THE BRITISH SIMULIID GROUP BULLETIN No. 21
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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

R. W. Crosskey, *Natural History Museum, Cromwell Rd. London. SW7 9BD*

MEMBERSHIP

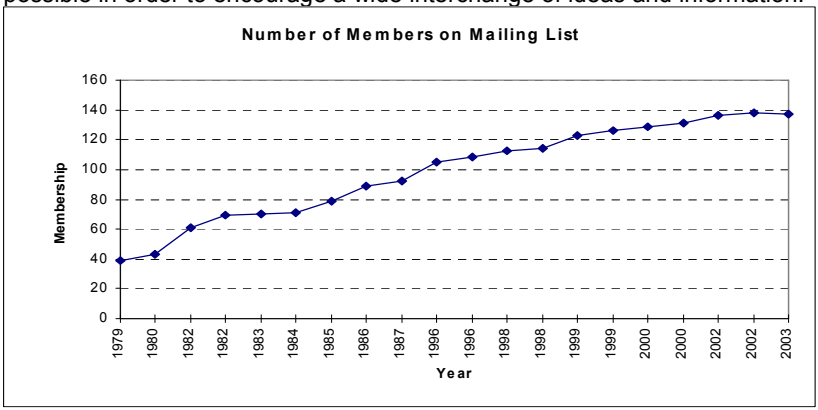
The British Simuliid Group was in effect originally formed in 1979 by 39 persons working on simullids in Britain who provided a note of their names, addresses and special interests to Trefor Williams, editor of the Newsletter of the British Simuliid Group, shortly after the initial meeting to start the 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

Kirsty E. Little[1], María-Gloria Basáñez[1], Mark P. Little[2] & Robert A. Cheke[3]

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2 Department of Epidemiology and Public Health, Imperial College London;
3 Natural Resources Institute, University of Greenwich

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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[2] *Department of Epidemiology and Public Health, Imperial College London*

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).

Acknowledgements : We thank the Medical Research Council, UK for financial support. Richard C. Collins and Tony J. Shelley kindly provided raw data for the analysis of the Cayapa form.

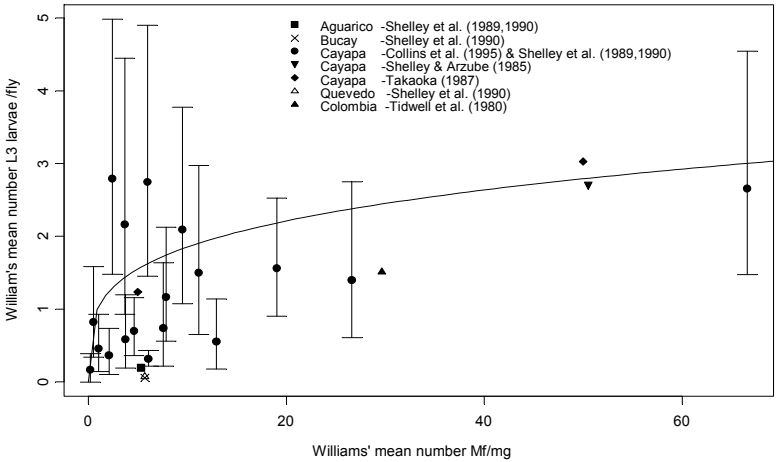

Fig. 1. The relationship between mean no. of L3 and mean Mf load. The data points not accompanied by 95% confidence intervals were obtained from published literature and overlaid on the graph (Refs. 13-15).

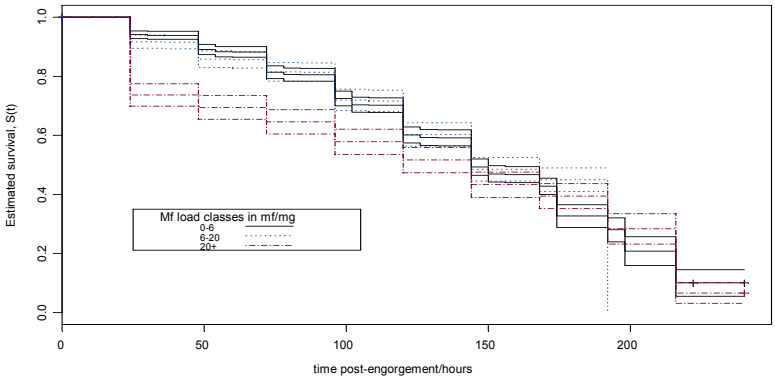

Fig. 2. Kaplan-Meier survivorship curves, *S(t)*, for groups of *S. exiguum s.l.* flies fed on different Mf loads over time p.e. (in hours) with 95% confidence intervals

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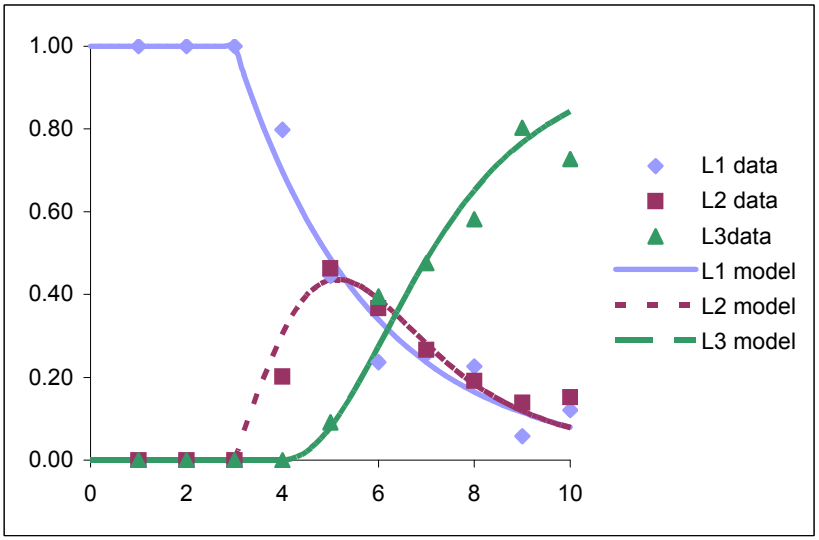

Fig. 3. Proportions of L1, L2 and L3 larvae relative to the total number of larvae at time p.e. (*t*, in days) in *S. exiguum s.l.* maintained in the laboratory for 10 days. Markers are data points; lines are the results of a simple deterministic model using constant rates of progression.

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Aggregated oviposition in *Simulium ochraceum* s.l.

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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.

MEMBERSHIP NOTICES

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THE BRITISH SIMULIID GROUP BULLETIN No. 22
July 2004

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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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Correction
In Bulletin No. 21, Alain Thomas's Department was given incorrectly. His address is:

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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:

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Postal Code:…….…

City:……..

Country:……..

Telephone:…….

Title of presentation Lecture/Poster (delete one)

THE BRITISH SIMULIID GROUP BULLETIN No. 23 January 2005

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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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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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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)

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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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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

JOACHIM REIDELBACH

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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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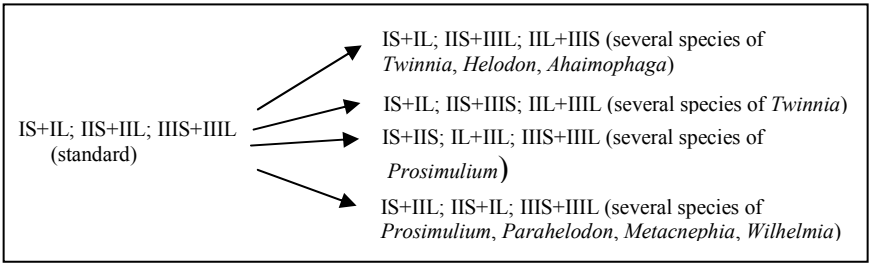
So far 310 blackfly species have been karyotyped. Among the 80 forms that have been described as cytotypes or "species", nearly all are potentially valid species. Studies of blackflies are being carried out in many regions of the world, including Europe, Africa, America, Australia and New Zealand. This 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)

GUNTHER SEITZ

District Government of Lower Bavaria, Regierungsplatz 540, D-84028 Landshut, Germany

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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MEMBERSHIP NOTICES

New Members

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Dr. Kevin Moulton, Assistant Professor, University of Tennessee, Entomology and Plant Pathology Dept., 2505 E. J. Chapman Drive, 432 Biotechnology Bldg., Knoxville, TN 37996-4560, U.S.A. *jmoulton@utk.edu*

Lost Members

Bulletins sent to the following members at the addresses below have been returned marked “gone away”. Can anyone provide the Editor with news or new addresses ?

Dr. M. Edwardes, Onderstepoort Veterinary Institute, Private Bag X5, South Africa

Prof. Marshall Laird. 193 Wharawhara Rd., RD2, Katikati, 3063, New Zealand.

Dr. T. McRae,, Entomology Dept., University of Queensland, Brisbane, Queensland 4072, Australia

THE BRITISH SIMULIID GROUP BULLETIN
No. 24 July 2005

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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

John Davies, 57 North Parade, Hoylake, Wirral, CH47 3AL, U.K.
e-mail to **daviesjb@liv.ac.uk.**
Phone within UK: 0151 632 4031, from abroad: 44 151 632 4031

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.

1963. Woodruff, A. W. Barnley, G. R. Holland, J. T. Jones, D. E. McCrae, A. W. R. McLaren, D. S. .Onchocerciasis and the eye in Western Uganda. Trans R Soc Trop Med Hyg. 57: 50-63.

1965. McCrae, A.W.R. Recent studies on non-anthropophilic *Simulium damnosum* Theo. in Uganda. Proceedings of the Xllth International Congress of Entomology, London, 1964: 823-824.

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1975. McCrae, A.W.R. Notes on the bionomics, ecology, and vectorial characteristics of the *Simulium neavei* group in Uganda. Annex to unpublished document WHO/ONCHO/WP/75.25 (1975) pp 17-21.
1978. McCrae, A.W.R. Intermittant eradication of *Simulium damnosum* Theo. on the Nile from Jinja., Uganda. 1951-1977. In Medical Entomology Centenary Symposium Proceedings, pp133-134, London: R. Soc. Trop. Med. Hygiene.
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 .
1994. McCrae, A.W.R. & Hill, N. Blood meal identifications from *Simulium posticatum*. British Simuliid Group Bulletin 3: 14.
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.
2002. Krüger, A., Hennings, I. & McCrae, A.W.R. 2002. A revision of the systematics of the *Simulium damnosum* complex. British Simuliid Group Bulletin 18: 16-17.

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.]

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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.

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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.