may not even need the adult Simuliids to complete their life cycle.

Keywords: Hydrachnidia, *Sperchon*, Simuliidae, adults, pupae, ectoparasites

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PATTERNS OF BLACKFLY DISTRIBUTION IN RELATION TO HABITAT STRUCTURE, STREAM DEGRADATION AND LAND USE IN STREAMS IN THE RIVER RUHR CATCHMENT AREA (GERMANY)

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Blackfly species were sampled over a period of two years at 32 sites in the catchment area of the River Ruhr during all seasons. Each sample was restricted to a 15-minute time period. During the spring season, 9 taxa were found: *Prosimulium hirtipes* (FRIES), *Simulium argyreatum* MEIGEN, *S. variegatum* MEIGEN, *S. ornatum* group, *S. equinum* (LINNAEUS), *S. aureum* group, *S. morsitans* EDWARDS, *S. reptans* (LINNAEUS), and *S. vernum* group.

Hydrochemical parameters, such as pH, conductivity, oxygen levels, and current velocity, were recorded on each sampling date. Substrates covering the sampled reach were recorded in 5% steps. Land use was calculated by a GIS approach, using ATKIS land cover data.

At the local scale, parameters of habitat quality (amount of woody debris, CPOM, FPOM, etc.) were correlated with blackfly distributions. At the stream scale, blackfly distributions depend on the width of the riparian vegetation. Riparian vegetation is known to be an important factor influencing oviposition sites for adult females (TIMM 1993, 1995). At a larger scale (catchment area), *P. hirtipes* shows strong correlations with land use (% urbanisation) and with geomorphological parameters (altitude).

Keywords: Simuliidae, Germany, River Ruhr catchment area, ecology, distribution patterns

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CURRENT KNOWLEDGE OF THE KARYOTYPES OF THE WORLD BLACKFLY FAUNA (DIPTERA, SIMULIIDAE)

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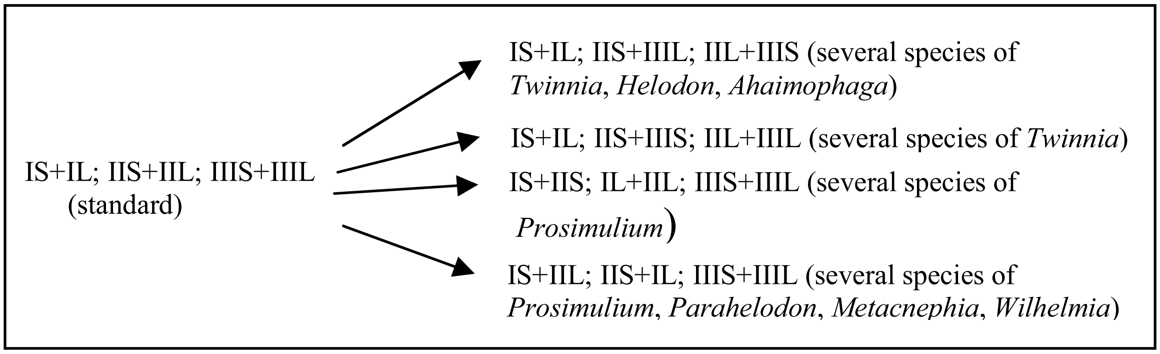
So far 310 blackfly species have been karyotyped. Among the 80 forms that have been described as cytotypes or “species”, nearly all are potentially valid species. Studies of blackflies are being carried out in many regions of the world, including Europe, Africa, America, Australia and New Zealand. This interest is due to the significant medical

and veterinary importance of this group, which includes blood-suckers and carriers of dangerous human and animal diseases.

Here we are presenting a summary of our original results and of the published data on blackfly karyotypes that has appeared between Kunze's reviews (1952, 1953) and 2001.

The majority of blackfly species (96%) have 2n=6. Several species (about 10) have 2n=4; parthenogenetic triploid populations have been found in some species of the genus *Prosimulium*, 3n=9. Isolated triploid individuals resulting from spontaneous mutations have been described in bisexual populations of *Cnephia*, *Odagmia*, *Wilhelmia*, and *Nevermannia*.

The modal karyotype is 2n = 6: IS + IL, IIS + IIL, IIIS + IIIL.



A characteristic feature of the family is the stable localisation of the main chromosomal markers: the Sim-end in IS, paracentromeric section with 5 dense thick bands and BRs in IIS, two puffs separated by the heterochromatin band and the fan-end in IIIS. Such constancy in the localisation of the chromosomal markers implies a cytological unity of this insect group that suggests the monophyletic occurrence of the family and the conservation of the optimum adaptive karyotype in the evolutionary process.

Evolution of the karyotype in the family takes place on the basis of: (1) fixed homozygous inversions; (2) formation of different sex-determining systems; (3) tandem chromosome fusions (macromutations) (*Astega*, *Eusimulium*); (4) transposition of the nucleolar organising region (macromutation) from IS into IIIL (*Ahaimophaga* - *Helodon*, *Odagmia* - *Simulium*); (5) reciprocal translocations of chromosome arms (macromutations): (6) small structural rearrangements (micromutations): "puff - band", "thin band - thick band"; (7) changes in morphology of the centromeric regions; (8) appearance of B chromosomes.

The evolution of the blackfly karyotype thus includes a wide spectrum of chromosomal rearrangements.

Keywords: Simuliidae, blackflies, karyotype, polytene chromosomes, world fauna

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THE BIOTOPE OF *SIMULIUM (RUBZOVIA) LAMACHI* DOBY & DAVID (DIPTERA, SIMULIIDAE) IN THE NORTHERN LIMESTONE ALPS NEAR BERCHTESGADEN (GERMANY)

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The species *Simulium (Rubzovia) lamachi* DOBY & DAVID has a very restricted distribution and is known only from small areas in Southern France (South Alps, Massif Central, Pyrenees), Spain (Sierra Tejeda in Andalusia) und Morocco (High Atlas, Rif) (CLERGUE-GAZEAU & VINÇON 1990). A spring rivulet in Germany can now be added as a further locality for this species. The breeding site is in the Berchtesgaden Alps, part of the northern limestone Alps, some 600 kilometres north-east of the most eastern known locality in the French Alps. The potential distribution range of this West Mediterranean species is considerably enlarged by this new record.

The preimaginal stages were found colonising the thin film of water that generally covers the lithic in a spring rivulet issuing from the foot of a north-facing slope at 760 metres above sea level. After a few metres this rivulet flows into a mountain stream belonging to the catchment area of the river Inn or the river Danube respectively. Two individuals of the *Simulium vernum*-group were identified as accompanying taxa of this simuliid species.

Further details may be found in: SEITZ, G. & M. FORSTER (2004): Erstnachweis von *Simulium (Rubzovia) lamachi* (Diptera, Simuliidae) in Deutschland. [First record of *Simulium (R.) lamachi* in Germany (Diptera, Simuliidae)]. - Lauterbornia 49: 33-36, Dinkelscherben.

Keywords: Simuliidae, *Rubzovia*, Bavaria, Germany, first record, zoogeography

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Prof. Marshall Laird. 193 Wharawhara Rd., RD2, Katikati, 3063, New Zealand.

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THE BRITISH SIMULIID GROUP BULLETIN No. 24 July 2005

CONTENTS

FROM THE EDITOR

Hands up all those who noticed the new Natural History Museum logo on the front cover! I preferred the old zebra logo.

In this number we have an obituary for Angus McCrae, a stalwart member of the Group, who died almost a year ago, the latest list of our 121 members, and an announcement about a proposed blackfly genome project, plus another traveller's tale.

The 26th British Simuliid Group Meeting was held in Berlin last year, so those who were not able to make it must be impatient for news of the next meeting, which is now given below. I hope that as many members as possible will attend. Indications are that the 2006 European Simuliidae Symposium will probably be held in Novi Sad, Serbia and Montenegro, possibly in September. There is an implicit invitation for us to join them. We need to discuss the implications at our next business session.

John Davies

The 27th Annual Meeting Announcement and call for presentations

The next 27th Annual Meeting will be held in the Seminar Room of the Oxford Museum, South Parks Road, Oxford.

On **Friday 2nd September 2005**, probably starting at 10.am.

An informal dinner will be held on the previous evening, 1st September.

We are indebted to Adrian Pont for agreeing to make the local arrangements. United Kingdom members should have received a formal notice by e-mail or post as appropriate before this Bulletin is issued. Please inform John Davies (not Adrian) if you wish to attend either or both the meeting and dinner, saying whether you will be accompanied by any friends, partners or colleagues., **and let him have the title of your proposed talk or poster** as soon as possible

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Angus W.R. McCrae 1932-2004

Angus, who died of cancer on 15 August 2004 was a long-time member of the British Simuliid Group. His name first appeared on the Members List in December 1982 shortly after his return from East Africa. He hardly missed a meeting and usually had something pertinent and amusing to say in most discussion sessions.

He was born on 14 February 1932 in Putney. After graduating in zoology from Cambridge University in 1956 and a spell working with D.S. Kettle's Scottish midge project he was appointed in 1958 to a position as Entomologist (Medical) in the Entomological Division (later the Vector Control Division) in the Medical Department of Uganda where he served under George Barnley. While there he was introduced to *Simulium damnosum* and *Simulium neavei* as the vectors of onchocerciasis along with other work on the vectors of malaria. Up until his transfer to the East African Virus Research Institute in 1966 he was involved in monitoring the effect on *S. damnosum* of the on-going intermittent larviciding at the Owen Falls Dam on the Victoria Nile at Jinja. The scheme had been initiated by G. Barnley and M.A. Prentice in 1951 and was a milestone in those early days of larviciding as a *Simulium* control method. It was during this time that his observations on behaviour patterns of "*damnosum*" from different localities that he became convinced that *S. damnosum* was a species complex - a concept that was by no means generally accepted at the time - and was an enthusiastic and active supporter of R.W. Dunbar's endeavours to separate and describe the cytospecies. He believed that the reason why the first few applications of insecticide at Jinja were followed by an absence of flies for three years or more, was that the original unknown cytospecies on this isolated stretch of river was eradicated in about 1956 and the river was only later repopulated by a cytospecies new to the area (now designated as *S damnosum s. s.*), probably originating from the Murchison Nile 150 km to the north east. As this 3-4 year absence of flies occurred several times he coined the phrase "intermittent eradication" to describe it. He also surveyed the *S. neavei* foci of Kigezi, Ruwenzori and Budongo.

Although his work at E.A.V.R.I. was mainly concerned with mosquitoes as vectors of arboviruses he continued to publish notes and papers in which the *S damnosum* species complex was the recurring theme. He left Uganda in 1971 at the time of the Idi Amin regime upheavals. Thereafter, apart from a short WHO consultantship in Ghana, the main thread of his employment was on the subject of vectors of malaria first at the Medical Research Council in the Gambia 1974 to 1977 then after gaining a PhD. by publication from Cambridge University in 1978, back to East Africa in a U.N. supported position at I.C.I.P.E. He left Africa to reside in Oxford in 1982 and joined C.A.B.I., Wallingford in 1989 where he remained until his retirement in 1992. More recently, he became interested in the distribution of the Blandford Fly, *S. posticatum,* and the identification of its blood meals.
The list of references given below is restricted to papers on *Simulium* and onchocerciasis, but he was a man of wide biological interests with an eye for the

unusual somewhat in the manner of the Victorian gentleman naturalist. His publications cover an extraordinarily wide range from Kaposi's sarcoma and Burkitt's tumour, "Nairobi eye" beetle toxins, the behaviour of click beetles, flies infesting emulsion paint, mosquitoes and tabanids feeding on plant sugar sources (he is probably the first to report this), arboviruses, and his enduring passion, Emperor moths (Saturniidae). He was also an enthusiastic ornithologist, reporting on such strange events as the association between nesting birds and wasps, and weaver birds and cat fish.

Away from science he was an accomplished painter working in both oils and watercolours. His friends treasure the water and oil paintings that he gave them and the individually drawn cartoon Christmas cards done in Indian ink and water colours which he laboriously sent out each year. An example of one of these is reproduced below.

Angus always had a unique attitude to any situation which many would have labelled as eccentric. He was an interesting companion and an accomplished raconteur, and was proud of his Scottish roots. Our meetings will not be the same without him.

Angus's Card for Christmas 2001 (original in Indian ink and watercolour)

Publication List

This list is restricted to papers on the subjects of blackflies and onchocerciasis - year date order irrespective of any joint authorship.

1963. McCrae, A.W.R. & Prentice, M.A. Some recent studies on the biology of *Simulium* vectors of onchocerciasis in Uganda. Biochemical Journal (Proceedings of the Biochemical Society) 89: 78-79.

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1984. McCrae, A.W.R. [Untitled: informal report of talk on sampling Simulium by human bait catches.] Newsletter of the British Simuliid Group 10: 2.

1986. McCrae, A.W.R. The effects of a single insecticide dose on a Nile population of *S. damnosum*. Newsletter of the British Simuliid Group 12 : 2 .

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1994. McCrae, A.W.R. & Hill, N. Host selection by the Blandford fly (*Simulium posticatum* Meigen), with blood-meal identifications. British Simuliid Group Bulletin 3: 23-27.

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John Davies (with vital help from R.W. Crosskey, J.N.Raybould, M.A.Prentice and D.S.Kettle)

Blackfly Genome Project

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A few of us have been discussing launching a black fly genome project. I've just returned from visiting Peter Cherbas & The Centre for Genomics and Bioinformatics, at Indiana University; everyone there is very enthusiastic about collaborating in this effort. We foresee an EST (expressed sequence tag) project, rather than a full genome sequencing effort, at least for the current application. We aim to produce a variety of cDNA libraries, sequence 50,000 clones (in a manner designed to minimize redundancy), create a web-based bank of ESTs, and produce and distribute macro-arrays on nylon filters. I hope for a follow-up project to produce microarrays, if it can be justified by the number of users, and the applications.

I would like to hear from anyone interested in collaborating on this project. The degree of participation can vary from:1) full participants: those with specific (large) projects in mind that might require specialized cDNA libraries for inclusion in the screen. Participants at this level will help write the proposal, especially in their own project-area.2) users of the products: e.g. people who will use the EST data banks,libraries or macroarrays. 3) interested & enthusiastic by-standers. Those who support the concept of a black fly genome project, but who have no specific application at the moment.

We particularly need to hear from those of you with specific projects in mind that require different types of cDNA libraries. As a start, we envision producing embryonic, mixed stage larvae, and adult libraries, probably sorted by sex where possible. I am interested in also producing a library from stressed larvae, and individuals infected with a variety of parasites/pathogens.

For anyone interested in tissue-specific mini-libraries, there will be an opportunity to visit the CGB and use their resources to isolate the required tissue.

I emphasize that this project isn't just for the DNA/RNA/protein types among us. Ecologists might be interested in adaptations to different habitats, behaviourists could look at sibling/sex differences, etc., etc. Anyone with interesting questions that can be addressed on a genetic level will benefit from the project, and can help bring it about.

This is a real chance to re-invigorate simuliidology, bring new students & colleagues into the fold, and to get around that "too difficult to breed in the lab" syndrome that plagues much of our work.

If you are interested, please contact me.

TRAVELLERS' TALES

La Sierra de la Macarena

Stephen Earle, a zoologist from Oxford University, made a collecting expedition to the Sierra de la Macarena in Colombia in 1955-56. This is a small mountain range lying to the east of, and slightly separated from, the main Andean chain, south of Bogota. He states that he was told that the name means "The hills of the boasting woman", and used the name as the title of his book about the expedition. However my Spanish dictionary translates Macarena as self-mortifying, and there is a famous Virgin and church of that name in Seville, which I think is probably the more likely origin of the name. **John Davies**

Stephen and his colleagues formed a base at Arama, 10 miles north of the Macarena, from whence they visited the Guéjar river. Camped on its bank he writes the following (p66-67):

> "…saw another electric eel in this water. Many other places are far more risky, but one is accustomed to them. Later, Rafael said "The eels aren't dangerous in themselves. The trouble is if they knock one unconscious one drowns." It's this sort of accident that gives the place a bad name.
>
> I sat on a rock and smoked, not for pleasure, but to keep the midges [defined in a glossary as *Simulium* spp. – Ed] away. These insects must be got over with, so far as that is possible, to save tedium. They were square-built, black flies with powerful thoraxes and big heads, approximately a tenth of an inch long. They bit from dawn to dusk, and we lived in a thin but pervasive cloud of them. They were wherever the river could be heard; they breed in fast

water. Hovering in clear sunlight or in the broken shade of the forest, they were invisible, so it seemed as if the air stung. They flew silently, alighted without one's feeling it, and were off again as obvious as ghosts. The bite was itchy for twenty minutes, but the effect cumulative. After walking on the beach or in the river, where they were most numerous, one was swollen, scratching and cross for an hour. In the forest, however, it was sufficient to keep moving.

They flew up one's trouser legs, but not down one's collar. They most frequently bit out of sight, under the chin, on the back of the neck or the lower side of a forearm; but if seen they vanished, wafted off in the air current preceding the slap. It still mystifies me what they ate as a rule; for there seemed to be a greater amount of these little black flies than of blood to go round among them. Were I selling the Macarena, I should point out there were very few mosquitoes there.

The river flowed through a sheer cleft under the peak of a green mountain, which it seemed to have sliced in half. On the far side rose the ledge of grass we'd seen from the plain, behind a spreading forest like ivy. A great white vulture floated almost motionless against the mountain, and the water poured out below, green, clear and fluted by the lines of the current."

*"*The Hills of the Boasting Woman*" by Stephen Earle, Peter Davies Ltd., London (1962)

[It would be interesting to know whether he collected any specimens, and whether they have been identified – Can anyone respond? - Ed.]

MEMBERSHIP LIST

The last Membership List was issued in May 1996, so it is high time that it was re-published, as there have been many changes since.

Note: Addresses without a specified country are in the U.K., e-mail addresses, where known, are given in italics.

Please notify the Editor of any errors or changes, especially regarding accents.

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<u>Changes of address:</u>

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Details are in the list above

Gene Brown has passed on the sad news that **Marshall Laird** has been suffering from Alzheimer's disease for some time, and is no longer able to participate.