

# Survey of Tabanidae (horseflies) in southern England 2014

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## Abstract

A preliminary survey of Tabanidae in southern England was carried out in 2014. Tabanids were sampled using NG2F traps baited with acetone and cow urine. Woodland produced the highest catches of Tabanidae with sometimes very large catches of *Tabanus bromius*. There were also good numbers of *Hybomitra distinguenda* along with *Chrysops* and *Haematopota* species. *Tabanus bromius* was also dominant in farmland and chalk downland. Coastal grazing marshes gave much lower numbers of tabanids, but included UK rarities such as *Atylotus rusticus* and *Hybomitra ciureai*. The trap-odour bait system proved highly suitable for carrying out tabanid biodiversity surveys but, to fully interpret the results, more information is needed on responses of each tabanid species to trap-odour bait systems.

## Introduction

Biting flies, clegs, deerflies, horseflies and their ilk, can be of considerable nuisance to man and livestock, and may carry various diseases. Their attentions can also affect the distributions and behaviour of wildlife and livestock, especially when present in large numbers in preferred watering or grazing places. Those issues aside, tabanids also contribute to our biodiversity. Some tabanid species are rare, or very rare, partly due to land-drainage or other habitat destruction. Beyond their presence or absence, little is known of their distribution and abundance, nor how this varies. To what extent those rare species are confined to or even present in nature reserves is unclear.

That lack of knowledge is due in part to the problems in surveying these insects. Most of the information currently on record arises from sightings of tabanids feeding on flowers, or coming to people, or to moving vehicles. Rare species, especially those not attracted to humans or large moving objects, tend to be under-recorded. Surveying biting flies by sight or by hand net is inefficient, highly time-consuming, and difficult to either quantify or replicate. Various traps have been used to sample these insects which, whilst better than simple searching, are often not very effective. Even so, there have been several attempts to use such traps to control tabanids.

Recent work in continental Europe and North America suggests that traps developed for tropical biting flies, in particular tsetse (*Glossina*), may be much more effective,

especially when used with odour baits. However, almost no work has been performed using these traps and odour baits to sample UK tabanid species.

This study therefore had several objectives:

- To increase our understanding of tabanid ecology, particularly rare or under-reported species.
- To detect areas with large numbers of tabanids, especially where their presence was not otherwise apparent.
- To determine whether odour-baited traps might provide a useful means of surveying some of the rarer tabanid species.
- To find areas suitable for conducting experiments to improve trap/odour-bait efficiency.

## Methodology

During the mid-1980s we designed the NGU-series of traps ([Brightwell et al., 1986](#)) for controlling tsetse flies in Kenya, and were the first to show cow urine is a useful odour bait for biting insects ([Dransfield et al., 1986](#)), especially when combined with other odour attractants. We subsequently demonstrated this trap odour-bait combination is highly effective for controlling tsetse flies ([Brightwell et al., 1997](#)). These odour-baited traps also caught large numbers of Tabanidae and stomoxiinae. One of the NGU series, the NG2F trap ([Brightwell et al. 1991](#)), was designed to optimize catch and to also be both cheap and easily constructed. Thus African farmers could themselves control tsetse and thereby reduce tsetse-transmitted trypanosomiasis among their cattle. This is the trap we selected for surveying tabanids in UK.

Viewed from directly above, the blue 'body' of the NG2F trap is perhaps 1.5 meters wide, and roughly  $\Lambda$ -shaped. If you include the trap's (1×1×1 meter) triangular cone, it would look roughly A-shaped - but, as its shape is more like a bird in flight, the 2 legs of the A are known as 'wings'.



Fig 1: An NG2F trap viewed from the front. This trap was set near the gravel-pit pools in Rye Harbour Nature Reserve, adjoining an industrial area.

Working downwards through Fig 1, you can see the tetrahedral polythene cage, the white netting cone which funnels the flies into the cage, the black cloth shelf and, through its entrance, the lower half of its black cloth target. The blue cloth wings are visible on each side of the shelf and target.

These traps will catch flies without odour baits, but they are rather inefficient. Carbon dioxide has long been known as an activator and attractant for biting insects, but in the 1980s further attractants for tsetse flies were identified by testing components of bovid breath including carbon dioxide, acetone and 1-octen-3-ol ([Vale et al., 1980](#)) and bovid urine including 3-n-propyl phenol and ammonia, a urine breakdown product ([Dransfield et al., 1986](#)). Since then several of these odours have been tested for tabanids. [French & Kline \(1989\)](#) showed that octenol (1-octen-3-ol) gives moderate increases for some species, whilst [Hribar et al., 1992](#) showed the same for ammonia vapour. [Krčmar \(2006\)](#) demonstrated the efficacy of urine from various domestic animals.

Carbon dioxide is usually impractical to use in the field, and octenol is both expensive and difficult to obtain. So for routine tabanid sampling we decided to use NG2F traps baited with acetone and cow urine. These odours were dispensed from separate containers: acetone vapour via a 5 mm diameter aperture, cow urine vapour via a 53 mm diameter hole (see Fig 2). The cow urine should be 'aged' some days before use.



Fig 2: Odour bait containers - acetone in front and cow urine behind. The acetone rain-cover has been removed to reveal its dispensing aperture.

These odour baits attract biting flies from some distance which, in reaction to the trap's blue 'body', approach and fly around the trap, then are stimulated to enter by the black target and shelf (within and above the trap's entrance, respectively). On attempting to leave, flies ascend within the trap's cone, then enter the cage (see Figs 1 and 3).



Fig 3: *Tabanus bromius* and *Chrysops* trapped in cage of NG2F trap. This polythene cage is designed to keep trapped flies away from the cage's entrance, and hence preserve trap efficiency.

From May to August 2014 a total of fourteen surveys, each of 1-3 days, were performed in a variety of habitat types in Sussex and Hampshire using NG2F traps odour-baited with acetone and cow urine.

## Results

We have grouped these results into the three main habitat types (for detailed results see [Annex 1](#)):

1. woodland (usually mixed deciduous and coniferous),
2. downland and farmland (open country with bushes), and
3. coastal grazing lands and salt marsh.

Deer were present in woodland and in lower numbers on chalk downland and farmland. Cattle and sometimes sheep were present on downland, farmland and the coastal grazing lands.

Surveys in May and June (before the main emergence period of Tabanidae) and in late August produced only *Stomoxys calcitrans* and a single *Haematopota pluvialis* and are not included in the results below.

Woodland (see Table 1) produced the highest catches of Tabanidae with sometimes very large catches of *Tabanus bromius*. Note, assuming these traps operated for similar periods each day, these catches are given as the mean catch per trap per day over the sampling period.

**Table 1. Catch per trap per day in woodland, July/August 2014**

Species	Selwyn Wood	Batts Wood	Brede High Wood
<i>Tabanus bromius</i>	106	10.5	30.3
<i>Hybomitra distinguenda</i>	10.5	0.3	0.8
<i>Hybomitra bimaculata</i>	0.5	0	0
<i>Chrysops caecutiens</i>	0	0.5	0
<i>Chrysops relictus</i>	0.5	0	0.5
<i>Haematopota pluvialis</i>	1.5	0	0

Catches were highest in mixed deciduous/coniferous woodland near Heathfield in East Sussex (Selwyn Wood) where up to 232 tabanids of 5 species were caught in one trap in a day. *Tabanus bromius* was the dominant species but there were also moderate numbers of *Hybomitra distinguenda*. Only one *Hybomitra bimaculata* was taken. Two of the *Chrysops* species were taken, along with several *Haematopota pluvialis*.

Farmland and chalk downland (see Table 2) produced moderate to high numbers of *Tabanus bromius*, but generally low numbers of other species. The moderate catches of *Tabanus bromius* on open chalk downland, a habitat not usually

associated with high tabanid activity, were especially notable with up to 35 caught per day.

**Table 2. Catch per trap per day in farmland and chalk downland, July/August 2014**

Species	Dudwell Farm	Knepp Castle Estate	Black cap Down
<i>Tabanus bromius</i>	9.5	8.0	23.0
<i>Hybomitra distinguenda</i>	0	0.5	0.3
<i>Chrysops caecutiens</i>	0	0.5	0
<i>Chrysops relictus</i>	0	0	0
<i>Chrysops viduatus</i>	0	0.5	0
<i>Haematopota pluvialis</i>	0	0.3	0
<i>Stomoxys calcitrans</i>	2.0	0.3	0

*Hybomitra distinguenda* was present but in very low numbers.

Coastal grazing land & salt marsh (see Table 3) produced low numbers of tabanids except for *Chrysops relictus* which was common in some sites.

**Table 3. Catch per trap per day in coastal grazing land & salt marsh, July/August 2014**

Species	Catch per trap per day		
	Pevensy Levels	Middle Farm	Rye Harbour
<i>Tabanus bromius</i>	0	0	0.3
<i>Hybomitra ciureai</i>	0	0	1.0
<i>Atylotus rusticus</i>	2.0	1.0	0
<i>Chrysops caecutiens</i>	0	0.5	0
<i>Chrysops relictus</i>	6.0	0	2.8
<i>Stomoxys calcitrans</i>	0	2.5	0.3

However the traps set in the coastal habitats did produce some rarities. *Atylotus rusticus* came to the traps not only on the Pevensy Levels, but also at Middle Farm near Lewes and a total of four *Hybomitra ciureai* were trapped at Rye Harbour.

*Stomoxys* were mostly caught from May to August in the immediate vicinity of cattle especially at Dudwell Farm, Middle Farm and the Knepp Estate. We also captured, by hand-net, a *Gasterophilus intestinalis* (not a tabanid but an important pest of horses) around horses at Knepp Castle Estate.

## Discussion and conclusions

Compared to visual searches and hand nets, the NG2F traps proved an effective sampling device. They yielded up to 200 *Tabanus bromius* per trap per day. They also enabled us to confirm the presence of *Hybomitra ciureai* in Rye Harbour Nature Reserve, and of *Atylotus rusticus* in the vicinity of Lewes. All tabanids caught by these traps were female.

As expected, the best weather for catching tabanids was hot, still, and humid. The best sites had high visibility of the trap to tabanids, and were either in the open or under high shade. At least for *Tabanus bromius*, good sites did not have to be close to water, viz the good catches high on chalk downland. Absence of deer in coastal areas may have been responsible for the very low catches of *Tabanus bromius* at Rye Harbour, Middle Farm and the Pevensy Levels.

Catches were poorly related to the numbers coming to walking humans. This was especially true for *Chrysops* and *Haematopota*, species which come very readily to walking people. We did get both in the traps, but in nothing like the numbers one would expect given how many one sees. The opposite was true for *Tabanus bromius*. Despite the superabundance of this species in traps in woodland, we have only rarely observed *Tabanus bromius* coming to man. This may be partly because they tend to settle on ones legs and go unnoticed, whereas *Chrysops* tend to bite around the head - and are hence much more conspicuous. But it probably also reflects a higher trap/bait efficacy for *Tabanus bromius* than for *Chrysops* and *Haematopota*. This higher efficacy may simply result from using bovid rather than human odours. Several workers have referred to *Tabanus bromius* being the commonest horsefly coming to traps in their part of Europe, for example [Krčmar et al. \(2005\)](#) found *Tabanus bromius* comprised over 50% of the sample collected by odour-baited canopy traps.

For biodiversity studies one would ideally like to use trap catches as some sort of indicator of the relative abundance of different tabanid species in the various locations and habitat types. However, this is fraught with difficulty. There is abundant evidence from tsetse research that different species of the genus *Glossina* respond quite differently to different trap designs and to different host odours. For example, cow urine is very attractive to *Glossina pallidipes*, but unattractive to *Glossina fuscipes* ([Terfa et. al, 2014](#)). This is hardly surprising since there will be strong selective pressure for niche differentiation between different species of blood feeding flies with respect to their favoured host, their feeding site on the host and their activity period. With tabanids we are dealing with 5 different genera of tabanids and many different species just in UK, all of which are liable to differ in their responsiveness to the sampling device, in this case an odour baited trap. Sampling tabanids by just observing numbers taking nectar at flowers is just as problematic as different species undoubtedly vary in how much they nectar feed versus blood feed.

The points above should be borne in mind when assessing the effectiveness of different trapping systems for Tabanidae. Sadly, too many published studies only consider pooled results. Comparison of catches with different odour baits and trap types should be done for each species separately. A comparison when different species are pooled is not only invalid statistically for reasons of heterogeneity, but is

uninformative because the overall effect will depend critically on the mix of species present. More emphasis on quantifying the differing responses of the various tabanid species to trap-odour bait systems would facilitate trap development and the interpretation of trap catches for biodiversity surveys.

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## Annex 1: Survey results May to August 2014

From May to August 2014 fourteen surveys were performed in Sussex and Hampshire using NG2F traps, odour-baited with acetone and cow urine.

The results of each survey are formatted thus:

(Survey)	Approximate location	Date
trap #	(Grid reference)	Description of each trap location
Trap setting and collection times		
Weather conditions during survey		
trap #	(notes)	Number and species of biting flies caught
(1)	Knepp Castle Estate Southern block	23-26 May 2014
trap 1	(TQ149203)	near pond 50m NW of safari kitchen, grassland under trees
trap 2	(TQ149204)	in grassland by bushes, 50m NM of trap 1
trap 3	(TQ150202)	by longdrop, 100m SW of safari kitchen, in grassland by wood
set 1630 Hrs 23 May, collected 1030 Hrs 26 May		
heavy rain 24 May then sunny periods, showers/sun 25 May, broken cloud 26 May, cool		
trap 1-3	(total)	14 Stomoxys
(2)	Abbots Ann	6-9 June 2014
trap 1	(SU337437)	Opposite pub, 30 m from River Pill, in grassland
trap 2	(SU336437)	Between river & road, in grass & scrub
set 1600-1700 Hrs. Collected 1000		
breezy, sunny periods, cool to warm		
trap 1	(during setting)	1 Haematopota (+ photo of Stomoxys on trap blue exterior)

trap 2 0

(3) near Selwyn's wood 18 July 2014

trap 1 (TQ557202) mixed woodland, near top of hill, near young spruce

trap 2 (TQ555199) mixed woodland, near bottom of hill

set 1000-1100. Collected 1650 to 1730

hot and sunny throughout. Traps set on a track in more-or-less sunny positions

trap 1 (1000-1100) 14 *Tabanus bromius*, 4 *Hybomitra distinguenda*, 1 *Haematopota pluvialis*, 1 *Chrysops relictus*

" (1100-1200) 37 *Tabanus bromius*, 5 *Hybomitra distinguenda*, 1 *Hybomitra bimaculata*

" (1200-1300) 60 *Tabanus bromius*, 4 *Hybomitra distinguenda*, 2 *Haematopota pluvialis*

" (1300-1600) 79 *Tabanus bromius*, 7 *Hybomitra distinguenda*

" (1600-1630) 17 *Tabanus bromius*

trap 2 (1100-1300) no data (cage blown off)

" (1300-1600) 5 *Tabanus bromius*, 1 *Hybomitra distinguenda*

(4) Batts Wood 22 July 2014

trap 1 (TQ637273) side of E-W hilltop track (in junction to track going N) 250m west of rebuilt woodsmans cottages. At 1430 so repositioned to main track centre and rotated 180 deg (to face south)

trap 2 (TQ634273) 300m W of trap 1, at side of E-W hilltop track (in junction to track going N)

trap 3 (TQ637277) valley bottom, at E tip of Wadhurst deer park, approx 400 m N of trap 2

trap 4 (TQ640274) 1/2 way up hill, N of rebuilt woodsmans cottages

1130 to 1250, collected 1500 to 1630

hot and sunny throughout. Traps set in more-or-less sunny positions

trap 1 (empty at 1430) 8 *Tabanus bromius*, 2 *Chrysops caecutiens* (assumed female)

trap 2 (~ 15 *T. bromius* at 1450) 16 *Tabanus bromius*, 1 *Hybomitra distinguenda*

trap 3 (~ 10 *T. bromius* at 1510) 14 *Tabanus bromius*, 2 *Haematopota pluvialis*

trap 4 (~ 4 *T. bromius* at 1530) 4 *Tabanus bromius*

(5) Brede High Wood 23 July 2014

trap 1 (TQ799206) North edge of most north-easterly heath

trap 2 (TQ799204) South edge of most north-easterly heath

trap 3 (TQ795202) E of stream, just E of south-westerly heath, in high shade

trap 4 (TQ794201) 50 m west of trap #3 in south-westerly heath

set 1130 to 1300, collected 1650 to 1730

hot and sunny throughout. Traps set on a track in more-or-less sunny positions

trap 1		21 <i>Tabanus bromius</i> , 1 <i>Hybomitra distinguenda</i>
trap 2		23 <i>Tabanus bromius</i>
trap 3		59 <i>Tabanus bromius</i> , 2 <i>Hybomitra distinguenda</i> , 2 <i>Chrysops relictus</i>
trap 4		18 <i>Tabanus bromius</i>

(6) Pevensey Levels 24 July 2014

trap 1	(TQ664053)	5 m from drainage ditch, sheep field
trap 2	(TQ665054)	5 m from drainage ditch, 100 m east of trap 1

set 1100 to 1200, collected 1300 to 1330

hot and sunny throughout. Traps set in full sun

trap 1 & 2	(total)	2 <i>Tabanus bromius</i> , 1 <i>Atylotus rusticus</i> , 3 <i>Chrysops relictus</i>
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(7) Dudwell Farm 25-26 July 2014

trap 1	(TQ677239)	in full sun. 50m E of barns, by dung heap & hay bales, partly obscured by dock & willowherb
trap 2	(TQ667235)	under high shade near footpath, part up hill, among trees in field w cows, by overgrown quarry

set 0930 to 1030, collected 1300 to 1330

cool & cloudy early but soon hot and sunny. Afternoon gen. cloudy & sultry

trap 1	(1000-1430)	9 <i>Tabanus bromius</i>
"	(1430-1830)	2 <i>Tabanus bromius</i> , 3 <i>Stomoxys</i>
"	(1830-0855)	1 <i>Stomoxys</i>
"	(0855-1800)	11 <i>Tabanus bromius</i> , 1 <i>Stomoxys</i>
trap 2	(1030-1445)	5 <i>Tabanus bromius</i>
"	(1430-1830)	5 <i>Tabanus bromius</i>
"	(1830-0915)	2 <i>Stomoxys</i>
"	(0915-1730)	6 <i>Tabanus bromius</i> , 1 <i>Stomoxys</i>

(8) Middle Farm 26 July 2014

trap 1	(TQ487080)	in overflow carpark, open grassland, next to a field with calves
trap 2	(TQ489078)	in 'Open Farm' field, by lama paddock, in open grassland

set 1100 to 1200, collected 1650 to 1730

generally hot and sunny

trap 1	(1100-1325)	1 <i>Atylotus rusticus</i>
"	(1325-1630)	1 <i>Atylotus rusticus</i> , 4 <i>Stomoxys</i>
trap 2	(1100-1325)	1 <i>Stomoxys</i>
"	(1325-1615)	0

(9)	Black cap Down & Anscombe Bottom	29 July 2014
trap 1	(TQ377129)	in full sun, chalk downland (grassland + bushes) at base of hill to right of main drove
trap 2	(TQ371125)	in full sun, downland (grassland + bushes) near top of hill at junction of main drove with track off to right
trap 3	(TQ369123)	in full sun, small clearing near top of Anscombe Bottom woodland (100 m down track after gate)
trap 4	(TQ376117)	in full sun, large clearing near bottom of Anscombe Bottom woodland

set 0930 to 1130, collected 1655-1800

generally hot and sunny

trap 1	(0930-1340)	6 <i>Tabanus bromius</i> , 1 <i>Hybomitra distinguenda</i> (p)
"	(1340-1800)	15 <i>Tabanus bromius</i>
trap 2	(1015-1310)	8 <i>Tabanus bromius</i>
"	(1310-1740)	27 <i>Tabanus bromius</i>
trap 3	(1100-1720)	2 <i>Tabanus bromius</i>
trap 4	(1130-1655)	34 <i>Tabanus bromius</i>

(10)	Rye Harbour Nature Reserve	31 July 2014
trap 1	(TQ922189)	300m east of Camber castle near Castle Water in open grassland
trap 2	(TQ927194)	300m east of trap 1 near Castle Water in open grassland
trap 3	(TQ932192)	100 m west of road by contaminated pools (lagoons)
trap 4	(TQ945186)	behind Lime Kiln Cottage on edge of saltmarsh

set 1000 to 1200. Collected 1300 to 1330

warm and sunny throughout with moderate to strong breeze. Traps set in full sun.

trap 1	(1640)	1 <i>Tabanus bromius</i>
trap 2	(1416)	1 <i>Hybomitra ciureai</i> , 6 <i>Chrysops relictus</i> , 1 <i>Stomoxys</i>
"	(1624)	1 <i>Chrysops relictus</i>
trap 3	(1330)	2 <i>Hybomitra ciureai</i> , 3 <i>Chrysops relictus</i>
"	(1610)	1 <i>Hybomitra ciureai</i> , 2 <i>Chrysops relictus</i>
trap 4	(1700)	0

(11)	Rye Harbour Nature Reserve	5 August 2014
trap 1	(TQ944186)	in regenerating saltmarsh, 150 m W of Lime Kiln Cottage
trap 2	(TQ942186)	in short grass, 200 SW of Martello tower, between caravan site, wet drainage channel, and dyke
trap 3	(TQ924178)	in open short grassland, 0.5 km NE of woodland, 1 km S

of castle  
 trap 4 (TQ931191) in long grass near viewpoint and ponds S of industrial area  
 set 1000 to 1200. Collected 1600 to 1725  
 hot dry and sunny throughout with light breeze. Traps set in full sun.  
 trap 1 (1600) 0  
 trap 2 (1630) 2 *Chrysops relictus*  
 trap 3 (1700) 4 *Chrysops relictus*, 1 *Stomoxys*  
 trap 4 (1725) 4 *Chrysops relictus*

(12) Knepp Castle Estate 7 August 2014  
 Southern block

trap 1 (TQ151202) on track at entrance to Newbarn Wood, nearest Newbarn Lane 2 horse water trough  
 trap 2 (TQ149199) in open grass near pond in Middle Link, where track across New Barn 1 crosses the public footpath  
 trap 3 (TQ136201) in open grass by pond, in NE end of Brookhouse 6  
 trap 4 (TQ137206) in grass under oak tree, S of pond in Wild Flower Meadow, by Wagstaffs wood

set 1000 to 1200. Collected 1630 to 1710

generally hot and sunny, but some high cloud in afternoon. Very light wind.

trap 1 (1630) 1 *Tabanus bromius*  
 trap 2 (1410) 6 *Tabanus bromius*  
 " (1635) 2 *Tabanus bromius*, 1 *Chrysops viduatus*, 1 *Stomoxys*  
 trap 3 (1445) 5 *Tabanus bromius*, 2 *Hybomitra distinguenda*  
 " (1655) 3 *Tabanus bromius*  
 trap 4 (1458) 5 *Tabanus bromius*  
 " (1710) 10 *Tabanus bromius*, 1 *Chrysops viduatus*, 1 *Haematopota pluvialis*

1 bot fly (*Gasterophilus intestinalis*) caught at 1340 on small dark pony in horse paddock by trap 1

(13) Middle Farm 9 August 2014

trap 1 (TQ487080) in overflow carpark  
 trap 2 (TQ488079) E of pond  
 trap 3 (TQ488081) 150m N of trap 2  
 trap 4 (TQ489079) 100m E of trap 2

set 1100 to 1200, collected 1556 to 1610

generally warm and mainly sunny

trap 1 (1100-1325) 1 *Stomoxys*  
 trap 2 (1100-1325) 2 *Stomoxys*  
 trap 3 (1100-1325) 0

trap 4	(1100-1325)	11 Stomoxys
(14)	Abbots wood	23 August 2014
trap 1	(TQ562083)	by shallow pond dug for dragonflies, in grassland/low scrub
trap 2	(TQ561085)	150m S of trap 1, on 'ride' through mixed deciduous wood
set 1100. Collected 1600		
cool, breezy, occasional sunshine		
trap 1&2		1 Stomoxys

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