

# Larger Brachycera Recording Scheme

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## From the Scheme Organiser Call-in for Larger Brachycera Records

I must apologise for the less than satisfactory feedback, due to family illness and moving to Scotland. This was at a time when we were moving towards the proposed atlas. However, assistance from the Biological Records Centre (Centre for Ecology and Hydrology) is getting things back on track. I would like to thank the staff there for their help.

This is now a call-in for **all** Larger Brachycera records not already submitted to the Scheme. The plan was for you to have this winter to identify and collate, submitting any new/outstanding records by 31<sup>st</sup> March, 2008. However, as the L.B. Newsletter did not appear last time (Darwyn's computer crashed and it was lost) you will need sufficient notice. Therefore, you will have another field season but all records are required by **30<sup>th</sup> September, 2008**. Even if you only have a handful of records of the commoner species, please send them as they all help to build up the picture of distribution and phenology; do not assume they will come via other sources, please send your original data. It is planned to make all the data available through the NBN Gateway in due course.

Thanks to all those dipterists who have sent in Larger Brachycera records over the past year. Please send any records to:

**Simon Hayhow, Larger Brachycera Recording Scheme, 2 Dreelside, Anstruther, Fife, Scotland KY10 3EF or e-mail: [simon@scotfishmuseum.org](mailto:simon@scotfishmuseum.org)**

Note that the best format for me is as an Excel spreadsheet

## A Further Record of *Choerades marginatus* (L.) in Norfolk

Steve Crellin

In the Larger Brachycera Recording Scheme Newsletter no. 26, Stuart Paston listed the recorded occurrences of *Choerades marginatus* in Norfolk. I can add a further record to those he listed.

During the Dipterists Forum field trip to Norfolk in 1993, I caught a pair of this species *in copula* at Ludham Marsh TG4017 on 6 July 1993. They were caught whilst resting on a bramble forming part of the hedge alongside the lane leading onto the marsh. I am not sure how this record has avoided the database but at least Stuart's article has highlighted its absence.

## Observations on egg-laying by *Bombylius minor* L.

Ian Cross

I don't know if this picture sheds any light on the behaviour of *Bombylius minor* or merely muddies the waters a little. On 27<sup>th</sup> August, 2007 I photographed *Bombylius minor* egg-laying at Morden Bog. The photograph shows a female as she hovers in front of holes of a solitary bee and flicks eggs towards them. Although I didn't see the host species actually using the hole on this occasion, I am convinced that *Colletes succinctus* is likely to be the main host. The habitat and flight time of *B. minor* (into early September) is a much better match for *succinctus* than *Colletes daviesanus*. Furthermore *succinctus*, but not *daviesanus*, was in evidence on the heath that day.



What also intrigues me is that I watched this female settling with her abdomen pressed to bare sand. I understand that they are presumed to be filling a pouch at the tip of the abdomen with sand to mix with the eggs as they are deposited. What is curious about this female is that she clearly has a clump of sand visible on the tip of her abdomen, not concealed inside as you might expect.

As I say, this probably leaves us none the wiser as to what precisely is happening, but I thought you might enjoy the picture.

The following two articles by Philip Entwistle are from the Highland Biological Recording Group Newsletter 17 (2004), Highland Naturalist No. 1 (2005) and HN No.2 (2006) respectively, with minor editing. They have been kindly made available by Philip and Stephen Moran for a wider audience.

## The Highland Horsefly Recording Project

**Philip F Entwistle**

Rhivra, Spinningdale, By Ardgay, Sutherland, IV24 3AD

Biting flies are an inevitable part of the summer scene in the British Isles, and especially so in Scotland north of the Clyde/Forth divide. The four suites in this sanguinary pack of cards are the midges (Ceratopogonidae), mosquitoes (Culicidae), black-flies (Simuliidae) and the horseflies (Tabanidae). We must not discount the 'biting horseflies' or stableflies (Stomoxynae), which may be encountered occasionally. Deerflies and the like (Hippoboscidae) seem not to bite man though he may occasionally become temporarily, if determinedly, infested; those attacking birds delight in playing hide and seek in the beards of ornithologists.

Though midges are far more numerous than horseflies, the latter compensate by size; indeed one of them, *Tabanus sudeticus*, is the bulkiest fly in Europe. I calculate it to be about 20,000 times the volume of a biting midge!

As with most, if not all, groups of blood-sucking flies it is only the female that bites, a habit necessary to mature her many eggs; male horseflies often seem elusive but can be found on flowers, though they may be more often seen resting on fence posts or sunny tree trunks. Males are said to swarm about tree and hill tops; females visit these swarms to obtain a mate. Eggs are laid in glutinous masses on foliage, usually where it overhangs damp or very wet ground or even water. Hatchlings fall and soon burrow out of sight. The larvae are carnivorous (eating other insect larvae, worms, etc.) and take from two to three years to complete their growth. There is then a fairly brief pupal period in the year of their adult emergence.

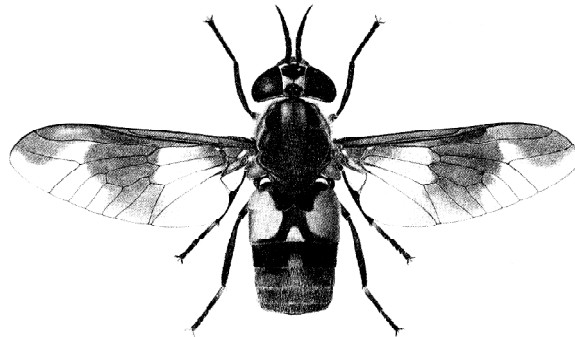
Adults will find you from mid May to September but the flight period varies with the species. Possibly the earliest is the very local *Hybomitra lurida* and the latest, *Chrysops relictus* and the two species of *Haematopota*, but precise records are rather slim. Undoubtedly the worst (peak) period for biting activity is from mid June to mid August.

There are almost certainly nine different species in Highland region while some old records exist for a further three. Thus, we have approximately a third of the thirty British species.

## Horseflies known from Highland region

Species	Distribution
<b>THUNDER FLIES</b>	
? <i>Chrysops caecutiens</i>	Brodie*, Nairn*
<i>C. relictus</i>	widespread
? <i>C. sepulchralis</i>	Sutherland*
? <i>C. viduatus</i>	Aviemore*
<b>CLEGS, DUN FLIES</b>	
<i>Haematopota crassicornis</i>	widespread
<i>H. pluvialis</i>	widespread
<b>HORSEFLIES</b>	
<i>Hybomitra distinguenda</i>	widespread
<i>H. lurida</i>	Brodie*, Nairn*, Golspie* & Sinningdale
<i>H. micans</i>	Nethy Bridge*
<i>H. montana</i>	widespread
<i>Tabanus cordiger</i>	Abernethy, Inverpolly, Lochinver*
<i>Tabanus sudeticus</i>	widespread

Whilst records are quite poor, about six species are undoubtedly widespread. Records are likely to be influenced by the boldness of the flies: *C. relictus* and the *Haematopota* species are aggressive biters but, in my experience, *T. sudeticus*, *T. cordiger* and *H. lurida* are more tentative. Indeed, I have never been bitten by the last two.

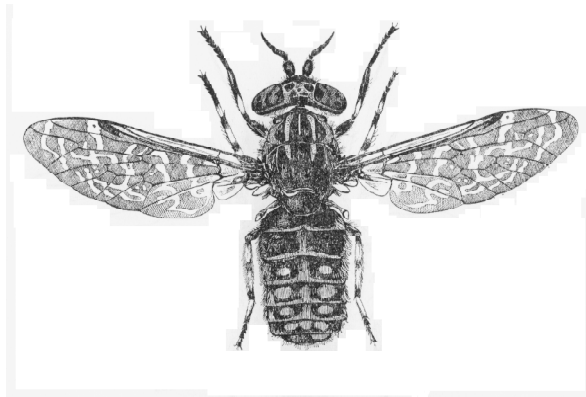


**Figure 1:** A *Chrysops* species (Thunder fly): noticeable for its brilliant, green-yellow eyes; base of abdomen often quite bright yellow; wings with a broad dark bar. (Plate 16, fig.2 from – Edwards, F.W., Oldroyd, H. & Smart, J. (1939) *British Blood-sucking flies*, British Museum, London)

Our prize species is, without doubt, the quite conspicuous *Hybomitra lurida*: probably largely a Highland species, we have 100 year old records for Brodie, Nairn and Golspie and, more recently, for Spinningdale Bog. It may also be present around Loch Lomond.

Another nationally local and rare species is the handsome, black *Hybomitra micans*, known in our area only from Nethy Bridge and possible unrecorded for over a hundred years. I have seen it in mid Wales, trying to suck blood from a Land Rover door handle! A further, apparently very local species is *Tabanus cordiger*, remarkable for its larvae which live under the shingle of

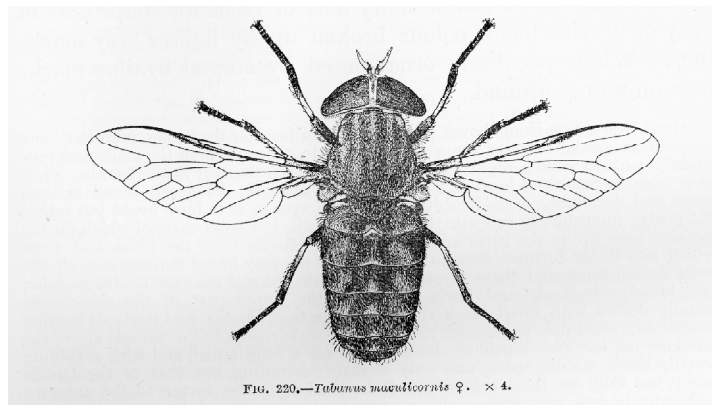
stream beds. In a wider, European context all three of these species are known to bite man but in Britain it has been my experience that they are reluctant to do so. Maybe, as possible with the monstrous *Tabanus sudeticus*, they prefer sheep, cattle and deer.



**Figure 2:** A *Haematopota* species (Cleg or dun fly): body grey and abdomen with paired pale spots; wings with a lacy, pale grey pattern. (Fig. 334 from Oldroyd, H. (1959) *Handbooks for the Identification of British Insects, IX (4), Diptera, Brachycera (Section A) Tabanoidea and Asiloidea*, Royal Entomological Society of London.)

*Chrysops* and *Haematopota* are quite similar in size (7-10 mm. long) but *Hybomitra* and *Tabanus* are quite a lot larger (12-16 mm.; 20-25 mm. in *T. sudeticus*) and are very robust flies.

Bites are painful and some people react quite severely with local reddening and swelling. The annoyance 'value' can be quite considerable, especially so in *C. relictus*, which usually bites the head and neck; though its approach is quite audible it seems to prefer attacking from behind and so can be quite difficult if not impossible to see. In contrast, *Haematopota* are rather more stealthy and a bite may be the first warning of enemy action. The bigger species (*Hybomitra* and *Tabanus*) can usually be detected before they bite and evasive action is often possible.



**Figure 3:** Representative of *Hybomitra* and *Tabanus* species (Horse flies): robust flies, variously patterned and quite often with some yellow or orange at the base of the abdomen; however, some species are very dark grey, brown or even black; wings always un-patterned and clear. (Fig. 220 from Verral, G.H. (1909) *British Flies, Volume V, Stratiomyidae and succeeding families of the Diptera-Brachycera of Great Britain*, Gurney & Jackson, London.)

Hungry female horseflies respond to certain cues. They seem firstly to locate their prey by following up the increasing density of trails of exhaled carbon dioxide (evaporating a block of frozen carbon dioxide – ‘dry ice’ – outdoors on a warm day can attract large numbers). Arrived at the general vicinity of the host they may be guided by body heat and a variety of olfactory stimuli; they seem to like dark colours (greys and blacks) and will usually treat red as black. Armed with this knowledge it is apparent that the perfect way to spend a happy day in horsefly country is to stay cool and fragrant, wear light colours and, ideally, to cease all respiratory activity.

The numbers of different diseases of man and other mammals that can be carried by horseflies is impressive, including as it does onchocerciasis, anthrax, loa loa (eyeworm), sleeping sickness, tularaemia and vesicular stomatitis. However, despite such versatility, this aspect of horsefly activity seems never to have been problematic in the British Isles.

There are several easy ways to catch female horseflies: -

- i) by judicious swatting (with minimal damage to the fly, please) as they settle to bite or with a butterfly net just before they do so.
- ii) By leaving open a sunward house door, when the flies will often become ‘trapped’ on the inside of the window (this is how I first discovered the rare *H. lurida*).
- iii) By an extension of ii, when parking a car on sunny days leave the windows open an inch or so, and flies will often become trapped inside, normally in a greater state of panic than the driver. (Curiously, few other insects will be so obtained.)

There are also more esoteric methods: I found that by coating a twenty foot pole with fruit tree banding grease and setting it up vertically I could trap many horseflies, a notable number of which were males (all had to be degreased in a mixture of benzene and petrol and blow dried before identification was possible). Baking trays with the inside painted black and filled with water and a dash of detergent are especially good for attracting males; but visit the trays at least every two days to be sure that they do not dry out and to recover flies in good condition (but still to be blow-dried!). Other, more elaborate, methods have been devised, but are less spontaneous – more information will be provided in a future article.

How can specimens be kept? If dead, they can be gently air dried (e.g. on a window-sill) and then potted. If live, they can be deep frozen. Always handle them very carefully as identification often depends on quite fragile surface features. Otherwise, add a label with date, locality, grid reference and notes, as is usual, please. Send the specimens to me and I will attempt identifications. If you would like to have a go at identifying them for yourself, let me know and I will supply details of appropriate literature.

# The Highland Horsefly Recording Project (2004-05)

Philip F Entwistle

This project was initiated in April, 2004 (Entwistle, 2004). It was continued during 2005, especially as the summer of 2004 was decidedly poor and Highland Biological Recording Group (HBRG) members were able to submit rather few records. In addition, it seems that some species may have rather local distributions tied, perhaps, to special habitat requirements so that, without a more prolonged study, their distributions are likely to remain incompletely understood.

However, despite all, it was possible to conduct at least a partial survey of literature, to obtain computerised records from Inverness Museum & Art Gallery (IMAG) and to examine specimens in their collections. Thus the development of preliminary distribution maps was enabled; these are presented here.

A curious aspect of the data so far located is a gap in records from about 1911 to 1978: this is clearly something to be further investigated. The very first record seems to be for *Hybomitra lurida* in 1837, but most of the older records fall during 1890 to 1911. In our distribution maps I have used different symbols to denote records to 1969 and records from 1970 onwards, simply to accord with the only other published British horsefly distribution maps (Drake, 1991). It may be noted that where, for particular 10 km. squares there are both old and new records, the latter conceal the former. Data from Drake has been incorporated into our own maps, though I do not, at present, know the provenance of most such records.

Even at this early stage of our work, the new maps represent a considerable advance on the old. For example, for Highland region, Drake noted only nine 10 km. square records for the common cleg, *Haematopota pluvialis*, whilst we can present nearly sixty; and for that monster, *Tabanus sudeticus* the respective figures are 13 and 35.

## An addition to the 2004 species list

Four records of *Hybomitra bimaculata* exist, three pre- and one post-1970. It was first encountered by a Mr Clarke at Inverdrue (NH821) in 1895 (Grimshaw, 1900). Not very much later G. H. Verrall (1909), that doyen of British dipterists (i.e. 'fly-men'), discussed it in detail as a "variety" of *Tabanus tropicus*, and mentioned a specimen from The Mound at Loch Fleet (NH79), Sutherland. It next appeared at Kinloch, Isle of Rum, in 1963 (Wormell, 1982) and lastly some time between 1985 and 1989 at Abernethy Forest where the collector is unknown but the record itself was found by Audrey Edgar in a Scottish Natural Heritage species list from that forest, and is incorporated in IMAG's data files. Hence it seems that the presence of *H. bimaculata* in Highland must be given serious consideration.

***Hybomitra lurida*** – This is one of our 'specialities', and a Red Data Book 3 (RDb3) species (amongst others, *Hybomitra micans*, for which a single old record exists, is RDb2 whilst *Tabanus cordiger* is 'notable'). Gill Nisbet found one in her kitchen at Boat of Garten on 31<sup>st</sup> May, whilst similarly I had it at Spinningdale on 28<sup>th</sup> May and 2<sup>nd</sup> June. Over the years 1994-2004, I have seen it during the period 28<sup>th</sup> May to 27<sup>th</sup> June.

***Chrysops*** – further old records have been located. *Chrysops caecutiens* occurred at Kincaig, near Kingussie (NH80), in 1889, whilst *C. viduatus* (then known as *C. quadratus*) was collected at Aviemore in 1893 & 1898 and at Rothiemurchus in 1895 (Grimshaw, 1900)

***Tabanus cordiger*** – Ian Evans submitted a specimen swatted by E. Crossman at Ordain (NC0923) on 2<sup>nd</sup> August, this confirming its current presence on the north-west coast. Colonel J W Yerbury found it at Lochinver from 24<sup>th</sup> June to 13<sup>th</sup> July 1911, and noted it to be common and "the first *Tabanus* to put in an appearance in the valley of the Inver". All this

seems to identify the Inver area, in general, as a firm locality; its presence in the extreme south-east of Highland has yet to be re-illuminated.

### **Preliminary conclusions**

- 1 There appear to be no horsefly records for Caithness.
- 2 The greatest species diversity per 10km square is as follows
  - NH91: 9 species
  - NH95: 7 species
  - NH69: 7 species
  - NJ02: 7 species
  - NH81: 6 species
- 3 Lying along the A95 in the south-east of Highland is a general area of very high species diversity. This comprises NH81, NH91 & NJ02: more essentially it seems to be a zone south of the road between Rothiemurchus and Nethy Bridge; it contains 11 of the 12 Highland species. (For the purposes of the above estimates, *Chrysops sepulchralis*, for which our only locality is "Sutherland", is omitted. Drake is rather optimistic about its real presence with us following its recognition at Newton Stewart, Dumfries & Galloway, whereas previously it had been thought to be restricted to Dorset heaths and the New Forest.)
- 4 Two other areas of quite high diversity and NH69 & 79, between the north side of the Dornoch Firth and Loch Fleet with eight species and NH85 & 95, the coastal strip from Whiteness Head to Findhorn Bay, in particular the Culbin area, also with eight species.

### **Acknowledgements**

For the use of records and specimens my thanks are offered to D.A. Beaton, R. Cottis, E. Gorman, C.M. Drake, A. Edgar, I. M. Evans, A. Jones, M. MacDonald, D. W. McAllister, J. McKellar, S. A. Moran, G. Nisbet, J. Watt and A. Youngman. My especial thanks go to Murdo MacDonald for production of the distribution maps and to Jonathan Watt for printing out IMAG's records.

### **References**

- Drake, C.M. (1991) *Provisional atlas of the larger Brachycera (Diptera) of Britain and Ireland*, Natural Environmental Research Council, Environmental Records Centre, Monks Wood Experimental Station, Huntingdon.
- Entwistle, P.F. (2004) *A horsefly recording project*, HBRG Newsletter, No.17, 4-6.
- Grimshaw, P.H. (1900) *Diptera Scotica: II – Inverness-shire*, *Annals of Scottish Natural History*, 84-91.
- Verrall, G.H. (1909) *British Flies Vol.V*, Gurney & Jackson, London.
- Wormell, P. (1982) *The Entomology of the Isle of Rhum National Nature Reserve*, *Biological Journal of the Linnaean Society*, 18, 291-401.
- Yerbury, J.W. (1912-1913) *A list of the Diptera met with in Wester Ross, with notes on other species known to occur in the neighbouring areas*. *The Scottish Naturalist*, October, December, 1912, January, April, May, June & August 1913.



## Provisional Maps (all generated using dmap)

N.B. The following species have very few records and therefore have not been mapped.

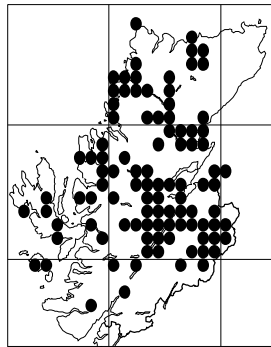
*Chrysops caecutiens*

*C. sepulchralis*

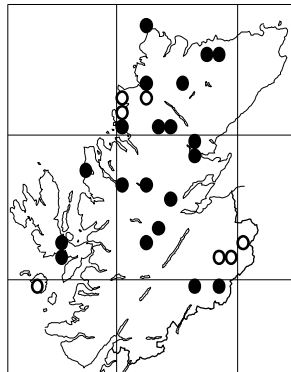
*C. viduatus*

*Hybomitra micans*

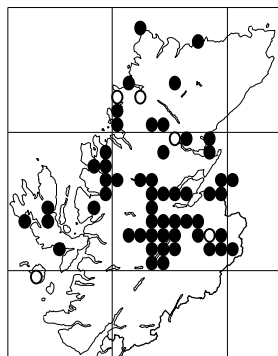
In the maps below the open circles represent records up to and including 1969. Solid dots represent records from 1970 onwards. This distinction has not been made in the map of 'overall records.



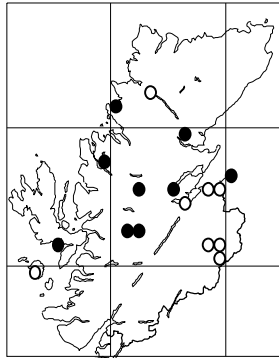
Map 1: Horseflies – all records to date



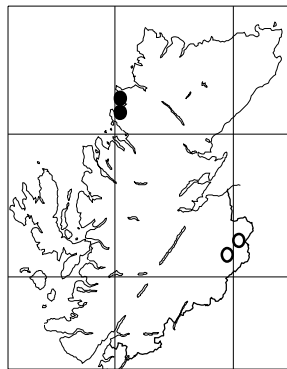
Map 2: *Haematopota crassicornis*



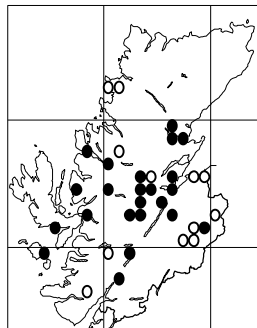
Map 3: *Haematopota pluvialis*



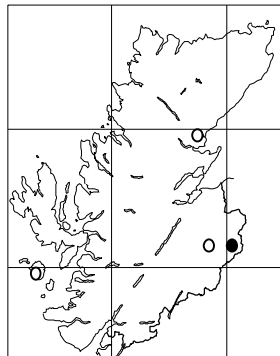
Map 4: *Chrysops relictus*



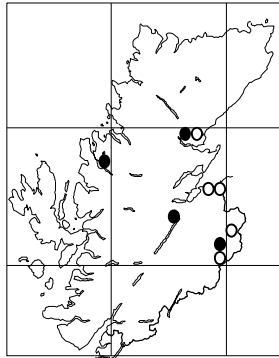
Map 5: *Tabanus cordiger*



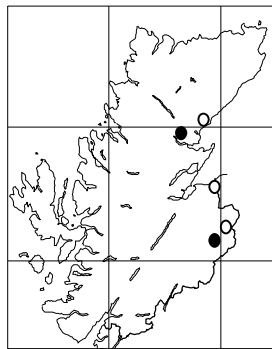
Map 6: *Tabanus sudeticus*



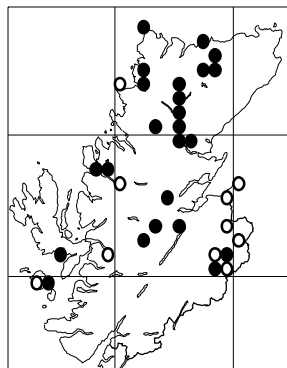
Map 7: *Hybomitra bimaculata*



Map 8: *Hybomitra distinguenda*



Map 9: *Hybomitra lurida*



Map 10: *Hybomitra montana*

## PROJECT UPDATE

### New 10 km. square records.

The success of horsefly recording depends greatly on weather, for most species will bite only on warm days and in sunlight. As the critical months in 2005, June, July and August, were dominated by dull conditions, there were rather few good days for observation.

Despite this, horseflies were recorded from seventeen 10 km. squares of which eight were new: NC14, 33, 70, NG50, NH39, 54, 77 & NM94. These bring the total number of squares from which horseflies have been recorded in Highland to 105. Of course, this is not to say that the horsefly fauna of each these squares is now known – far from it, for many of them are likely to yield more species records.

## The species seen in 2005.

Species	No. of 10 km. squares. Records to end 2004*	No. of 10 km. squares Records in 2005	No. of new 10 km. squares. Records added in 2005 with full national grid reference
<i>Chrysops relictus</i>	16	1	0
<i>Haematopota crassicornis</i>	25	2	0
<i>Haematopota pluvialis</i>	56	13	(7) NC129245, NC166457, NC210106, NC328319, NC728022, NH339973, NH635547
<i>Hybomitra bimaculata</i>	4	1	(1)NH671907
<i>Hybomitra distinguenda</i> **	10	2	(2)NH549504, NJ030160
<i>Hybomitra lurida</i>	5	1	0
<i>Hybomitra montana</i>	33	2	(2) NC328319, NH339973
<b><i>Tabanus sudeticus</i></b>	35	4	(2) NG5805, NM973539

Table 1: Tabanidae in Highland Scotland: number of 10 km. square records to end 2004, 10 km. squares in which species were noted on 2005 and, where different, new 10 km. square records for 2005.

\* includes pre-1970 records

\*\* includes doubtful forms

Table 1 lists these together with the number of 10 km. square records and the 'new' squares. Only two species, *Hybomitra micans* and *Tabanus cordiger*, remained elusive. The former is well known for its reluctance to approach man. *Chrysops caecutiens* and *C. viduatus*, which were recorded in the 19<sup>th</sup> Century, have yet to be seen again.

### Special notes

***Hybomitra bimaculata*:** Drake (1991) was unable to map any records north of the Lake District, despite clear references in Verrall (1909) to *Tabanus topicus bisignatus* (now regarded as a synonym of *H. bimaculata*. One of our forms, collected in 2005, keys out in Oldroyd (1969) and Chvála *et al* (1972) to *Hybomitra bimaculata* var. *bisignata*) from Aberfoyle in Perthshire and The Mound, Sutherland. This is a confusing species as it appears to exist in darker and lighter forms. A specimen I attribute to the former was caught attacking my legs, a typical *bimaculata* habit, on 10 vii 2005 at Spinningdale. Three specimens, apparently the brighter form, were taken, one in the house at Spinningdale (11 vii 2005) and two by sweeping with a net in Spinningdale Bog (10 vii 2005), the latter keying out in Oldroyd (1969) to *H. bimaculata* var. *collini*. However, Stubbs and Drake (2001) note that the existence of transitional colour forms refutes the validity of *bisignata* and *collini*, and this is endorsed for Europe as a whole by Chvála *et al* (1972), though in neither work does the relative prevalence of the described forms and intermediates receive comment. Further material is needed before we can resolve the *H. bimaculata* identity question in Highland.

***Hybomitra distinguenda*:** This is a striking horsefly, bright orange on the sides of the first four abdominal segments. Gill Nisbet took a specimen on 28 vi 2005 at Abernethy (NJ030160), which seems to exhibit features of *H. solstitialis*. Edwards *et al* (1939) comment on the difficulty of separation of these two species, while Goffe (1931), considering specimens of *H. distinguenda* taken by Philip Harwood and J.E. Collin around Nethy Bridge in the mid 1920s, went so far as to write "I think it not unlikely that we have a new species here, and entomologists who visit the Scottish Highlands in this and succeeding years should look out for it."

The issues of doubt around the local identity of *H. bimaculata* and *H. distinguenda* serve to emphasise two points. Firstly, compared to England and Wales, the horsefly fauna of Scot-

land cannot claim to be well understood. Secondly, though as insects horseflies are bodily large (especially those belonging to the genera *Atylotus*, *Hybomitra* and *Tabanus*) the morphological and colour characteristics on which species can be separated are often very critical. I remember a fellow student, David Greathead, opting, as an undergraduate project, to study the genitalia of the British Tabanidae; insect male genitalia have usually an important place in species definition, those of females less so. But he found few features of any value and, indeed, no text on identification makes mention of male genitalia. Female genital structures are, except for some *Hybomitra* species, similarly deemed useless. Such general amorphisms are characteristic of horsefly species separation. Further specimens and records would be greatly appreciated.

**Acknowledgements:** very many thanks to Kenna Chisholm, Ian M. Evans, Susan Finlay, Jean Hagley, Stephen Moran and Gill Nisbet for specimens and records.

### References

- Chvála, M., Lyneborg, L. & Moucha, J. (1972) *The Horse Flies of Europe*. Entomological Society of Copenhagen.
- Drake, C.M. (1991) *Provisional atlas of the larger Brachycera (Diptera) of Britain and Ireland*, Natural Environmental Research Council, Environmental Records Centre, Monks Wood Experimental Station, Huntingdon.
- Edwards, F.W. , Oldroyd, H., & Smart, J. (1939). *British Blood-sucking Flies*. British Museum, London.
- Entwistle, P.F. (2004) **A horsefly recording project**, *HBRG Newsletter*, No.17, 4-6.
- Entwistle, P.F. (2005) **The horsefly recording project (2004-05)**. *The Highland Naturalist*, **1**, 7-10.
- Goffe, E.R. (1931) British Tabanidae with an account of the principal variation. *Trans. Ent. Soc. S. England*, **6**, 43-114.
- Oldroyd, H. (1969) **Diptera Brachycera Section (a) Tabanoidea and Asiloidea**. *Handbooks for the Identification of British Insects. IX (4)*, Royal Entomological Society of London.
- Stubbs, A. & Drake, C.M. (2001) *British Soldierflies and their Allies*. British Entomological and Natural History Society, London.
- Verrall, G. H. (1909) *British Flies Vol. V*, Gurney & Jackson, London.