Dipterists Digest

1995
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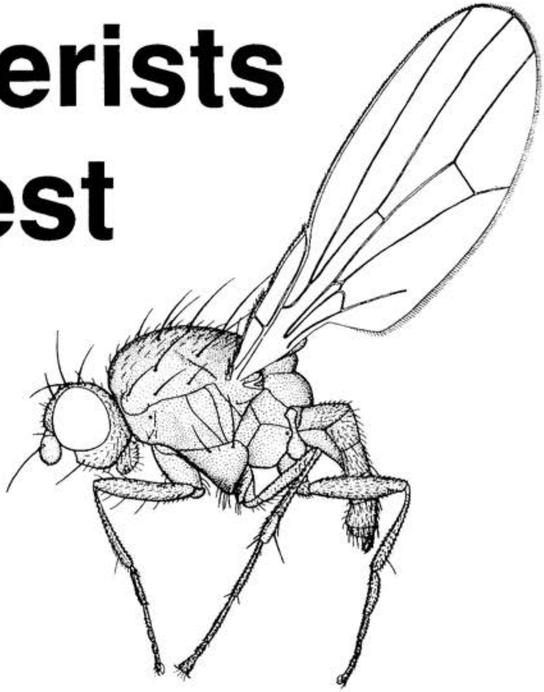

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Dipterists Digest

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Dipterists Digest is the journal of the **Dipterists Forum**. It is intended for amateur, semi-professional and professional field dipterists with interests in British and NW European flies. The scope of **Dipterists Digest** is:

- the behaviour, ecology and natural history of flies;
- new and improved techniques (e.g. collecting, rearing etc);
- the conservation of flies;
- provisional and interim reports from the Diptera Recording Schemes, including maps;
- records and assessments of rare and scarce species including those new to regions, countries, districts etc;
- local faunal accounts and field meeting results specially if accompanied with good ecological/natural history interpretion;
- descriptions of species new to science, and
- notes on identification including deletions, ammendments to standard key works and checklists.

Articles may be of any length up to 3,000 words and must not have been accepted for publication elsewhere. Items exceeding this length may be serialised or printed in full, depending on competition for space. Articles should be written in clear and concise English, preferably typed double spaced on one side of A4 paper. Style and format should follow articles published the most recent issue. References to journals should give the title in full. Only scientific names should be underlined. Tables should be on separate sheets. Figures should be drawn in clear black ink, about twice their printed size and lettered clearly. Descriptions of new species should include a note of which museum or institution type material is being deposited. Material submitted on 3.5" computer disc should be in ASCII format and accompanied by hard copy. Authors will be provided with twenty reprints of papers of two or more pages in length.

Articles and notes for publication should be sent to the Editor, Dr Graham E. Rotheray, Royal Museum of Scotland, Chambers Street, Edinburgh, Eh1 1JF, UK. Enquiries about subscriptions and information about the **Dipterists Forum** should be addressed to the Membership Secretary, Liz Howe, Ger-y-Parc, Marianglas, Tynygongl, Benllech, Gwynedd, LL74 8NS, UK.

Dipterists Digest 1995 **2**, 1-4

DISCUSSION PAPER
Of what use are the bright colours of hoverflies?

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I can remember an afternoon in my parents' garden, some 25 years ago, before I became especially interested in entomology - at school I had preferred chemistry. That day I realised for the first time that some of the yellow and black insects on the flowers were flies, and not wasps. I could distinguish the flies (they were probably *Syrphus ribesii*) by the length of their antennae, but until then I had never spotted the difference.

Some years later, when studying the genetics of insect mimicry, I read several comments to the effect that many syrphids have such poor similarity to wasps, or any other hymenoptera, that their bright colours must have some purpose other than mimicry. The suggestion made was that to be a poor mimic is of no use to a fly, for only a very close resemblance is worthwhile.

The resemblance of an edible species of fly to stinging insects is an example of Batesian mimicry, so named after the 19th century naturalist Henry Walter Bates. He collected butterflies in South America and noticed that similar colour patterns could be found on species from different families. He used the analogy of a defenceless moth "wearing the appearance of a wasp" (Bates, 1862) and thus concluded that some tropical butterflies were poisonous, and advertised this fact to predators; whilst others were counterfeits.

The species protected by some unpleasant taste, poison or sting is called the model. Another species that is edible, and has no means of defence, is called the mimic. Of course, these resemblances have evolved through natural selection. Within the mimetic species there was genetic variation. The individuals with patterns that deceived predators most successfully would have survived, reproduced and passed on their genes. The mimicry then improved step by step. The predators involved could be any that select their prey by sight, but we assume that insectivorous birds are the most significant ones.

There are two points often made about Batesian mimicry:

1. To obtain best protection, a particular mimic "should be" less common than its model, for otherwise predators will tend to associate the appearance shared by model and mimic with edibility.

2. The better the resemblance, the greater the mimic's protection.

These points are all very well, and correct, but the uncomfortable truth is that in the case of British hoverflies we can also see that:

3. Some mimetic syrphids are more numerous than their bee and wasp models.

4. The most sophisticated mimics are scarce (consider *Chrysotoxum*, *Arctophila* and *Criorhina*).

Thinking of the well-known *Syrphus ribesii*, the immediate comments would be that it can be extremely abundant and at the same time is one of the yellow and black syrphids that puts least effort, physiologically, into producing a convincingly wasp-like colour pattern. We could make the simplistic conclusion that no mimicry is involved, and the bright colours have some other, as yet unknown, function.

The problem here is to find the right question. No insect knowingly tries to disguise itself as another - that is obvious! However, nor is natural selection aiming at the same goal. As far as we know, evolution works by serendipity, making use of whatever turns up. If a mutation increases the chances of a fly's survival, and so of passing on its genes to the next generation of flies, then that is sufficient and the mutation spreads. So if looking a bit like a wasp leads to better fortune than not looking like a wasp at all, the mimicry is useful for that fly. A slight resemblance to a noxious model may give occasional protection, as many simple experiments have shown.

A few years ago I did a few tests on a robin's view of mimicry. It had regular meals of insects, which were frequently hoverflies (it almost seems sacrilegious now!). Its favourite food was mealworms, but of three flies offered most often, its preferences at the start were:

1. *Eristalis tenax* - highly favoured

2. *Eoseristalis arbustorum* - also eaten readily

3. Bluebottles (*Calliphora*) - would be eaten, but usually were left until all hoverflies had been taken

At one point the robin was given a few dead honeybees. To be kind to the bird I had removed the stings. Even so, at first they were left alone, and when eventually tackled, they were given the full treatment for de-stinging - the bees were rubbed on the ground several times, then broken up and eaten in small pieces. For several days afterwards the order of preference was reversed, so that bluebottles were taken before either of the *Eristalis*. The more bee-like species, *E. tenax*, received most protection at first, and was treated with caution for some time after (see Heal, 1982, for more details). However, the robin's attitude to *E. arbustorum* also changed, although it resembles a honeybee only to a slight extent. Had I put live honeybees into the cage and the robin received a sting, no doubt its aversion to any bee-like insect would have been that much greater.

In the real world, predators have a rather different situation. They have a split second to make their choice, far less than my robin in its cage, which could study the insects all morning if it chose to! A suitable combination of colours and movements could deter a predator long enough for the fly to escape. If this is the case then, the question is not 'Of what use are the bright colours of syrphids?' but, 'Why haven't **all** Diptera evolved to look like bees and wasps?' I can suggest a few reasons. Some are obvious. A fly is unlikely to evolve long antennae, purely to imitate a wasp, if it has no other need for them. More likely is that a hoverfly that already needs long antennae, perhaps to search out a particular habitat in which its eggs are laid, and makes jerky movements as it uses the antennae, then has a lot to gain from adding to its appearance suitable yellow and black markings.

Less obvious is visibility. Bright markings attract attention. An edible insect would rather not be noticed. When not active, inconspicuousness is the ideal. When active, flying from flower to flower in search of food, it is going to be easily seen, and so a brighter mimetic pattern may help its survival then. On average though, the best pattern may be a compromise and so less than a complete copy of the model.

Another factor that bears on the best choice of pattern is the flight period, as the number of active models will change from month to month. In spring, the best model to copy is the honeybee, *Apis mellifera*, because honeybee workers will start foraging on warm days in early spring. Mimics active then include *Eristalis tenax*, *E. pertinax* and *Epistrophe eligans*. When bumblebee workers of several *Bombus* species increase in numbers, during June and July, hoverflies that mimic them are also seen. Examples of *Bombus*-mimics are *Volucella bombylans*, *Merodon equestris*, *Criorhina berberina* and *Eristalis intricarius*. As wasp workers of *Vespula* species tend to increase later in the summer, so wasp mimicry also peaks later in the season.

Limitations on colour patterns can be set by physiology. Many hoverflies are dark along the mid-line of the abdomen where the dorsal blood vessel carries blood forward to the thorax. Looking at *Eupeodes (= Metasyrphus) luniger* or *Scaeva pyrastri*, why don't the yellow bands extend right across the abdomen without interruption, as on a wasp's abdomen? A reason may be that as dark cuticle absorbs heat more rapidly than yellow, the blood pumped forward to the flight muscles of the thorax is warmed up on its way.

An even more severe limitation on perfect mimicry can be the fly's life history. Fast breeders may not be able to afford the niceties of subtle mimetic patterns. If there are lots of aphids to eat, there are greater benefits to be gained, via natural selection, by developing as quickly as possible and making good use of a fluctuating food supply. Detailed mimetic patterns can be created when there is a lengthy larval development, and this will usually be the case for larval foods that are always present, but of low nutritional value, such as rotting wood. This explains why very common species are often poor mimics, and the best mimics may be very scarce. This is contrary to the simple assumption that better mimicry will make a species more abundant, but natural selection acts on individuals and not on a whole species. Population numbers are usually controlled by factors such as food supply or weather conditions.

My conclusion is that Batesian mimicry occurs extensively in British hoverflies. Any aspect of colouring, movement or behaviour (or even sound or smell) can be used to improve the insect's chances of survival. The more features used, the better, but even one feature is better than none at all.

Jon Heal

I am not sure if many *Dipterists Digest* readers spend their time contemplating evolution. In fact, "studying evolution" may seem a slightly dilettante activity when conservation of what we have now is so obviously pressing. However, I suspect that by thinking about how evolution has taken place through natural selection in the past, we can learn quite a few things about the ecology of existing species. And so we may learn more about how to conserve them.

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New Flies for Yorkshire - Mr. Peter Skidmore, Diptera Recorder for the Yorkshire Naturalists' Union, kindly informs me that the following three species of fly have not been recorded before in the county. The three sites mentioned are located in the Barnsley district of South Yorkshire.

***Vanoyia tenuicornis* (Macquart) Stratiomyidae**

A single female was swept from the rushy south-west corner of Elsecar Reservoir on 23.vi.1993. Apart from one Humberside site, this small, black soldier-fly was thought to be confined to southern England where it has increased in recent years (C.M. Drake, 1991 *Provisional Atlas of the larger Brachycera,* BRC, ITE). In addition, with thanks to Derek Whiteley for this information, four Sheffield area localities have been discovered subsequent to the present record. Whether these recent records indicate an expanding range or simply a neglect of recording in the past is uncertain.

***Beckerias pannonicus* Aczel Pipunculidae**

A male and two females were swept from waste ground at Manvers, an abandoned colliery on the Barnsley/Rotherham boundary on 30.vi.1993 (♀) and 13.vii.1993 (♀ & ♂). The identification was kindly confirmed by Michael Ackland to whom I am most grateful. Formerly known as *Cephalops curtifrons* Coe, this RDB1 species (S.J. Falk, 1991, *Review of scarce and threatened flies of GB,* part 1, NCC) may be under-recorded in Britain. The present records extend its known range northwards from Oxford. According to information kindly supplied by Alan Stubbs, in some years it is fairly frequent in river valley fen in southern England, although, curiously, females are seldom seen. The females reported here may be only the second time they have been captured in Britain.

***Lophosia fasciata* Meigen Tachinidae**

This dark and very striking fly, with its cloudy sub-apical wing band, rather conopid-like abdomen and axehead-shaped third antennal segment is unlikely to be overlooked by even the most blinkered non-tachinidologist! A female was swept from shrubbery at the edge of a sandy ride in Howell Wood on 10.viii.1993. *Lophosia fasciata* was considered very rare by C.J. Wainwright (1928, *Transactions Entomological Society London* **76,** 139-254 + 1932, 1940 & 1941 supplements) and it is a notable species in Falk (1991). F.I. Van Emden (1954, *Handbooks for the Identification of British Insects* **10(4a)**) listed just a few southern counties with the note "bred from *Aelia*" (Hemiptera). Stuart Foster kindly informs me that this shield-bug is unknown in Yorkshire. - **JOHN D. COLDWELL,** 16 Railway Cottages, Dodworth, Barnsley, South Yorkshire, S75 3JJ.

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Sphaerophoria species B, a hoverfly (Diptera, Syrphidae) previously unrecognised in Britain

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When preparing *British Hoverflies* there were some specimens that had to be put aside until I had a better understanding of the more difficult genera. Among these was a male *Sphaerophoria* somewhat like *fatarum* Goeldlin (at that time called *abbreviata* on the British list), but the genitalia and habitat were not right. In the period before and after publication of the book in 1983 the taxonomy of the genus has become much better understood in Europe, with the definition of far more species (Goeldlin, 1989: also see Speight, 1988). Having now seen much more material of *fatarum* in the field and under the microscope, it is with greater confidence that my specimen can be said to be distinct from other British species, and indeed different from other described European species as far as I am aware. Having only one specimen, with the chance that it is aberrant, the safest expedient is to draw attention to it as 'species B' in the hope that more material will be forthcoming for a proper resolution of its status.

The specimen was taken on 6 May 1976 at Blean Woods, Kent. At the time the National Nature Reserve was largely unmanaged dense coppice. My hoverfly was found whilst visiting sunny rides to the south side of the reserve, within commercially managed forest.

In the key in *British Hoverflies*, species B will run unhappily to *abbreviata* (= *fatarum*). Considered critically, neither of the lobes of the male genitalia match the illustration. The toothed lobe is upright and rather straight sided whilst the hairy lobe is far too short for *fatarum*. The projection on the inner curve is particularly well developed as a bulge. However, the most clearly seen feature which distinguishes Species B is the presence of exceptionally short hairs at the apex of the hair lobe; all other related *Sphaerophoria* have very long hairs (Fig. 1). The inner process is moderately developed and blunt, as in *fatarum*. The second basal cell in the wings is virtually entirely covered in microtrichia, as in *fatarum*. The abdomen has narrowly separated spots on tergites 2-4 and the legs are entirely yellow.

The only other British species with the hairy lobe so short is *potentillae* Claussen which among many differences lacks a projection on the inner curve and it is a species of wet heath and bog. *S. fatarum* is also a species of boggy ground, being very widespread in Scotland and more local in the south. In Kent the only obvious potential *fatarum* habitat is at Hothfield Bog, some 20km distant from Blean Woods. *S. bankowskae* has genitalia somewhat like *fatarum* (Plant, 1990) but in that species the femora are extensively black. Species A (of Stubbs & Falk, 1983) remains little known.

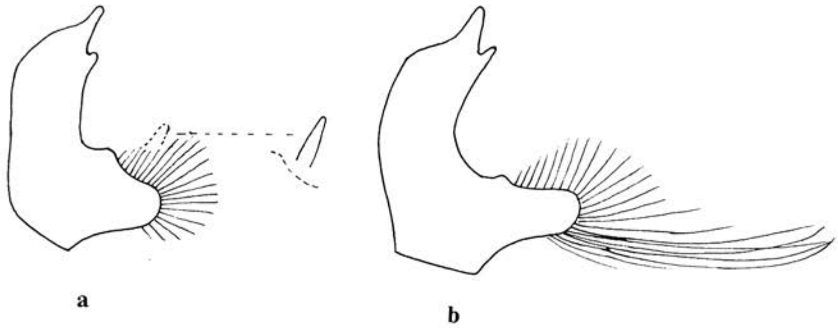

Fig. 1. *Sphaerophoria* male genitalia (orientation as in *British Hoverflies*). a. Species B, showing also apex of inner process. b. *fatarum* (9 July 1991, Red Burn, Skye).

A *British Hoverflies* style statement is as follows:-

Sphaerophoria Species B

A small species with spotted abdomen. The male genitalia have a very short hairy lobe with exceptionally short hairs; the toothed lobe is rather rectangular and the inner curve has a projection. Wing length 5mm.

It is known from a single male that was found in 1976 in a sunny ride at Blean Wood, Kent. May.

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Dipterists Digest 1995 **2**, 8-12

Amiota collini, a new European species of *Amiota* sensu stricto (Diptera, Drosophilidae)

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Until now seven species of *Amiota* sensu stricto were known from Europe (Máca, 1980) and the status of the nominal taxon *A. lacteoguttata* (Portschinsky, 1892) is still uncertain. A further European species, described here, is known to occur in Britain, the Czech Republic and Slovakia.

Amiota collini **sp. n.**

Diagnosis

Blackish species with milky white areas on face, postpronotal lobe and area around the suture between anepisterum and anepimeron. Arista with ventral rays short. Hind femora without outstanding setae. Last segment of at least fore tarsi dark. C_3 range more than 0.6. Male terminalia characteristic in shape.

Description

Terminology generally follows McAlpine (1981). However, the genitalia of *Amiota* are rather complex in structure and we have chosen to follow Máca (1980). Whenever possible the terminology of Wheeler (1987) for the genitalia of Drosophilidae is indicated by brackets. Description based on male.

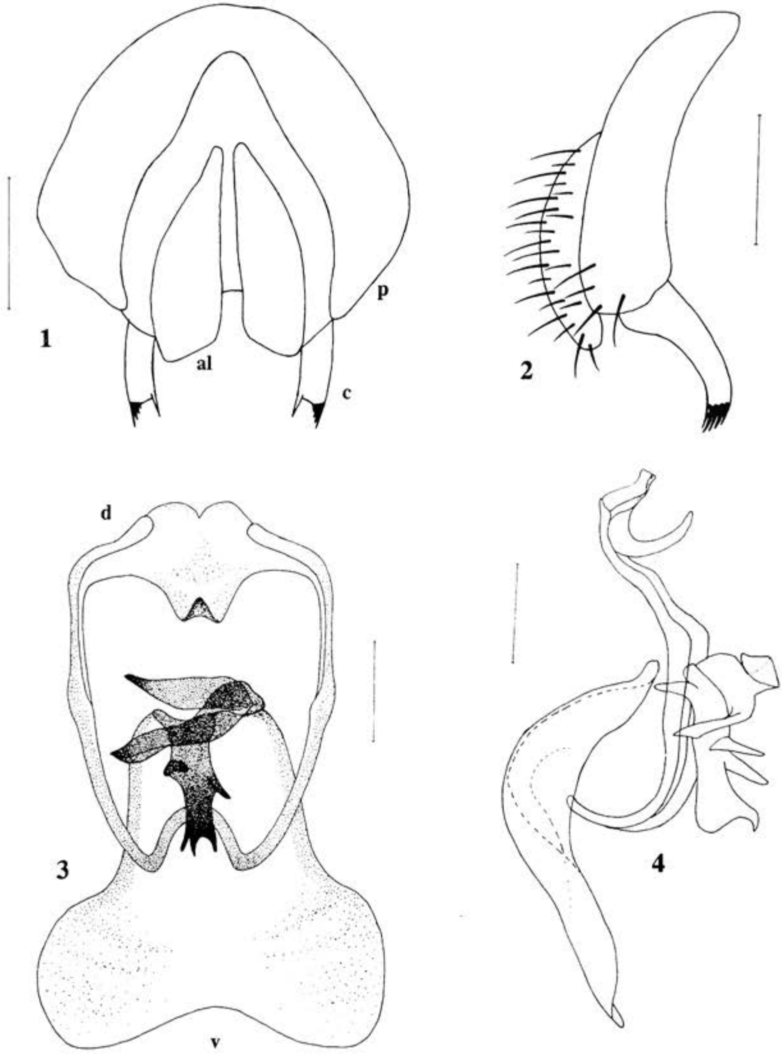
Head: frons dull, upper part brownish black, the lower part somewhat lighter; proclinate orbital seta very little longer than posterior reclinate orbital seta; anterior reclinate orbital seta little more than half as long as posterior reclinate orbital seta; outer vertical setae about as long as proclinate orbital setae; inner vertical setae little longer than posterior reclinate orbital setae; ocellar triangle with a pair of ocellar setae as long as proclinate orbital setae and about three pairs of shorter setae; postocellar setae very small; about ten short fronto-orbital setullae along each compound eye; interfrontal setulae rather thin and short, about ten in number, half of them scattered on the middle of the frontal vitta, the other half clustered close above the middle of the ptilinal suture on the frontal vitta; ptilinal fissure strongly curved. Face dark brown above a white transverse facial band; carina straight and more or less disappearing in the facial band; genae pale brownish yellow; vibrissae strong, other genal setae short and rather inconspicuous. Occiput dark brown; postocular setae short but these on the postgenae strong. Antennae darkish brown except for extreme base of arista, which is lighter; pedicel (second antennal segment) with one longer and several shorter dorsal setae; first flagellomere (third antennal segment) covered with pile about as long as the arista is thick at its base; arista with only moderately long dorsal rays (5) and short ventral rays (8). Mouthparts yellowish except for blackish clypeus; palpi with two or three long and several short black setae.

Thorax: mesonotum brownish black, pleura somewhat lighter; postpronotal lobe and area around the suture between anepisterum and anepimeron white; all setae black.
Chaetotaxy: one strong postpronotal seta; two strong notopleural setae; one strong presutural supra-alar seta; two postsutural supra-alar setae, the anterior seta less than half as long as the posterior one; one weak postalar seta; two pairs of dorsocentral setae, the anterior dorsocentral setae about half the length of the posterior dorsocentral setae; two prescutellar setae almost as long as the anterior dorsocentral setae; acrostichal setae in about ten rows, laterally of the acrostichals the mesonotum is covered with setae in about the same density; katepisternum with two long setae along the upper margin and several short setae on the median surface, pleura otherwise bare. Scutellum same colour as mesonotum, the pair of lateral as well as the pair of apical scutellar setae strong. Wings hyaline, all veins brownish yellow. c.i.=1.95, 4v-i-2.7, 4c-i=1.95, 5x-i=1.5, Ac-i=3.5, Cx-i=0.7, M-i=0.8, C3-range=0.68. Wing length = 2.6mm. All measurements concern holotype. Halteres yellowish brown. Legs: coxae yellow, at most basally a little darkened. Femora yellow, fore femora a little darker than posterior femora; fore femora with an anteroventral and a posteroventral row of slender setae; hind femora bare on posterior surface. Tibiae yellow, fore tibia may be little tannish; all tibiae with short pre-apical setae but on the fore tibiae rather inconspicuous; mid tibia with short apical seta. Tarsi: extreme tip of fourth and whole of fifth tarsal segment of fore legs dark, the darkening of same tarsal segments in mid and hind legs varying from to the same extent as in the fore tarsi in some specimens to complete absence in other specimens; first tarsomere (metatarsus) of mid leg with about 32 posteroventral cuneiform setullae. No other conspicuous setae on legs.

Abdomen: tergites and sternites rather dark brownish, of about the same colour as thoracic pleura. Genitalia: periphallic organs: periandrium (epandrium) narrowed medially, ventroapically with four setae, anal lamellae (cerci) covered with long as well a short setae, claspers (surstyli) slender, apically with four teeth on the outer side and with a pale spine posteromedially (Figs 1, 2), on the inner side are some hardly discernible hairs; phallic organs (aedeagus and parameres) apparently fused, asymmetrical (Figs 3, 4), the tips of this structure show some slight variation. Ejaculatory apodeme as in Fig. 5.

Type material: holotype male, Chippenham Fen, 30.vii.1951 (Cambridgeshire, Great Britain, no collector given but most likely J.E. Collin) [Hope Entomological Collections of the Oxford University Museum, Oxford, United Kingdom]; paratype male: Slovakia: Kamenín, salty meadow, 47°53'N/18°39E', 130m, Barták, 25.iv.1986 [collection Barták]; 3 paratypes males: Czech Republic: Pečky, *Salix* shrubs, 50°05'N/15°02'E, 200m, Barták 16.v.1988 [collection Barták]. The paratypes will be deposited in the collection of the Department of Entomology of National Museum at Prague. The female is unknown. The species is named after the late Mr J.E. Collin who most likely collected the type specimen and recognised it as a new species but never described it.

Amiota sp. n.



Figs. 1-4. *Amiota collini* n.sp. male genitalia, scale 0.10mm: (1) posteroventral view of the periphallic organs, p = periandrium (epandrium), al = anal lamellae (cerci), c = claspers (surstyli) (setae omitted); (2) lateral view of the periphallic organs; (3) posteroventral view of the phallic organs, d: dorsal side; v ventral side; (4) lateral view of the phallic organs.

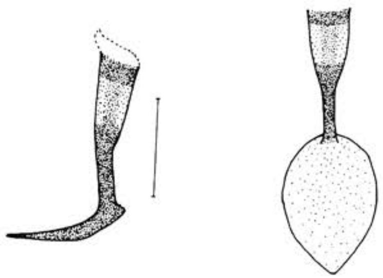


Fig. 5. ***Amiota collini*** **n.sp. male genitalia: ejaculatory apodeme, scale 0.05mm.**

Systematic position: *Amiota collini* is probably closely related to *A. nigrescens* Wheeler, 1952. The periphallic organs are similar to those of that species although less hairy (Hsu, 1949: pl. 1, fig. 9 [as *Amiota* "arizonensis" Wheeler]; Okada, 1960: 92). The phallic organs, however, are different from those of *A. nigrescens* (G.C. Steyskal, *pers. comm.*).

Acknowledgements

We thank Dr G.C. Steyskal for his comments on the possible relationship between *A. nigrescens* and *A. collini* and data on the genital morphology of the former species. Dr G. McGavin made it possible to study the Collin Collection at the Hope Entomological Collections at the Oxford University Museum, Oxford. Dr M. Barták (College of Agriculture, Prague) kindly allowed us to study his private collection.

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***Spelobia clunipes* (Diptera, Sphaeroceridae) reared from toad faeces** - Throughout the summer of 1993 a large common toad (*Bufo bufo bufo* (Linnaeus, 1758)) lived in a small depression scooped out of the soil under a piece of metal sheeting lying on my allotment garden in Blackford, Edinburgh (NT2571; V.C. 83). When I checked under the metal sheet on 10.x.1993 the toad had gone but strategically placed in the depression was a piece of toad excrement. It was black with fragments of beetle exoskeletons discernable and very large. The U-shaped sausage was some 6cm long with a diameter of 12mm. Smith (1951, New Naturalist, British Amphibians & Reptiles, Collins) remarks that in keeping with the toad's large appetite its excretions are also large, however the extra large size of this one suggests a prehibernation clean-out. The faecal material was carefully transferred to a clean screw-topped plastic pot and placed in an unheated outside shed. In spite of the prevailing cold temperatures, on 11.xii.1993 seven imagines of *Spelobia clunipes* (Meigen, 1930) emerged from the excreta. Identification was confirmed from the male genitalia using Pitkin (1988, *Handbooks Identification British Insects* **10(5e)**). This species has been reared from a wide range of mammal and bird-associated substrates but this seems to be the first record of its association with amphibian waste material.- **K.P. BLAND,** 35 Charterhall Road, Edinburgh EH9 3HS.

Dipterists Digest 1995 **2,** 13-23

Advances to the British Hoverfly List: 1901 to 1990

ALAN E. STUBBS, 181 Broadway, Peterborough, PE1 4DS

The son of some friends, when aged about 12, announced that his ambition was to get a Nobel Prize in science. However, he was defeatist, bemoaning the fact that he was born too late, everything having been discovered already.

Each generation of dipterists must feel rather like that, the more so when the countryside seemingly has so little good habitat to offer in comparison with the times of Verrall. I well remember Cyril Hammond saying he felt sorry for the new generation of dipterists because sites were not as productive as they used to be, and that comment dates from 25 years ago or more; but he envied those starting out when even the common species were new and exciting to them.

The counter balance is that many of us can travel more easily and that there are now so many more species known to go out and look for. There is only one hoverfly that has not been found in recent years, *Myolepta potens* (and we cannot yet say that is extinct).

Thus, whilst each book on the British hoverfly fauna can create the daunting impression that everything has been discovered, this review shows that each generation has made major advances. Some people may feel that such advances are inconvenient because keys become out of date, yet they would hopefully agree that to find a species new to Britain is a morale booster. Remember that many of the new discoveries have been made by those amateurs without particular specialist knowledge. The subject can never become dull if there is always the prospect of finding something new, perhaps even new to science.

Apart from the historical interest of a review such as this, there is a very practical application of the listing of first dates of publication for each species. When tracing published species records in the literature, it is useful to know how far back to search and essential to know the state of knowledge of the fauna at the time. The same applies to museum collections that may have been well curated in the past. Sometimes understanding is gained from the keys which were current at the time but the context of species mapping and splits still has to be interpreted.

The monographic book by Verrall (1901) was a magnificent compilation, the first truly comprehensive reference on a group of flies in Britain. The author had clearly been in contact with many of the active dipterists of the latter part of the nineteenth century and it is perhaps not too surprising that subsequently it took a while before new species came to light. However, the publication of Verrall's book should have resulted in more people taking a rigorous look at hoverflies, with the recognition of further species. That opportunity would apply until 1914 when the First World War intervened, leading to a catastrophic loss of many men of that generation. Thus in the next 29 years from 1901 only 4 species were published as new. These included two Scottish Highland rarities, in an area that had already been worked hard and continued to receive attention. The other two were interesting new colonists. *Eumerus tuberculatus* had become an introduced pest of gardens. *Volucella zonaria* gained its first authenticated record, showing that size and conspicuousness are no bar to gaining a first (subsequently this species has become established in Britain).

This period of apparent quiescence was deceptive since Verrall's nephew, JE Collin, had been at work behind the scenes. Thus in 1931 Collin published 9 additions, apart from revised names, and 6 of the other 8 additions in the period to 1939 were also his. Seven of these British species were new to science (subsequently found elsewhere in Europe). Most of these additions arose through refinement of taxonomy, especially within difficult genera such as *Neocnemodon*, *Pipiza*, *Cheilosia*, *Metasyrphus* and *Brachyopa*, together with *Eristalis*, *Parhelophilus* and *Sphegina*. *Brachyopa* rose from one to four species. *Triglyphus* was a new genus (not due to Collin this time!). Significantly, Collin had introduced the innovation of using genitalia illustrations for some of his revisions.

Coe got a look in for the first time in 1940, with recognition of *Neoascia obliqua* as new to science and *Chalcosyrphus eunotus* as an addition. However, Collin was to dominate the 1940s (and 1950s) just as the 1930s. He sorted out additions among *Chrysotoxum*, *Scaeva*, *Melangyna*, *Myolepta*, *Parasyrphus* and *Pipizella*. Among 4 species new to science were 2 mis-named species on the British list. A few other people managed to publish their own additions, with Morley finding *Callicera spinolae* in Suffolk and C.J. Wainwright adding *Scaeva albomaculata* and *Hammerschmidtia*. The latter is a delayed addition since it was first found by Yerbury in 1905, seemingly having escaped formal notice. *Sphaerophoria loewi*, *Cheilosia velutina* and *C. globulipes* appear in the Kloet & Hincks checklist, 1945, but I have not been able to trace any prior publication placing them on the British list. The check list absorbed many of the views on the use of names of Goffe, and also Collin, a matter of deeply argued debate in journals over the previous couple of decades.

Perhaps it is necessary to reflect on the fact that Coe, working at the British Museum (Natural History), as it was then called , did not publish many of the additions of his time. It would seem that Collin's antagonism towards the Museum led to a broad gulf and lack of liaison. Coe would have found it quite difficult in the shadow of Collin. It is also necessary to assess the impact of Coe's Handbook (1953). Undoubtedly it gave impetus (to me included) but it proved enormously discouraging since the keys were difficult and infuriating to use. It put entomologists off hoverflies, or resulted in a restriction to the easier genera. However, as the only post-war key of scope in print, it is said that Coe's key became an important reference and influence in post-war Europe.

Whereas the 1930s saw the addition of some not unduly rare species, the 1940s and 1950s were very much a period of discovering really rare insects. Regional specialities, such as *Callicera spinolae*, *Myolepta potens*, *Chalcosyrphus eunotus* and *Chrysotoxum octomaculatum* illustrate the successes of the time. The 1940s was also the decade of the migrant, with two very rare Mediterranean *Scaeva* and it is probable that *Parasyrphus mallinellus* represents a newly colonised species taking advantage of the development of conifer plantations.

These two decades had been a declining period of additions. The Second World War took its toll of entomologists and the fabric of society so it was not until well into the 1950s that a semblance of normality was re-built. The lean period for additions got even leaner, as Collin made his last addition, *Neocnemodon pubescens* in 1960, and Crow, as we used to say, 'crowed' about his discovery of *Eriozona syrphoides*, a spectacular bumble-bee mimic published in 1969. Both these additions of the 1960s were colonists in our ever expanding conifer plantations.

An old era had passed, a new one began. The new dominating force was Dr Martin Speight who in the 1970s added 9 species to the British Isles list, including the upgrading of some varieties of *Sphaerophoria*, and the re-instatement of *Melanostoma dubium*. He also sorted out the old *Syrphus arcuatus* problem, with recognition of *Metasyrphus nielseni*. It was a new upsurge in hoverfly studies in mainland Europe that gave confidence since it was possible to capitalise on new European revisions. There were revelations in the taxonomy of *Sphaerophoria* from the use of genitalia characters (strangely Verrall illustrated the genitalia of *S. scripta* but failed to do likewise with the rest of the genus), and in *Metasyrphus* the deployment of microtrichia was in vogue, very much within a new phase of more critical examination of taxonomy. Speight's great contribution was to use these new references as a spring board to revise British material, a matter aided by his great success in having built up his own collections, Scottish material being especially significant. He also discovered *Cheilosia ahenea* in Ireland and *C. sahlbergi* on Scottish mountains. Whilst there were great rarities added, it was also a period of revising taxonomy and recognising species splits even among the not so rare species, such as *Paragus haemorrhous* which proved commoner than the long standing name *P. tibialis*. A further example of this sort was found by Stubbs with the recognition that Scottish material of *Xylota florum* was in fact *X. coeruleiventris* which had been unrecognised even in long standing series in the Natural History Museum.

While the development of new keys for *British Hoverflies* started about 1973, it was not until the late 1970s that the more critical additions were sorted out and resolved (in part!). Thus the 1980s started with a number of additions by Stubbs, and the hoverfly recording scheme organiser at that time, Dr Philip Entwistle. Additions in time for the book were made in *Anasimyia*, *Neocnemodon*, *Neoascia*, *Dasysyrphus*, *Sphaerophoria* and *Cheilosia*, plus a *Lapposyrphus* new to science. The use of lettered forms and species was used in order not to hold up the book and some, but by no means all, have been subsequently resolved.

The book lasted all of three years before additions started at a steady rate. Speight and Stubbs were involved again but it was a pleasure to see others also carrying the list forward. *Cheilosia*, *Metasyrphus*, *Platycheirus*, *Sphaerophoria*, *Epistrophe* and *Orthonevra* were the genera involved. This surge throughout the 1980s came from a wide range of origins, including critical study of museum collections, new field studies in previously little worked areas (including *Sphaerophoria potentillae* on a dipterists' field meeting in little known north Devon) and wider ranging recording resulting from the recording scheme. Some species were migrants or new colonists associated with conifers, including *Metasyrphus lundbecki*.

1990 started in spectacular style in January with Speight *et al* adding 3 *Platycheirus* new to science. In February/March a new *Sphaerophoria* and a new *Epistrophe* had been identified from earlier seasons collecting and in March *Eristalis pratorum* was found in the field. This was surely one of the most remarkable three months this century for the British list of hoverflies. Additions to the British list since 1900 are summarised in Fig. 1.

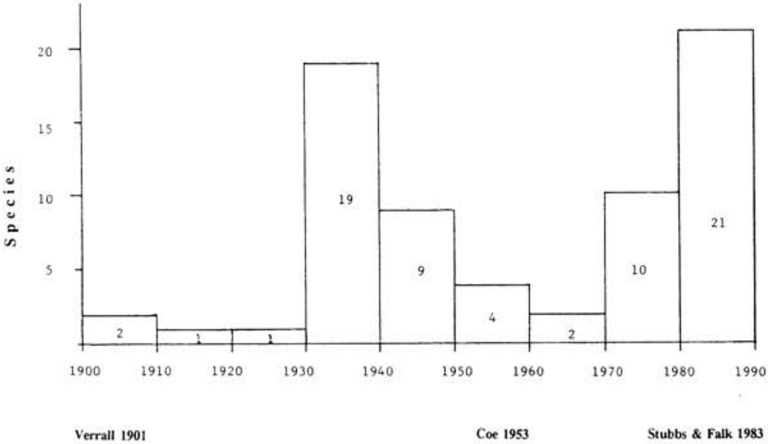

Fig. 1. The number of species added to the British Hoverfly list 1900-1990

There are several underlying ways in which species have been added.

A. The gain of more material, and in particular fresh material in good condition, of scarce species - leading to the recognition of species splits.

B. A more critical taxonomic approach, including the use of genitalia and microtrichia. The interplay between advances in understanding in Britain and Europe has had advantages in both directions.

C. The colonisation in Britain of species that were absent or overlooked in Verrall's day. *Volucella zonaria* has gained a good foothold in the greatly expanded urban area of London, perhaps assisted by the climatic advantage found in large urban areas (though it also occurs elsewhere). *Eriozona* and a number of other aphid feeding species have colonised the greatly expanded areas of conifer woodland.

D. The geographic coverage which develops over the years as dipterists come to live in or holiday in previously little explored areas. The mobility of the car and the increasing number of dipterists clearly adds to the scope. More people are learning to explore and to look critically at what they have found. The advent of Diptera field meetings has played its part.

The hoverfly list will continue to grow. The spectacular recent advances in *Platycheirus* and *Sphaerophoria* are probably still not exhausted and other genera, including *Pipiza* and *Metasyrphus*, leave scope for further revision. There are plenty more temperate European species that could yet be found in the south and we have still hardly considered the potential extra Scandinavian elements that could well occur in Scotland. Even apart from what still lies in collections and the field at present, there is also the strong possibility of further colonists of the newer habitats, especially conifer plantations. Future generations of dipterists will find new ways of reviewing our hoverfly fauna, taxonomic and ecological. Undoubtedly one of the prospects of high potential is advances in larval taxonomy, leading to revised species concepts, where through the new pioneer work of such people as Dr Graham Rotheray the initiative once more is home based.

Chronological additions to the British Hoverfly list since Verrall (1901)

Names in brackets are not new to the British list at the date mentioned, usually applying to the introduction of a new name which replaces an earlier one.

1903 *Chamaesyrphus caledonicus* (Sharp, EMM **39**: 197). (as *lusitanicus*, mis-ident., = *caledonicus* Collin, 1940).
1904 *Callicera rufa* (Verrall, *EMM* **40**: 229).
1918 *Eumerus tuberculatus* (Collin, *Trans. ent. Soc. Lond (Proc) (xxvii)*).
1923 *Volucella zonaria* (first authentic specimen, Scott, *EMM*, **59**: 260).
1931 *Neocnemodon latitarsis* (Collin, *EMM*, **63**: 154-155).
Neocnemodon verrucula sp. nov. (Collin, *EMM*, **63**: 155-156).
Pipiza lugubris (true *lugubris*) (Collin, *EMM*, **63**: 156).
[*P. austriaca* (correction for *lugubris* Verrall) (Collin, *EMM*, **63**: 156-157).]
Cheilosia nigripes (earlier *nigripes* were mis-ident.) (Collin, *EMM*, **63**: 158-9).
Cheilosia pubera (Collin, *EMM*, **63**: 177).
C. semifasciata (as *fasciata* Egger, mis-ident.) (Collin, *EMM*, **63**: 177-8).
Metasyrphus latilunulatus sp. nov. (as *Syrphus*) (Collin, *EMM*, **63**: 179-180).
Eristalis abusivus sp. nov. (Collin, *EMM*, **63**: 180-181).
Parhelophilus consimilis (Collin *EMM*, **63**: 181-182).
Metasyrphus nielseni of Speight 1977 (as *arcuatus* of Collin, *Ann. Mag. nat. Hist.* **7**: 67-91).
1933 *Triglyphus primus* (Aubertin & Diver, *EMM*, 69: 188-189)
1937 *Sphegina kimakowiczi* (Collin, *EMM*, **62**: 182-184).
Sphegina verecunda sp. nov. (Collin, *EMM*, **62**: 184-185).
1939 *Brachyopa insensilis* sp. nov. (Collin, *EMM*, **64**: 105-106).
Brachyopa pilosa sp. nov. (Collin, *EMM*, **64**: 107-108).
Brachyopa scutellaris (Collin, *EMM*, **64**: 107).

Xylota xanthocnema sp. nov. (Collin, *EMM*, **64**: 108-109).
Helophilus groenlandicus (Bertram, *Proc. R. Phys. Soc. Edin.* **23**: 1-72).

1940 *Neoascia obliqua* sp. nov. (Coe, *EMM*, **76**: 18-19).
[*Chrysotoxum verrallii* sp. nov. (Collin, *EMM*, **64**: 154-5).]
Chrysotoxum octomaculatum (Collin, *EMM*, **64**: 154-6) (first authentic record; *octomaculatum* of Verrall was mis-ident, proved to be sp. nov. = *verralli*).
[*Chrysotoxum latilimbatum* sp. nov. Collin = var. within *C. elegans* Verrall, not of Loew].
[*Chamaesyrphus caledonicus* sp. nov. Collin = *EMM*, **64**: 157-158) (revised name for *lusitanicus* - see 1903).]

1941 *Chalcosyrphus eunotus* (Coe, *EMM*, **77**: 193-197).

1942 *Callicera spinolae* (Morley, *Trans. Suffolk Nat. Sci.*, **5**: 14-15).

1942 *Scaeva albomaculata* (Wainwright, *EMM*, **78**: 3-4).

1944 *Hammerschmidtia ferruginea* (Wainwright, *EMM*, **80**: 8, though first caught in GB by Yerbury in 1905).

1945 *Sphaerophoria loewi* (Kloet & Hincks Check List; no other source traced).
Cheilosia globulipes (Kloet & Hincks Check List; no other source traced).
C. velutina (Kloet & Hincks Check List; no other source traced).

1946 *Scaeva mecogramma* (Collin, *Proc. R. ent. Soc. Lond.* (B), **15**: 11-12).
Melangyna ericarum sp. nov. (Collin, *Ent. Rec.*, **58**: 117-119).

1950 *Mylopta potens* (Collin, *J. Soc. Br. Ent.*, **3**: 133-137).

1952 *Parasyrphus mallinellus* sp. nov. (Collin, *Proc. R. ent. Soc. Lond.* (B) **21**: 35-36).
P. nigritarsis (Collin, *Proc. R. ent. Soc. Lond.* (B) **21**: 35-36).
Pipizella varipes (Collin, *J. Soc. Br. Ent.* **4**: 85-88).

1960 *Neocnemodon pubescens* (Collin, *Ent. Rec.* **93**: 144-145).

1969 *Eriozona syrphoides* (Crow, *Ent. Rec.* **81**: 237-238).

1973 *Sphaerophoria abbreviata* (Speight, *Ent. Rec.* **106**: 228-233).
S. philanthus (? = var. *dubia* of Coe.) (Speight, *Ent. Rec.* **1-6**: 228-233).
S. taeniata (upgraded from var.) (Speight, *Ent. Rec.* **106**: 228-233).

1974 *Cheilosia sahlbergi* (Speight, *Ent. Rec.* **86**: 193-194).

1975 *Xylota coeruleiventris* (Stubbs, *Proc. & Trans. Br. Ent. Soc.* **8**: 51).

1976 *Sphaerophoria virgata* (Speight, *Ent. Rec.* **88**: 300-301).

[1977 *Metasyrphus nielseni* (Speight, *Ent. Rec.* **89**: 154-155). (ex. *Syrphus arcuatus* Collin 1931; Coe 1953).]

1978 *Cheilosia ahenea* (Speight, *Ir. Nat. J.* **19**: 217-222). (as *laskei*).
Paragus haemorrhous (Speight, *Ent. Rec.* 90: 100-107). (by splitting *tibialis*).
Melanostoma dubium (Speight, *Ent. Rec.* **90**: 226-230). (re-instatement, first genuine record) [may yet be sunk again!]

1980 *Neocnemodon brevidens* (Stubbs, *Ent. Rec.* **92**: 45-46).

1981 *Neoascia interrupta* (Falk, Smith & Stubbs, *Proc. Trans. Br. ent. nat. Hist. Soc.* **14**: 12-14).

1981 *Anasimyia contracta* (Stubbs, *Proc. Trans. Br. ent. nat. Hist. Soc.* **14**: 10-11).
A. interpuncta (Stubbs, *Proc. Trans. Br. ent. nat. Hist. Soc.* **14**: 10-11).

1982 *Dasysyrphus friuliensis* (Entwistle, *EMM*, **118**: 245).

1983 *Metasyrphus* (*Lapposyrphus*) sp. A, (Entwistle, in *British Hoverflies*).

Sphaerophoria batava (Stubbs, *British Hoverflies*).
Cheilosia griseiventris (Stubbs, *British Hoverflies*).
C. sp. A, (Stubbs, *British Hoverflies*).
(Other *Cheilosia* forms now sunk by Falk, C+D = *proxima*; *Pipiza noctiluca* forms still of unknown relevance or status).

1986 *Cheilosia uviformis* (Speight *Ir. Nat. J.* **22**: 159). (as *argentifrons*).
Platycheirus sp. A. (Stubbs, *British Hoverflies, Supplement* = *nielseni* sp. nov. Vockeroth, 1990, *Can. Ent.* **122**: 659-766).

1987 *Metasyrphus lundbecki* (Soot-Ryen, 1946) (Watt & Robertson, 1990, *Dipterists Digest* **6**: 23-27).

1988 *Platycheirus amplus* sp. nov. (Speight & Vockeroth, *Ir. Nat. J.* **22**: 518).

1989 *Sphaerophoria potentillae* Claussen, 1984 (Stubbs, *Dipterists Digest*, **2**: 34-35).
Epistrophe melanostoma (Zetterstedt, 1843) (Beuk, *Diptera Recording Schemes Bulletin*, **28**; see also Beuk, 1990 *EMM* **126**: 167).
Orthonevra sp., ? sp. nov. (Drake, *Diptera Recording Schemes Bulletin*, **28**).

1990 *Platycheirus europaeus* sp. nov. (Goeldlin, Maibach & Speight, *Dipterists Digest* **6**).
P. occultus sp. nov. (Goeldlin, Maibach & Speight, *Dipterists Digest* **6**).
P. ramsarensis sp. nov. (Goeldlin, Maibach & Speight, *Dipt. Dig.* **6**).
Sphaerophoria bankowskae Goeldlin, 1989 (Plant, *Br. J. ent. nat. Hist. Soc.* **3**: 178; also *Dipterists Digest* No. 3: 32-33).
Eristalis pratorum (Meigen, 1822) (Falk, *Br. J. ent. nat. Hist. Soc.* **3**: 139-141).
Metasyrphus ochrostoma (Zetterstedt, 1849) (Heaver, *Hoverfly Newsletter* **10**).

Taxonomic review of Verrall's 1901 list and subsequent changes

Classification and order of tribes follows Stubbs and Falk (1983).

BACCHINI

Verrall includes all species of *Baccha*, *Pyrophaena* and *Xanthandrus*.

Under *Melanostoma* his *dubia* was a form of *mellinum* rather than the true *dubia* added in 1978. *M. dubia* may be sunk again (MacGowan, pers. comm.).

The list of *Platycheirus* remained the same from 1901 to Stubbs & Falk 1983, though Verrall placed *ambiguus* in *Melanostoma*. It is only in recent years that more critical taxonomic study has revealed a split in *P. peltatus* (1986 & 1988) and in the *clypeatus* group (1990), resulting in five extra species.

Within *Paragus* Verrall listed only *albifrons* (as *bicolor*, a mis-identification) and *tibialis*. The latter was split in 1978, with most material belonging to *haemorrhous*.

SYRPHINI

Chrysotoxum, *Doros*, *Sphaerophoria* and *Xanthandrus* stood as separate genera, together with *Melangyna quadrimaculata*, but all other species were placed within *Syrphus*.

In 1940 the *Chrysotoxum octomaculatum* of Verrall was recognised as belonging to a new species, *C. verralli*, as a result of finding the true *octomaculatum*.

Xanthandrus pedissequum is referred to as *X. ornatus* by Verrall.

The following additions to Verrall's *Syrphus* subsequent to 1901 are *Melangyna ericarum* (1946), *Metasyrphus latilunulatus* (1931), *M. neilseni* 1977 but previously as *arcuatus* mis-ident., 1931), *Parasyrphus mallinellus* (1952) and *P. nigritarsis* (1952). *Dasysyrphus nigricornis* is now treated as a variety of *D. venustus* (though many continental authors separate this species on mainland Europe).

Eriozona syrphoides was added in 1969.

The most chaotic genus has been *Sphaerophoria*. Verrall recognised *rueppellii* (as *flavicauda*), *scripta* and *menthastri*. Verrall's varieties of *scripta* are not of any taxonomic value. However, he included two varieties of *menthastri* (true *picta* sunk in *menthastri*). *Sphaerophoria loewi* has been traced back to the Kloet & Hincks Check List of 1945, but a considerable number of further additions have been made in recent years.

CALLICERINI

Only *Callicera aenea* was known in 1901. *C. rufa* was added in 1904 and *C. spinolae* in 1942.

CHEILOSINI

Most *Cheilosia* were included in Verrall's book. The main point to be aware of is the interpretation of 3 species, the confusion being sorted out by Collin (1931, *EMM* **63**: 159). Quite clearly the misplacing of *antiqua* is a critical point but note that the interpretation of these names had been chaotic for many years.

Verrall names		Collin names
sparsa	=	*antiqua*
antiqua	=	*nasatula*
-	=	*nigripes*

Other additions are *pubera* (1931), *ahenea* (as *sahlbergi*, 1974), *semifasciata* (as *fasciata*, 1931), *velutina* (1945) and *uviformis* (1986, as *argentifrons*). *C. globulipes* (1945) is almost certainly just a variety of *praecox*, a species of Verrall.

Portevinia maculata lies within *Cheilosia* in Verrall. *Ferdinandea* and *Rhingia* are complete, each with two species.

CHRYSOGASTERINI

Chrysogaster, *Lejogaster* and *Orthonevra* are complete (*O. splendens* for some strange reason was within *Chrysogaster*).

Verrall only knew of *Brachyopa bicolor* but Collin (1939) recognised that there was a species complex necessitating the description of 2 species new to science based on British material and the recognition of a third extra species.

Myolepta luteola stood alone until *M. potens* was added in 1950. *Hammersmidtia ferruginea* was added in 1944.

Neoascia has seen some changes. The species we call *aenea* (or more recently *meticulosa*) was ascribed to *floralis* by Verrall, a misidentification. *N. obliqua* was added in 1940 and *N. interrupta* in 1981.

ERISTALINI

Verrall's *Helophilus* has been split, with the definition of *Anasimyia*, *Parhelophilus* and *Lejops*. Verrall had 3 *Anasimyia*, which is now 5 species including *contracta* (1981) and *interpuncta* (1981). *Parhelophilus* has received the addition of *consimilis* (1931). This leaves *Helophilus* with only 3 of Verrall's species, to which has been added *groenlandicus* (1939), and *Lejops* which takes *vittata*.

Eristalis has seen the addition of *abusivus* (1931) and *pratorum* (1990). Verrall's *E. aeneus* and *E. sepulchralis* have been separated into *Eristalinus*. *Mallota* and *Myathropa* remain as single species genera.

MERODONTINI

Merodon and *Psilota* remain represented by single species. *Eumerus tuberculatus* was added in 1918.

PELECOCERINI

Pelecocera tricincta was known to Verrall and *Chamaesyrphus scaevoides* was slipped in as a late extra in his addenda and corrigenda. *C. caledonicus* was added in 1903.

PIPIZINI

It is not surprising that this troublesome tribe should have been subject to many changes.

Heringia heringi and *Trichopsomyia flavitarsis* were placed in *Pipizella*, together with *P.*

maculipennis and *P. virens*. The latter species was split in 1952, with the addition of *varipes* which proved the commoner of the two.

Pipiza was a real mess. Verrall's *P. signata* and *P. quadrimaculata* are no longer recognised as occurring in Britain, his specimen of the latter probably being 4-spotted *P. fenestrata*. His *P. lugubris* is in fact *austriaca*, the true *lugubris* being added in 1931.

Neocnemodon was represented only by *vitripennis*, additions being made in 1931, 1960 and 1980.

Triglyphus primus was first reported in 1933.

SERICOMYINI

All 3 species were known to Verrall though *Sericomyia silentis* was referred to as *S. borealis* and *Arctophila fulva* as *A. mussitans* (the latter name has recently been suggested as being the correct one to use).

VOLUCELLINI

Volucella zonaria was added in 1923.

XYLOTINI

The list of Verrall was fairly good since the New Forest has been well worked and even the classic areas in the Scottish Highlands had received attention. *Chalcosyrphus nemorum* was placed in *Xylota* and *Blera* was called *Cynorrhina*.

We no longer treat *Criorhina oxyacanthae* as a distinct species but regard it as a variety of *C. berberina*.

Additions comprise the great rarity *Chalcosyrphus eunotus* (1941), together with two *Xylota* stemming from species splits. *Xylota xanthocnema* 91939) was a new find, though resembling *X. sylvarum* whilst *X. coeruliventris* (1975) had stood confused within *X. florum* since Verrall's time.

MICRODONTINI

All three species are in Verrall's book, though *Microdon eggeri* was referred to as *M. latifrons*.

Overall species totals on the British list

Verrall (1901) included 194 species which are currently regarded as valid on the British list for that period. Coe (1953) took the total to 234 species, as given in a check list by Parmenter (1954). Stubbs & Falk (1983) gave a check list with 250 named species, plus 6 unnamed species and 9 forms of uncertain status. As now interpreted the list should be 253 species, including *Cheilosia proxima* (*Cheilosia* D + E), *Cheilosia* sp. A. and *Lapposyrphus* sp. A. In Coe and this work, *Cheilosia globulipes* is counted as a distinct species though such an interpretation is doubtful. Whilst *Cheilosia* is now sorted out, there are forms of *Pipiza* and *Sphaerophoria* that are still unresolved.

Subsequent additions to the end of 1990 comprise 13 species, including an as yet unnamed *Orthonevra*. This takes the British list to 266 (or 265 if *Cheilosia globulipes* is discounted).

Verrall (1901)	Coe (1953)	Stubbs & Falk (1983)	1990
194	234	253 (revised)	266

Since Verrall there has been on average 0.8 species added per year, in the last decade 2.2 species per year. Subsequent to the period under review, further additions are *Sphegina siberica* (Stubbs, 1994) *Paragus constrictus* (Speight & Chandler, 1995) and *Sphaerophoria* species B (Stubbs, 1995).

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Dipterists Digest 1995 **2**, 24-28

The soldier fly *Stratiomys chamaeleon* on Anglesey and the Black Isle

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The soldier fly, *Stratiomys chamaeleon* L. has a widespread distribution, occurring in Europe and parts of Asia (Rozkosny, 1982). However, it is absent from much of northern Europe and has a very restricted range in Britain, where it is regarded as endangered (Shirt, 1987). Early reports indicate a scattered distribution in southern Britain (Verrall, 1909), with records from 16 vice-counties (Drake, 1991). There were also more northerly localities in the 19th century with records from the Edinburgh area (Verrall, 1909) and from Braemar, South Aberdeen (G. Rotheray, *pers. comm.*). Contemporary records are confined to Cothill Fen and Dry Sandford Pit in Berkshire and two sites on Anglesey (Falk, 1991).

Stratiomys chamaeleon was first collected on Anglesey at Cors Erddreiniog National Nature Reserve by P. Skidmore & J.J Burn on 24.vii.1980 (Rees, 1983). More recently, three adults were taken at the same site on 11.vii.1987 during the Dipterists' Recording Scheme meeting in Bangor (M.J. Morgan, *pers. comm.*). In the same year, three adults were observed on umbel flowers in a lane adjacent to Gwenfro & Rhos y Gad SSSI (A. Stubbs, *pers. comm.*).

From 1988 to 1992 we investigated the distribution and ecological requirements of *S. chamaeleon* on Anglesey fens, concentrating our efforts at Cors Erddreiniog.

Distribution

We recorded *S. chamaeleon* from eight sites in eastern Anglesey (Table 1). All but one of these are calcareous, tufa-rich flushes or fens dominated by tussocks of *Schoenus nigricans* L. and *Juncus subnodulosus* Schrank, with open pools and runnels. This corresponds to the *Schoenetum nigricantis* (M13) mire community of the National Vegetation Classification (Rodwell, 1991) which has a very restricted distribution in Britain; the main foci are on Anglesey, the Llyn Peninsula, the Oxfordshire fens, Norfolk and the North York Moors (W. Fojt, *pers. comm.*).

An adult female taken at Braelangwell Wood SSSI on the Black Isle (VC 106; East Ross) on 16.vii.1991 was swept from structurally similar tufa-rich flushes, although the floristic composition differed from those on Anglesey with an abundance of small sedges, yellow saxifrage *Saxifraga aizoides* L. and associated stands of juniper (*Juniperus communis* L.) and birch (*Betula* L.).

Searches for larvae were carried out at all Anglesey sites but they were located only at Cors Erddreiniog and Waun Eurad (Table 1). The identity of these was determined using draft keys produced by A. Stubbs and confirmed when we successfully reared a male and female *S. chamaeleon* from larvae collected in 1990. Breeding at Braelangwell Wood was verified by the discovery of two pupal exuvia within the flushes.

Table 1. Records of *Stratiomys chamaeleon* adults and larvae on Anglesey and the Black Isle

Site	Grid Reference	Habitat	Date of visit	No. of flies	No. of males	No. of females	No. of larvae
Cors Bodeilio	SH503774	calcareous fen	06.8.90	1			
Cors Erddreiniog	SH475828	calcareous flushes	02.8.90	1		1	
Cors Erddreiniog	SH478826	calcareous flushes	12.7.87	1		1	
			03.4.88				3
			06.5.88				several
			01.8.89	2	1	1	
			05.8.89	9	9		
			28.7.90	19	8	11	
			04.8.90	10	8	2	
			11.5.91				2
			27.5.91				2
			23.6.91				1
			06.7.91	2	1	1	
			21.7.91	70	55	15	
			17.8.91	9	3	6	
			17.5.92				20
			27.6.92	2	2		
			14.7.92	79	49	26	
			24.7.92	29	4	25	
Cors Erddreiniog	SH475812	calcareous flushes	31.8.92				1 pupal exuvium
Gwenfro & Rhos y Gad	SH514793	calcareous flushes	07.9.91	1		1	
			11.8.91	1	1		
Plas y Brain	SH507794	arable field	06.7.90	1		1	
Talwrn	SH487763	calcareous flush	03.8.91	1		1	
Waun Eurad	SH506805	calcareous basin mire	12.5.90				1
			28.7.90	1	1		
			07.8.91	14	9		
			11.8.91	2		5	
						2	
Braelangwell Wood	NH680637	calcareous flushes	16.7.91	1		1	
			18.7.91				1 pupal exuvia

Larval Ecology

Larvae were found in these tufa-rich flush systems, where they avoid the main runnels but occupy instead shallow, side pools with little through-flow of water. The chemical composition of these flushes was investigated by Boyer (1984) and found to be base-rich (pH of 7.3) with high levels of dissolved calcium (122 mg/1). Such concentrations may be crucial to the survival of the larvae which are known to secrete calcium carbonate into the cuticle to prevent desiccation (Oldroyd, 1969). On the continent, larvae of *S. chamaeleon* have been recorded from the margins of freshwater ponds and spring pools as well as from more saline conditions (Rozkosny, 1982).

Larvae were found in all months that we visited the study sites although the number found was small, even after intensive searches (Table 1). An unusually high count of 20 was achieved on 17.v.1992 at Cors Erddreiniog. They were most frequently observed on warm, sunny days when they were gliding through the silty substrate, presumably feeding on animal and plant detritus. Immobile larvae were located by looking for shallow depressions in the water surface caused by the apical coronet of pinnate float-hairs surrounding the spiracle. Occasionally, they were found with the head and mouthparts protruding from a 10mm wide conical-shaped depression in the substrate. In captivity, larvae immediately burrowed into the substrate.

All the larvae found were of medium to large size (30 to 45mm) and may be between 3 to 5 years old (A. Stubbs, *pers. comm.*). This suggests that the younger age classes adopt more subterranean feeding habits as we regularly came across the much smaller larvae of the soldier flies, *Oxycera pygmaea* (Fallén) and *Oplodontha viridula* (Fabricius) within the flush systems.

Adult Ecology

Adults were on the wing from late June to the middle of August, with peak numbers occurring in mid to late July (Table 1). This corresponds with the June to July flight period reported by Rozkosny (1982). They were best searched for on calm, sunny days when they were feeding on umbel flowers. During the early part of the season most flies were found on hogweed, *Heracleum sphondylium* L. with a switch to parsley water-dropwort, *Oenanthe lachenalii* C. Gmelin as the summer progressed. Several other foodplants were noted (Table 2) but these appear to play only a minor role. Ismay (1981) reported a female *S. chamaeleon* taken on *Heracleum* L. and K. Porter (*pers. comm.*) found adults feeding on wild parsnip, *Pastinaca sativa* L., and this strong preference for umbellifers is further supported by the observations of Knuth (1909) and Rozkosny (1982) for the species (Table 2).

Stratiomys chamaeleon was observed to feed selectively on nectar rather than pollen and this may explain the predilection for umbellifers with their well exposed nectaries (Proctor & Yeo, 1973). Each floret was thoroughly vacuumed before walking or flying to an adjacent flower.

At Braelangwell Wood there was a lack of umbels within the vicinity of the flushes suggesting an alternative nectar source. The presence of yellow saxifrage could be significant as *Saxifraga* L. has been recorded as a food plant for *S. chamaeleon* (Rozkosny 1982).

From 1988 to 1990, numbers of adults recorded during a site visit were small, with a peak count of 19 flies in July 1990 at Cors Erddreiniog. By contrast, in the summers of 1991 and 1992 numbers were much higher with maximum counts of 70 and 79 flies at Cors Erddreiniog and 12 at Waun Eurad. There were marked differences in both the numbers of male and female flies and in their dispersal; there tended to be fewer females which were concentrated around the larval flushes whilst males ranged more widely and were encountered up to 1km from known breeding sites.

Table 2. Foodplants of adult *Stratiomys chamaeleon*

present study	Knuth (1909)	Rozkosny (1982)
Angelica sylvestris L.*	*Aegopodium podagraria* L.*	*Aegopodium* L.*
Centaurea nigra L.	*Anethum graveolens* L.*	*Caltha* L.
Cirsium arvense (L.) Scop.	*Anthriscus sylvestris* (L.)	*Carum* L.*
Filipendula ulmaria (L.)	Hoffm.*	*Chrysanthemum* L.
Maxim.*	*Daucus carota* L.*	*Crataegus* L.
Heracleum sphondylium L.*	*Fagopyrum esculentum* Moench	*Daucus* L.*
Mentha aquatica L.	*Heracleum sphondylium* L.*	*Heracleum* L.*
Oenanthe lachenalii C. Gmelin*	*Oenanthe fistulosa* L.*	*Peucedanum* L.*
Pulicaria dysenterica (L.) Bernh.	*Peucedanum oreoselinum* (L.)	*Saxifraga* L.
Succisa pratensis Moench	Moench*	*Sium* L.

* indicates umbellifers

Discussion

Although there is now a more accurate picture of the distribution of *S. chamaeleon* on Anglesey, much of the breeding biology remains to be discovered. The distinctive egg masses which have been found on the underside of leaves of aquatic plants on the continent (Rozkosny, 1982) have not been located at the Anglesey breeding sites. There is still a lack of information on the mating and egg-laying habits of this species.

Future surveys of *S. chamaeleon* should concentrate on the main foci of the *Schoenetum nigricantis* mire community which appears to be the main breeding site. In 1992, we visited several sites in the North York Moors, several of which have a rich stratiomyid fauna. Although *S. chamaeleon* was not encountered, our visits did not coincide with the peak flight period. There have been a number of entomological surveys of the base-rich fens of Norfolk, but it is possible that small populations of *S. chamaeleon* do occur and are awaiting discovery.

As most of the Anglesey sites are protected as SSSI's or NNR's, the major threats to the larval habitat are eutrophication from agricultural run-off and desiccation during prolonged droughts. Such factors will have a deleterious impact not only upon *S. chamaeleon* but also upon the diverse invertebrate fauna associated with these base-rich flushes.

The isolated populations of *S. chamaeleon* may benefit from positive management of larval and adult habitats. Light grazing by horses or cattle will help to maintain the open structure of the flush system. This would ensure the continuation of the present vegetation and provide open, muddy pools for larval development. The maintenance of umbel-rich areas adjacent to flushes would provide a convenient nectar source for adult flies.

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Dipterists Digest 1995 **2**, 29-30

Further new records of fungus-breeding Phoridae (Diptera)

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Further rearings of scuttle flies from fungi, carried out by R.E.E., have yielded the following new records, identified by R.H.L.D. The fungus nomenclature follows Phillips (1981), except where amended by Bon (1987). Records of named Phoridae reared from named fungi have been reviewed by Disney (1994).

Megaselia berndseni (Schmitz)

Fourteen reared from *Amanita fulva* (Sch.) Seyot collected at Barnham Broom, Norfolk (Grid Ref. 63/0807) on 23 July 1992. The species has been reared from 21 fungus species previously, but not from this species. This is the first record of a named phorid from *A. fulva*. Six reared from *Panaeolus campanulatus* (Bull. ex Fr.) Quél. collected at Hoe Rough, Norfolk (Grid Ref. 53/9716) on 12 May 1991. This is a new host record and only the second named phorid reported from this fungus species.

Megaselia flava (Fallén)

Two reared from *Peziza vesiculosa* Bull. ex St. Amans collected at Quidenham, Norfolk (Grid Ref. 62/0289) on 31 July 1987. This species has been reared from eight fungus species previously. The rearing from *P. vesiculosa* is a new record and the first named phorid reported from this host.

Megaselia flavicans Schmitz

Forty six reared from *Russula delica* Fr. collected at Pentney Common, Norfolk (Grid Ref. 53/7213) on 24 August 1988. This is the first record of a named phorid from this fungus and the twenty second fungus species recorded as a host for this fly.

Megaselia hirtiventris (Wood)

Twenty eight reared from *Agaricus macrosporus* (Moller & Schaeff.) Pilat collected at Quidenham, Norfolk (Grid Ref. 62/0289) on 31 July 1987: eighteen from *Agaricus praeclaresquamosus* Freem. (= *A. placomyces* Peck) collected at Santon Downham, Suffolk (Grid Ref. 52/8187) on 15 May 1989: eight from *Agaricus silvicola* (Vitt.) Peck collected at Chesterton Wood, Warwickshire (Grid Ref. 42/3457) on 29 August 1988: and fourteen from *Agaricus vaporarius* (Pers.) Cappelli collected at South Walsham, Norfolk (Grid Ref. 63/3613) in October 1989, the flies emerging in March 1990. This fly has previously been reared from six species of fungus, four of them *Agaricus* species. The new records are new host records and all (along with *M. nigra* - see below) are the first records of named phorids from these four fungus species.

Megaselia nigra (Meigen)

Eleven reared from *Agaricus silvicola* collected at Ashwellthorpe Woods, Norfolk (Grid Ref. 53/1397) collected 12 July 1992: thirteen from *Agaricus vaporarius* collected at South Walsham (Grid Ref. 63/3613) in August 1990: three from *Exidia truncata* Fr. (= *E. glandulosa* Fr.) collected at Thursford Wood, Norfolk (Grid Ref. 53/9733) on 1 April 1992: one from *Piptoporus betulinus* (Bull.) Karst. collected at Lound waterworks, Suffolk (Grid Ref. 63/5100) in July 1992: and two from *Vascellum pratense* (Pers.) Kreisel from Overy Staithe, Norfolk (Grid Ref. 63/8444) collected 6 August 1985. Previous records of this species are primarily from *Agaricus campestris* L. ex Fr. and the cultivated *A. bisporus* (Lange) Pilat and *A. bitorquis* (Quél.) Sacc. and eight other species of *Agaricus*. The five fungus hosts reported here are all new host records and all are the first records of named phorids from these fungi (along with the *M. hirtiventris* reported above).

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Dipterists Digest 1995 **2**, 31-36

Feeding behaviour and mouthpart structure of larvae of *Microdon eggeri* and *Microdon mutabilis* (Diptera, Syrphidae)

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The feeding habits of european *Microdon* larvae have been little studied since Donisthorpe (1927) hypothesised that they feed on buccal pellets ejected by their ant hosts. In America, however, van Pelt and van Pelt (1972) observed *Microdon baliopterus* Loew feeding on larvae of the ant, *Mononorium minimum* (Buckley). They recorded that the larva of this *Microdon* species snatching prey under itself and extracting the internal contents through slits in the integument. Duffield (1980) and Garnet *et. al.* (1990) also observed *Microdon* larvae feeding on ant eggs and larvae. Results presented here show that larvae of two further *Microdon* species, *Microdon eggeri* (Mik) and *Microdon mutabilis* (L.), are predators of eggs and larvae of Formicidae and that the mouthparts are particularly suited for grasping prey rapidly under threat from worker ants.

Materials and Methods

During this study, some 200 third instar larvae of *Microdon mutabilis* have been reared with the resulting adults released at the collection site. Also, second instar larvae of *Microdon mutabilis* and *Microdon eggeri* have been successfully maintained in culture and observations made on feeding behaviour. The two species of *Microdon* studied here are simple to separate. The larva of *M. eggeri* has a network of protruding setae all over the dorsal surface. These setae are absent in *M. mutabilis* (Dixon, 1960). Ant species were identified using Bolton and Collingwood (1975) and Collingwood (1979).

Live *Microdon* larvae and host ant species were collected from localities on the Isle of Mull, Scotland. The ant nests were kept in a dark area of the laboratory and temperature was maintained at 20° C. Observations on feeding behaviour of *Microdon* larvae were conducted in the laboratory with cultures contained in clear plastic containers. To prevent disturbance, observations were made using a red photographic light. More detailed observations being made using low voltage tungsten halogen dichroic light.

The mouthparts of *M. eggeri* and *M. mutabilis* were examined from third (=final) stage larvae collected in 1993 from localities on the Isle of Mull, Scotland. Extracted mouthparts were also examined from other British localities and from norwegian *M. eggeri*. To extract the mouthparts, larvae were killed by immersion in hot water (90° C.). The anterior end was dissected dorsally and placed in 20% KOH for 24-36 hrs. After which time the cephalopharyngeal skeleton was placed in fresh KOH for a further 24 hrs to remove remaining tissues with further microscope dissection as required. The extracted skeleton was then immersed for 10-15 minutes in glacial acetic acid and cleared for 5-10 minutes in clove oil. Slide preparations were made by immersing skeletons in xylene for 5 minutes and mounting in Euparol or Eukitt, both of which are xylene based. Staining was unnecessary in the majority of specimens, however, when stain was used basic Fuscin gave adequate results with 30 seconds immersion.

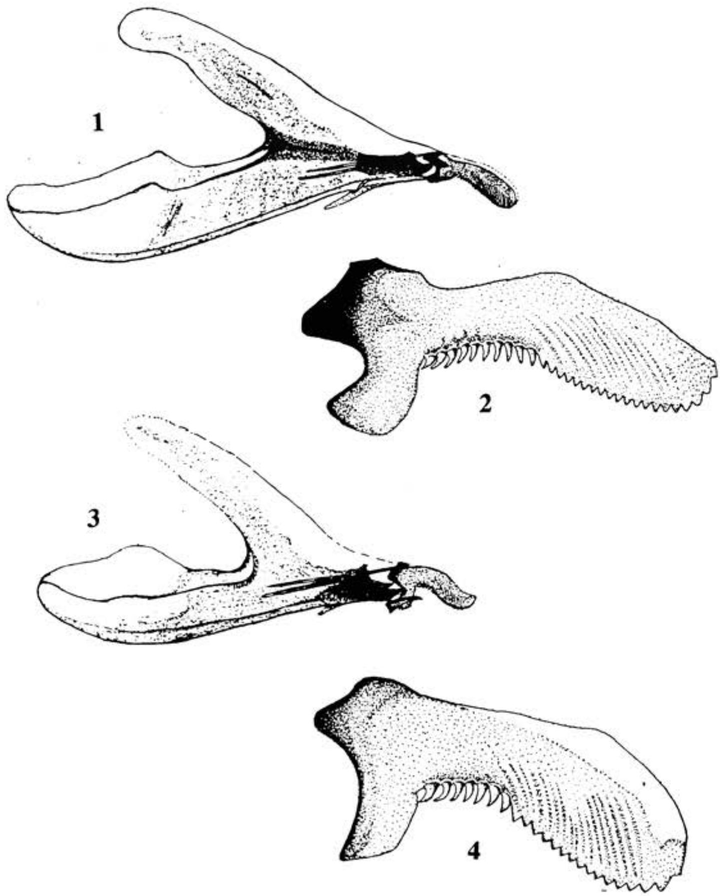

Fig. 1. *Microdon* mouthparts. 1, *M. eggeri*, whole cephalopharyngeal skeleton, lateral view; 2, *M. eggeri*, mandible, lateral view; 3, *M. mutabilis*, whole cephalopharyngeal skeleton, lateral view; 4, *M. mutabilis*, mandible, lateral view.

To prevent distortion, no cover slip was used in most of the 50 preparations. Covered mounts were made of single mandibles and labium structures finally ringed with sealant and shellac. Drawings were made from slide preparations through a compound trinocular microscope with the aid of a squared eyepiece or stage micrometer graticules.

Results

To determine whether *M. eggeri* larvae are predators of ant eggs, a nest of *Formica lemani* Bondroit ants containing second stage larvae of *M. eggeri* was collected in September 1993 from a locality on the Isle of Mull.

Observations at intervals over 24hr periods revealed that workers ants were active with the eggs until about 02.00h. At this time, with worker vigilance reduced, *M. eggeri* larvae (< 5) became active. Initial larval movement being associated with the marginal band: the spinules being raised and lowered. This was immediately followed by movement of the ventral surface. From the resting site to the ant eggs, distances of up to 50mm were covered in less than 3 minutes. Feeding activity lasted for 3-15 minutes, then larvae returned to their resting sites.

In capturing food, ant eggs were gathered up on the anterior serrations and teeth of the mandibles (Fig. 1) which were projected forward. The mandibles were then retracted rapidly under the marginal band. The eggs were broken up between the mandibles and the labium and totally consumed. Time spent gathering and feeding ant eggs per feeding session depended on the reactions of the ant workers. When alerted fully, workers placed themselves between the *M. eggeri* larvae and the eggs and this prevented predation until workers moved away. Workers also responded by moving eggs from the path of an approaching *M. eggeri* larva. It appears that the movement of satiated *M. eggeri* larvae away from the brood deters workers moving the surviving eggs to another site.

To determine whether *M. mutabilis* larvae are predators of ant broods, second stage larvae were collected from a locality on the Isle of Mull on 7.iv.1994 in a *F. lemani* nest.
Six second stage larvae of *M. mutabilis* were placed in a plastic box containing a nest of *Myrmica ruginodis* Nylander. The *M. mutabilis* larvae were placed ventral surface down on the nest material comprising fragments of wood from the original tree stump. They remained still for three days, observations being made at hourly intervals. On the fourth day, two of the larvae began to move. Observations of these two larvae were made at 30 minute intervals as they moved towards the brood chamber. The brood consisted of some 150 larvae, constantly attended by workers. There was no evidence of ant workers attempting to impede the progress of the *M. mutabilis* larvae, which reached the brood chamber at the end of day 4. No attempts to move the brood were made by the workers and the two *M. mutabilis* larvae settled at the edge of the brood chamber.

About six hours later, one of the *M. mutabilis* larvae extended its mouthparts beyond the marginal band and moved towards the brood. In response, worker ants climbed on to the dorsal surface of the larva. With ant workers stationed on the dorsal surface, *M. mutabilis* larvae made reduced attempts to feed and worker ants were occasionally successful in grabbing back ant larvae. Five larvae were observed in about 70 prey capture sequences. Prey capture in *M. mutabilis* larvae was similar to *M. eggeri*. Prey were rapidly captured between the mandibles and pulled back under the body. The serrated margins of the mandibles and those of the labium assisting in holding the prey in position (Fig. 2). Once under the body, the front part of the thorax was inverted in a "swan neck" and the internal contents of prey were completely removed. Again, the serrated margins of the mandibles and the labium probably assisting in the process of mechanically breaking up the prey. Evidence of *M. mutabilis* larvae having fed is provided by the accumulation of black material in the gut which is visible both ventrally and dorsally.

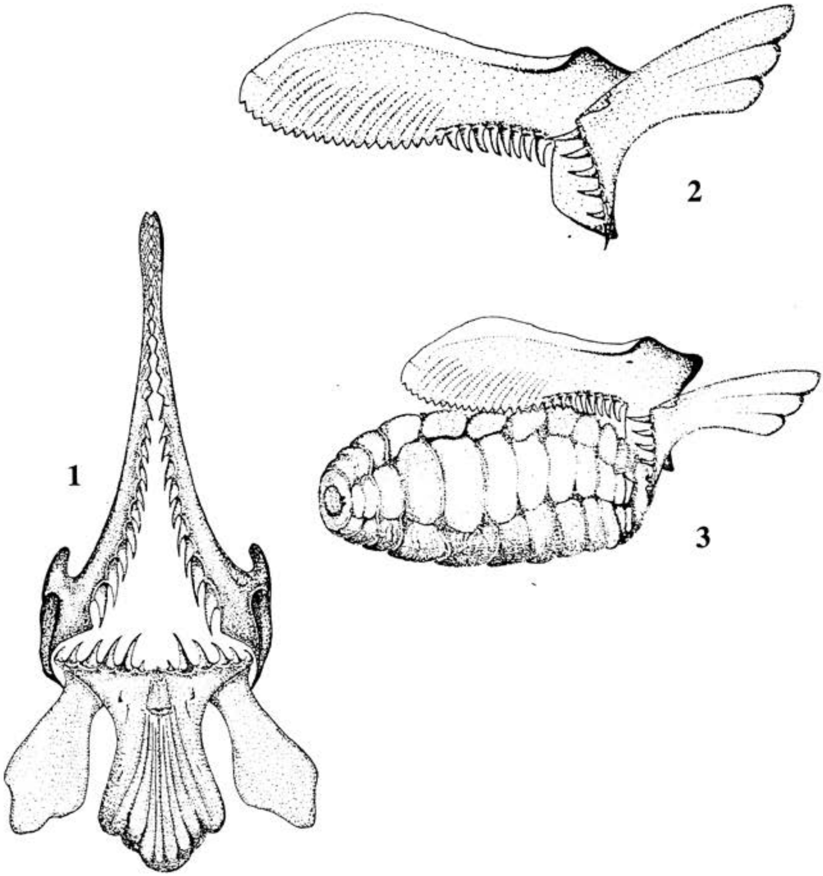

Fig. 2. ***Microdon mutabilis*** **mouthparts. 1, anterior section of cephalpharyngeal skeleton, ventral view; 2, anterior section of cephalpharyngeal skeleton, lateral view; 3, schematic representation of captured ant larva impaled on the mouthparts.**

Discussion

The observations presented here show that second and third stage larvae of *M. eggeri* and *M. mutabilis* are predators of ant eggs and larvae. These results support the similar findings of van Pelt and van Pelt (1972), Duffield (1980) and Garnet *et. al.* (1990) and suggests that predation of the early stages of ants is typical of *Microdon* larvae.

The cephalopharyngeal skeletons of *M. eggeri* and *M. mutabilis* are sufficiently different to enable them to be identified (Fig. 1). In the field, this may be helpful because the dorsal remains of empty puparia are frequently removed by worker ants leaving only the ventral sole to which the mouthparts are usually attached.

It appears that worker ants have few effective defences against the feeding strategy adopted by the larvae of the two *Microdon* species investigated here. By feeding at night, when worker ants are least active, *Microdon* larvae appear to utilise a strategy that elicits a minimum response from worker ants. This may be important as the only effective defence against *Microdon* larvae could be for the ants to move their brood to other parts of the nest or to abandon the nest altogether. If *Microdon* larvae elicit such responses, they may represent an unrecognised factor influencing ant distribution.

Certainly *Microdon* larvae can be major causes of brood mortality. The observations presented here suggest that up to 125 ant larvae may be consumed by an individual *Microdon* larva. On Mull, an average of 5.5 (range 0-17) *M. mutabilis* larvae were present in nests of *F. lemani* recorded over a ten year period. Furthermore, both species of *Microdon* larvae were occasionally found together in the same *F. lemani* ant nest. The estimated larval food requirements for an average nest containing 5-6 larvae could be in excess of 700 ant larvae. With such large numbers being required for development, competition for food may occur. This may explain the wide divergence in size of *Microdon* typically present in ant nests on Mull. Laboratory observations of *M. mutabilis* larvae suggest one element of competition could be lack of space close to the ant brood. On reaching the brood chamber *M. mutabilis* larvae stationed themselves in the approach tunnels which physically prevented other *Microdon* larvae from approaching the brood. Late arrivals often left, presumably to search for food elsewhere.

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Dipterists Digest 1995 **2**, 37-40

Diptera on Sule Skerry, Orkney

ADRIAN R. PLANT, 30 Dorset Street, Blandford Forum, Dorset, DT11 7RF

The island of Sule Skerry is situated off the north coast of Scotland about 66km west of Brough Head in Orkney at 4° 24'W, 59° 06'N (HX6324). The island measures at most 700x300m with a maximum height of c15m. A wide peripheral supralittoral "spray zone" gives way in the centre of the island to about six hectares of peaty soil in which are found the burrows of approximately 45,000 pairs of puffins, *Fratercula arctica*. The rocky periphery is mostly occupied by lesser (but still large) numbers of breeding seabirds of various species. A few plants of scurvy-grass, *Cochlearia*, occur on the rocks and there is a small area of introduced grasses near the automatic lighthouse. An almost uniform sward of scentless mayweed, *Tripleurospermum maritimum,* covers the puffin colony growing on the wet salt-laden peat. There is no fresh water and the few semi-permanent pools found on the peat are brackish, being frequently inundated with wind blown sea spray, and are heavily enriched with guano and dead birds. The climate is temperate oceanic and the island, being small and low, is very exposed to wind and sea; indeed there is evidence that at least once in recent years, a part of the island has been breached and washed over by big seas during winter storms.

I am unaware of any previously published reports on the entomology of Sule Skerry, which would be expected to be of interest if only because of the remoteness of the island. Additionally, the Diptera associated with seabird colonies has been little studied and this paper presents a list of the Diptera largely collected during a visit to the island on 20-25.vii.1993. Collections were made by hand searching, sweep netting and white pan traps. Material was determined by the author, or by J Deeming (JC), EG Hancock (EGH), P Withers (PW), P Roper (PR), CE Dyte (CED), CW Plant (CWP), M Ackland (MA) and A Pont (APo), as indicated in the species list. The initials NC indicate that the record is extracted from a letter, dated 13.ix.1985, from Norman Cobley to David Budworth detailing observations made on Sule Skerry during the spring of 1985 (Table 1).

Discussion

A total of only 43 species of Diptera (Table 1) is not unexpected given the small size and isolation of Sule Skerry. However the number of species reported here is undoubtedly incomplete and might be extended by more specialist collecting techniques and by collecting at other times of year.

Several components of the Diptera fauna can be identified although there may be considerable overlap between these. It is implicit from the high salt-loading of the entire island that all the species are halo-tolerant. This is exemplified by the Dolichopididae, all of which are known from saline habitats (C.E. Dyte *pers. comm.*). *Dolichopus griseipennis* and *D. diadema* are rarely found away from salt marshes and on Sule Skerry were commonly found near pools in the peaty soil. The chironomids *H. variabilis* and *H. fucicola* are truly halophilic species associated with marine pools. Both have been reported from the Orkney Islands (Laurence, 1992) and the latter is also known from Lundy and Skokholm (P. Roper *pers. comm.*) while *C. halophilus* ia a widespread species breeding in brackish pools. *Coelopa frigida, S. calida* and *T. zosterae* breed in seaweed but since there is an apparent lack of shore-cast seaweed on the island it is possible that immature stages will be found in salt-laden terrestrial detritus or in the weed and other materials comprising nests of shags, *Phalacrocorax aristotelis*.

Table 1 Diptera recorded from Sule Skerry during spring 1985 and 20-25 July 1993

Tipulidae EGH
Tipula paludosa Meigen
Psychodidae PW
Psychoda albipennis Zetterstedt
Ceratopogonidae PR
Culicoides pulicaris (L.)
Chironomidae PR
Chironomus halophilus Kieffer
Halocladius fucicola (Edwards)
H. variablis (Staeger)
Lymnophyes exiguus (Goetghebuer)
Sciaridae
Bradysia brunnipes (Meigen)
Corynoptera sp. PR
Hybotidae
Platypalpus palliventris (Meigen)
Empididae
Rhamphomyia variablis Fallén
Dolichopididae CED
Dolichopus diadema Haliday
D. griseipennis Stannius
D. nubilus Meigen
D. plumipes (Scopoli)
Syntormon pallipes (F.)
S. pallipes var. *pseudospicatus* Stobl
Lonchopteridae
Lonchoptera lutea Panzer
Syrphidae
Helophilus pendulus (L.) CWP
Platycheirus manicatus (Meigen) CWP
Eupeodes corollae (F.) NC
Coelopidae JD
Coelopa frigida (F.)
Heleomyzidae JD
Heleomyza serrata (L.)
Tephroclamys rufiventris (Meigen) NC
Sphaeroceridae
Telomerina flavipes (Meigen)
Thoracochaeta zosterae (Haliday)
Piophilidae JD
Parapiophila vulgaris Fallén
Ephydridae JD
Hydrellia ?griseola (Fallén)
Limnellia quadrata (Fallén)
Scatella paludum (Meigen)
S. silacea Loew
S. stagnalis (Fallén)
Drosophilidae JD
Parascaptomyza pallida (Zetterstedt)
Scaptomyza graminum (Fallén)
Agromyzidae JD
Phytomyza pullula Zetterstedt
Calliphoridae
Calliphora vicina Robineau-Desvoidy NC
Cynomya mortuorum (L.)
Scatophagidae
Scatophaga calida Curtis
S. stercorea (L.)
Anthomyiidae MA
Pergamyia betae (Curtis)
Fanniidae APo
Fannia glaucescens (Zetterstedt)
Muscidae JD
Helina reversio Harris

Phytophagous Diptera are limited by the small number of plants present. *Phytomyza pullula* has been reported to mine leaves of *Tripleurospermum* (Spencer, 1976). The ephydrid, *H. griseola* and the drosophilid, *S. graminum* are known to mine many plants (Smith, 1989) but their host plants on Sule Skerry were not determined. The hoverflies, *E. corollae* and *P. manicatus*, which may be immagrants here are predatory on aphids in the larval stage (Rotheray, 1993).

Large amounts of putrifying material (corpses, faeces, abandoned eggs etc) that accumulate during the spring and summer months are a feature of high density seabird colonies is. It is not surprising therefore that coprophilous and carrion-feeding Diptera in Heleomyzidae, Piophilidae, Ephydridae, Calliphoridae and Fannidae feature prominently in the species list (Table 1). Other species with related habits such as *S. pratorum, L. exiguus* and *H. pendulus* apparently favour mud enriched with putrifaction products, while others may be opportunistic predators in rich soils and muds (*H. reversio,* Empididae, Hybotidae). This section of the fauna appears to represent species which occur in a wide variety of decaying matter and it is doubtful if any have an obligate association with the nests, carrion and excrement of birds.

The soil of Sule skerry is honeycombed with the subterranean burrows and nest chambers of breeding seabirds. The Diptera of mammal burrows has been investigated (Hackman, 1963; 1967) and although a little is known of the Diptera of bird nests (Woodroffe, 1953; Rotheray, 1989), the fauna of subterranean avian burrows is virtually unknown. *Heleomyza serrata, T. rufiventris, T. flavipes* and *C. mortuorum* reported here are known from vole burrows (Hackman, 1963), but also occur elsewhere. For example *H. serrata* favours vole burrows but is known in other media such as bird's nests, soil and *Fistulina* fungi, while *T. rufiventris* is also reported from fungi (Smith, 1989). I have no evidence that any of the Diptera found on Sule Skerry were associated with seabird burrows or, indeed, with the seabird colony in general. However the possibility of specific burrow associations remains a fertile topic for additional work.

Acknowledgements

I wouls like to thank Dave Budworth and the Sule Skerry Ringing Group for the opportunity to visit the island and J. Deeming, E.G. Hancock, P. Withers, P. Roper, C.W. Plant, M. Ackland and A. Pont for determination of the specimens. The financial support of the British Trust for Ornithology, Pharos Marine Ltd., Scottish Naturalists' Trust, Scottish Ornithologists' Club, Seabird Group, Royal Society for the Protection of Birds and Tecquipment Ltd., is gratefully acknowledged.

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Diptera notes from Staffordshire - **Hibernating Hoverflies?**

Whilst sawing up some old branches in April 1992, a cavity was found that had been formed by heartrot. The cavity, approximately 15mm in diameter and 150mm long contained the following; fourteen specimens of *Episyrphus balteatus* (Degeer), three specimens of *Syrphus ribesii* and three specimens of *Eupeodes (= Metasyrphus) luniger* (Meigen). All of the flies were found grouped together and unfortunately dead. The branches had been removed from a Cherry tree (*Prunus*) and stored by the side of a garden shed for around five years. Presumably the flies entered the cavity to overwinter and died, or failed to escape.

Conops vesicularis L. (Diptera-Conopidae), first Staffordshire records for 60 years

Two specimens of the notable conopid, *Conops vesicularis*, have been recorded at Sandon Hall, Staffordshire (SJ9528). The specimens were collected in Malaise traps on the following dates, 14 & 17.v.92. *Conops vesicularis* was last recorded in Staffordshire in 1932 by Harry Britten at Chartley Moss (Emley, D.W. 1992. *Staffordshire Flies, a provisional list, 2nd edition*. Staffordshire Biological Recording Scheme Publication No. 15, Stoke-on-Trent City Museum and Art Gallery).

Pocota personata Harris (Diptera-Syrphidae) in Staffordshire

A specimen of the RDB2 species, *Pocota personata* was taken in a Malaise trap on the 20.vi.92 at Sandon Hall, Staffordshire (SJ9528). This species is not included in Emley, D.W (1992. *loc. cit.*) and therefore appears to be the first record for the county. My trap was sited within the wooded area of the garden at Sandon Hall which has a large population of mature Beech trees. Stubbs & Falk (1983 *British Hoverflies*) state that *P. personata* breeds in rot holes and has a affinity for Beech. - **MICHAEL C. BRIAN,** 1 Trevelyans Green, Trinity Fields, Stafford ST16 1LJ

Dipterists Digest 1995 **2**, 41-48

The distribution of the genus *Aedes*: subgenera *Aedes, Aedimorphus* and *Finlaya* in Britain

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Distribution maps have now been published for the genera *Anopheles*, *Culex*, *Coquillettidia*, *Culiseta* and *Orthopodomyia* (Rees & Snow 1990, 1992, 1994). The genus *Aedes* is the largest of the British genera with 14 species arranged in four subgenera: *Aedes*, *Aedimorphus*, *Finlaya* and *Ochlerotatus*. This paper deals with the first three of these, each of which contains only a single species. The remaining subgenus will be the subject of the final paper in this series.

The following maps were produced from data stored in a computer database (dBASEII) and analyzed by a BASIC program developed on an IBM-compatible PC. The records prior to 1940 are primarily those from Marshall (1938). Where possible, the original references to the distributions were examined in order to produce accurate records. As in previous papers in this series, these older records are plotted only when they are sufficiently specific to enable a 10km square Ordnance Survey grid reference to be determined. The most recent records take precedence in Figs. 2-4, with data from Marshall (1938) having priority in the life history calendars.

Data for 1940-1969 have been gleaned from published records, and the most recent group (1970 to date) are primarily those received directly by the British Mosquito Recording Scheme (BMRS), together with information extracted from published literature.

Since the preparation of the distribution maps for the genera *Coquillettidia*, *Culiseta* and *Orthopodomyia* in July 1992 (Rees & Snow, 1994), 35 new records have been added (Fig. 1). This makes a total of 1725 sites in Britain from which mosquitoes have been reported. These range over 859 10km squares and 101 Vice Counties. The maps show clearly that there are many areas including 11 Vice Counties in which no species have been recorded. Collecting in these areas may well prove extremely profitable.

The three species will now be considered in turn with a brief description of the larvae and adults, an outline of their ecology and life histories, and a commentary on their known distributions. Further information on identification and biology may be found in Cranston *et al.* (1987) and Snow (1990).

Aedes (Aedes) cinereus (Fig. 2)

Adults of *A. cinereus* are almost entirely blackish brown except for a reddish thorax and two narrow pale stripes on the sides of abdomen. Larvae have extremely long anal papillae, a feature shared only with *A. sticticus*.

The one-year life cycle is typical of *Aedes*, with oviposition occurring in the summer in dry areas prone to freshwater flooding. Aquatic sites are more or less open and sunlit, and larvae have been collected in flooded meadows, shallow pools, ponds, ditches and marshes. After hatching, larval development is necessarily rapid, for in some cases habitats dry out in early summer. *Aedes cinereus*, plentiful in undrained fenland at Wicken (Cambs.), was absent from adjacent drained fenland where water did not stand as long (Macan, 1939). According to the life history calendar in Marshall (1938), larvae have not been recorded later than June. However, he records a larva that he collected personally in August 1936 from Inverery, Argyllshire.

Adult *A. cinereus* appear in June and persist into September (rarely October), though the biting peak occurs in July (Service, 1969). Daylight hours are spent in dense, low vegetation including thick grass (Wesenberg-Lund, 1921).

Females feed principally on mammalian blood and, while not primarily attracted to humans, bite them readily when available. Hungry females will not seek out bait in an exposed sunlit situation by day, but will attack in numbers at night (Service, 1971). They will however attack during the day in shady situations, or in the low vegetation in which they habitually rest.

Aedes cinereus has a widespread but patchy distribution in Britain, extending as far north as Inverary (Strathclyde) and Loch Venachar (Tayside) (Marshall, 1938). In this paper we have assumed that Marshall's record for Landrech is actually for Lendrick, a village near the shores of Loch Venachar.

Aedes (Aedimorphus) vexans (Fig. 3)

In general appearance adult *A. vexans* resemble *A. cantans* although there are several differences, the most obvious being that in *A. vexans* the pale abdominal bands narrow in the centre. Larvae are characterised by the comb which has very few scales, and the pecten with some widely spaced spines.

Since first recorded in Britain at the end of the last century from an unspecified site (Verrall, 1888), there have been sporadic reports of *A. vexans* from scattered localities in England and Wales, the most recent in 1989 (Ramsdale & Smith, 1990). It has twice been found in Woking and Morden Park (Surrey), breeding in flooded grass (Davies, 1958; P F Mattingly, pers. comm.). *Aedes vexans* is an important day-biting pest in many parts of its range though only recorded once as such in Britain, at Finchley (London) (Marshall, 1938). The scarcity of records at one time suggested that it might be sporadically introduced, but successive recent records from Wimbledon and Morden indicate that it may be established (P F Mattingly, pers. comm.).

Marshall (1938) recorded *A. vexans* from Mildenhall (Suffolk), Shotover (Oxon.), Dolgellau (Gwynedd), Finchley (London), Tring (Herts.), Hayling Island (Hants.) and Arundel (Sussex). Additional published records are from Cambridge, Clifton (Bristol) and Merton (London) (all Natural History Museum specimens), Wimbledon (London) (Mattingly, 1950), Morden (London) (Nye, 1955), Woking (Surrey) (Davies, 1958), Brownsea Island (Dorset)

(Service, 1968) and Cliffe (Kent) (Ramsdale & Smith, 1990).

Aedes (Finlaya) geniculatus (Fig. 4)

This striking mosquito has conspicuous white knee spots, a white pattern on the thorax and white patches on the abdomen which do not form complete bands. Larvae, too, have many distinguishing characters, among them smooth antennae and evenly aligned comb scales.

A thorough study of the biology of this species was carried out by Yates (1979). The aquatic stages are found in water-filled tree holes. Larvae have been collected from ash (*Fraxinus excelsior*), beech (*Fagus sylvatica*), birch (*Betula pendula*), horse chestnut (*Aesculus hippocastanum*), sweet chestnut (*Castanea sativa*), elm (*Ulmus* sp.), hornbeam (*Carpinus betulus*), lime (*Tilia* sp.), Norway maple (*Acer platanoides*), oak (*Quercus* sp.) and sycamore (*Acer pseudoplatanus*). One record exists of larvae in a ground pool together with *A. cinereus* (Marshall, 1938). Eggs are laid on the sides of the cavities and await submergence after rainfall. *Aedes geniculatus* is most common in larger rot holes but may also be found in smaller holes, often at the base of trunks. Overwintering may be as either eggs or larvae, although only eggs can withstand freezing.

Adult emergence begins in April and there are often two generations each year with the last adults of the season being reported in September. Females bite people readily but seldom enter houses.

In the British Isles, *A. geniculatus* is widespread and often abundant in English woodlands as far north as Gosforth Park (Northumberland), but has not been reported from Ireland, Scotland or Wales.

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We wish to thank the many collectors who have provided records upon which this paper is based.

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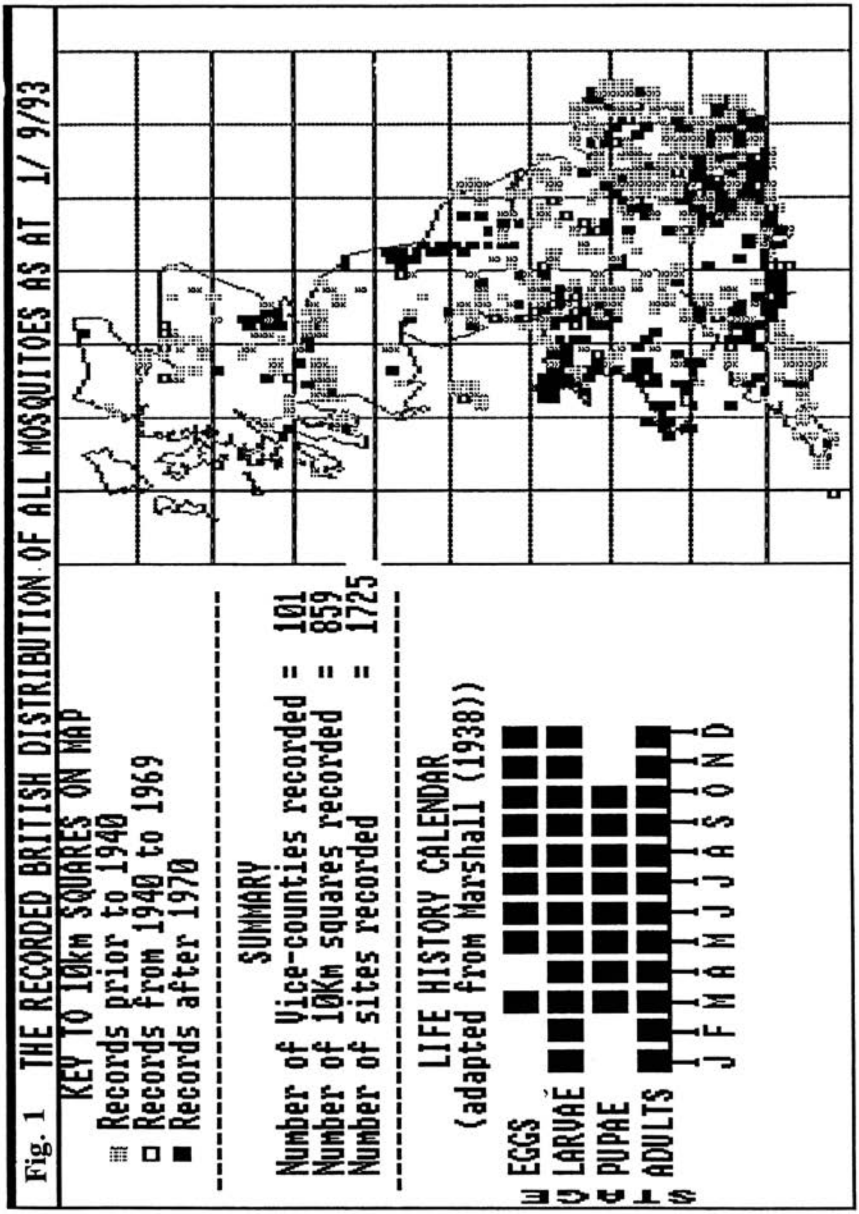


Fig. 1 THE RECORDED BRITISH DISTRIBUTION OF ALL MOSQUITOES AS AT 1/ 9/93
KEY TO 10km SQUARES ON MAP
Records prior to 1940
Records from 1940 to 1969
Records after 1970
SUMMARY
Number of Vice-counties recorded = 101
Number of 10Km squares recorded = 859
Number of sites recorded = 1725
LIFE HISTORY CALENDAR
(adapted from Marshall (1938))
STAGE
EGGS
LARVAE
PUPAE
ADULTS
J F M A M J J A S O N D

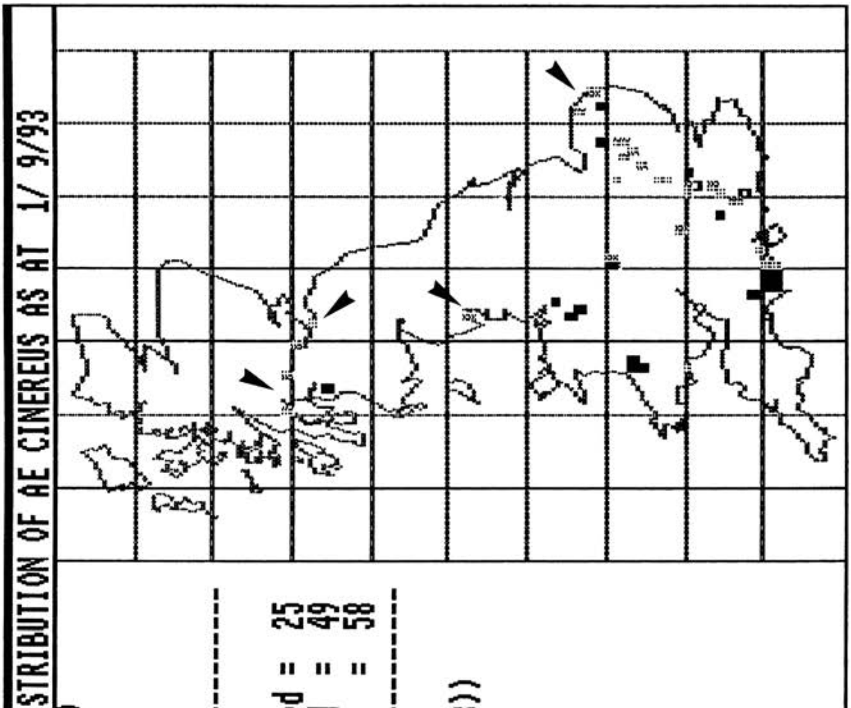

THE RECORDED BRITISH DISTRIBUTION OF AE CINEREUS AS AT 1/ 9/93
KEY TO 10km SQUARES ON MAP
Records prior to 1940
Records from 1940 to 1969
Records after 1970
SUMMARY
Number of Vice-counties recorded = 25
Number of 10Km squares recorded = 49
Number of sites recorded = 58
LIFE HISTORY CALENDAR
(adapted from Marshall (1938))
STAGE
EGGS
LARVAE
PUPAE
ADULTS
J F M A M J J A S O N D
Base data from Marshall (1938)
Further data from BMG records

Fig. 2

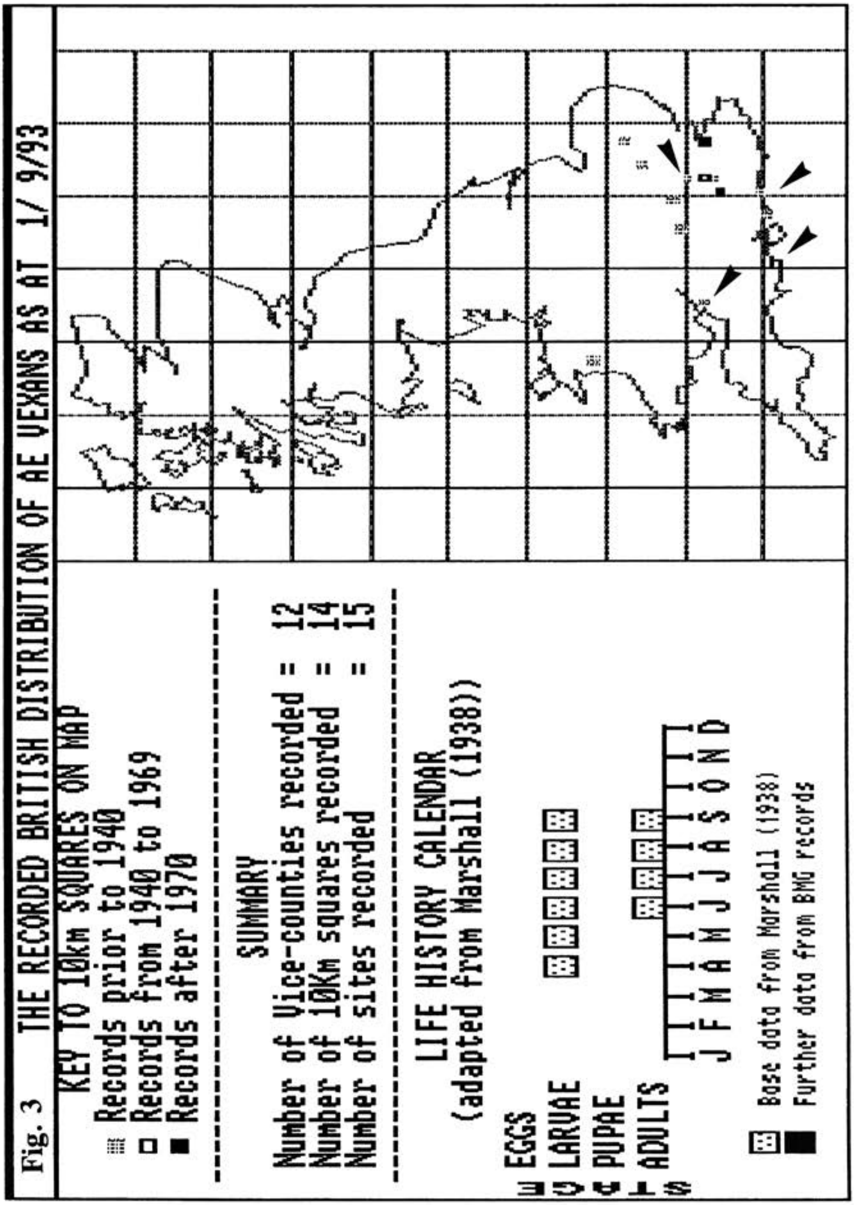


Fig. 3
THE RECORDED BRITISH DISTRIBUTION OF AE VEXANS AS AT 1/ 9/93
KEY TO 10km SQUARES ON MAP
Records prior to 1940
Records from 1940 to 1969
Records after 1970
SUMMARY
Number of Vice-counties recorded = 12
Number of 10Km squares recorded = 14
Number of sites recorded = 15
LIFE HISTORY CALENDAR
(adapted from Marshall (1938))
STAGE
EGGS
LARVAE
PUPAE
ADULTS
J F M A M J J A S O N D
Base data from Marshall (1938)
Further data from BMG records

Fig. 4 THE RECORDED BRITISH DISTRIBUTION OF AE GENICULATUS AS AT 1/ 9/93

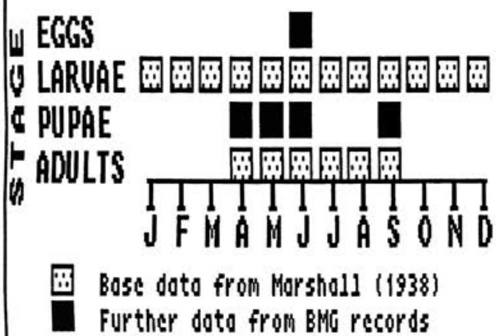
KEY TO 10km SQUARES ON MAP

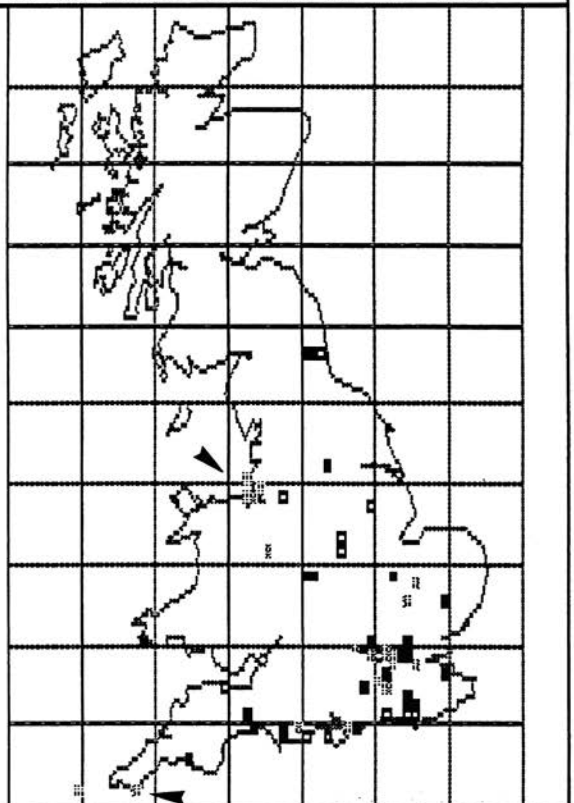
- Records prior to 1940
- Records from 1940 to 1969
- Records after 1970

SUMMARY

Number of Vice-counties recorded	=	29
Number of 10Km squares recorded	=	62
Number of sites recorded	=	84

LIFE HISTORY CALENDAR
(adapted from Marshall (1938))





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