Compilation of Bulletins 16 to 20

Use your "Find" facility to look for key words instead of an index

BRITISH SIMULIID GROUP BULLETIN NO. 16, DECEMBER 2000

Contents **Number 16, December 2000**

FROM THE EDITOR

Because our last meeting was held in the first half of the year and was reported in Bulletin No. 15 (June 2000), this December number contains only one meeting poster report which could not be included with the others due to lack of space. Instead we have a mixed bag of articles including probably the last published work of Edward Newman, originator of the order name 'Simuliidae', a Travellers' Tale from Iceland, and sadly, a memorial note to Mmme Françoise Beaucornu-Saguez. Lastly, a new development in the Blanford Fly saga. Again my thanks to those who have sent in contributions - keep them coming!

John Davies

NEXT MEETING

Trefor Williams reports that he has approached Melanie Bickerton who has responded that they would definitely like to hold the next BSG Meeting at Birmingham. Dates etc. not yet decided.

British Simuliid Group Bulletin No. 16, December 2000

POSTER PRESENTED AT THE 23rd ANNUAL MEETING

S*imulium*'s innate immune system: Involvement of cytotoxic haemocytes?

H-E Hagen *The Wellcome Trust, 183 Euston Rd., London NW1 2BE* and **S. Klager** *Dept., of Biological Sciences, University of Slaford, Salford, M5 4WT.*

Onchocerca microfilariae upon entering the haemocoel of *S. damnosum* are killed and cleared in an effective and species-specific manner. Interestingly, unlike other insects, blackflies do encapsulate and/or melanise the parasites during their initial immune response. This fast removal of vast amounts of cells, i.e. microfilariae, without any signs of an "inflammatory" reaction, are the hallmark of apoptosis. Experiments have been carried out using caspase inhibitors and an *in situ* cell death detection assay (TUNEL) which demonstrates that microfilariae die due to elevated levels of apoptosis. Moreover it seems that this induction of apoptosis is mediated by serine proteases of the blackfly. Additional *in vivo* experiments using the peptide RGDS as an inhibitor for putative integrin-like receptors have revealed that in the presence of this peptide survival of microfilariae in its vector *S. damnosum* is enhanced. This is the first indication that haemocytes are involved in the killing of the parasite, and that this killing is receptor-driven. These findings have led to the hypothesis that microfilariae might be killed by Natural Killer-like haemocytes which patrol the haemocoel.

British Simuliid Group Bulletin No. 16, December 2000

NOTES, VIEWS AND CORRESPONDENCE

Edward Newman on *Simulium* in 1876

The article which follows was, I understand, unearthed by the Librarian at the Natural History Museum and passed to Roger Crosskey who forwarded it to me. Edward Newman is of interest to simuliidologists as he was the originator of the name Simuliidae (1834) (as order Simuliites) in his "Attempted division of British insects into natural orders" (*Entomological Magazine* 2: 379-431, 1843), while he had discussed blackflies in his "Grammar of Entomology" of 1841. This article is taken from "*The Field, The Country Gentleman's Newspaper*" of May 13th, 1876 and was stimulated by a response to a query in the Correspondence columns. I find it a fascinating read with some wonderful English. It sets out the perceived knowledge of blackfly biology at the time with some interesting inaccuracies, but the narrative frequently digresses into criticisms of his contemporaries with phrases such as "our leaders and teachers often turn us aside when in the earnest pursuit of knowledge" and "[the works of] older naturalists in their careful and elaborate folios and quartos, which find no parallel among the hasty and superficial productions of the present day". There is also the random use of the terms ‘gnats’, ‘sandflies’ and ‘mosquitoes’ while the name blackfly was apparently not yet in use.

Sadly, Newman died on 12 June 1876, just 4 weeks after this article was published, and *The Field* of June 17th 1879 carried his obituary.

The article is reproduced with the original spelling and formatting.

LIFE-HISTORY OF THE SANDFLY OR SIMULIUM
By EDWARD NEWMAN

The occurrence of the sandflies or Simulium reptans in Britain, recently noticed in an answer to a correspondent in Scotland (A.B.H.), is not new. From time to time members of this genus of flies have cropped up in different parts of Great Britain and Ireland, have crawled over our skins by day, and have produced an intolerable sensation of titillation. The gnats or Culices have done the same on many a sultry summer night, and have added injury to insult by piercing our eyelids and inserting a siphon with which to extract a drop of blood, often leaving a swelling that lasts for several days, sometimes to such an extent as even to close the eye and produce an effect anything but pleasant to the proprietor, and eliciting observations from the spectator that are always uncomplementary if not offensive. The culprit is not unfrequently captured in the act, and taken red-handed to some very scientific man, who pronounces it a "true mosquito" an insect with which he is perfectly familiar, having suffered from its bites in the West Indies or Australia, in Cape Colony, or some other far distant locality, where he has perchance sojourned, or of which he has unquestionably heard: he will forthwith write to the local paper, and record the phenomenon in all its sensational details. Thus originates a little panic, which is fanned into flame by being copied from paper to paper, the culprit often being multiplied into "immense swarms" and the narrative being always accompanied by some advice for their extermination; consequently everyone is anxious to exhibit a true mosquito, and all "clever people" are eager to master this branch of scientific law.

Now a mosquito is a myth, a ghost, an idea, the chameleon, a bugbear, and yet it must be shown, in order to substantiate all the allegations that have been made respecting it; so gnats and flies, of all kinds, sizes, shapes, and colours, are impounded, crushed, and exhibited as the real Simon Pure, to the edification of the learned, the confusion of the ignorant, and the great comfort of the exhibitors. The particular insect which your correspondent has sent participates in this persecution, and may possibly acquire a popularity rivalling that of the "potato bug", or even that of Phylloxera itself. I have received specimens from Ireland, and others from Devonshire, thus supporting the notion that warmth and moisture are favourable to its development, but by no means implying the probability of its increase to any injurious or even annoying extent. In fact, I cannot readily believe that an insect which remains dormant or unnoticed for so long a period is likely to affect an ultimate settlement as a denizen among us. Moreover, we have the highest natural history authority for not deciding that such and such conditions are exclusively favourable to the increase of the gnats, which are so great an annoyance in less favoured countries than our own. Humboldt observes with respect to the Simulia and Culices of South America that "their geographical distribution does not depend solely on the heat of climate or the excess of humidity, but on causes difficult to characterise" - a profound and truthful observation, self-evident to everyone who will think of it, for we find these insects quite as abundant about the poles as under the equator. That mosquitoes, sandflies, gnats or midges may become, and do become, an intolerable nuisance in some countries, is absolutely certain. Between the little harbour of Higuerote and the mouth of the Rio Unare in South America, Humboldt informs us that "the wretched inhabitants are compelled to stretch themselves on the ground, and to pass the night buried in the sand three or four inches deep, leaving out the head only, which they cover with a handkerchief". You will find it also in Mouffet's most amusing and instructive "Theatrum" -and far more precious it is to me with its quaint Latin and homely woodcuts, than the most costly tome on my entomological bookshelf* you will find I say, to what on extent these insects abound in the West Indies, Peru, and Italy, and that they are *crudeles et venenati,triplices caligas imo ocreas item perjorantes*. Only think of their biting through three pair of stockings and one pair of boots! In Dr Harris's “Treatise on the injurious insects in the United States", a great number of truly appalling statements are made respecting these sandflies.

It has been asserted during recent times that their attacks on cattle, horses, and swine are often fatal: but this may safely be attributed to numbers, and not to individual poison. "In Hungary they frequently swarm to such an extent as to suffocate sheep and cows, by entering the throat and windpipe. It is even said that the ponderous elephant has succumbed to these insignificant insects", since in the pages of Kirby and Spence we read, after details of their doings, "It is not therefore incredible that Sapor, King of Persia, should have been compelled to raise the siege of Nisibis by a plague of gnats, which, attacking his elephants and beasts of burthen, so caused the rout of his army:" ("Introduction to Entomology", vol. i., p. 118)

Not be having the means of verification at hand, I allude to this record with hesitation, and simply as an unauthenticated report. But, returning to the more immediate subject of this paper, Simulium reptans, Linnaeus informs us it is so incredibly numerous in Lapland as entirely to cover a man's body, turning a white dress into a black one, occupying the whole atmosphere. In the north of Europe their numbers are so great that they have been compared to snow when falling thickest. "The Lapps cannot take a mouthful of food, or lie down in their cabins, without having their mouth and nostrils filled with them".

I believe the first scientific account of this pest was published at Stockholm by Professor Freis in 1824, and the translation or rather an abstract, appeared in the first edition of my "Grammar of Entomology" in 1835: this, as well as the second edition, not published until 1841, supplies nearly the whole of the information we yet possess respecting it: and, as these works have been out of print very many years, I think that the readers of *The Field* will scarcely object to its repetition, especially now that an inquiry respecting its name has been instituted, showing that itself and its doings are somewhat unfamiliar. Happy indeed is this unfamiliarity; happy indeed is the comparative immunity which in this land we enjoy from the persecution, the irritation, inflicted on man and beast by these seemingly insignificant insects.

The eggs of the sandfly appear to be at present unknown, but the larvae are found on the stems of the Oenanthe Phellandrium, the fine-leaved water dropwort, on that portion of the stem only which is generally submerged; they are long, cylindrical, considerably thicker posteriorly, and almost perfectly transparent. The head is united to the body by a very short neck - so short, indeed, that the head appears continuous with the body, but is certainly not so. It has four jaws, which move horizontally; these are the mandibles and maxillae - their offices being entirely changed on their conversion into a siphon by a process that is worthy of study by all entomologists, but I cannot stop to describe it now. The structure of the mouth in the diptera is totally unknown to our leading the entomologists; nor is this the most lamentable feature in our science, since those who ought to be our leaders and teachers often turn us aside when in the earnest pursuit of knowledge. To use the familiar but not very elegant expression, they shunt us into a siding instead of keeping us on the mainline to the knowledge of truth. During the past summer infinite pains were taken to convince the neophyte that the species of Syrphus and Eristalis fed exclusively on liquid honey, whereas their food consists entirely of dry and hard pollen granules, as proved by the immense quantity of these productions always to be found stowed away in their stomachs.

The second segment of the larva is thickened, and provided with a conical foot, retractile within the body, and thus capable of being withdrawn from observation. At the other extremity, of the maggot are two prehensile claspers, which are also retractile within the body, and thus alike also capable of concealment; indeed, in this respect they almost exactly resemble the claspers of moths. Entomologists formerly called these claspers legs, and very excusibly so, because they saw that the claspers performed all the functions of legs. Well, in walking - subaqueous walking - the foot is firmly fixed on some immovable object, as the stem of a water plant, and then the claspers and the other end of the maggot are brought up and firmly fixed, the back arched during the operation: the foot then relaxes its hold, the body is again stretched to its full extent, and the claspers brought up to the fore foot as before, and attached further on; thus the maggot progresses by a series of strides, like a geometer caterpillar. The food of this curious larva is unknown; some entomologists have suggested that it feeds on the rind of the dropwort, others that it preys on microscopical animalcules which are floating or sporting in water. When full grown it spins a little purse-like sheath - indeed, something rather like a silken watch pocket - which is hung up on the stems or among the subaqueous leaves of the dropwort, and in this purse it changes to a chrysalis in an upright position: the head and shoulders are kept well above the rim of the purse, and probably it is thus made sure of the supply of atmospheric air necessary for the preservation of life. The chrysalis is very like that of a small moth; it is motionless, of a transparent brown colour, and distinctly exhibits the various parts of the perfect insect through the skin.

Attached to the back, or rather to each side of the back of the head, are four slender, almost hair-like cilliated appendages; and these doubtless serve as respiratory organs. They are very similar to those observable in the larvae of gnats, which are adapted for *breathing* water, in a manner analogous to the gills of fishes. Such a provision for aquatic respiration is by no means uncommon among those larvae - and they are many - which pass the earlier part of their existence in the water, and are represented by several of the older naturalists in their careful and elaborate folios and quartos which find no parallel among the hasty and superficial productions of the present day. Early in July the chrysalis, encircled in a bubble of the air brilliant as quicksilver, rises to the surface of the water, and there floats for a moment; then it opens by a straight fissure down the back, and the Simulium emerges a perfect fly. Another moment she rests in her bubble, like Anaduomene in her shell, and then the bubble bursts and vanishes, and the fly remains standing on the water, with so delicate a touch that it makes no impression on the liquid surface. Entirely satisfied with the perfect safety of her apparently perilous position, she walks the water a thing of life.

Edward Newman.

*The date of Mouffet's "Theatrum" is 1634

British Simuliid Group Bulletin No. 16, December 2000

Mme Françoise Beaucournu-Saguez: memorial note

Françoise Beaucournu-Saguez died on the llth August 2000. Over two decades (1972-1992) she published many valuable studies on the simuliids of western Europe, North Africa and the Middle East. Several of these papers resulted from personal fieldwork that she undertook in France, Spain, Portugal and Morocco. It is to her that we owe the first discovery that the female of *Simulium velutinum* can be distinguished from that of other European species of the *S. aureum* group (= *Eusimulium* s. str.) by lacking the usual pigmented “nipple” on the spermatheca at the base of the duct[1] - a character that has proved constant and very reliable for recognizing this species among otherwise inseparable females. The firsts among her faunistic findings include the discovery that *Simulium ruficorne* - best known as an Afrotropical species[2,3] - has a toehold on the European continent, in Portugal and Spain . Most notable in her oeuvre of formal taxonomy for the Palaearctic region is her description (with Dr Yehuda Braverman who collected the material) of *Levitinia freidbergi*[4] from ephemeral streams on the Golan Heights (Syria under Israeli Military Administration): like the other two species of this genus, both from Central Asia, this Middle Eastern simuliid is highly aberrant and its larva has no filtering head-fans. Also deserving to be highlighted is Françoise B.-S.’s one paper relating to the extra-Palaearctic fauna. This describes another weirdly aberrant blackfly, *Crozetia seguyi*[5]. The strange genus *Crozetia* was first made generally known to simuliidologists by Lewis Davies[6] who visited the Crozet archipelago in 1969 and 1972/3 and redescribed in detail the only species then known, *C. crozetensis*.

On the non-taxonomic side of Beaucournu-Saguez’s output should be mentioned the investigations on anthropophily by blackflies in France to which (with her husband and other colleagues) she turned her attention most recently. Of special interest for specialists in Britain are papers showing that there is some man-biting problem with *Simulium posticatum* in northwest France[7] and summarizing and mapping the history and distribution of simuliid-anthropophily in France as a whole[8]. (In the latter article it is good to see in French: the "Mouche de Blandford"!)

Mme Beaucournu-Saguez was associated with the Department of Parasitology and Applied Zoology at the University of Rennes in northwest France; she is survived by her husband, Professor Jean-Claude Beaucournu, a specialist mainly on fleas (Siphonaptera) in that department and co-author for some of her simuliid contributions.

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3 Beaucournu-Saguez, F. 1975. Récoltes de Simulies (Diptera, Simuliidae) dans le sud-est de l'Espagne. Annales de la Société entomologique de France (n.s.)

11 (l): 73-89.

4 Beaucournu-Saguez, F. & Braverman, Y. 1987. A new species of *Levitinia* Chubareva and Petrova (Diptera, Simuliidae) from the Golan Heights, Israel. Annales de Parasitologie humaine et comparée **62** (l): 59-75.

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6 Davies, L. 1974. Evolution of larval head-fans in Simuliidae (Diptera) as inferred from the structure and biology of *Crozetia crozetensis* (Womersley) compared with other genera. Zoological Journal of the Linnean Society **55** (3): 193-224.

7 Beaucournu-Saguez, F., Chevrier, S., Dubois, B., Genete, M., de Lemos, J B., Mutel, P. & Beaucournu, J. C. 1990. Etude préliminaire d'un foyer de simuliidose a *Simulium posticatum* Meigen, 1838 dans le Département de l'Eure. Impact médical. Médecine et Maladies Infectieuses **20** (6/7): 279-283.

8 Beaucournu, J. C., Beaucournu-Saguez, F. & Chevrier, S. 1992. La simuliidose humaine en France: son ancienneté, sa répartition, les espèces anthropophiles. Annales de Parasitologie humaine et comparée **67** (6): 202-208.

R. W. Crosskey

British Simuliid Group Bulletin No. 16, December 2000

Common or vernacular names for Simuliids

Some time ago I sent out via the Simuliidae Mail List a request for contributions towards an inventory of common names for simuliids that I have been compiling. Thanks to those who took the trouble to respond, the number of names that I have now stands at about 180. However, the geographical distribution is very patchy as you will see from the list below; classified by rough geographical areas. The list does not include the 'international' names such as 'blackflies', 'simulies' 'simulidos' etc. which are associated with the large language groups.

Africa: 38
America, North: 2
America, Central & South: 98
Asia (inc. Burma, India, Pakistan, former USSR): 22
Australia, New Zealand, Pacific Islands: 2
Europe (inc. Fennoscandia): 14
Iceland: 10

If anyone knows of any names belonging to local languages, whether in common use or obsolete, whether published or not, that they would like to pass on, I would be grateful to receive them. In particular, from Africa (about 80% of the names I have are from Nigeria, the rest of West, Central and Eastern Africa are poorly represented), and North America (did the native North American Indians have words for blackflies as they still do in S. America?).
To give an idea as to what I am looking for, here are a few

examples:

mawi (sing), ***morwesia*** (pl); Mende language, Sierra Leone; *S. damnosum*

pium (sing), ***piuns*** (pl); several Amerindian languages, Amazonia; *S. amazonicum* group

potû ; Hindustani, W. Himalayas, India; *S. indicum*

If the name has been published, a reference would be helpful.

Please send your contributions to me by e-mail at **daviesjb@liv.ac.uk**, or by mail at Liverpool School of Tropical Medicine, Pembroke Place, Liverpool L3 5QA, U.K.. If the list ever gets published, all contributors will be acknowledged.

John Davies

Blackfly Web Sites

Two Sites have been set up on the World Wide Web which are dedicated to simuliids. The first at **www.blackflies.org.uk** gives general information regarding blackflies and their life history and has links to other sites of a similar nature. A new addition is the inclusion of a picture gallery of images of all blackfly stages which are available for downloading free of charge.

A second site **www.simulium.org.uk** is intended to contain information of more interest to specialists. At present it contains the complete text of the last *Bulletin*, No 15. but I am considering whether we could include a list of recent and forthcoming publications (i.e. those that have been accepted by a journal). What do you think?

Anyone is welcome to contribute material or ideas to either site and can do so by e-mailing me at **John@blackflies.org.uk**

John DaviesAn antidote for Blackfly bites

Bulletin No. 8, December 1996 contained a piece by Mike Ladle and Stewart Welton entitled "The Blandford Fly - Absolutely the last word". It seems that this was premature, we should have known that this story was going to run and run. One of our ardent and dedicated researchers has reported finding an interesting new product which is claimed to alleviate the effects of The Blandford Fly. As most members will know, the Blandford Fly is *Simulium posticatum* Meigen. The makers of this product, Badger Brewery, have kindly provided specimens of their labels, and details of local suppliers can be found on their web site at **www.badger-brewery.co.uk**
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[Your Editor is considering calling for volunteers to assist in carrying out a controlled experiment to determine the optimum frequency of application required to achieve the maximum effect.]

British Simuliid Group Bulletin No. 16, December 2000

TRAVELLERS' TALES

Great Balls of Blackflies

I am indebted to Gisli Mar Gislason for pointing me in the direction of a paper written by B. V. Peterson, concerning a collecting trip he and Mr. E.F.Bond made to Iceland in 1962. Although primarily a taxonomic work, the species descriptions are also accompanied by biological notes. The piece which follows is taken from the description of *Simulium vittatum*. It is evident that although having experienced the infamous attacks by blackflies in parts of Canada, in Iceland, Bob had been confronted by something quite extraordinary, as it is unusual to find such an eloquent description embedded in a formal taxonomic paper. Read on....

> *Simulium vittatum* is the most abundant and widespread of Icelandic black flies. The author collected it all across the island from many different types of streams ranging from large, fast, cold rivers to tiny trickles of warm, sulphurous water originating from the condensation of volcanic steam. As mentioned above, this species varies considerably in size. Specimens reared from the colder water streams tended to be larger than those reared from warm water streams of volcanic origin. It was specimens from the latter type stream that first led me to think there was an undescribed species in Iceland (Peterson 1965, p. 17).
>
> Early travellers in Iceland (e.g. Mohr 1786, Pálsson 1791-97 (published 1945), Thienemann 1827) often mentioned the nuisance caused by black flies. Probably all of these early accounts refer to *S. vittatum*. This species traditionally has been very abundant in the vicinity of lake Mývatn, and according to Nielsen *et al*. (1954), the name of the lake is derived from these pestiferous flies.

Simulium vittatum primarily feeds on horses and, to a lesser extent, on cattle and other animals. Occasionally it bites man but more often is a nuisance because of its habit of hovering around the head and darting into the eyes, ears, nostrils, and even the mouth.

Females of this species were bothersome to the author in several localities but never as they were near Vogar and Reykjahlídh along the northeast shore of lake Mývatn. In the late evening (9:00 p.m.) of 3 July 1962, huge swarms of *S. vittatum* almost totally engulfed my companion and me. Never have I seen so many black flies at one time. They were all over us, crawling into every conceivable opening they could find in our clothing and on our person. They covered my glasses so I could not see through them nor could I see clearly without them. It was difficult to breathe and about all I remember hearing was the faint humming of millions of tiny wings. I had to swing my collecting net back and forth in front of my face to make it possible to see and breathe without swallowing large numbers of flies. The net filled very quickly with large balls of moving flies which continually had to be dumped. Hundreds of flies had crawled inside my clothes which became sticky with their mashed bodies. This hoard of flies continued swarming until the sun dropped nearly to the horizon after which they rapidly dissipated. Through all this, neither my companion nor I received a single bite. An Englishman who was fishing in the lake at the time was forced to retire to the lodge. He received only one bite high on his bald forehead.

In the late afternoon (5:30 p.m.) of 7 July 1962, at Hof. near Vopnafjördhur in northeast Iceland, I had the opportunity to observe large mating swarms of *S. vittatum*. The males formed large, loose swarms, flying with their abdomens at an angle of about 45° and the legs hanging straight down. The flight pattern was essentially the same as reported by Peterson (1962). As females entered the swarm, males would vie for them. Successfully coupled pairs left the swarm, many of them falling to the ground. In most instances the male took a position on top of the female with his abdomen curved underneath her. Sometimes the female would drag her coupled mate on his back along the ground, and in some cases small balls of copulating pairs were formed. Many mating pairs landed on our white automobile where they were easily and clearly observed. In most instances the mating process lasted only a few seconds. Often several males tried to mate with a single female at the same time, and males were continually testing the sex of other males in their quest for a suitable partner.

B.V.Peterson. (1977) The Black Flies of Iceland. *Can. Ent*. 109: 449-472.

--British Simuliid Group Bulletin No. 16, December 2000

MEMBERSHIP NOTICES

Geographical Distribution of Members

We have at present 132 members, distributed world-wide as follows:

United Kingdom	68	North America	22
Europe	14	Cent. & S. America	9

Africa S. of Sahara 8 Australia & New Zealand 4 and 1 member each in Denmark, Iceland, Jordan, Morocco, Slovakia, Sweden and Turkey.

New Members

Alan Rizzo, University of Portsmouth, School of Biological Sciences, King Henry Building, King Henry St., Portsmouth PO1 2DY, U.K.

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Return to start of document

BRITISH SIMULIID GROUP BULLETIN NO. 17, JUNE 2001

CONTENTS Number 17, July 2001

FROM THE EDITOR

So, another *Bulletin* is ready for publication. As Editor, it is most gratifying to be supplied with more material than can be squeezed into one number, although this has its accompanying problems regarding what to postpone (so far, nothing has been rejected). There are already a couple of articles lined up for the December number. As I have said before, many thanks to those of you who have sent in contributions or suggestions for articles.

In this number, I am particularly sad to include an Obituary to Botha De Meillon who passed away at the end of 2000. He will always be remembered for his contribution to the “African Simuliid Bible” familiarly known as “Freeman and De Meillon”, without which those of us who worked in Africa would have been all at sea.

John B. Davies, Editor

NEXT MEETING

The **24th Annual Meeting** of the British Simuliid Group is planned to be held in conjunction with Birmingham University during **18th to 19th October 2001**. It is being organised by Melanie Bickerton and Malcolm Greenwood.

Please start thinking about your talk or poster. Presentations on the theme of UK or aquatic ecology would be preferred.

Members will be contacted by mail with further details nearer the time, but in the meantime, if you have any queries contact **Melanie Bickerton, Department of Geography, University of Birmingham, Edgbaston, Birmingham, B15**

2TT UK. [e-mail: M.A.Bickerton@bham.ac.uk]. It is anticipated that overnight accomodation will be available within the University.

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----OBITUARY

Botha De Meillon

Simuliidologists in general, and Africa hands in particular, will have been saddened to learn of the passing of Botha De Meillon who died in his sleep on 6 December 2000 in Philadelphia, aged 98. In *Simulium* circles he was probably best known for his co-authorship of the 1953 monograph generally referred to as "Freeman and De Meillon", and which is still very much the starting point for any newcomer to the African Simuliid fauna.

In honour of his 90th birthday his colleagues published (in 1993) a Festschrift summarizing the life and scientific achievements of this remarkable man. The following summary has been compiled very largely from this document

He was born on 15th October 1902 in Prieska on the Orange River in Cape Colony where he was educated at home or in farm schools until going to Pretoria Boys School at the age of 14. From 1921-26 he attended the University of Witwatersrand where he obtain his BSc and MSc. In 1926 he found employment at the South African Institute for Medical Research (SAIMR) in the departments of Parasitology and Entomology, becoming head of Entomology in 1930.

In 1931 he established the malaria research station at Tzaneen in the northern Transvaal, and while there he developed the indoor insecticide spraying method of mosquito control using pyrethroids, which all but eradicated malaria in South Africa. At the same time he started work on the Simuliidae, Siphonaptera and Ceratopogonidae of South Africa.

Even though the simuliidae were not his main occupation, between 1930 and 1959 he authored or co-authored 16 taxonomic works, containing descriptions of 37 new nominal species from Africa south of the Sahara and Madagascar. Of these, two works are of particular importance to simuliidologists, the first “On the Ethiopian Simuliidae” in the Bulletin of Entomological Research (1930), and his monograph “Simuliidae of the Ethiopian Region” which he co-authored with Paul Freeman of the British Museum (Natural History) and published in 1953.

The 1930 paper was called "On the Ethiopian Simuliidae" but actually provided rather more than its simple title suggested: it included an identification key to females and provided illustrations of the gills for all those species in which the pupil stage was by then known. The latter was important, because in practice the pupa was then (and remains) the most useful life stage for everyday species recognition, particularly when dealing with a previously unworked or little-known fauna. However, De Meillon was careful to point out a fact he had recognised pretty much at the start of his simuliid studies: that different species sometimes have virtually identical pupal gills, so rearing of adults from pupae and studying associated adult characters has fundamental importance in taxonomy.

For nearly a quarter of the century the 1930 paper provided the only practical starting point for studying the Afrotropical blackfly fauna. One of its side-effects was to stimulate E. G. Gibbins, a health inspector in Uganda, into studying the

Simuliids of eastern Africa and the Congo basin. Between them, Gibbins and De Meillon described virtually all the regional *Simulium* species recognised and newly named during the 1930's. The discovery by J.P.McMahon in 1949-50 that the early stages of *Simulium neavei* exist only in obligate phoretic relationship with river crabs, the appeals for help in identifying the Kenyan and other East African species, coupled with the realisation that onchocerciasis was far more widespread in tropical Africa than anyone had envisaged, prompted Paul Freeman at the British Museum to attempt a review of the African simuliid fauna. He soon found that many of the type specimens were in the SAIMR in Johannesburg, the product of De Meillon's research. Thus was the collaboration established, and the "Simuliidae of the Ethiopian Region" was finally published in 1953, without the authors ever meeting.

De Meillon's main contribution to entomology and public health, however was in the field of mosquito (both Anopheline and Culicine) taxonomy, behaviour and control. From 1936 onwards, he became increasingly in demand as a consultant to other African countries, such as Swaziland, Mozambique and Zambia (then Northern Rhodesia), and his work on the Culicines of South Africa was one of the reasons the Rockefeller Foundation chose to established an Arbovirus Research Station at Rietfontein in the 1950's.

In 1960 he was seconded to WHO as Advisor on Malaria to the Regional Director, Brazzaville, and two years later resigned from SAIMR to join WHO, Geneva, as Acting Director, Division of Parasitic Diseases. Soon after (1963-65), he became Project Leader, WHO Filariasis Unit in Rangoon, then moved to Washington DC as head of the South-East Asia Mosquito Project from 1966 to 1973. Hes activities during these latter years led to the award in 1973 of the U.S. Department of Defense Certificate for Meritorious Service and the U.S. Department of the Army Citation “for selfless dedication and professional competence”. In South Africa and elsewhere he received many other awards, including the South African Medical Association Silver Medal in 1975, and the Elsdon-Dew Medal of the Parasitological Society of South Africa.

During his lifetime he published a total of 189 papers (including the 16 mentioned above), 142 as senior or sole author. Anyone wishing to consult the full list of publications or read more about this remarkable man should consult the Festschrift quoted below.

I met Botha on several occasions, the first being in 1 to 8 July 1968 at the historical OCCGE, USAID and WHO sponsored meeting in Tunis, on “The Feasibility of Onchocerciasis Control” which kick-started what was to later become the Onchocerciasis Control Programme in the Volta River Basin. We were members of a small entomological working group charged with the impossible task (given our general lack of knowledge of the ground and paucity of information) of estimating the cost of controlling *S. damnosum* s.l. in Upper Volta (now Burkina Faso), northern Ivory Coast and northern Ghana, using ground application of DDT to the breeding rivers. If I remember correctly, other members were René LeBerre, Rolf Garms, J. P. McMahon, Douglas Marr, and Hugo Jamnback. After two long sessions, which went well into the night and involved copious quantities of beer and coffee, we concluded that this could not be done for less than one million US dollars per year. The meeting greeted this estimate with shocked disbelief, but I think it had the effect of making the planners more receptive to the possibilities of aerial application. Little did we know at the time that it would transpire to be a gross underestimate! Latterly, Botha must have wondered at the behemoth of a control scheme he had helped to launch.

De Meillon had a somewhat gruff manner which at first was rather off-putting. However, his sense of humour and constant stream of anecdotes soon put one at ease, and his enthusiasm, down to earth good sense and breadth of knowledge soon endeared him to all his associates. He is greatly missed.

John B. Davies, Editor.

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MEETING REPORT

Annual North American Meeting of Simuliid Workers

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The annual North American meeting of simuliid workers was held 10-12 March 2001 at the Archbold Biological Station in Lake Placid, Florida. This meeting was the fourth held under the auspices of the Southern Extension and Research Activities Information Exchange Group. The meeting was organized by E. W. Gray and chaired by D. H. Arbegast. Thirty workers attended, including 24 from the United States, 5 from Canada, and 1 from the Galapagos Islands.

The following 18 presentations were given:

Black flies and non-targets at the Branch River Country Club, Wisconsin (**R. W. Merritt,** Department of Entomology, Michigan State University, East Lansing, MI)

Military experience with black flies (**C. A. Stoops & P. H. Adler**, Department of Entomology, Clemson University, Clemson, SC)

Simulium bipunctatum in Galapagos — what control is feasible? (**T. Poulsom & C. E. Causton**, Charles Darwin Research Station, Galapagos Islands)

Journeys through black flies: pathogens we've met along the way (**C. E. Beard, P. H. Adler & C. A. Stoops**, Department of Entomology, Clemson University, Clemson, SC)

The Metropolitan Mosquito Control District's Black Fly Control Program (**J. Walz & K. R. Simmons,** Metropolitan Mosquito Control District, St. Paul, Minnesota)

Algal effects on the efficacy of *Bti* in an orbital shaker bioassay system (**M. S. Stephens, E. W. Gray, J. P. Overmyer & R. Noblet**, Department of Entomology, University of Georgia, Athens, GA)

Insecticide toxicity evaluations with *Simulium vittatum* IS-7 colony: mixture assessments and food influence (**J. P. Overmyer, E. W. Gray, M. S. Stephens & R. Noblet**, Department of Entomology, University of Georgia, Athens, GA)

The Archbold Biological Station and the ecology of the Lake Wales Ridge (**M. Deyrup**, Archbold Station, Florida)

What's so special about honeydew anyway? (**T. Stanfield**, Department of Biological Sciences, Brock University, St. Catharines, Ontario)

Update on the Polynesian project (**D. A. Craig**, Department of Biological Science, University of Alberta, Edmonton, Alberta)

New species found last summer in Pennsylvania (**D. I. Rebuck**, Black Fly Suppression Program, Harrisonburg, Pennsylvania)

Involvement of county personnel in the New Jersey black fly program (**A. Crans, T. Rainey, F. Carle & C. Musa**, Rutgers University, East Brunswick, NJ [presented by D. H. Arbegast, Black Fly Suppression Program, Harrisonburg, Pennsylvania])

North to the Horton: black fly diversity and biogeography in the Northwest Territories (**D. C. Currie**, Centre for Biodiversity & Conservation Biology, Royal Ontario Museum, Toronto, Ontario & **P. H. Adler**, Department of Entomology, Clemson University, Clemson, SC)

The continuing cytological study of *Inseliellum* (**M. Spironello**, Department of Biological Sciences, Brock University, St. Catharines, Ontario)

A preliminary survey of the distribution and cytogenetics of *Simulium arcticum* in westcentral Montana (**G. F. Shields**, Department of Natural Sciences, Carroll College, Helena, Montana)

Sibling speciation in the *Leucocytozoon* vector *Simulium slossonae* (**C. L. Evans & P. H. Adler**, Department of Entomology, Clemson University, Clemson, SC)

A phylogenetic analysis of Nearctic *Simulium* s. str. (Diptera: Simuliidae) using two mitochondrial genes (**M. Smith**, Centre for Biodiversity & Conservation Biology, Royal Ontario Museum, Toronto, Ontario)

Simulium pictipes is not, and other taxonomic discoveries (**P. H. Adler**, Department of Entomology, Clemson University, Clemson, SC)

British Simuliid Group Bulletin No. 17, June 2001

SCIENTIFIC CONTRIBUTIONS

Deux Simulies nouvelles pour le Nord de l'Afrique : *Simulium (Nevermannia) angustitarse* et *Simulium (Simulium) trifasciatum*

B. Belqat*, M. Dakki et M. Errami***
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***: Institut Scientifique de Rabat*

Au Maroc le genre *SIMULIUM* est présenté par sept sous-genres : *Crosskeyellum, Eusimulium, Nevermannia, Obuchovia, Rubzovia, Simulium* et *Wilhelmia*. Les deux sous-genres *Nevermannia* et *Simulium* sont sans doute les plus représentés avec, respectivement, deux groupes *(S. (N.) ruficorne* et *S. (N.) vernum)* et trois groupes *(S. (S.) bezzii, S. (S.) ornatum et S. (S.) variegatum)*.

Durant l'étude menée sur les Simulies du Rif, deux espèces, jusqu'à présent de distribution Eurosibérienne *(Simulium (Nevermannia) angustitarse)* et Européenne *(Simulium (Simulium) trifasciatum)* sont recensées pour la première fois au Nord de l'Afrique. Cette découverte nous a permis d'élargir considérablement leur aire de répartition jusqu'au sud de la paléarctique occidentale.

Sous-genre NEVERMANNIA Enderlein
groupe *Simulium (Nevermannia) ruficorne*
***Simulium (Nevermannia) angustitarse* (Lundström)**

Localités et matériel étudié :
1. Aïn Sidi Brahim Ben Arrif, 500m, Province de Larache, Localité Bâb

Hachef-Aïssa, 35°18'22" N ; 5°36'57" W. Le 09-III-1998 : 1 larve.
2. Oued Bou îch, 1200m, Province de Chaouen, Localité Bou Rhaît, 35°00'56" N ; 4°57'30" W. Le 25-II-2000 : 1 larve.
3. Aïn Bab Tariouente, 1405m, Province de Chaouen, Localité Jbel beni salah, 35°01'04" N ; 5°00'27" W. Le 23-II-1998 : 2 larves. Le 22-VI-1998 : 4 nymphes.
4. Oued Kétama , 1480m, Province de Al Hoceima, Localité Koudiat Ech chiba, 34°59'03" N ; 4°34'34" W. Le 30-IV-1998 : 1 nymphe. Le 12-XI-1998 : 1 larve. Le 22-VI-1998 : 1 larve, 3 nymphes. Le 20-IV-1999 : 1 larve.

L'espèce a été signalée en Angleterre (Bass, 1998) dans des biotopes de ruisseaux herbeuses. Dans la péninsule Ibérique, Crosskey et Crosskey (2000) la récoltent en Andalousie et au Nord de l'Espagne. González (1997) la signale dans les cours d'eau de moyenne altitude à eaux modérément froides. L'espèce est aussi bien représentée dans d'autres pays d'Europe tels que, le Portugal (Santos Grácio, 1985), l'Allemagne, la Suède, le Norvège et le Danemark (Crosskey et Howard, 1997).

Au Rif, l'espèce a été capturée dans 4 localités rattachées à trois provinces Rifaines (Larache, Chaouen et Al Hoceima). Elle paraît être liée essentiellement aux cours d'eau de moyenne et haute altitude (500-1480m), mais semble plutôt préférer les plus hautes altitudes (1405 et 1480m). Les biotopes où elle se tient sont une petite rivière (Oued Ketama) à fond limoneux, à végétation abondante, à température oscillant entre 11 et 16°C et au courant modéré. Les autres gîtes qu'elle affectionne correspondent à des ruisseaux encombrés par la végétation aquatique et caractérisés par une température moyenne de 12°C, un cours lent et un lit formé essentiellement de limon. Nos renseignements écologiques paraissent concorder avec ceux de Crosskey et Crosskey (2000) puisqu'en Espagne ils signalent l'espèce entre 580 et 1200m et ceux de González et al. (1986) qui la récoltent en amont de la rivière Yeguas.

Avec ces nouveaux points de capture au Rif, nous élargissons donc jusqu'en Afrique du Nord, l'aire de répartition de *Simulium angustitarse*.

Sous-genre *SIMULIUM* Latreille s.str.
groupe *Simulium (Simulium) ornatum*
***Simulium (Simulium) trifasciatum* Curtis**

Localités et matériel étudié :
5. Oued Sgara, 1300m, Localité Tleta Ketama, 34°52'29" N ; 4°37'07" W. Le 30-IV-1998 : 3 larves, 5 nymphes. le 20-IV-1999 : 12 larves, 8 nymphes.
6. Oued ketama, 1283m, Localité Tleta Ketama, 34°52'29" N ; 4°37'07" W, 20-IV-1999 : 4 larves, 6 nymphes.
7. Oued Ketama , 1340m, Localité El Mouzarâr, 34°52'42" N ; 4°36'57" W. Le 12-XI-1998 : 6 nymphes.

L'espèce a été signalée en divers pays d'Europe tels que, l'Espagne, la France, la Grande Bretagne, l'Italie, l'Autriche et la Tchécoslovaquie (Crosskey et Howard, 1997). Cette forme paraît cantonnée, en Espagne, dans de petits ruisseaux de faible altitude (150-520m), à fond de pierres, à courant lent et à végétation abondante (Beaucournu-Saguez, 1975). González-Peña (1990), la signale dans divers petits cours d'eau appartenant au bassin versant Llobregat à des altitudes comprises entre 90 et 700m, dans des eaux généralement limpides bien oxygénées et présentant un grand écart thermique (5-23°C).

Au Rif cette espèce apparaît comme une forme strictement montagnarde puisqu'elle n'a été recueillie que dans trois rivières arborisées de haute altitude (1300-1340m). Dans ces gîtes, le biotope se caractérise par un lit le plus souvent pierreux, riche en végétation aquatique, un cours modéré à rapide en certains points et par une température allant de 13.3°C à 16.8°C.

Au point de vue de sa distribution verticale, nos observations concordent avec celles de González-Peña (1990) qui indique que dans les Pyrénées, l'espèce occupe le même type de biotopes signalés par elle mais à plus haute altitude (1260-1890m). De même les caractéristiques des biotopes que nous donnons sont comparables à ceux signalés en littérature, sauf que, au Rif, *Simulium (Simulium) trifasciatum* affectionne plutôt des rivières plus ou moins larges. L'espèce se tient alors en divers bras où le cours est ralenti par la végétation.

Taxonomiquement, cette espèce ne peut être identifiée avec certitude qu'à partir du genitalia. Par conséquent, sa plaque ventrale, très caractéristique par son processus nasiforme large, à extrémité arrondie et la présence de tubercules épineux sur la capsule céphalique et le thorax (Knoz, 1965), sont deux preuves irréfutables de l'existence de cette espèce au Rif.

Son aire d'extension donc, avec le point de capture (Rif Central Marocain) que nous signalons pour la première fois s'étend maintenant jusqu'en Afrique du Nord.

Remerciements:

Nous remercions vivement le Dr. R. W. Crosskey pour l'identification d'une partie du matériel.

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Distribution Summary of the Simuliidae of Morocco with New Data for the Rif Mountains

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Abstract

Forty-two species of simuliids are now known from Morocco;

including 13 from the Rif Mountains recorded here for the first time, of which two are also new to N. Africa.

Introduction

The following checklist summarises the species presently known from Morocco. Sites where we provide the first record of a species in either North Africa or the Rif Mountains are indicated by the word "**new**". Sampling sites in the Rif Mountains (details in Table 1) are listed within square brackets. The occurrence of a species in other regions of the country is also given. Taxa are listed as in the World Inventory of Crosskey & Howard (1997).

Simulium species recorded from Morocco

Genus **GRENIERA** Doby & David, 1959
fabri Doby & David, 1959.
Middle Atlas, **new** for the Rif [Rif:27; 31; 34]

Genus **METACNEPHIA** Crosskey, 1969
blanci (Grenier & Theodorides, 1953)
High Atlas, Middle Atlas, Anti Atlas, Rif
? **nuragica** Rivosecchi, Raastad & Contini, 1975
tredecimata: Grenier et al., 1957
(misident)
Coastal Méséta (region of Rabat)

Genus **PROSIMULIUM** Roubaud, 1906
Subgenus *PROSIMULIUM* Roubaud s. str.
<u>*P. (P.) aculeatum* species-group</u>
faurei Bernard, Grenier & Bailly-Choumara, 1972.
Middle Atlas, **new** for the Rif [Rif:4; 5; 15;30; 31]

<u>*P. (P.) hirtipes* species-group</u>
laamii Beaucournu-Saguez & Bailly-Choumara, 1981
Central Rif Mountains (Jbel Tidighine)
latimucro (Enderlein, 1925).
High Atlas, **new** for the Rif [Rif:1; 4; 6]
rufipes (Meigen, 1830).
new record for North Africa [Rif: 2; 4; 6; 8; 9; 11; 13; 14; 17; 25; 26; 27; 28]
tomosvaryi (Enderlein, 1921).
new record for North Africa [Rif:3; 4; 5; 6; 22; 25; 27; 28; 30]

Genus **SIMULIUM** Latreille, 1802
Subgenus *CROSSKEYELLUM* Grenier & Bailly-Choumara, 1970
gracilipes Edwards, 1921
Western Middle Atlas (plain of Saïs)

Subgenus *EUSIMULIUM* Roubaud, 1906
angustipes Edwards, 1915
High Atlas, Middle Atlas
mellah Giudicelli & Bouzidi, 2000
High Atlas
petricolum (Rivosecchi, 1963).
latizonum: Bailly-Choumara & Beaucournu-Saguez (misident.)
High Atlas, **new** for the Rif [Rif: 3; 4; 6; 7; 11; 12; 15; 16; 23; 24]
velutinum (Santos Abreu, 1922)
latinum (Rubtsov, 1962)
High Atlas, Middle Atlas, Anti Atlas, Rif

<u>*S. (N.) ruficorne* species-group</u>
angustitarse (Lundström, 1911)
new record for North Africa. [Rif: 6; 10; 13; 28]
ibleum (Rivosecchi, 1966).
High Atlas, **new** for the Rif [Rif:10; 28]
lundstromi (Enderlein, 1921)
latigonium (Rubtsov, 1956)
High Atlas
ruficorne Macquart, 1838
High Atlas, Anti Atlas, Rif

<u>*S. (N.) vernum* species-group</u>
brevidens (Rubtsov, 1956)
High Atlas (record may be in error, verification needed)
carthusiense Grenier & Dorier, 1959
Rif. [Rif: 11]
costatum Friederichs, 1920.
High Atlas, Middle Atlas, **new** for the Rif [Rif:25; 28]
cryophilum (Rubtsov, 1959) .
pusillum: Séguy, 1930. (misident.)
High Atlas, **new** for the Rif [Rif:1; 2; 3; 4; 5; 6; 8; 10; 13; 15; 16; 23; 25; 26; 27; 28; 29]
(chromosomal confirmation by P. Adler)
toubkal Bouzidi & Giudicelli, 1986
High Atlas
vernum Macquart, 1826 .
latipes: authors pre-1972 (misident)
High Atlas, **new** for the Rif;[Rif:10; 28]
(chromosomal confirmation by P. Adler)

Subgenus *OBUCHOVIA* Rubtsov, 1947
auricoma Meigen, 1818.
Rif. [Rif:18; 19; 20; 21]
galloprovinciale Giudicelli, 1963.
Rif. [Rif:8; 13; 16; 18; 32]
marocanum Bouzidi & Giudicelli, 1988
High Atlas, Rif

Subgenus *RUBZOVIA* Petrova, 1983

CRENOSIMULIUM Giudicelli & Thiery, 1985
knidirii Giudicelli & Thiery, 1985
High Atlas
lamachi Doby & David, 1960
High Atlas, Rif

Subgenus *SIMULIUM* Latreille s.str.
S. (S.) bezzii species-group
bezzii (Corti, 1914)
atlas Séguy, 1930
High Atlas, Middle Atlas, Anti Atlas, Rif
S. (S.) ornatum species-group
egregium Séguy, 1930
High Atlas
intermedium Roubaud, 1906
nitidifrons Edwards, 1920
reptans var. *fasciatum*: Séguy, 1930 (misident)
High Atlas, Middle Atlas, Rif
ornatum Meigen, 1818 (complex)
subornatum: Séguy, 1930 (misident)
High Atlas, Middle Atlas, Anti Atlas, Rif
trifasciatum Curtis, 1839.
new record for North Africa, Rif [Rif: 7; 8; 9]

S. (S.) variegatum species-group
atlasicum Giudicelli & Bouzidi, 1989
High Atlas
berberum Giudicelli & Bouzidi, 1989
High Atlas
variegatum Meigen, 1818
High Atlas, Rif
xanthinum Edwards, 1933
gaudi Grenier & Faure, 1957
High Atlas, Middle Atlas, Rif

? *S. (S.) venustum* species-group
sp. indet.
Rif. [Rif:4; 6; 8] (first record; chromosomal identification by P. Adler)

Subgenus *WILHELMIA* Enderlein, 1921
S. (W.) equinum species-group
equinum (Linnaeus, 1758)
High Atlas, Middle Atlas
pseudequinum Séguy, 1921
mediterraneum Puri, 1925
barbaricum Séguy, 1930
High Atlas, Middle Atlas, Anti Atlas, Rif
quadrifila Grenier, Faure & Laurent, 1957
Rif. [35; 36; 37; 38]
sergenti Edwards, 1923
ariasi Séguy, 1925

High Atlas, Middle Atlas, Rif

Table 1 .List of principal sampling sites harbouring the species recorded in the Rif Mountains, with localities, altitudes and geographical coordinates.

No.	Site	Locality	ALTITUDE	Geographical Co-ordinates.
Al Hoceima Province				
1	Spring K. En Nâsser	Khandek En Nâsser	1640 m.	34°53'04" N ; 4°43'35" W
2	Spring Quanquben	Jbel Bou Bessoui	1600 m.	34°57'45" N ; 4°40'47" W
3	River Ouringa Tamdâ	Sikh	1580 m.	34°55'38" N ; 4°35'56" W
4	River Iouchirene	Tidouine	1540 m.	34°55'06" N ; 4°32'01" W
5	River Mrinet	Ouareg	1500 m.	34°57'07" N ; 4°27'16" W
6	Stream Ketama	Koudiat Ech Chiba	1480 m.	34°59'03" N ; 4°34'34" W
7	River Ketama	El Mouzarâr	1340 m.	34°52'42" N ; 4°36'57" W
8	River Sgara	Tleta Ketama	1300 m.	34°52'29" N ; 4°37'07" W
9	River Ketama	Tleta Ketama	1283 m	34°52'29" N ; 4°37'07" W
Chaouen Province				
10	Spring Bab Tariouente	Jbel Beni salah	1405 m.	35°01'04" N ; 5°00'27" W
11	River after FiFi	Bab El Karne	1280 m.	35°00'24" N ; 5°12'07" W
12	Streamlet lagoon FiFi	Fifi	1200 m.	35°01'29" N ; 5°12'25" W
13	Streamlet Bou îch	Bou Rhaît	1200 m.	35°00'56" N ; 4°57'30" W
14	Streamlet after FiFi	Ahoundar	1000 m.	34°58'03" N ; 5°13'57" W
15	River Biyada	Jbel Setsou	880 m.	35°04'19" N ; 5°09'18" W
16	River Maâmala	Beni Derkoul	840 m.	35°03'35" N ; 5°04'05" W
17	River Tazarine	Beni Oualal	200 m.	35°04'09" N ; 5°20'00" W
18	River Aarkôb	Arherarose	100 m.	35°16'22" N ; 4°50'12" W
19	River Sidi Yahya Aârab	Sidi Yahia Aârab	80 m.	35°17'33" N ; 4°53'25" W
20	River Amazithen	El Ouesteyine	80 m.	35°18'33" N ; 4°54'36" W
21	River Jenane en Nich	Jenane en Nich	60 m.	35°16'29" N ; 4°52'01" W
22	River Ouringa	Jebha	40 m.	35°11'42" N ; 4°41'18" W
Larache Province				
23	Streamlet S . El Mokhfi	Pic de Bou Hachem	1400 m.	35°15'16" N ; 5°30'43" W
24	Streamlet Bou Hachem	Pinède B. Hachem.	1200 m.	35°15'59" N ; 5°30'39" W
25	Spring El Ksour	Es Soukkâne	1200 m.	35°19'03" N ; 5°31'14" W
26	River Taïda	Taïda	590 m.	35°21'12" N ; 5°31'57" W
27	River Tisgris	Hmmadesh	580 m.	35°22'09" N ; 5°31'34" W
28	Spr. S. Brahim B. Arrif	Bâb Hachef-Aïssa	500 m.	35°18'22" N ; 5°36'57" W
29	River Stitou	S. K. Beni Arous	190 m.	35°20'56" N ; 5°33'16" W
30	River Hannacha	Koudiet Ejkhoûr	170 m.	35°19'09" N ; 4°38'12" W

Tétouan Province

31	River Ankouda	Bezouâla	80 m. 35°30'56" N ; 5°41'41" W
32	River Nakhla	Koudiet Krikra	80 m. 35°27'09" N ; 5°25'29" W
33	River kebir	Koudiet Krikra	80 m. 35°27'17" N ; 5°25'50" W
34	River Jbel Habib	Tleta de Jbel Habib	40 m. 35°28'14" N ; 5°48'06" W
35	River El Kebir	Tieta de Jbel Habib	20 m. .35°28'14" N; 5°54'05" W
36	River Rmel amont	Bou Reïhal	46 m.35°52'40" N; 5°28'24" W
37	River Ajrss aval	Aïn el Hsn	80 m.35°33'20" N; 5°31'14" W
38	River Râouz	Zaouia	100 m.35°41'53" N; 5°30'00" W

Acknowledgements

We are very grateful to Dr. R. W. Crosskey of The Natural History Museum, London, for his continuous advice and for examining some of our specimens.

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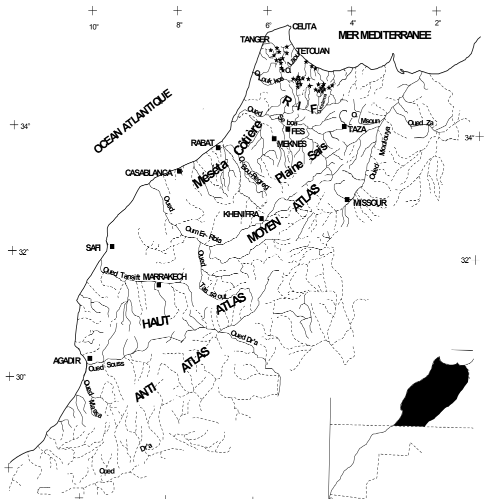

Map of Morocco showing simuliid sampling sites, positions of principal mountain ranges and other regions of previous reports.

★ = Sites providing first Rif records. Haut Atlas = High Atlas; Moyen Atlas = Middle Atlas; Oued = River (Wadi)

-201

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NOTES, VIEWS AND CORRESPONDENCE

A Brief History of Northeast Regional Project NE-118 in the USA

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The Northeast Regional Project entitled Black Fly Damage Thresholds, Biology and Control — or NE-118 as it was both officially and informally christened — was North America's all-time, premiere vehicle for facilitating research, collaboration, and information exchange on the Simuliidae. The project grew out of the First Inter-Regional Conference on North American Black Flies, which was organized and hosted by John F. Burger at Dixville Notch, New Hampshire, from 31 January to 2 February 1977. The conference at Dixville was inspired by the informal gatherings that the Canadian workers held during the 1950s and 1960s. Following the Dixville conference, Edward Piper organized a meeting held on 14 April 1977 in Boston, Massachusetts, during which Jeffrey Granett presented a draft outline of the potential project to the dozen northeastern scientists in attendance. Working from this draft, J. F. Burger, E. W. Cupp, J. D. Edman, R. W. Merritt, and J. Granett formulated the project's formal proposal. The project officially began on 1 October 1977 and expired on 30 September 1996.

Cooperative Regional Projects, such as NE-118, are supported by allotments of research funds under the United States Hatch Act (as amended 11 August 1955). Under this federal legislation, funds are allocated annually to each state for cooperative research in which two or more state agricultural experiment stations cooperate to solve problems that concern the agriculture of more than one state.

The objectives of NE-118, as originally written, were to 1) establish nuisance, economic and pathogenic threshold levels for black flies in relation to human health, human activity, agricultural animals, and wildlife; 2) analyze the population dynamics of pest black flies and factors contributing to their distribution and abundance; 3) initiate the development of safe, efficacious methods to manage pest black fly populations. Through three subsequent project renewals, each providing five additional years beyond the original five-year run, the objectives changed to emphasize systematics, larval and adult behavior, and the improvement of *Bacillus thuringiensis israelensis* (*Bti*) as a biological control agent for black flies.

NE-118 originally consisted of six participating states: Delaware, Maine, Massachusetts, Michigan, New Hampshire, and New York. Pennsylvania, Rhode Island, and West Virginia joined in 1978 and Maryland came aboard in 1979. Most states participated for the remainder of the project, although the institutions or agencies (and their representatives) sometimes changed, while a few states such as Rhode Island and Delaware left the project in the early 1980s. The representative(s) of each participating state were referred to collectively as the Technical Committee. NE-118 rapidly grew into an international forum, with participants informally, but routinely, joining the group from countries such as Canada and England. By the late 1980s, the project officially had expanded beyond the bounds of the northeastern United States to include Technical Committee representation from the participating states of Arizona, California, Florida (1985 only), Nebraska, and South Carolina. Quebec and Ontario became official participants during the final five-year renewal in 1991. The project was served by five administrative advisors: E. H. Piper (1977-1979), D. E. Leonard (1980-1983), W. C. Dunham (1984-1988), D. L. McLean (1989-1990), and R. G. Helgesen (1991-1996). Robert C. Riley served as the Cooperative State Research Service - United States Department of Agriculture (CSRS-USDA)[1] representative for the project's entire duration.

The project required an annual meeting (Table 1) and a yearly progress report from each official participant that would be used to prepare a comprehensive annual report for the CSRS office in Washington, DC. The annual meeting lasted 2-3 days, attracted an average of about 30 attendees, and typically involved 20 or more presentations. Progress reports were given by each member of the Technical Committee (alphabetically by state), followed by presentations from other attendees, a final discussion, and a business meeting to elect officers (Chair, Vice Chair, and Secretary) for a one-year term and establish the specifics for the subsequent year's meeting. In 1988, the meeting format was modified to integrate presentations by Technical Committee members with those of other attendees under the three objectives at that time (systematics, biology, and control). Meetings were run by the elected Chair of the Technical Committee. The Secretary recorded the minutes, which later were distributed to members of the Technical

Committee and to the Directors of the Agricultural Experiment Stations of the participating state universities. The format of the meetings was formal, but the milieu was informal. The meetings fostered collaborations and introduced many graduate students to the community of simuliid workers.

During its 20-year life, NE-118 was one of the most productive Regional Projects in the history of the CSRS. Nearly 20 theses were produced by graduate students who were supported, at least in part, by funds allocated to state universities through the project. More than 100 papers on simuliids were published by personnel of the official participating institutions. The project also spawned an annotated list of black flies in the northeastern United States (Cupp & Gordon 1983), the International Conference on Ecology and Population Management of Black Flies (1985), and an edited volume on black flies (Kim & Merritt 1988) that involved 48 contributors from around the world. In 1981, at the fourth annual meeting of NE-118, an ad hoc subcommittee was established to report on the progress of *Bti* and to recommend standardized laboratory and field protocols for its use against black flies; the result was an edited publication (Molloy 1982).

By the mid 1990s, due partly to the success of *Bti*, the status of black flies as major pests had diminished among the powers that be, and administrative support for a fourth renewal was not forthcoming. One might say that the success of NE-118, in part, ultimately spelled the project’s demise. In 1998, NE-118 was replaced with a new five-year project entitled Black Fly Biology, Economic Problems, and Management, or SERA-IEG-29, authored by P. H. Adler and J. W. McCreadie. This project operates in an official, but less formal, configuration under the auspices of the Southern Extension and Research Activities Information Exchange Group (SERA-IEG) of the Southern Association of Agricultural Experiment Station Directors. The Group holds annual meetings, typically in Florida, that generally attract more than 30 attendees from around the world.

[1] Precursor of the Cooperative State Research, Education, and Extension Service - USDA.

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Table 1. Annual meetings of NE-118, including locations, chairs, dates, and numbers of attendees.

Date	Location	Chair	Attendees
5-6 January 1978	University of Massachusetts, Amherst, MA	J. Granett	14
4-5 January 1979	University of Massachusetts, Amherst, MA	J. GRANETT	12
6-7 February 1980	Michigan State University, East Lansing, MI	J. D. Edman	28
10-11 February 1981	Thruway House Hotel, Albany, NY	R. W. Merritt	36
27-28 April 1982	Ramada Inn, Bangor, ME	J. F. Burger	32
26-27 April 1983	Honey in the Rock Motel, Beckley, WV	J. W. Amrine	41
13-14 February 1984	Holiday Inn, Portsmouth, NH	K. C. Kim	32
28-31 May 1985*	Pennsylvania State University, State College, PA	D. P. Molloy	98
14-16 February 1986	Michigan State University, East Lansing, MI	I. N. McDaniel	29
17-18 February 1987	National Museum of Natural History, Washington, DC	J. D. Edman	27
9-11 February 1988	Balsams Hotel, Dixville Notch, NH	J. W. Amrine	37
14-15 February 1989	Loews Le Concorde Hotel, Quebec City,	J. F. Burger	31

	Quebec		
12-13 April 1990	Sheraton Hotel, Charleston , SC	R. W. Merritt	32
14-15 April 1991	California Department of Health, Berkeley, CA	K. E. Gibbs	19
1-3 March 1992	University of Massachusetts, Amherst, MA	P. H. Adler	29
28 February - 2 March 1993	Manoir du Lac Delange, Quebec City, Quebec	K. P. Pruess	32
28 February - 1 March 1994	Archbold Biological Station, Lake Placid, FL	J. F. Burger	27
23-25 February 1995	Rancho de la Osa, Sasabe, AZ	R. W. Merritt	28
23-24 February 1996	Flamingo Lodge, Everglades National Park, FL	F. F. Hunter	29

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* The International Conference on Ecology and Population Management of Black Flies was held in lieu of the annual meeting, although the Technical Committee met briefly before the Conference.

British Simuliid Group Bulletin No. 17, June 2001

MEMBERSHIP NOTICES

Changed Addresses

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THE BRITISH SIMULIID GROUP BULLETIN No. 18, March 2002

CONTENTS

FROM THE EDITOR

Discerning readers will have noticed a change to the cover of *The Bulletin.*

For some time I have been unhappy that the Bulletin has never had a proper financial base, and have expressed this disquiet at a number of our Annual Meetings. Up till now, the printing and distribution costs have been met jointly by the Liverpool School of Tropical Medicine and the School of Biological Sciences, Liverpool University, who had absorbed the costs into their budgets. We are all indebted to the Heads of Departments who have supported *The Bulletin* in this way since 1992, but although continued support has always been implied, there has never been any certainty, and in this climate of tightening fiscal control, I have always feared that the axe might fall at any time.

It was therefore with alacrity that I accepted an offer from Rory Post and Dick Vane-Wright, Keeper of Entomology, Natural History Museum, to publish *The Bulletin* under the umbrella of the Museum. This will obviously give *The Bulletin* a more assured future, and also, when the time comes for me to relinquish the editorship, my successor will not be obliged to hunt for a sponsor.

Honorary Secretary

Trefor Williams, who has given sterling service as Honorary Secretary to the British Simuliid Group since its inception in February 1979, and was also editor of the Newsletters and the first three *Bulletins*, has indicated that he thinks it is time to hand over his duties to someone else. If any member would like to volunteer, or suggest a name, please get in touch with me so that hopefully we can decide on a successor at the next Annual Meeting.

Botha DeMeillon Obituary: a correction

In *Bulletin* No. 17, there was an inaccuracy my account of the historic “Feasability of Onchocerciasis Control” meeting held in Tunis, 1968, which DeMeillon attended, and in which I stated that De Meillon and others in the entomological working group were involved in formulating the first ever budget for OCP. Prof. Rolf Garms has a better recollection of the meeting than I, and has written to me as follows:

> “As far as I remember only three of the entomological working group were condemned to estimate the first budget of the OCP in the Volta River Basin. These were you, Hugo Jamnback and myself. Our estimate was 2.5 million dollars per year, which was a shock for the meeting. So, in the final report, this amount was quoted as an outside limit and it was suggested that it might be possible to reduce the cost to 2 or even 1.5 million. I like to present this story when, in our annual course on Tropical Medicine, I am talking about onchocerciasis control.”

Thank you Rolf for putting the record straight.

John B. Davies, Editor

24th BRITISH SIMULIID GROUP MEETING
18th October 2001, University of Birmingham.

At the 23rd. Meeting, held at Salford in the spring of 2000, it was proposed that we should try to hold the next meeting in conjunction with the freshwater biologists at Birmingham

University as we had done in 1995. Thanks to the efforts of Trefor Williams, Malcolm Greenwood and Melanie Bickerton, this came to pass, and the 24th Annual Meeting was held in the new School of Geography and Environmental Sciences, University of Birmingham on 18th October 2001.

As usual, those who arrived the evening before, assembled at the Staff House Bar to meet old acquaintances, and to fortify themselves before tackling a local Balti restaurant. About 20 members, spouses and friends turned up, and the conversation was brisk and animated. We were particularily pleased to welcome three visitors, one from Hamburg and two from Wageningen.

The meeting itself, began at 10.00 am. Unfortunalely, Prof. Geoff Petts, Pro-Vice Chancellor for Research, University of Birmingham, who expected to open the meeting was called away at the last minute, so the chair was taken by Malcolm Greenwood.

The morning session was devoted to a local blackfly biting problem that quite fortuitously had cropped up the previous August near a Water Park to the northeast of Birmingham. Thus making this meeting particularily relevant. The surprising fact is that there appear to be no previous records of blackflies causing a serious problem in this area and everyone was caught unawares, although there had been occasional reports of a mild biting nuisance around the headwaters of the River Cherwell in Oxfordshire earlier in the year. Steven Falk, of the Warwickshire Museum, presented an excellent summary of the situation, which is reproduced below. A local resident, Mrs. Sue Jones, described her personal experiences.

These presentations were followed by a lively discussion, during which the following points were made:

1. The identity of the fly needs to be confirmed. Some adult female specimens were identified as *Simulium lineatum* and *S. variegatum* by Prof. Ian Burgess, whilst another sample was identified by Roger Crosskey as *S. noelleri.*
2. Species taken by sweep-netting riverine vegetation may not necessarily be the same as those biting.
3. In view of the difficulty in identifying adult female simuliids (especially when squashed!), immature stages, particularily pupae, must be collected from the suspect rivers and identified as they are easier to identify. Adults should be reared from the pupae, for comparison with biting specimens.

The meeting concluded with a vote of thanks to Melanie Bickerton for organising the meeting so well.

The 25th Annual Meeting

No date has yet been set for the next annual meeting, however, Jon Bass was asked if he could see whether it could be held in Dorset, possibly at the River Labs.

Presentations made to the Meeting

There were eight verbal presentations, and four posters which are listed in the order of presentation. Where authors have provided abstracts, these are included. Readers wishing to receive details of the other presentations should contact the individual authors. In the case of multiple authors, the presenter's name is underlined.

Simuliidae in British river habitat assessment and water quality monitoring

***Melanie Bickerton**, University of Birmingham*

Anaphylactic Shock probably resulting from multiple Blackfly (Simulium) bites in the English Midlands

***Steven Falk,** Senior Keeper of Natural History, Warwickshire Museum, Market Place, Warwick CV34 4SA*

Between Thursday 23rd and Sunday 26th August 2001, five people were admitted to hospital with severe anaphylaxis shortly following severe biting by biting insects. Three of these had been visitors to Kingsbury Water Park in north Warwickshire, the other cases were from nearby Nuneaton and the Walmley area of north Birmingham. Such a high incidence of anaphylaxis is almost unheard of in this region and one victim (an angina sufferer) nearly died.

The accounts given by two of the victims, plus investigations by local medical experts, seemed to indicate mass *Simulium* biting was the cause, though some of the victims claimed that they had been bitten by mosquitoes. The author carried out surveys of various parts of Kingsbury Water Park on Wednesday 28th in fine weather to determine what sorts of biting insect were present. Mosquitoes were very active in the shaded damp woodland and a sample of about 20 specimens was taken. But they were not encountered in the open situations where one of the anaphylaxis victims claimed to have been subject to biting by small flying insects that did not match the description of mosquitoes. Simuliid flies by contrast were encountered in very large numbers within the open grassland, tall herb and scrub areas towards the River Tame (which passes through the north side of the site). About 100 specimens were taken. Their numbers were particularly large within rank *Deschampsia cespitosa*, *Arrhenatherum elatius* grassland and stinging nettle beds within 50 metres of the river during the morning. They were less evident during the heat of the day, but appeared to become more active again in late afternoon. Whilst specimens could be found up to a 1km from the river, numbers were much reduced. No horseflies were encountered, though it is known that *Haematopota* and *Chrysops* spp. are present at the site.

The samples were sent to Dr Ian Burgess of the Medical Entomology Centre in Cambridge who identified the mosquitoes as *Aedes cantans* Meigen and *A. cinereus* Meigen, both common species. The simuliids were *Simulium lineatum* (Meigen) and *S. variegatum* Meigen. The former simuliid was the more abundant. It probably has three generations per year and breeds in weedy streams and rivers of moderate current. The River Tame, which is fairly shallow, gravel bottomed, of moderate flow and supporting plentiful crowfoot growth seems ideal for this species. *S. variegatum* has three generations per year and favours large swift stony streams. Both species have been recorded attacking larger mammals and presumably also attack humans, though no evidence of anaphylaxis linked to their biting has been found by the author. The presence of the 'Blandford Fly' *S. posticatum*, which became infamous as a serious nuisance in Blandford Forum, Dorset, was not detected and it seems more likely that mass biting resulted from one or both of the two *Simulium* species detected in the samples **(though we are awaiting Mel Bickerton's results of a sample of possible *posticatum* from the Birmingham area)**.

Neither *Simulium* species is rare, or likely to be a new feature of the area, though improved water quality of the River Tame may have increased populations. A possible cause of the problem was the weather at the end of August, which was characterised by very warm, humid, windless conditions. This would have favoured the build up of large, mobile *Simulium* populations in the grassland adjacent to the river. Some of the victims were lightly-dressed individuals who had had been in the vicinity of the River Tame (at least one was a fisherman) away from any grazing stock. It would appear that a combination of fine weather, and access to lightly-dressed individuals where *Simulium* numbers are particularly high can result in mass biting leading to anaphylaxis. Discussion with medical experts suggests that anaphylaxis probably only results from mass biting, not isolated attacks, and different individuals are likely to vary in their degree of susceptibility. Unfortunately two of the victims feel that it was mosquitoes that were responsible. The chances are that these individuals came into contact with both categories of insects during their visit to the Water Park, but attack by a large swarm of tiny *Simulium* is far less noticeable than attack by a much smaller number of more conspicuous mosquitoes. It is thus suspected that *Simulium* flies were the cause of their illness and not mosquitoes.

Anaphylaxis resulting in death of livestock has been suspected as resulting from mass *Simulium* attacks, though no fully documented incidents have been encountered on the world wide web or literature. If any readers are aware of proven links between anaphylaxis and *Simulium*, the author would be keen to receive information. For the time being, this note should be viewed as a notification of a suspected relationship.

Warwickshire County Council, which runs Kingsbury Water

Park, North Warwickshire Borough Council and Warwickshire Health Authority have taken the following measures to reduce the risk of further anaphylaxis cases on its land:

- Placing signs along the riverside paths and leaflets at main entrances, asking people to dress appropriately (trousers, long-sleeved tops and closed shoes) to use insect repellent, and to seek medical attention immediately if they feel unwell (quoting the number of NHS Direct).
- Providing 'Black-fly awareness' training to the country park rangers to ensure that they know what the flies look like, and where they tend to be most numerous. The author prepared a sample of dead flies within a magnifying 'bug box' and accompanying photocopies of illustrations of simuliids and other biting flies, to be kept at the staff quarters at the visitor centre.
- Specific training to rangers (who are already qualified first-aiders) on the handling of anaphylaxis victims.
- Liaison with accident and emergency units of local hospitals
- Dissemination of information to other organisations likely to be affected by the issue e.g. other local authorities within the affected area, other health organisations, GPs, schools, local wildlife trusts, English Nature (West Midlands and Peterborough), plus special study groups such as The British Simuliid Group and Dipterists Forum.

Acknowledgements

The author is grateful to Dr. Huda Mohamed and Debra Khan (Warwickshire Health Authority), the staff of Kingsbury Water Park, Dr. Mel Bickerton (University of Birmingham), Dr Ian Burgess (Medical Entomology Centre) and Paul Williams (North Warwickshire Borough Council) for assistance in the production of this note.

Distribution of Simuliid species downstrearn of the Roadford Reservoir, SW England: Changes recorded over 10 years post-impoundment

***Ian Morrissey,** University of Birmingham*

Simuliidae in The Netherlands: first results gathered during an identification course

***Tj.H. van den Hoek** and **R. Wiggers**, Alterra ,- Green World Research Institute, P.O. Box 47, 6700 AA, Wageningen, The Netherlands*

In The Netherlands, routine sampling and identification of freshwater macroinvertebrates is mainly carried out by experts of local and regional governmental organisations, like Provincial Environment Agencies and Water Boards.

For years these taxonomists have encountered problems with the identification of Simuliidae due to insufficient knowledge of the taxonomy. Consequently, there are no reliable data available on the distribution and ecology of simuliid species in The Netherlands. Some major causes which have exacerbated the neglection of this group are:

II. the confusing taxonomy and the difficult morphological characteristics;
III. the lack of a reliable reference collection updated to the latest taxonomy and;
IV. the lack of knowledge about species distribution.

The latest updated list of Simuliidae found in The Netherlands was published in 1984 and listed only 12 simuliid species. When comparing this list with lists of other Northern European countries, it became evident that the Dutch list was rather short and probably far from complete.

Table 1 shows the number of Simuliidae species found in some of the Northern European countries:

Table 1: Simuliid species richness in some of the Northern European countries

Country	Number of species	Reference
Britain and Ireland	32	Bass, 1998
Denmark	22	Jenssen, 1984
Eastern Germany	35	Seitz, 1992
The Netherlands	12	Mol, 1984

Despite the loss of potentially suitable habitats due to intensive farming, a variety of running waters can still be found in The Netherlands, so a revision of the list seemed appropriate.

In order to tackle the taxonomic difficulties taxonomists encountered, we decided to organise an identification course prompted by positive feedback from Dutch experts. Jon Bass from the Centre for Ecology and Hydrology (Dorset, UK) was asked to give this course. Besides information on anatomy, morphology and ecology of Simuliidae a substantial part of the course was dedicated to the identification of larvae and pupae found in different regions in our country.

All attending taxonomists were asked to bring along simuliids collected in their region. During the course these specimens were used for identification. This resulted in a list of 21 species based on 75 sites (Table 2). All together, these sites cover all regions where Simuliidae are likely to be found.

Table 2: Comparison of the 1984 species list with the species identified during the course.

Simuliidae species	Mol (1984)	Simuliidae listed during the identification course
1*Prosimulium hirtipes*		X
2*Stegopterna richterii*		X
3*Simulium angustitarse*		X
4*Simulium lundstromi*	X	X
5*Simulium cryophilum*	X	X
6*Simulium vernum* (species complex)	X	X
7*Simulium juxtacrenobium*		X
8*Simulium dunfalense / Simulium urbanum*		X
9*Simulium costatum*	X	X
10*Simulium angustipes*	X	X
11*Simulium aureum*	X	X
12*Simulium lineatum*		X
13*Simulium equinum*	X	X
14*Simulium erythrocephalum*	X	X
15*Simulium intermedium*		X
16*Simulium ornatum* (species complex)	X	X
17*Simulium trifasciatum*	X	X
18*Simulium morsitans*	X	X
19*Simulium posticatum*		X
20*Simulium reptans*		X
21*Simulium noelleri*	X	X

The species *Stegopterna richterii*, *Simulium juxtacrenobium* and *Prosimulium hirtipes* need confirmation through pupae and/or adult identification, as they are based only on larval specimens.

Distribution and ecology

Simulium morsitans was only found in relatively wide lowland streams in the northern part of The Netherlands, all characterised by a low current and scattered patches of vegetation.

Some species/groups appeared more widely distributed over several regions, such as *Simulium ornatum* species complex, *Simulium vernum* species complex and *Simulium noelleri*. *Simulium posticatum* was only found in a fourth order stream near the eastern border with Germany. The species *Simulium aureum*, *Simulium equinum* and *Simulium cryophilum* were found in second and third order lowland streams.

Simulium intermedium and *Simulium costatum* were collected from a few lowland headwater streams. *Simulium costatum*, *Simulium angustitarse* and *Simulium lineatum* were only found in the headwaters of some upland streams in the very south.

Conclusion and further investigation

The identification course on Simuliidae turned out to be of great value. Besides, extending the already existing list with an additional eight species identified during the course, it can be regarded as the first step for Dutch taxonomists to become used to identify Simuliidae.

It is likely that The Netherlands host more species than the current 21 listed. Intensive sampling and increased taxonomical knowledge will contribute to the development of an up-to-date species list. During the course the Dutch experts agreed to send us the results of Simuliidae collected in their region. With these data we will gain a better understanding about the ecology, distribution and ecological significance of Simuliidae in the Netherlands.

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Eradication of the vector *Simulium neavei* from an onchocerciasis focus in western Uganda

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Between-village heterogeneity in the human blood index of *Simulium damnosum s.l.* and onchocerciasis modelling in Northern Cameroon

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Introduction. The role of host choice by onchocerciasis vectors at a particular time and locality, depends on species-specific preferences and probably also on a combination of vector and host density, and availability of preferred and alternative hosts. However, most mathematical models of vector-borne infections encapsulate all these factors under the single (and fixed) umbrella of the parameter representing the proportion of bloodmeals taken on humans (h), also known as the human blood index. In previous onchocerciasis models, h was kept constant for localities in northern Cameroon at 0.3[1] and 0.5.[2] With the development of species-specific DNA probes, populations of the savannah members of *S. damnosum s.l.* in West Africa are now known to harbour a geographically variable proportion of human- and nonhuman-derived *Onchocerca* larvae,[3] suggesting greater variability of the human blood index. Here we modify a previous model[1] to estimate village-specific values of h. We also obtain estimates of absolute vector density and correlate this with both h and distance from the village to vector breeding sites. Finally, we contrast model outputs of the predicted mean no. of L3/biting fly, and the relationship between the basic reproduction number (R_0) and annual biting rate under the assumptions of constant and heterogeneous h.

Model assumptions. Let H_x denote human hosts, H_y non-human (ungulate) hosts, V_x the no. of vectors feeding on humans, V_y the no. of vectors feeding on nonhumans, and g the interval between two consecutive bloodmeals. The proportion of total vectors, V, taking a bloodmeal on humans is $h_x = V_x/(V_x+V_y)$. The annual biting rate (β) can be written as $\beta = (V\,h_x)/(H_x\,g) = V_x/(H_x\,g)$ and the no. of vectors feeding on humans as $V_x = \beta\,H_x\,g$, with values for β and H_x in each village as reported,[4-6] and g equal to 3-4 days. While R_0 represents the maximum (unconstrained) reproductive potential of the parasite (the average no. of mature females produced by a female worm during her reproductive lifespan in the absence of regulatory processes), the effective reproductive number, R, can be expressed as a function of parasite density. At endemic (pre-control) equilibrium, $R = 1$, as each female worm replaces only herself during her lifetime.

Results and Discussion. We measured parasite density in terms of the pre-control mean microfilarial load (M) in the community, and obtained the values of h_x that satisfied $R(M) = 1$ for each village. Values of h_x ranged from 0.6 to 0.006, and decreased with increasing V. In northern Cameroon, the human blood index had been reported to vary between 0.2 and 0.5.[6] Estimated values of V decreased with increasing distance of the village from breeding sites.[5] We proceeded to use the new h_x values in the equation describing the rate of change with respect to time of the mean no. of L3 larvae/fly, L.[1] Allowing for heterogeneity in the human blood index improved model fit significantly. Finally, we recalculated R_0 and plotted the values against annual biting rate. Under the hypothesis of constant h_x, R_0 varies linearly with β. In contrast, the new values of R_0 are lower than those previously estimated, and the relationship with β becomes nonlinear. This implies that changes in vector density would have to be reduced to very low levels to substantially reduce the basic reproductive number of *O. volvulus* by vector control programmes.

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Estimating the prevalence and intensity of *Onchocerca volvulus* infection in *Simulium guianense s.l.* using the O-150 polymerase chain reaction assay

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Introduction. Because mass ivermectin distribution depresses *Onchocerca volvulus* infection, traditional dissection methods have become inefficient. Entomomological tools are needed which are both species-specific and highly sensitive for surveillance in controlled areas. The O-150 polymerase chain reaction (PCR) assay for the detection of *O. volvulus* has been tested and validated using *Simulium damnosum s.l.* in the Onchocerciasis Control Programme area in West Africa,[1] and *S. ochraceum* in Mexico.[2] We report its application to *S. guianense* Wise *s.l.*, the main vector in hyperendemic areas of the Amazonian focus between Venezuela and Brazil. This technique would provide estimates of the proportion flies infected (using whole bodies) or infective (using only heads), but not of the no. of larvae/fly. The former, together with biting rates (*BR*), provide a measure of the infective biting rate (*IBR*). The latter, forms part of the transmission potential (*TP*), a component of the force of infection. Knowledge of the relationship between transmission, infection, and morbidity is essential for monitoring control programmes.

Methods.

<u>*Prevalence of vector infection and comparison of dissection vs. O-150 PCR pool screening.*</u> A total of 5,979 host-seeking *S. guianense* flies were collected using from dawn to dusk during 7 consecutive days in May 2000 (rainy season) at the Yanomami locality of Coyowë-theri. The ivermectin distribution programme commenced in 1994. At the time of this study the community had received 7 rounds of (annual) treatment. After assessing parity status in the field, flies were stored in 100% ethanol, with half being processed by dissection (at CAICET) and the other half using the PCR-assay (at Alabama). Confidence limits (95% CL) for the proportion of infective flies were obtained by the exact method for dissected flies and by PoolScreen™ for PCR-tested flies,[3] with pool size = 50 flies.

<u>*Intensity of vector infection: estimating the mean infective larval load*</u>

from the proportion of infective flies. We explored the distribution of L3 larvae among pre-control *S. guianense* samples (1982–1993). In 10 out of 14 samples (*n* = 148–4,325 flies) the distribution was significantly overdispersed, with variance over mean ratio >1. For these samples, parameter *k* of the negative binomial distribution was estimated. Values of *k* ranged from 0.002 to 0.02 and increased linearly with the mean. The relationship between proportion of infective flies, *P*, and mean no. of L3 larvae/fly, *m*, was fitted (by maximum likelihood) using an underlying negative binomial distribution with $k(m) = k_0 + k_1 m$. Estimates were k_0 = 0.001 and k_1 = 0.249.

Results. *DBR* in May 2000 was 790 flies/person-day. There was no statistically significant difference between the prevalence of infective flies estimated by either method. Dissection of 2,729 flies resulted in 7 with *O. volvulus* L3 larvae (0.26%; 95% CL = 0.10–0.53). Eleven pools out of 63 (3,150 heads) were positive by PCR (0.38%; 95% CL = 0.19–0.69). *MIBR's* were 64 (25–130) and 93 (46–169) infective bites/person-month, respectively. The mean no. of L3/fly was 0.003 (0.001–0.006) by dissection (*MTP* = 73 L3/person-month). The estimated larval load in the PCR-processed flies was, however, 0.009 (0.004–0.016) L3/fly (*MTP* = 220).

Discussion. After 7 rounds of ivermectin (coverage = 46–78% of total population), the arithmetic mean mf load in Coyowë has decreased from 64 to 23 mf/mg and CMFL from 19 to 9 mf/snip. Entomological indicators are not yet reflecting this change. The pre-control percentage of infective flies was 0.21% (0.10%–0.26%) in the rainy months of April–July 1993 (*n* = 11,442). The pre-ivermectin transmission potential (0.009 L3/fly; *DBR* = 808; *MTP* = 225) is also very similar to that from the PCR-processed flies. We will continue refining statistical methods to obtain accurate estimates of transmission intensity from prevalence in vectors, and exploring the relationship between entomological and epidemiological indices. The use of any larval stage, instead of L3 only, may be more practical (no separation of heads required) and more sensitive for the purposes of entomological surveillance.[4]

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Interspecific hybridisation and potential gene flow in the *Simulium damnosum* complex

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It has been known for more than 25 years that the morphospecies *Simulium damnosum* s.l. exists as a series of chromosomally-defined cytospecies. During this time studies of morphology, proteins, cuticular hydrocarbons and DNA have largely failed to discover additional taxonomic traits by which the adult flies can be identified (except in a few cases). This is in marked contrast to species complexes in some other families such as Drosophilidae and Culicidae.

A possible explanation for this might be that within the *S. damnosum* complex regular interspecific hybridisation has slowed the genetic divergence of sibling species. There is direct evidence for interspecific hybridisation. In cytotaxonomic studies where the total number of specimens examined has been presented 14/12452 (=0.09%) hybrids and 1/12452 (=0.008%) backcross progeny have been found (Post, 1984). A further three backcross progeny have been recorded by Boakye and Meredith (1993). These are high rates of hybridisation. Indirect evidence from molecular phylogeny reconstruction (Morales Hojas, 2001) and the interspecific distribution of insecticide resistance (Boakye and Meredith, 1993) are fully consistent with this idea.

Posters displayed at the meeting

A revision of the systematics of the *Simulium damnosum* complex

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The molecular systematics of a broad selection of samples of the *Simulium damnosum* complex from various parts of Africa was studied by sequence analysis of the ND4 and 16S mtDNA fragments. Some of the samples had been collected in the 1960s and were used then by Dunbar in his early cytogenetic studies. This enabled us to compare both Dunbar's and our own results. It turned out that the *S. damnosum* complex comprises two main branches which by geographical distribution of the species are almost exactly separated by the equator and not, as considered hitherto, divided into an East and a West African clade. The northern branch covers the 'Nile' group including the 'squamosum', 'Nile' and 'sanctipauli' subcomplexes, whereas the southern branch includes the 'Sanje' and 'Kibwezi' groups. Although most of the highly anthropophilic vector species belong to the northern clade the phylogenetic relationships within the complex do not correlate with host preferences or other behavioural/ecological characteristics.

The results suggest changed systematic positions for *S. mengense* and 'Kagera', and *S. rasyani*, *S. latipollex* and *S. machadoi* are placed into the system for the first time. The cytoform 'Kaku' appears to be identical with *S. pandanophilum*.

Simulium damnosum complex in the Gulf of Guinea.

Mabintu Mustapha, RJ.Post, P.K.Flook, A.L.Millest, R.A.Cheke, P.J.McCall, MD.Wilson, S.Somiari, J.B.Davies, R.A.Mank, P. Genen, A.Sima and J.Mas.
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Biting and infection rates of *Simulium exiguum s.l.* and *S. quadrivittatum* in two hyperendemic areas of Ecuador before the initiation of ivermectin control

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Background and Objectives. In Esmeraldas Province in Ecuador there was a high prevalence of onchocerciasis among the Chachi (Amerindian) and the Black populations before the mass ivermectin distribution programme was introduced.[1] The main vectors are *Simulium exiguum* Roubaud s.l. (without cibarial armature) and *S. quadrivittatum* Loew (with armed cibarium). Other species are *S. escomeli* and *S. bipunctatum*.[2] Pre-ivermectin entomological evaluations were conducted in 1995-1996 in two hyperendemic localities of the Cayapas river with the objective of investigating spatial and temporal variation in the biting patterns and rates of infection (with *Onchocerca volvulus* larvae) of *S. exiguum* s.l. and *S. quadrivittatum*. This would provide the Ecuadorian programme for onchocerciasis control with baseline data for entomological monitoring of control progress, and indicate the months and times of the day that would maximise efficiency of entomological sampling for REntA (Rapid Entomological Assessment) methods.

Methods and Data Analysis. The study area comprised the localities of El Tigre (ET) and San Miguel (SM). Fly collection took place every other month between Nov 1995 and Nov 1996 at four sites per locality: two by the river Cayapas and two in the village. Host-seeking simuliids were collected from 08:00 to 12:00 and from 13:00 to 17:00 h for four consecutive days per month using 20 min. collection periods per hour and site. Flies were counted, identified, and divided into two groups, one to be dissected manually and the other to be analysed using O-150 PCR pool screening (results elsewhere).

Determinants of vector density. We multiplied the no. flies in 20' period x 3 to obtain the no. flies per hour. The logarithmic transformation, i.e. Log (no. flies+1) was used to normalise the distribution. A four-factor ANOVA: locality, site, month, hours of the day (and their interactions) was conducted.

Biting and Infection rates. The daily biting rate (*DBR*) was estimated as the geometric mean no. of flies per hour x 12 = No. flies per day = *DBR*. Monthly biting rates (*MBR*) were calculated multiplying *DBR* by the corresponding no. days in each month. Multiplying *MBR* times the proportion of infective flies in the sample gives Monthly Infective Biting Rates (*MIBR*), and *MBR* times the mean no. L3 larvae per dissected fly gives the Monthly Transmission Potential (*MTP*).

Results and Discussion. *S. exiguum* was more abundant in ET

(Geometric mean MBR = 2,077 bites/person-month) than in SM (GM-MBR = 706). In contrast, *S. quadrivittatum* was more abundant in SM (Gm-MBR = 1,898) than in ET (GM-MBR = 755). *S. exiguum* was more frequently collected by the river sites while *S. quadrivittatum* was more frequently collected outside the houses. For both species, biting rates were higher from March through July (end of dry season and rainy season) than during the dry season (September through January). *S. exiguum* showed a clearly bimodal pattern during the day (with peaks of biting activity early morning and late afternoon). *S. quadrivittatum* bites more frequently in the morning. *S. exiguum* had higher overall infective biting rates (MIBR = 16 and 7 in, respectively, ET and SM) than those of *S. quadrivittatum* (MIBR = 2 in both ET and SM). MTP values were higher in ET for both vector species, but while *S. exiguum* exhibited the highest MTP (~ 250) in July (rainy season), *S. quadrivittatum* had its highest MTP (~ 25) in March (end of dry season). This difference in MIBR and MTP (about 1 order of magnitude higher in *S. exiguum* than in *S. quadrivittatum*) is consistent with the results of fly feeding experiments, which demonstrate a higher vector competence of 'unarmed' *S. exiguum* (Cayapas form) in comparison to that of 'armed' *S. quadrivittatum*.[2,3]

Acknowledgements. JC Vieira was a short-term entomological consultant for the Onchocerciasis Elimination Program for the Americas (OEPA) and acknowledges the support of the Ecuadorian programme for Onchocerciasis Control. L Brackenboro conducted data analyses as part of her MSc project at the former Wellcome Trust Centre for Epidemiology of Infectious Disease, Oxford University. M-G Basáñez thanks the Wellcome Trust.

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Spatial and seasonal variation of biting and parity rates of blackfly vectors in the Amazonian onchocerciasis focus

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Introduction and Objectives. The Amazonian onchocerciasis focus encompasses Yanomami populations between Venezuela and Brazil. It has been well characterised for the highland areas, where *Simulium guianense s.l.* is an efficient vector, responsible for hyperendemic transmission[1] but less so for the lowlands. Infection prevalence has been shown to increase with altitude along two river systems.[2] This positive association could be partially explained by clinal variation in the *Simulium* species composition, blackfly abundance, and vector competence along the gradient. A recently implemented ivermectin-based control campaign has demanded investigation of entomological indicators and risk factors along this altitudinal gradient. We present information on spatial and seasonal variation in relative abundance (*RA*), daily biting rates (*DBR*), and proportion of parous flies (*PP*) of *S. oyapockense s.l.*, *S. incrustatum* and *S. guianense s.l.* in 6 sentinel localities up to 240 m above sea level (asl) along the Ocamo/Putaco (A) and Orinoco/Orinoquinto river systems (B) within the control area.

Methods and Data Analysis. The study area comprised the Yanomami villages of Ocamo, Maweti, Awei-theri, Pashopeka, Mahekoto-theri and Hasupiwei-theri. In each village, and during 1 to 5 consecutive days per visit, all blackflies that landed to bite on two human attractants were caught during 30 min. of each hour from 07:00 to 18:30 h. This amounted to 12 half-hour intervals per collecting day. Collections took place between 1995 and 1999 with most communities visited more than once as to cover both dry and rainy seasons for each community. In the field, all hourly-caught flies were identified to species,[3,4] counted, and dissected for parity status. RA was expressed as the percentage represented by each species of the total collected at each locality and season. DBR's were obtained by multiplying each 30 min. collection period by 2 (with the exception of the 18:00-18:30 h), adding the hourly totals and taking the arithmetic mean of the daily totals. DBR's were multiplied by the corresponding no. of days in the month to obtain monthly biting rates (MBR). PP is the percentage of parous flies in the sample. Multiplying MBR times PP gives the monthly parous biting rate (MPBR). Abiotic variables included rainfall and river height (routinely measured at the meteorological station of Ocamo).

Results and Discussion. *S. oyapockense* prevailed below 150 m along both river systems. Above this altitude and up to 240 m, *S. incrustatum* and *S. guianense* become more frequently and evenly collected along river system A, but not along B, where *S. incrustatum* remained absent. The *DBR* of *S. oyopockense* was higher during the dry season along river system A whereas the converse occurred along river system B. The *DBR* of *S. incrustatum* was lowest during early rains, while that of *S. guianense* was highest during this period. Values of *MPBR* suggest that the months contributing most to onchocerciasis transmission are probably the dry season and the transition periods between seasons. This has been confirmed for *S. guianense* in the locality of Coyowë-theri (250 m asl). There was a significant negative cross-correlation between *PP* of *S. oyapockense* and river height (2- and 3-month lagged), whereas river height (1- and 2-mo lagged) was positively correlated with *PP* for *S. incrustatum*. This suggests an interplay between favoured breeding sites, their proximity to villages, breeding site dynamics and survival of immature populations which varies for each species.

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NOTES, VIEWS AND CORRESPONDENCE

R.C.Muirhead-Thomson (1914-2000)

Born in Kilmaurs, Scotland on 2 May 1914, and graduated in 1936 at Glasgow University with a 1st class honours Bsc degree in Zoology, obtaining his DSc in 1942. Although devoting most of his life to studying the vectors of malaria, he did have an interest in onchocerciasis and blackfly vector control, publishing a paper on "The development of *Onchocerca volvulus* in... *S. damnosum"* in the *Am. J. trop. Med & Hyg*. Vol. 6 In 1957.

Between 1957 to 1966 he was with the World Health Organisation in India, Zimbabwe and Geneva.

In 1966 he obtained a grant from the Medical Research Council to carry out laboratory evaluations of *Simulium* larvicides. This was followed by a series of publications spanning the years 1977 to 1983 on the toxicity of permethrin, temephos, decamethrin, and chlorphoxim to *Simulium* larvae. This was at the time that the Onchocerciasis Control Programme was looking for alternative larvicides to temephos (Abate). In addition to publishing about 54 papers, he wrote seven books, of which two described the impact of insecticides on aquatic fauna, and one on the behaviour pattens of blood-sucking flies.

He was very courteous, but considered something of a loner and eccentric. He was an enthusiastic photographer, and cartoon drawer. His wife pre-deceased him in 1988, and he died on 4th October 2000, leaving no children or close relatives.

Two more detailed obituaries by Mike Service can be found in the *Annals of Tropical Medicine and Parasitology*, 95: 857-858 (2001) and *Antenna* 26 (1): 9-11, from which much of the above information has been gleaned.

John. B. Davies

A memorial note on Anna Ilyina

Anna never wrote a paper on blackflies, nor did her name even once appear on the title page of one, but her death deserves to be remembered in the *BSGBulletin.* It was she who, through her loyalty to the late I. A. Rubtsov and dedication to her work for him, ensured the very high curatorial standard of the simuliid collection in the Zoological Institute of the Soviet (now Russian) Academy of Sciences in Leningrad (now St Petersburg). Anna became Rubtsov's assistant in 1949 and remained in this post until Rubtsov's retirement in 1979 - and informally continued in effect as his assistant for several years afterwards. We met Anna when we visited St Petersburg in 1997 to work on the 'Rubtsov' collection. While we were there Anna came in daily to help us find the types and other specimens that we wanted to see, gamely climbing steps and bringing down weighty slide boxes and specimen drawers - a task that would have taxed many younger than her 75 years.

Anna Alexeevna Ilyina (= Il'ina) was born on 16 November 1924 and died on 14 January 2001. She was an unassuming person, kind and quiet and much loved by the staff of the Zoological Institute - which it would not be wholly true to say of Rubtsov himself. She was meticulous with the collection, even arranging the pinned specimens not only in beautifully neat rows but with those from the same locality in date order of their capture. Anna's work as technician mainly involved slide-making and collection maintenance but she also typed Rubtsov's manuscripts and (sometimes) accompanied him on collecting trips; early on she went with him to Irkutsk Province in Siberia and in 1951 to the Crimea in Ukraine; in 1956 she made the first of several more local trips in Leningrad Province. It was on the 1956 field trip that Anna collected the original material of S*imulium annae* which Rubtsov named for her (as *Eusimulium annae)* in his *Fauna of the USSR* simuliid volume (1956). A photograph of Anna with Rubtsov at the microscope, probably taken about this time, is on page 5 of the English language bibliography of Rubtsov's work on Simuliidae (Crosskey, 1999, *Studia dipterologica* 6: 3-32).

It has been with the help of our dipterist friend Vera Rikhter at the Zoological Institute in St Petersburg that we have been able to provide some of this thumbnail sketch and we thank her warmly.

Roger W. Crosskey and Peter H. Adler

MEMBERSHIP NOTICES

New Members

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THE BRITISH SIMULIID GROUP BULLETIN

No. 19

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CONTENTS

STEVE MOSS

MEMBERSHIP NOTICES

FROM THE EDITOR

Your *Bulletin* continues to florish, as evidenced by this somewhat thicker edition, and already about half of the next is spoken for. As next year will be our 25th jubilee, I am hoping to make the 20th *Bulletin* a special number, and if space permits hope to include an index to all 20 *Bulletins.* Nevertheless, please keep material coming in. One section that I thought we might include is a section of short anecdotes on member's experiences, amusing, interesting or even libellous. Think about it and send in your contributions.

John Davies Editor.

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STEVE MOSS

The totally unexpected death of Dr. S.T. (Steve) Moss on 25 October 2001, came as a shock to all who knew him. Steve had maintained a close relationship with the Group since its inception in 1979. As a mycologist he was one of the first to take in interest in the ecological relationship between the Simuliidae and fungae, at a time when the search for bio control agents was on, contributing in the 5th. *Newsletter,* an illustrated key to the *Trichomycetes* associated with *Simulium* larvae, which I am told still remains the definitive key to this day- in fact a request for a copy was received by the Editor earlier this year. In all, Steve contributed 5 papers, notes or talks in the *Newsletter*, and two more in the *Bulletins* He also organised the memorable 1991 meeting in Postsmouth, which was preceded by a gargantuan 7-course repast at a French restaurant the evening before.

Steve began science as an external student of London University, later obtaining an MSc from Birkbeck College, and a PhD from Reading. His interests encompassed not only freshwater aquatic fungae but the fungi of the Mary Rose wreck, and marine fungi in general.

He was an active member of the British Mycological Society, being on its Council and General Secretary for many years, finally being elected President in 2000. As a person he was gentle, kindly and most helpful to those who requested information or assistance. He was a painstaking and meticulous worker and an excellent lecturer. He has left a gap that will be hard to fill.

John Davies

Editor's Note: Some of the information above has been borrowed from an obituary by Stefan Buczacki which appeared in *The Mycologist* Vol. 16 p 87, May, 2002, kindly supplied to us by Alan Rizzo.

MEETING REPORTS

24th ANNUAL BRITISH SIMULIID GROUP MEETING 18 September 2002 – Center for Hydrology & Ecology, Dorset, U.K.

This year the meeting was held in Dorset, near Wareham at the new Center for Ecology and Hydrology (CEH) located behind a formitable security system, at Winfrith Technology Park. As usual, those members and friends who travelled down early, met for an informal dinner the evening before, this time at the Rajpoot Indian Restaurant, Wareham. Twenty-one persons were present, the numbers possibly reflecting the distance many of us had to travel. We were very pleased to welcome colleagues from Germany and Austria. Overall, it was a lively group generating some heated discussions, possibly fuelled by the cuisine.

The main meeting on the 18th was opened by Professor Alan Gray, Director of the Center for Ecology and Hydrology, Dorset who explained that the Center is a combination of the former IFE River Laboratories at East Stoke and the former Research Station at Furzebrook, and is now situated in splendid new laboratories at Winfrith. CEH is presently involved in launching a new *Atlas of the British Flora*, which shows that, in terms of biodiversity, the richest six square mile square in the United Kingdom is located in Dorset and contains the town of Wareham. This is the reason why the laboratory is sited where it is.

The morning session, attended by 21 members, included four 20-minute presentations, (abstracts below), plus two posters and was followed by a discussion on three matters of business:

1. Post of Honorary Secretary. As stated in Bulletin No. 18, Trefor Williams, who has given sterling service as Honorary Secretary to the Group since its inception in February 1979, and was also editor of the Newsletters and the first three *Bulletins*, has indicated that he thinks it is time to hand over his duties to someone else. Members had been requested to suggest nominations, but the only person proposed felt that although he was interested, his future was so uncertain that he could not accept the post at present. There being no other nominations, it was decided to defer the decision until the next meeting, with your Editor standing in as temporary Hon. Secretary.

Next Meeting The 25th Jubilee Meeting is due to fall in 2003. It was felt that some effort should be made to make the meeting a little special. One proposal was that we should try to combine with the German Simuliid Group, but they hold their meetings every two years, the next being in 2004. There seemed to be a general consensus that it should be held in London, the venue of the first meeting in 1979, with both The Natural History Museum and Imperial College being suggested. It was left to the acting Hon. Sec. to develop this further. We have since received an informal suggestion from Manfred Car and Doreen Werner that we consider joining their next meeting in Berlin, 2004.

In the afternoon, we all travelled the short distance to the old River Laboratory at East Stoke for an opportunity to collect specimens from R. Frome (accompanied by some inaccurate weilding of grappling hooks). Unfortunately, very few pupae could be found – mainly *S. equinum* - although there was an abundance of small larvae. The meeting ended with a vote of thanks to Jon Bass and his colleagues for organising an excellent meeting.

PAPERS PRESENTED AT THE MEETING

Survey of the Blackflies (Diptera: Simuliidae) from Belize

A.J.Shelley, L.M.Hernández and **M. Penn**,
Department of Entomology, The Natural History Museum, London SW7 5BD, U.K.

Five onchocerciasis foci are recorded in Central America (Guatemala and Mexico), but none in Belize. Two cases of human onchocerciasis, probably from Guatemala or Mexico, were previously recorded from

Belize and in 1959 a parasitological survey accompanied by a preliminary survey for possible simuliid vector species. No other cases of onchocerciasis were found, although three simuliid species that transmit *O. volvulus* elsewhere were recorded. It was concluded that the risk of transmission of onchocerciasis in Belize could only be assessed once the epidemiology of the disease was better understood in Guatemala and Mexico.

Forty years on the epidemiology of the disease in Latin America is well documented, Belize has developed significantly as a result of an improved road infrastructure and migration of people from neighbouring countries (especially Guatemala) has significantly increased. The present survey was carried out to provide data on the current distribution and biology of Simuliidae in Belize and an overview of the factors that might influence the dispersal of human onchocerciasis to the country.

Twelve simuliid species were collected in Belize, seven of which are known vectors. The record of *S. veracruzanum* is corrected for Belize. Primary vectors are *S. ochraceum* (in Guatemala and Mexico) and *S. metallicum* (in northern Venezuela). Most of species are widely distributed in Belize, except *S. ganalesense* which was only found in southern Belize in sympatry with *S. haematopotum*. *Heminectha* species were recorded from fast flowing rivers and waterfalls. Other simuliid species were collected in different water courses. The anthropophilic species in Belize can be divided in two groups depending on the presence or absence of cibarial teeth. Other factors that affect the host capacity are discussed. No routine examination for onchocerciasis is carried out in hospital in Belize.

Simuliidae: Key to Larvae and Pupae from Central and Western Europe, CD-ROM Edition

Wolfgang Lechthaler[1],and **Manfred Car**[2]

[1] *Technisches Büro für Biologie, Brunneng. 76/22, A-1160 Wien, Austria: wolfgang.lechthaler@chello.at*

[2] *Institut für wissenschaftliche Analyse, Adolf Hruzastr. 3, A-2345 Brunn am Gebirge, Austria: manfredcar@utanet.at*

Material and Methods

Simuliidae larvae and pupae derive from the collection of the junior author (MC), missing species were kindly provided by BASS and CROSSKEY (Britain), KNOZ (Czech Republic), MALMQUIST (Sweden), NIESIOLOWSKY (Poland), RAASTAD (Norway), and SEITZ and WERNER (Germany).

Preparation and photography was made by W.L. using a digital video-camera, which allows the production of high-quality images of objects under microscopes with low or high magnification. Images show an analysis of 752 x 494 per chip, in total, they contain of about 1.3 million picture elements.

Image acquisition, archiving, and processing was carried out by using a special software-program of SIS (Soft Imaging Systems), Analysis, V. 3.1. A various range of applications allows manual or automatical measurements of microscopic structures, to insert editable overlays with text and graphic supports or to edit images by using filters.

To eliminate the limited depth of focus, a restricting problem of light microscopy, images were produced with the software-module EFI (Extended Focal Imaging), which extracts those parts of the image that are in focus. Mounted into a single image, these details result in an image with unlimited depth of focus and maximal information.

The Key

The digital key enables the user to determine larvae and pupae of 70 blackfly species, which represent the Simuliidae fauna of 17 European countries:

Andorra	**Denmark**	**Liechtenstein**	**Slovenia**

Andorra	**Denmark**	**Liechtenstein**	**Slovenia**
Austria	**France**	**Luxembourg**	**Switzerland**
Belgium	**Germany**	**Netherlands**	
Britain **Czech Republic**	**Hungary** **Ireland**	**Poland** **Slovakia**	

It consists of 4 parts:

V. **Faunistic-ecological part:** A checklist for each country containing ecological parameters for each species can be drawn from the database.

VI. **Digital Key:** The user decides between two photos of taxonomic important features which way to follow. For each step 2 – 4 features can be compared.

VII. **Morphological Atlas:** An illustrated description of the larval and pupal morphology. The user may choose from a sequence of photos with exact explanation of taxonomic features or ask for a feature in a search window and find the adequate photo.

VIII. **Gallery:** Larval and pupal stages of each species are represented in the database of 2000 photos with about 15 - 20 pictures. Depending on the size of the screen the user may open an unlimited number of pictures to compare similarities of and differences between blackfly species.

The key covers more than two third of the North- and South-European Simuliidae fauna. Future updates will cover the missing European species.

The Effect of Different *Onchocerca-Simulium* Combinations on the Outcome of Ivermectin-Based Control Programmes

Sharon Kennedy and **María-Gloria Basáñez**

Imperial College Faculty of Medicine (St. Mary's Campus), Department of Infectious Disease Epidemiology, Norfolk Place, London W2 1PG, UK.

Rationale. *Simulium* vectors of *Onchocerca* parasites are known to vary geographically in biological, ecological and behavioural traits,[1] underlining a potential to differentially affect the outcome of ivermectin-based control programmes. Two *O. volvulus-Simulium* combinations were chosen to represent savannah and forest species of *S. damnosum s.l.* from West Africa (*S. damnosum s.s./ S. sirbanum*, and *S. leonense,* respectively) and a third one from Latin America, with a well-developed cibarial armature (*S. ochraceum s.l.* from Mesoamerica). A pre-existing mathematical model[2] was used to represent different structural assumptions in relation to the three chosen complexes, and various ivermectin-based control strategies were simulated. A sensitivity analysis was conducted to test whether the outcome of these control strategies was sensitive to variations in vector-related parameters. This study provides estimates of the time required to reduce onchocerciasis transmission according to different control strategies and vector species, and provides a foundation for further exploration of the role of inter- and intraspecific vector variation in onchocerciasis transmission and its control.

Methods*.* Three equations, representing the rates of change with respect to time of mean adult worm and microfilarial burden per person and infective larval load per fly were used.[2] Structural assumptions were defined in the model as limitation of larval development within the vector (savannah species); proportionality (forest), and initial facilitation (Mesoamerica). Exposure-dependent parasite establishment within the human host was assumed throughout. Model solutions were obtained with the Berkeley-Madonna numerical integration package. Two definitions of model sensitivity were used: 1. when choosing the most influential parameters on which to base subsequent analyses, criteria were based both on the absolute difference between the maximum and minimum outcome parasite loads obtained within the parameter range explored (Table 1), and on this difference expressed as a proportion of the maximum [(max-min)/max]; 2. when investigating the effect of the most influential parameters on the outcome of different control strategies, the variable of interest was defined in terms of the no. of years and no. of treatments required to reduce the Annual Transmission Potential (ATP) by 95% and 99% of pre-control endemic equilibrium values. Control strategies were simulated to reflect annual, biannual and triannual ivermectin treatments with low (50%), moderate (65%) and high (80%) coverage (C) of the total host population. Microfilaricidal efficacy (E) was set at 95%. Each treatment was represented in two ways: 1. A PULSE function providing an immediate reduction in microfilarial (M) numbers corresponding to M[1-(E x C)], and 2. A MOD function providing a reduction in female worm fecundity, representing a non-cumulative 30% decrease from pre-control levels over one year.[3]

Table 1: Parameter values and ranges used in study

Parameter representing:	*S. damnosum s.l.* (*S. ochraceum s.l.* when different) Nominal value	Range used in Sensitivity Analysis
Natural vector mortality (uninfected)	1/week	1 every 2 days-1 every 3 months
Linear parasite-induced vector mortality	0.5968 (0.4327)	0.05-5 per microfilaria ingested
Quadratic parasite-induced vector mortality	0.0025 (0.00027)	0.00025-0.025 (0.0003-0.003) per mf^2
Severity of density-dependent limitation*	0.0205 (0.132)	0.00205-1.32 per mf
Interval between 2 consecutive blood-meals	1 every 3 days	4/day-1 every 30 days
Proportion of L3 larvae inoculated into humans	0.5	0-1
Degree of anthropophagy	0.5	0-1
Proportion of parasites establishing successfully	~2% (~0.2%)	<1% - 30% (<0.02% - 3%)
Annual biting rate	15,000	1,000 - 300,000 bites per person per yr

* Parameter value = 0 by definition for forest species of *S. damnosum s.l.* (proportionality)

Table 2: Effect of different structural assumptions associated with each vector-parasite combination on the outcome of selected ivermectin control strategies, ABR = 15,000

Species combination	Years to 95% reduction in ATP (No. treatments)			Years to 99% reduction in ATP (No. treatments)		
	Annual	Biannual	Tri-annual	Annual	Biannual	Tri-annual
S. damnosum s.l. (savannah)	N/A	9.5 (18)	3 (8)	N/A	34 (67)	19 (55)
S. damnosum s.l. (forest)	23	4.5 (8)	3 (7)	N/A	22 (43)	11 (32)
S. ochraceum s.l.	6	3 (5)	2 (5)	14	5 (10)	3 (7)

N/A not attained; Nominal parameter values used with 65% coverage level

Results. Model outputs were most sensitive to variations in parameters representing: a) parasite establishment within the vector; b) Annual Biting Rate (ABR); c) degree of anthropophagy, and d) the proportion of infective (L3) larvae inoculated into humans, per bite. These parameters

were deemed to warrant further investigation. The model was least sensitive to variations in the survival of uninfected flies, and parasite-induced vector mortality. In general, an increase in value of any of the most influential parameters, was associated with longer times to reduce

ATP, and this effect was exacerbated when 2 or more parameters were varied simultaneously. Annual treatments failed to attain a 95% reduction in original ATP when coverage was low. Biannual and triannual treatments, even at low coverage levels, consistently reduced

ATP faster than did annual treatments at high coverage levels. Although triannual treatments reduced ATP faster than biannual treatments this was not always associated with a reduction in the overall number of treatments required (Table 2).

Discussion. Forest species of *S. damnosum s.l.* required longer treatment durations to reduce ATP than did savanna species due to the higher ABR, parasite establishment, and human-blood index assumed for forest species. However, despite a higher degree of anthropophagy and vector density, *S. ochraceum* required shorter programme durations than *S. damnosum s.l.* to attain similar reductions in ATP. This is probably due to stronger constraints on parasite establishment resulting from the presence of a cibarial armature in the former, which translates into a lower vector competence. The results of this study suggest that geographical variations in vector-parasite combinations have the potential to differentially influence the outcome of ivermectin-based control programmes and this should be investigated further.

Acknowledgements. Sharon Kennedy extends her thanks to the Medical Research Council, UK, for financial support during her 'MSc in Modern Epidemiology' at Imperial College. Christophe Fraser, John Williams, Christl Donnelly, Orli Bachall and Geoff Garnett, at the Department of Infectious Disease Epidemiology, provided useful advice for model implementation and execution of the sensitivity analysis. Rory Post, from the Natural History Museum, London, encouraged us to look at the differential impact of different simuliid species on treatment outcome and provided helpful bibliographic references and discussion.

References:

1. Shelley AJ (1994) Factors affecting filarial transmission by Simuliids. *Advances in Disease Vector Research* **10**: 183-214
2. Basáñez M-G, Ricardez-Esquinca J (2001) Models for the population biology and control of human onchocerciasis. *Trends in Parasitology* **17**: 430-438

4Plaisier AP, van Oortmarssen G, Habbema JDF, Remme JDF, Alley ES (1990) ONCHOSIM: a model and computer simulation programme for the transmission and control of onchocerciasis. *Comput. Meth. Programs Biomed.* **31**:43-56

A Proposal to make all past BSG publications available in Electronic Format

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

Since 1979 the British Simuliid Group has published 13 annual *Newsletters* and 18 *Bulletins*. As editor, I get several requests per year for articles which have been published in both journals. Most often the requests come via the Internet and I send out copies of the papers by the same method.
The *Bulletins* had their beginning at a time when word processors were becoming common, if not quite universal, amongst scientists and over the years they have been prepared using a variety of different programs and formats from Word Perfect to MS Word. The earlier *Newsletters* were issued as mimeographed sheets, which while perfectly readable, are not suitable for scanning and converting into word processor documents using an optical character recognition (OCR) program because the printing is too indistinct. Fortunately, all the *Bulletins* have been saved on diskettes and over the past few years I have been converting their files into the most common current document formats. Each page of the *Newsletters* has been scanned and saved as a facsimile graphics file.

It would seem that the next obvious step would be to make all the data available to members as a complete set. This can now be done easily by writing all the files to CD Rom, (they easily fit on a single CD), for despatch by post. I would need to make a small charge to cover the costs of materials and postage, probably of the order of £5.00 or its equivalent in other currencies. Would anyone interested in receiving a CD Rom, please contact me via e-mail at daviesjb@liv.ac.uk so that I can judge the numbers that might be required.

An alternative would be to post all the files on a Web Page, and I am looking into the feasibility of that. Some back numbers of the Bulletin are already available on the SIMULIIDAE Mail List archives, but here we are severely limited as to the amount of space available.

Posters Shown at the Meeting

Diptera Predators of World Blackflies (Simuliidae)
Doreen Werner: *Humboldt University, Berlin, Germany*

Long-term trends in mortality rates of Simulium posticatum and the persistance of non-target blackfly species in the Dorset Stour, subject to a single annual Bti treatment

Stewart Welton, Mike Ladle and Jon Bass, *CEH Dorset.*

OTHER MEETING REPORTS

Annual North American Meeting of Simuliid Workers

Peter H. Adler and Craig A. Stoops, *Department of Entomology, Clemson University, Clemson, SC 29634-0365 USA*

The 25th annual North American meeting of simuliid workers was held 26-28 January 2002 at the Archbold Biological Station in Lake Placid, Florida. This meeting was the fifth and final annual meeting held under the auspices of the Southern Extension and Research Activities Information Exchange Group. The meeting was organized and chaired by C. A. Stoops of Clemson University. Twenty-five workers attended, including 21 from the United States and four from Canada. The next annual North American meeting of simuliid workers will again be held at the Archbold Biological Station, this time from 1 to 3 February 2003 as an informal gathering with no official umbrella.

The following 16 presentations were given at the 2002 meeting:

Larval feeding behavior and time budgets for the *Simulium tuberosum* group and *Simulium jenningsi* group in the laboratory (**C. A. Stoops & P. H. Adler**, Clemson University, Clemson, SC)

Factors influencing the relative abundance of hindgut trichomycetes in larval black flies (**J. W. McCreadie**, University of South Alabama, Mobile, AL)

Laboratory assessments of potential changes in black fly treatment protocols to mitigate the effects of algae on the efficacy of *Bti* (**J. Overmyer, M. Stephens, E. W. Gray & R. Noblet**, University of Georgia, Athens, GA)

Complex is not always better (**T. Stanfield & F. Hunter** [presented by M. Spironello], Brock University, St. Catharines, Ontario)

Seven years of black fly management at Musgrove Mill Golf Club (**E. W. Gray & J. Overmyer**, University of Georgia, Athens, GA)

The role of Valent BioSciences in black fly control (**C. Royals**, Valent BioSciences , Tampa, FL)

Black flies: the melting pot habitat (**C. E. Beard**, Clemson University, Clemson, SC)

Simuliid symbionts in the Great Smoky Mountains (**W. Reeves**, Clemson University, Clemson, SC)

Genetic responses to stress in black flies (**C. Brockhouse & L. Purcell**, University of South Alabama, Mobile, AL)

How well do we know the black flies of North America (**P. H. Adler**, Clemson University, Clemson, SC **& D. C. Currie**, Royal Ontario Museum, Toronto, Ontario)

Recently discovered black flies in Pennsylvania (**D. I. Rebuck**, Department of Environmental Resources, Harrisburg, PA)

A phylogenetic investigation of *Simulium* s. s. using a total evidence approach (**M. Smith**, University of Toronto, Toronto, Ontario)

A continuing chromosomal study of the Pacific black flies, and an investigation of simuliid polytene chromosomes using FISH (**M. Spironello**, Brock University, St. Catharines, Ontario)

Crozetia – a storm in a tea cup. Or, check the types (**D. A. Craig**, University of Alberta, Edmonton, Alberta)

Whither *Crozetia*: speculation about the phylogenetic position of the

Crozet Island black flies (Diptera: Simuliidae) (**D. C. Currie**, Royal Ontario Museum, Toronto, Ontario **& D. A. Craig**, University of Alberta, Edmonton, Alberta)

Year-end summary of world use of *Bti* (**R. A. Fusco**, Valent Bio-3 Sciences, Mifflintown, PA)

SCIENTIFIC CONTRIBUTIONS

A synoptic list of the named mermithid parasites described from simuliid hosts

Roger W. Crosskey[1] and **George O. Poinar**[2]:
[1] *Department of Entomology, The Natural History Museum, London SW7 5BD, U.K.*
[2] *Department of Entomology, Oregon State University, Corvallis, Oregon 97331, U.S.A.*

When one of us (RWC) was preparing a bibliography of the simuliid works of the late I. A. Rubtsov (1902-1993)[1] it became evident how extensive had been Rubtsov's work on the mermithid nematodes in relation to blackflies. He first took up research on the mermithids fairly late in life, according to Rubtsov (to GOP) in 1959 - when he would have been 57 years old. Thereafter he became so involved with them that 40% of his simuliid publications from 1963 onwards relate also to mermithids and by the time of his death he had (in all) described over 450 nominal species of these parasitic worms[2]. (It is necessary to say 'nominal' species as many parasitologists have misgivings about Rubtsov's readiness to describe purportedly new mermithid species from the in-host larval stage alone and in the long run some of his species may well be invalidated.)

The number of mermithid taxa described or codescribed by Rubtsov from blackfly hosts is relatively small, 39 species and 14 subspecies and varieties, but it is nevertheless not easy for the blackfly worker outside Russia to get a 'handle' on these because almost all were described in Russian and the literature is sometimes difficult and scattered. It seemed useful to us, therefore, to capitalise on information about these mermithids obtained when the bibliography of Rubtsov's simuliid works was being prepared by providing a handy list of the mermithid taxa concerned, the references to their original descriptions, and their blackfly type hosts. However, such a by-product alone would be very much less useful than a complete list of all the species of Mermithidae from simuliid hosts that have been recorded in the world literature. Consequently we have put together the following list in the hope that it could prove of value as a starting point for anyone taking up the study of blackflies vis-à-vis their mermithid nematode parasites. In total we list 88 mermithid species in 10 genera from 21 countries.

Notes. (1) All nominal species, subspecies and varieties of mermithids are listed alphabetically in their originally published binomina or trinomina. (2) Bibliographic references have been checked to source. (3) The simuliid host names are given in presently valid form, as shown in the world inventory of Crosskey & Howard (1997); blackfly authors' names if required can be found in the same work. (4) Where the simuliid name used by the author in the mermithid work is no longer valid this is shown by annotation in parentheses - when enclosure in inverted commas indicates misidentification (e.g. as 'latipes' under vernum) and non-enclosure in inverted commas indicates junior synonymy (e.g. as galeratum under reptans).

Austromermis namis Poinar, 1990
Reference: Revue de Nématologie 13 (4), 395-402.
Type host: Austrosimulium multicorne.
Country: New Zealand (South Island).

Ditremamermis montana Camino, 1998
Reference: Fundamental and Applied Nematology 21 (1), 69-74.
Type host: Simulium rubiginosum.
Country: Argentina (Buenos Aires).

Ditremamermis simuliae Camino & Poinar, 1989
Reference: Neotropica 34 (92) (1988), 93-97. [Note: volume '36' printed on title page of article in error.]
Type host: Simulium bonaerense.
Country: Argentina (Buenos Aires).

Gastromermis bobrovae Rubtsov, 1974
Reference: Aquatic mermithids, Part II. 222 pp. "Nauka", Leningrad [in Russian].
Type host: Prosimulium alpestre.
Country: Russia (Siberia).

Gastromermis boophthorae Welch & Rubtsov, 1965
Reference: Canadian Entomologist 97 (6), 581-596.
Type hosts: Simulium erythrocephalum, S. morsitans, S. rostratum (as 'verecundum'), S. vernum (as 'latipes').
Country: Russia (European).

var. cinerea Welch & Rubtsov, 1965 (invalid name, variety described post-1960).
Reference: Canadian Entomologist 97 (6), 581-596.
Type hosts: Simulium erythrocephalum, S. morsitans, S. noelleri (as 'argyreatum').
Country: Russia (European).

var. coerulescens Welch & Rubtsov, 1965 (invalid name, variety described post-1960).
Type hosts: Simulium erythrocephalum, S. cryophilum.
Country: Russia (European).

var. distoma Welch & Rubtsov, 1965 (invalid name, variety described post-1960).
Reference: Canadian Entomologist 97 (6), 581-596.
Type hosts: Simulium erythrocephalum, S. noelleri (as 'argyreatum'), S. reptans (as galeratum).
Country: Russia (European).

var. glaucescens Welch & Rubtsov, 1965 (invalid name, variety described post-1960).
Reference: Canadian Entomologist 97 (6), 581-596.
Type hosts: Simulium erythrocephalum, S. morsitans, S. noelleri (as 'argyreatum'), S. rostratum (as 'verecundum').
Country: Russia (European).

var. minifrons Rubtsov, 1967 (invalid name, variety described post-1960).
Reference: Trudy Zoologicheskogo Instituta 43, 59-92 [in Russian]
Type host: Simulium morsitans.
Country: Russia (European)

ssp. mutica Rubtsov, 1971
Reference: Scripta Facultatis Scientarum Naturalium Universitatis Purkynianae Brunensis (Biologia) 2 (1), 97-132.
Type host: Simulium ornatum.
Country: Britain (Scotland).

var. vittata Welch & Rubtsov, 1965 (invalid name, variety described

post-1960).
Reference: Canadian Entomologist 97 (6), 581-596.
Type hosts: Simulium morsitans, S. noelleri (as 'argyreatum').
Country: Russia (European).

Gastromermis clinogaster Rubtsov, 1967
Reference: Trudy Zoologicheskogo Instituta 43, 59-92 [in Russian]
Type host: Simulium aureum.
Country: Russia (European).

Gastromermis cloacachilus Poinar & Takaoka, 1981
Reference: Systematic Parasitology 3, 13-19.
Type host: Gigantodax wrighti.
Country: Guatemala.

Gastromermis cordobensis Camino, 1991
Reference: Memorias do Instituto Oswaldo Cruz 86 (2), 223-227.
Type host: Simulium lahillei.
Country: Argentina (Córdoba).

Gastromermis crassicauda Rubtsov, 1967
Reference: Trudy Zoologicheskogo Instituta 43, 59-92 [in Russian]
Type host: Simulium morsitans.
Country: Russia (European).

Gastromermis crassifrons Rubtsov, 1967
Reference: Trudy Zoologicheskogo Instituta 43, 59-92 [in Russian].
Type host: Simulium erythrocephalum.
Country: Russia (European).

Gastromermis doloresi Camino, 1993
Reference: Memorias do Instituto Oswaldo Cruz 88 (4), 571-575.
Type host: Simulium wolffhuegeli.
Country: Argentina (Córdoba).

Gastromermis fidelis Doucet, 1982
Reference: Communicaciones del Museo Argentino de Ciencias Naturales "Bernardino Rivadavia" (Parasitologia) 2, 11-17.
Type host: Simulium wolffhuegeli (as wolffhuengeli, error).
Country: Argentina.

Gastromermis iguazuensis Camino & Villalobos, 1997
Reference: Nematologica mediterranea 25 (1), 105-108.
Type host: Simulium pertinax.
Country: Argentina (Misiones).

Gastromermis leberrei Mondet, Poinar & Bernardou, 1977
Reference: Canadian Journal of Zoology 55 (8), 1275-1283.
Type host: Simulium hargreavesi.
Country: Mali.

Gastromermis likhovosi Rubtsov, 1976
Reference: Zoologichesky Zhurnal 55 (4), 1292-1298 [in Russian].
Type host: Simulium equinum.
Country: Tajikistan.

Gastromermis longispicula Rubtsov, 1967
Reference: Trudy Zoologicheskogo Instituta 43, 59-92 [in Russian].
Type host: Simulium morsitans.
Country: Russia (European).

Gastromermis massei Doucet & Cagnolo, 1997
Reference: Fundamental and Applied Nematology 20 (6), 565-569.
Type host: Simulium wolffhuegeli (as

wolffhuengeli, error).
Country: Argentina (Córdoba).

Gastromermis mesostoma Poinar & Takaoka, 1986
Reference: Systematic Parasitology 8 (1), 51-55.
Type host: Simulium japonicum.
Country: Japan.

Gastromermis metae Curran & Hominick, 1981
Reference: Nematologica 27, 259-274.
Type hosts: Simulium equinum, S. ornatum.
Country: Britain (England).

Gastromermis odagmiae Rubtsov, 1967
Reference: Trudy Zoologicheskogo Instituta 43, 59-92 [in Russian].
Type host: Simulium ornatum.
Country: Russia (European).

Gastromermis philipponi Mondet, Poinar & Bernadou, 1977
Reference: Canadian Journal of Zoology 55 (8), 1275-1283.
Type host: Simulium cervicornutum.
Country: Ivory Coast.

Gastromermis rosalba Rubtsov, 1967
Reference: Trudy Zoologicheskogo Instituta 43, 59-92 [in Russian].
Type hosts: Simulium angustipes (as securiforme), S. rostratum (as 'verecundum').
Country: Russia (European).

Gastromermis simulii Belturganov, Gubaidulin & Dubitsy, 1990
Reference: Izvestiya Akademii Nauk Kazakhskoi SSR (Seriya Biologicheskaya) 6 (162), 39-48 [in Russian].
Type host: simuliid larvae (unidentified).
Country: Kazakhstan.

Gastromermis tschubarevae Rubtsov, 1974
Reference: Aquatic mermithids, Part II. 222 pp. "Nauka", Leningrad [in Russian]
Type host: Simulium variegatum.
Country: Georgia.

Gastromermis vaginiferous Camino, 1986
Reference: Neotropica 31 (86) (1985), 143-147.
Type host: Simulium wolffhuegeli.
Country: Argentina (Buenos Aires).

Gastromermis virescens Rubtsov, 1967
Reference: Trudy Zoologicheskogo Instituta 43, 59-92 [in Russian].
Type host: Simulium erythrocephalum.
Country: Russia (European).
var. acutipenis Rubtsov, 1967 (invalid name, variety described post-1960).
Reference: Trudy Zoologicheskogo Instituta 43, 59-92 [in Russian].
Type host: Simulium erythrocephalum.
Country: Russia (European).

Gastromermis viridis Welch, 1962
Reference: Annals of the Entomological Society of America 55 (5), 535-542.
Type host: Simulium vittatum.
Country: USA (Wisconsin).

Hydromermis doloresi Camino, 1993
Reference: Memorias do Instituto

Oswaldo Cruz 88 (4), 571-575.
Type host: Simulium jujuyense.
Country: Argentina (Córdoba).

Isomermis benevolus Poinar & Takaoka, 1979
Reference: Japanese Journal of Sanitary Zoology 30 (4), 305-307.
Type host: Simulium metallicum.
Country: Guatemala.

Isomermis bipapillata Poinar & Takaoka, 1986 (as bipapillatus)
Reference: Systematic Parasitology 8 (1), 51-55.
Type host: Simulum japonicum.
Country: Japan.

Isomermis brevis Rubtsov, 1972
Reference: Aquatic mermithids, Part I. 254 pp. "Nauka", Leningrad [in Russian].
Type host: Simulium morsitans.
Country: Russia (European).

Isomermis lairdi Mondet, Poinar & Bernadou, 1977
Reference: Canadian Journal of Zoology 55 (12), 2011-2017.
Type host: Simulium damnosum.
Country: Ivory Coast.

Isomermis rossica Rubtsov, 1968
Reference: Zoologichesky Zhurnal 47 (4), 510-524 [in Russian]
Type hosts: Simulium cryophilum, S. erythrocephalum, S. lundstromi (as kerzhneri), S. morsitans, S. rostratum (as 'verecundum'), S. vernum (as 'latipes').
Country: Russia (European).

Isomermis tansaniensis Rubtsov, 1972
Reference: Aquatic mermithids, Part I. 254 pp. "Nauka", Leningrad [in Russian].
Type host: Simulium damnosum.
Country: Tanzania.

Isomermis vulvachila Poinar & Takaoka, 1981.
Reference: Systematic Parasitology 3 (1), 13-19.
Type host: Mayacnephia pachecolunai.
Country: Guatemala.

Isomermis wisconsinensis Welch, 1962
Reference: Annals of the Entomological Society of America 55 (5), 535-542.
Type host: Simulium vittatum.
Country: USA (Wisconsin).

Limnomermis caudata Gafurov, 1982
Reference: Izvestiya Akademii Nauk Tadzhikskoi (Otdelenie Biologicheskik Nauk) 1979 (2), 33-39 [in Russian].
Type host: simuliid larvae (unidentified)
Country: Tajikistan.

Limnomermis cryophili Rubtsov, 1967
Reference: Zoologichesky Zhurnal 46 (1), 24-34.
Type hosts: Simulium cryophilum, S. vernum (as 'latipes').
Country: Russia (European).

Limnomermis europea Rubtsov, 1971
Reference: Scripta Facultatis Scientarum Naturalium Universitatis Purkynianae Brunensis (Biologia) 2 (1), 97-132.
Type host: 'Eusimulium' sp. (Simulium subgenus not

determinable).
Country: Britain (Scotland).

Limnomermis macronuclei Rubtsov, 1967
Reference: Zoologichesky Zhurnal 46 (1), 24-34.
Type hosts: Simulium cryophilum, S. vernum (as 'latipes').
Country: Russia (European).

Limnomermis subtropicalis Villalobos & Camino, 1997
Reference: Memorias do Instituto Oswaldo Cruz 92 (3), 339-341.
Type host: Simulium orbitale.
Country: Argentina (Misiones).

Mesomermis adulta Gafurov, 1979
Reference: Izvestiya Akademii Nauk Tadzhikskoi (Otdelenie Biologicheskik Nauk) 1979 (2), 33-39 [in Russian].
Type host: simuliid larvae (unidentified).
Country: Tajikistan.

Mesomermis alaica Gafurov, 1982
Reference: Izvestiya Akademii Nauk Tadzhikskoi (Otdelenie Biologicheskik Nauk) 1982 (4), 91-93 [in Russian].
Type host: simuliid larvae (unidentified).
Country: Kyrgyzstan.

Mesomermis albicans Rubtsov, 1966
Reference: In - Cherepanov (ed.), New species in the fauna of Siberia and adjoining regions, 109-147 [in Russian].
Type hosts: Simulium cryophilum, S. morsitans, S. noelleri (as 'argyreatum'), S. reptans (as galeratum), S. vernum (as 'latipes').
Country: Russia (European).

Mesomermis arctica Rubtsov, 1972
Reference: Aquatic mermithids, Part I. 254 pp. "Nauka", Leningrad [in Russian].
Type host: Simulium giganteum.
Country: Russia (European).

Mesomermis baicalensis Rubtsov, 1972 (availability date)
Reference: Aquatic mermithids, Part I. 254 pp. "Nauka", Leningrad [in Russian].
melusinae var. baicalensis Rubtsov, 1966 (invalid name, variety described post-1960).
Reference: In - Cherepanov (ed.), New species in the fauna of Siberia and adjoining regions, 109-147 [in Russian].
Type host: Prosimulium alpestre.
Country: Russia (Siberia).

Mesomermis bistrata Rubtsov, 1966
Reference: In - Cherepanov (ed.), New species in the fauna of Siberia and adjoining regions, 109-147 [in Russian].
Type host: Simulium vernum (as 'latipes').
Country: Russia (European).

Mesomermis brevis Rubtsov, 1966
Reference: Doklady Akademii Nauk SSSR 169 (5), 1236-1238 [in Russian].
Type host: Prosimulium isos.
Country: Russia (Siberia).

Mesomermis camdenensis Molloy, 1979
Reference: Journal of Nematology 11 (4), 321-328.
Type host: Simulium tuberosum.

(Other cited host: S. venustum.)
Country: USA (New York).

Mesomermis canescens Rubtsov, 1972 (availability date).
Reference: Aquatic mermithids, Part I. 254 pp. "Nauka", Leningrad [in Russian]. melusinae var. canescens Rubtsov, 1966 (invalid name, variety described post-1960).
Reference: In - Cherepanov (ed.), New species in the fauna of Siberia and adjoining regions, 109-147 [in Russian].
Type host: Simulium noelleri (as 'argyreatum').
Country: Russia (European).

Mesomermis caucasica Rubtsov, 1972
Reference: Aquatic mermithids, Part I. 254 pp. "Nauka", Leningrad [in Russian].
Type host: Simulium variegatum.
Country: Georgia.

Mesomermis crassa Belturganov, Gubaidulin & Dubitsky, 1990
Reference: Izvestiya Akademii Nauk Kazakhskoi SSR (Seriya Biologicheskaya) 6 (162), 39-48 [in Russian]
Type host: simuliid larvae (unidentified).
Country: Kazakhstan.

Mesomermis crassivaginae Camino, 1985
Reference: Revista del Museo de la Plata (Nueva Serie) (Zoologia) 14 (150), 1-19.
Type host: Gigantodax chilensis.
(Other cited host: Cnesia dissimilis.)
Country: Argentina (Neuquén).

Mesomermis dissimilis Camino, 1985
Reference: Revista del Museo de la Plata (Nueva Serie) (Zoologia) 14 (150), 1-19.
Type host: Cnesia dissimilis.
Country: Argentina (Neuquén).

Mesomermis ethiopica Rubtsov, 1972
Reference: Aquatic mermithids, Part I. 254 pp. "Nauka", Leningrad [in Russian].
Type host: Simulium damnosum.
Country: Tanzania.

Mesomermis flumenalis Welch, 1962
Reference: Annals of the Entomological Society of America 55 (5), 535-542.
Type host: Simulium venustum.
Country: Canada (Ontario).

Mesomermis gafurovi Belturganov, Gubaidulin & Dubitsky, 1990
Reference: Izvestiya Akademii Nauk Kazakhskoi SSR (Seriya Biologicheskaya) 6 (162), 39-48 [in Russian]
Type host: simuliid larvae (unidentified).
Country: Kazakhstan.

Mesomermis guatemalae Poinar & Takaoka, 1981
Reference: Systematic Parasitology 3 (1), 13-19.
Type host: Simulium metallicum.
Country: Guatemala.

Mesomermis japonica Poinar & Saito, 1979
Reference: Japanese Journal of Sanitary Zoology 30 (2), 147-149.
Type host: Simulium japonicum.
Country: Japan.

Mesomermis khodzhikenti Gafurov & Lebedeva, 1988
Reference: Doklady Akademii Nauk Uzbekskoi SSR 1988 (1), 48-50 [in Russian].
Type hosts: Simulium baracorne, S. desertorum, S. equinum (as avetjania, error for avetjanae), S. ferganicum, S. flaveolum, S. litshkense, S. quattuordecimfilum. (Also S. 'pygmaeum' sensu Rubtsov, as pygma error, ? identity.)
Country: Uzbekistan.

Mesomermis kondarensis Gafurov, 1979
Reference: Izvestiya Akademii Nauk Tadzhikskoi (Otdelenie Biologicheskikh Nauk) 1979 (2), 33-39 [in Russian].
Type host: simuliid larvae (unidentified).
Country: Tajikistan.

Mesomermis longicaudiensis Belturganov, Gubaidulin & Dubitsky, 1990
Reference: Izvestiya Akademii Nauk Kazakhskoi SSR (Seriya Biologicheskaya) 6 (162), 39-48 [in Russian].
Type host: simuliid larvae (unidentified).
Country: Kazakhstan.

Mesomermis macroforameni Gafurov, Belturganov & Gubaidulin, 1989
Reference: Izvestiya Akademii Nauk Kazakhskoi SSR (Seriya Biologicheskaya) 4 (154), 34-39 [in Russian].
Type hosts: Simulium hiemale (as ssp. of alajense), S. caucasicum, S. ornatum-group sp., Sulcicnephia sp.
Country: Kazakhstan.

Mesomermis mediterranea Rubtsov, 1971
Reference: Scripta Facultatis Scientarum Naturalium Universitatis Purknyianae Brunensis (Biologia) 2 (1), 97-132.
Type host: Simulium pseudequinum (as mediterranea).
Country: Morocco.

Mesomermis melusinae Rubtsov, 1966
Reference: In - Cherepanov (ed.), New species in the fauna of Siberia and adjoining regions, 109-147 [in Russian].
Type hosts: Simulium cryophilum, S. erythrocephalum, S. morsitans, S. noelleri (as 'argyreatum'), S. ornatum, S. rostratum (as 'verecundum'), S. vernum (as 'latipes').
Country: Russia (European).

melusinae var. biseriata Rubtsov, 1966 (invalid name, variety described post-1960).
Reference: In - Cherepanov (ed.), New species in the fauna of Siberia and adjoining regions, 109-147 [in Russian].
Type host: Simulium morsitans.
Country: Russia (European).

Mesomermis minuta Rubtsov, 1972
Reference: Aquatic mermithids, Part I. 254 pp. "Nauka", Leningrad [in Russian].
Type host: Simulium morsitans.
Country: Russia (European).

Mesomermis nortensis Camino, 1991.
Reference: Neotropica 37 (97), 3-7.
Type host: Simulium lahillei.

Country: Argentina (Tucumán).

Mesomermis ochrae Camino, 1985
Reference: Revista del Museo de La Plata (Nueva Serie) (Zoologia) 14 (150), 1-19.
Type host: Simulium delponteianum.
Country: Argentina (Buenos Aires).

Mesomermis odeschti Gafurov, 1979
Reference: Izvestiya Akademii Nauk Tadzhikskoi (Otdelenie Biologicheskikh Nauk) 1982 (1), 33-39 [in Russian].
Type host: simuliid larvae (unidentified).
Country: Tajikistan.

Mesomermis ornata Rubtsov, 1966
Reference: In - Cherepanov (ed.), New species in the fauna of Siberia and adjoining regions, 109-147 [in Russian].
Type host: Simulium ornatum.
Country: Russia (European).

Mesomermis ornatissima Camino, 1994
Reference: Research and Reviews in Parasitology 54 (1), 29-31
Type host: Simulium bonaerense.
Country: Argentina (Buenos Aires).

Mesomermis paradisus Poinar & Hess, 1979
Reference: Nematologica 25, 368-372.
Type host: Prosimulium exigens.
Country: USA (California).

Mesomermis paralella Rubtsov, 1972
Reference: Aquatic mermithids, Part I. 254 pp. "Nauka", Leningrad [in Russian].
Type host: Prosimulium alpestre.
Country: Russia (Siberia).

Mesomermis patrushevae Rubtsov, 1972
Reference: Aquatic mermithids, Part I. 254 pp. "Nauka", Leningrad [in Russian].
Type host: simuliid larvae (unidentified).
Country: Russia (Siberia).

Mesomermis pivaniensis Rubtsov, 1980
Reference: In - Sonin (ed.), Helminths of insects, 155 pp. "Nauka", Moscow [in Russian].
Type host: Simulium vulgare.
Country: Russia (European).

Mesomermis prisjaznoi Rubtsov, 1972
Reference: Aquatic mermithids, Part I. 254 pp. "Nauka", Leningrad [in Russian].
Type host: simuliid larvae (unidentified).
Country: Russia (European).

Mesomermis robusta Gafurov, Belturganov & Gubaidulin, 1989
Reference: Izvestiya Akademii Nauk Kazakhskoi SSR (Seriya Biologicheskaya) 4 (154), 34-39 [in Russian].
Type hosts: Simulium hiemale (as ssp. of alajense), S. bezzii-group sp. (as Tetisimulium sp.).
Country: Kazakhstan.

Mesomermis sibirica Rubtsov, 1972
Reference: Aquatic mermithids, Part I. 254 pp. "Nauka", Leningrad [in Russian].
Type host: Simulium murmanum (as relictum).

Country: Russia (Siberia).

Mesomermis simuliae Müller, 1931
Reference: Zeitschrift für Morphologie und Ökologie der Tiere 24: 82-147.
Type host: 'Simulia' (unidentified to species).
Country: Germany.
ssp. acricauda Rubtsov, 1971
Reference: Scripta Facultatis Scientarum Naturalium Universitatis Purkynianae Brunensis (Biologia) 2 (1), 97-132.
Type host: Simulium ornatum, Simulium s. str. sp. (as Odagmia sp.).
Country: Britain (Scotland).
ssp. acutangula Rubtsov, 1971
Reference: Scripta Facultatis Scientarum Naturalium Universitatis Purkynianae Brunensis (Biologia) 2 (1), 97-132.
Type hosts: Simulium argenteostriatum, S. monticola.
Country: Slovakia.
ssp. obtusicauda Rubtsov, 1971
Reference: Scripta Facultatis Scientarum Naturalium Universitatis Purkynianae Brunensis (Biologia) 2 (1), 97-132.
Type host: Prosimulium hirtipes (sensu Rubtsov, applies to allied sp., ? mixtum).
Country: USA (New York State).

ssp. rotunda Rubtsov, 1971
Reference: Scripta Facultatis Scientarum Naturalium Universitatis Purkynianae Brunensis (Biologia) 2 (1), 97-132.
Type host: Simulium s. str. sp. (as Odagmia sp.).
Country: Czech Republic.

Mesomermis subandina Camino, 1985
Reference: Revista del Museo de La Plata (Nueva Serie) (Zoología) 14 (150), 1-19.
Type host: Gigantodax chilensis.
Country: Argentina (Neuquén).

Mesomermis talgarica Belturganov, Gubaidulin & Dubitsky, 1990
Reference: Izvestiya Akademii Nauk Kazakhskoi SSR (Seriya Biologicheskaya) 6 (162), 39-48 [in Russian].
Type host: simuliid larvae (unidentified).
Country: Kazakhstan.

Mesomermis tumenensis Rubtsov & Novitskaya, 1975
Reference: Materialy Nauchnykh Konferentsy Vsesoyuznogo Obshchestva Gel'mintologov 26 (1974), 239-246 [in Russian].
Type host: simuliid larvae, description not relatable to specific hosts among several possible host species from which worms may have emerged (seven simuliid species named as present in the Ob River provenance).
Country: Russia (Siberia).

Mesomermis vashkovii Rubtsov & Novitskaya, 1975
Reference: Materialy Nauchnykh Konferentsy Vsesoyuznogo Obshchestva Gel'mintologov 26 (1974), 239-246 [in Russian].
Type host: simuliid larvae, description not relatable to specific hosts among several possible host species from which worms may have emerged (seven simuliid species named as present in the Ob River provenance).
Country: Russia (Siberia).

Mesomermis vernalis Rubtsov, 1966

Reference: In - Cherepanov (ed.), New species in the fauna of Siberia and adjoining regions, 109-147 [in Russian].
Type hosts: Simulium cryophilum, S. morsitans, S. vernum (as 'latipes').
Country: Russia (European).

Neomesomermis travisi Vargas, Rubtsov & Fallas, 1980
Reference: Revista de Biología Tropical 28 (1), 73-89.
Type hosts: Simulium metallicum, S. panamense.
Country: Costa Rica.

Octomyomermis bonaerensis Camino, 1988
Reference: Revista Ibérica de Parasitologia 48 (2), 183-186.
Type host: Simulium bonaerense.
Country: Argentina (Buenos Aires).

Octomyomermis longispiculae Camino, 1992
Reference: Neotropica 38 (100), 105-109.
Type host: Simulium wolffhuegeli.
Country: Argentina (Buenos Aires).

Spiculimermis fluvialis Rubtsov & Mitrochin, 1973
Reference: In - Cherepanov (ed.), New and little-known species in the fauna of Siberia 7, 5-17 [in Russian].
Type hosts: Simulium erythrocephalum, S. morsitans.
Country: Russia (Siberia).

Rapid cross-reference list by simuliid host species name

Simuliid species names are alphabetical regardless of generic position. Morphospecies known to be aggregates of chromosomal cytoforms are marked '(complex)'; in such cases nothing is known that ties the mermithid parasite records unequivocally to particular cytoforms. Hosts pertaining to the varieties and subspecies of mermithid parasites are listed for simplicity under the appropriate species.

alpestre, Prosimulium - Gastromermis bobrovae, Mesomermis baicalensis, M. paralella
angustipes, Simulium - Gastromermis rosalba
argenteostriatum, Simulium - Mesomermis simuliae
'argyreatum': misidentification, see noelleri
aureum, Simulium - Gastromermis clinogaster
avetjanae: synonym, see equinum
baracorne, Simulium - Mesomermis khodzhikenti
bezzii species-group, Simulium - Mesomermis robusta
bonaerense, Simulium - Ditremamermis simuliae, Mesomermis ornatissima, Octomyomermis bonaerensis
caucasicum, Simulium - Mesomermis macroforameni
cervicornutum, Simulium - Gastromermis philipponi
chilensis, Gigantodax - Mesomermis crassivaginae, M. subandina
cryophilum (complex), Simulium - Gastromermis boophthorae, Isomermis

rossica, Limnomermis cryophili, L. macronuclei, Mesomermis albicans, M. melusinae, M. vernalis
damnosum (complex), Simulium - Isomermis lairdi, I. tansaniensis, Mesomermis ethiopica
delponteianum, Simulium - Mesomermis ochrae
desertorum, Simulium - Mesomermis khodzhikenti
dissimilis, Cnesia - Mesomermis crassivaginae, M. dissimilis
equinum, Simulium - Gastromermis likhovosi, G. metae, Mesomermis khodzhikenti
erythrocephalum, Simulium - Gastromermis boophthorae, G. crassifrons, G. virescens, Isomermis rossica, Mesomermis melusinae, Spiculimermis fluvialis
Eusimulium sp. - Limnomermis europea
exigens, Prosimulium - Mesomermis paradisus
ferganicum, Simulium - Mesomermis khodzhikenti
flaveolum, Simulium - Mesomermis khodzhikenti
galeratum: synonym, see reptans
giganteum, Simulium - Mesomermis arctica
hargreavesi, Simulium - Gastromermis leberrei
hiemale, Simulium - Mesomermis macroforameni, M. robusta
hirtipes (sensu Rubtsov), Prosimulium - Mesomermis simuliae
isos, Prosimulium - Mesomermis brevis
japonicum, Simulium - Gastromermis mesostoma, Isomermis bipapillata, Mesomermis japonica
jujuyense, Simulium - Hydromermis doloresi
kerzhneri: synonym, see lundstromi
lahillei, Simulium - Gastromermis cordobensis, Mesomermis nortensis
'latipes': misidentification, see vernum (complex)
litshkense, Simulium - Mesomermis khodzhikenti
lundstromi, Simulium - Isomermis rossica
mediterranea: synonym, see pseudequinum
metallicum (complex), Simulium - Isomermis benevolus, Mesomermis guatemalae, M. travisi
monticola, Simulium - Mesomermis simuliae
morsitans, Simulium - Gastromermis boophthorae, G. crassicauda, G. longispicula, Isomermis brevis, I. rossica, Mesomermis albicans, M. melusinae, M. minuta, M. vernalis, Spiculimermis fluvialis
multicorne, Austrosimulium - Austromermis namis
murmanum, Simulium - Mesomermis sibirica
noelleri, Simulium - Gastromermis boophthorae, Mesomermis albicans, M. canescens, M. melusinae
orbitale, Simulium - Limnomermis subtropicalis
ornatum (complex), Simulium - Gastromermis boophthorae, G. metae, G. odagmiae, M. melusinae, M. ornata, M. simuliae
ornatum species-group, Simulium - Mesomermis macroforameni
pachecolunai, Mayacnephia - Isomermis vulvachila

panamense, Simulium - Neomesomermis travisi
pertinax, Simulium - Gastromermis iguazuensis
pseudequinum, Simulium - Mesomermis mediterranea
pygmaeum (sensu Rubtsov), Simulium - Mesomermis khodzhikenti
quattuordecimfilum, Simulium - Mesomermis khodzhikenti
relictum: synonym, see murmanum
reptans, Simulium - Gastromermis boophthorae, Mesomermis albicans
rostratum, Simulium - Gastromermis boophthorae, G. rosalba, Isomermis rossica, M. melusinae
rubiginosum, Simulium - Ditremamermis montana
securiforme: synonym, see angustipes
Simulium sensu stricto sp. - Mesomermis simuliae
Sulcicnephia sp. indet. - Mesomermis macroforameni
tuberosum (complex), Simulium - Mesomermis camdenensis
variegatum, Simulium - Gastromermis tschubarevae, Mesomermis caucasica
venustum (complex), Simulium - Mesomermis camdenensis, M. flumenalis
'verecundum': misidentification, see rostratum
vernum (complex), Simulium - Gastromermis boophthorae, Isomermis rossica, Limnomermis cryophili, L. macronuclei, Mesomermis albicans, M. bistrata, M. melusinae, M. vernalis
vittatum (complex), Simulium - Gastromermis viridis, Isomermis wisconsinensis
vulgare, Simulium - Mesomermis pivaniensis
wolffhuegeli, Simulium - Gastromermis doloresi, G. fidelis, G. massei, G. vaginiferous, M. longispiculae
wrighti, Gigantodax - Gastromermis cloacachilus

Unidentified larval hosts (Soviet Union literature) - Gastromermis simulii, Limnomermis caudata, Mesomermis adulta, M. alaica, M. crassa, M. gafurovi, M. kondarensis, M. longicaudiensis, M. odeschti, M. patrushevae, M. prisjaznoi, M. talgarica, M. tumenensis, M. vashkovii

Appendix re Rubtsov & Doby (1971)

Rubtsov, I.A. & Doby, J.M. 1971. Mermithides parasites de Simulies (Diptères) en provenance du nord et de l'ouest de la France. Bulletin de la Société zoologique de France 95 (1970): 803-836. [French with English summary: publication date 5.vii.1971 stated on last page (p. 898) of journal part]

This work describes two purportedly new species and seven new subspecies of mermithids based on free-living adult worms and/or post-parasitic juveniles collected from various rivers in northwestern and northern France. The title of the paper is misleading in its implication that the new taxa are parasitic on Simuliidae. The authors have drawn this inference simply from the fact that simuliids are present in the type locality streams. In all, twelve blackfly species are listed as present in the various streams. The mermithids described in the work are:

Gastromermis ambianensis Rubtsov & Doby, 1971 (p. 810)
? Hydromermis angusta Rubtsov & Doby, 1971 (p. 813)
Isomermis rossica gallica Rubtsov [sole author] in Rubtsov & Doby, 1971 (p. 807)
Mesomermis simuliae avrensis Rubtsov & Doby, 1971 (p. 834)
Mesomermis simuliae brachyamphidis Rubtsov & Doby, 1971 (p. 827)
Mesomermis simuliae brevipenis Rubtsov & Doby, 1971 (p. 821)
Mesomermis simuliae latichordata Rubtsov & Doby, 1971 (p. 822)
Mesomermis simuliae longipenis Rubtsov & Doby, 1971 (p. 821)
Mesomermis simuliae paimponti Rubtsov & Doby, 1971 (p. 829)

Rubtsov in Laird (1981: Blackflies: the future for biological methods in integrated control, p. 176) listed the mermithids "that have so far been reported from blackflies". The list included eight of these nominal taxa (M. s. longipenis misspelt longipes) and omitted '? Hydromermis angusta' (presumably because of doubtful generic affiliation). All the names have to be omitted from the mermithid/simuliid host parasite list in the absence of any concrete proof of association.

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THE BRITISH SIMULIID GROUP BULLETIN

No. 20

June 2003

CONTENTS

MEMBERSHIP NOTICES	11
Special pull-out Supplement Index to Bulletins Nos. 1 to 20	i to xii

FROM THE EDITOR

As this is the 20th Bulletin it is commerated by the inclusion of an Index to all 20 Bulletins, produced at long last – thanks to Peggy and Roger Crosskey – who took on a task that I had avoided doing ever since I took over the Editorship. The first Editor, Trefor Williams had dutifully indexed Bulletins 1 to 3, but I confess that I balked at the job. I am sure that we are all grateful.

Whilst the Index takes up the greater part of the number, there are also juxtaopposed two Travellers' Tales from the Amazon Basin, written nearly 200 years apart, showing that the *Simulium* biting problem has scarsely changed. There is also a memorial note to Mme Monique Clergue-Gazeau,

John Davies, Editor

25th Jubilee BSG Meeting - September 2003

Comment: Creation date: 01/04/2003

The next **British Simuliid Group Meeting** will be held on Wednesday 24th September 2003 in the Palaeontology seminar room of the Natural History Museum, South Kensington, London, and will be organised by Tony Shelley. Since this is our 25th meeting, we hope to be able to attract as many members as possible.

If you have not already done so, please inform him of your intention to attend and indicate whether you intend giving a presentation, talk, or show a poster

Details of the programme, lunch arrangements and the pre-meeting dinner will be posted to those who have responded when we have more information. A list of suitable hotels can be obtained from Tony Shelley, or can be found under Important Announcements on the “Blackflies” website at http://www.entomologist.free-online.co.uk .

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NOTES, VIEWS AND CORRESPONDENCE

Mme Monique Clergue-Gazeau: memorial note

The death of Monique Clergue-Gazeau in the year 2000 has brought almost to an end, hopefully only temporarily, a distinguished record of simuliid studies in France since World War 2 - starting with Paul Grenier at the Institut Pasteur in Paris in the 1940s and 1950s, followed by Jean-Marie Doby at the University of Rennes and Auguste Dorier at the University of Grenoble in the 1950s and 1960s, and continuing most recently with Françoise Beaucournu-Saguez of Rennes (died 2000, see Bulletin 16: 8-10) and Monique Clergue-Gazeau of the Paul Sabatier University in Toulouse. Beaucournu-Saguez and Clergue-Gazeau carried the flame for simuliidology in France from the mid-1970s almost to the present time and their loss is a blow to blackfly studies in general; they spread their taxonomic and faunal nets wider than their home territories and published valuable works embracing not only simuliids in France but also North Africa and parts of the Middle East. Luckily, Jean

Giudicelli of Marseille, though formally retired, remains in harness continuing his studies on the blackflies of Morocco and Lebanon.

Monique Gazeau was born on 20th November 1931. In the manner common in France, she added her husband's name Clergue upon her marriage. Throughout her professional life she was associated with the Centre National de la Recherche Scientifique, to which she was affiliated as a research fellow in October 1964. She was not part of the teaching faculty and thus was able to devote her time to biological research, attached to the Laboratoire d'Hydrobiologie of the Paul Sabatier University in Toulouse. Over several years she alternated her life between the out-station laboratory of the C.N.R.S. located in the foothills of the Pyrenees at the village of Moulis, whence her fieldwork in the mountains could be easily undertaken, and her permanent base in Toulouse, where she returned when in need of full-scale university facilities to bring her field studies to publication.

Monique C.-G.'s early biological research was on the urodele Amphibia, her specialist student thesis (1963) providing a comparative study of lake and cave-dwelling species, and her doctoral thesis (1972) being on the reproductive and developmental life of the cavernicolous species of these amphibians in the Pyrenees. These studies were a far cry from her later involvement with the Simuliidae. That came about in 1983 at a time when the laboratory to which she was attached decided upon a change of direction in its research thrust and needed someone to specialise in this family of benthic insects. It was this change which, fortunately for everyone interested in the Simuliidae of the western palaearctic area, brought M. C.-G. into the fold of blackfly research. The Simuliidae, one could say, were wished upon her, but she became deeply committed to this family and between 1985 and 1993 published (sometimes with colleagues) a dozen significant papers. Of these one should highlight her important keys to the simuliids of the Pyrenees[9], a work based largely on her own fieldwork. In another direction, notable works are those resulting from her investigations on the impact of hydro-electric dams on the lotic fauna[3,5] The 1980s was a busy time in France for collaborative projects with students from countries under erstwhile French influence, and Monique C.-G. became drawn to an interest in the circum-Mediterranean simuliid fauna, coauthoring papers on blackflies in Lebanon[1] and North Africa [2,4,10] but not personally collecting in these areas. She did, however, visit Tunisia to be part of the thesis jury for Moncef Boumaiza, a colleague with whom she wrote two of her papers[2,4]. Her last publications, in 1993[1][1,12] , were with Dr Gilles Vinçon, a close colleague in hydrobiology. Through all these activities her interest in vertebrate biology never waned and we have learned that through her latter years she continued to participate in studies on reptilian embryology!

Monique Clergue-Gazeau was a person of great kindness who was always specially helpful to her younger colleagues, supremely honest in all matters, and never for long discouraged by the setbacks she encountered. She retired on 1st January 1992. Sadly, soon after the death of her husband in a car crash in 1999, she fell victim to bone cancer.

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TRAVELLERS' TALES

Provocation of the pium

Contributed by R.W.Crosskey

It isn't often that blackflies come to the notice of media correspondents so it is novel to see that John Simpson, doyen of BBC foreign correspondents, having been to the Amazon, has something to say about them in his wander down memory lane - disclaimed as an autobiography - *Strange Places, Questionable People, Macmillan 1998.*

"We made a bumpy landing along a grassy patch cut out of the forest. A group of almost naked indians stood and smiled at us, and the doctor who was to be our guide ran forward to shake hands. I hadn't expected a young, attractive woman. Maria turned out to be from a wealthy family on the Atlantic coast, who had decided to give everything up and work here. The heat was overpowering, even at nine in the morning. All around us was the sound of flesh being slapped: I had been warned about the pium [Simulium], the tiny midges which brought up great welts with their stings ..."

"The pium hung round our heads in a small, private, cloud: and not just ours as newcomers but the indians' as well. Each of these detestable little insects was the size of an inverted comma on a printed page, so everywhere we went we seemed to be in quotation marks, like clumsy jokes. I had my own cloud, like the rest, but they didn't sting me. Perhaps it was the roll-on insect repellent I used but it might just have been the way I smelled. The others found my immunity mildly annoying*.

Maria's mother, hot but indefinably glamorous with her golden earrings, was sitting in the cedarwood *fazenda* where they lived fanning Maria's baby. Mother and daughter were both so badly bitten by the pium that their feet seemed to be tattooed. The house was stripped of everything: doors, windows, furniture. Only a few hammocks swing in the breeze, Butterflies the size of my opened hands showed flashes of yellow or orange like petticoats, and a bird with a wonderfully liquid warbling cry spent most of the day in the nearby banana trees."

**Roger Crosskey tells me that he was equally unaffected, having no reaction to bites after being used by Brian Duke and Tony Shelley as their engorgement bait while on an Amazon trip!*

*I like to identify the location of Traveller's Stories as accurately as possible. J.S. Does not say where this village is, but later in his narrative he describes travelling for twelve hours by motor canoe up the Envira (Embira) river to Simpatia which I have found close to the border of Peru at Lat. 9°44'S, Long. 71° 38'W. - **Editor.***

Humboldt on the Orinoco

In 1799 Alexander von Humboldt set out to explore the little-known world of South America, accompanied by his friend Bonpland. His tribulations have been described by Douglas Botting*, also an explorer, who followed the same route in the late 1960s and presents the experiences as recorded in Humboldt's writings with feeling and added detail.

"Late on the night of the 15 April 1800 the party reached the foot of the Atures and Maipures rapids, the Great Cataracts. These forty miles of shattered rocks and violent water - one of the longest and most perilous sets of rapids in South America - marked the end of navigation for shipping along the Lower Orinoco. For centuries they had sealed off the unexplored interior of Venezuela from the populated coastlands to the north. Only light canoes in the hands of expert local Indian watermen could enter that treacherous labyrinth and hope to reach the calm waters at the other end. Usually the canoes became waterlogged in the process, often they capsized and on occasions were smashed to pieces against the rocks so that the Indians, battered and bleeding, had to swim for their lives. If progress by water became impossible then the canoes had to be manhauled with immense difficulty over land.

Humboldt and Bonpland spent two days at Father Zea's humble house at Atures while the Indians struggled to haul the unladen canoe through the cataracts. They found the small mission, a mile or so from the river, in the most deplorable state. The Indian population was reduced to less than fifty - partly due to the 'guilty practice of preventing pregnancy by the use of deleterious herbs' -

and they lived in wretched conditions and suffered continually from sickness. Father Zea himself had been ill with his *calenturita*, his 'little fever', for eight months and was often attacked with fits of malaria during the journey. Moreover, it was abominably hot and clouds of biting insects filled the air so thickly that Humboldt was unable to see the sky through his astronomical instruments.

From now on, in fact, the insects were to become the dominating factor in their lives. Father Zea, after observing that there were fewer insects above a height of fifteen feet, had built a kind of tree house where it was possible to breathe more freely, and every evening Humboldt and Bonpland used to climb up a ladder to this refuge in order to dry their plants and write up their journals. Even so, they were beginning to suffer visibly from the immense quantity of bites they had received at Atures, and their hands had swollen considerably.

> “People who have not navigated the great rivers of equinoctial America, can scarcely conceive how, at every instant, without intermission, you may be tormented by insects flying in the air; and how the multitude of these little animals may render vast regions almost uninhabitable. It is impossible not to be constantly disturbed by the mosquitoes, zancudos, jejenes, and tempraneros, that cover the face and hands, pierce the clothes with their long needle-formed suckers, and getting into the mouth and nostrils, cause coughing and sneezing whenever any attempt is made to speak in the open air. In the missions of the Orinoco, in the villages on the banks of the river, surrounded by immense forests, the plague of the mosquitoes affords an inexhaustible subject of conversation. When two persons meet in the morning, the first questions they address to each other are: 'How did you find the zancudos during the night? How are we today for the mosquitoes?'
>
> In the Great Cataracts this suffering may be said to attain its maximum. I doubt whether there is a country on earth where man is exposed to more cruel torments in the rainy season. What appeared to us very remarkable is that at different hours of the day you are stung by distinct species. From half past six in the morning till five at night the air is filled with a tiny biting fly called jejen. An hour before sunset the tempraneros, a species of small gnat, take their place. Their presence scarcely lasts an hour and a half; they disappear between six and seven in the evening, or, as they say here, after the Angelus. After a few minutes' repose, you feel yourself stung by zancudos, another species of' gnat with very long legs. The zancudos, the proboscis of which contains a sharp-

pointed sucker, causes the most acute pain, and a swelling that remains several weeks. The Indians pretend to distinguish the zancudos and the temprancros 'by their song'. At fixed and invariable hours, the air is peopled with new inhabitants, and we might guess blindfold the hour of the day or night by the hum of the insects, and by their stings.

It is neither the dangers of navigating in small boats, nor the savage Indians, nor the serpents, crocodiles, or jaguars, that make Spaniards dread a voyage on the Orinoco; it is as they say with simplicity, *'el sudar y les moscas'* (the sweat and the flies).

Some of the devices for escaping these insect hordes were as ingenious as Father Zca's tree house. Some Indian tribes slept in little clay ovens full of smoke from a wet brushwood fire-Bonpland used to creep into these suffocating places to dry his plants. Others buried themselves up to the neck in sand and covered the face with a cloth. Some daubed themselves with mud or turtle oil, others recommended the insect-repellant qualities of a putrescent crocodile or smouldering cow-dung. In the Great Cataracts the Indians took refuge at night on rocks in the middle of the river, and Humboldt himself suggested that Europeans might travel sealed inside linen bags stiffened with whalebone hoops. But for the most part the only effective thing a man could do during the tortured hours of daylight was wave his arms about and slap himself. "The more you stir yourself," the missionaries would say, "the less you'll be stung.' The Indians, Humboldt noted, automatically slapped each other in their hammocks even in their sleep.

On the evening of' the 16 April, the travellers heard that the canoe had been safely negotiated through the Atures rapids. The next morning they set out along the bank to rejoin it and after two arduous days on the river reached Father Zea's mission at Maipures - a solitary place, full of the distant roar of the cataracts but mercifully free of insects.

The rapids of Maipures were even grander and wilder than the Atures, and Humboldt and Bonpland never tired of gazing down on them from the top of a nearby hill. For several miles the broad bed of the river was filled with an archipelago of islands-massive iron-black rocks covered in luxuriant forest trees and joined together by granite dikes. Through the narrow channels between the islands and over the falls formed by the dikes the river roared and swirled in a series of torrential cataracts. The surface of the water was a sheet of foam, and a thick mist, a whitish fog, hung over it for as far as the eye could see. In the evening the refracted sunlight formed rainbows which appeared and disappeared among the falls like will-o'-the-whisps - an exquisite optical illusion. The noise of this enormous weight of' falling water was deafening, especially at night.

Beyond the Great Cataracts an unknown land began. All that Humboldt knew about it was what he had learnt by hearsay, for nothing had ever been written about it by anyone who had ever been there. Even at the time of his visit, nearly 300 years after Diego de Ordaz first nosed his way into the Orinoco and Sir Walter Raleigh ventured along its lower reaches in search of El Dorado, there were only half a dozen white men living there in the space of 300 miles"

These blackflies have since been extensively studied at the Centro Amazónico para Investigación y Control de Enfermedades Tropicales (CAICET), Puerto Ayacucho, located at the foot of the Atures rapids. I know from personal experience the intensity of biting that can be found along the R. Orinoco, having visited there. The main species involved was most likely *Simulium oyopockense s.l.* Floch & Abonnenc --**Editor**

[Douglas Botting, Humboldt and the Cosmos. Sphere Books Ltd. 1973 295pp.]

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Index to the British Simuliid Group Bulletins

Nos. 1 to 20 (1992-2003)

Compiled by M.E. and R.W.Crosskey
(with additions from Nos. 19 and 20 by J.B.Davies)

[The Index may be separated by loosening the staples between pages 12 and 13]

Index to the British Simuliid Group Bulletins Nos. 1 to 20 (1992-2003)

The information contained in the first 20 issues of the B.S.G. Bulletin, published between May 1992 and June 2003, is presented in this index in four sub-set indexes, according to the topic (subject matter), the scientific names of Simuliidae, the scientific names of other organisms, and the names of contributing authors. For each entry the issue numbers are given first, followed by the relevant page(s) in parentheses; where the same indexed item occurs in separate articles within an issue the page references are separated by a slash (/). References to 'onchocerciasis' *per se* pertain to the disease in humans. The titles/authors of talks and posters given at B.S.G. meetings but never supplied as full text for publication have been disregarded, left unindexed because of lack of content. In the contributor index each author's name is accompanied by full initials even if not all initials are provided in the article heading; when known the author's usual or preferred full forename is given in parentheses.

Topic Index

Blackfly Scientific Names Index

Index of Other Organism Names

Contributor Index

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