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continued inside back cover

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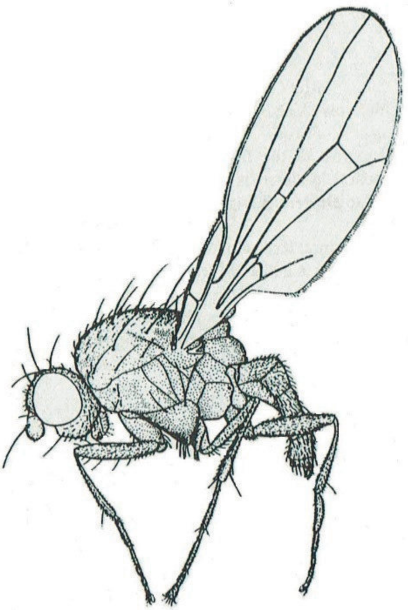
Cover illustration: ***Pamponerus germanicus*** **(Linnaeus, 1758) (Asilidae), male found at Findhorn, Moray, 30.vi.2019, on low vegetation by a small pond (precise location was at NJ05536393) adjacent to a pine plantation, evidently blown from nearby dunes in the strong prevailing wind (P.J. Chandler: photo Alan Watson Featherstone) (see article "*Metopia tshernovae* Rohdendorf (Diptera, Sarcophagidae) an overlooked British species?" on page 100, regarding the location and habitats at the site).**

A Nationally Scarce species with all British records from coastal dunes, most from the west coasts of England and Wales, with a few Scottish records, including some from adjacent parts of the Moray Firth (Culbin Forest, a known site, on the west side of Findhorn Bay, is partly in the same hectad).

Dipterists Digest



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Editorial Panel

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 European flies. All notes and papers submitted to Dipterists Digest are refereed. Articles and notes for publication should be sent to the Editor at the above address, and should be submitted with a current postal and/or e-mail address, which the author agrees will be published with their paper. Articles must not have been accepted for publication elsewhere and should be written in clear and concise English. **Contributions should be supplied either as E-mail attachments or on CD in Word or compatible formats.**

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;
- reports from the Diptera Recording Schemes, including maps;
- records and assessments of rare or scarce species and those new to regions, countries etc.;
- local faunal accounts and field meeting results, especially if accompanied by ecological or natural history interpretation;
- descriptions of species new to science;
- notes on identification and deletions or amendments to standard key works and checklists.

Articles should be in A5 format with text in 9-point and Times New Roman font, title 12 point and author's name 10.5 point, with 1.27cm (narrow) side margins. Figures should be drawn in clear black ink, about 1.5 times their printed size and lettered clearly. Colour photographs will also be welcomed. Figures and photographs should be supplied separately as hard copy or as jpegs at 300dpi.

Style and format should follow articles published in recent issues. A short Summary (in the form of an Abstract) should be included at the beginning of each article. References to journals should give the title of the journal in full. **Scientific names should be italicised.** Authors of scientific names should be given in full and nomenclature should follow the most recent checklist, unless reflecting subsequent changes. Descriptions of new species should include a statement of the museum or institution in which type material is being deposited.

Authors will be provided with a pdf of their contribution and, if requested, up to 5 separate copies of papers of two or more pages in length.

Enquiries about subscriptions and information about the **Dipterists Forum** should be addressed to the Membership Secretary, John Showers, 103 Desborough Road, Rothwell, Kettering, Northamptonshire NN14 6JQ, showersjohn@gmail.com

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Changes in the phenology of Britain's hoverflies (Diptera, Syrphidae)

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Summary

We explore the changes in the phenology as revealed by the flight period, of 61 univoltine hoverfly species using two regression techniques. When linear regression is applied, all tend to fly earlier than they did 39 years ago. In 49 species the change is significant. Using the 10-percentile date (i.e. day number within a year by which 10% of records were received), we show that the extent of change varies according to the flight period of each species, with the strongest response seen in those species that originally peaked in May.

When quantile regression was applied, the sample suitable for analysis dropped from 61 species to 30 species; all of which are shown to have advanced their 10-percentile date; however, when the 50-percentile date was analysed it was found that emergence of 25 species advanced. This analysis highlights a general trend of advances in the emergence of most univoltine hoverflies, but also shows that current data are not robust enough to draw firm conclusions for many species over such a long time-frame.

Introduction

Phenological responses to climate change of both plants and animals are extensively documented (Visser and Both 2005), but comparatively little has been published on Diptera; exceptions include Graham-Taylor *et al.* (2009), Hassall *et al.* (2017), Luder *et al.* (2018) and Morris (2000). Many examples involve records of the first dates on which various events were observed each year: the first swallow, the first cuckoo, the first flowering of various plants (Collinson and Sparks 2008). Moussus *et al.* (2010) emphasised the weakness of opting for first dates for analysis of flight periods and recommend use of percentiles, i.e. the date by which some given percentage of records was observed. This approach eliminates the considerable variation in the earliest date and ensures that the emergence has fully commenced.

Although there has been considerable interest in hoverflies as pollinators, there appears to have been comparatively little investigation into the possibility of a mis-match developing between flowering times of plants and the peak emergence of pollinators (Forrest and Thompson 2011). Part of the problem of investigating these relationships, and others such as range retractions, lies in the lack of long-term monitoring programmes (Thomas *et al.* 2006) and the consequent reliance upon opportunistic data for most analyses. In most parts of the World there is a paucity of such data (see Sánchez-Bayo and Wyckhuys 2019 for indicative map) but Western Europe, and especially the UK, is comparatively data-rich. In addition to various research groups investigating aspects of pollinator ecology (e.g. Baldock *et al.* 2015; Potts *et al.* 2010; Senapathi *et al.* 2015), there is a long history of biological recording in the UK (Roy *et al.* 2014).

The UK Hoverfly Recording Scheme holds in excess of 1 million records (Ball *et al.* 2018) of the 283 species of hoverflies (Syrphidae) currently listed for the British Isles (see Chandler 1998 and updates), the majority of which cover the period 1980 to 2018. All taxa are represented but, inevitably, there is a strong bias towards those species that are both common and readily recognised. Given that changes in the phenology of hoverflies have already been established, the question that follows is: 'whether there is a uniform rate of change amongst species; and, if the rate of change is not uniform, is there a pattern within the differences?'

We investigate the hypothesis that the advancement of the flight period for species which fly earlier would be expected to be greater than those that fly later. It is postulated that, by the end of May, any changes in temperature would be less significant and species that fly in mid-summer would change less.

Hoverflies have a variety of life strategies: some are continuously brooded (multivoltine); others have two generations (bivoltine) at least in part of their range; and some have a single generation per year (univoltine) (see phenology histograms in Ball *et al.* 2011). There can be significant differences in the size of spring and summer generations of bivoltine/multivoltine hoverfly species as a result of droughts and heatwaves (Morris 2019) or heavy rainfall. Consequently, any analysis that includes these life-histories may be excessively influenced by within-year conditions. The following analysis is therefore confined to univoltine species.

It is also possible that warmer temperatures might extend the flight period into the autumn and early winter, hence that the flight period of autumnal species may have shifted later. There are, however, very few species of univoltine hoverfly with a substantially autumnal flight period, and it is therefore unlikely that this hypothesis can be tested using the techniques adopted in this analysis.

Methods

Unique records (i.e. unique combinations of species, date and grid reference) for those species listed as 'univoltine' by Syrph-the-Net (Speight 2014) were extracted from the Hoverfly Recording Scheme (HRS) database for the period 1980 to 2018. The list was confined to species with records in each year, thus excluding scarcer species for which the data would be insufficient to draw a reliable conclusion. It also omitted any species that arrived in the UK, or was only recognised as British, since 1980. This list comprises 61 species (listed in Appendix 1).

To illustrate the techniques employed, Fig. 1 shows an example depicting the flight period of *Epistrophe eligans* Linnaeus, 1758 in 2017. The histogram shows the number of records received each week. The dates by which 10% and 50% of the records were received are indicated. Fig. 2 shows all records of *E. eligans* across the entire period. The box and whisker plot shows the distribution of records by date within each year. The 50-percentile date (median) is shown at the centre of the box, the dimensions of the box show the inter-quartile range (dates between which 25% and 75% of dates were received). The whiskers indicate the range from 5% to 95% of records. Finally, the dots show outliers, i.e. dates which fall outside the 5-95% range. Four regression lines are overlain: two result from estimating the 10-percentile and 50-percentile dates for each year and then fitting a linear regression between these dates and the year. The other two result from quantile regressions (Koenker 2018), using the whole dataset to estimate the linear relationship between the 10 and 50% quantile dates (i.e. parameter tau of 0.1 or 0.5 respectively). The regression results are shown in Table 1.

Regression	**Intercept**	**Slope**	**p-value of slope**
Linear regression of year vs 10-percentile date	1199.5	-0.5436	3.58e-05
Linear regression of year vs 50-percentile date	1101.7	-0.4858	4.13e-05
Quantile regression, tau=0.1	1395.6	-0.6429	0.0000
Quantile regression, tau=0.5	957.6	-0.4138	0.0000

Table 1. Regression results for *Epistrophe eligans*.

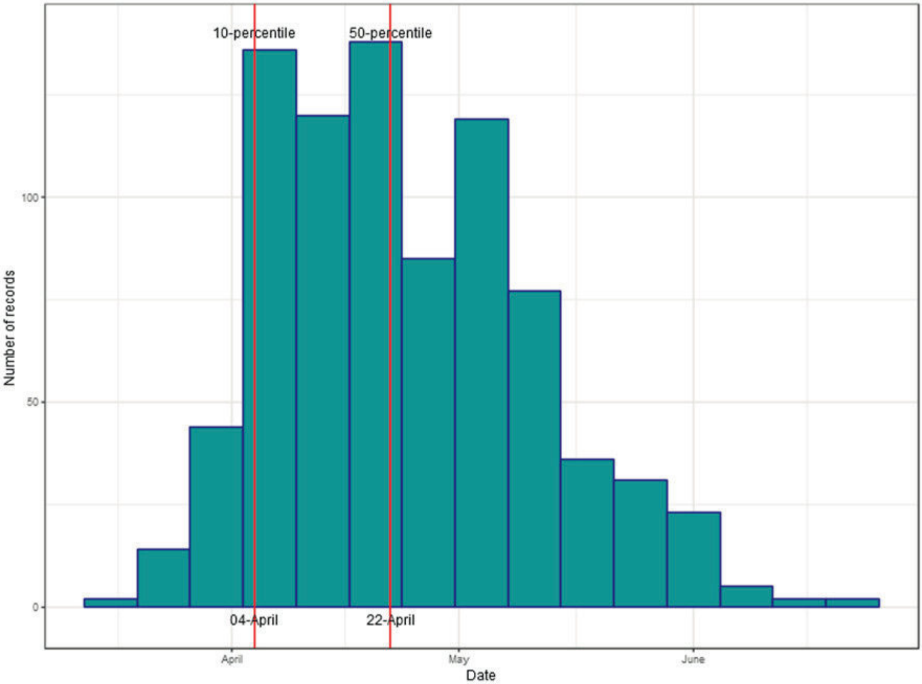

Fig. 1. Flight period of *Epistrophe eligans* in 2017; a histogram showing number of adult records received each week with the 10-percentile and 50-percentile dates indicated.

For each species, a linear regression was therefore calculated for the 10- and 50-percentile date within each year vs the year. The results are shown in Table 2. The resulting estimate of the slopes were then plotted for each species against the overall median date of its flight period (Fig. 3 and Fig. 4). These figures are overlain by a trendline showing a linear regression of the estimated slope vs the overall median date for each species. Also superimposed is a smoothing spline (df = 5).

These two analyses include species for which the numbers of records in some years are small (Table 2), and therefore the reliability of the results may be doubted. Quantile regression was applied to the same dataset to establish whether a more reliable result could be achieved. In this analysis trends were calculated for both the 10-percentile and 50-percentile dates (parameters tau=0.1 and tau=0.5). It was found that stable results could be achieved where the minimum number of records in any one year did not drop below 7; but in so doing the list of species available for analysis dropped from 61 to 31. The results of quantile regressions for each of these species are shown in Appendix 2.

The slopes estimated by the quantile regression are plotted against the overall median flight date for each species in Fig. 5 for both the 10-percentile and 50-percentile regressions. In both cases the estimated rates of change in flight period are more negative (i.e. flight period shifting earlier) the earlier the overall median flight date.

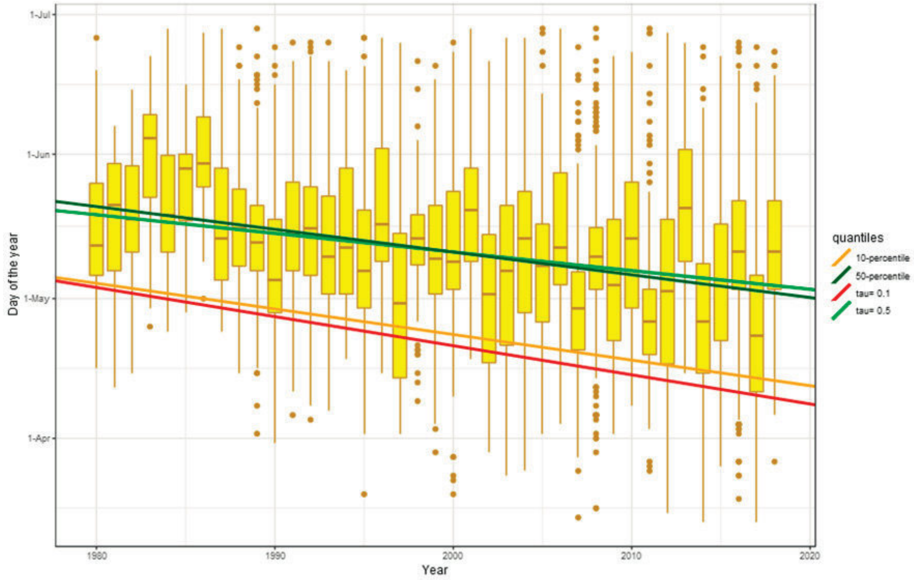

Fig. 2. Boxplot showing distribution of records of *Epistrophe eligans* for each year from 1980 to 2018, showing regressions fitted to 10-percentile and 50-percentile dates and the results of quantile regression for tau values of 0.1 and 0.5.

Results

Using linear regression, the date at which the 10-percentile date was reached over the 39-year study period advanced in 61 species (Fig. 3). Of the 61 species, the slope of the regression of 10-percentile date vs year was negative in all cases (i.e. the 10-percentile date tended to become earlier in more recent years) and was significant at the 95% confidence limit for 49 of them (Table 2).

When quantile regression is applied to the (reduced) sample of species, it can be seen that the slope of regression for advancement of the 50-percentile fraction is steeper than that for the 10-percentile fraction (Fig. 5).

Discussion

Each warm spring or winter heatwave leads to new and surprising single records. For example, in February 2019 there were two records of *Epistrophe eligans* (a species more normally seen in April and May) posted on the UK Hoverflies Facebook page (Facebook 2019). These individual records, whilst interesting, are usually outliers from the main block of records and greater weight should be placed on the 10-percentile or 50-percentile dates. Investigation at these levels strongly suggests that the majority of univoltine hoverfly species have adjusted their flight times in response to warmer springs.

It is noteworthy, however, that the smoothing spline applied in Figs 3 and 4 suggests that species that fly very early in the spring or towards the middle of the year are less influenced by warming springs. The factors responsible for these differences may differ and we hypothesise that there are two separate sets of factors involved in early spring and mid-year emergence.

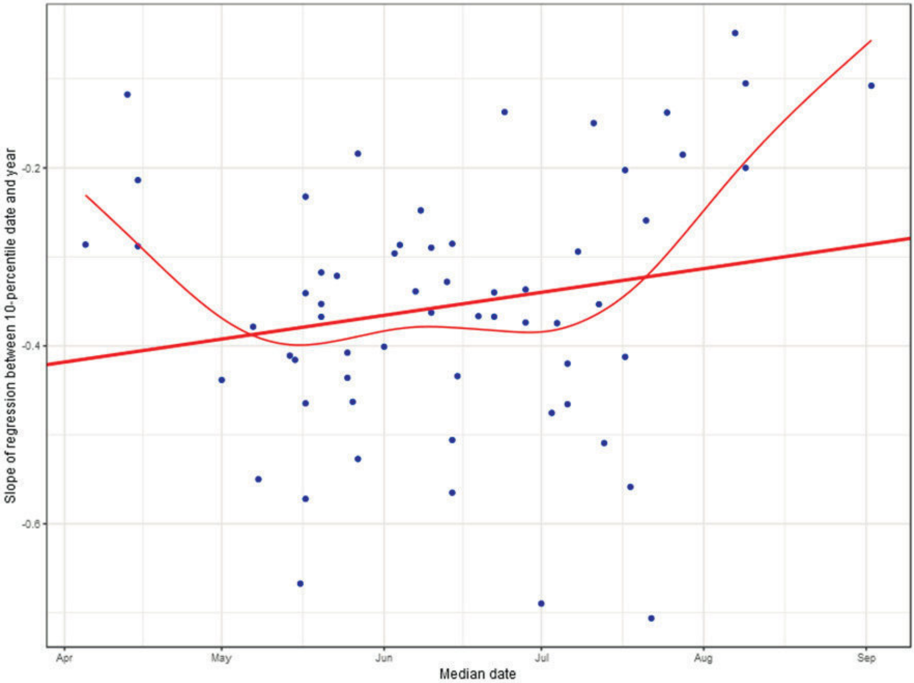

Fig. 3. Slope of linear regression of 10-percentile date vs year for each species plotted against its overall median date. A linear trendline is overlain resulting from a linear regression of the estimated slope for each species vs its overall median date (p=0.00015). A smoothing spline (5 d.f.) is also overlain.

A relatively small group of species emerge to fly in March and early April, some of which, such as *Cheilosia albipila*, *Cheilosia grossa* and *Melangyna quadrimaculata*, are specialists that occur in a relatively narrow suite of habitats (Stubbs and Falk 2002). To find them, the entomologist must find a suitable lure (flowering plant) in suitable habitat and employ specialist equipment such as telescopic net handles (Ball and Morris 2015). They must also find a suitable weather window at a time of year when the weather is often inclement. Consequently, the numbers of records each year are small and the possibility of detecting change is correspondingly limited. It might therefore be inferred that sampling technique is influential; however, anecdotally it should be noted that in the past five years the recorder-base has grown substantially and yet there are few indications of a substantial increase in the number of records or of exceptionally early dates (unlike experience with *Epistrophe eligans*). We therefore suspect that emergence of these early spring species is not as significantly influenced by warmer spring conditions as species that used to emerge later on.

For species that would once have flown from late April to June, there is greater potential for the effects of warmer springs to influence flight times. Amongst this assemblage there seems to be a much stronger (but variable) response, with some species such as *Epistrophe eligans* advancing flight times by 15 to 20 days over the norm for the early 1980s. The huge variation in response also suggests that the influence of warmer springs is variable and that an additional set of influences may also help to govern emergence times. The precise factors will vary from species to species, but may include the cumulative impact of days above a certain temperature needed to break diapause. The data do not, however, facilitate detailed investigation.

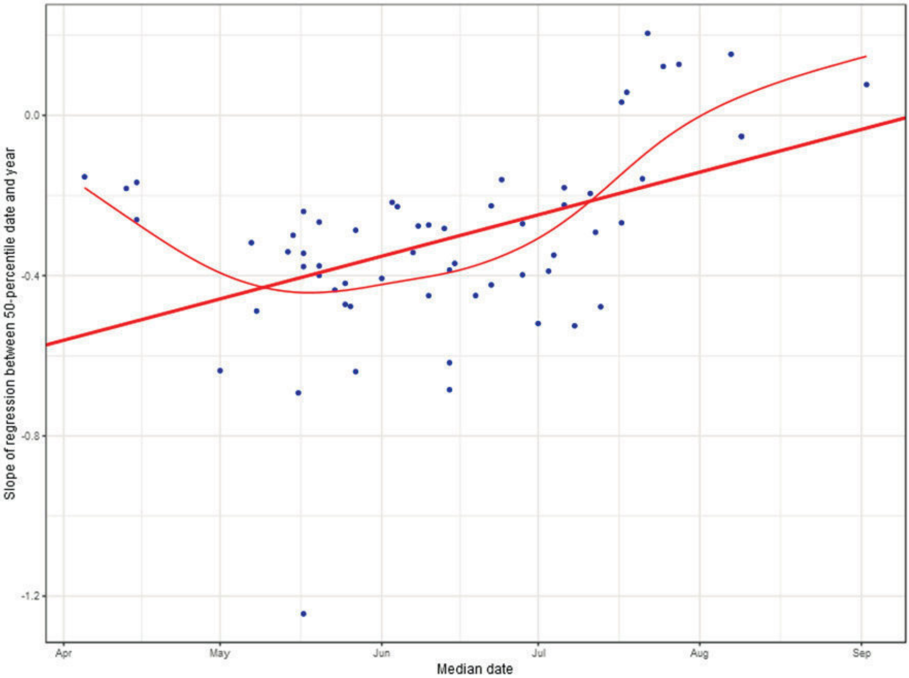

Fig. 4. Slope of linear regression of 50-percentile date vs year for each species plotted against its overall median date. A linear trendline is overlain, resulting from a linear regression of the estimated slope for each species vs its overall median date (p=0.143). A smoothing spline (5 d.f.) is also overlain.

Those species whose peak emergence lies at, or beyond, the June equinox show the lowest (non-significant) response to warmer springs. This difference suggests that whilst there may be a limited impact from warmer spring temperatures, the main controlling influences are as yet undetermined. Hassall *et al.* (2017) showed that, whilst it is possible to demonstrate global changes, the precise factors involved are unclear. More detailed study and recording is needed if these species are to be better understood. Important factors may include optimal temperatures for egg and larval development, in addition to cues that precipitate adult emergence.

The question that follows is 'whether there is phenological decoupling between hoverfly flight times and the flowering times of particular plants?' As far as we are aware, there are no oligolectic hoverflies and therefore there is unlikely to be a direct problem for any specific plant that is reliant upon hoverflies as pollinators. Hoverflies are, however, an important part of the 'pollinator' assemblage and therefore any phenological decoupling may be indicative of a wider problem amongst pollinators.

Hassall *et al.* (2017) investigated a wider selection of hoverflies, including multivoltine species, and concluded that whilst their standardised dataset suggested that the end of the flight period was advancing at the same rate as at the beginning of the season, this was not apparent in the ad hoc data held in an earlier version of the dataset used in our analysis. There are a variety of possible reasons for this difference, but the most obvious one is that the standardised dataset came from a single Malaise trap in central England, whereas the ad hoc dataset derives from observers covering a much wider geographical spread. In our experience, flight times can be heavily influenced by latitude (Ball and Morris 1992, Morris 2019). Consequently, the pattern seen in the ad hoc data may reflect a much wider range of phenological responses. Our current analysis suggests that amongst univoltine species the rate of advance of the 50-percentile is somewhat greater than the 10-percentile and that flight periods may in fact be shortening.

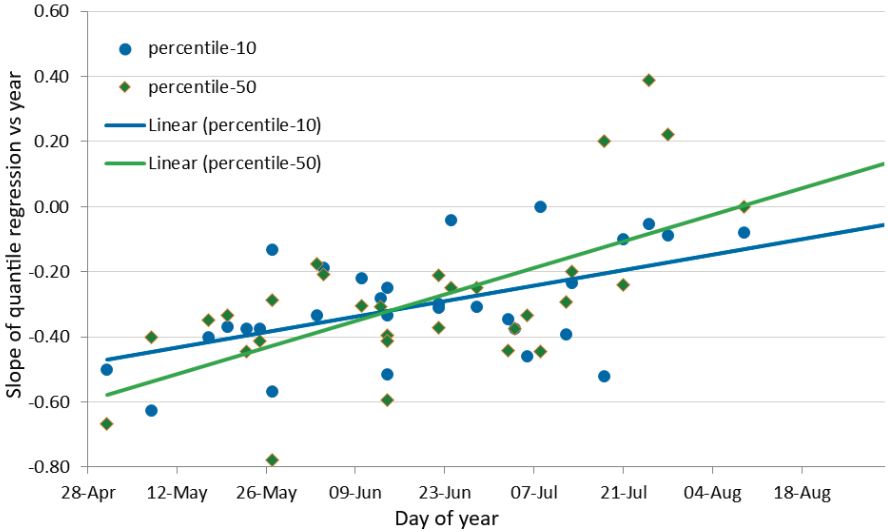

Fig. 5. Slope of quantile regression for each species vs overall median date of flight period. The overlain trendlines show linear regressions (10-percentile, p=0.00512; 50-percentile, p=0.00524).

A more serious problem may arise if early heatwaves that trigger hoverfly emergence are followed by a return to cooler conditions. Cooler conditions can limit the ability of the insects to maximise their reproductive potential (Berger *et al.* 2008, Hodkinson 2005) and therefore populations in subsequent years may be lower than they might otherwise have been. In the past 20 years there have been several instances of elevated temperatures and sunshine in April, followed by a cooler (and wetter) than average period in May. The impact of these events may be one of the factors behind a wider decline in invertebrates highlighted in recent studies (e.g. Hallmann *et al.* 2017). Unfortunately, there are neither field nor experimental data to investigate this possible effect. Direct links between weather and hoverfly numbers using opportunistic data cannot be made because there are too many variables to account for differing levels of abundance.

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Appendix 1: Results of linear regression of 10- and 50-percentile date within each year vs year for univoltine species for which records are available in every year from 1980 to 2018. Where the p-value for the hypothesis that the slope is zero is less than 5%, the cell is highlighted.

Species	Total records	Min records in any one year	Overall median flight date	Slope 10-percentile vs year	p-value	Slope 50-percentile vs year	p-value
Brachyopa scutellaris Robineau-Desvoidy, 1843	884	4	15-May	-0.4157	0.0023	-0.2992	0.0208
Brachypalpoides lentus (Meigen, 1822)	1,053	6	07-Jun	-0.3387	0.0011	-0.3422	0.0045
Chalcosyrphus nemorum (Fabricius, 1805)	2,362	17	14-Jun	-0.5649	0.0001	-0.6847	0
Cheilosia albipila Meigen, 1838	533	4	13-Apr	-0.1175	0.3934	-0.1824	0.2385
Cheilosia albitarsis (Meigen, 1822)	8,651	36	27-May	-0.184	0.0305	-0.2866	0.0002
Cheilosia antiqua (Meigen, 1822)	551	4	20-May	-0.3175	0.0052	-0.3995	0.0028
Cheilosia grossa (Fallén, 1817)	711	3	05-Apr	-0.2862	0.0426	-0.1533	0.2869
Cheilosia lasiopa Kowarz, 1885	625	2	17-May	-0.2323	0.049	-0.2399	0.0441
Chrysogaster virescens Loew, 1854	670	2	10-Jun	-0.3626	0.0122	-0.45	0.0043
Chrysotoxum cautum (Harris, [1776])	1,274	10	04-Jun	-0.2866	0.0079	-0.2277	0.0191
Chrysotoxum elegans Loew, 1841	388	1	22-Jul	-0.7061	0.0055	0.205	0.4695
Chrysotoxum festivum (Linnaeus, 1758)	2,518	12	21-Jul	-0.2591	0.0352	-0.1584	0.3265
Chrysotoxum verralli Collin, 1940	831	2	17-Jul	-0.4123	0.0009	-0.2681	0.0202
Criorhina asilica (Fallén, 1816)	436	1	25-May	-0.4359	0.0005	-0.4192	0.0004
Criorhina berberina (Fabricius, 1805)	2,208	26	03-Jun	-0.2961	0.0104	-0.2171	0.0381
Criorhina floccosa (Meigen, 1822)	1,228	9	20-May	-0.3673	0.0081	-0.3756	0.0014
Criorhina ranunculi (Panzer, 1804)	953	4	15-Apr	-0.288	0.0461	-0.1672	0.23
Dasysyrphus pinastri (De Geer, 1776)	745	2	08-Jun	-0.2477	0.334	-0.276	0.1675
Dasysyrphus venustus (Meigen, 1822)	3,392	22	23-May	-0.3214	0.0002	-0.436	0
Epistrophe eligans (Harris, [1780])	10,133	33	08-May	-0.5498	0	-0.4883	0
Epistrophe grossulariae (Meigen, 1822)	6,377	47	28-Jul	-0.1851	0.1425	0.1274	0.379
Epistrophe nitidicollis (Meigen, 1822)	640	1	26-May	-0.4629	0.0081	-0.4768	0.0047
Eristalis rupium Fabricius, 1805	522	2	17-Jul	-0.2024	0.2408	0.033	0.8711
Eumerus funeralis Meigen, 1822	2,196	11	06-Jul	-0.4199	0.004	-0.2239	0.4122
Lejogaster metallina (Fabricius, 1781)	3,067	29	28-Jun	-0.3737	0.0003	-0.2702	0.1476
Leucozona glaucia (Linnaeus, 1758)	5,382	29	09-Aug	-0.1051	0.2306	-0.0523	0.5642
Leucozona laternaria (Müller, 1776)	2,622	18	12-Jul	-0.3532	0	-0.2917	0.0002
Leucozona lucorum (Linnaeus, 1758)	9,289	45	25-May	-0.4077	0.0001	-0.4719	0
Melangyna cincta (Fallén, 1817)	1,148	6	17-May	-0.5854	0	-1.2535	0.0009
Melangyna compositarum/labiatarum	2,481	15	11-Jul	-0.1496	0.5861	-0.1949	0.4111

Melangyna lasiophthalma (Zetterstedt, 1843)	1,760	6	13-Apr	-0.1971	0.0227	-0.2338	0.059
Melanogaster hirtella (Loew, 1843)	5,162	19	13-Jun	-0.328	0.0001	-0.2822	0.005
Meligramma trianguliferum (Zetterstedt, 1843)	371	2	16-May	-0.6671	0.0033	-0.6925	0.0496
Merodon equestris (Fabricius, 1794)	8,413	36	10-Jun	-0.2897	0.0111	-0.2736	0.0045
Neoascia geniculata (Meigen, 1822)	417	1	01-Jul	-0.6896	0.005	-0.5195	0.0549
Neoascia meticulosa (Scopoli, 1763)	1,360	15	27-May	-0.5271	0	-0.6396	0
Neoascia obliqua Coe, 1940	379	3	01-Jun	-0.4009	0.1201	-0.4069	0.2358
Orthonevra geniculata (Meigen, 1830)	294	1	14-May	-0.4109	0.0687	-0.3406	0.134
Orthonevra nobilis (Fallén, 1817)	1,237	7	08-Jul	-0.2941	0.0345	-0.5252	0.0223
Parasyrphus punctulatus (Verrall, 1873)	1,926	12	01-May	-0.4383	0.0008	-0.6371	0.0001
Parhelophilus frutetorum (Fabricius, 1775)	945	6	15-Jun	-0.434	0.0006	-0.3696	0.0012
Parhelophilus versicolor (Fabricius, 1794)	1,428	9	14-Jun	-0.5058	0.0001	-0.6173	0
Pipiza austriaca Meigen, 1822	1,071	6	19-Jun	-0.3666	0.0007	-0.4497	0.0098
Pipiza luteitarsis Zetterstedt, 1843	379	1	07-May	-0.3785	0.0013	-0.3179	0.0012
Pipizella viduata (Linnaeus, 1758)	3,503	20	22-Jun	-0.3399	0.0001	-0.2257	0.0145
Platycheirus angustatus (Zetterstedt, 1843)	3,870	34	04-Jul	-0.3745	0.0023	-0.3489	0.0319
Platycheirus granditarsus (Forster, 1771)	6,856	30	25-Jul	-0.1378	0.2133	0.1222	0.5378
Platycheirus occultus Goeldlin, Maibach & Speight, 1990	923	2	06-Jul	-0.4656	0.0265	-0.1806	0.3156
Platycheirus peltatus (Meigen, 1822)	4,538	15	18-Jul	-0.5585	0	0.0576	0.8654
Platycheirus podagratus (Zetterstedt, 1838)	1,358	4	17-May	-0.3407	0.0002	-0.3442	0.0013
Platycheirus tarsalis (Schummel, 1837)	1,926	7	17-May	-0.4646	0.0002	-0.3774	0.0009
Portevinia maculata (Fallén, 1817)	2,312	18	13-Jul	-0.5092	0.0017	-0.4776	0.0262
Sericomyia superbiens (Müller, 1776)	1,127	8	02-Sep	-0.1076	0.3195	0.0769	0.5158
Tropidia scita (Harris, 1780)	2,815	14	14-Jun	-0.2852	0.003	-0.3859	0.0035
Volucella bombylans (Linnaeus, 1758)	9,973	46	22-Jun	-0.3672	0.0002	-0.4232	0
Volucella inanis (Linnaeus, 1758)	4,534	6	09-Aug	-0.1999	0.0576	-0.0525	0.577
Volucella inflata (Fabricius, 1794)	1,462	7	24-Jun	-0.1372	0.3061	-0.1604	0.1887
Volucella zonaria (Poda, 1761)	5,238	5	07-Aug	-0.0484	0.7214	0.1526	0.2426
Xanthogramma citrofasciatum (De Geer, 1776)	602	1	20-May	-0.3529	0.0006	-0.2663	0.0043
Xanthogramma pedissequum (Harris, 1776)	4,840	19	03-Jul	-0.4754	0.0002	-0.3888	0.0068
Xylota jakutorum Bagachanova, 1980	949	6	28-Jun	-0.3367	0.0373	-0.398	0.0276

Appendix 2: Results of Quantile regression for species with at least 7 records available in every year from 1980 to 2018

Species	Results of quantile regression			
	tau = 10	p-value	tau=50	p-value
Arctophila superbiens	-0.0526	0.5438	0.0714	0.2118
Chalcosyrphus nemorum	-0.5161	0	-0.3939	0
Cheilosia albitarsis	-0.1333	0	-0.2857	0
Chrysotoxum cautum	-0.1875	0.0037	-0.2069	0.0003
Chrysotoxum festivum	-0.1	0.0592	-0.2414	0.002
Criorhina berberina	-0.3333	0	-0.1765	0.001
Criorhina floccosa	-0.3684	0	-0.3333	0
Dasysyrphus venustus	-0.375	0	-0.4444	0
Epistrophe eligans	-0.625	0	-0.4	0
Epistrophe grossulariae	-0.087	0.0571	0.2222	0
Eumerus funeralis	-0.4583	0	-0.3333	0.0948
Lejogaster metallina	-0.3077	0	-0.25	0.0037
Leucozona glaucia	-0.08	0.01	0	1
Leucozona laternaria	-0.3929	0	-0.2917	0
Leucozona lucorum	-0.375	0	-0.4118	0
Melanogaster hirtella	-0.28	0	-0.3077	0
Merodon equestris	-0.2188	0	-0.303	0
Neoascia meticulosa	-0.5676	0	-0.7778	0
Orthonevra nobilis	0	1	-0.4444	0.0026
Parasyrphus punctulatus	-0.5	0	-0.6667	0
Parhelophilus versicolor	-0.3333	0	-0.5937	0
Pipizella viduata	-0.3103	0	-0.2121	0.0004
Platycheirus angustatus	-0.375	0	-0.375	0
Platycheirus granditarsus	-0.0526	0.1928	0.3889	0
Platycheirus peltatus	-0.5217	0	0.2	0.2463
Portevinia maculata	-0.4	0	-0.3478	0
Riponnensia splendens	-0.2333	0.0018	-0.2	0.066
Tropidia scita	-0.25	0	-0.4138	0
Volucella bombylans	-0.3	0	-0.3704	0
Volucella inflata	-0.04	0.4641	-0.25	0.0001
Xanthogramma pedissequum	-0.3462	0	-0.4412	0

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Thick-headed flies (Diptera, Conopidae) in north Scotland

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Summary

An analysis of 362 records of Conopidae in north Scotland held by the Highland Biological Recording Group shows that 4 species are present and widespread. They fly from April to October, each with a restricted flight season. *Myopa buccata* is earliest, followed by *Physocephala nigra*, *Sicus ferrugineus* and *Conops quadrifasciatus*. Various Asteraceae, especially *Jacobaea vulgaris* and *Cirsium* spp., were most often recorded as flowers visited. Hosts of *Conops* and *Physocephala* are likely to be more diverse than currently acknowledged.

Introduction

The Highland Biological Recording Group (HBRG) has accumulated 362 records of conopids, 84% of them since 2000, and has targeted recording of the family since 2002. These form the vast majority of recent records of Conopidae in the public domain in north Scotland and are analysed here to add to our knowledge of the family there. Most of our records lie in the Highland Council local authority area, which covers vice-counties 96, 97, 104-109 and parts of 95 and 98. Other records not analysed here are held in other datasets, notably the national Biological Records Centre.

Seven species of Conopidae are recorded in Highland (Smith 1969; D. Clements *pers. comm.*): *Conops quadrifasciatus* De Geer, 1776, *Myopa buccata* (Linnaeus, 1758), *M. testacea* (Linnaeus, 1767), *Physocephala nigra* (De Geer, 1776), *Sicus ferrugineus* (Linnaeus, 1761), *Thecophora fulvipes* (Robineau-Desvoidy, 1830) and *T. atra* (Fabricius, 1775). All are represented in the HBRG data except for *M. testacea* and the two *Thecophora*. Highland records of *Thecophora* are all pre-1945 except for one *T. fulvipes* in 2011 (D. Clements *pers. comm.*). The only other species recorded in Scotland are *C. flavipes* Linnaeus, 1758 and a 'surprising' record of *C. ceriaeformis* Meigen, 1824 from NO69, vice-county 91 (Smith 1969). *Physocephala nigra* was designated as 'RDB3 Rare', currently 'IUCN (pre 1994) – Rare', by Falk (1991). The biology of the family was described by Clements (1997).

Methods

This paper is based solely on records in the HBRG database, all details of which are available on the National Biodiversity Network Atlas https://nbnatlas.org/. Records are casual and opportunistic with no systematic survey or monitoring, though recording of the family has been encouraged by HBRG since 2002. Identification was usually made in the field, but records from non-specialists were always confirmed from photographs or specimens. This is not controversial in the case of the very distinctive *S. ferrugineus* and *P. nigra*, their only known UK congeners being absent from Scotland (Smith 1969; NBN Atlas). *Conops flavipes*, should it be encountered, is sufficiently different in body pattern from the very common *C. quadrifasciatus* to attract extra attention, and the same applies to *Myopa testacea* which usually lacks a strong pattern on the wings. *Thecophora* species are distinctive and their absence in the dataset is considered to reflect at least extreme scarcity in the area.

The data

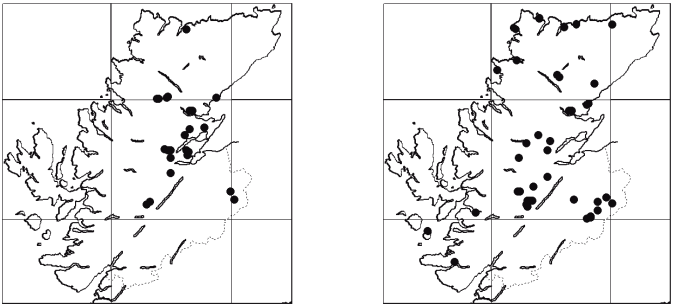
This analysis is based on the records summarised in Table 1.

Species	<2000	2000-2009	2010-2019	total records
Myopa buccata	5	16	23	**44**
Physocephala nigra	20	16	22	**58**
Sicus ferrugineus	14	42	51	**107**
Conops quadrifasciatus	18	75	60	**153**
Totals	**57**	**149**	**156**	**362**

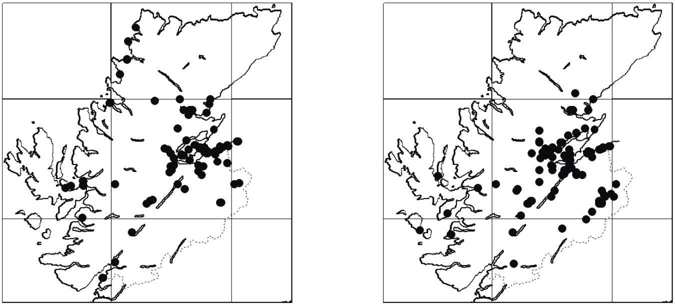
Table 1. Summary of the temporal range of records used in this paper. All are from the Highland Biological Recording Group database.

Distribution in north Scotland

The distribution of our four species in the Highland Council area is shown in Fig. 1.



Myopa buccata *Physocephala nigra*



Sicus ferrugineus *Conops quadrifasciatus*

Fig. 1. Distribution of records of Conopidae in the Highland Council local authority area in the Highland Biological Recording Group database.

All four species are widely distributed in Highland. Gaps in the north and west may reflect lack of recording effort there. However, the absence of *Conops*, abundant over most of the area and easy to see, north and west of a line from Skye to SE Sutherland is likely to be real, especially given the records of the much scarcer *Physocephala* in these parts.

Records in the HBRG database from outside Highland are:

Myopa buccata - Fallin, NS89, vice-county 86, 2009.

Physocephala nigra - Mainland, Orkney HY32 and HY40, vice-county 111, 2011 and 2015.

Sicus ferrugineus - Carron Valley NS78, vice-county 86, 1978; Deeside NJ40, vice-county 92, 2018; Roseisle NJ16, vice-county 95, 2015; Polanach NM95, vice-county 98, 2011.
Conops quadrifasciatus - Edinburgh NT27, vice-county 83, 2008-2013; Roslin NT26, vice-county 83, 2015; Stirling NN59, vice-county 86, 2011; Aberfoyle NN50, vice-county 87, 1977; Meikleour NO13, vice-county 89, 2012; Deeside NJ40, vice-county 92, 2018; Roseisle NJ16, vice-county 95, 2015.

Phenology
The four Highland species have different but overlapping flight seasons, *Myopa* earliest and *Conops* latest (Fig. 3). Extreme dates are shown in Table 2.

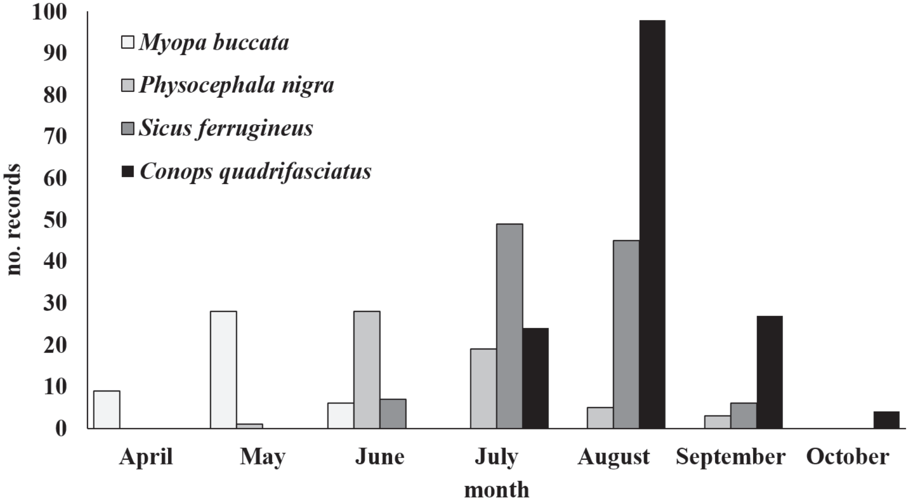


Fig. 3. Phenology of conopid flies in north Scotland from the Highland Biological Recording Group database.

Species	first date	last date	length of season (days)
Myopa buccata	11 April	14 June	64
Physocephala nigra	11 May	18 September	130
Sicus ferrugineus	7 June	13 September	98
Conops quadrifasciatus	17 July	10 October	85

Table 2. Phenology of conopid flies in north Scotland from the Highland Biological Recording Group database.

Habitat
Myopa buccata was most often encountered in open woodland sites, often basking on the ground-layer vegetation such as *Vaccinium myrtillus*. *Physocephala nigra* usually frequents open areas of moor or heath. Both *S. ferrugineus* and *C. quadrifasciatus* were found in a wide range of habitats and frequently in gardens. Open forest tracks were also favoured. There is no indication in our data of any specific habitat requirement for any of the species.

Flowers visited

85 records cited a total of 98 flowers visited by Conopidae (Table 3). Use as forage was not specified in all cases, and no reference was made to the type of nourishment taken, though Proctor and Yeo (1973) stated that *Conops* and *Sicus* take only nectar and do not eat pollen. All four flies visited a range of flowers, but ragwort *Jacobaea vulgaris* was cited in 39 and *Cirsium* species in 17 records, together representing 59% of all flower visits recorded. Asteraceae accounted for 70% of records. Perhaps surprisingly, only two visits to hogweed *Heracleum sphondylium* were noted, none to wild angelica *sylvestris*, and one to an unspecified umbellifer. Both these Apiaceae are common, widespread, and generally very attractive forage plants for a wide range of generalist Diptera in Highland (*pers. obs.*).

Species	Forage plants	no. of records
Myopa buccata	*Taraxacum*	4
5 records, citing 5 plants	*Crataegus*	1
Physocephala nigra	*Jacobaea vulgaris*	2
6 records, citing 7 plants	*Cirsium*	1
	Erica cinerea	1
	Galium saxatile	1
	Thymus polytrichus	1
	Veronica	1
Sicus ferrugineus	*Jacobaea vulgaris*	8
22 records citing 27 plants	*Cirsium vulgare*	5
	Centaurea nigra	3
	Cirsium arvense	2
	Hypochaeris radicata	2
	Succisa pratensis	2
	Campanula rotundifolia	1
	Apiaceae	1
	Erica cinerea	1
	Heracleum sphondylium	1
	Prunella vulgaris	1
	Sonchus	1
Conops quadrifasciatus	*Jacobaea vulgaris*	28
51 records citing 58 plants	*Cirsium arvense*	8
	Origanum majorana	8
	Calluna vulgaris	4
	Succisa pratensis	4
	Echinops	2
	Centaurea nigra	1
	Cirsium	1
	Heracleum sphondylium	1
	Mentha	1

Table 3. Plants visited by Conopidae in the north of Scotland. Data are from the Highland Biological Recording Group database.

Hosts

We have very little information on potential hosts. One *M. buccata* was found at a 'bee-bank' where *Andrena ruficrus* Nylander, 1848 and *Nomada leucophthalma* (Kirby, 1802) (implying the presence of *A. clarkella* (Kirby, 1802)) were present. *Sicus ferrugineus* was observed, on separate single occasions, chasing workers of *Bombus lapidarius* (Linnaeus, 1758), *B. pratorum*

(Linnaeus, 1761), *B. lucorum* s.l., and either *B. lucorum* s.l. or *B. terrestris* (Linnaeus, 1758). One *S. ferrugineus* was observed 'pouncing' on the syrphid *Volucella bombylans* (Linnaeus, 1758), form *plumata*, perhaps an unintended consequence of Batesian mimicry (N. Owens *pers. comm.*).

Discussion

The four species of Conopidae are all widespread and reasonably frequent in Highland and not obviously under any threat. *Physocephala nigra*, the only one to have any conservation designation, is the most widely distributed of all in north Scotland and the only conopid to have been recorded in Orkney. Falk (1991) recognised 'about 10 known post 1960 sites scattered widely' in the Scottish Highlands. Our data have records from 33 hectads in the north, perhaps placing it outside the criteria for UK designation. In the European context, however, the Scottish population may be very significant.

The distribution of *C. quadrifasciatus* in Great Britain, as indicated on the NBN Atlas https://nbnatlas.org/ is odd for such a conspicuous fly. There is an obvious gap between central Scotland and Sunderland where the equally obvious *C. flavipes* is recorded. The gap is not apparent in the maps of the other conopids, suggesting that recording effort is not responsible and that *C. quadrifasciatus* may have a disjunct distribution in Great Britain with distinct Scottish and English populations.

The range of flowers recorded is subject to substantial observer bias. The inclusion of marjoram *Origanum majorana*, for example, is entirely due to records from two observers in whose gardens the herb was cultivated. The high incidence of Asteraceae in the list, and especially the dominance of *Jacobaea vulgaris* (48% of plants cited) in the visits of *C. quadrifasciatus*, is probably of wider significance.

Our data add nothing positive to the very limited information on the hosts used by Conopidae. Stuke (2017) listed what is known of host associations, but our work suggests that these cannot be complete or exclusive. For *M. buccata*, he lists as doubtful hosts unspecified Vespidae and two *Andrena* species found commonly in Highland: *A. lapponica* (Zetterstedt, 1838) and *A. scotica* Perkins, 1916. Hosts of *P. nigra* are given as *Bombus muscorum* (Linnaeus, 1758), *B. terrestris* and, doubtfully, *B. hortorum* (Linnaeus, 1761). *Bombus muscorum* and *B. terrestris* are very scarce at best in the range of the fly in Highland (Macdonald and Nisbet 2006; Macdonald, *pers. obs.*). It seems certain that other hosts are used, possible candidates being the widespread and often common *B. lucorum* (Linnaeus, 1761), *B. cryptarum* (Fabricius, 1775), *B. magnus* Vogt, 1911, *B. soroeensis* (Fabricius, 1777), *B. jonellus* (Kirby, 1802), *B. monticola* Smith, 1849, *B. pratorum*, *B. pascuorum* (Scopoli, 1763) and *B. hortorum*. Similarly, the (doubtful) hosts of *C. quadrifasciatus* are cited as *Bombus lapidarius*, *Bombus terrestris*, and social wasps Vespidae. The two bees are again far more restricted in Highland than the fly, and potential hosts are the same as listed above for *P. nigra*. Our observations of *S. ferrugineus* are consistent with the general view that it will parasitise a range of bumblebees. Stuke (2017) gave *Vespula vulgaris* (Linnaeus, 1758) as a doubtful host, and (as confirmed hosts) *B. terrestris*, *B. lapidarius*, *B, pratorum*, and *B. hortorum*.

Acknowledgements

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***Platypeza hirticeps* Verrall and *Callomyia dives* Zetterstedt (Diptera, Platypezidae) new to the Isle of Man (V.C. 71) –** My records of *Lindneromyia dorsalis* (Meigen, 1804) and *Paraplatypeza atra* (Meigen, 1804) were recently reported as the first for the family Platypezidae from the Isle of Man (Chandler, P.J. 2020. Flat-footed Fly Recording Scheme Newsletter 3. 4 pp. *Bulletin of the Dipterists Forum* **89**). Two less frequent species of this family can now be added.

During a visit to the Manx Wildlife Trust's Cooildarry reserve (SC320896) on 13.ix.2019 to survey the Diptera, I swept a male of *Platypeza hirticeps* Verrall, 1901 from foliage in an area of the reserve close to an abandoned fuller's earth mill. Cooildarry is a deeply wooded valley which forms the upper part of Glen Wyllin. The woodland is semi-natural but is predominantly formed of elm, ash, alder, beech and sycamore. The reserve is also noted amongst the island's mycologists for its range of fungi.

Five days later, on 18.ix.2019, I visited an area of woodland above Greeba (SC315806) known as the King's Forest (or Greeba Plantation) and swept another male *P. hirticeps* from foliage. A female, presumed to be the same species, was also caught during this visit. The females are not believed to be certainly distinguishable from those of *P. aterrima* Walker (Peter Chandler *pers. comm.*). The south-facing and steeply sloping woodland is a mix of coniferous plantation with deciduous elements around the edges of the plantation. This was a new site to me that I became aware of from following on Facebook the IOM Fungus Group, who commented on the wood being a good site for fungi.

On 17.ix.2019, I swept a male of *Callomyia dives* Zetterstedt, 1838 from sunlit foliage alongside a footpath climbing through the wooded slopes of Lhergy Frissell (SC449933). This area of north-facing woodland, to the south of the town of Ramsey, is mainly coniferous but with small deciduous trees such as sycamore and holly, particularly alongside the footpaths.

Both species were recently given the status of Data Deficient (Chandler, P.J. 2017. A review of the status of the Lonchopteridae, Platypezidae and Opetiidae flies of Great Britain Natural England Commissioned Reports, Number 246). Previously, both had been rated as Nationally Scarce (Falk, S.J. and Chandler, P.J. 2005. A review of the scarce and threatened flies of Great Britain. Part 2: Nematocera and Aschiza not dealt with by Falk (1991). Species Status No. 2. Peterborough, Joint Nature Conservation Committee) and as RDB3 by Shirt, D.B. (Ed.) 1987. (British Red Data Books: 2. Insects. Peterborough, Nature Conservancy Council).

I thank Peter Chandler for confirming my identifications and for encouraging me to write up these records. I am grateful to the Manx Wildlife Trust for allowing me to record Diptera on their nature reserves – **STEVE CRELLIN,** Shearwater, The Dhoor, Andreas Road, Lezayre, Ramsey, Isle of Man IM7 4EB; steve_crellin1@hotmail.co.uk

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Diptera associated with compost heaps at Lode, Cambridgeshire, including *Sphaerocera pseudomonilis* ssp. *hallux* Roháček & Florén (Diptera, Sphaeroceridae) new to Britain

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Summary

The results of a two-year study of the Diptera associated with compost heaps at Lode, Cambridgeshire are given, including *Sphaerocera pseudomonilis* ssp. *hallux* Roháček & Florén, 1997 (Sphaeroceridae) new to Britain.

Introduction

In 2017 and 2018, I investigated the Diptera fauna associated with the compost heaps belonging to the National Trust Property of Anglesey Abbey, Lode, Cambridgeshire (TL528624). The composting area consists of three separate bays of area 8m by 6m and each 2m high, enclosed on three sides with wooden sleepers and placed up against an area of plantation woodland. Two of the bays are devoted to the production of leaf mould, the remaining one to compost. A variety of plant materials is used in the making of the compost, with a significant proportion being of grass cuttings from the extensive lawns at the property. A shredder is used to reduce the woody material and the heap is turned regularly, producing a "hot bed" which may be an important factor in the development of some species.

Diptera were collected by waving a sweep net over the compost heaps and floor of the bays. Disturbing the compost with a stick seemed to increase the catch, probably as many of the Sphaeroceridae seemed reluctant to fly or were concealed just below the surface. In 2017, I made 33 visits between 19 March and 15 October and in 2018 there were 13 visits between 14 April and 14 September. Because of the high temperatures and prolonged drought in 2018, the compost heap became very dry in July and August and there was little activity during that time.

Notable Records

Greenomyia mongolica Laštovka & Matile, 1974 (Mycetophilidae)

This fungus gnat was swept from the compost heap on several occasions during 2017. Since it was first recorded in this country from Surrey in 2006 (Chandler 2008), this species has become quite frequent locally. Larvae have been recorded on the surface of decayed wood (Zaitzev 1982), although the frequency with which it was recorded at the compost heap, with most of the records being of females, suggests that it may have been developing there.

Pseudopomyza atrimana (Meigen, 1830) (Pseudopomyzidae)

Although widely distributed in this country, this species is normally encountered as an odd individual. In 2017, between 14 May and 26 September, 41 specimens were swept from the compost heap, consisting of 24 males and 17 females. The only other occasion I have found it in numbers, was in 2011 when several were collected from a stack of pine trunks in the Kings Forest, Suffolk (TL805718) (Perry 2012), the usual sort of habitat in which they are thought to develop. However, there have been similar observations of *P. atrimana* attracted to compost, when in 2012 a mass occurrence of adults was found on heaps of rotting cut grass in woodland areas of the Muránska planina National Park in Slovakia (Roháček 2012). On these occasions, mating was observed, further indicating that *P. atrimana* may develop in this situation, although this has yet to be proven by direct rearing from the substrate.

Meroplius minutus (Wiedemann, 1839) (Sepsidae)
A female was collected from the compost heap on 15 August 2017. Adults have been observed on rotting vegetation and compost previously (Pont and Meier 2002), although this may not be suitable for development, as dung and carrion seem to be the preferred medium for development.

Acartophthalmus bicolor Oldenberg, 1910 (Acartophthalmidae)
A female found on 15 August 2017 may have been a stray from the adjacent woodland, although it is thought to develop in a range of decaying animal and vegetable matter.

Ischiolepta scabricula (Haliday, 1836) (Sphaeroceridae)
With its reduced eyes and short wings this species is probably very secretive in habits and is rarely recorded. Between 2 August and 26 September 2017, 2 males and 6 females were swept from the compost heap, a habitat it has been noted from before (Pitkin 1988).

Pseudocollinella jorlii (Carles-Tolrá, 1990) (Sphaeroceridae)
A female was collected from the bays containing leaf mould on 24 May 2018. I had thought that this species might be restricted to south-west Britain, with previous records from South Wales (Gatt 2001) and Cornwall (Perry 2017). However, I also found it at Chippenham Fen, Cambridgeshire (TL555698) on 20 and 22 October 2018, by sweeping over exposed wet peat. It may have been overlooked in East Anglia because of its similarity to *P. humida* (Haliday, 1836), but I think it is more likely that it has spread into this region in recent years.

Rachispoda brevior (Roháček, 1991) (Sphaeroceridae)
A pair was swept from the floor of the bays containing leaf mould, along with numerous *R. limosa* (Fallén, 1820), on 13 September 2018. At the time it was described there appears to have been only one previous record from Britain, at Fowlmere, Norfolk in 1951 (Roháček 1991). However, it is proving to be more widespread and I have other records for 2018 from Chippenham Fen, Cambridgeshire (TL555698), Walberswick, Suffolk (TL484740) and Farlington Marshes, Hampshire (SU685040).

Sphaerocera pseudomonilis ssp. *hallux* Roháček & Florén, 1997 (Sphaeroceridae)
On 9 April 2017, two pairs of *S. pseudomonilis* ssp. *hallux* were swept from the compost heap and a further female was obtained there on 3 May 2018. It is very similar in appearance to *S. monilis* Haliday, but lacks the white tarsal segments on the front leg, a noticeable feature of that species. It also has the scutellum posteriorly more angular than in *S. monilis,* where it is rounded. It was described from material caught in pitfall traps exposed in a grass refuse heap in Sweden in 1983 and 1985, and since that time has been recorded from the Nearctic region, China and the Czech republic (Marshall *et al*. 2011) and very recently from Germany (Stuke and Roháček 2019). It differs from the nominate subspecies *S. pseudomonilis pseudomonilis* Nishijima & Yamazaki, 1984 known from Japan, by differences in the male gonostylus and female sclerites (Roháček and Florén 1987). A further female was caught in a bottle trap baited with grass cuttings placed in a rabbit burrow, just behind the compost bays in the plantation woodland on 23 April 2018. Another subspecies *S. pseudomonilis* ssp. *asiatica* has been described from Pakistan (Papp 1988).

Drosophila mercatorum Patterson & Wheeler, 1942 (Drosophilidae)
Two females were collected from the compost heap on 20 September 2017. This is a widely distributed pantropical species, probably of Neotropical origin, which is established in Southern Europe and was first recorded in this country from Hillingdon, Middlesex in 1994 (Bennett *et al.*

1995). It develops in a wide range of decaying plant material and the heat generated by the rotting compost may have been an important factor in its survival here.

Drosophila testacea von Roser, 1840 (Drosophilidae)
This species is widely distributed on the continent, where it has been reared from various fungi, but appears to be uncommon in this country and I have not seen it before. One female was swept from the compost heap on 20 September 2017.

Scatophila unicornis Czerny, 1900 (Ephydridae)
In August and September 2017, ephydrids became numerous on the damp floor of the two compost bays containing leaf mould. During that period, I recorded five species of *Scatophila,* an unprecedented occurrence for that genus in my experience. Single males of *S. unicornis* were recorded on 22, 24 August and 9 September. This appears to be a genuinely rare species, which I have only seen once before at Wicken Fen, Cambridgeshire (TL548700) on 3 April 1993.

Fannia gotlandica Ringdahl, 1926 (Fanniidae)
A female was swept from the compost heap on 26 September 2017. This species has been reared from detritus in a hollow elm (d'Assis-Fonseca 1968).

Lispocephala brachialis (Rondani, 1877) (Muscidae)
A male of this predatory species was swept from the compost heap on 29 July 2017. It was thought to be restricted to northern and western areas until it was recorded from the Kings Forest, Suffolk in 2011 (Perry 2012), where it was found around a stack of pine trunks along with *Pseudopomyza atrimana*. On both occasions it was probably attracted to the large numbers of small flies present as potential prey. It is thought to develop in running water among bryophytes; however, the Kings Forest record was far away from any water and I found another male there on 12 December 2018. It is obviously well established in the Breckland region now with further single males found at Brandon Country Park, Suffolk (TL788850) on 20 March and 21 August 2019. To date, all the specimens I have found have been males, suggesting that the females may remain close to the development sites.

Discussion

Many species of Diptera develop in decaying vegetation and compost heaps are an obvious place to look for them, but there appear to be few if any published accounts from this country. An interest in the Sphaeroceridae encouraged me to start looking at this habitat and in 2016 I investigated my own small compost heap. I identified a modest nineteen species of Sphaeroceridae there, but it did include a few species I had not seen before and encouraged by this I decided to sample the much larger Anglesey Abbey compost bays the following year. A total of fifty-three species of Sphaeroceridae were identified during a two-year period, including one new to Britain, indicating that this is an important habitat for that family. Many of the Diptera collected, especially some of the Sphaeroceridae such as *Bifronsina bifrons* (Stenhammar, 1855), *Coproica ferruginata* (Stenhammar, 1855), *C. hirticula* Collin, 1956 and *C. pusio* (Zetterstedt, 1847), were often present in vast numbers and a short period of sweeping soon resulted in enough material for several hours sorting. The size of the compost heap and in particular the heat that it generated, which may have speeded development, were probably contributing factors in making the habitat so prolific. There is an obvious correlation between the species recorded here and those associated with dung as noted by Skidmore (2010). Many species are common to both lists and the heat generated by the decaying compost could explain the presence of *Stomoxys calcitrans* (Linnaeus, 1758), which in cooler latitudes is thought to require the higher temperatures generated by manure heaps to develop in.

Numbers of Diptera found in the bays containing leaf mould were always much lower than in the one containing compost; however, the floor of these bays proved to be particularly attractive to *Rachispoda* species (Sphaeroceridae) and Ephydridae. In the autumn, the dead heads of dahlias are added in large numbers and they seem to attract a profusion of Drosophilidae.

One of the surprising results of this investigation was the presence of several species normally associated with dead wood habitats such as *Ectaetia clavipes* (Loew, 1846) and *Fannia gotlandica* Ringdahl, 1926. Small branches and hedge trimmings were shredded and added to the compost heap and this may be one explanation, although the presence of adults does not prove they had developed there.

In the past, Anglesey Abbey burnt a lot of their garden waste and the drive to recycle as much material as possible is a relatively recent innovation. This has created a habitat that many species of Diptera have been able to take advantage of and the same must be true of many similar properties up and down the country. I intend to continue to record there and it is hoped other dipterists might consider investigating this habitat, should a similar situation occur near them.

Acknowledgements

I would like to thank the National Trust for allowing me to record Diptera at Anglesey Abbey. Thanks are also due to Peter Chandler who named the Mycetophilidae, to Dave Brice (Norfolk, UK) who identified *Rachispoda brevior* and to Paul Gatt (Wickford, UK) who confirmed my identification of *Sphaerocera pseudomonilis* ssp. *hallux.* I am also grateful to Martin Ebejer, Paul Gatt and Jindřich Roháček for their helpful comments in drafting this paper.

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Appendix. Species found at Anglesey Abbey Compost Bays and the year recorded.

ACARTOPHTHALMIDAE

Acartophthalmus bicolor Oldenberg 2017

CAMILLIDAE

Camilla flavicauda Duda 2017

CARNIDAE

Meoneura neottiophila Collin 2017, 2018, *M. vagans* (Fallén) 2017

DOLICHOPODIDAE

Chrysotus blepharosceles Kowarz 2018, *C. neglectus* (Wiedemann) 2018, *Dolichopus griseipennis* Stannius 2018, *Microphor holosericeus* (Meigen) 2018

DROSOPHILIDAE

Drosophila busckii Coquillett 2017, *D. hydei* Sturtevant 2017, *D. immigrans* Sturtevant 2017, *D. melanogaster* Meigen 2017, 2018, *D. mercatorum* Patterson & Wheeler 2017, *D. simulans* Sturtevant 2017, *D. suboscura* Collin in Gordon 2017, *D. suzukii* (Matsumura) 2017, *D. testacea* von Roser 2017, *Lordiphosa andalusiaca* Strobl 2017, *L. fenestrarum* Fallén 2017

EMPIDIDAE

Dolichocephala irrorata (Fallén) 2017, *Hilara brevistyla* Collin 2018, *Rhamphomyia atra* Meigen 2018

EPHYDRIDAE

Ditrichophora calceata (Meigen) 2017, *Limnellia quadrata* (Fallén) 2017, *L. surturi* Andersson 2017, *Philygria flavipes* (Fallén) 2017, *P. picta* (Fallén) 2017, *P. vittipennis* (Zetterstedt) 2017, *Scatella lacustris* (Meigen) 2017, *S. stagnalis* (Fallén) 2017, *Scatophila caviceps* (Stenhammar) 2017, 2018, *S. cribrata* (Stenhammar) 2017, *S. despecta* (Haliday) 2017, *S. noctula* (Meigen) 2017, *S. unicornis* Czerny 2017

FANNIIDAE

Fannia gotlandica Ringdahl 2017, *F. lepida* (Wiedemann) 2017, *F. manicata* (Meigen) 2017, *F. monilis* (Haliday) 2017, *F. scalaris* (Fabricius) 2017, *F. umbrosa* (Stein) 2017

HYBOTIDAE

Crossopalpus humilis (Frey) 2017, *C. minimus* (Meigen) 2017, *C. nigritellus* (Zetterstedt) 2018, *Tachydromia aemula* (Loew) 2017

MILICHIIDAE

Desmometopa sordida (Fallén) 2017, *Madiza glabra* Fallén 2018

MUSCIDAE

Azelia aterrima (Meigen) 2017, *A. nebulosa* Robineau-Desvoidy 2017, *Coenosia humilis* Meigen 2017, *C. testacea* (Robineau-Desvoidy) 2018, *C. tigrina* (Fabricius) 2017, *Hydrotaea cyrtoneurina* (Zetterstedt) 2017, *H. meteorica* (Linnaeus) 2017, *Lispocephala brachialis* (Rondani) 2017, *Phaonia palpata* (Stein) 2017, *Stomoxys calcitrans* (Linnaeus) 2017

MYCETOPHILIDAE

Docosia sciarina (Meigen) 2017, *Greenomyia mongolica* 2017

PHORIDAE

Conicera dauci (Meigen) 2017, 2018, *C. schnittmanni* Schmitz 2017, *C. tarsalis* Schmitz 2017

PIOPHILIDAE

Liopiophila varipes (Meigen) 2017, *Allopiophila vulgaris* (Fallén) 2017, *Protopiophila latipes* (Meigen) 2017

PSEUDOPOMYZIDAE

Pseudopomyza atrimana (Meigen) 2017

SCATOPSIDAE

Coboldia fuscipes (Meigen) 2017, *Ectaetia clavipes* (Loew) 2017, *Scatopse notata* (Linnaeus) 2017, *Swammerdamella brevicornis* (Meigen) 2017, *Thripomorpha coxendix* (Verrall) 2017

SEPSIDAE

Meroplius minutus (Wiedemann) 2017, *Sepsis cynipsea* (Linnaeus) 2017, *S. fulgens* Meigen 2017, *S. violacea* Meigen 2017, *Themira annulipes* (Meigen) 2017, *T. minor* (Haliday) 2017

SHAEROCERIDAE

Bifronsina bifrons (Stenhammar) 2017, 2018, *Chaetopodella scutellaris* (Haliday) 2017, 2018, *Coproica acutangulata* (Zetterstedt) 2017, *C. ferruginata* (Stenhammar) 2017, 2018, *C. hirticula* Collin 2017, 2018, *C. hirtula* (Rondani) 2017, 2018, *C. lugubris* (Haliday) 2017, 2018, *C. pusio* (Zetterstedt) 2017, 2018, *C. vagans* (Haliday) 2017, 2018, *Copromyza equina* Fallén 2018, *C. nigrina* (Gimmerthal) 2018, *C. stercoraria* (Meigen) 2018, *Crumomyia fimetaria* (Meigen) 2017, 2018, *Elachisoma aterrimum* (Haliday) 2017, 2018, *E. pilosum* (Duda) 2017, 2018, *Eulimosina ochripes* (Meigen) 2017, *Gonioneura spinipennis* (Haliday) 2017, *Ischiolepta pusilla* (Fallén) 2017, 2018, *I. scabricula* (Haliday) 2017, *I. vaporariorum* (Halday) 2017, 2018, *Leptocera caenosa* (Rondani) 2017, 2018, *L. fontinalis* (Fallén) 2017, 2018, *L. nigra* Olivier 2017, 2018, *Limosina silvatica* (Meigen) 2018, *Lotophila atra* (Meigen) 2017, *Minilimosina fungicola* (Haliday) 2017, 2018, *M. v-atrum* (Villeneuve) 2018, *M. vitripennis* (Zetterstedt) 2017, *Opacifrons coxata* (Stenhammar) 2017, 2018, *Opalimosina liliputana* (Rondani) 2017, 2018, *O. mirabilis* (Collin) 2017, 2018, *Pseudocollinella humida* (Haliday) 2017, 2018, *P. jorlii* Carles-Tolrá 2018, *Pteremis fenestralis* (Fallén) 2017, 2018, *Pullimosina heteroneura* (Haliday) 2017, 2018, *P. pullula* (Zetterstedt) 2017 *P. vulgesta* Roháček 2017, *Rachispoda brevior* (Roháček) 2018, *R. limosa* (Fallén) 2017, 2018, *R. lutosa* (Stenhammar) 2017, *R. lutosoidea* (Duda) 2017, *Spelobia clunipes* (Meigen) 2018, *S. luteilabris* (Rondani) 2017, 2018, *S. talparum* (Richards) 2018, *Sphaerocera curvipes* Latreille 2017, 2018, *S. monilis* (Haliday) 2017, 2018, *S. pseudomonilis* ssp. *hallux* Roháček & Florén 2017, 2018, *Telomerina flavipes* (Meigen) 2017, 2018, *T. pseudoleucoptera* (Duda) 2018, *Terrilimosina schmitzi* (Duda) 2017, *Trachyopella coprina* (Duda) 2017, 2018, *T. leucoptera* (Haliday) 2017, 2018, *T. lineafrons* Spuler 2017, 2018

STRATIOMYIDAE

Beris chalybata (Forster) 2018, *Microchrysa polita* (Linnaeus) 2017, *Pachygaster leachii* Stephens in Curtis 2017, *Sargus bipunctatus* (Scopoli) 2017,

SYRPHIDAE

Neoascia podagrica (Fabricius) 2017, *Syritta pipiens* (Linnaeus) 2017, *Xylota segnis* (Linnaeus) 2017

Dipterists Digest 2020 **27,** 25-28

First records of Agromyzidae (Diptera) using a species of *Phygelius* as hosts

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Summary

A species of the flowering plant genus *Phygelius* is recorded as host for Agromyzidae for the first time. Larval mines on Cape figwort (*Phygelius capensis*) were discovered in a private garden in Bradninch, Devon, from which an adult agromyzid was successfully reared. A description and illustration of the larval mine is included, along with details of a historic, previously unconfirmed, record of larval mines on this host plant.

Introduction

In October 2019, I was contacted by Andrew Cunningham who informed me he had successfully reared [collected: 24 Aug 2019, emerged: 23 September 2019] an agromyzid from a leaf-mine (Fig. 2) on Cape figwort (Scrophulariaceae, *Phygelius capensis*) collected from a private garden in Bradninch, Devon. As no Agromyzidae species are known to utilise this host genus (Benevent-Corai *et al.* 2005, Spencer 1990, Michael von Tschirnhaus *pers. comm.*), Andrew provided images of the larval mine and reared an adult to seek my opinion; the reared imago closely resembled *Amauromyza verbasci* (Bouché, 1847), an oligophagous species which is known to utilise plants in the Scrophulariaceae [*Buddleja*, *Scrophularia* and *Verbascum*].

To confirm the species, the specimen (Fig. 1) was sent to me and upon detailed examination of the adult [♀] and puparium, comparing it to reared material in my collection, *A. verbasci* was confirmed to be the causer, representing the first known record of Agromyzidae utilising *Phygelius* as a host.

Discussion

Amauromyza verbasci, a relatively common leaf-mining agromyzid, forms a large, upper-surface blotch mine that is preceded by a short corridor section, with frass in largish scattered grains. Pupariation usually occurs externally, with the larva vacating the mine via an exit slit which may be lower or upper surface. Infrequently, the larva may pupariate within the mine (Warrington 2017). Several mines may occur on the same leaf. Based on larval records (250) held by the National Agromyzidae Recording Scheme, *A. verbasci*, in Britain, shows distinct preference for utilising *Verbascum* species as hosts.

Host genus	**% of records**
Buddleja	6
Scrophularia	25
Verbascum	69
	100

In the extensive worldwide Agromyzidae bibliography database of Michael von Tschirnhaus, only one publication has reference to *Phygelius* (Frankum 2009); larval mines were observed by Maggie Frankum on *P. capensis* in her Leicester garden, 14 July 2009, with the causer clearly being dipterous, based on images of the larva and puparium. Unfortunately, no adults were successfully reared to confirm the causer. Mines were also discovered by her on 7

August 2011, but the larvae had vacated the mines and no determination was therefore possible. However, based on the larval leaf-mine (Fig. 4) and puparium images kindly provided by Maggie Frankum, I am happy that these too are the mines of *A. verbasci*, confirming *Phygelius* as a new host genus for Agromyzidae.

Fig. 1. *Amauromyza verbasci* [♀] reared from *Phygelius capensis.*

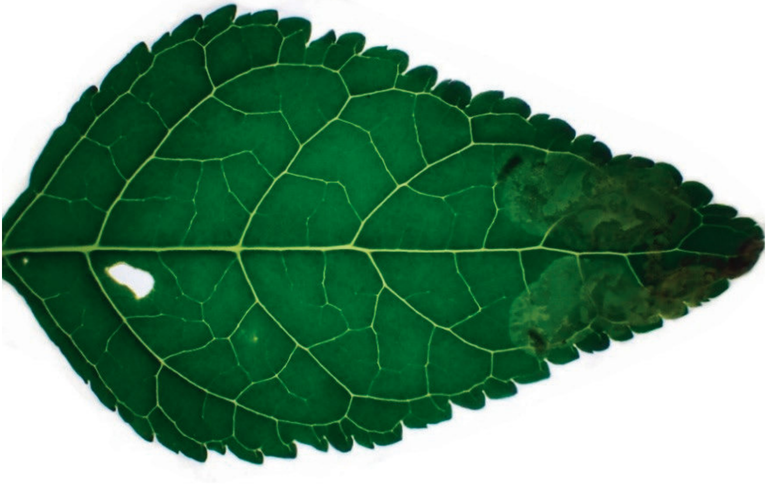

Fig. 2. Larval leaf-mine of *A. verbasci* on *Phygelius capensis.*

Fig. 3. ***Phygelius capensis*** **from which** ***A. verbasci*** **was reared.**

Fig. 4. Larval leaf-mines of ***Amauromyza verbasci*** **on** ***Phygelius capensis.***

The plant, from which *A. verbasci* was reared (Fig. 3), had no mines present when checked on 13 October 2019; of the other known hosts of *A. verbasci*, only *Buddleja* is present nearby [no mines present]. At the Leicester site, again, *Buddleja* is present, along with *Verbascum* [no mines detected on either genus].

Mines that are morphologically identical to those of *Amauromyza verbasci* have been noted most years since 2009 on *Phygelius x rectus* 'Moonraker' in a garden near Goring Heath, south Oxfordshire (SU6779) but not reared; several species of *Verbascum* mined by this species grew in the same flowerbed (Charles Godfray *pers. comm.*).

Phygelius species are fed upon by other insects, chiefly capsid bugs (Miridae) and more commonly, figwort weevils (Curculionidae), whilst the figwort sawfly, *Tenthredo scrophulariae* Linnaeus, 1758, has also been recorded on this host genus (Andrew Salisbury *pers. comm.*). Also known as Cape fuchsia, owing to the flowers resembling those of *Fuchsia* spp, this semi-evergreen, small, hardy shrub is a popular garden plant due to its cold hardiness and long flowering season. At the time of year the *Phygelius* mines were observed, the other known hosts of *A. verbasci* would also be in leaf; it will be intriguing to discover if this new host genus is to become an established larval host plant of *A. verbasci* or if the records discussed here represent exceptional observations.

Acknowledgements

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A re-examination of the records of *Agromyza frontella* (Rondani, 1875) (Diptera, Agromyzidae) on *Trifolium pratense* – The leaf-mines of the agromyzid *Agromyza frontella* (Rondani, 1875), discovered for the first time in Britain on *Trifolium pratense* on 4 September 2011, separately by MB and RE (Banthorpe, M. and Edmunds, R. 2013. *Trifolium pratense* – a new host plant for *Agromyza frontella* (Rondani) (Dip.: Agromyzidae). *Entomologist's Record and Journal of Variation* **125**(2)**,** 72-73) were re-examined in the light of current knowledge by BW (National Agromyzidae Recording Scheme organiser).

Fig. 1. Mine originally identified as *Agromyza frontella* found by MB on *Trifolium pratense* in 2011 (Banthorpe and Edmunds 2013).

Fig. 2. Mine of *Agromyza frontella* on *Trifolium* from Totternhoe, Bedfordshire.

The mines are distinctive, in that they initially form a gallery which usually doubles back and then widens considerably into a blotch. The mines found by MB (Fig. 1) were atypical in that they formed a large blotch centred over the midrib, with several galleries leading off this structure. To BW, they resembled those of the closely related *Agromyza nana* Meigen, 1830 – a common leaf-miner of *Trifolium* species. BW later found and collected similar mines on *Trifolium pratense*, with the resulting reared adults proving to be *Agromyza nana* Meigen, 1830. The mines found by RE are typical of *A. frontella*, and so the new host record still stands.

Interestingly, Andy & Melissa Banthorpe found typical mines of *A. frontella* on *Trifolium* on 31 October 2011 at Totternhoe, Bedfordshire, V.C. 30 (Fig. 2) - **MELISSA BANTHORPE,** 32 Long Close, Lower Stondon, Bedfordshire, SG16 6JS, vc30moths@picus.co.uk, **ROB EDMUNDS,** Embankment House, Farthing Road, Downham Market, Norfolk, PE38 0AF, rdedmunds@btinternet.com and **BARRY WARRINGTON,** 221a Boothferry Road, Hessle, East Yorkshire, HU13 9BB, agromyzidaers@gmail.com

Dipterists Digest 2020 **27,** 31-36

Phytoliriomyza nigrifrons (Hendel) comb. nov. (Diptera, Agromyzidae) new to Great Britain and comparison with *Phytoliriomyza mikii* (Strobl) (Diptera, Agromyzidae)

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Summary

Phytoliriomyza nigrifrons (Hendel, 1920) **comb. nov.** is reported as a species new to Great Britain, based upon a single female collected in East Yorkshire. Details of the discovery are provided, along with a description of the adult and comparison with the very similar *Phytoliriomyza mikii* (Strobl, 1898) (Diptera, Agromyzidae). The species is hereby transferred from *Liriomyza* Mik to *Phytoliriomyza* Hendel.

Introduction

On 26 August 2019, a female agromyzid, resembling a *Liriomyza* species, was collected from a small section of mixed vegetation along the Humber estuary in Hessle, East Yorkshire (V.C. 61). The specimen immediately stood out, owing to the darkened frons and black third antennal segment, features which are rare within European *Liriomyza* species. As the specimen possesses slightly longer than normal pubescence [not longer than diameter of basal section of arista] on the third antennal segment, it runs to couplet 17 in Spencer (1976), then, owing to the matt mesonotum, *Liriomyza artemisicola* de Meijere, 1924 is suggested. However, the solidly black, somewhat elongated, third antennal segment [round, brownish distally, yellowish below and on inside in *L. artemisicola*] and darkened frons [yellow in *L. artemisicola*] are sufficiently different from that species for it not to be considered. Using Papp and Černý (2017), the female runs to couplet 99, where again, *L. artemisicola* is considered, along with *Liriomyza michaeli* Papp 2017 [a species agreeing very closely with *L. artemisicola* on external features].

In the key by Hendel (1931-6: 198), the specimen runs to couplet 25, where the first option is *Liriomyza nigrifrons* Hendel, 1920; 'frons dark brown, third antennal segment black, longer than wide, *acr* 2 in rows, ending before 2nd dorsocentral [*dc*]. The last section of vein M_{3+4} shorter than twice the penultimate'; the female agrees strongly with this description. As the frons does possess some slight yellowing, it could be interpreted as running to couplet 26, with *Phytoliriomyza mikii* (Strobl, 1898) [not *miki* as frequently misspelt] the suggested species owing to the matt mesonotum; these two species are similar, with only a few differentiating features, which are discussed below.

As a darkened frons is a feature present in many *Phytoliriomyza* species, using the keys by Spencer (1976) and Papp and Černý (2017) for this genus, the specimen runs to couplets 6 and 11 respectively, with *P. mikii* the determination owing to the dark third antennal segment. The key to European *Phytoliriomyza* species by Zlobin (2005) was also utilised, with the specimen running readily to couplet 8: *P. dorsata* (Siebke, 1863) or *P. pectoralis* (Becker, 1908). Neither species agrees with the female discussed here owing to the solidly dark mesonotum and yellow palps respectively.

Images and morphological notes of *L. nigrifrons* holotype [♀], held in the Natural History Museum in Vienna, were kindly sent to me for comparison; although the holotype is not in perfect condition, all morphological features agree with the specimen from Hessle, the only slight variation being that, in the holotype, the upper orbits are more yellow compared to the marginally darkened upper orbits of the specimen in question.

A detailed examination of known *P. mikii* specimens [17 in the collection of Michael von Tschirnhaus and one loaned from the Natural History Museum, London], confirmed that the female is *Phytoliriomyza nigrifrons* and not the closely related *Phytoliriomyza mikii*. This represents the first known occurrence of this species in Great Britain.

Identification

Phytoliriomyza nigrifrons (Hendel, 1920) **comb. nov.**
Liriomyza pectoralis nigrifrons Hendel, 1920: 144.
Liriomyza nigrifrons Hendel, 1931-6: 200, 234. Holotype ♀ in HENDEL coll. Natural History Museum Vienna.

Hendel (1920: 144) originally treated *Phytoliriomyza nigrifrons* as a subspecies of *Phytoliriomyza pectoralis* (Becker, 1908), where it runs to the same couplet [20] as *P. mikii*. Hendel (1931-6: 200, 234) later raised it to full species status, as *Liriomyza nigrifrons*. As mentioned above, *P. nigrifrons* is very similar to its sister species *P. mikii;* the key external morphological differences are given in Table 1. *Phytoliriomyza nigrifrons* is a relatively small species, with a wing length of 1.5-2.5mm, the wings being slightly infuscate. Frons significantly darkened (Fig. 2) by minute blackish scales which reach to the ocellar triangle, orbits mostly yellow but slightly darkened adjoining eye and at level of upper *ors*. Two reclinate *ors*, the upper marginally longer, with one incurved *ori*. Orbital setulae short, very sparse and marginally reclinate.

Third antennal segment (Fig. 1) black [first and second yellow], slightly elongated, with distinct pubescence which is not longer than diameter of basal section of arista. Sensorial pit of third antennal segment close to middle of basal half. Hind margin of eye black, *vte* on dark ground, *vti* on border of yellow and dark ground. Occiput dark. Mesonotum blackish-grey [extremely narrowly yellow at margin of scutellum], distinctly matt with *acr* sparse, in two rows, ending before 2nd *dc*. Scutellum broadly yellow centrally with dark edges (Fig. 3). Femora largely yellow, with weak brownish striations; tibiae and tarsi darker, brownish. Abdomen dark, front tergites faintly yellowish.

Table 1. Comparison of key morphological features between *P. nigrifrons* and *P. mikii*.

	Phytoliriomyza nigrifrons	***Phytoliriomyza mikii***
Dark scales on frons	Present	Absent*
Orbital setulae	Marginally reclinate, few upright	Upright
Lunule	Slightly higher than semi-circle	Lower than semi-circle
3rd antennal segment	Longer than deep	+/- as long as deep
Arista	Longer than diameter of eye	Shorter than diameter of eye
Occiput	Dark	Yellow*
Palpi	Yellow, faintly darkened distally	Greyish-black
Mesopleuron	Largely yellow	Dark, yellowish dorsal ¼
Scutellum	Broadly yellow centrally, dark edges	Largely dark
acr	2 rows	2-4 rows
Femora	Yellow with brownish striations	Yellow*
Tibiae	Dark, brownish	Yellow*
Abdomen	Dark	Partly yellowish laterally
Wings	Slightly infuscate	Normal, hyaline

* one specimen [♂, collected Abisko, Sweden] loaned from NHM London possesses faintly darkened frons, dark occiput and legs. However, Spencer (1976) stated that *P. mikii* can possess frons slightly greyish above and variably coloured legs [brownish-yellow in type from Austria to entirely black in specimens from Abisko, Sweden].

Fig. 1. ***Phytoliriomyza nigrifrons*** **(Hendel, 1920), female in left lateral view.**

Fig. 2. ***Phytoliriomyza nigrifrons*** **(Hendel, 1920), frontal view.**

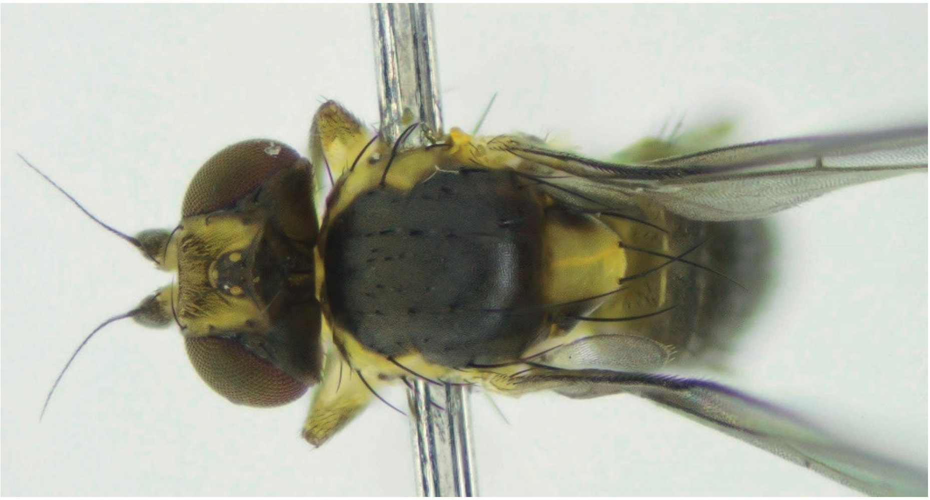

Fig. 3. ***Phytoliriomyza nigrifrons*** **(Hendel, 1920), viewed from above.**

It is assumed that Hendel placed this species in *Liriomyza*, owing to the slightly reclinate orbital setulae [Hendel (1931-6) erected *Phytoliriomyza* as a subgenus for a single *Liriomyza* species, *perpusilla* (Meigen, 1830), having entirely proclinate orbital setulae]. *Phytoliriomyza* was later raised to full generic rank by Frey (1941). Spencer (1966) examined the type of *mikii*, which Hendel (1920: 144; 1931-6: 232) treated as *Liriomyza*, and found the genitalia belonged to the genus *Lemurimyza* (cf. Spencer 1965), a genus which occupied an intermediate position between *Liriomyza* [distinctly reclinate orbital setulae] and *Phytoliriomyza* [distinctly proclinate orbital setulae]; orbital setulae in *Lemurimyza* may be proclinate, upright or reclinate. Hendel (1931-6: 232) suggested *mikii* and *pectoralis* may be identical, which is not so but *pectoralis* was found to also belong to *Lemurimyza* (Spencer 1966). Later, von Tschirnhaus (1972) synonymised *Lemurimyza* with *Phytoliriomyza*, based on the overall similarity of the male postabdomen.

Although no males of *nigrifrons* are known, based on its close relationship with *mikii* and *pectoralis*, the species is hereby transferred to *Phytoliriomyza,* a genus which - different from *Liriomyza* - always lacks the male stridulation organ and never has an ejaculatory duct which is swollen and pigmented between the phallophorus and mesophallus.

Biology

The larval habits of *P. nigrifrons* are not known; however, as its sister species *P. mikii* has been collected 31.vii.1968 in a series of 14 specimens by Michael von Tschirnhaus from a Danish swamp at the north-eastern end of lake “Örum Sö”, 56°48’20”N, 8°20’52”E, containing the following flora, it is highly probable its host lies within these genera/species: marsh horsetail (*Equisetum palustre*) [the dominant plant which was mainly swept], lesser water-parsnip (*Sium erectum* (= *Berula erecta*)), northern water-hemlock (*Cicuta virosa*), water pennywort (*Hydrocotyle palustris*), great spearwort (*Ranunculus lingua*), marsh cinquefoil (*Comarum palustre*), willowherb (*Epilobium* sp.), common reed (*Phragmites australis*), water mint (*Mentha aquatica*), reed sweet-grass (*Glyceria maxima*), bogbean (*Menyanthes trifoliata*), forget-me-not (*Myosotis* sp.), dock (*Rumex* sp.), marsh stitchwort (*Stellaria palustris*), branched bur-reed (*Sparganium erectum*), mare’s-tail (*Hippuris vulgaris*), bulrush (*Typha* sp.), common club-rush/great bulrush (*Schoenoplectus lacustris* or *S. tabernaemontani*) and sedge (*Carex*), with thistle (*Cirsium*), valerian (*Valeriana*), cinquefoil (*Potentilla*) and meadowsweet (*Filipendula*) nearby on firm ground [but no sweeping undertaken]. From the above list, only the following genera/species are present at the Hessle collecting site: *Equisetum palustre*, *Epilobium*, *Filipendula*, *Myosotis*, *Phragmites australis*, *Rumex* and *Cirsium*, with the latter three genera being rather dominant. Other genera present in relative abundance include *Achillea*, *Artemisia*, *Atriplex*, *Heracleum* and *Sonchus*, along with various grasses. Despite extensive efforts to collect additional material, no further specimens were obtained from the Hessle site.

Distribution

This is a very rare species, described (Hendel 1931-6) on the basis of a female collected on the island of Rab in Dalmatia [a historical region of Croatia, a narrow belt of the east shore of the Adriatic Sea, from the island of Rab in the north to the Bay of Kotor in the south]. *Phytoliriomyza nigrifrons* is known elsewhere from the Azores, Canary Islands and mainland Portugal; Frey (1945: 93) gave details of specimens collected from two Azorean islands [São Miguel and Terceira] and mainland Portugal [Agualva], with Hendel (1936: 122) citing specimens collected from Tenerife [Las Mercedes]. Previously unpublished data is hereby included; '♀ *L. nigrifrons*: Code X928, leg. M. von Tschirnhaus, 28.iii.1994, Azores, island São Miguel, 37°53'N 25°46'W, agricultural way upwards from João Bom to SSE to the crater edge of "Caldeira das Sete Cicades", 200 until 500m asl, way down to Remédias'.

Acknowledgements

I would like to thank Michael von Tschirnhaus (University of Bielefeld, Germany) for his much valued time, correspondence and previously unpublished collecting data, Peter Sehnal (Natural History Museum, Vienna) for providing key images and details of type material and Nigel Wyatt (Natural History Museum, London) for the loan of valuable comparison material.

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CORRECTION: Mechanisms and patterns of feeding in some leaf-mining larvae (Diptera, Agromyzidae, Drosophilidae and Anthomyiidae) by GRAHAM E. ROTHERAY (2019. 26, 117-137).

In Fig. 3 in this paper the leaves were reversed and consequently wrongly labelled. A replacement for this figure is provided here. A corrected pdf of the article can be obtained on request.

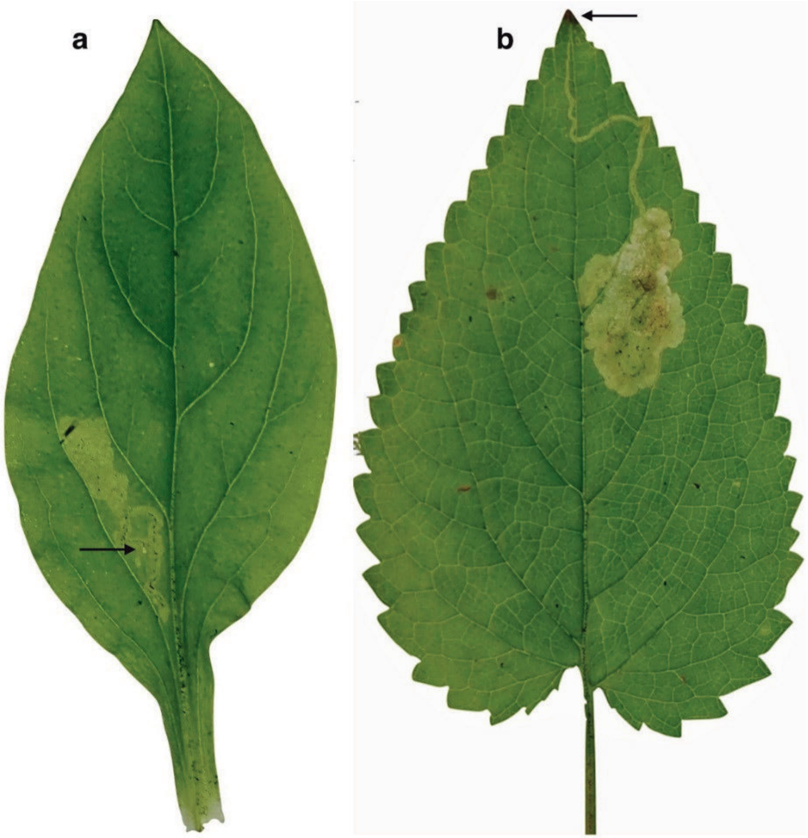

Fig. 3. ***Amauromyza*, linear to blotch mines, arrows indicate position of egg: a, *A. flavifrons* on *Silene dioica*; b, *A. labiatarum* on *Stachys*.**

Dipterists Digest 2020 **27,** 37-40

Liriomyza virgula Frey (Diptera, Agromyzidae) new to Great Britain

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Summary

Liriomyza virgula Frey, 1946 (Diptera, Agromyzidae), is reported as a species new to Great Britain based upon a single male collected from Edderthorpe Ings, South Yorkshire. A description of the adult and its European status are provided.

Introduction

During December 2019, I loaned a small sample of Agromyzidae specimens from John Coldwell, which were to be photographed for an upcoming website. Upon examining one specimen previously determined as *Liriomyza equiseti* de Meijere, 1924 [collected 29.vi.2013, Edderthorpe Ings (part of RSPB's Old Moor complex), from a long-abandoned railway line, comprising general scrub and rough grassland (Fig. 3); other species collected at the same time were *Melanagromyza cunctans* (Meigen, 1830), *Ophiomyia orbiculata* (Hendel, 1931) and *Phytomyza ranunculi* (Schrank, 1803)], the phallus did not agree with that species. Using the key by Spencer (1976), the specimen runs readily to couplet 56, where, owing to the phallus detail, *Liriomyza virgula* Frey, 1946 is the determination and not *Liriomyza freyella* Spencer, 1976.

An image of the phallus (Fig. 1) was sent to Miloš Černý who agreed that the specimen is *Liriomyza virgula*, which represents the first known occurrence of this species in Great Britain.

Identification

This relatively small species, with a wing length of c1.75mm, usually possesses 2 *ors* and 1 *ori*, with the third antennal segment small, possessing short, normal pubescence. Frons slightly projecting above eye in profile. Mesonotum with 1+3 *dc*, with *acr* sparse, in 3-4 scattered rows.

Liriomyza larissa Hering, 1956 was synonymised with *L. virgula* by Spencer (1976), on the basis that the male genitalia of each holotype are identical to each other, despite the striking difference in external colouration, *virgula* being particularly dark with *larissa* largely yellow. Spencer states 'it seems clear that *virgula* is merely a northern, melanic form of *larissa*'.

In the specimen collected by John Coldwell, the frons, third antennal segment and orbits [slightly paler than frons] are yellow, mesonotum matt, blackish-grey with weak subshine, mesopleuron largely yellow, with small black bar ventrally, femora mostly yellow, with slight brownish tinge, tibiae and tarsi darker, brown. Last section of vein M_{3+4} 2¼ that of penultimate.

Male genitalia possess several species-specific characteristics: large, broad cerci; subepandrial sclerite broad, with narrow lateroclinate dorsal arms and narrow ventral arms, which possess a pair of longish setae; distiphallus (Fig. 1), with a pair of up-curved tubes that widen at their apex; ejaculatory apodeme with broad base, short 'neck' and a dark, broad, rounded blade. Although only the phallus is preserved, its distinctive form is sufficient enough to determine the species from other closely related species.

Biology

Larval and host details are not known. However, other species in the *equiseti*-group are known to utilise *Equisetum*, which is present in quantity at the collecting site (Fig. 2).

Although phylogenetically closely-related species often follow the 'principle of competitive displacement', in that species with identical ecological niches cannot coexist for long in the same habitat, collections made by von Tschirnhaus (*pers. comm*), shows that coexistence on the common host is possible; *L. equiseti* and *L. occipitalis* collected from the same dense stand of *Equisetum arvense* [SE Howacht, Germany], *L. equiseti*, *L. occipitalis* and *L. virgula* caught together from same *Equisetum* sp. [Schleswig-Holstein, Germany] and *L. occipitalis* along with a single female of *L. freyella* or *L. virgula* swept from *Equisetum arvense* [Abisko, Sweden].

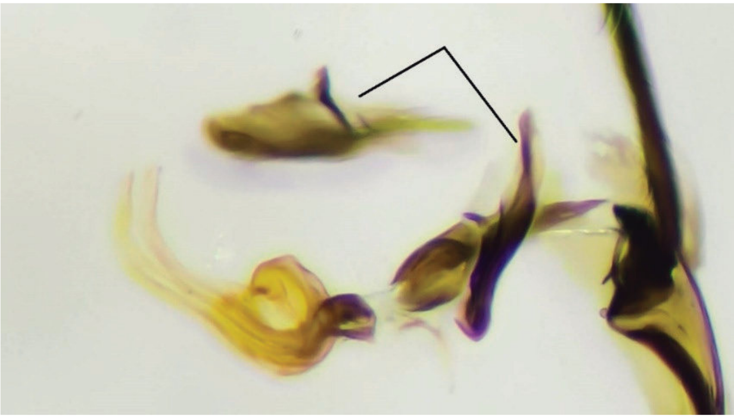

Fig. 1. *Liriomyza virgula*: phallus in left lateral view [lines indicate loose postgonite-sclerites not forming part of phallus].

Fig. 2. Large stand of *Equisetum* sp. at collecting site.

Fig. 3. Edderthorpe Ings [looking down on RSPB Old Moor] biotope.

Distribution

Liriomyza virgula is a Western Palaearctic species, known from the following countries: Belgium (Scheirs *et al.* 1995), Belarus, Czech Republic (Černý *et al.* 2001), Estonia (Elberg and Zlobin 1992), Finland, France, Germany, Hungary (Papp and Černý 2017), Italy (Süss 1987), Kazakhstan (Černý 2019), Latvia (Karpa 2008), Lithuania (Pakalniškis 1993), Norway (Andersen 2016), Slovakia (Vála and Černý 2009), Switzerland (Černý and Merz 2007) and Turkey (Civelek *et al.* 2009).

Acknowledgements

Many thanks go to John Coldwell for kindly passing on the specimens, providing background information, supplying figures 2 and 3 and allowing me to retain the specimen in my private collection. Thanks also to Miloš Černý (Halenkovice, Czech Republic) for taking the time to confirm the determination and Michael von Tschirnhaus (University of Bielefeld, Germany) for providing previously unpublished observations.

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Two species of Agromyzidae (Diptera) added to the Irish checklist –

Two species of leaf-mining flies are added to the Irish checklist based on their distinctive leaf-mines. A larval mine of *Phytomyza brunnipes* Brischke, 1881 was found by Aideen O'Doherty at Florence Court (H175343), a National Trust Estate in Co. Fermanagh, Northern Ireland, on sanicle (*Sanicula europaea*), on 26.v.2019. This species forms a brownish, irregular, broad, upper surface corridor, often following the midrib on each leaf segment.

Aideen also found a larval mine of *Phytomyza stolonigena* Hering, 1949, on creeping buttercup (*Ranunculus repens*) at the Stormont Estate (J398750), Co. Down, on 20.i.2019. This species mines in the petiole, with corridors radiating out into the blade. Both records were submitted, with supporting images, via iRecord – **BARRY P. WARRINGTON,** 221A Boothferry Road, Hessle, East Yorkshire, HU13 9BB; agromyzidaeRS@gmail.com

Dipterists Digest 2020 **27,** 41-44

New host plant genera for *Cerodontha* (*Poemyza*) *hammi* Spencer (Diptera, Agromyzidae)

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Summary

Two new host plant genera for the leaf-mining agromyzid, *Cerodontha* (*Poemyza) hammi* Spencer, 1971 are recorded in Britain. Adults were successfully reared from larval leaf-mines on *Elymus* and *Zea,* genera not previously known to be utilised by the species.

Introduction

In August 2017, I was contacted by Mark Wilson who provided images of leaf-mines (Figs 1 and 2) on *Zea* which was grown by his wife in their Somerset (Crowcombe, V.C. 5) garden.

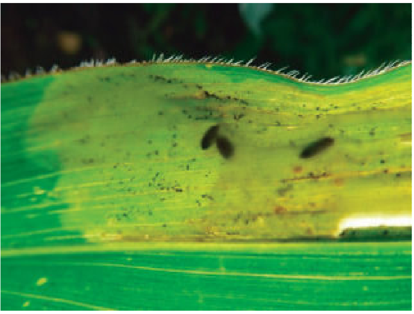
This was the second year they had grown sweetcorn, with this year's variety been 'Minipop F1' (Mr Fothergill's seed). Six plants were grown; however, only a single leaf was mined on one plant. Interestingly, commercial maize is being grown in the vicinity, for an anaerobic digestor, which is approximately 1.7km from the garden. Mark Wilson has looked at some of the plants present here but did not locate any larval mines.

The mines, which contained six puparia, were sent to me and all puparia produced adults, which, after examination of external features and male genitalia, were confirmed to be *Cerodontha* (*Poemyza*) *hammi* Spencer, 1971.

Rob Edmunds collected leaf-mines (Figs 3-6) on couch grass (*Elymus repens*) on 21 October 2017, on the bank of the Great Ouse, Norfolk (Downham Market, V.C. 28). Two mines were found; one contained three puparia whilst the other possessed two.

The puparia were carefully removed from the mines and placed into specimen pots, which were kept in an outbuilding to over-winter. The puparia were brought indoors on 2 March 2018, which resulted in a female emerging on 14 March 2018, along with a hymenopterous parasitoid [species unknown]. Although females are frequently difficult to determine, the specimen was sent to me and compared to known specimens of *C.* (*P.*) *hammi*; all morphological features, particularly the eye : jowl ratio, confirmed the adult to be *C.* (*P.*) *hammi*.

1



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Figs 1-6. ***Cerodontha*** **(*Poemyza*)** ***hammi*** **Spencer leaf-mines: 1 and 2, on *Zea*: 1, leaf with broad elongated mine, which started at the leaf tip; 2, mine shown in transparency, with three of the six puparia visible; 3-6, on *Elymus*: showing similar broad elongated mines, with puparia present.**

Discussion

This species closely resembles *Cerodontha* (*Poemyza*) *incisa* (Meigen, 1830), with the key morphological difference being that of the eye : jowl ratio. In *C.* (*P.*) *incisa,* the jowls are 1/10th height of the eye, whilst in *C.* (*P.*) *hammi*, this ratio is much less, at a quarter to a sixth.

Male genitalia are similar to *C.* (*P.*) *incisa* and *C.* (*P.*) *melicae* Nowakowski, 1973. However, in *C.* (*P.*) *hammi*, the tips of the hypophallus are acute and narrow, the left paraphallus is only a dot and the distiphallus tubules are not fused together (as incorrectly described by Spencer). The tubules are also shorter than in *C.* (*P.*) *incisa* and *C.* (*P.*) *melicae*.

Spencer (1976) stated that the puparium is brown, with the posterior spiracular processes adjoining, each with three bulbs. However, the text is incorrect as the puparium was incorrectly mounted (von Tschirnhaus *pers. comm.*) and actually referred to an *Agromyza* species. The puparium (Fig. 7) is actually deeply segmented, shining, metallic black with the posterior spiracles on a conspicuous projection, similar to that of *C.* (*P.*) *incisa*.

Fig 7. *Cerodontha (Poemyza) hammi* puparium viewed from below.

Cerodontha (*P.*) *hammi* was described by Spencer (1971) but was later synonymised with *C.* (*P.*) *incisa* (Spencer and Martinez 1987). It was resurrected from synonymy by von Tschirnhaus (1992), but this was later rejected by Zlobin (2005). *Cerodontha* (*P.*) *incisa* is also known to utilise *Elymus* and *Zea* (Benavent-Corai *et al.* 2005).

Distribution

Spencer (1976) mentioned that the species is only known from Oxford. In the National Agromyzidae Recording Scheme database, there are seven records: East Kent (V.C. 15), South Essex (V.C. 18), Berkshire (V.C. 22), West Norfolk, (V.C. 28), North Lincolnshire (V.C. 54), South-east Yorkshire (V.C. 61) (Warrington 2017) and County Durham (V.C. 66). In Europe, the species is known from Denmark and Germany.

Acknowledgements
I would like to thank Mark and Heather Wilson for providing the puparia along with background information and images (Figs 1 and 2), Rob Edmunds for sending the reared adult and providing details and images (Figs 3-6) of the discovery, and Michael von Tschirnhaus (University of Bielefeld, Germany) for his correspondence and previously unpublished information.

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Further records of *Crossopalpus curvinervis* (Zetterstedt) (Diptera, Hybotidae) from Kent – Earlier (Clemons, L. 2012. *Crossopalpus curvinervis* (Zetterstedt) (Diptera, Hybotidae) new to Britain from North Kent. *Dipterists Digest* (*Second series*) **19,** 154) I reported *Crossopalpus curvinervis* as new to Britain from a male swept along a dry bank, bordering saltmarsh, at Oare Marshes near Faversham on 9 September 2012. Subsequently, on 7 July 2016, a female was swept from an area of pulverised ash infill with brackish pools at Rushenden Marshes (TQ903709), Queenborough, Sheppey and on 20 April 2019 a male was swept along a shaded track at Conyer (TQ962653) near Sittingbourne. While recently looking through a backlog of unidentified material two further specimens were found. On 11 April 2009 there was an earlier male from the Conyer site and on 25 July 2009 a male was swept from old sandpits with scrub at Dungeness (TR065199). All the known sites are near to the coast of East Kent (V.C. 15) – **LAURENCE CLEMONS,** 14 St. John's Avenue, Sittingbourne, Kent ME10 4NE

Dipterists Digest 2020 **27,** 45-49

Craneflies (Diptera, Tipuloidea) trapped by the leaves of long-leaved Spanish butterwort, *Pinguicula vallisneriifolia* Webb (Lentibulariaceae)

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Summary

In the Cazorla Parque Natural, Jaén Province, Spain, in June 2019, an area of cliff face was seen covered with a butterwort, the leaves of which had trapped large numbers of insects. These were sampled for the cranefly element, which numbered 19 species. Several of these appear to be new records locally, not found to date by traditional collecting methods. The effectiveness of the leaf glandular secretions in relation to immobilising different sizes of the flies is discussed.

Introduction

The butterwort, *Pinguicula vallisneriifolia* Webb, typically grows on base-rich rock faces and walls at altitudes of between about 400 and 1500m in southern Spain. It is characterised by mauve flowers with white-based petals, usually bearing no or only slightly darker veins; mature leaves are very long and narrow and twisted towards their apices and have wavy margins (Fig. 1). The north eastern area of Cazorla of Jaen Province is an epicentre for the distribution of *P. vallisneriifolia* (IUCN Red List; Legendre 2000). This plant is distinctive within the genus in growing new elongate leaves starting in June through to August. The basal leaf-rosette typical of *Pinguicula* species develops as normal in spring, but is replaced by the new summer leaf growth. The photograph shows both types of leaves as the basal rosette gradually becomes senescent as summer develops (Fig. 1); all the leaves produce sticky mucilage (Zamora 1995).

As our sampling was rather time-limited it was restricted to removing mainly whole insects with a view of identifying them and check if they corresponded to the local fauna as far as the use of sweep netting revealed. It transpired that comprehensive studies of *P. vallisneriifolia* and the prey analysis of another butterwort *P. nevadense* (Lindb.) Casper has been carried out (Zamora 1990, 1995). These papers provide most useful data for discussing our own observations.

Method

Leaves were examined from an area of about one metre square of steep scree of compacted stones densely packed with butterwort plants (Fig. 2). All the craneflies that appeared to have sufficient body parts to allow subsequent identification were removed as carefully as possible together with parts of leaves when necessary to avoid damage. The samples were collected into tubes containing about 80% strength ethanol. Later the specimens were processed by washing in 100% ethanol, floating free from any residual mucilage, and then identified. The better quality insects were dried and pinned or carded to act as vouchers and have been deposited in the Hunterian Museum, University of Glasgow.

Fig. 1. Plants of *Pinguicula vallisneriifolia* showing captured prey (photo S.M. Hewitt).

Results

Craneflies identified from sampling butterwort, *Pinguicula vallisneriifolia* Webb., on 16 June 2019, growing alongside the Aguaecebos de Gil Cobo trail (coordinates 38.976, -2.894), are listed alphabetically within each of three families of Tipuloidea.

Tipulidae
Tipula (*Lunatipula*) *cinereicolor* Pierre, 1924. 6 spms.
Tipula (*Lunatipula*) *cirrata* de Jong, 1995. 13 spms.
Tipula (*Lunatipula*) *fabiola* Mannheims, 1968. 1 spm. Not found locally by sweeping.
Tipula (*Lunatipula*) *iberica iberica* Mannheims, 1963. 4 spms.
Tipula (*Lunatipula*) spp. 4 spms unidentifiable as terminalia missing.

Limoniidae
Antocha vitripennis (Meigen, 1830). 2 spms.
Austrolimnophila latistyla Starý, 1977. 1 spm. Not found locally by sweeping.
Dicranomyia chorea (Meigen, 1818). 4 spms.
D. didyma (Meigen, 1804). 19 spms.
D. lucida de Meijere, 1918. 2 spms. Not found locally by sweeping.
D. imbecilla Lackschewitz, 1941. 8 spms.
Dicranophragma (*Brachylimnophila*) *nemorale* (Meigen 1818). 1 spm, confirmation of this species recognised from fieldwork locally in Cazorla in 2018 and 2019 as new to Spain.

Fig.2. View of the sampling location on the Aguaecebos de Gil Cobo trail, 16 June 2019 (photo S.M. Hewitt).

Ellipteroides lateralis (Macquart, 1835). 1 spm.
Helius hispanicus Lackschewitz, 1928. 2 spms.
Limonia nubeculosa Meigen, 1804. 17 spms.
Molophilus ibericus Starý, 2011. 1 spm.
Ormosia hederae (Curtis, 1835). 1 spm.
Pseudolimnophila lucorum (Meigen, 1818). 1 spm.

Pediciidae
Pedicia (*Amalopis*) *occulta* (Meigen, 1830). 2 spms. Not found locally by sweeping.
Tricyphona immaculata (Meigen, 1804). 3 spms. Not found locally by sweeping.

Discussion

The list of nineteen species (totalling 93 specimens) includes five not seen locally from this part of Jaén Province during the concurrent period of surveying. This demonstrates that these insectivorous plants might be considered useful samplers of local species diversity in addition to normal techniques when limited to short visits. The time was restricted to about 1.5 hours at this particular site in 2019. This plant "by-catch" extends over several days at least and operates during both day and night.

The immobilisation of these relatively large nematocerans just by wing tip or leg extremities, contrasted with the many small insects of various orders firmly adherent to the leaf surfaces (Fig. 1). During his comprehensive investigation, Zamora (1995) noted that only insect prey of 5.00 mm body length (including the head) or shorter were stuck flat onto the leaf surfaces. As these provide an immediate source of nutrients for the plants the larger insects were excluded from his data gathering and analysis. Zamora (1995) found the taxonomic composition of the smaller prey to be 64% Nematocera and 20% other Diptera as measured over several periods during June, July and August. In the case of tipuloids sampled by the authors in 2019, the majority were only caught by legs or wing tips but had failed to escape (Fig. 3). Some *Tipula* species were still alive and struggling to escape but even when caught by the extreme tip of an appendage seemed unable to free themselves. Although captured by the mucilage on the leaf surfaces these larger flies do not contribute any nitrogen or other nutrients to the plants and might be considered a by-catch of no benefit in contrast with the numerous whole bodies of smaller insects. It is possible that when the larger insects eventually fall off the leaves they contribute to the chemical needs of the butterworts as they enter the ground beneath the plants. This would not be the case with plants growing on vertical rock faces. The high density of plants in the area chosen for sampling might be explained by this possibility although the scree would also provide greater opportunity for establishment from seed.

Fig. 3. *Pinguicula vallisneriifolia* with a *Dicranomyia didyma* (Limoniidae) suspended between leaf edges (photo E.G. Hancock).

Zamora (1995) did not identify any of the Nematocera even to family level. In an earlier analysis of the prey of *P. nevadense*, another butterwort of southern Spain but with the normal basal leaf rosette, the trapped insects all had a body length of less than 4.00mm (Zamora 1990). In his work, Zamora considered other factors such as plant aspect and the variability of mucilage quantity between plants, which varied according to abiotic conditions such as sun and shade. He observed kleptoparasitism by a variety of other invertebrates plus lizards that removed prey items from the plants.

From our results there is a preponderance of large craneflies as there were only four species less than 5.00 mm body length, namely one specimen of each of the genera *Ellipteroides*, *Ormosia* and *Molophilus* and the two individuals of *Dicanomyia lucida*, that is 5 out of the total 93 specimens. This is quite the opposite of size distribution in the group as a whole. This apparent disproportion is partly because the smaller Limoniidae had been partially digested and insufficient remains could be either detected or identified. The opposite applies for larger specimens that were suspended and dried in situ and easier to gather and process. It is the product of a sampling bias by both plant biology and of entomological technique.

It might be considered that many of the larger craneflies would manage to escape capture by autotomy, detaching a limb, and then flying away. It was not possible during our visit to observe this happening or have time to find evidence of detached legs with no corresponding fly. The ability to survive limb loss or wing damage following predator attack is deemed to be one of the survival mechanisms for craneflies and other insects. Research on the escape of craneflies when a leg is simply trapped rather than actively attacked has shown that they are not always successful. Nentwig (1982) conducted experiments with tipulids, limoniids and Opiliones (harvestmen), clamping or gluing a leg and measured the time before they escaped. "The animals pulled and tugged at this leg without great success" and within an hour only one out of 15 opilionids and 7 from 14 tipulids broke free. Experimenting also with actual spiders' webs found that none of these kinds of invertebrate could extricate themselves (Nentwig 1982). This would seem to explain why large craneflies only marginally stuck to the butterwort leaves in Cazorla were available to be collected.

Acknowledgments

Dr Eduardo Galante, Dr Maria-Ángeles Marcos García and Dr Antonio R. Ricarte Sabater of Centro Iberoamericano de la Biodiversidad (CIBIO), Universidad de Alicante, Spain, are thanked for facilitating field work and the authorities of the Junta de Andalusia, for issuing a collecting permit Resolución Expte PNSCSV/110/CV/19. Fellow members of the Malloch Society provided convivial companionship as usual.

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A probable, and unusual, larval record of *Odontomyia ornata* (Meigen) (Diptera, Stratiomyidae) in Warwickshire – On 17 April 2019, a soldierfly larva was found by JG during a pond-dipping activity in a pond within Warwickshire Wildlife Trust's Parkridge reserve, on the edge of Solihull (vice-county 38 Warwickshire, grid reference SP160787). A similar larva, that may or may not have been the same individual, was seen a week or so later. JG consulted colleagues, who suggested that the larva could be the soldierfly *Odontomyia ornata* (Meigen). That species is categorised as Nationally Scarce (Drake, C.M. 2017. A review of the status of Larger Brachycera flies of Great Britain. *Species Status* No. 29. Natural England Commissioned Reports, Number 192) and has not been recorded before in Warwickshire, according to data held by the Soldierflies and Allies Recording Scheme; neither is there any record for the county on the NBN Atlas. Record details and photographs of the larva were supplied to the recording scheme via iRecord: https://www.brc.ac.uk/irecord/record-details?occurrence_id=9812190

JG took photos and a video of the larva, which she estimated to be about 5–6cm long (likely to have been an over-estimate but clearly a large larva). The photos are consistent with available descriptions of the larva of *O. ornata*, and with the key to soldierfly larvae in Stubbs and Drake (2014. *British soldierflies and their allies: an illustrated guide to their identification and ecology*. British Entomological and Natural History Society). MCH passed the images on to several other entomologists with experience of soldierfly larvae and all agreed that they appeared to show *O. ornata*. However, one critical confirmatory feature, the position of the anal slit on the underside of the last abdominal segment, was not visible in any of the photos, leaving a small question-mark over the identification, although all agreed that it did not appear to be a species of *Stratiomys*, and that given the size and markings there are no other obvious alternative species.

The other intriguing thing about this larva is the habitat in which it was found. This was a freshwater pond, which was refurbished in February 2018 (with a new liner) and filled from rainwater alone. No other water runs into it. In July 2018 some new plants were bought (from a company based in Staffordshire) and introduced via a coir mat. This had been pre-planted with lesser pond-sedge, cyperus sedge, reed sweet-grass, yellow iris, purple-loosestrife, water mint, reed canary-grass, common club-rush and pendulous sedge. However, only the yellow iris, water mint and pendulous sedge survived a dry spell in summer 2018. Other plants were retained from the pond before the refurbishment: marsh-marigold, water-lily (probably native), and brooklime. It seems unlikely that soldierfly larvae or eggs were introduced with the plants, but this is impossible to know. The pond is extremely healthy, and during the same pond-dipping session newtlets, damselfly larvae, freshwater flatworms, and freshwater snails were found, among other midge and mosquito larvae.

In the past, *O. ornata* has usually been associated with ditches in grazing marshes, and indeed Stubbs and Drake (*ibid*.) described this soldierfly as a good flagship species that is "almost confined to grazing marshes". However, in recent years the recording scheme has received records of adults in other habitats, including by gravel pits in Berkshire (2016) and in a cemetery in east London (2017), so it appears that the adults are at least capable of dispersing into new areas, and perhaps they are now exploiting a wider range of breeding sites. The Diptera.info website contains at least one report of a larva of *O. ornata* in a small garden pond (northern Germany, 2016).

We are grateful to Adrian Chalkley, Judy Webb and Richard Chadd for reviewing the photos and providing information on the most likely identification **– MARTIN C. HARVEY,** Evermor, Bridge Street, Great Kimble, Aylesbury, HP17 9TN, kitenetter@googlemail.com, and **JENNI GODBER,** 9 Lyndhurst Avenue, Skegness, Lincolnshire, PE25 2QE

A surprising occurrence of *Ellipteroides alboscutellatus* (von Roser) (Diptera, Limoniidae) in South-East England – It was reported in a note concerning a fungus gnat (Chandler, P.J. and Alexander, K.N.A. 2018. *Macrobrachius kowarzii* Dziedzicki (Diptera, Mycetophilidae), second and third British records. *Dipterists Digest* (*Second Series*) **25,** 86) that a survey was carried out during 2018 at Forge Wood (TQ6520) in Dallington Forest, East Sussex, aimed at recording the saproxylic insects of this site. Five flight interception traps had been placed on trees with evidence of decay by Jamie Simpson, who passed the samples to KA for sorting and determination, the Diptera then being passed to PC for that purpose.

One trap, which otherwise had a relatively small Diptera catch, had caught a mating pair of a medium-sized mainly black cranefly. It was a surprise to find that these belonged to the uncommon species *Ellipteroides alboscutellatus* (von Roser, 1840), which was unexpected at a site in the south-east. Identification was confirmed by comparison with a male swept by PC at Shelf Held Coppice in the Wyre Forest on 7 August 1988, during a British Entomological Society field meeting (Plant, C.W. 1988. Field Meeting. Wyre Forest, Worcestershire and Shropshire, 6/7 August 1988. *British Journal of Entomology and Natural History* **1,** 187). An adult male and one of its several sites in the Wyre Forest were illustrated by Mick Blythe (2010. *Ellipteroides* Craneflies (Diptera: Limoniidae) in the Wyre Forest. *Wyre Forest Study Group Review* **2010,** 34-37). Other European species of the subgenus *Protogonomyia* Alexander, 1934, to which it belongs, were considered; from figures of their genitalia provided on the Catalogue of the Craneflies of the World website (*ccw.naturalis.nl*) it was clear that all are quite distinct in structure and could not be confused with *E. alboscutellatus*.

This species has been the subject of detailed ecological investigations by David Heaver (2005. The ecology of *Ellipteroides alboscutellatus* (von Roser, 1840) (Diptera, Limoniidae) in England. *Dipterists Digest* (*Second Series*) **13,** 67-86; 2014. Further observations on the ecology of *Ellipteroides alboscutellatus* (von Roser) (Diptera, Limoniidae) in England and Wales. *Dipterists Digest* (*Second Series*) **21,** 41-54). Thorough descriptions of the known sites were included. These studies showed that flushed *Palustriella* (= *Cratoneuron*) moss beds on perched springline tufa flushes were the preferred habitat, most of the surviving sites with these conditions now being found in woodland in the west and north of England. From the distribution maps provided by Heaver (2014) it is apparent that most sites are clustered near the Welsh border, although only one site is known within Wales, with two sites in Somerset, one in Lancashire and several in Yorkshire. David Heaver (*pers. comm.*) describes the common features of its sites as always with some discernible water flow, ranging from the edges of quite fast flow systems, to more sluggish seeps, with distinct tufaceous silts and fine gravels indicating clear tufa formation at work, usually with a reasonable level of illumination suiting growth of *Palustriella*, but otherwise botanically rather impoverished, and typically with a distinct spring-head, sometimes more than one, leading to varying deltaic expressions downstream.

It has since been reported by John Kramer (2018. A new site for *Ellipteroides alboscutellatus*. *Cranefly Recording Scheme Newsletter* **33,** 9. **In** Bulletin of the Dipterists Forum **85**) that Judy Webb found this species in good numbers on 7 July 2017 at Worton Wood, near Oxford, where they were flying around tufa springs with *Palustriella* present. The assemblage of other cranefly species recorded there included some with calcareous associations. Although some distance from the known range, the habitat fits with previous observations.

The precise location at Dallington Forest of the beech on which the trap was placed was at TQ6525820791, near the top of a wooded slope down to a stream, so it is assumed that the mating pair had strayed from their larval habitat, which is likely to have been near the stream in the valley bottom. The site has SSSI status for its ghyll woodland, which has a rich Atlantic vascular plant flora, resulting from a warm moist microclimate characteristic of The Weald and the west of

Britain. There are many such deep steep-sided wooded ravines in the High Weald and Dallington Forest is considered one of the richest including sandstone cliffs and extensive alder carrs where flushes develop around springs and open boggy areas with at least six species of *Sphagnum*. The site is not calcareous, so apparently does not conform to the expected habitat for *E. alboscutellatus*. However, there is a gypsum (calcium sulphate) seam in the area, which might locally provide similar conditions to tufa formation, though this has not been confirmed. A mine operated by British Gypsum is at nearby Brightling; it is mined down to 300 metres rather than surface quarrying. Alan Stubbs (*pers. comm.*) comments that, since the Wealden rocks are uplifted into an elongate dome, the gypsum horizon should reach the surface beyond the point where it is mined, though the lateral extent of the gypsum seams is unknown.

To investigate the possibility of a population of *E. alboscutellatus* at Dallington Forest, PC made visits during 2019. The flight period of this species was stated by Heaver (2014) to be 10 June to 28 August, but June dates were exceptional with most records from July onwards. A preliminary visit, accompanied by Jamie Simpson, was made on 13 May to assess the habitat, starting in the main ghyll near to where the trapping took place, continuing down the valley to the south end of the site, and then following a circuit through the woodland via a side stream. There are several flushes adjacent to the stream, though it was understood that these were drier than was normally the case, as a result of the drought in the summer of 2018. A second visit took place on 6 August, deferred from the previous day because of heavy rain. This was planned to coincide with the flight period of the cranefly but none was located, so no confirmation could be made of its likely habitat. As various factors might account for its absence on this occasion, no conclusions could be drawn and more frequent visits during its potential flight period will be necessary to establish whether a breeding population is present at this locality.

The survey in 2018 was evidently affected by the drought predominating in south-east England during that year, resulting in relatively low catches being obtained. The 87 species of Diptera identified included only 10 species of craneflies and 31 species of fungus gnats, although there were some interesting records among the latter, e.g. *Dynatosoma cochleare* Strobl, 1895 and *D. thoracicum* (Zetterstedt, 1838). A wider area could be covered on the 2019 visits and it was already evident from the visit in May that a different set of species was being recorded. This was reinforced by the findings of the August visit, so a third visit was arranged for the autumn, and this was on 22 October. However, this was during a spell of wet weather and the visit again had to be deferred by a day; wet vegetation from the previous day and a cold start had an effect so catches were low until the afternoon.

The three visits resulted in records for 202 species of Diptera, including 21 species of craneflies (all but 2 additional) and 80 species of fungus gnats (14 in common with the survey bringing the site total to 97 species); overall 30 species were in common, so 259 species have been recorded. The craneflies included the local species *Limnophila schranki* Oosterbroek, 1992, a female by the stream on 17 May, and *Tasiocera jenkinsoni* Freeman, 1951 swept in the ghyll on 6 August. There were only three previous British records of *T. jenkinsoni*, two of them from Sussex; like other species of *Tasiocera*, it is very small and inconspicuous – though, as the two common species are spring flying, any *Tasiocera* caught during the summer is worth checking.

We thank Jamie Simpson for his interest in investigating the insect fauna of Forge Wood, resulting in the discovery of *E. alboscutellatus* and other interesting records at this site. PC is also grateful to him for conducting him on a tour of the woodland on his first visit in May and for conveying him to the area on his August visit. David Heaver, Alan Stubbs, John Kramer and Pete Boardman provided useful discussion on the implications of this find, and Jamie Simpson provided information concerning the habitats and geology of the locality – **PETER J. CHANDLER**, 606B Berryfield Lane, Melksham, Wilts SN12 6EL, and **KEITH N.A. ALEXANDER**, 59 Sweetbrier Lane, Heavitree, Exeter EX1 3AQ

Dipterists Digest 2020 **27,** 53-59

First records of breeding of the bee-fly *Anthrax anthrax* (Schrank) (Diptera, Bombyliidae) in Britain in 2018/2019, demonstrated by observations near Canterbury, Kent in 2019

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Summary

One *Anthrax anthrax* (Schrank, 1781) bee-fly was seen briefly on 19 June 2018. In 2019, it was identified as a female from the photograph taken at the time, and another female was found at exactly the same spot on 26 May. Individuals were later seen on another 14 occasions over 18 days, 26 May to 15 June, at various other places in the garden.

It was possible to distinguish between sexes and individuals from direct observation and examination of photographs and estimates of the probable total population are made. Two focal points of activity were identified 80m apart and investigations are ongoing to find the natal sites. The dates and timing of each fly's first appearance, and their absences suggest that the flies' emergences were not simultaneous and that they quickly dispersed from the sites.

General behaviour was observed including oviposition, suggesting that breeding took place in 2019. Reference to known potential egg production in other *Anthrax* species allows some estimate of the productivity of the Canterbury population to be made. Conservation and the potential impact on mason bees are discussed.

Fig 1. ***Anthrax anthrax*****: male, 29/05/2019, left; female, 07/06/2019, right.**

Introduction

Since the first authenticated sighting of a female *Anthrax anthrax* (Schrank, 1781) by Rob Mills near Cambridge in 2016 (Mills and Harvey 2016) there has been some speculation about the establishment of the fly in Britain. Not knowing about the Cambridge fly at the time, I was surprised to see a female in my garden near Canterbury in 2018. But a two year gap since the Cambridge event suggested it was probably a fluke, albeit a harbinger for the future. Sightings of two individual flies on one day each for a few minutes each do not constitute evidence of breeding.

The weather in June 2018 was hot and dry in East Kent, with the wind throughout May and June mostly light and from the east and north, precisely the direction of Belgium 100km away where *A. anthrax* has been recorded. That's no great distance for a long-winged fast flyer with a fair wind behind it. It is apparently increasing in Belgium and the Netherlands (Observation.org 2020) and when laying eggs, these flies are on the wing for several hours a day. Breeding was finally confirmed in Canterbury in 2019.

Methods

My customary search of the 0.2ha (0.5acre) mixed garden conducted at least twice a day looking for insects was made throughout April, May, June, July and August. The *Anthrax* flies were seen at two sites, designated north and south, 80m apart. After their first appearances the walls of the house and associated buildings (north site) were searched for signs of bee and bee-fly activity. This was increased in mid-June to include occasional searches of the neighbouring properties.

Photographs were taken at every opportunity. A comparison of my photographs of individuals was made with 65 published photographs gathered from the internet and means of identifying individuals were found

Results

Sexual dimorphism and individual identification.

Males can be recognised by their semi-holoptic eyes, half of female's spacing and they have an additional white band on the abdomen: males have five; females have three, the third reduced to an indistinct spot and the fourth missing.

Fig. 2. *Anthrax anthrax*: heads: male left, female right; abdomens: male left, female right.

Subsequently the photographs were examined in detail and it was discovered that the individuals could be separated from one another by examining the veins at the wing tip, particularly R_{2+3} and R_4, their shape, the extent of any associated dark patches and the shape of the individual cells. Photographs from the internet confirmed that there is considerable, subtle, but unique variation in the shape of the veins and dark patches; in effect a fingerprint. In Fig. 3 I have only indicated a few obvious features but there are many more.

Five different flies were found, a male and four females. A fifth female was identified by behaviour, oviposition, and abdominal markings (Fig 4.). Four other flies were not seen well enough to be sexed or individually identified.

The abdominal markings can be seen at a distance provided that the fly remains stationary and if one knows what to look for (I didn't at the time). All the identified flies were present for a limited period and were apparently not concurrent.

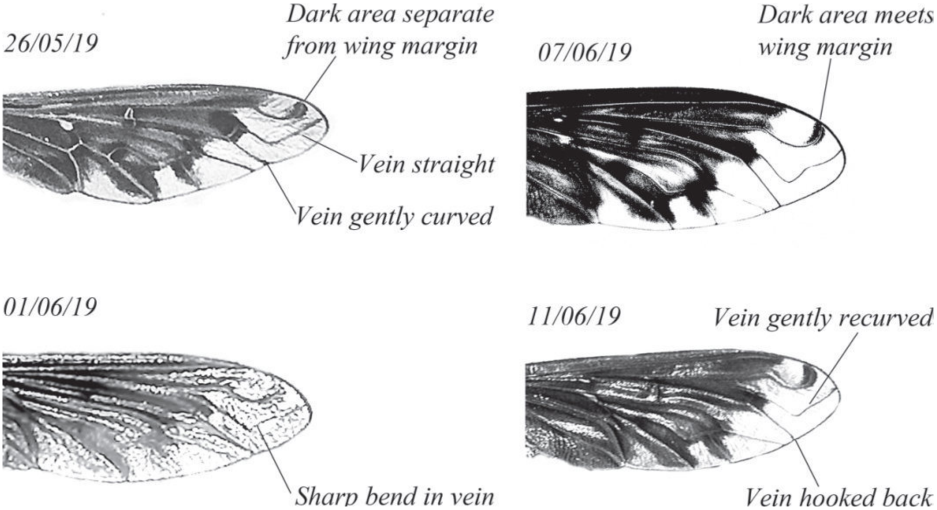

Fig. 3. Comparison of wingtip pattern.

Fig. 4. Comparison of 11/06/2019 (left) and 15/06/2019 (right) indicating a fifth female. Note poverty of 1st white band in 11/06 and the narrower gap in last band compared to 15/06.

Gaps between sightings of one to five days are evident. At the time, I thought this was due to inclement weather; the bee-flies are most active in sunny weather, but in retrospect, and in view of their different identity, I think it more likely that the dates reflect their emergence. Also their appearance in a very small locality (most were in an area 10m x 20m) suggests that the emergence sites were nearby. No identified individual was seen more than once but was replaced by another, suggesting that dispersal was rapid. It is quite conceivable that the multiple sightings, e.g. 11 and 14 June, were all separate flies.

Table 1. Sightings of *Anthrax anthrax* by date; ID indicates definite identification of sex.

DATE	SEX	LOCATION	EXIT/FLEW
26 May	female, (ID)	south, on compost heap	east
29 May	male (ID)	north, greenhouse floor	south
30 May	sex unknown	north, on table and chair	north
1 June	female (ID)	north, ovipositing on wall,	east.
1 June	female	north, ovipositing on big wall,	south
6 June	female (ID)	north, in conservatory, rain	
7 June	female (ID)	north, in conservatory, rain	south
11 June	sex unknown	north, patio, flying about	west
11 June	female (ID)	north, resting on chair	north
11 June	sex unknown	north, low on shed door	west
14 June	sex unknown	south, on nipplewort	east
14 June	sex unknown	south, flying about	east.
15 June	sex unknown	north, on paving	south
15 June	female (ID)	north, ovipositing on big wall south	

General behaviour

The flies were mainly seen resting on man-made objects: a clod of compacted dried soil from a large flowerpot (2018), a white plastic chair, a blue carpet, the concrete floor of the greenhouse, paving stones, a wooden shed door, a wooden table, a wooden chair, a wooden firewood shed, the conservatory wall and a gardener's green plastic kneeling device. They were never seen on bare soil or on grass after the first occasion in 2018, but in view of their colouring they could be easily missed in such circumstances.

They were only seen at plants twice although there were abundant wild and cultivated plants in all parts of the garden. An unsexed and unidentified individual was seen hovering closely but erratically, at a *Lapsana communis* (nipplewort) flower on 14 June (*there is a video of a similar one on Wikipedia*). From there it flew into the gloom beneath a sycamore tree (*Acer* sp.) where there are log piles. A little later that day, one was seen flying about near the compost heap (south site) a few metres from the nipplewort clump, and as it flew away, it hesitated by an umbellifer leaf, touched down briefly and flew away into the gloom beneath the trees.

There were several large clumps of nipplewort, ragwort, various umbellifers and blackberries widely dispersed in various other places which I paid particular attention to for their general fly interest, but no other flower related activity was seen. Another that I surprised near the greenhouse seemed to hesitate over some nearby potato plants but did not settle. Marston (1964), watching *Anthrax limatulus* (Say, 1829) at a concrete bridge in the USA, noted that in spite of many suitable plants nearby no feeding was observed.

Oviposition

On three occasions individuals were seen apparently ovipositing on brick walls around the house and outbuildings; on 01/06/2019 twice but on different walls, and 15/06/2019 on the same very large wall as the second sighting of 01/06/2019 when it was photographed. The yellow genital area could be seen to be protruded both when it was in flight and at rest.

Occasionally the fly completely entered the larger holes and gaps in the mortar, stayed a moment then flew out. Quite often it visited blemishes on the bricks or a shadows cast by a chip in a brick. Oviposition was only seen on sunny, very hot days.

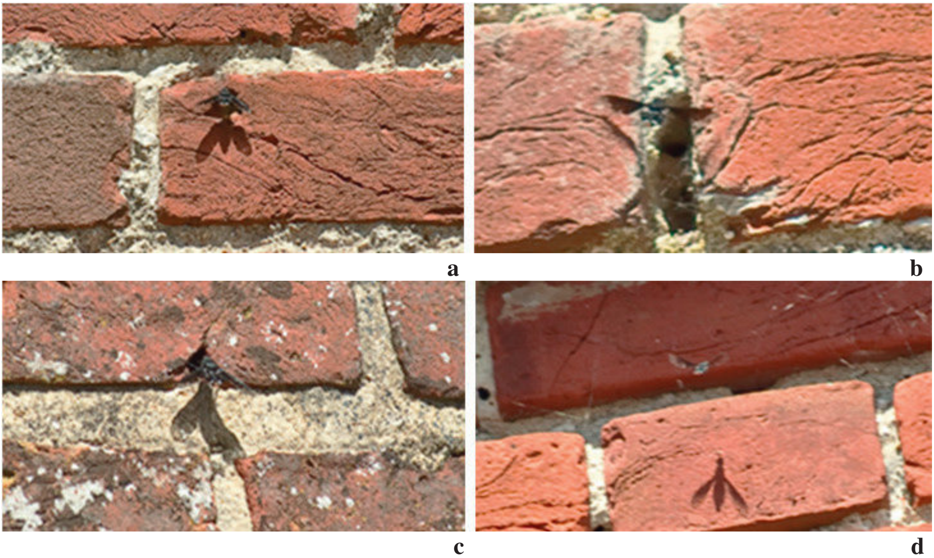

Fig. 5. ***Anthrax anthrax*** **close to a brick wall: a, at a shadow cast by chip in brick, 15/06/19; b, at a hole, 15/06/19; c, at another chip 15/06/19; d, visiting a larger hole 15/06/19.**

Discussion

Attention has recently been drawn to the vast number of assorted insects which migrate over southern England every year. Tracking flocks of insects by radar has shown not only their collective tonnage but the surprising speed and distance of travel: up to 58kph for 200 to 300 km (Gao *et al.* 2016). *Anthrax anthrax* has occurred near the extreme southwestern Belgian border with France (Observation.org) which has a similar climate to East Kent and is only 100km away. So it is possible that the 2018 fly was a stray. But if so, there now seems little doubt it was a gravid female and that egg-laying took place in the Canterbury area in 2018.

Five definite females and a male were seen in 2019, not far from the sighting of 2018 (aprox 80m). Although only four females were positively identified as specific individuals by wing pattern, it seems very likely that there were two more. The fly seen ovipositing on 15 June, for example, was clearly a female and has some characters in common with that seen on 11 June but it appears to have different abdominal markings (see Fig. 3). If correct, five females were present. The flies seen on 14 June were not identified as females, but there is a 50/50 chance that they were, giving the possibility of seven females.

The natal site was not found. At the south end of the garden, with four sightings, there are ash log piles (they tend to split longitudinally), and assorted rotting tree stumps at various stages of decay. They are always in deep shade and very cool in spring. The only bee activity seen there have been two bumblebee nests in the ground and the emergence of three sharp-tailed bees (*Coelioxys* sp.) apparently from a rotten apple tree log. When cutting and splitting the logs in the autumn, I have not seen any evidence of bees. All of this material was inspected daily. There are always various bees, including solitary bees, in the general area feeding on wild flowers but none has been known to be associated with the logs.

The remainder of sightings were 80m away to the north round the house, particularly around a stone paved area outside a conservatory in which one got trapped during rain on 6 June.

There are hundreds of square metres of old brick walls with broken pointing on which the flies were seen ovipositing. Inspection of this brickwork is ongoing, so far with minimal success.

On one east facing wall, there is a small bee hotel and a bee-fly was seen near it, apparently ovipositing. But it avoided the hotel and went side to side, up and down but never on it. Needless to say this facility was constantly inspected, but there was never a sign of bee-flies and no trace of pupal cases. It is generally occupied by very small black bees and the occasional leafcutter bee, but in 2019 several tubes had been sealed with clay plugs, suggestive of *Osmia* bees. I have not seen this before. The black residents use a waxy substance.

Contemporaneously with the bee-flies, a few small bees were seen in the greenhouse and the conservatory. About 11mm long and with orange fur, they have not been seen before and were possibly males of *Osmia bicornis*.

Conclusion and speculation

Anthrax anthrax bred for the first time in England at Canterbury in 2018, and again in 2019. There were at least five, possibly seven, females present.

Marston (1964), speaking of *Anthrax limatulus*, a parasite of solitary wasps in America, estimated from his observations that egg production can be prodigious at 1000+ eggs per day and that egg laying is largely promiscuous or random; Fabre (1922) used the term “broadcast”. Marston listed several innappropiate oviposition sites including bits of mud on the concrete wall, his shirt and face, dark spots on the wings of a moth, even as it was flying away, but mostly odd random holes in the concrete and old wasp nests. This behaviour is echoed by other writers on other *Anthrax* species (Yeates and Greathead 1997), the stimulus for laying apparently being a dark spot. Marston collected the eggs and found that only 4% had been laid at a place where survival was at all likely. He subsequently hatched the eggs.

Egg production at a bare minimum of 800 per day seems to be the rule in the genus *Anthrax* and if *A. anthrax* is similar, in view of the similar catholic taste in egg-laying sites, and if all five females at Canterbury laid 800 eggs per day for three weeks they could have produced 84,000 eggs of which, by Marston’s calculation, 3,360 could have been in viable sites and could have survived. But, if 50% of those failed due to secondary parasitism and other predators, and if after emergence 25% of the flies met with an unfortunate accident, there could still be 1260 survivors.

By reversing the calculation, we can estimate that the 2018 female had to lay some 200 eggs, allowing for predation and other losses, in order to produce the estimated maximum of eight adults. An afternoon's work. But if she laid at the usual rate for the genus on several days there may already be thriving colonisation. This street has many very old houses with neglected brick walls. The city of Canterbury and its environs have countless hectares of them; there is no limit in the vicinity to potential expansion of *Anthrax anthrax.*

Conservation issues

There will be those who will object to another bee parasite entering the British fauna. I have already experienced this in conversations. But losses of bees are unlikely to exceed those in Germany at 2% and there is a simple non-intrusive way of dealing with this by controlling the bee-flies' predation. This merely involves deluding them.

In Mediterranean countries where *Osmia* species are actively encouraged (farmed?) as pollinators, predation by *A. anthrax* can be high, up to 95% at worst, 2% at least. A solution has been found. It appears that the bee-fly shows a distinct preference for laminar nesting spaces, that is a set of flat plates with rectangular entrance holes in them. When the bees nest in the square holes they have a high rate of parasitism (47%). The bees on the other hand show a preference for tubular cavities where they suffer a lower rate (5%).

So the answer is to provide both types of accommodation but to make the holes in the laminar structure only 5mm deep, paint the inside of the holes black and the outside yellow thus maximising contrast. If the flies lay their eggs in these they cannot survive, but the bees cannot nest in them and in their tubes are left alone (Krunić *et al.* 2005).

On the other hand those wanting to encourage the flies have only to change their bee accommodation from tubular to laminar with open holes and sacrifice a few bees while providing bees with tubes sited elsewhere.

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Wikipedia, https://en.wikipedia.org/wiki/Anthrax_anthrax

Corrections and changes to the Diptera Checklist (43) – Editor

It is intended to publish here any corrections to the text of the latest Diptera checklist (publication date was 13 November 1998; the final 'cut-off' date for included information was 17 June 1998) and to draw attention to any subsequent changes. All readers are asked to inform me of errors or changes and I thank all those who have already brought these to my attention.

Changes are listed under families; names new to the British Isles list are in bold type. The notes below refer to addition of 11 species, resulting in a new total of **7204** species (of which 41 are recorded only from Ireland).

An updated version of the checklist, incorporating all corrections and changes that have been reported in *Dipterists Digest*, is available for download from the Dipterists Forum website. It is intended to update this regularly following the appearance of each issue of *Dipterists Digest*.

Mycetophilidae. It has been established (*Sciaroidea.info*) that the monograph by J. WINNERTZ, although presented orally on 6 May 1863, was published in 1864 **(**Beitrag zu einer Monographie der Pilzmücken. *Verhandlungen der Zoologisch-Botanischen Gesellschaft in Wien* **13,** 637-964)**,** hence the date of authorship of all names proposed there has been amended to that year.

The following species were added by P.J. CHANDLER (2020. Fungus Gnats Recording Scheme Newsletter **11,** 8 pp. *Bulletin of the Dipterists Forum* **89**):
Boletina ***gusakovae*** Zaitzev, 1994
Epicypta ***torquata*** Matile, 1977
Phronia ***elegantula*** Hackman, 1970
Trichonta ***girschneri*** Landrock, 1912

Simuliidae. According to M. KÚDELA, T. BRÚDEROVÁ, L. JEDLIČKA, R. BERNOTIENĖ, P. CELEC and T. SZEMES (2014. The identity and genetic characterization of *Simulium reptans* (Diptera: Simuliidae) from central and northern Europe. *Zootaxa* **3802**(3)**,** 301-317) the identification of *Simulium galeratum* by J.C. DAY, T.I. GOODALL and R.J. POST (2008. Confirmation of the species status of the blackfly *Simulium galeratum* in Britain using molecular taxonomy. *Medical & Veterinary Entomology* **22,** 55-61) was incorrect and they established its true identity (Andy Godfrey *pers. comm.*):
Simulium ***reptantoides*** Carlsson, 1962 = *S. galeratum*: Day *et al*. 2008, misident.

Dolichopodidae. In the present issue it is argued that *Syntormon pseudospicatum* is a good species (this had been queried in Note 14 in the checklist), and the opinion is expressed that the gender of the generic name *Syntormon* should be restored to neuter, contrary to the preceding Note 13 where the view of Grichanov (2014) that it should be masculine, as treated in its original publication by Loew, was supported.

Agromyzidae. The following species are added in the present issue:
Cerodontha (*Icteromyza*) ***rozkosnyi*** Černý, 2007
Liriomyza ***virgula*** Frey, 1946
Metopomyza ***junci*** von Tschirnhaus, 1981
Ophiomyia ***ungarensis*** Černý, 2015
Phytoliriomyza ***nigrifrons*** (Hendel, 1920 – *Liriomyza*)

Chloropidae. In the checklist it was suggested in Note 2 that *Meromyza depressa* sensu Ismay was an undescribed species but M. VON TSCHIRNHAUS (2007. Acalyptrate Fliegen (Diptera: Schizophora, „Acalyptratae“) der jungen Düneninseln Memmert und Mellum unter besonderer Berücksichtigung der Agromyzidae und Chloropidae Ergebnisse der Untersuchungen von 1984 –1986 und 1994. *Drosera* **2007,** 99-136) identified it as the following species, which should be added to the list (Jens-Hermann Stuke *pers. comm.*):
Meromyza ***virescens*** von Roser, 1840 = *M. depressa*: Ismay, 1981, misident.

Sphaeroceridae. The following species and subspecies are added in the present issue:
Sphaerocera ***pseudomonilis*** Nishijima &Yamazaki, 1984 ssp. ***hallux*** Roháček & Florén, 1997

Sarcophagidae. It has been advised (Daniel Whitmore *pers. comm.*) that it has been proposed by Thomas Pape in a new draft of the world catalogue that homonymy with *Myophora soror* Robineau-Desvoidy, 1830 should not be recognised, thus restoring the following name:
Sarcophaga soror Rondani, 1860 = *S. discifera* Pandellé, 1896

The following species is added in the present issue:
Metopia ***tshernovae*** Rohdendorf, 1955

Dipterists Digest 2020 **27,** 61-82

The identity of *Syntormon pseudospicatum* Strobl (Diptera, Dolichopodidae)

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Summary

Syntormon pseudospicatum Strobl has been regarded as either a valid species or a synonym of *S. pallipes* Fabricius, representing one end of the spectrum of variability in colour and hairiness of the hind leg. It is shown here that the variation in measured characters was discontinuous and that the two species are clearly distinct using morphometric analysis. *Syntormon pseudospicatum* in Britain, and perhaps throughout its range, is almost confined to brackish sites. The strong evidence from structure and habitat suggest that *S. pseudospicatum* is a good species. Strobl's type specimen is re-described. A key to distinguish males is given.

Introduction

Species of *Syntormon* are small dark green or yellow-marked sympycnines found in a variety of wetlands. World-wide about 110 species have been described, of which 41 are known in the West Palaearctic and 15 from Britain (Chandler 1998, Grichanov 2013). The male secondary sexual characters (MSSC) provide external features that are useful in most cases in their identification without resorting to examination of the tiny hypopygium. MSSC are expressed in elongate antennae and in a wide range of modifications in leg chaetotaxy, and often most conspicuously in the shape of the hind basitarsus and its setae. Despite the obvious nature of these MSSCs, the validity of *S. pseudospicatum* Strobl, 1899, remains contentious: is it a synonym of *S. pallipes* (Fabricius, 1794) or a valid species? Grichanov (2013), Chursina and Grichanov (2019) and Maslova *et al*. (2019) regarded *S. pseudospicatum* as a synonym but Negrobov (1971, 1975), Pollet (2011) and Persson *et al*. (2019) retained its species status.

Syntormon pallipes is a common Palaearctic species and the first in the currently recognised genus to be described. Loew (1850) regarded it as a very variable species. He described three varieties but was reluctant to raise them to the rank of species since they seemed to form a continuum from those with entirely pale hind femora, tibiae and base of the basitarsi, and whose tibiae and basitarsi had sparser, shorter setae, to those with dark apical rings on the hind femora and tibiae, entirely black tarsi, and denser, longer setae on the tibiae and basitarsi; he divided the darker types into two varieties. Species were later described that match Loew's pale variety, including *S. pseudospicatum* and *S. uncitarsis* Becker, 1902. Becker (1918) later decided that these two pale species were merely pale forms of *S. pallipes*. Indeed, there is nothing in Strobl's (1899) description of *S. pseudospicatum* that differs from Loew's more detailed description made half a century earlier, with the exception of the face character that Becker (1918) ascertained, on examining the type specimen, was an artefact due to shrinkage. Once this apparently conspicuous difference from *S. pallipes* is removed, Strobl's (1899) description then has only two convincing characters that differentiate his species from *S. pallipes*: all the femora and tibiae are entirely yellow, and the hind basitarsus is black only in the apical half. Becker (1918) made the observation (my translation) "As an additional difference, Strobl could have mentioned that the hind tibiae were scantily or only shortly ciliated." Parent (1938) agreed with Becker's conclusion but did not include the paler leg colour in his description of *S. pallipes* (despite the fact that he treated *S. pseudospicatum* as synonym of *S. pallipes*), whereas Lundbeck (1912), who appears to have been unaware of *S. pseudospicatum* as he did not give it as a synonym of *S. pallipes*, gave an accurate description of the colour variation.

Negrobov's (1975) key separates the species as follows:

- First segment of hind tarsi with two hooks merged practically to the apex. Hind tibia with a row of dense bristles on the outside. Hind tibia apically and hind tarsi basally dark …………………………………………………………………….. *pallipes*
- First segment of hind tarsi with two hooks separated practically to the base. Hind tibiae with sparser bristles. Hind tibiae apically and hind tarsi basally yellow ……………………………………………………………………. *pseudospicatum*

Maslova *et al*. (2019) and Chursina and Grichanov (2019) examined about 140-150 specimens from widely separated locations in the Palaearctic, and which probably included some in common to both studies. Maslova *et al*. (2019) concluded that the characters used by Negrobov (1971) were too variable to allow the two species to be distinguished and, in one series of specimens, there were transitional forms in which the characters overlapped. Chursina and Grichanov (2019) used morphometric and genetic analysis (see Discussion). Like Loew and Becker, both sets of workers concluded that all the specimens were *S. pallipes*, making *S. pseudospicatum* a junior synonym. I and my colleague Roy Crossley had also examined many specimens, mainly from Britain. Using Negrobov's key, pale British specimens of *pallipes* could be identified as *S. pseudospicatum*, but not satisfactorily since none showed consistent differences in the separation of the hooks on the hind basitarsus, as illustrated by Negrobov (1971). *Syntormon pseudospicatum* was added to the British list on the advice of C.E. Dyte (Chandler 1998) but possibly on a misunderstanding of its true identity.

The existence of paler and darker forms is uncontested, but whether they represent distinct species cannot be resolved by merely examining the type specimens since several eminent dipterists have already done this. Instead, the issue appears to be whether the variation is continuous, as would be expected in a highly variable species, or shows a discontinuity corresponding to the two taxonomic entities. In this paper, I first establish the nature of the variation using a principal component analysis, then identify characters that most reliably separate the species using a discriminant analysis. I also redescribe Strobl's type specimen of *S. pseudospicatum*. Distribution and habitat information from the British national recording scheme that includes dolichopodids is used to show preferences of the two taxa.

Methods

Measurements or counts of 29 characters were made in 157 British specimens collected from widely separated areas, and 21 specimens from France, Greece, Portugal and Spain, including Strobl's holotype of *S. pseudospicatum* (Table 1, Fig. 1). The features selected were those already known to be variable, along with more detailed measurements of the hind tarsus and antenna which show important taxonomic MSSCs in the genus. Measurements were made at x90 magnification to the nearest unit of an eye-piece graticule or to half a unit for characters smaller than 12 units (1 unit = 0.0155 mm). The angle between the hook on the hind basitarsus and the segment's shaft was measured by fixing a protractor to the eye-tube of the microscope and a pointer to the eye-piece, and lining up a squared graticule in the eye-piece with the axes of the hook and tarsus. Although the measurements could be made with precision to 1 degree, the curvature of the front edge of the column with hooks and basitarsus shaft introduced some error.

Principal component analysis (PCA) was carried out on a correlation matrix. To avoid a possible complication of allometry, lengths were first standardised by dividing by the longest measured character (hind tibia) as this was the most accurately measured feature. This was thought to be a better procedure than using the residuals of the regression of each character with the tibia since the regression would be based on both taxa, thus introducing bias and dependence on the specimens used in the dataset (Rae 2002). The resulting size-standardised variables were then almost or completely uncorrelated with the tibia length. Several characters deviated from normality using a Shapiro-Wilk test, in particular the width of the rings on each of the three hind-leg segments were clearly bimodal, so no transformation could normalise these data. When each species was treated separately, each character had an almost or completely normal distribution, so combining them into a bimodally distributed dataset was an unavoidable source of error. Transformations applied to all characters using logs (ln x+1) or arc-sine (since the size-standardised values were proportions) made no useful difference, sometimes being either marginally better or worse for different characters, so none was applied. Rare outliers were one reason for deviation from normality but these were genuine values when checked so there was no reason to remove or replace them with an average value. A few mainly trivial variables were excluded, but also Tibia_ring (see Table 1) which was very closely cross-correlated with Femora_ring, leaving 20 characters.

Once it had been established using PCA that there were two distinct groups, specimens were allocated to either *S. pseudospicatum* or *S. pallipes*. Discriminant analysis was used to identify characters that best separated the species. Instead of using the size-standardised raw data, a new set of variables was constructed using ratios of lengths that better described some aspect of shape, for instance the ratio of the length of the dark ring on the femur to the total femur length. These characters, along with counts and the hook angle, are given in Table 2. It was expected that these ratios would be of better use when constructing an identification key than the less easily usable lengths of the raw data. An alternative procedure to this subjective choice of derived characters would have been to use the vast number of all possible ratios and counts, which would have been unwieldy and time-consuming to analyse. Tergite colour was omitted as it was measured as a nominal variable whose inclusion would violate one of the many assumptions of discriminant analysis (Zuur *et al.* 2007). As with the original measurements, some were not normally distributed within each species, but as no transformation consistently improved the distributions, none was applied. Successive runs of the analysis were made, dropping the variable with the lowest discriminant coefficient until a small number of useful variables remained that still achieved high separation of the species. Differences between mean values of each variable were tested after checking for non-significance in the variance ratio of each pair of characters. Both PCA and discriminant analysis were undertaken using Community Analysis Package 4 (Pisces Conservation 2007). Excel with the Analyse-it add-in was used for all other analysis.

Information on British distribution and habitat affinity was obtained from my own collecting and from data sent to me in my capacity as organiser for dolichopodids in the national recording scheme for empidids, hybotids and dolichopodids (Dipterists Forum 2019). The data are held privately and are not currently publicly available. Dates of records of *S. pseudospicatum* are 1904-1969 for 32 specimens in the Natural History Museum, London, and 1971-2018 for 68 records from several competent recorders. *Syntormon pallipes* records cover the period 1876 to 2018 and are impossible to disentangle from *S. pseudospicatum*.

I have used the neuter gender for the species names, as argued by Drake and Welter-Schultes (in press). There it is shown that a series of mistakes by Loew (1857) precluded the name of his new genus being masculine, contrary to his intention.

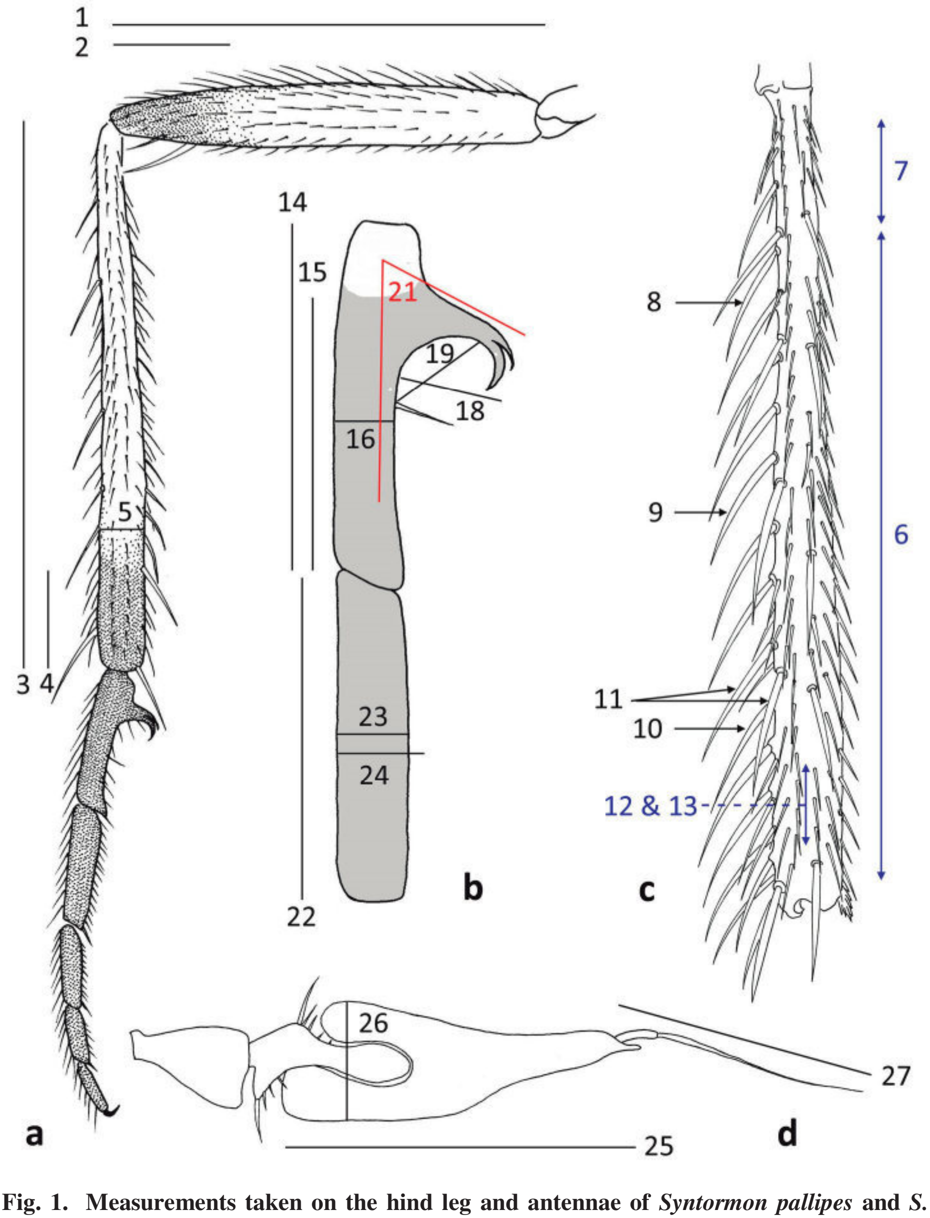


Fig. 1. Measurements taken on the hind leg and antennae of *Syntormon pallipes* and *S. pseudospicatum*. The numbers cross-refer to Table 1. Black line: lengths; blue lines: counts between arrows; red lines: angle subtended: (a) hind leg; (b) hind tarsus 1st and 2nd segments; (c) hind tibia, dorsal face; (d) antenna, inner face.

Table 1. *Syntormon pallipes* and *S. pseudospicatum* features measured in 178 specimens, and 20 characters (with their labels) used in principal component analysis. The positions of most measurements are shown in Fig. 1. Parts of legs always refer to the hind leg.

Anatomical feature	Number	Measurement	Label for PCA
Femur	1	length to trochanter on dorsal edge	Femora_L
	2	length of dark ring on mid-line of anterior face	Femora_ring
Tibia	3	length	
	4	length of dark ring on mid-line of anterior face	
	5	diameter at 1st antero-dorsal seta	Tibia_W
Tibial fringe	6	number of hairs from 1st antero-dorsal seta to tip, ignoring the apical seta	
	7	number of hairs proximal to 1st ad seta	
		[all these hairs in 6 and 7]	Fringe_N
	8	length of hair at basal ¼ point of tibia	
	9	length of hair at midpoint of tibia	
	10	length of hair at apical ¾ point of tibia	
		[average of these three lengths, 8, 9 and 10]	Fringe_L
	11	diameter of hair next to last antero-dorsal seta relative to this seta (estimate)	Fringe_rel-diam
	12	subapical subsidiary hair row, total number of hairs, ignoring apical seta	Subfringe_N
	13	subapical subsidiary row, number of hairs as large as those in anterior fringe	Subfringe_big_N
Basitarsus	14	length	Metatarsus_L
	15	length of black ring on centre-line of anterior face	Metatarsus_ring
	16	diameter at narrowest, near mid-point	Metatarsus_W
Basitarsus hook	17	shape: curved or upright (inconsistent)	
	18	height	Hook_H
	19	length from hook's inner face to upright setula on antero-ventral face of shaft	Hook-to-Hair
	20	angle of hook's main axis with main axis of tarsus shaft	
	21	angle of hook's proximal edge with main axis of tarsus shaft	Hook_angle
Tarsus 2nd segment	22	length	Tarsus2_L
	23	diameter	Tarsus2_W
	24	diameter including ventral pubescence	
Antenna	25	postpedicel length	Antenna_L
	26	postpedicel width	Antenna_W
	27	arista length	Arista_L
Tergite	28	yellow patch present on 2nd tergite	
	29	yellow patch present on 3rd tergite	
Thorax	30	length including scutellum, dorsal view	Thorax_L

Table 2. Characters used in discriminant analysis. The numbers in the equations refer to the numbered characters in Table 1 and Fig. 1.

Code	Equation
Femora_ring	2÷1
Tibia_ring	4÷3
Tarsus_ring	15÷14
Tibia_thickness	5÷3
Tarsus_D1:D2	16÷23
Tarsus_L1:L2	14÷22
Hook_H:hair	18÷19
Fringe_N	6+7
Fringe_L	average of 8, 9, 10
Fringe_tibia_ratio	(average of 8, 9, 10) ÷ 5
Fringe_diam	11
Fringe_subrow_N	12
Fringe_subrow_big	13
Tergite_colour	28
Anten_L:arista	25÷27
Anten_L:H	25÷26
Hook_H:shaft	18÷16
Hook_angle	21

Results

Morphometrics

The PCA plot of the first two axes showed two distinct clusters with almost no overlap and no indication of continuous variation from one to the other (Fig. 2). These two clusters corresponded well with the species regarded as *S. pseudospicatum* on the left and *S. pallipes* on the right. The first axis explained 34% of the variance in the sample, with a high eigenvalue (6.80), and the second axis explained a further 15% of the variance but with a relatively small but still important eigenvalue (2.92). The next two axes explained relatively little of the remaining variation despite having eigenvalues greater than 1.0; cumulatively all four axes still explained only 60% of the total variation (axis 3: eigenvalue 1.31, 6.5% of total variation; axis 4: eigenvalue 1.07, 5.4%). Points for the two taxa overlapped almost completely when the second and third axes were plotted (not shown), suggesting that higher axes would reveal no further insight. Eigenvectors having the greatest influence were those orthogonal to the diagonal axis that separates the two species: the number of hairs in the main and subsidiary tibial fringes (Fringe_N, Subfringe _N) which were greater in the direction of *S. pseudospicatum*, and, in the opposite direction towards *S. pallipes*, greater values for the average length of hairs in this fringe (Fringe_L), the relative thickness of these fringe hairs compared with the antero-dorsal seta (Fringe_rel-diam), the number of large hairs in the subsidiary row (Subfringe_big_N), the width of the dark rings of the femora and basitarsus (Femora_ring, Metatarsus_ring), and the angle of the shaft of the hook (Hook_angle). Characters that did not help in describing the separation of the species were indicated by vectors lying approximately in the direction of the diagonal axis between them; these were several characters relating to the antennae and lengths of leg segments.

Specimens of both species from Britain and continental Europe are indistinguishable on the PCA plot, despite their wide geographic separation and different climates where they developed (from Kefalonia in Greece to northern Scotland). Strobl's type specimen from Spain is at the fringe of the *S. pseudospicatum* cluster but clearly related to British and French specimens.

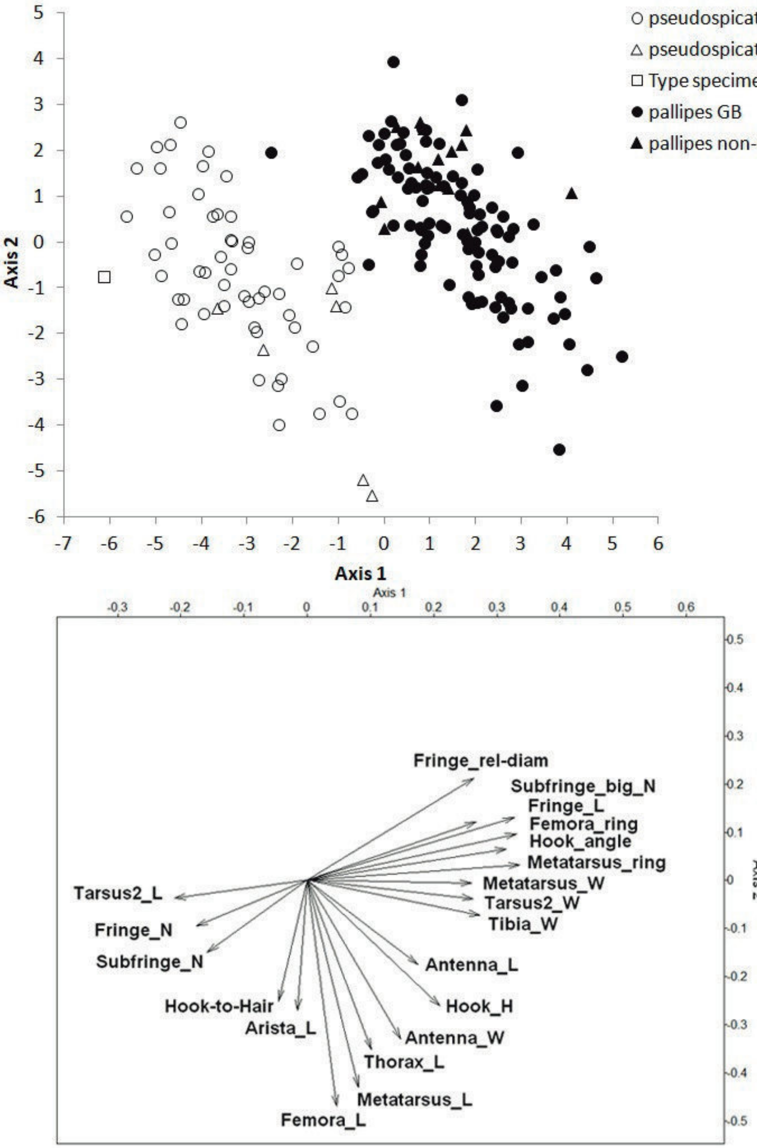


Fig. 2. Principal component analysis of *Syntormon pallipes* and *S. pseudospicatum* measurements. Upper graph shows the distribution of scores along the first two axes, distinguishing British (GB) and non-British (non-GB) specimens, and indicating Strobl's type specimen. Lower graph shows the vectors for all 20 variables.

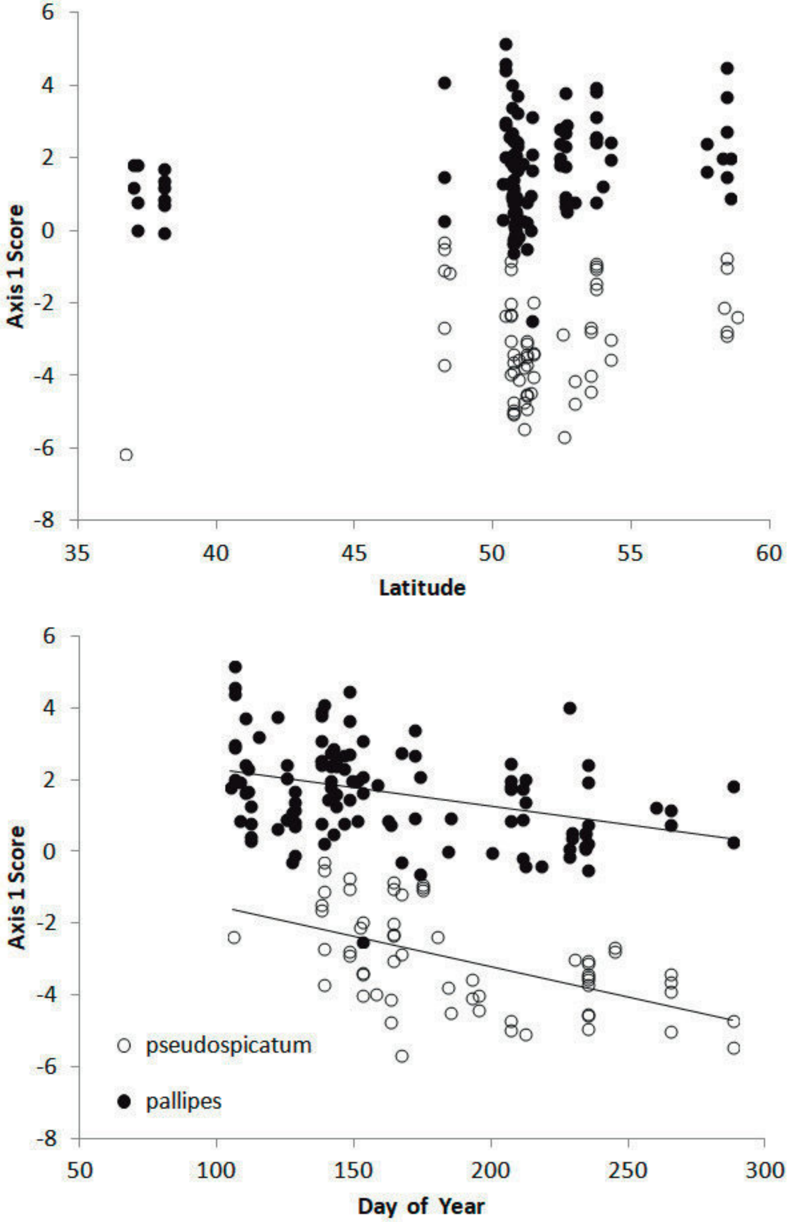


Fig. 3. Axis 1 score of PCA plotted against latitude (above) and date of collection, expressed as day number of the year (below) for *Syntormon pseudospicatum* (open circles) and *S. pallipes* (black circles).

To identify two groups for discriminant analysis, the specimens were allocated using their position in the PCA plot. Clearly some guesswork was needed for points on the touching boundaries of the clusters. The ratio of the dark ring on the hind tibia (present in *S. pallipes*, absent in *S. pseudospicatum*) was strongly correlated with the femora ring ($r^2 = 0.93$) so was excluded to satisfy an assumption of the method. In the step-wise removal of the least influential character, all but the three characters with highest discriminant function coefficients could be removed before any specimen was incorrectly identified. These three variables were the ratio of the black rings to total lengths of the femur and basitarsus, and the average length of the hairs on the tibial fringe. The eigenvalue had dropped from 13.98 with all 16 variables to 9.18 with just the three final variables, and the test statistics (chi-squared of the canonical correlation, Wilk's lambda) remaining highly significant at each step. Two other variables that were removed late in the procedure were the ratio of the basitarsus to second tarsal segment and the relative thickness of the fringe hairs to the adjacent antero-dorsal seta at the distal quarter of the tibia. The first of these was a statistical artefact resulting from genuine outliers that produced non-normality in the data for this variable. The second variable for relative thickness of the hairs was clearly of some additional value in distinguishing the species.

Separate PCA ordinations for each species showed a diffuse cluster for each, with no distinct groupings within the cluster on a plot of the first two axes (not presented here). The first axis in both ordinations explained only 19-20% of the variance, suggesting there were only weak gradients within the data. In *S. pseudospicatum*, the gradient was dominated by the width and number of hairs in the fringe. In *S. pallipes* these gradients were dominated by a wider ring on the hind femur, robust hind tibia and a wider fringe, but the number of hairs in the fringe was unimportant. Thus the two species appear to show only partial similarity in the main areas of variation. The large variability in leg colour in *S. pallipes*, ranging from the more usual narrow apical ring to entirely black, may correspond to Loew's (1850) second and third varieties.

Mean values of each variable were calculated using untransformed values of the size-standardised lengths. Values are not presented as lengths and ratios have little practical use. Tests for the differences between the mean values of the two species were significant for most variables, with some doubt about the validity of a t-test for a few variables where the variance ratio was significant (that is, the variances were not similar). These included the bimodally distributed variables relating to the black rings on the femur and tibia, and the yellow basal ring on the basitarsus, and three other variables where genuine outliers led to non-normality in the data. Non-significant differences in means mainly related to the thorax length and antennae, although not postpedicel length which was minutely but significantly shorter in *S. pseudospicatum* ($p<0.05$). The bulk of the characters relating to the legs were therefore the most important source of the differences between the species. Absolute lengths for the hind tibia and thorax, taken as two values likely to represent total size, were almost identical, even though those for *S. pseudospicatum* were significantly greater ($p<0.05$).

The axis 1 score of the PCA may be taken as a surrogate for the shape of specimens, and which can be correlated with external factors that may influence it. Time of year and latitude were tested. Time of year (as day number) was restricted to British and French specimens to avoid early or unknown dates for Portugal, Spain and Greece. There was a weak decline in axis 1 score through the year for both species ($r^2=0.137$ for *S. pallipes*, 0.296 for *S. pseudospicatum*) (Fig. 3). The parallel motion of the change in the score suggests that the two species remain distinctly separate all through the year. Latitude for all specimens showed no relationship (Fig. 3).

Colour pattern in some dolichopodids shows a seasonal change. If some of the variation in *S. pallipes* and *S. pseudospicatum* can be shown to correlate with season, it would reinforce the contention that they are separate species. Two characters were examined: the colour of tergites 2 and 3 (either all green or with large yellow lateral marks) in both species, and the length of the black ring on the hind femur of *S. pallipes* (*S. pseudospicatum* has no femoral ring so cannot be tested). In both species the tergite colour showed a pronounced seasonal change in frequency: entirely green tergites predominated in early-flying specimens and those with yellow patches predominated later in the year (Fig. 4). The same trend has been seen in a Belgian population (Marc Pollet *pers. comm.*). The length of the black ring in *S. pallipes* also showed a weak correlation with time of year ($r^2 = 0.18$) but the slope was highly significantly different from zero ($p<0.0001$), which suggested that some aspect of season influenced the pattern, from a wider ring in spring to a narrower one in late summer (Fig. 5).

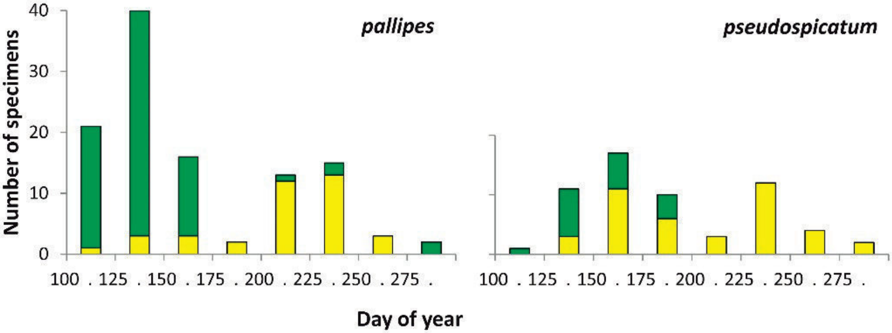


Fig. 4. Number of specimens with entirely green tergites (green bars on histograms) or with yellow patches on tergites 2 and 3 (yellow bars) of British and French specimens of *Syntormon pseudospicatum* and *S. pallipes* in blocks of 25 days through the year.

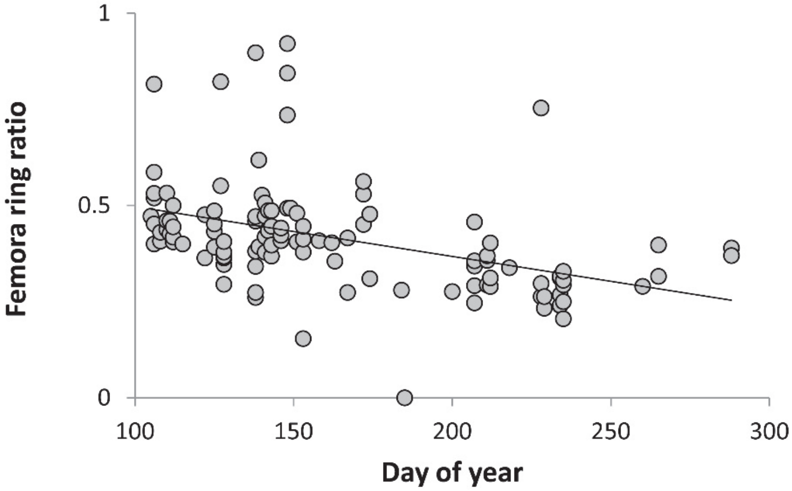


Fig. 5. Ratio of the length of the black ring to total length of the hind femur plotted against date of capture (day of year) for 112 specimens of *Syntormon pallipes*.

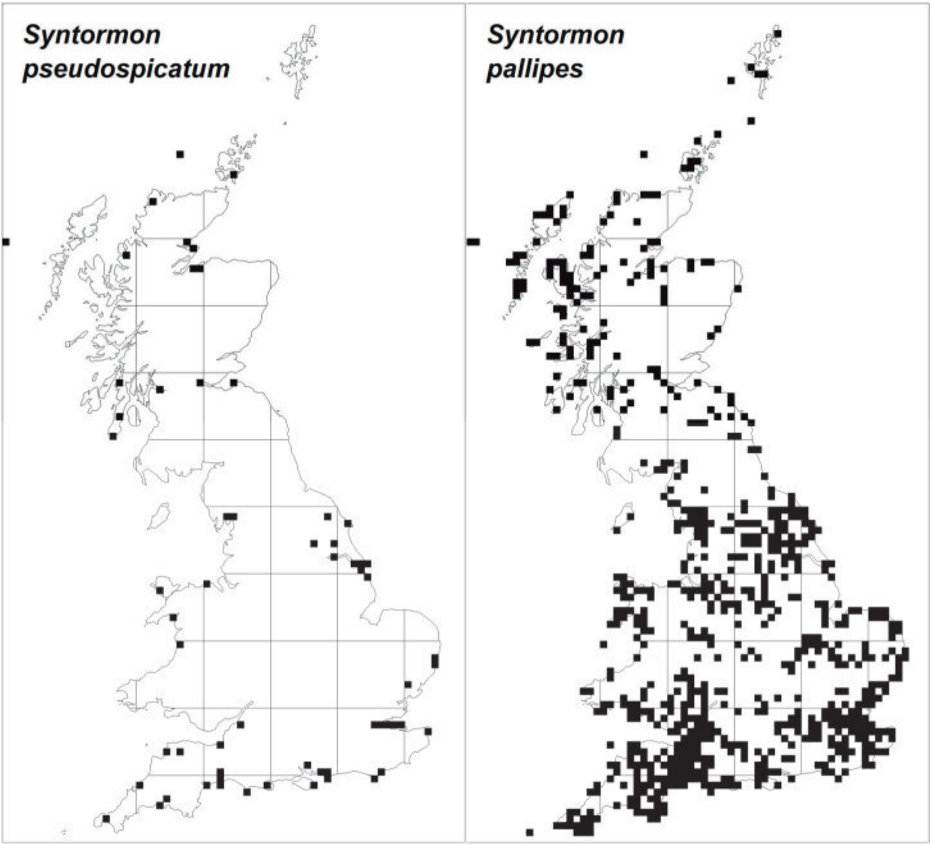


Fig. 6. Distribution of *Syntormon pseudospicatum* and *S. pallipes* in Britain.

Habitat

A further important external factor differentiating these species was habitat preference. The British distribution of *pseudospicatum* is almost exclusively coastal (Fig. 6), and it has been found on brackish sites, mainly saltmarsh and rarely at seepages on coastal cliffs. Only rarely has *pseudospicatum* been found at inland freshwater sites, and then only a few kilometres from the coast, which suggests that they may have been strays. My French specimens were also from saltmarsh, and Strobl's type specimens was collected from Algeciras on the Spanish coast. Pollet and Meuffels (2016) stated that *S. pseudospicatum* has a clear preference for mud and saltmarsh in The Netherlands where it can be numerous. *Syntormon pallipes* is widespread and eurytopic, occurring at both freshwater and brackish sites. Both species have been collected at the same brackish sites on the same day on several occasions, while only a short distance inland away from saline influence only *S. pallipes* was found. Lundbeck (1912) also found both together although he did not use the name *S. pseudospicatum* for his paler form. A full analysis of the British distribution of the two species is not currently possible with the data in the national recording scheme as many coastal records of *S. pallipes* probably include *S. pseudospicatum* (Dipterists Forum 2019). This may apply particularly to the Scottish coastal records; for example, both species were recorded by Plant (1995) from the tiny island of Sule Skerry north of the Scottish mainland.

Re-description of *Syntormon pseudospicatum* holotype

I provide a re-description of the holotype of Strobl's *S. pseudospicatum*, kindly given in loan by the Naturhistorisches Museum, Vienna, Austria. The male specimen is in very good condition, lacking only the left antenna, the tip of the right arista, and the one of the two claws of the right hind basitarsus. Characters that were missing or obscured have been substituted by the condition found in British specimens and indicated in square brackets.

There are two labels on the staging pin. The upper is Strobl's original white handwritten label:
Synt. pseudo-
spicatum
m. Algiciras ? [the isolated last character, indicated here by "?", is illegible]
Strobl.
The lower label is a red typed label:
HOLOTYPUS

Redescription. **Male**. Body length 3.1mm, wing length 3.4mm measured from base, 3.0mm measured from vein h. **Head.** Frons glossy metallic purple-blue, faintly microtomentose, shining either side of ocellar triangle; width at front ocellus about 2.5 times as long as distance from hind ocellus to anterior ridge above antennae. Face tapered from below antennae to mouth edge but strongly shrunken in the type specimen [in undistorted specimens, parallel in lower half, its narrowest width half its width under antennae]; silver-dusted [slightly golden just below antennae]; black ground colour. Ocellus raised above level of flat upper frons. Occiput metallic green but dulled by white dust, ground colour scarcely visible in lateral view. Eyes finely hairy; lower facets about twice diameter of upper facets. Palps small, triangular, black with silver dusting and inconspicuous fine short white hairs; proboscis small, dark brown, with hairs about equal to its depth. Antennae black; scape bare with apical inwardly directed conical projection, its apical width equal to segment length; pedicel with coronet of apical short setae and long conus twice as long as basal width of segment; postpedicel long, parallel-sided in basal half, tapering in apical half to pointed tip; entirely covered with short curled pale hairs; arista inserted dorsally just behind tip of postpedicel, finely pubescent; ratio of scape: pedicel: postpedicel: arista – 11: 15.5: 40: 19+ (arista broken, only one present). Chaetotaxy typical for the genus: 2 long ocellars, 2 long upper orbitals, 2 very short postocellars, their length equal to ocellar triangle length, postoculars black in upper third (8 setae including 2 set back from marginal row at vertex), white in lower two thirds (13 setae), about 9 long white setae on lower occiput mediad of postocular row. **Thorax.** Metallic green except meron which is almost black above mid and hind coxae, and metepimeron which is green-tinged but nearly black; dorsum sub-shining and thinly pale grey-dusted, but less dusted and darker copper-coloured along lines of ac and dc setae and at most seta insertion points; pleura ground colour mainly obscured by grey-white dust; scutellum more shiny on smooth central half, granular and coppery on lateral quarters; dorsum flat in front of scutellum in area bordered by last two dc and end of ac row; ac biserial in front (first 3 pairs), then uniserial (8 setae) but with setae pointing alternately left and right, row ending between 4th and 5th dc setae, fairly long, about ⅓ length of adjacent dc and about equal to distance between ac and dc rows; dc – 2 pre- and 4 post-suturals, 5th inset, 1-5 similar in size, the 4th the shortest, the 6th longest (about 1.3 x length of 5th); intra-alar – 1 pre- and 2 post-suturals in almost straight line; 1 strong posterior supra-alar; 1 moderately strong anterior supra-alar; anterior slope of dorsum with about 7 fine short black setae in front of dc, 3 longer black outside dc; 2 notopleurals, anterior stronger and almost on lower suture; 1 strong upper and 1 weak lower postpronotal; about

5 fine short white lower and about 11 fine white upper proepisternals; 3 (?4) short black pronotals either side; 3 fine white katepisternal hairs just in front of posterior spiracle; vertical row [5-6] of metepimeron hairs [equally spaced on posterior corner; only 3 visible in type], [single fine white setae at top and bottom of outer face, not visible in type]; scutellum with 2 long strong lateral, 2 very short fine 'apical' hairs and similar hair on side in front of lateral seta. **Legs.** All pale yellow of similar hue but black, although greyed by thin dust, on basal ⅔ of mid and most of hind coxae (yellow-tipped), outer basal corner of front coxa, tarsomeres 4+5 of front leg, 2-5 of mid and hind legs, and apical ½ of hind basitarsus; grading yellow to black on segments where colour changes. Chaetotaxy of legs: Front leg (I): coxa I – all hairs and apical setae yellowish white; femur I – short pre-apical pv scarcely longer than vestiture hairs; no ventral vestiture; tibia I – very short pd at apical quarter, its length about 1.5 times vestiture which is rather short and in regular rows, minute apicals; anterior apical comb well developed; tarsal I segments unmodified. Mid leg (II): coxa II – apical and outer anterior setae black, hairs white, inner apical setae white; trochanter II with 2 black ad setae [usually only 1]; femur II – black preapical anterior, posterior and pv just distal to anterior, ventral vestiture of fine pale hairs along most of length; tibia II – ad at ⅙ paired with pd, at ⅓, just beyond ½, small pd at ¾, weak ventral at ½; apicals ad, pd, av all strong, remaining apicals weak; tarsomeres II unmodified. Hind leg (III): coxa III – 1 strong black outer seta at basal ¼, a few tiny white hairs on upper and lower parts of outer face, and slightly stronger white hair below main seta; trochanter III – 1 black ad; femur III – black pre-apical pv, anterior and stronger av twice length of anterior; depth of femur 1.5 times maximum depth of mid and fore femora; tibia III – 4 ad and 4 pd more or less equally spaced but not paired except for the most distal setae; 2 av at apical ¼; 2 pv at apical ¼; anterior row on entire length of rather weak setae only slightly (about 1.2 times) longer than shaft width; posterior vestiture slightly denser in apical ⅕ ; small posterior apical comb; width of shaft marginally greater than mid tibia; tarsus III – basitarsus with ventral column at its base with bifid claws curving distally; 1 small nearly upright setae in mid ventral position; vestiture slightly longer in basal anterior cluster; remaining tarsomeres unmodified. Claws on all legs short, pulvilli reaching about ¾ claw length, empodium distinct. Length ratios of femur, tibia, tarsomeres 1-5 (relative to tarsomere 5 expressed as 1.0) in front leg 6.9/6.8/4.4/1.9/1.4/1.1/1, mid leg: 7.8/8.4/4.4/2.1/1.4/0.9/1, hind leg 7.9/10.4/2.6/2.6/1.6/1.1/1. **Wings.** Entirely hyaline, slightly grey-tinged, equally shaded all over; veins dark but costa and bases paler, yellow at extreme base proximal to vein h; venation typical of *Syntormon*; microtrichia even over all cells except extreme base of cells at root of wing where microtrichia are minute and sparse; calypter yellow with narrow slightly darkened margin where hairs arise, hairs yellow; [halter yellow with base of stem brown – missing (right-hand) or entirely obscured (left-hand) on type]. **Abdomen.** All tergites metallic green, shining but thinly dusted; T2 and T3 with yellow lateral patches extending full width of lateral margin and narrowing dorsally, on T2 nearly reaching the midline, more widely separated on T3; all setae and vestiture black dorsally but 2 white marginal setae on T1 on lower edge, white hairs on T1 laterally and anterior two ranks dorsally, white vestiture along lower margin of all tergites; dorsal vestiture of T2–T4 in 5-6 ranks; longest marginal setae about half tergite length; hypopygial capsule black; sternite 1 dark, 2, 3 and anterior corners of 4 yellow, 5 dark; sternite hairs white.

Discussion

When I started this study, I tended to agree with the opinion of several eminent dolichopodid workers that *S. pseudospicatum* is merely a variety of *S. pallipes*. It was therefore somewhat surprising that the morphometric analysis and habitat specificity indicate that they are almost certainly different. A key result is that the variation that so many previous authors persuaded themselves was gradual is actually discontinuous. Furthermore, there are small differences in the basitarsus shape that, along with the well-established leg colour and chaetotaxy, contribute to the separation of these two species. Not only are there strong morphological grounds for keeping the species separate but *S. pseudospicatum* has a narrow habitat range compared to that of *S. pallipes*, the former species being almost restricted to saltmarshes and other brackish sites in northern Europe where it may live alongside *S. pallipes*.

Criticism may be levelled at the use of untransformed ratios in both PCA and discriminant analysis, particularly as some of the most influential characters had bimodal distributions which cannot be normalised. Hills (1978) recommended using the logarithm of ratios but this did not appear to markedly affect the present results.

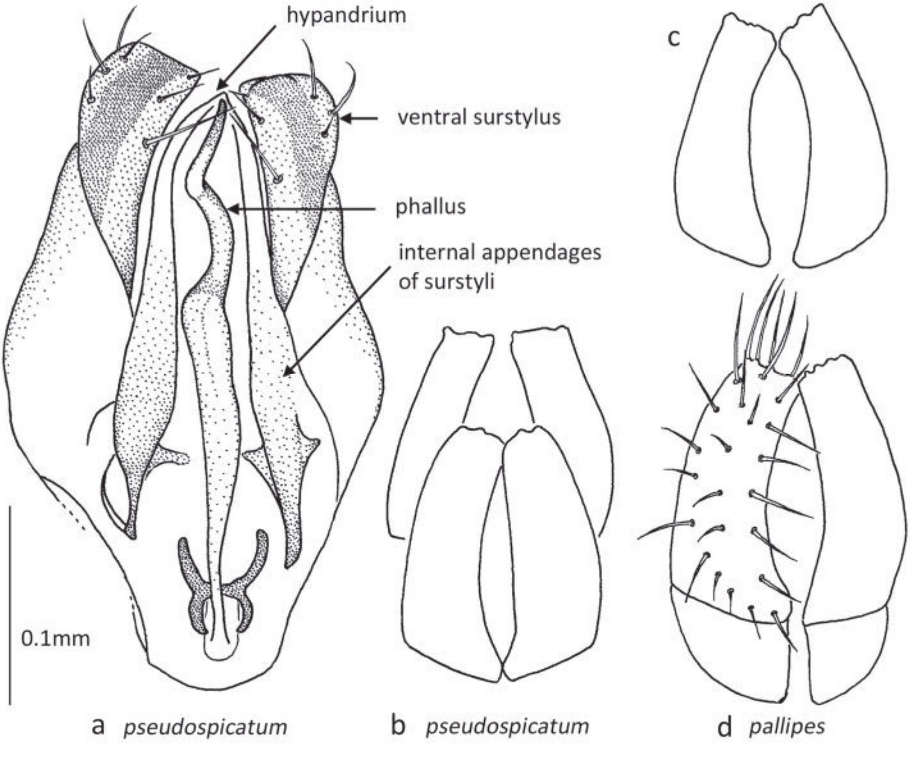


Fig. 7. Genitalia and cerci of *Syntormon pseudospicatum* and *S. pallipes*: (a) whole capsule in ventral view of *pseudospicatum*; (b) cerci of *pseudospicatum* (two examples); (c) cerci of *pallipes*; (d) cerci of *pallipes* (another specimen) showing setae and the basal membrane connecting the cerci to the capsule.

Since first submitting this paper for publication, Maslova *et al*. (2019) and Chursina and Grichanov (2019) published their papers on *S. pallipes* and *S. pseudospicatum*, and concluded that they were one variable species, *S. pallipes*. Maslova *et al*. (2019) illustrated the genitalia of both species and enumerated differences that they detected although, as they regarded *pseudospicatum* as a synonym of *S. pallipes*, they interpreted these differences as part of the variation within *S. pallipes*. Some of the described features appear due to the angle of view, particularly the length of the terminal section of the phallus, but also several differences in the cerci that they illustrated in dorsal view. I have illustrated the genitalia of *S. pseudospicatum* in ventral view (Fig. 7) which is identical to the figure of *S. pallipes* in Maslova *et al*., indicating that their figure of *S. pseudospicatum* with a rounded hypandrium is probably an artefact of the preparation. Two examples of the cerci of each species (Fig. 7) show slight variation but are effectively indistinguishable, and this suggests that the variation described by Maslova *et al.* (2019) is trivial (and their figures also inaccurately show the cerci as a single plate although it is two separate articulated appendages). My own conclusion is that the genitalia are indistinguishable (see also Drake in preparation). However, genitalia may not be the final arbiter in distinguishing species, particularly as the clearly distinct species *Syntormon monile* Haliday in Walker and *S. silvianum* Pârvu have very similar genitalia, and differences between the genitalia of several British *Syntormon* are trivial compared to conspicuous differences in their legs and antennae.

Chursina and Grichanov (2019) present a different issue. The chance must be vanishingly small of two studies being undertaken independently and concurrently on the same pair of species using morphometric analysis, and coming to the opposite conclusion. This has happened with *S. pallipes* and *S. pseudospicatum*. Chursina and Grichanov (2019) analysed one leg colour character, geometric morphometry of wing size and shape, and molecular sequences of COI and 12S rRNA. I cannot fault the work except for two points. The photograph of the hind leg of the taxon they call *S. pseudospicatum* does not resemble Strobl's type or any of the specimens I used in my analysis; in particular, the basitarsus is narrow and almost cylindrical, and the basal column with its terminal hooks lies at a shallow angle to the shaft, with the hooks apparently being almost undeveloped. Secondly, they identified specimens using Negrobov's (1975) key, in which the first character mentioned is the degree of division of the two hooks on the hind basitarsus, but I cannot see this difference between the specimens I have examined. Whatever the reasons for our different conclusions, they must explain both sets of results which cannot be dismissed since they are well supported by statistical analysis. In brief, Maslova and Grichanov (2019) described three main results. There were significant differences in wing centroid size and shape between populations from different geographic areas, and in shape (but not centroid size) between the two colour forms although the test statistic suggested a smaller difference between colour forms than between populations. Canonical variate analysis applied to wing shape did not clearly separate the two colour forms. Using molecular data, specimens of *S. pseudospicatum* from Iran could not be distinguished from *S. pallipes* from the same population or from Belgian *S. pallipes*. Finally, they found significant differences between populations in the ratio of the apical ring of the hind femur (and clearly a test of this ratio between colour forms could not be undertaken as the ratio for *S. pseudospicatum* has a mean and variance of zero). In contrast, my results show a conclusive discontinuity in the variation of leg colour and morphology, different habitat preferences, and colour variation that may be partly explained by seasonality but not geographic location. Of these, the pronounced habitat specificity of *S. pseudospicatum* is presumably under genetic control expressed through physiology or behaviour, which need not show a morphological counterpart.

There are three possible reasons for the difference in our results and conclusions. The most seductive, in that it encompasses both sets of results, is that the two taxa may be rapidly speciating so that some characters do show genuine differences, notably in leg morphology and colour, but not in wing or genitalia morphology. If this is the case then *S. pseudospicatum* has an uncertain status, and whether it is considered a species or given a lower rank becomes subjective.

Secondly, the two species may represent an example of polyphenism, which is the ability of animals with the same genotype to develop distinctly different alternative phenotypes without intermediates, resulting from the environmental conditions encountered during their development (Nijhout 1999). For instance, colour forms arise under different temperature regimes, as in syrphids (Rotheray and Gilbert 2011) and *Lonchoptera* (Baud 1973), and in Auchenorrhyncha feeding on different plant hosts (Claridge and Gilham 1992). In this scenario, *S. pseudospicatum* would be a polyphenotype of *S. pallipes* induced by saline conditions. One counter to this suggestion is that both species may be collected together on the same site and day. This suggests that larvae develop under similar conditions which would be expected to affect both species equally. I have not examined females in fine detail but other authors concur with my conclusion that there are no obvious differences in females collected with males of either species, yet if salinity is operating on one polymorphic species then it affects only male secondary sexual characters, which makes the suggestion suspect.

The third rather prosaic reason is that one of us is wrong, and that more detailed genetic analysis using a wider range of genetic loci may be needed to resolve this. If indeed *S. pseudospicatum* is shown to be merely a phenotype of *S. pallipes*, it would represent one of the most extreme examples within the Palaearctic dolichopodid fauna, having two remarkably disjunct forms in addition to marked continuous variation within the ringed, hairier form.

I continue the rest of this discussion on the assumption that the two species are distinct. Clearly, if they are one variable species than much of what is discussed will be inapplicable.

Both *S. pallipes* and *S. pseudospicatum* exhibit a wide variation in the colour of the second and third tergites, although in both species the tergites tend to be either completely dark green or largely yellow, with little of the gradation that is found in the leg colour of *S. pallipes*. It is of no taxonomic value despite Parent (1938) describing the form with dark tergites as *S. pallipes* and those with yellow patches as var. *pseudospicatum*. In my sample, yellow patches were found in roughly two thirds (69%) of *S. pseudospicatum* and one third (32%) of *S. pallipes*. Through the season, individuals of both species became ‘paler’ on average (that is, more specimens had large yellow tergite patches) and in *S. pallipes* the hind femur became paler on average (that is, the black apical rings became narrower). Early-flying individuals therefore tend to be darker than those found later in the year. If *S. pseudospicatum* was a pale form of *S. pallipes*, it would be expected to be more frequent later in the season, but this is clearly not the case; their seasonal distributions are similar (Figs 3, 4).

Several other species have been synonymised with *S. pallipes* or described as varieties: *Rhaphium hamatum* Zetterstedt, 1843, *S. uncitarsis* Becker, 1902, variety *inmaculatus* Santos Abreu, 1929, and subspecies *S. pallipes longistylus* Grichanov, 2001. *Syntormon uncitarsis* was synonymised with *S. pallipes* by Becker himself, perhaps with some resignation as he says (my translation) “At last, I too was able to convince myself of these great variations [described by Loew], and must therefore designate my species *uncitarsis* from Egypt as only a paler variant” (Becker 1918). His comment at the end of his 1902 description strongly suggests that it is indeed the same species as *S. pseudospicatum* as Becker says (my translation) “This species had so much in common with the description of *S. pseudospicatum* that I would not have dared to re-describe it had Prof. Strobl not established the difference by comparing my types with his own; he remarked ... that the touching of the eyes of his males in a point under the antennae was not, as I suspected, caused by shrinkage of the face, but represented the natural condition.” I too have examined one of Strobl’s males (the holotype, but Becker’s text implies that Strobl had more males) and I agree with Becker that the eyes touch because the face has shrunk, and it is hardly in its natural condition. I compared Becker’s description of *S. uncitarsis* against Strobl’s male, with which it agrees well apart from the face shape, minor differences in colour pattern that are within the wide variability of dolichopodids, and the hairs on the hind tibia which Becker described as absent (Die Hinterschienen haben durchaus keine borstliche Bewimperung). However, the description of *S. uncitarsis* does not fit the concept of *S. pallipes* that I have established in this paper, that is, with ringed femora and tibia and with moderately long stout hairs on the hind tibia. It may be relevant that the possible habitat of *S. uncitarsis* was brackish, in common with that of *S. pseudospicatum*. In his introduction, Becker gives the localities he visited in Egypt, and the locality of his *S. uncitarsis* at "Fayum" was the Fayum Oasis. Although this is a considerable way from the sea, about 200km, it is probable that Becker visited the saline Lake Qarun in this oasis area; this lake is now a Ramsar site and probably an attractive place for a dipterist to have visited on an extended expedition lasting, as Becker's did, from November to May. If *S. uncitarsis* was collected from a brackish site, then its habitat also fits that of *S. pseudospicatum*. I have not seen Becker's specimens, so hesitate to confirm a synonomy of *S. uncitarsis* with *pseudospicatum*, although it seems far more logical than placing *S. uncitarsis* as a synonym of *S. pallipes*.

Zetterstedt (1843) described *Rhaphium hamatum* which Loew (1850) synonymised with *S. pallipes*, but his description of the legs as yellow and the hind basitarsus as often pale at the base fits *S. pseudospicatum*, compared to variety 'a' of his new species whose hind femora have black apices, which fits *S. pallipes*. He goes on to briefly describe two male varieties of *S. pallipes* (and a third being represented by females only), based on the colour of the tergites and hind femora: 'b' is apparently a mixture of both *S. pallipes* and *S. pseudospicatum*, and 'c' is most likely to be *S. pseudospicatum*. Zetterstedt also gave a short description of *S. pallipes* but, comparing this with his new *R. hamatum*, I cannot understand why he thought his species was distinct, although he did seem unsure about the exact identity of Fabricius's *pallipes*. I have not seen his specimens but I guess that they include both *S. pallipes* and *S. pseudospicatum*, and therefore *S. hamatum* cannot be treated as a synonym of either species until a lectotype is designated. If it transpires that the most appropriate lectotype fits *S. pseudospicatum* then *hamatum* would become the senior synonym.

Grichanov (2001) described *S. pallipes longistylus* from Madagascar and stated that it was closely related to the 'subspecies' *pseudospicatum*, but did not enumerate the differences from this phenotype but only those from *S. pallipes pallipes* (the nominotypical subspecies having to be erected once subspecies are described). The considerably longer arista relative to the postpedicel of ssp *longistylus* puts it well outside the range of European *S. pseudospicatum*, with a ratio quoted as 41:25, that is, arista 1.64 times the length of postpedicel, compared to the maximum of 0.86 times in my *pseudospicatum* sample. Grichanov (2018) retained its status as a subspecies of *S. pallipes* (his earlier synonym with the nominotypical *pallipes* (Grichanov 2013) was apparently an error, Igor Grichanov *pers. comm.*), but there are conspicuous differences from both *S. pseudospicatum* and *S. pallipes* that suggest that it is a distinct species. As well as its Madagascan provenance and the long arista, other conspicuous differences are possessing only 5 strong dc setae (6 in European *Syntormon* (Parent 1938)), the fore coxae with black apical setae (not yellow), and yellow hind coxae (not grey with yellow tip).

Santos Abreu (1929) described var. *inmaculatus* from the Canary Isles. In his very detailed re-description of the nominal *pallipes*, the hind femora and tibia have dark apical rings and the basitarsus is blackish brown or almost completely black, so this must indeed be *S. pallipes*. However, his very brief description of his variant distinguishes *inmaculatus* from *pallipes* on only small differences in the colour of the face, frons and sternites and absence of the yellow patches on the second and third tergites. He did not mention the colour of the hind leg, which he surely would have done given his very detailed description of the nominal type. His females of var. *inmaculatus* differ from the nominal type in lacking yellow tergite patches. I have not seen his specimens but guess that they are the colour form of *S. pallipes* without yellow patches on the tergites. In both *S. pallipes* and *S. pseudospicatum*, the occurrence of yellow patches might be merely polymorphism (although I have not proven this), so var. *inmaculatus* probably has no taxonomic status. Santos Abreu himself used the term 'variety' for his new taxon, which under ICZN (1999) rules is infrasubspecific (ICZN Article 45.6.4), but the taxon given in the Palaearctic catalogue is a trinomial subspecies (Negrobov 1991). This is probably incorrect but is irrelevant if *inmaculatus* is only a colour variety of two other species. Incidentally, *S. inmaculatum* has been cited in Pollet (2011) and repeated in the PESI (2020) portal as *immaculatum* (with two 'mm'); this appears to be an unjustified emendation as *inmaculatum* (with an 'n') is acceptable Latin.

From a conservation perspective, *S. pseudospicatum* is far too widespread in Britain to deserve a conservation status but it is part of the assemblage strongly associated with saltmarshes and brackish sites. Such sites are well represented in Britain compared to some other European countries but they are not free of pressures from port development, truncation by sea defences, erosion and rising sea levels (Covey and Laffoley 2002) so identifying suites of specialists of this habitat is a valuable exercise. Even if *S. pseudospicatum* is eventually synonymised with *S. pallipes*, it remains a considerably more interesting form than many taxa that suffer synonymy, and should be recorded separately from *S. pallipes*.

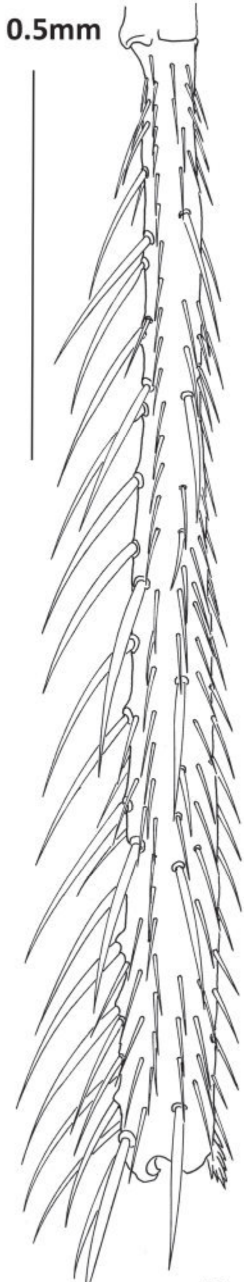
Identification

Negrobov's key, quoted in the introduction, used a hook character that is difficult to interpret since the two hooks in specimens that I have examined are mounted on the top of the column. Their separation from each other varies only slightly but inconsistently in *S. pallipes* and *S. pseudospicatum*; they never arise near the base of the column, but perhaps this is not what Negrobov meant and maybe details have been lost in translation. Strobl's type specimen of *S. pseudospicatum* differs from Negrobov's (1971) figure in the hind basitarsus being black in the apical half, and not entirely yellow as he probably mistakenly illustrated.

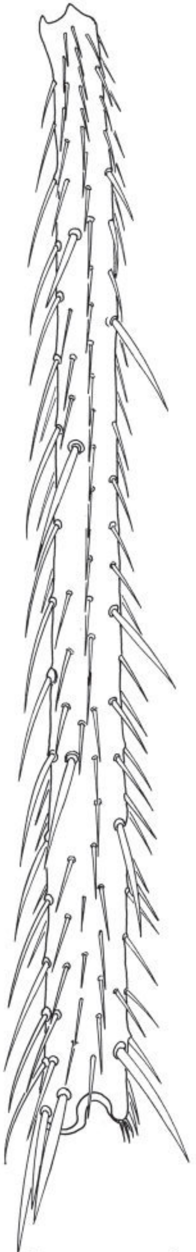
Discriminant analysis showed that three characters separate the species with no errors: ratio of the black ring to total length of the femur, the same ratio for the black ring on the basitarsus and the average length of the hairs on the tibial fringe. Although the ring on the tibia was not included in the analysis because it was so closely cross-correlated with the femur ring, it would also be another reliable character for separating the species. An additional useful character was the relative thickness of the fringe hairs to the adjacent antero-dorsal seta at the distal quarter of the tibia, although assessing this requires more care. The ratio of the lengths of the first two tarsal segments of the hind leg had a strong influence on the separation of the species in the discriminant analysis but the difference in the means, although highly significant, was trivial and certainly of no practical use in separating the species. The number of hairs in the tibial fringe was the same for both species, contrary to the impression given by Loew (1850) and Becker (1918) who described the fringe of *S. pseudospicatum* as sparser, or more scantily haired, than that of *S. pallipes*. It is not the number but stoutness and length of the hairs that give rise to the differing impressions of the density of hairing. In fact, the short subsidiary row has more hairs in *S. pseudospicatum* than in *S. pallipes*, although they are finer.

The following rather detailed couplet should separate nearly all specimens, although usually there will be no need to check more than the first three characters (separated by semicolons in the couplet). Despite this high level of detail, some outliers will almost certainly be found. Typical hind tibia, showing the fringes, and hind basitarsi showing the range of variation in the uprightness of the column with hook are shown in Fig. 8.

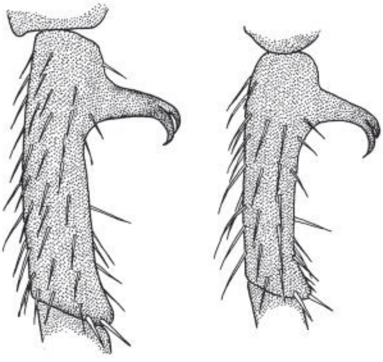
Fig. 8. Hind tibia, dorsal face, and two examples of hind basitarsus, anterior face, of *Syntormon pallipes* (a, c) and *S. pseudospicatum* (b, d). Both basitarsi on left-hand side are from Brittany, France, those on the right-hand side are from Devon, England; tibiae are of English specimens. The dark ring on the tibia of *S. pallipes* has been omitted for clarity; see Fig. 1.



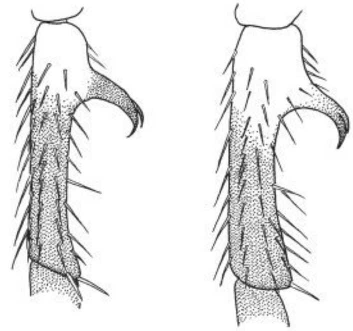
a. *pallipes*



b. *pseudospicatum*



c. *pallipes*



d. *pseudospicatum*

1 Hind femora and tibia each with a dark apical ring that may extend to their bases (Fig. 1a); hind basitarsus entirely black (Fig. 8c); anterior fringe of hind tibia composed of longer, thicker hairs (average length 1.8 x shaft diameter at penultimate antero-dorsal seta, rarely as short as 1.4 times, hairs nearly as stout as antero-dorsal setae, Fig. 8a); subsidiary apical hair row dorsal to the main anterior row usually with at least one apical hair as stout as those of the ad row, more usually 2-3 such hairs (Fig. 1c characters 12 &13); basitarsal column with hooks usually more upright (proximal edge making an angle of 55-85° with tarsus axis, Fig. 8c) .... *pallipes*

\- Hind femora and tibia entirely pale; hind basitarsus pale in about the basal third (Fig. 8d); anterior fringe of hind tibia composed of shorter, thinner hairs (average length 1.5 x shaft diameter at penultimate antero-dorsal seta, rarely as long as 1.9 times, hairs only 2/3 as thick as antero-dorsal setae, obviously thinner, Fig. 8b); subsidiary apical hair row dorsal to the main anterior row usually with no or only one apical hair as stout as those of the anterior row; basitarsal column with hooks usually more slanting and curved (proximal edge making an angle of 45-70° with tarsus axis, Fig. 8d) …………………………………. *pseudospicatum*

Acknowledgements

I thank Roy Crossley for fruitful discussion about the reality of *S. pseudospicatum* and for the loan of specimens, Richard Lane for learned discussion about morphometric analysis, the Naturhistorisches Museum, Vienna, Austria, for the loan of the type specimen of *S. pseudospicatum* from the Gabriel Strobl collection, Duncan Sivell (Natural History Museum, London) for arranging this loan and providing access to the NHM Diptera collection and Val McAtear of the Royal Entomological Society's library for providing obscure literature. Marc Pollet made many helpful comments on the first draft, and Igor Grichanov clarified the status of his Madagascan *S. pallipes longistylus*. Distribution maps were made using DMAP.

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Changes to the Irish Diptera List (30) – Editor

This section appears as necessary to keep up to date the initial update of the Irish list in Vol. **10,** 135-146 and the latest checklist of Irish Diptera (Chandler *et al*. 2008). Species are listed under families. The gain of 9 species cited here brings the total Irish list to 3458.

Mycetophilidae
Boletina bidenticulata Sasakawa & Kimura, 1974 (added by Chandler 2020b)
Leia longiseta Barendrecht, 1938 (added by Chandler 2020b)
Manota unifurcata Lundström, 1913 (added by Chandler 2020b)
Mycetophila gibbula Edwards, 1925 (added by Chandler 2020b)
Rymosia connexa Winnertz, 1864 (added by Chandler 2020b)

Platypezidae
Agathomyia lundbecki Chandler in Shatalkin, 1985 (added by R. Mitchell in Chandler 2020a)

Phoridae
Phalacrotophora fasciata (Fallén, 1823) (added by Nelson in the present issue)

Agromyzidae
Phytomyza brunnipes Brischke, 1881 (added by Warrington in the present issue)
Phytomyza stolonigena Hering, 1949 (added by Warrington in the present issue)

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Chandler, P.J. 2020a. Flat-footed Fly Recording Scheme Newsletter **3** Spring 2020. 4 pp. *Bulletin of the Dipterists Forum* No. **89**.
Chandler, P.J. 2020b. Fungus Gnats Recording Scheme Newsletter **11** Spring 2020. 8 pp. *Bulletin of the Dipterists Forum* No. **89**.

Dipterists Digest 2020 **27,** 83-88

The horseflies (Diptera, Tabanidae) of north Scotland

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Summary

An analysis of records of Tabanidae since 2000 in north Scotland in the Highland Biological Recording Group database and collection of the late Philip Entwistle shows the current presence of nine species. *Atylotus fulvus* and *Tabanus cordiger* are rare and local in the highlands; *Hybomitra distinguenda*, and *H. lurida* are scarce in the east; *Chrysops relictus*, *Haematopota crassicornis* and *Hybomitra montana* are frequent and widespread; *Haematopota pluvialis* and *Tabanus sudeticus* are common and widespread. The flight season for all except the early *H. lurida* peaks in July. *Chrysops caecutiens*, *C. viduatus* and *Hybomitra bimaculata* were recorded in small numbers before 1990 and may still be present in small numbers.

Introduction

The late Philip Entwistle (1931-2012) encouraged members of the Highland Biological Recording Group (HBRG) in 2004 to record horseflies to expand our knowledge of the family in the north of Scotland (Entwistle 2004, 2005, 2006, 2008). Since 2000 we have accumulated 407 records of 9 species, enough to provide an account of the current status of the family in the Highland Council local authority area, which covers vice-counties 96, 97, 104-109 and parts of 95 and 98.

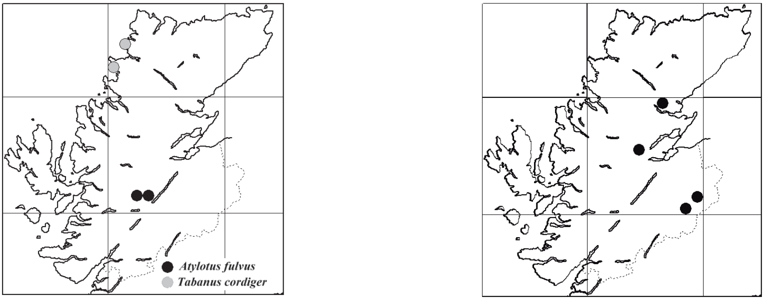
Methods

This paper is based solely on records in the HBRG database, including those in the collection of Philip Entwistle which is currently held by one of us (SM). Details of all the records used are available on the National Biodiversity Network Atlas (https://nbnatlas.org/). Records are casual and opportunistic with no systematic survey or monitoring, though the family has been targeted by HBRG since 2004. Records from non-specialists were always confirmed from photographs or specimens. Comments on wider distribution draw on maps in Harvey (2018). These maps include HBRG data.

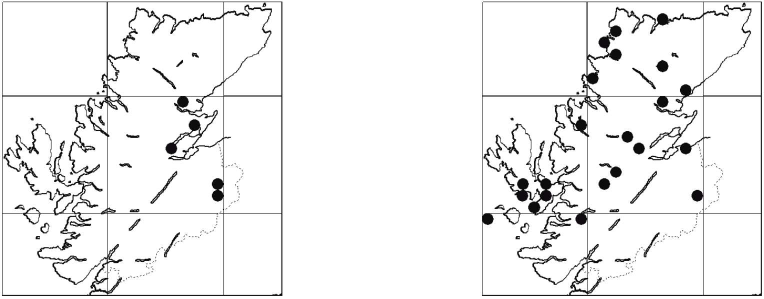
The species

This analysis is based on the records summarised in Table 1. In addition, HBRG holds a record of *Chrysops viduatus* (Fabricius, 1794) from 1984. Harvey (2018) maps records of *C. caecutiens* (Linnaeus, 1758) from 1989 and an unconfirmed record of *Hybomitra muehlfeldi* (Brauer in Brauer & von Bergenstamm, 1880) from 1911. Stubbs and Drake (2014) suggested that this may be the result of nomenclatural confusion, the old name *tropicus* referring also to *H. bimaculata*. A few old (pre 1990) records of *H. bimaculata* exist across the area, but records in 2005 and 2008 in Entwistle's collection and mapped in Harvey (2018) are errors. His specimens have been examined and are incorrectly labelled. Entwistle (2008) also mentions an old undated record of *Chrysops sepulcralis* (Fabricius, 1794) and *Hybomitra micans* (Meigen, 1804) 'unrecorded for over a hundred years'. Stubbs and Drake (2014) noted for *H. micans* that 'Verrall included the Scottish Highlands (Nethy Bridge)'. We have found no reference to any other Scottish record. It is possible that *C. caecutiens*, *C. viduatus*, and perhaps *H. bimaculata* are still present in Highland in small numbers.

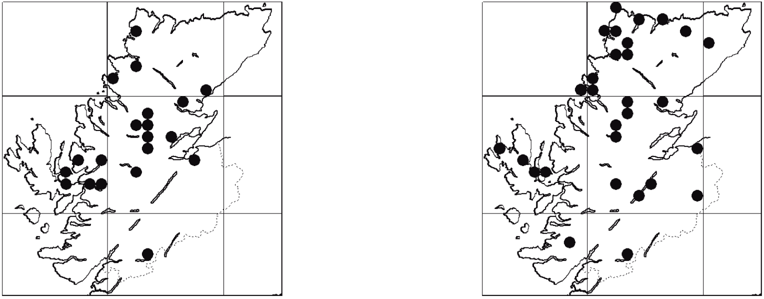
Three of our species are categorised by Drake (2017): *H. lurida* as 'Nationally Rare' and 'Vulnerable'; *A. fulvus* and *T. cordiger* as 'Nationally Scarce' and 'Least concern'.



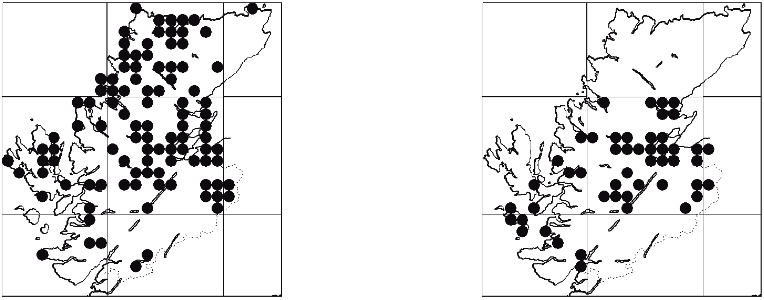
Atylotus fulvus, *Tabanus cordiger* *Hybomitra distinguenda*



Hybomitra lurida *Chrysops relictus*



Haematopota crassicornis *Hybomitra montana*



Haematopota pluvialis *Tabanus sudeticus*

Fig. 1. Distribution of Tabanidae in north Scotland in the Highland Biological Recording Group database.

Species	2000-2004	2005-2009	2010-2014	2015-2019	total records
Atylotus fulvus (Meigen, 1804)	0	4	7	3	**14**
Chrysops relictus Meigen, 1820	2	9	6	10	**27**
Haematopota crassicornis Wahlberg, 1848	1	12	6	4	**23**
Haematopota pluvialis (Linnaeus, 1758)	14	61	49	38	**162**
Hybomitra distinguenda (Verrall, 1909)	4	10	1	3	**18**
Hybomitra lurida (Fallén, 1817)	6	4	3	3	**16**
Hybomitra montana (Meigen, 1820)	1	24	8	5	**38**
Tabanus cordiger Meigen, 1820	1	1	0	0	**2**
Tabanus sudeticus Zeller, 1842	7	32	42	26	**107**
Totals	**36**	**157**	**122**	**92**	**407**

Table 1. Summary of the temporal range of records used in this paper. All are from the Highland Biological Recording Group database.

Distribution

The species can be assorted subjectively into four groups based on distribution and abundance. These are defined in Table 2. Maps for all species are shown in Fig. 1.

Species	Abundance	Distribution in Highland
Atylotus fulvus *Tabanus cordiger*	rare	very local
Hybomitra distinguenda *Hybomitra lurida*	scarce	eastern
Chrysops relictus *Haematopota crassicornis* *Hybomitra montana*	frequent	widespread
Haematopota pluvialis *Tabanus sudeticus*	common	widespread

Table 2. Subjective categories of abundance and distribution of Tabanidae in north Scotland in the Highland Biological Recording Group database.

Our data show no obvious association of any species with a particular habitat, though more systematic detailed observations might reveal such for the scarcer ones. They are generally found in open habitats, woodland edge and in rides and clearings in woodland. As noted by Entwistle (2008) and Stubbs and Drake (2014), several species (*C. relictus*, *H. pluvialis*, *H. montana*, *T. cordiger* and *T. sudeticus*) are readily attracted to recently parked vehicles.

Reflecting the distribution of recorders, most records are from relatively low altitudes, below 150m, but *H. crassicornis* has been found at 400m; *H. pluvialis* at 320m; *H. montana* at 270m; and *T. sudeticus* at 874m.

Phenology

Except for the early-flying *H. lurida*, the species have very similar flight seasons concentrated in June and July. These are detailed in Table 3 and Fig. 2. The early flight season of *H. lurida* may make it appear scarcer than it really is. Flies active in spring in Highland are traditionally severely under-recorded because of the lack of resident dipterists.

Species	First date	Last date	Length of season (days)
Atylotus fulvus	21 June	23 September	94
Chrysops relictus	13 June	8 August	56
Haematopota crassicornis	23 June	31 July	38
Haematopota pluvialis	9 June	23 August	75
Hybomitra distinguenda	5 June	24 July	49
Hybomitra lurida	27April	19 June	53
Hybomitra montana	9 June	29 July	50
Tabanus cordiger	2 August	4 August	data deficient
Tabanus sudeticus	21 June	25 August	65

Table 3. Phenology of Tabanidae in north Scotland in the Highland Biological Recording Group database.

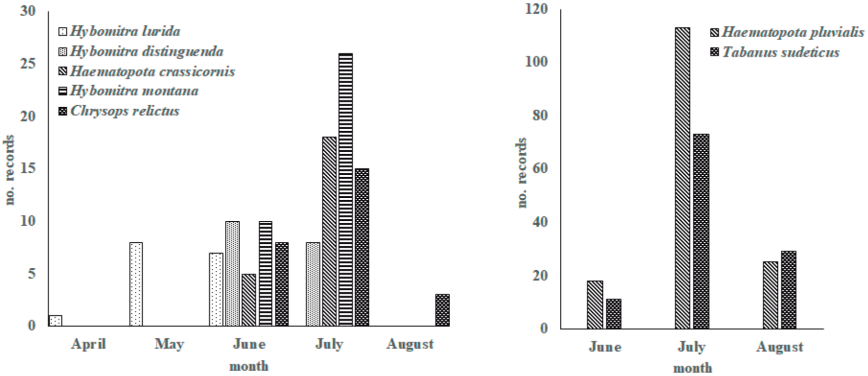


Fig. 2. Phenology of Tabanidae in north Scotland in the Highland Biological Recording Group database. *Atylotus fulvus* and *Tabanus cordiger* are omitted because of inadequate data.

Notes on selected species

Atylotus fulvus. This fly is known from old records in Scotland but was thought extinct there for over 70 years until found in Glen Moriston (NH21, 31; vice-county 106) by Jane Bowman in 2005 (Stubbs and Drake, 2014). It appears to be well-established in that area, having been seen frequently up to July 2019, though not all encounters have been formally recorded. Outside Highland it was found on 14 July 2013 by Hayley Wiswell at Kinloch Rannoch (NN65, vice-county 88). The Soldierflies and Allies Recording Scheme has records from 2016 and 2017 on Mull (NM31 and NM42, vice-county 103). *A. fulvus* remains a very scarce fly in Scotland, but in Glen Moriston at least it seems not to give immediate cause for concern.

Chrysops relictus. The striking appearance of this fly encourages submission of photographs by non-specialists, especially as it bites humans freely, so it is probably over-represented in our data. Numbers of records vary substantially from year to year, though the reasons for this are not clear. Only two were reported from 2014-16 and none in 2017, but 2018 saw six records.

Haematopota crassicornis. Edwards *et al.* (1939) highlighted the unusual frequency of males of this species in collections, suggesting that this species is ‘less prone to attack man than are those of the other species’. In our records where the sex was specified, in *crassicornis* the sex ratio was 5 males : 7 females, while in *pluvialis* it was 5 males : 48 females. The sample is small, but consistent with the earlier observation.

Haematopota pluvialis. 'The' Cleg is a scourge of the Highlands in summer, often encountered in large numbers. It will feed on any available exposed human skin, often raising painful and sometimes persistent sores, though some people are scarcely troubled by them. It is almost ubiquitous away from built-up areas. Many gaps in the map are probably explained by lack of recording effort rather than lack of flies. Very common species are not reported as diligently as rarer ones, and the identification of *H. pluvialis* requires specialist examination, so it is probably under-represented in our data.

Tabanus cordiger. Our only two records – and the only post-1989 records we have found – are from Sutherland, vice-county 108 on 2 August 2004 and 4 August 2009. It appears that this is very scarce in Highland.

Tabanus sudeticus. This spectacularly large fly is widespread in our area though probably absent from the far north (NC and ND) where five far less noticeable species have been recorded. The data show very wide inter-annual variation in numbers of records. Although recorded in every year from 2001-2019, numbers per year ranged from 1 to 22. 2008 and 2012 had 14 and 22 records respectively while no other year exceeded 8 records. Recorder effort is not an obvious driver as the variation is not evident in other species, and it seems clear that the population fluctuates significantly. We have not noted any tendency of this fly to bite humans. Sue Tarr (*pers. comm.*) has noted a distinct association with cattle. Jane Bowman (*pers. comm.*) has observed it feeding at fermenting sap-runs created by goat moth *Cossus cossus* larvae. Although usually encountered in rural habitats, we have six records from urban Inverness.

Discussion

Given that tabanids are thermophilic and dislike wind (Stubbs and Drake 2014) it is something of a surprise that northern Scotland holds 9, possibly 12, of the 30 British species. However, only five species are widespread and two really common there. None of the species is confined to the north, though arguably some populations are important within the UK.

Hybomitra lurida has its main range in north Scotland (Stubbs and Drake 2014). Other species (*A. fulvus*, *H. distinguenda*, *H. montana*) appear to have disjunct distributions in Great Britain, the Highland or wider Scottish ranges clearly separate from those farther south. In some cases, this might be an artefact of patchy recording effort, though large empty areas in the south of Scotland and northern England, areas where Diptera are reasonably well covered and other tabanids are mapped, suggests that significant gaps are real.

The clearest example is perhaps *A. fulvus*, whose known Scottish population is separated from the nearest in the north of England by some 300km. *Hybomitra distinguenda*, and to a lesser extent *H. montana*, show a gap in Central and Southern Scotland of 150-200km (Harvey 2018). If real, these gaps in distribution increase the importance of the Highland populations, but the absence of hard information on the precise ecological requirements of the flies will make targeted conservation actions difficult, even for the rarer northern species.

Acknowledgements

We are indebted to all the naturalists who provided records to HBRG, particularly the late Philip Entwistle who stimulated the group's interest in this family and provided many records through his collection. The draft was read by Jimmy McKellar, and Martin Harvey who provided useful details from the Soldierflies and Allies Recording Scheme. Maps were prepared with DMAP.

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The ladybird parasitoid *Phalacrotophora fasciata* (Fallén) (Diptera, Phoridae) new to Ireland – In May 2019, on a visit to Brackagh Moss Nature Reserve (J017510), County Armagh, Northern Ireland, some batches of *Coccinella septempunctata* (Linnaeus, 1758) eggs were seen in the cracks on some chestnut paling. Over the next few weeks, ladybird larvae were seen on the same paling with pupae present on 23 June. Whilst photographing one of these pupae, a small orange fly was observed inserting its ovipositor on the underside of a pupa. Some of the photographs taken were posted on the UK Ladybirds Facebook page and Richard Comont identified the fly as a phorid parasitoid of the genus *Phalacrotophora*. This genus is represented by four species in Great Britain, but only *P. berolinensis* Schmitz, 1920 is listed as Irish (Chandler, P.J., O'Connor, J.P. and Nash, R. 2008. *An annotated checklist of the Irish two-winged flies* (*Diptera*). 261 pp. The Irish Biogeographical Society in association with The National Museum of Ireland). It was decided to rear the parasitoid to determine which species was present at Brackagh Moss and RC gave advice on how to do this and what to expect.

Eleven pupae were collected on 24 June and placed individually in plastic pots which were kept indoors. Four pupae died for unknown reasons and one produced an adult ladybird. Phorid larvae emerged from six pupae and they in turn pupated, with adults emerging between 18 and 22 July. The numbers of adults obtained totalled 34 (individual totals of 13, 10, 7, 3, 1 and 0) with a sex ratio of 18 males and 16 females. These were initially determined as *P. fasciata* (Fallén, 1823) by BN using the key by R.H.L. Disney and P. Beuk (1997. European *Phalacrotophora* (Diptera: Phoridae). *Entomologist's Gazette* **48,** 185-192). Specimens were sent to RC who agreed with the identification. BN also checked for the possible occurrence of *P. harveyi* recently described by R.H.L. Disney and D.A. Smith (2016. A new species of *Phalacrotophora* Enderlein (Diptera: Phoridae) from England. *Entomologist's Monthly Magazine* **152,** 189-192), but all the female specimens examined conformed to *P. fasciata*. Voucher specimens will be deposited by BN in the National Museum of Ireland. I wish to thank Richard Comont for his advice and help in rearing and determining the species – **BRIAN NELSON,** 37 Derrycarne Road, Portadown, Co Armagh, BT62 1PT; brian.37derrycarne@btinternet.com.

Dipterists Digest 2020 **27,** 89-90

Nuptial gifts in *Rhamphomyia* (Diptera, Empididae)

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Summary

Mating behaviour in *Rhamphomyia sulcata* (Meigen, 1804), involving presentation of a prey insect to the female, is described and discussed.

On 16 May 2013, I was puzzled to observe, clinging to the outside wall of my conservatory (Codford, Wiltshire, ST966402) a complex dipteran grouping which I'd never seen before. The photographs I managed to take before the pairing dissolved led me into a fascinating field of study. The species is of course *Rhamphomyia sulcata* (Meigen, 1804), and I was a privileged observer of a coupling in which the male has presented the female with a 'gift' - in this case a small bibionid (Fig. 1) – to 'distract her attention' while he copulates with her.

Fig. 1. Mating pair of *Rhamphomyia sulcata* (Meigen) with a bibionid prey.

This behaviour is not restricted to the Empidinae, but has been most carefully studied in this taxon. Osten-Sacken (1877) first noted it among *Hilara* species, and the American entomologist Edward Kessel (1955) published a definitive paper. He may have been the first to use the phrase 'nuptial gifts', and he noted that while the 'gift' often consisted of a dead insect, in other cases (as Osten-Sacken had observed) the gift was an insect wrapped in silk, and in some cases the silk wrapping itself *was* the gift. Kessel studied *Empis bullifera* Kessel & Kessel, 1951 in California, and agreed with other researchers that the material of the 'silk' secretion came from the salivary glands as the empid attacked the prey. In *Hilara*, on the other hand, it seems that the secretion is produced by the male expanded front metatarsus. Kessel pursued his observations to the point of remarking that there appeared to be an evolutionary trend towards a condition in which the nuptial gift has no food value. He named the successive stages 1 to 8. On this scale, my observation of *R. sulcata* is at stage 2; by stage 8 the gift package contains no prey at all. This has led in turn to studies of what have come to be called 'worthless nuptial gifts.' LeBas *et al*. (2004) concluded that female behaviour in genuine gift-giving species is susceptible to the occurrence of male 'cheating'; and they concluded that worthless gift-giving may have evolved through sensory exploitation of female preferences for edible gifts. LeBas and Hockham (2005) also observed a pairing in which the gift was the body of a female *R. sulcata.*

Other taxa in which similar behaviour has been observed include bushcrickets and other Orthoptera; there is a huge literature on sexual signals among insects, courtship behaviour and paternal selection. But it seems that Empididae have evolved this gifting behaviour to its widest extent and most frequent demonstration. It is very hard not to use anthropomorphic metaphors in describing what it going on, but we should resist that temptation. This is not a case of boy meets girl and bribes her to let him have his wicked way with her. Are we to suppose that males of these species 'cheat' and/or that the females are 'duped'? The phenomenon seems instead to have evolved to correlate mating effort with paternal investment, and has been observed in several insect groups (Sadowski *et al*. 1999). The size of the gift does not seem to be important in the selection factors of the females; some researchers have found that females base their selection on an assessment of the size of the gift, but in an inverse sense; bigger is not necessarily better.

Moreover, Ritchie and Vahed (2011) have drawn attention to an extraordinary addition to the list of deceptive traits, demonstrated by the males of a new species of empid from Mt. Fuji, *Empis* (*Coptophlebia*) *jaschhoforum* Daugeron, in which the fifth tarsal segment (not the metatarsus) is modified on either one or both forelegs. The authors hypothesise that this could reflect antagonistic frequency-dependent evolution between males and females, in a sexual system driven by cheating in which gift-giving is mimicked. Clearly research and speculation will continue. Apart from the fascinating study and speculation which this behaviour opens up, my experience shows, almost above all, how a chance observation can broaden one's knowledge and stimulate further investigation. A few minutes later and I would have been too late.

Acknowledgements

I thank Nigel Jones and Steve Hewitt for valuable comments.

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Dipterists Digest 2020 **27,** 91-100

Some cranefly records from Cazorla National Park, Jaén Province, Spain with description of a new species of *Baeoura* (Diptera, Tipuloidea)

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Summary

Two visits to the Cazorla Parque Natural, Jaén Province, Spain in 2018 and 2019 have resulted in several species records that are new to Spain or the Iberian Peninsula in general. A new species of *Baeoura* Alexander, 1924 (Limoniidae) is described. A subspecies of *Tipula* (*Yamatotipula*) *afriberia* Theowald & Oosterbroek, 1980, namely *italica* Theowald, Dufour & Oosterbroek, 1982, is elevated to species level. *Dicranophragma* (*Brachylimnophila*) *nemorale* (Meigen, 1818) is a new record for Spain; *Dicranomyia* (*Dicranomyia*) *imbecilla* Lackschewitz, 1941 and *Gonomyia abscondita* Lackschewitz, 1935 are new to the Iberian peninsula.

Most samples were obtained by sweep netting along the valley of the Rio Guadalquivir and its tributaries. Published and some earlier unpublished records are incorporated.

Introduction

The list of species of tipuloid Diptera recorded in 2018 and 2019, all identified by the author, is given in alphabetical order within the three families. Commentary on status is given where thought of interest and earlier records from the area are included. Abbreviated collectors' names are given as E.G. Hancock (EGH); Vladimir Blagoderov (VB); Stephen Hewitt (SMH). Preserved samples have been lodged in the Hunterian Museum, University of Glasgow (Entry Numbers, 2018.7.5 and 2019.10.6) and specimens also deposited in the University of Alicante and National Museums Scotland. Details of the sampling sites, mostly by use of a sweep net, are listed here with GPS decimal coordinates to avoid repetition within the list.

Arroya de las Aquascebas, along the Aguascebas de Gil Cobo track, 38.168, -2.889
Cueves del Peinero, stream margins, 38.102, -2.868
Iznatoraf, wet rock face with extensive tufa deposits next to road, 38.117, -2.890
Los Tableros, seepage and wet rock face, 38.122, -2.879
Rio Guadalquivir, unless otherwise stated this covers the area along the river valley from the Hotel Mirasierra for a few kilometres downstream past Coto Rios as far as the Control de Aguamula. Coordinates centred at 38.049, -2.848
Sierra de Segara, Pontones, Nacimiente de Segara, 38.105, - 2.691
Vadillo Castril, Loma de la Mesa, amongst pines, 1600m, 37.993, -2.915
Vadillo Castril, Arroya Frío Ó de los Urbios, 37.937, -2.904

The data presented here increase knowledge of the fauna of Spain and complement recent papers by Dr Jorge Mederos (e.g. Mederos and Eiroa 2015, 2016 and 2017) and Dr Miguel Carles-Tolrá (e.g. Carles-Tolrá 2010). Some earlier tipuline records from Cazorla (Dufour and Oosterbroek 1990; Dufour 1991) are from the autumnal period and have not been confirmed by more recent visits at that time of year.

Species List

Tipulidae

Dolichopeza albipes (Strom, 1768). Rio Guadalquivir, swept by tributary stream, 29.v.2018, 1♂, VB.

Nephrotoma appendiculata pertenua Oosterbroek, 1978. Rio Guadalquivir, 900 m, 23.iv.1994, P. Oosterbroek & C. Hartveld (*pers. comm.*, August 2018).

Nephrotoma cornicina (Linnaeus, 1758). Cueves del Peinero, swept by stream, 16.vi.2019, 2♂, EGH.

Nephrotoma guestfalica (Westhoff, 1879). Rio Guadalquivir, 26.v-1.vi.2018 and 11-17.vi.2019, abundant in area, EGH.

Nephrotoma luteata (Meigen, 1818). Rio Guadalquivir, 26.v-1.vi.2018, 1♂, 1♀; 16.vi.2019, 1♂, EGH.

Nephrotoma scalaris scalaris (Meigen, 1818). Rio Guadalquivir, 26.v-1.vi.2018, 1♂; Cueves del Peinero, 16.vi.2019, 1♂, EGH.

Tipula (*Lunatipula*) *acuminata* Strobl, 1900. Rio Guadalquivir, 900 m, 23.iv.1994, P. Oosterbroek & C. Hartveld (*pers. comm.*, August 2018); Rio Guadalquivir, 26.v-1.vi.2018, 2♂, EGH & SMH.

Tipula (*Lunatipula*) *cinereicolor* Pierre, 1923. Rio Guadalquivir, 26.v-1.vi.2018, 7♂, 1♀; Cueves del Peinero, 16.vi.2019, 5♂, 3♀; Los Tableros, seepage and wet rock face, 13.vi.2019, 1♂, EGH; Arroya de Aguascebas, attached to leaves of butterwort (*Pinguicula vallisneriifolia* Webb), 16.vi.2019 (Hancock and Hewitt 2020).

Tipula (*Lunatipula*) *cirrata* de Jong, 1995. Rio Guadalquivir, swept mainly along streams, 26.v-1.vi.2018, 7♂, EGH; Arroya de Aguascebas, attached to leaves of butterwort (*Pinguicula vallisneriifolia* Webb), 16.vi.2019 (Hancock and Hewitt 2020).

Data from type material: Rio Guadalquivir, 900 m, 22.iv.1994 and Rio Aguamula, 700m, 23.iv.1994, P. Oosterbroek & C. Hartveld (de Jong 1995).

Tipula (*Lunatipula*) *fabiola* Mannheims, 1968. Arroya de Aguascebas, attached to leaves of butterwort (*Pinguicula vallisneriifolia* Webb), 16.vi.2019, 1♂ (Hancock and Hewitt 2020).

Tipula (*Lunatipula*) *iberica iberica* Mannheims, 1963. Rio Guadalquivir, 26.v-1.vi.2018, common in area, EGH; Cueves del Peinero, 16.vi.2019, 2♂, EGH; Arroya de Aguascebas, attached to leaves of butterwort (*Pinguicula vallisneriifolia* Webb), 16.vi.2019 (Hancock and Hewitt 2020).

Tipula (*Lunatipula*) *pustulata* Pierre, 1920. Vadillo Castril, Loma de la Mesa, dry habitat sweeping amongst open pines, 1600m, 14.vi.2019, 5♂, 3♀, EGH.

Tipula (*Lunatipula*) *subfalcata* Mannheims, 1967. Rio Guadalquivir, 26.v-1.vi.2018, 4♂; Cueves del Peinero, 16.vi.2019, 2♂, 4♀, EGH.

Tipula (*Mediotipula*) *nitidicollis* Strobl, 1909. Rio Guadalquivir, 26.v-1.vi.2018, 2♂; 12-17.vi.2019, 1♂, EGH.

Tipula (*Savtshenkia*) *subsignata cazorla* Dufour, 1991. Data from type description: Sierra de Cazorla, 3 km west Blanquillo Mtn, Lancha de la Cigara, 1100m alt., "bord de rivière, joncs, falaises calcaires, St.18", 29.ix.1989, C. Dufour & J.P. Haenni (Dufour 1991).

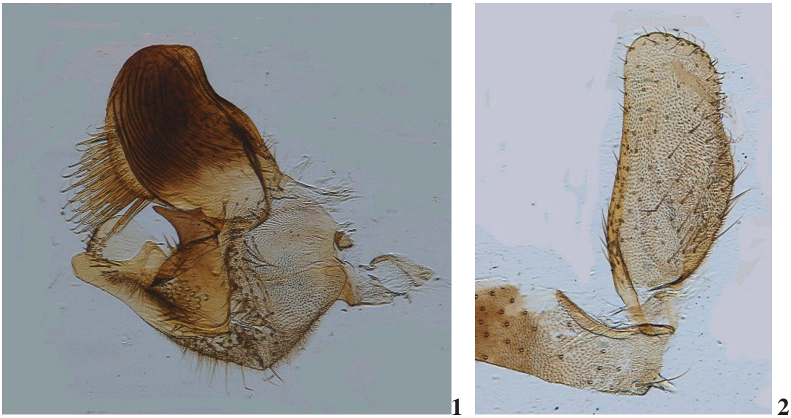
Tipula (*Tipula*) *(?) oleracea* Linnaeus, 1758. Rio Guadalquivir, 26.v-1.vi.2018, 1♀, EGH.

Tipula (*Vestiplex*) *vaillanti andalucia* Dufour & Oosterbroek, 1990. Data from type description: 8km southwest of Blanquillo, Embalse de Aguaderondo, 1000m, forêt Claire broussailleuse, bord de ruisseau, 29.ix.1989, Dufour & Haenni (Dufour and Oosterbroek 1990). Also, 2♂ collected by M. v. Veen, 4.ix.1993 (*pers. comm.*, August 2019).

Tipula (*Yamatotipula*) *afriberia* Theowald & Oosterbroek, 1980. Rio Guadalquivir, 26.v-1.vi.2018, 2♂; 17.vi.2019, 1♂, 1♀, EGH. Also recorded in the Rio Guadalquivir area at 900 m, 23.iv.1994, P. Oosterbroek & C. Hartveld (*pers. comm.*, August 2019).

Taxonomic Note: *T. afriberia* was described initially as a subspecies of *montium* Egger, 1863, based on material from north Africa (Morocco and Algeria) and southern Spain (Malaga and Teruel) and subsequently elevated to species level (Oosterbroek 1994). A subspecies was added, *afriberia italica* Theowald, Dufour & Oosterbroek, 1982, occurring from Austria, southern Switzerland, Italy, Slovenia and westwards to Portugal. The specimens from Cazorla are consistent with *afriberia* s.s. as described and illustrated by Oosterbroek (1994) in all features of the hypopygium and clearly distinct from *italica*. A male of *T. afriberia* from Cazorla whose genitalia have been cleared to show details is illustrated (Figs 1-3). The distribution of these two taxa overlap within the Iberian Peninsula, for example both are known from the province Teruel (Oosterbroek 1994; Eiroa and Carlos-Tolrá 2019) and *italica* is here elevated to species status:

Tipula (*Yamatotipula*) *italica* Theowald, Dufour & Oosterbroek, 1982, stat. n.



Figs 1-2. *Tipula* (*Yamatotipula*) *afriberia* from Rio Quadalquivir, 2018: 1, inner dististyle; 2, outer dististyle.

Fig. 3. *Tipula* (*Yamatotipula*) *afriberia* from Rio Quadalquivir, 2018, gonapophyses and aedeagal guide with 8th sternite.

Tipula (*Yamatotipula*) *barbarensis* Theowald & Oosterbroek, 1980. Rio Guadalquivir, 26.v-1.vi.2018, 1♂, Hotel Mirasierra, 1♂, EGH. Rio Guadalquivir, 900m, 23.iv.1994, P. Oosterbroek & C. Hartveld (*pers. comm.*, August 2018). This species is found elsewhere in south-east Spain, the Baleares and Northwest Africa.

Limoniidae

Antocha vitripennis (Meigen,1830). Rio Guadalquivir, 26.v-1.vi.2018 and 11-17.vi.2019, EGH. Abundant along entire river valley; an older record from specimen data in the Hunterian Museum from Coto Rios in pitfall trap and other samples, 13-16 September 1976, M.J. Morgan; Arroya de Aguascebas, attached to leaves of butterwort (*Pinguicula vallisneriifolia* Webb), 16.vi.2019 (Hancock and Hewitt 2020).

Austrolimnophila latistyla Starý, 1977. Arroya de Aguascebas, attached to leaves of butterwort (*Pinguicula vallisneriifolia* Webb), 16.vi.2019 (Hancock and Hewitt 2020).

Baeoura rotherayi sp. nov.

Holotype: Spain, Jaén Province, Cazorla, Cueves del Peinero, 16.vi.2019, ♂, swept by stream, E.G. Hancock. Hunterian Museum Acc. No. 162700 (left wing mounted separately on microscope slide No. 485).

Description: Overall body colour blackish brown, shiny under a slight tomentose dusting and with short pale hairs; length 2.4mm. Antennal scape, pedicel and four basal flagellomeres shortly oval, clothed in short white hairs; flagellomeres 5-13 with verticils and lacking short hairs hence visibly shiny; each segment progressively longer and narrower towards apex. Thorax pale yellow laterally along dorsum margin and pale on upper parts of pleural edge where they meet this line; lower parts of pleura becoming pale brown; ventral area pale yellow from the neck down between the leg bases; apical half of scutellum yellowish brown. Mid and fore coxae brown, hind coxa pale, legs shiny black with short black hairs. Wing length 4.8mm, membrane tinged grey-brown; Sc_1 meets costa beyond fork in Rs (Fig. 4). Hypopygium with gonostylus complex seen in lateral view (Fig.7a) and aedeagus elongate and sinuous (Figs 5, 7b); parameres recurved, basal part slightly diverging and apical section curved inwards (medially); at the return angle a prominent spur extends apically protruding beyond the ends of the gonocoxites (Figs 5, 6, 7c).

Etymology: This species is named for Graham E. Rotheray, fellow dipterist and friend over many years.

Comments: This new species was collected by sweeping along the sides of the Arroya del Raso de la Honguera and the Arroya de Aguascebas Grande in an area of open pine woodland at an amenity site with car parking, walking trails and a picnic area. The site, called Cueves del Peinero, had several other interesting species as referred to in this list. Physically, *B. rotherayi* is very similar to *B. armata* Mendl, 1985 (Figs 7 d-f) which is known only from Crete. The principal differences are in the shape of the gonostylus and the presence of a spur emanating from the return angle of the re-curved parameres. The aedeagus is longer and more sinuous. Two other species of *Baeoura* have been described from Iberia: *B. longefiligera* Mendl, 1986 was described from a single male from Arroyo de la Vid (Caceres) and *B. ebenina* Starý, 1981 which is known from Spain, Portugal and Morocco. In the key provided by Driauach and Belqat (2015), *B. rotherayi* runs to the last couplet (number 8), being a blackish species with Sc_1 reaching beyond fork of Rs and can be accommodated as follows:

8. Tergite 9 with short, broad lobe on each side of its posterior margin (Corsica and Sicily) .... *B. directa* (Kuntze)

– Tergite 9 without broad lobes ………………….. 9

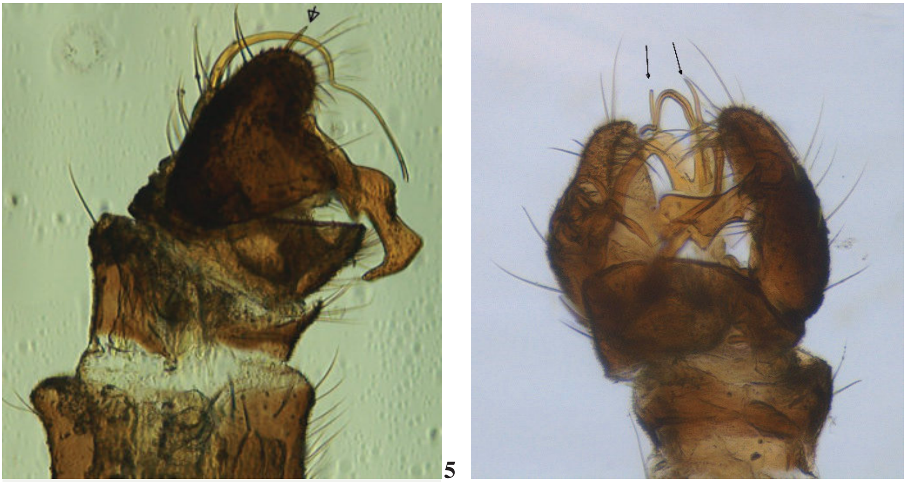
9. Parameres strongly recurved with a spur at the return angle (Figs 6, 7c); aedeagus strongly sinuous (Figs 5, 7b) (Spain) .... *B. rotherayi* sp. nov.

– Parameres with no spur at the return angle (Fig. 7f); aedeagus slightly sinuous (Fig. 7e) (Crete) …………………………………………………………………………….. *B. armata* Mendl

Dicranomyia (*Dicranomyia*) *chorea* (Meigen, 1818). Rio Guadalquivir, common in the area, 26.v-1.vi.2018 and 11-17.vi.2019, EGH; Arroya de Aguascebas, attached to leaves of butterwort (*Pinguicula vallisneriifolia* Webb), 16.vi.2019 (Hancock and Hewitt 2020).

Dicranomyia (*Dicranomyia*) *didyma* (Meigen, 1804). Rio Guadalquivir, common near river bank and surrounding areas, 26.v-1.vi.2018; 11-17.vi.2019, EGH; Arroya de Aguascebas, attached to leaves of butterwort (*Pinguicula vallisneriifolia* Webb), 16.vi.2019 (Hancock and Hewitt 2020).

Fig. 4. Wing of *Baeoura rotherayi* sp. nov., length 4.8mm.



Figs 5-6. Hypopygium of *Baeoura rotherayi* sp. nov.: 5, lateral view, arrow points to spur on parameres; 6, dorsal view, arrows point to spur on parameres.

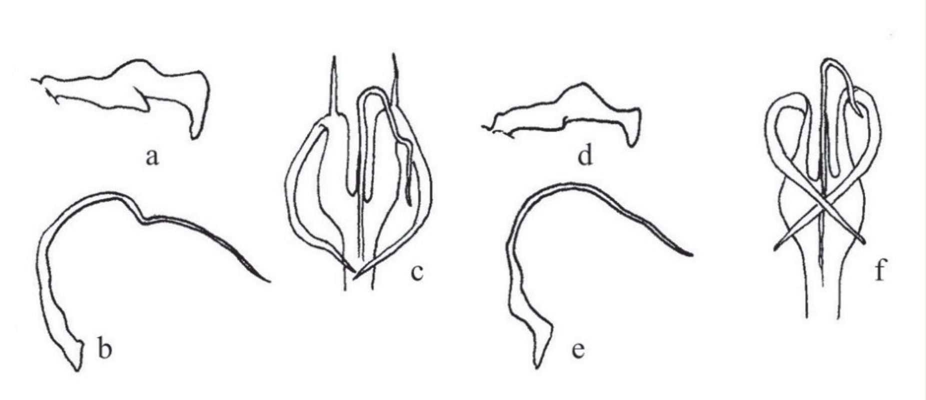


Fig. 7. Details of hypopygium of *Baeoura rotherayi* sp. nov.: a, gonostylus; b, aedeagus, lateral view; c, aedeagus and parameres, ventral view. *B. armata*: d, gonostylus; e, aedeagus, lateral view; f, aedeagus and parameres, ventral view (after Mendl, 1985).

Fig. 8. Rock face over 4 metres high covered with thick tufa deposit on roadside near Iznatoraf; *Dicranomyia imbecilla* was common, resting on the wet surfaces.

Dicranomyia (*Dicranomyia*) *lucida* de Meijere, 1918. Arroya de Aguascebas, attached to leaves of butterwort (*Pinguicula vallisneriifolia* Webb), 16.vi.2019, 2♂ (Hancock and Hewitt 2020).

Dicranomyia (*Dicranomyia*) *goritiensis* (Mik, 1864). Rio Guadalquivir, by wet rocks on side stream, and in Malaise trap, 26.v-1.vi.2018, EGH & VB.

Dicranomyia (*Dicranomyia*) *imbecilla* Lackschewitz, 1941. Swept near Hotel Mirasierra, 6.v-1.vi.2018, 3♂, EGH & SMH; wet rocks near Iznatoraf, 13.vi.19, common on tufa rock face (Fig. 8); Cueves del Peinero, 16.vi.2019, 1♂, 2♀; EGH Arroya de Aguascebas, attached to leaves of butterwort (*Pinguicula vallisneriifolia* Webb), 16.vi.2019 (Hancock and Hewitt 2020). **New record for Iberia**.

This species has been recently separated within the former *mitis* complex (Starý and Stubbs 2015). The occurrence in Cazorla reinforces the ecological data from sites in Britain, Bulgaria, Switzerland, Germany and the Czech Republic that suggest it is typical of montane habitat on calcareous rocks and in mainland Europe at least, often associated with tufa deposits. Earlier species records given as *Dicranomyia mitis* (sensu lato) from Iberia should be subjected to re-examination of the preserved specimens for validation.

Dicranomyia (*Dicranomyia*) *magninota* Starý, 2009. Arroya de las Aguascebas, 2.vi.2018, 1♀, EGH. Data from type description: Rio Aguamula, Sierra de Cazorla (700m), 23.iv.1994; Rio Guadalquivir, Sierra de Cazorla (900 m), 22.iv.1994, 1♂; P. Oosterbroek & C. Hartveld (Starý 2009).

Dicranomyia (*Dicranomyia*) *novemmaculata* (Strobl, 1906). Rio Guadalquivir, Malaise trap, 38.042°N, 2.860°W, 26 May 2018, 1♀, VB.

Dicranomyia (*Glochina*) *pauli* Geiger, 1983. A record of this species from Cazorla from 8km southwest of Blanquillo, Embalse de Aguaderondo, 1000m, 29 September 1989, forêt Claire brous-sailleuse, bord de ruisseau (Starý 2014).

Dicranomyia (*Glochina*) *sericata* (Meigen, 1830). Rio Guadalquivir, swept along river bank, 26.v-1.vi.2018, 5♂, 2♀, EGH.

Dicranophragma (*Brachylimnophila*) *nemorale* (Meigen, 1818). Swept near Hotel Mirasierra, 26.v-1.vi.2018, 1♂, EGH; Cueves del Peinero, 16.vi.2019, 1♀; EGH; Arroya de Aguascebas, attached to leaves of butterwort (*Pinguicula vallisneriifolia* Webb), 16.vi.2019, EGH (Hancock and Hewitt 2020). The species is distributed throughout the Palaearctic including Portugal. **New record for Spain**.

Dicranoptycha fuscescens (Schummel, 1829). Rio Guadalquivir, swept along a side stream near Control de Aguamula, 12.vi.2019, 2♂, EGH.

Eleophila maculata (Meigen, 1804). Cueves del Peinero, 16.vi.2019, 1♂, EGH.

Ellipteroides (*Ellipteroides*) *lateralis* Macquart, 1835. Los Tableros, seepage and wet rock face, 13.vi.2019, 1♂; Cueves del Peinero, 16.vi.2019, 1♂, 1♀, EGH; Arroya de Aguascebas, attached to leaves of butterwort (*Pinguicula vallisneriifolia* Webb), 16.vi.2019 (Hancock and Hewitt 2020).

Ellipteroides (*Protogonomyia*) *ida* Starý & Mendl, 1984. Los Tableros, seepage and wet rock face, 13.vi.2019, 1♂, EGH; Cueves del Peinero, 16.vi.2019, 3♂, 4♀, EGH.

Ellipteroides (*Ramagonomyia*) *mendli* Hancock & Starý, 2019. Arroya de las Aguascebas, 2.vi.2018, 4♂, 3♀, EGH. This is the type locality for the species. Paratype data include Rio Guadalquivir, 31 May 2018, on exposed riverside sediment, SMH.

Erioptera (*Erioptera*) *lutea* (Meigen, 1804). Rio Guadalquivir, Malaise trap, 38.024°N, 2.871°W, 26.v.2018, 1♂, 1♀, VB.

Gonomyia sicula Lackschewitz, 1940. Near Hotel Mirasierra, swept in woodland, 29.v.2018, 2♂, EGH.

Gonomyia abscondita Lackschewitz, 1935. Near Hotel Mirasierra, swept in woodland, 29.v.2018, 1♂, VB. The species is widespread in Europe and also known from the Rif in Morocco. **New record for Iberia**.

Helius hispanicus Lackschewitz, 1928. Rio Guadalquivir, 11-17.vi.2019, 1♂, 1♀; Cueves del Peinero, 16.vi.2019, 1♀, EGH; Arroya de Aguascebas, attached to leaves of butterwort (*Pinguicula vallisneriifolia* Webb), 16.vi.2019 (Hancock and Hewitt 2020).

Hexatoma bicolor (Meigen, 1818). Vadillo Castril, Arroya Frío Ó de los Urbios, abundant on sandbank behind damaged dam, 14.vi.2019, EGH.

Hoplolabis (*Paralisia*) *obtusiapex* (Savchenko, 1982). Rio Guadalquivir, swept along river bank, 26.v-1.vi.2018, 1♂, EGH.

Ilisia maculata (Meigen, 1804). Rio Guadalquivir, Malaise trap, 1♀, 1♂, VB; near Hotel Mirasierra, swept in woodland, 26.v-1.vi.2018, 1♂, EGH; Cueves del Peinero, 16.vi.2019, 1♂, EGH.

Limonia maculipennis (Meigen, 1818). Sierra de Segara, Pontones, Nacimiente de Segara, 30.v.2018, 2♂, 1♀; Sierra de Piornar, 28.v.2018, 2♂, EGH.

Limonia nubeculosa Meigen 1804. Rio Guadalquivir and other surrounding areas, 26.v-1.vi.2018, EGH and 11-17.vi.2019; Arroya de Aguascebas, attached to leaves of butterwort (*Pinguicula vallisneriifolia* Webb), 16.vi.2019 (Hancock and Hewitt 2020).

Molophilus bifidus Goetgebuer, 1920. Rio Guadalquivir, 26.v-1.vi.2018, EGH, 1♂, Malaise trap, VB. There are some slight differences in the hypopygium from other European specimens; a larger sample might establish if this is consistent in other Iberian samples.

Molophilus griseus (Meigen, 1804). Near Hotel Mirasierra, swept in woodland, 26.v-1.vi.2018, 1♂, EGH.

Molophilus ibericus Starý, 2011. Rio Guadalquivir, common by sweeping along riverbank amongst emergent rushes, 26.v-1.vi.2018, EGH & SMH; Arroya de Aguascebas, attached to leaves of butterwort (*Pinguicula vallisneriifolia* Webb), 16.vi.2019 (Hancock and Hewitt 2020).

Molophilus obscurus (Meigen, 1818). Rio Guadalquivir, swept along river bank amongst emergent rushes, 26.v-1.vi.2018, 5♂; Los Tableros, seepage and wet rock face, 13.vi.2019, 1♂, EGH.

Ormosia hederae (Curtis, 1835). Arroya de Aguascebas, attached to leaves of butterwort (*Pinguicula vallisneriifolia* Webb), 16.vi.2019 (Hancock and Hewitt 2020).

Paradelphomyia (?) *senilis* (Haliday, 1833). Cueves del Peinero, 16.vi.2019, 1♀, EGH. Females in this genus cannot be identified to species level. *P. senilis* has been recorded in both Spain and Portugal and so may be a species likely to occur in Cazorla.

Pseudolimnophila lucorum (Meigen, 1818). Rio Guadalquivir, 26.v-1.vi.2018, 4♂, 1♀; 11-17.vi.2019, 1♂; Los Tableros, seepage and wet rock face, 13.vi.2019, 1♂, EGH; Arroya de Aguascebas, attached to leaves of butterwort (*Pinguicula vallisneriifolia* Webb), 16.vi.2019 (Hancock and Hewitt 2020).

Symplecta hybrida (Meigen, 1804). Rio Guadalquivir, swept by river, 26.v-1.vi.2018, EGH.

Thaumastoptera insignis Lackschewitz, 1940. Los Tableros, seepage and wet rock face, 13.vi.2019, 1♂, EGH.

Pediciidae

Pedicia (*Amalopis*) *occulta* (Meigen, 1830). Arroya de Aguascebas, attached to leaves of butterwort (*Pinguicula vallisneriifolia* Webb), 2♂, 16.vi.2019 (Hancock and Hewitt 2020).

Tricyphona immaculata (Meigen, 1804). Arroya de Aguascebas, attached to leaves of butterwort (*Pinguicula vallisneriifolia* Webb), 16.vi.2019 (Hancock and Hewitt 2020).

Acknowledgements

Travel and accommodation were arranged as part of on-going planned field work by the Malloch Society, with the kind assistance and support of Dr Eduardo Galante, Dr Maria-Ángeles Marcos García and Dr Antonio R. Ricarte Sabater of Centro Iberoamericano de la Biodiversidad (CIBIO), Universidad de Alicante, Spain. The authorities of the Junta de Andalusia are thanked for issuing collecting permits Resolución Expte 71/CV/18 and PNSCSV/110/CV/19. Pjotr Oosterbroek, Christophe Dufour and Jaroslav Starý have responded promptly and usefully to questions on some older records and nomenclature.

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Metopia tshernovae **Rohdendorf (Diptera, Sarcophagidae) an overlooked British species? –** On 30 June and 1 July 2019, I surveyed habitats managed by the Findhorn Hinterland Trust, near the village of Findhorn on the Moray Firth, comprising dunes, maritime heath, grassland and a 50 year old pine plantation. This visit to record Diptera was at the request of Alan Watson Featherstone, who accompanied me around the site.

In this type of sandy habitat, it was not surprising to see a few *Metopia*, presumed to be *M. argyrocephala* (Meigen, 1824), and one of each sex was retained (the precise location was at NJ05016386). On closer examination of the male it was noticed that there was a narrow dark stripe between the large silvery plates on the head, which are contiguous in *M. argyrocephala*, and in the key to the Scandinavian species (Pape, T. 1987. The Sarcophagidae (Diptera) of Fennoscandia and Denmark. *Fauna Entomologica Scandinavica* **19,** 203 pp) it thus ran to *M. tshernovae* Rohdendorf, 1955. Pape (*op. cit.*) noted that there may be intermediate specimens and confirmation is necessary from the male genitalia, for which he figured the aedeagus; the gonopods in *M. tshernovae* are shorter and broader apically while in *M. argyrocephala* they are longer, more curved and tapered to a point apically. Dissection of the Findhorn male showed that it agreed with the figure of *M. tshernovae* in this respect. They also differ in that the row of strong frontal bristles on each side of the frons continues onto each silver plate in *M. tshernovae* but stops short in *M. argyrocephala*, which may have only a few weak bristles there. The females are not separable. I checked male specimens identified as *M. argyrocephala* in my collection, collected widely in England and Scotland, but no *M. tshernovae* were present among them.

I recalled mention in the report on the Dipterists Forum field meeting based at Nottingham in 2015 (Stubbs, A. 2015. Summer 2015 Field Meeting. *Bulletin of the Dipterists Forum* **80,** 25-28) that *M. tshernovae* was found at a sand exposure on Rainworth Heath Nottinghamshire Wildlife Trust Nature Reserve (SK5958), during that meeting, but it was not formally recorded as new to Britain and the specimen has not been located for checking. Some of Steven Falk's photographs under *M. argyrocephala* on his Flickr site have a gap between the silver plates so may be *M. tshernovae*, but specimens are not available for checking (Steven Falk *pers. comm.*).

Though clearly rarer than *M. argyrocephala*, it seems that *M. tshernovae* is widespread in Britain. As it is likely that these species have been confused, I have begun to check males under *M. argyrocephala* in museum collections, so far carried out at Oxford and Cardiff. This only resulted in finding one male from Tubney Wood, south-west of Oxford, collected on 31 July 1931 by J. Collins, in the collection of the Oxford University Museum of Natural History, on dissection confirmed to be *M. tshernovae*. The sarcophagid collection at the Natural History Museum, London had been curated in recent years by Daniel Whitmore and had earlier been checked against Pape's keys by Nigel Wyatt (*pers. comm.*) without any *M. tshernovae* being identified.

Nothing specific is known of the biology of *M. tshernovae* but it is presumed that, like *M. argyrocephala*, development is in the nests of ground-nesting solitary bees and wasps.

I thank Daniel Whitmore and Nigel Wyatt for information on the Natural History Museum collection, Mark Pavett for enabling my examination of the collection at Cardiff, and Zoë Simmons for the loan of the Tubney Wood male. I am grateful to Alan Watson Featherstone for arranging my visit to Findhorn, and for his hospitality during my stay there - **PETER J. CHANDLER,** 606B Berryfield Lane, Melksham, Wilts SN12 6EL

Dipterists Digest 2020 **27,** 101-115

Hoverflies (Diptera, Syrphidae), robber flies (Diptera, Asilidae) and soldier flies (Diptera, Stratiomyidae) along the Kyrenia Mountains of Cyprus

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Summary

With the aim to start a survey of the hoverflies (Diptera, Syrphidae) of the Kyrenia mountain range of Cyprus, a Malaise trap was first placed in a suburban garden in Lapta, at the northern footholds of the Kyrenia mountains. The Malaise trap collected almost continuously between May 2017 and December 2018. During this period nineteen hoverfly species, at least ten robberfly species and two species of soldier flies were collected. A limited number of field trips also took place; on these 18 species of hoverflies were recorded. Two hoverfly species, *Eumerus armatus* Ricarte & Rotheray, 2012, and *Callicera fagesii* Guérin-Méneville, 1844 are published here for the first time from Cyprus. One soldier fly of the genus *Chorisops* is new to science and will be published in a separate paper. Two robber fly genera are new to Cyprus. All robber fly genera collected are in need of revision.

Introduction

Cyprus is the third largest island in the Mediterranean region, with a land area of 9251 km^2 and has a unique geological history. It was never part of the Eurasian or the African continent, but is a segment of oceanic crust and mantle which was uplifted as a result from tectonic movements of the African and Eurasian plates about 20 Ma. In the north, distance from the mainland of Turkey is about 75 km, in the east 150 km from Syria and 380 km from Egypt in the south. In the west the closest shores are the Greek islands of Karpathos and Rhodes at 380 km (Delipetrou *et al.* 2018). A land bridge or a range of islands to the Near East may have existed during the Messinian Salinity Crisis towards the end of the Miocene, 5.97-5.53 Ma (source: wikipedia.org, accessed March 22, 2020). Cyprus is divided into three geomorphological zones: the Troodos Mountains, the Kyrenia or Pentadaktylos Range and the Mesaoria plain with rugged morphology and varied geology. It has a typical Mediterranean climate. In total about 1730 km^2 (about 18%) is forested, and around 2138 km^2 (about 23%) is shrubland (Delipetrou *et al.* 2008; Vogiatzakis *et al.* 2016). The Kyrenia Range is 175 km in length and is usually described as a coastal mountain range; it runs parallel to the coast and only reaches the seashore in three places: Kayalar, Yedikonuk and at Cape Andreas. The maximum altitude of the mountain range is around 1025 m a.s.l. and the general elevation in the western and central sectors is 600 m on average. The core of the range is composed of a hard type of limestone, forming impressive peaks as Buffavento, St. Hillarion, Kornos, and Besparmak (Dreghorn 1978, 1979). The Kyrenia mountain range is an important site for both plant and animal biodiversity (Özden *et al.* 2016).

The rural landscape is dominant and usually intermixed with natural elements (Vogiatzakis and Manolaki 2017). It may be called remarkable that, despite the rich nature of the island and its relatively high percentage of endemism, the Dipteran fauna of Cyprus has only poorly been studied and published (Ebejer 2016). While Georghiou in his monograph on the insects of Cyprus (Georghiou 1977) published 2884 species of insects, of which 415 were Diptera, forty years later the total number of insects from Cyprus is estimated around 6000 species (Sparrow and John 2016). Around 1800 of these are Diptera, belonging to 76 families (Ebejer 2016). However, most information is scattered across a number of collections. Publications and records dealing with the Diptera of the Mesaoria plains and the Kyrenia mountain range of Cyprus are scarce.

Many insect families play an important role as pollinators (Altieri 1999, Klein *et al*. 2007, Ollerton *et al*. 2011, Ssymank *et al*. 2008). Well-known pollinators are bees (Hymenoptera: Anthophila), all of which collect pollen specifically to feed their larvae; the honey bee of course which is kept to pollinate and produce honey, and wild bees which not only need to find a food source, but also a nesting site and other conditions in order to thrive. Human influenced sites, including gardens, support a variable diversity of bees. After bees, Diptera are the second most important group of anthophilous insects (Larson *et al*. 2001). Hoverflies are an example of flies that are important pollinators, sometimes occurring in high numbers. Hoverflies need nectar as an energy supply, and the females need pollen as a food source for egg development. A second interesting example of ecosystem service the hoverfly offers to agroecosystems, is that many species' larvae are important predators of aphids, so they are serving as bio-control agents in agroecosystems (Ssymank *et al*. 2008).

2017	**2018**
10-19.v.2017	20-27.iii.2018
19-26.v.2017	1-22.iv.2018
26.v-3.vi.2017	22.iv-5.v.2018
3-17.vi.2017	19.v-3.vi.2018
17.vi-9.vii.2017	3-16.vi.2018
9-16.vii.2017	16-24.vi.2018
16-30.vii.2017	24.vi-12.vii.2018
30.vii-13.viii.2017	30.viii-9.ix.2018
10-17.ix.2017	9-16.ix.2018
17-24.ix.2017	16-30.ix.2018
24.ix-1.x.2017	30.ix-14.x.2018
1-8.x.2017	14-28.x.2018
22-29.x.2017	28.x-16.xi.2018
5-12.xi.2017	16.xi-9.xii.2018

Table 1. List of dates the Malaise trap was running, showing placing and emptying dates of the collecting bottle.

Getting to know the biodiversity of a region is an important step for making the right policy on protecting a region's natural resources, as to ensure the long-term preservation of biodiversity should be the goal of most governments since the Convention on Biological Diversity in Rio de Janeiro in 1992 (Schouten 2007). For a better knowledge of the Diptera diversity in Cyprus, a survey has been started in the Kyrenia region. Different habitats will be monitored and surveyed within the next years. To assist in discovering more hoverfly species on the island, in May 2017 a Malaise trap was placed in a suburban garden in the foothills of the Kyrenia mountains of Lapta (Lapithos).

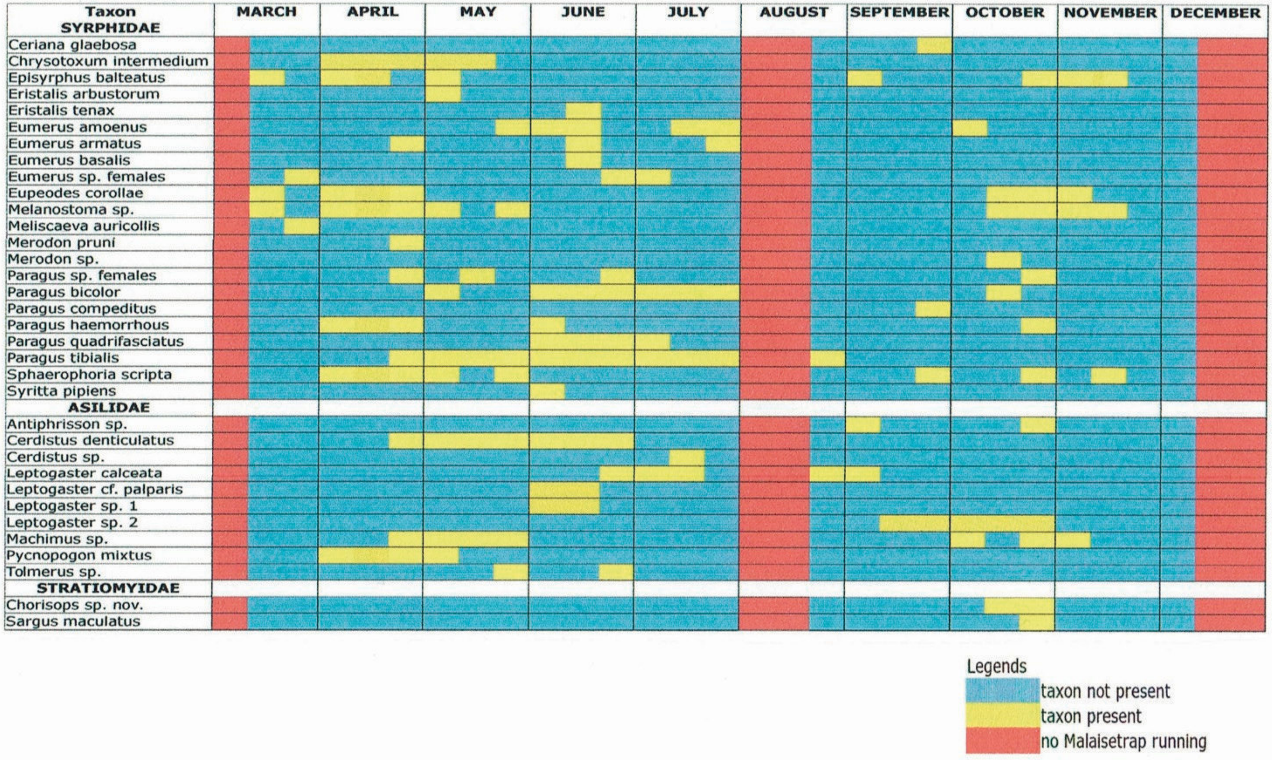
Material and methods

One of the most productive insect-collecting methods is using a Malaise trap, and it is a good way to collect Diptera (Brown 2005). During this research a Malaise trap was installed on 10 May 2017 in Lapta (Lapithos) (35.34770°N 33.15040°E). The trap was managed by Özge Özden. With only a few gaps in the summer of 2017 and between November 2017 and March 2018, the trap functioned until it was destroyed by a storm on 9 December 2018. In 2017, the collecting started more than two months later and ended one month earlier, than in 2018 (Table 1). The collecting bottle was filled with a 70% ethanol solution.

Samples were then stored in 200ml vials, containing 70% ethanol until processing. After shipping the samples to the Netherlands, AvE sorted the hoverflies, robber flies and soldier flies respectively, for further identification. Selected specimens were then pinned, others remain stored in ethanol. Robber flies were sent to RvdB, who is currently revising the Cyprus robber fly fauna. Hoverflies and soldier flies were identified by AvE. Additionally, during a handful of field trips, insects were collected by insect net.

Fig. 1. The Malaise trap, in the back of the garden. In the background the Kyrenia mountains. May 2017. Photo: A. van Eck.

Fig. 2 (opposite). Flight periods of the taxa treated in this paper.



Taxon **SYRPHIDAE**	MARCH			APRIL			MAY			JUNE			JULY			AUGUST			SEPTEMBER			OCTOBER			NOVEMBER			DECEMBER		
Ceriana glaebosa	🟥	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟥	🟥	🟦	🟦	🟦	🟨	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟥	🟥
Chrysotoxum intermedium	🟥	🟦	🟦	🟨	🟨	🟨	🟨	🟨	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟥	🟥	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟥	🟥
Episyrphus balteatus	🟥	🟨	🟦	🟨	🟨	🟦	🟨	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟥	🟥	🟦	🟨	🟦	🟦	🟦	🟦	🟨	🟨	🟨	🟦	🟦	🟥	🟥
Eristalis arbustorum	🟥	🟦	🟦	🟦	🟦	🟦	🟨	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟥	🟥	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟥	🟥
Eristalis tenax	🟥	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟨	🟦	🟦	🟦	🟦	🟥	🟥	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟥	🟥
Eumerus amoenus	🟥	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟨	🟨	🟨	🟦	🟦	🟨	🟨	🟥	🟥	🟦	🟦	🟦	🟦	🟨	🟦	🟦	🟦	🟦	🟦	🟦	🟥	🟥
Eumerus armatus	🟥	🟦	🟦	🟦	🟦	🟨	🟦	🟦	🟦	🟦	🟨	🟦	🟦	🟦	🟨	🟥	🟥	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟥	🟥
Eumerus basalis	🟥	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟨	🟦	🟦	🟦	🟦	🟥	🟥	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟥	🟥
Eumerus sp. females	🟥	🟦	🟨	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟨	🟨	🟦	🟦	🟥	🟥	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟥	🟥
Eupeodes corollae	🟥	🟨	🟦	🟨	🟨	🟨	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟥	🟥	🟦	🟦	🟦	🟦	🟦	🟨	🟨	🟨	🟦	🟦	🟦	🟥	🟥
Melanostoma sp.	🟥	🟨	🟦	🟨	🟨	🟨	🟨	🟦	🟨	🟦	🟦	🟦	🟦	🟦	🟦	🟥	🟥	🟦	🟦	🟦	🟦	🟦	🟨	🟨	🟨	🟨	🟦	🟦	🟥	🟥
Meliscaeva auricollis	🟥	🟦	🟨	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟥	🟥	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟥	🟥
Merodon pruni	🟥	🟦	🟦	🟦	🟦	🟨	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟥	🟥	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟥	🟥
Merodon sp.	🟥	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟥	🟥	🟦	🟦	🟦	🟦	🟦	🟨	🟦	🟦	🟦	🟦	🟦	🟥	🟥
Paragus sp. females	🟥	🟦	🟦	🟦	🟦	🟨	🟦	🟨	🟦	🟦	🟦	🟨	🟦	🟦	🟦	🟥	🟥	🟦	🟦	🟦	🟦	🟦	🟦	🟨	🟦	🟦	🟦	🟦	🟥	🟥
Paragus bicolor	🟥	🟦	🟦	🟦	🟦	🟦	🟨	🟦	🟦	🟨	🟨	🟨	🟨	🟨	🟨	🟥	🟥	🟦	🟦	🟦	🟦	🟦	🟨	🟦	🟦	🟦	🟦	🟦	🟥	🟥
Paragus compeditus	🟥	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟥	🟥	🟦	🟦	🟦	🟨	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟥	🟥
Paragus haemorrhous	🟥	🟦	🟦	🟨	🟨	🟨	🟦	🟦	🟦	🟨	🟦	🟦	🟦	🟦	🟦	🟥	🟥	🟦	🟦	🟦	🟦	🟦	🟦	🟨	🟦	🟦	🟦	🟦	🟥	🟥
Paragus quadrifasciatus	🟥	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟨	🟨	🟨	🟨	🟦	🟦	🟥	🟥	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟥	🟥
Paragus tibialis	🟥	🟦	🟦	🟦	🟦	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟥	🟥	🟨	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟥	🟥
Sphaerophoria scripta	🟥	🟦	🟦	🟨	🟨	🟨	🟨	🟦	🟨	🟦	🟦	🟦	🟦	🟦	🟦	🟥	🟥	🟦	🟦	🟦	🟨	🟦	🟦	🟨	🟦	🟨	🟦	🟦	🟥	🟥
Syritta pipiens	🟥	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟨	🟦	🟦	🟦	🟦	🟦	🟥	🟥	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟥	🟥
ASILIDAE																														
Antiphrisson sp.	🟥	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟥	🟥	🟦	🟨	🟦	🟦	🟦	🟦	🟨	🟦	🟦	🟦	🟦	🟥	🟥
Cerdistus denticulatus	🟥	🟦	🟦	🟦	🟦	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟦	🟦	🟦	🟥	🟥	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟥	🟥
Cerdistus sp.	🟥	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟨	🟦	🟥	🟥	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟥	🟥
Leptogaster calceata	🟥	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟨	🟨	🟨	🟦	🟥	🟥	🟨	🟨	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟥	🟥
Leptogaster cf. palparis	🟥	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟨	🟨	🟦	🟦	🟦	🟦	🟥	🟥	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟥	🟥
Leptogaster sp. 1	🟥	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟨	🟨	🟦	🟦	🟦	🟦	🟥	🟥	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟥	🟥
Leptogaster sp. 2	🟥	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟥	🟥	🟦	🟦	🟨	🟨	🟨	🟨	🟨	🟦	🟦	🟦	🟦	🟥	🟥
Machimus sp.	🟥	🟦	🟦	🟦	🟦	🟨	🟨	🟨	🟨	🟦	🟦	🟦	🟦	🟦	🟦	🟥	🟥	🟦	🟦	🟦	🟦	🟨	🟦	🟨	🟨	🟦	🟦	🟦	🟥	🟥
Pycnopogon mixtus	🟥	🟦	🟦	🟨	🟨	🟨	🟨	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟥	🟥	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟥	🟥
Tolmerus sp.	🟥	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟨	🟦	🟦	🟨	🟦	🟦	🟦	🟥	🟥	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟥	🟥
STRATIOMYIDAE																														
Chorisops sp. nov.	🟥	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟥	🟥	🟦	🟦	🟦	🟦	🟦	🟨	🟨	🟦	🟦	🟦	🟦	🟥	🟥
Sargus maculatus	🟥	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟥	🟥	🟦	🟦	🟦	🟦	🟦	🟦	🟨	🟦	🟦	🟦	🟦	🟥	🟥

Legends
🟦 taxon not present
🟨 taxon present
🟥 no Malaisetrap running

Description of the Malaise trap sampling site

Lapta (Lapithos) is a suburban area close to the city of Kyrenia. The Malaise trap was placed in between some fruit trees (*Prunus dulcis*, *Punica granatum*, *Citrus limon*, *Citrus reticulata*, *Eribotrya japonica*, *Olea europaea*) in a biologically managed garden, meaning no synthetic fertilisers or pesticides are used. The Malaise trap was placed over a hosepipe used for irrigation of the fruit trees, so this spot stayed comparatively moist all year round, attracting many insects. From April 2018 onwards, the Malaise trap was moved only a couple of metres, within the same habitat type. The fruit tree growing garden is bordered by olive groves, shrubs and Mediterranean maquis. A stretch of olive groves, gardens and arable land, approximately 800 metres wide, separates the garden from the actual foothills of the Kyrenia mountain range (Fig. 1).

species	**year** 2017	**year** 2018
Eristalinae		
Ceriana glaebosa (Van Steenis & Ricarte, 2016)		1
Eristalis arbustorum (Linnaeus, 1758)	1	
Eristalis tenax (Linnaeus, 1758)	1	
Eumerus amoenus Loew, 1848	7	
Eumerus armatus Ricarte & Rotheray, 2012	1	2
Eumerus basalis Loew, 1848	2	
Eumerus sp.	1	2
Merodon sp.		1
Merodon pruni (Rossi, 1790)		1
Syritta pipiens (Linnaeus, 1758)	1	
Syrphinae		
Chrysotoxum intermedium (Meigen, 1822)	2	5
Episyrphus balteatus (De Geer, 1776)	4	59
Eupeodes corollae (Fabricius, 1794)	8	66
Melanostoma sp.	6	69
Meliscaeva auricollis (Meigen, 1822)		1
Paragus bicolor (Fabricius, 1794)	5	3
Paragus compeditus Wiedemann, 1830		1
Paragus haemorrhous Meigen, 1822	3	9
Paragus quadrifasciatus Meigen, 1822	6	
Paragus tibialis (Fallén, 1817)	18	16
Paragus (*Pandasyophthalmus*) sp.	1	1
Paragus (*Paragus*) sp.		3
Sphaerophoria scripta (Linnaeus, 1758)	5	7

Table 2. Hoverfly species in the Malaise trap in 2017 and 2018 respectively.

Results of the Malaise trap survey 2017-2018

SYRPHIDAE

Georghiou (1977) reported twenty hoverfly species from fifteen genera for Cyprus. Van Steenis *et al*. (2019) listed a total of 52 hoverfly species recorded over a short collecting period in October

2017. The total number of hoverfly species expected to occur on Cyprus lies around seventy (Van Eck *in prep*.).

In the Malaise trap, 318 specimens of hoverflies were collected, comprising 19 species, belonging to 12 genera (Table 2). Most species collected are commonly found in human influenced habitats in Cyprus, perhaps with the exception of *Eumerus armatus* Ricarte & Rotheray and the *Merodon* species. Due to their abundant occurrence and the non-specific feeding modes of the adult flies, species like *Episyrphus balteatus* (De Geer), *Eupeodes corollae* (Fabricius), *Eristalis arbustorum* (Linnaeus), *E. tenax* (Linnaeus) and *Sphaerophoria scripta* (Linnaeus), serve as important pollinators in gardens, fruit trees and crops. Larvae of Syrphinae attack aphids and can consume considerable numbers of them.

Periods in which the different taxa were collected are displayed in Fig. 2.

Species section

Ceriana glaebosa Van Steenis & Ricarte, 2016

Van Steenis *et al*. (2016) came to the conclusion that all records of *Ceriana vespiformis* (Latreille, 1804) from Cyprus actually belong to this distinct species, so far only known from Cyprus. The larvae of this species are unknown (Van Steenis *et al*. 2016). Larvae of its Mediterranean counterpart *C. vespiformis* may be found in decaying wood and sap runs of several deciduous trees such as oak (*Quercus* spp) and are found in *Fraxinus angustifolia* and *Morus alba* (Van Steenis *et al*. 2016). In Portugal the first author observed egg depositing behaviour in the hollow of a *Fraxinus angustifolia*. Despite attempts to find similar behaviour by *Ceriana glaebosa* in Cyprus, it is still unknown where the larvae may be found.

Chrysotoxum intermedium (Meigen, 1822) *B*

In Europe, two species are recognised morphologically under the name '*Chrysotoxum intermedium*' (Speight 2018). Speight (2018) summarised the present state of knowledge about this situation. The Cyprus specimens are identified as the taxon *Chrysotoxum intermedium B* as followed by Speight (2018) and Speight and Sarthou (2017).

Although a fairly common species in the Mediterranean basin, its larval biology is unknown. It is suggested that species of the genus *Chrysotoxum* are associated with ant nests, where they may feed on root aphids (Rotheray 1993, Speight 2018). The adults of *C. intermedium* are conspicuous wasp mimics, often flying low through the vegetation. In Cyprus they have been observed feeding on flowers such as yellow Asteraceae, *Ferula communis*, *Hedera* sp. and *Smyrnium olusatrum* (pers. obs. AvE).

Episyrphus balteatus (De Geer, 1776)

The late start of the project in 2017 (Table 1) clearly reflects in the low numbers in that year. In Central and Northern Europe this migratory species is most abundant in the summer months July and August (Bartsch *et al*. 2009, Reemer *et al*. 2009, Röder 1990). In Cyprus its peak abundance seems to lie earlier, in the spring, but it can be found in every month around the year. It is also an important species as a pollinator in crops and gardens, including fruit trees (de Buck 1990). Its larvae are mostly aphidophagous, known to prey on dozens of aphid species but occasionally also target on other arthropods, mostly in shrubs and trees (Speight 2018).

Eristalis arbustorum (Linnaeus, 1758)

Larvae of *Eristalis* species are aquatic or subaquatic, usually in shallow standing water, but have also been found in media like manure and compost heaps (Speight 2018). It is a common species and adults are generalist flower visitors (euryanth) (Röder 1990). Because this species is very abundant in Cyprus throughout the year it acts as an important pollinator in gardens and crops (de Buck 1990).

Eristalis tenax (Linnaeus, 1758)
Also called 'drone fly', and a good bee mimic, which has a cosmopolitan distribution. Larvae can be extremely abundant in even the most eutrophic, organically rich media, such as dung, slurry and rotting materials. Adults are highly migratory and therefore can be found almost anywhere during most of the year, and survive mild winters as adults. In Cyprus it is one of the most commonly found hoverflies and a generalist flower visitor (Röder 1990, Speight 2018).

Eumerus amoenus Loew, 1848
For unknown reason, this species was collected in 2017 only, but throughout the year.

The larvae of species of *Eumerus* are phytophagous or saprophagous, meaning that they live on living or decaying plant tissue. The larvae eat their way through the stems and roots of plants, usually those with storage organs (bulbs, tubers, rhizomes or swollen roots) or rotting parts of plants (Ricarte *et al*. 2017). For most species the host plant is still unknown. *Eumerus amoenus* is one of the most common species in the Mediterranean, found in several plants, including crops (Speight 2018).

Eumerus armatus Ricarte & Rotheray, 2012
This is the first published record of this species for Cyprus.

The lesser bulb fly *E. armatus* was described from the Greek island of Lesvos (Ricarte *et al.* 2012). In the Malaise trap, two males and one female were collected. The host plant is unknown for *E. armatus*.

Eumerus basalis Loew, 1848
Like *E. amoenus*, a common species in the (eastern) Mediterranean and likewise on Cyprus. But, also like *E. amoenus*, collected in 2017 only. The host plant(s) are apparently unknown (Speight 2018). It can be found on the flowers of *Foeniculum vulgare*, but has also been observed flying near the bases of these plants (pers. obs. AvE).

Eupeodes corollae (Fabricius, 1794)
The late start of the project in 2017 (Table 1) clearly reflects in the low numbers in that year. It is an abundant species throughout the year. Important as a pollinator in crop production and gardens (Wojciechowicz-Żytko and Jankowska 2017). Its larvae are predaceous, known to prey on many aphid species (Röder 1990, Rotheray 1993).

Melanostoma sp.
The late start of the project in 2017 (Table 1) clearly reflects in the low numbers in that year.

Further investigation needs to be applied to all specimens of this genus in Cyprus. The specimens collected do not satisfactorily match existing species. Taxonomically the genus *Melanostoma* stays complicated, despite recent publications, e.g. Haarto and Ståhls (2014).

Melanostoma is a very common genus in Cyprus, typically found in grasslands, meadows, and gardens where it flies on flowering grasses and other low-growing flowers. Its larvae are aphid-feeding, on a wide range of plants, including grasses (Speight 2018).

Meliscaeva auricollis (Meigen, 1822)
This is a fairly common species in Cyprus, but only collected once in the Malaise trap. Its larvae are aphid-feeding in shrubs, bushes, trees but also on crop species (Speight 2018). It has also been found in olive trees, where larvae were feeding on psyllids (Rojo *et al*. 1999).

Merodon pruni (Rossi, 1790)
One male specimen was caught in the Malaise trap (22.iv-5.v.2018). This species may have wandered away from the surrounding more natural vegetation. However, its host plant is as yet unknown, but may be available in the gardens as well. It has been observed to visit flowers of yellow Apiaceae, such as *Smyrnium connatum* and *Foeniculum vulgare* (pers. obs. AvE).

Merodon sp.
This is the *Merodon* sp. nov. 2 (*natans* group) in Van Steenis *et al*. (2019). This species has once been reared from the small bulbs of *Prospero autumnalis* (unpubl. AvE).

Paragus bicolor (Fabricius, 1794)
A total of eight specimens were collected, from middle of May till the end of July and in October, peaking in June with four specimens.

Paragus compeditus Wiedemann, 1830
One male specimen was collected in the period 30.ix-14.x.2018. The species is rather common on Cyprus, but apparently gardens such as these are not its preferred habitat.

This species was reared from larvae collected on Cyprus. Larvae were collected on 7 and 9 May 2017, on the leaves of reed-grass *Phragmites australis*, in colonies of the mealy plum aphid *Hyalopterus pruni* (Geoffroy, 1762) (Homoptera, Aphididae). Adult emergence took place at the end of the same month (pers. obs. AvE).

Paragus haemorrhous Meigen, 1822
Twelve specimens were collected from the beginning of April till beginning of June and in October, nine of them being in the first period. This may be an indication of two generations flying in one year. *Paragus haemorrhous* is less thermophilous, and prefers more shady places than its ‘twin species’ *P. tibialis*.

Paragus quadrifasciatus Meigen, 1822
For an unknown reason, this species was collected in 2017 only. Six specimens were collected, equally divided over time from the beginning of June till that of July.

Paragus tibialis (Fallén, 1817)
This was the most common *Paragus* species in the garden, with 33 specimens collected from mid-April till the end of August, but clearly most numerous in May when about fifty percent of the specimens were collected. It seems the more thermophilous species compared to *P. haemorrhous*, which is expressed by its more southern distribution, around the Mediterranean, whereas the latter is a common species as far north as Scandinavia (Speight 2018).

Sphaerophoria scripta (Linnaeus, 1758)
This is an abundant species all over Cyprus and can be collected in all kinds of habitats. This slender hoverfly can be a dominant visitor of low-growing flowers, vegetables and herbs. Here it pollinates flowers, and its predaceous larvae hunt for aphids (Wojciechowicz-Żytko and Jankowska 2017).

Syritta pipiens (Linnaeus, 1758)

This common species on Cyprus, was collected only once in these two years: one male 3-17.vi.2017.

ASILIDAE

A total of 211 specimens of robber flies were collected, belonging to six genera (Table 3). Since knowledge of Mediterranean robber flies is far from complete, and many genera need revision, it is not possible to provide a more detailed list of species present in the Malaise trap, as presented here.

taxon	**year** 2017	**year** 2018
Asilinae		
Antiphrisson	1	1
Cerdistus denticulatus (Loew, 1849)	47	58
Cerdistus sp.	1	
Machimus sp.	6	2
Tolmerus sp.	1	3
Brachyrhopalinae		
Pycnopogon mixtus (Loew, 1847)	3	46
Leptogastrinae		
Leptogaster calceata Engel, 1925	3	6
Leptogaster cf *palparis* Loew, 1847		3
Leptogaster sp. 1	2	
Leptogaster sp. 2	9	18

Table 3. Robber flies in the Malaise trap in 2017 and 2018 respectively.

The material from the Malaise trap, however, is of great interest to the study of Cyprus robber flies. It is not possible to provide any reliable list of species occurring on Cyprus. The knowledge of Asilidae occurring in Cyprus is far from complete. To give some examples: Georghiou (1977) listed the following seven taxa occurring in Cyprus: *Antiphrisson adpressus* (Loew), *Aphamartania syriaca* Schiner [= *Paraphamartania syriaca* (Engel 1930)], *Bactria microlabis* (Loew, 1857), *Cerdistus denticulatus* (Loew), *Machimus* cf. *chrysitis* (Meigen), *Machimus* sp. and *Promachus* sp. *Bactria* Meigen, 1820 is a southern African genus and *microlabis* is otherwise referred to *Promachus*; according to Londt and Dikow (2017), the taxonomic positions of *Bactria* and *Promachus* require clarification through revision and, in case of a synonymy, *Bactria* has priority. Ghahari *et al*. (2014) mentioned two species from Cyprus, not collected in the Lapithos Malaise trap: *Promachus microlabis* Loew, 1857 and *Stichopogon chrysostoma* Schiner, 1867. Tomasovic (2013) mentioned four species of *Promachus* from Cyprus: *P. cypricus* (Rondani, 1856), *P. microlabis*, *P. leoninus* Loew, 1848 and *P. mustela* Loew, 1854. Ebejer (2016) showed photographs of three species from Cyprus: *Promachus leoninus*, *Pycnopogon mixtus* (Loew, 1847) and a *Machimus* species. Geller-Grimm's database (*http://www.geller-grimm.de/asilidae.htm,* accessed 27-11-2019) lists the following five species as known from Cyprus: *Neomochtherus olivierii cypreus* Tsacas, 1968, *Philonicus albiceps* (Meigen, 1820), *Promachus cypricus, Promachus microlabis,* and *Stichopogon chrysostoma.*

The specimens collected here consist of at least ten species, some possibly new to science. The chance that a number of species are endemic for Cyprus is real. The genus *Leptogaster* is an example of a genus in need of a revision, and material from Cyprus is very useful. Other genera are awaiting revision too. For this reason, collecting robber flies on Cyprus is contributing to the understanding and revision of Asilidae in the whole East Mediterranean region; immediate results though are not to be expected. Periods in which the different taxa were collected are displayed in Fig. 2.

Species section

Antiphrisson

Whether this is the species *A. adpressus*, mentioned by Georghiou (1977) still needs to be confirmed.

Cerdistus denticulatus (Loew, 1849)

This species was very common in the garden during the last week of April until early July, peaking from the first week of May till the first week of June. One male specimen, collected in the period 16-30.vii.2017, is unidentified to species level and needs closer examination.

Leptogaster

First published records of this genus for Cyprus. *Leptogaster calceata* Engel, 1925 was collected from the beginning of July until approximately the middle of September. Then there are at least three as yet unspecified taxa collected in the Malaise trap. One pair of *Leptogaster* sp. 1 was collected only in the period 3-17.vi.2017. *Leptogaster* sp. 2 was flying from middle of September till the end of October. And there is *Leptogaster* cf *palparis* Loew, 1847, with one male and two females in the period 3-24.vi.2018. The identities of these specimens still need to be assessed.

Machimus

Eight specimens of *Machimus* were collected. Their identity still needs to be assessed. Their flight period being end of April till early June, and beginning of October till middle of November suggests more than one species may be involved. This genus is in great need of revision.

Pycnopogon mixtus (Loew, 1847)

This is a strictly univoltine spring species, collected both years. It appears almost exclusively in the month of April.

Tolmerus

This is the first published record of this genus for Cyprus. Three females and possibly also a male of this genus have been collected, for all of which the species await confirmation.

STRATIOMYIDAE

Georghiou (1977) listed the following two species from this family: *Beris cypria* James, 1970 (which was collected by Georghiou, from cherry and apple (James 1970)) and *Geosargus maculatus* Lindner, 1936. By 2001, eight more species were added for Cyprus: *Chorisops tibialis* (Meigen, 1820), *Oxycera limbata* Loew, 1862, *Stratiomys cenisia* (Meigen, 1822), *S. longicornis* (Scopoli, 1763), *Nemotelus argentifer* Loew, 1846, *N. brachystomus* Loew, 1846, *N. cypriacus* Lindner, 1937, and *N. pantherinus* (Linnaeus, 1758) (Woodley 2001).

In the Malaise trap, 75 specimens of soldier flies were collected, belonging to two species of two genera.

Species section

Chorisops sp. nov.

This is probably the species mentioned for Cyprus as *C. tibialis* by Woodley (2001). The specimens collected here have clearly different terminalia from those of *C. tibialis*. Also, the terminalia are different from other, recently described, species of *Chorisops* from the Mediterranean region. Thus, specimens from Cyprus are likely to be new to science and possibly endemic to Cyprus. Further research is ongoing, and eventually it will be described in a separate publication.

The flight period of *Chorisops* sp. nov. is very short, and seems restricted to the autumn; 57 specimens from 22-29.x.2017 and 14 specimens from 14-28.x.2018.

A related autumn species, *Chorisops tunisiae* (Becker, 1915) with a (western) Mediterranean distribution (Yimlahi *et al*. 2017) has been reared from larvae found in rotting leaves of *Opuntia* sp. (Abrantes, Portugal; leg. & coll. AvE).

Sargus maculatus (Lindner, 1936)

This species was described under the genus name *Geosargus* Bezzi, 1907 from specimens collected from the Troodos Mountains in Cyprus. It has rarely been collected since. According to Woodley (2001), *S. maculatus* also occurs in Israel.

Having collected four specimens in this garden, at low altitudes, suggests the species may well occur widely in Cyprus. All specimens were collected in the period 28.x-16.xi.2018. The flight period seems to be extremely short, confined to late autumn, so it can be assumed that for these reasons it is so rarely collected.

In 2016 the first author found some specimens in the Troodos Mountains:

2 females, 28.x.2016, Nicosia province, Platania Forest Station, 34.94890°N 32.92790°E, 1100m asl, on *Hedera* flowers. Leg. & coll. AvE.

1 specimen, 6.xi.2016, Limasol province, Saittas, Arkolachanias river valley, 34.87478°N 32.91496°E, 720m asl. Not collected.

A related autumn species, *Sargus bipunctatus* (Scopoli, 1763) with a wide European, and also North African and Near East distribution (*https://fauna-eu.org*; accessed 29-11-2019) has been reared from larvae found in rotting plant material (Tilburg, The Netherlands; leg. & coll. AvE).

Results of field trips 2017-2019

A list of eighteen hoverfly species collected during a handful of field trips is given below (Table 4). Field trips took place in 2016 (April 27), 2017 (May 10 and 11), 2018 (March 29) and 2019 (March 5, 6, 7 and 8). It must be noted that time for field trips was limited. In early March 2019, after a long winter period with exceptionally wet and cold weather, it was still cool, cloudy and rainy on most days. Therefore, numbers of hoverflies were low. Nevertheless, one interesting species was recorded for the first time on Cyprus. Localities visited are displayed in Fig. 3.

Callicera fagesii Guérin-Méneville, 1844

New species to Cyprus. 1 ♀, Kyrenia, Kormakitis, 35.34156°N 33.01595°E, foraging on *Smyrnium olusatrum*, 4.iii.2019, AvE leg. & coll., ZFMK-DIP-00055261

For a long time, only one species of *Callicera* was known to occur in Cyprus, *C. macquarti* Rondani, 1844. In fact, specimens collected from Cyprus were described as *Callicera loewi* by Verrall (1913) (Speight 1991). However, Speight (1991) considered it a junior synonym of *C. macquarti*. Although *Callicera* is a widespread genus throughout the European Mediterranean, with several species that might occur on Cyprus, it was only recently that another species was discovered. Cyprus being quite remote from the nearest mainland, the island may be harder to be reached by widespread species such as *C. aurata* (Rossi, 1790) and *C. spinolae* Rondani, 1844. Therefore, the discovery of this female *C. fagesii* came as a pleasant surprise. No mature forests are found in proximity to the collection site, but it is possible that suitable mature trees offering larval habitat are growing in this ancient rural region.

Species
Callicera fagesii Guérin-Méneville, 1844
Chrysotoxum intermedium Meigen, 1822
Episyrphus balteatus (De Geer, 1776)
Eristalinus aeneus (Scopoli, 1763)
Eristalinus taeniops (Wiedemann, 1818)
Eristalis similis (Fallén, 1817)
Eristalis tenax (Linnaeus, 1758)
Eumerus amoenus Loew, 1848
Eupeodes corollae (Fabricius, 1794)
Meliscaeva auricollis (Meigen, 1822)
Merodon hirtus (Sack, 1932)
Myathropa florea (Linnaeus, 1758)
Paragus tibialis (Fallén, 1817)
Pelecocera pruinosomaculata Strobl, 1906
Scaeva pyrastri (Linnaeus, 1758)
Sphaerophoria scripta (Linnaeus, 1758)
Syritta pipiens (Linnaeus, 1758)
Xanthandrus comtus (Harris, 1780)

Table 4. Hoverfly species collected during field trips along the Kyrenia Mountain range.

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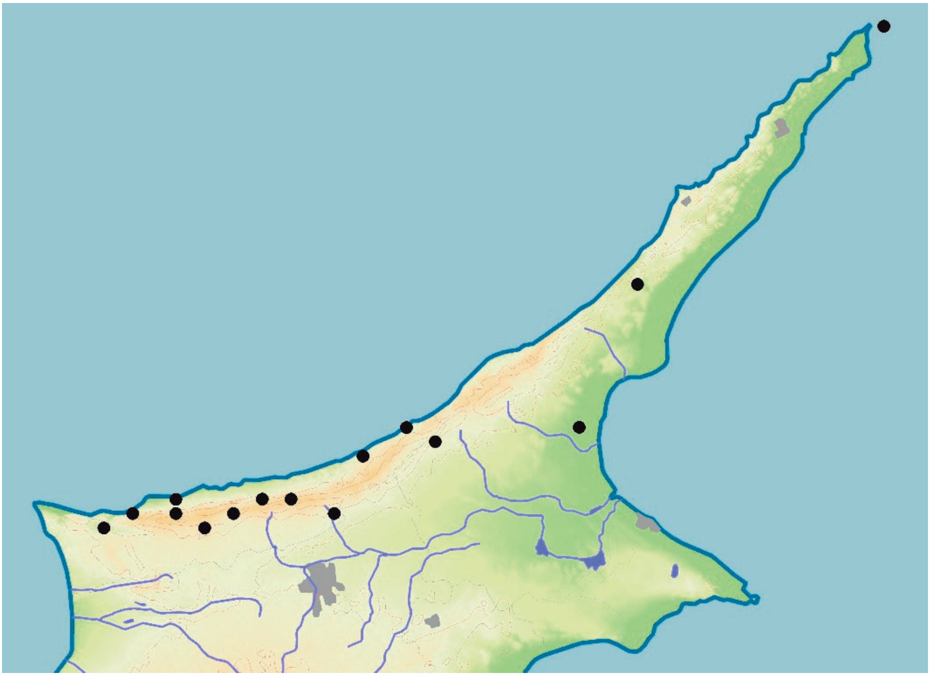

Fig. 3. Localities visited in the Kyrenia mountain range.

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Continued range-expansion by *Rhamphomyia marginata* (Fabricius) (Diptera, Empididae): the first records for Norfolk – On 23 April 2019, at around 1300 hrs, AJM netted a distinctive but unfamiliar fly in a clearing in Thetford Forest near Croxton (TL8788); habitat was regrowth of pine, with some birch and hawthorn. Soon after, on 26 April 2019, DA and David Norgate had a similar experience, catching a distinctive fly at MV light at Sculthorpe Moor in north Norfolk (TF901299) (Figs 1-3), which DA identified as *Rhamphomyia marginata* (Fabricius, 1787) by comparison with the key by M. Hackston (2018. Empididae, genus *Rhamphomyia* illustrated key. *https://sites.google.com/site/mikesinsectkeys2/home/brachycera/empididae*). This identification was confirmed soon afterwards by Tony Irwin, and the find was then reported on the 'Norfolk Moths' Facebook group. At this point AJM realised the likely identification of the Croxton specimen, subsequently also confirmed by Tony Irwin.

Figs 1-3. *Rhamphomyia marginata* female, from Sculthorpe, Norfolk (photos D. Appleton).

The species was first recorded in Britain in 1971 (Chandler, P.J. 1973. *Rhamphomyia* (*Pararhamphomyia*) *marginata* Fabricius (Dipt., Empididae), a remarkable addition to the British list. *Proceedings of the British Entomological & Natural History Society* **6**(3)**,** 73-76), with that sighting and most subsequent ones being from Kent. Outlier records have been from Hampshire in 2009 and 2019, Essex in 2015, Hertfordshire in 2017 and Northamptonshire in 2017 (Plant, C.W. 2017. *Rhamphomyia marginata* (Fabricius) (Diptera, Empididae) discovered in northern Hertfordshire. *Dipterists Digest* (*Second Series*) **24,** 77-78; Nigel Jones *pers. comm.*).

The records reported here are the first two for Norfolk, with the Sculthorpe record being the most northerly British record to date of which we are aware. Many records of this species have been of individuals coming to light although diurnal captures are not unprecedented, for example as discussed by Laurence Clemons (1999. Notes and observations of *Rhamphomyia marginata* (Fabricius) (Diptera, Empididae) in East Kent. *Bulletin of the Kent Field Club* **44,** 89-93), and the lack of further records from light traps in East Anglia seems surprising. Perhaps this is due simply to a lack of awareness of the species amongst moth-trappers to date.

Many thanks to Tony Irwin for confirming the identification and drawing references to our attention, and to Nigel Jones and Peter Chandler for providing information on other records – **ANDY MUSGROVE,** Tendaba, The Street, Shotesham NR15 1YG; andymusbubo@gmail.com and **DAVE APPLETON,** 44 Eastgate Street, North Elmham NR20 5HD

Dipterists Digest 2020 **27,** 117-119

Flies (Diptera, Canacidae and Chloropidae) mating with the wrong species may pose a taxonomic pitfall

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Summary

Species mating with the wrong kind may occur more often than we imagine. Circumstances that may lead to this and the possible consequences are briefly outlined with a focus on taxonomic implications.

Deposited in the collections of the National Museum of Wales, Cardiff and placed in the drawer with the species *Tethina strobliana* (Mercier, 1923) (Canacidae) is a male *T. strobliana* pinned in copulation with a female *Tricimba humeralis* (Loew, 1858) (Chloropidae) (Fig. 1). The specimen data is: Malta, Salina, 22.iv.1994, leg. J.C. Deeming.

Shuker *et al*. (2015) defined reproductive interference thus: "(it) arises when individuals of one species engage in reproductive activities with individuals of another, leading to fitness costs in one or both species. Reproductive interference (RI) therefore has two components. First, there must be misdirected mating interactions. Second, there must be costs associated with these misdirected interactions." Mating with an individual from a congeneric species is not rare, especially under laboratory conditions. Mating with a completely unrelated species, not only from a different genus but even from a different family altogether, as in this case, is not common and probably takes place only in very unusual circumstances. The costs of such reproductive interference are obvious and significant. And when this happens it is obvious to the taxonomist that things have gone wrong and the two separate species are so recognised.

Sexual reproduction in insects has been a well-studied topic for many years. Notwithstanding the complex anatomical structures of both sexes but usually more so in the males, structures that themselves pose barriers to successful copulation, all insects have elaborate strategies for mate selection. Spatial and temporal factors aside, courtship displays conducted aerially or on a leaf, tree trunk or other object bring the sexes closer together. Visual cues with pheromone release are usually the next steps. At this stage the pair generally would copulate. The female makes her selection (copulation), but in some species she still has options, deselection (copulating but rejecting the ejaculate), mates with several males in quick succession, stores and later chooses which sperm to use. But the whole process can go badly wrong from the start if the female mates with a male from a different species.

Closely related sympatric species mate with the wrong species more often than we may imagine – a subject intensively studied in the Drosophilidae (Manzano-Winkler *et al*. 2017). When this happens fecundity and offspring viability is limited. Reduced fertilization, an altered development time for the ova and reduced acceptability for further mating of the female with or without enhanced aging all play a part in various combinations in different species. In short, it does not bode well for the successful production of the usual number of fertile offspring when such a mating takes place. Kishi (2015), in his review of the subject, pointed out that not only is RI density dependent but that it is also influenced by environmental factors such as resource availability, male promiscuity and female tactics to avoid mating with non-conspecific males.

It is not difficult to envisage situations where sympatric species of the same genus with similar biology and ecology, along with similar external morphology, find themselves aspirated in number and spending a long enough period in a pooter. Such closely related species are more likely to mate with the wrong kind. John Deeming and I were collecting flies at the saltmarsh in Salina, where both species *Tethina strobliana* and *Tricimba humeralis* were numerous among a wide array of other smaller Diptera. Fairly large unselected samples were aspirated using pooters, in which the flies remained for the rest of the day. No doubt the proximity of males and females of many of the species resulted in pheromone release that would have prompted mating, most of the time with individuals of the same species, but inevitably errors of "mistaken identity" would have occurred and one couple has been so preserved.

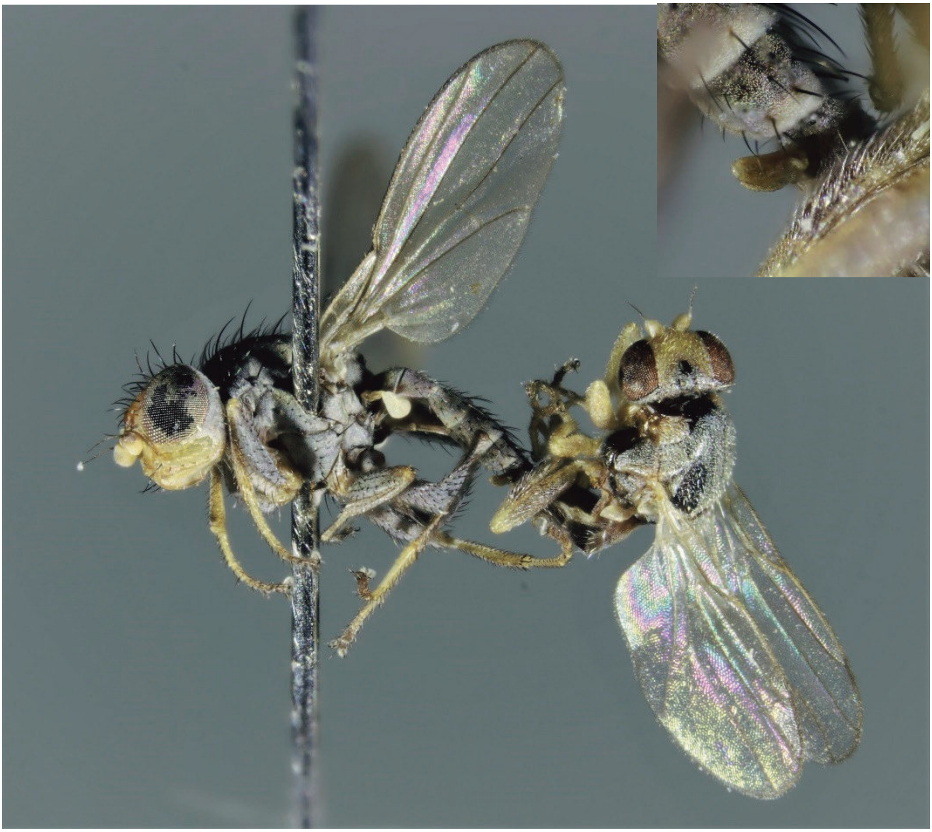

Fig. 1. Male *Tethina strobliana* (Canacidae) left, mating with a female *Tricimba humeralis* (Chloropidae) right. Inset: enlarged view of the surstylus of *T. strobliana*.

It is often written on specimen labels and in papers that the individuals were "taken in cop", but it is only implied that they were "in cop" *in nature* before being captured, which may not have been the case at all. Should a pair "in cop" be taken from the wild in isolation it can reasonably be assumed that they belong to the same species. However, small specimens are so often taken in number and retained in a pooter or even in a Malaise trap bottle that it must occur quite often that the copulation was artificially induced between the different species. The female sex of many species of Diptera, if known at all, is often not or only with considerable difficulty distinguishable from congeners. This raises the possibility that some females although so intimately associated with males, in fact may not be conspecific.

Collectors need to be aware that "in-cop." does not automatically mean "same species". A further assessment should be undertaken noting the collecting method, presence of related species in the locality and a careful examination of both male and female specimens.

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***Sphenometopa claripennis* (Villeneuve) (Diptera, Sarcophagidae) new to Greece, from the island of Crete –** As part of Diptera sampling on Crete in June 2019 by JP, two males of *Sphenometopa claripennis* (Villeneuve, 1933) were collected on Mount Psarí (Ψαρί) in the western part of the island (35.3744N 24.037E), at an altitude of about 1300 m. The two specimens, collected by hand net, were first observed while circling each other 10–15 cm above a sandy mountain path, appearing like two silvery pendulum balls attached to a thread, a behaviour commonly observed also in other species of *Sphenometopa* Townsend. The landscape was rocky and barren, almost devoid of vegetation. Crete is only the second known locality of occurrence of this species in political Europe after Cyprus (Pape, T. 2004. Fauna Europaea: Diptera, Sarcophagidae. Fauna Europaea version 2.4. http://www.faunaeur.org [Accessed February 5th, 2020]). *Sphenometopa claripennis* is widespread in Central Asia and the Middle East, and was recently recorded from Syria and Iran for the first time (Verves, Y.G.

and Khrokalo, L.A. 2020. Review of the genus *Sphenometopa* Townsend, 1908 (Diptera: Sarcophagidae) of the Middle East. *Biologia*: *doi.org/10.2478/s11756-020-00425-x*). The species is morphologically very similar to *S. fastuosa* (Meigen, 1824), which is widespread in central-southern Europe, but can be distinguished by the completely unmarked wing of the male (Fig. 1).

Fig. 1. Male *Sphenometopa claripennis* (Villeneuve) from Mount Psarí, Crete (© SMNS).

The biology is known for very few species of *Sphenometopa*, the larvae of which are kleptoparasites of solitary wasp nests (Verves and Khrokalo *op. cit.*). The genus comprises about 50 species worldwide, nine of which occur in Europe, mostly in southern regions (Pape *op. cit.*). Fig. 1 was stacked in Helicon Focus version 6.7.1 Pro from 48 images and edited in Adobe Photoshop; individual images were taken with a Canon EOS 5DSR camera with MPE 65 mm macro lens, attached to a StackShot Macro Rail operated by the Visionary Digital Passport software; lighting was provided by a Studio Pro Dynalite Flash Generator. The specimens are deposited at Staatliches Museum für Naturkunde Stuttgart, Germany (SMNS).

Thanks are due to H. Rajaei (SMNS) for his help with the photograph – **DANIEL WHITMORE,** Staatliches Museum für Naturkunde Stuttgart, Rosenstein 1, 70191 Stuttgart, Germany; daniel.whitmore@smns-bw.de, and **JAAKKO POHJOISMÄKI,** University of Eastern Finland, Department of Environmental and Biological Sciences, P.O. Box 111, 80101 Joensuu, Finland.

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Three species of Agromyzidae (Diptera) new to Great Britain with additional European data and morphological notes

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Summary

Three species of Agromyzidae (Diptera) are reported as new to Great Britain. *Cerodontha* (*Icteromyza*) *rozkosnyi* Černý, 2007, *Metopomyza junci* von Tschirnhaus, 1981 and *Ophiomyia ungarensis* Černý, 2015 are hereby added to the British Diptera list based on specimens collected by Ivan Perry (IP). Each species is discussed, with previously unpublished European and Asian data included for *Metopomyza junci*.

Introduction

In February 2020, BPW was sent some Agromyzidae specimens collected and provisionally determined [based on external features] by IP. The sample included specimens identified as '*Metopomyza junci*', '*Cerodontha* (*Icteromyza*) *geniculata*' (Fallén, 1823) and '*Ophiomyia* sp'.

All specimens were dissected by BPW, with the male genitalia being examined in detail; this permitted a positive identification of *M. junci*, with the '*C. geniculata*' proving to be *Cerodontha* (*Icteromyza*) *rozkosnyi* and the *Ophiomyia* sp. being determined as *O. ungarensis*. These records represent the first known occurrence of each species in Great Britain.

Cerodontha (*Icteromyza*) *rozkosnyi* Černý, 2007

Identification

Using the key by Spencer (1976), the specimens run to couplet 4; as they possess yellow [although can be slightly darker] frons, *C.* (*I.*) *geniculata* is the determination. However, the male genitalia are quite different to that species. In the key by Papp and Černý (2016), the males run to couplet 5: *C.* (*I.*) *geniculata* or *C.* (*I.*) *rozkosnyi*.

Here, although the species may be separated on the basis of width of frons [in ratio to eye width] or the length of penultimate/ultimate sections of vein M_{3+4}, these features can be difficult to ascertain and/or are frequently variable. Therefore, examination of the male genitalia is necessary to enable separation between *C.* (*I.*) *geniculata* and *C.* (*I.*) *rozkosnyi*.

Cerodontha (*I.*) *rozkosnyi* possesses 2 *ors* and 2-3 *ori*, with orbital setulae erect and sparse. Arista distinctly pubescent. Lunule broad, twice as broad as high, with ocellar triangle extending to anterior margin of frons. Mesonotum with 1+3 *dc*, *acr* in 4 rows. Frons, lunule, face and gena yellow, with third antennal segment black, first and second yellow to yellowish-brown. Third antennal segment small with short pubescence. Legs mostly black, with all knees broadly yellow, tibiae and tarsi blackish-brown. Male genitalia (Fig. 1) distinctive; distiphallus more than twice as long as mesophallus, formed as a pair of long, slender, proximally curved tubes, never curving above mesophallus. Caudal projection well developed. Cerci long and curved ventrally. Ejaculatory apodeme with small V-shaped blade.

Biology

Larval details are unknown; however, as all specimens were collected from stands of *Eleocharis* [Cyperaceae, a known host for *Icteromyza* spp] at the edge of pools, it would be reasonable to assume that this genus can be considered as a host for *C.* (*I.*) *rozkosnyi.*

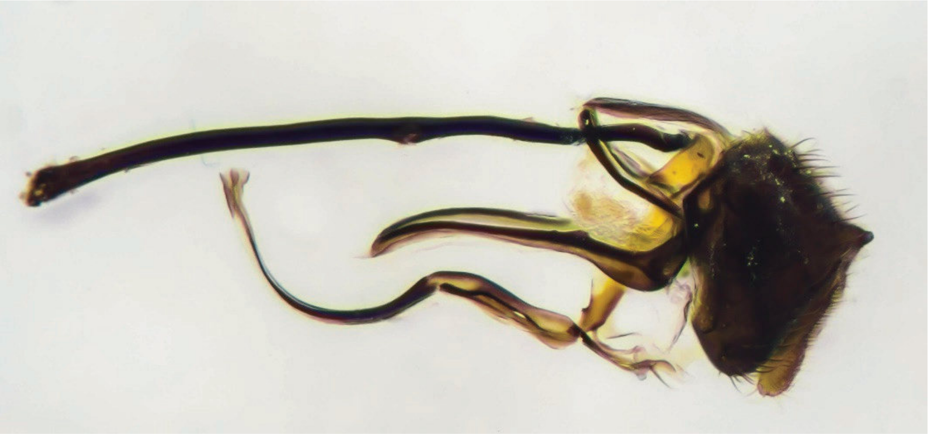

Fig. 1. ***Cerodontha*** **(*****Icteromyza*****)** ***rozkosnyi*** **Černý: male phallus in left lateral view.**

Distribution

This species was described from material collected in the Czech Republic, Romania and Morocco (Černý 2007). Additional confirmed records are known from Greece (Černý 2011a), Hungary (Papp and Černý 2016), Israel (Černý 2011b), Switzerland (Černý and Bächli 2018) and Turkey (Dursun *et al.* 2015). Specimens were swept by IP from the following sites:

Location		Date	Quantity
Quy Fen, Cambs	TL514627	23.viii.1991	1♂
Wicken Fen, Cambs	TL557695	23.vii.1992	2♂
Hatchet Pond, New Forest, Hants	SU368017	19.vii.1999	1♂
Roydon Common, Norfolk	TF679229	09.viii.2016	1♂
Gwithian Towans, Cornwall	SW582421	21.vi.2018	1♂

Discussion

As discussed earlier within this manuscript, *C.* (*I.*) *geniculata* is very similar [*C.* (*I.*) *bohemani* (Rydén, 1951) and *C.* (*I.*) *michaeli* Zlobin, 2000 (not a British species) are also similar in terms of general appearance and coloration but with differing genitalia] and examination of the male genitalia should be conducted to allow a positive determination. The above collection sites indicate that *C.* (*I.*) *rozkosnyi* is quite widespread and it may prove to be present elsewhere in British Isles if the probable host plant genus, *Eleocharis*, is targeted. *Eleocharis* spp. are heavily attacked by the monophagous fly *Diplotoxa messoria* (Fallén, 1820) (Chloropidae) which could be a competitor in the larval stage.

Metopomyza junci von Tschirnhaus, 1981

Identification

When using the key by Papp and Černý (2017), the specimens run readily to couplet 6; owing to the sides of the abdominal tergites being yellow, *M. junci* is the determination. This is a small species, extremely similar to *M. scutellata* (Fallén, 1823), only specimens with lower parts of basal abdominal tergites yellow or detailed examination of male genitalia allows positive separation. There are usually 2-3 *ors*, 2-3 *ori*, with orbital setulae sparse. Third antennal segment longer at top than bottom, as long as high, or slightly longer than high, with dark pubescence.

Mesonotum possesses 3+0 *dc* [infrequently 2+0 or 4+0], with *acr* in 4-7 rows. As in *M. scutellata*, the inner postalar seta (*ipa*) is absent.

A mostly all-dark species, with frons being yellowish to dirty-brown. Notopleural triangle partly brownish, not black. Legs dark, with all knees yellow. Wing with costa extending to M_{1+2}, last section of M_{3+4}, on average, x3.2 that of penultimate.

Medial lamella of epandrium possesses two rows of large, dark, blunt pegs, with the subepandrial sclerite extremely similar to that of *M. scutellata*. The surstyli vary in terms of the shape and number of teeth; at the front and rear end there can be 1 or 2 median-orientated teeth, on the concave inner edge, there is, occasionally, sometimes only on one side of the body, an equally large tooth. The distiphallus (Fig. 2) comprises a sub-cylindrical basal part and a pair of slightly up-curved tubes distally. Hypophallus asymmetrical, possessing 2 darkened lamellae in lateral view. Ejaculatory apodeme with a rather narrow blade and a globuliform bulb (Fig. 2).

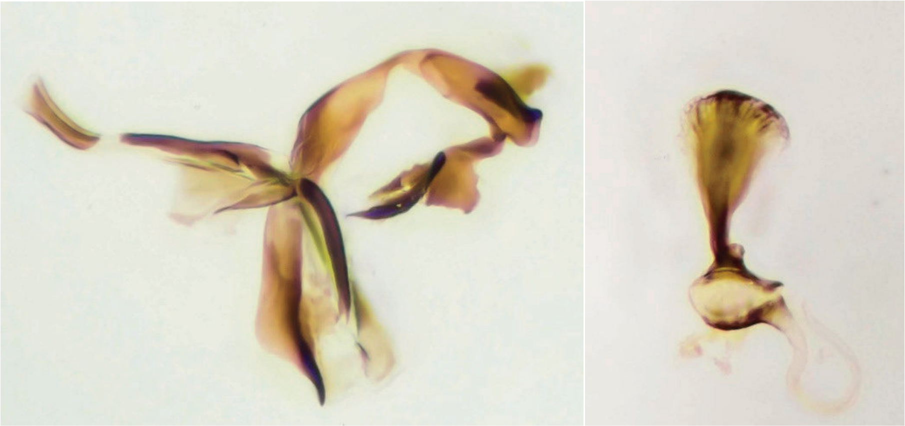

Fig. 2. ***Metopomyza junci* von Tschirnhaus: left, male phallus in left lateral view; right, ejaculatory apodeme [not to scale].**

Biology

Larva yellow, 2.7mm long, superficially similar to *M. scutellata*. *Metopomyza junci* is known to utilise *Juncus*, chiefly *J. gerardii*, saltmarsh rush. The egg is always laid on the underside of the leaf, next to the convex centre line. Upon hatching, the larva crosses the leaf and creates a short, 3-7mm, corridor which is difficult to see [often later overrun by the main mine]. The mine then widens to fill the entire leaf blade, extending to the tip and later towards the base of the leaf.

The puparium is partly glued to the outside of the leaf, possibly as an adaptation so that the larva does not succumb to unfavourable marine tide conditions before the larval skin hardens (von Tschirnhaus 1981). Adults are on the wing between May and September, with numbers peaking in July.

Distribution

Metopomyza junci was described from 504 specimens collected in Denmark and Germany (von Tschirnhaus 1981) and is also known from Hungary (Papp and Černý 2017), the Netherlands, Poland, Portugal (Gil-Ortiz *et al.* 2011), Lithuania (Pakalniškis 1990) and Slovakia (Vála and Černý 2009). Previously unpublished European and Asian data are hereby included:

Country	Location		Date	Leg.		
					♂	♀
Austria	Burgenland	47°47'54"N, 16°41'38"E	01.vi.1985	G. Bretfeld	-	1
Denmark	Tipperne NR	55°53'49"N, 08°12'47"E	26.vii.1968	M. von Tschirnhaus	1	1
Germany	Thuringia	51°22'13"N, 11°17'01"E	14.vi.1998	M. von Tschirnhaus	1	3
Germany	Brenner Moor	53°48'56"N, 10°21'10"E	30.vi.1971	M. von Tschirnhaus	4	1
Germany	Isle of Sylt	54°52'37"N, 08°28'11"E	20.vii.1987	M. von Tschirnhaus	1	-
Germany	Isle of Sylt	54°47'58"N, 08°17'30"E	19.vii.1987	M. von Tschirnhaus	7	2
Germany	Niedersachsen	53°02'20"N, 11°25'38"E	09.vi.2018	M. von Tschirnhaus	1	2
Germany	Murnauer Moos	47°37'34"N, 11°09'25"E	23.vii.1990	Frank Püchel	5	2
Hungary	Kiskunság National Park	46°50'14"N, 19°11'41"E	23.viii.1986	M. von Tschirnhaus	-	1
Kyrgyzstan	SW shore of lake Yssyk-Köl, 15 km E of Ottuk	42°18'20"N, 76°28'57"E	30.viii.2003	M. von Tschirnhaus	-	1
Kyrgyzstan	Stancia It-Agar, river Rečka Čyškan	42°N, 73°E	19.viii.2003	M. von Tschirnhaus	1	2
Russia, Siberia SW	Oblast Tomsk	55°45'40"N, 83°21'24"E	02.viii.2000	M. von Tschirnhaus	2	-
Slovakia	Malacky District	48°31'52"N, 17°00'27"E	01.ix.1990	M. von Tschirnhaus	-	1

Discussion

Adults were collected by IP from coastal sites adjacent to the North Sea: Holme Dunes (TF712450), Norfolk, 8.viii.1998, 1♂; The Naze (TM266247), Essex, 10.vii.2010, 1♂; Shingle Street (TM374436), Norfolk, 5.v.2016, 1♀ and 3.viii.2016, 1♂. Although coastal saltmarsh is the preferred biotope, the collecting sites listed in the table above include differing habitats; inland salty bog [Brenner Moor], flood plain [Niedersachsen], dry swamp [Kiskunság], marsh along lake [Yssyk-Köl], swampy river bank [Stancia It-Agar] and wet meadow [Malacky District].

Metopomyza junci may prove to be well-established in Britain, saltmarsh rush being relatively common along the shoreline.

Ophiomyia ungarensis Černý, 2015

Identification

The male runs to couplet 38 in Papp and Černý (2015); then, owing to the facial keel being broad and flat between bases of the antennae, *O. ungarensis* is the determination and not *O. orientalis* Černý, 1994 [the genitalia of *O. orientalis* although superficially similar, are quite different in detail].

This recently described species is relatively small, with wing length of 1.8mm, costa extending to vein M_{1+2}, ultimate section of M_{3+4} approx. 1.16 times as long as penultimate. Orbits forming a narrow ring in front of eye when viewed in profile. Orbital setulae sparse, all reclinate, 2 slender *ori* and 2 *ors*. Vibrissal fasciculus short, broader at base and curving apically. Mesonotum with 2 *dc*, *acr* in 6-8 irregular rows.

Male genitalia with distiphallus (Fig. 3) symmetrical, mesophallus narrow and short with basiphallus possessing asymmetrical long arms. Ejaculatory apodeme with narrow blade.

Černý stated that this species appears to be closely related to *O. asparagi* Spencer, 1964 but the structure of the distiphallus complex, hypandrium and ejaculatory apodeme are distinctly species-specific.

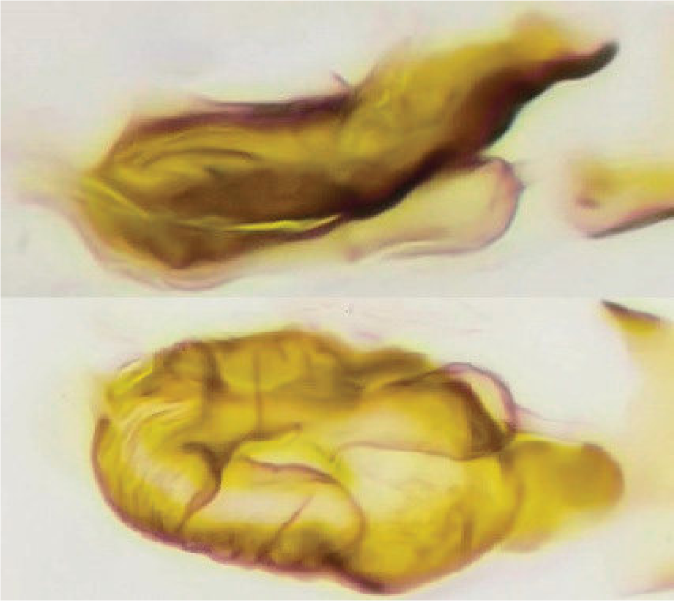

Fig. 3. *Ophiomyia ungarensis* Černý: distiphallus complex; upper, left lateral view; lower, viewed from below.

Biology

At present, its lifestyle is unknown.

Distribution

Ophiomyia ungarensis is only known from Hungary (Papp and Černý 2015), Turkey (Černý 2019) and Ukraine (Guglya 2016).

Discussion

The specimen was collected by IP at Sheepleas (TQ087519), Surrey, 17.vii.2010, from herb-rich chalk grassland. Although it may be of no great significance, it should be noted that the site possessed an abundance of dodder [*Cuscuta* sp.].

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rozkosnyi and *Ophiomyia ungarensis*, and Michael von Tschirnhaus (University of Bielefeld, Germany) for confirming the determination of *M. junci* and providing previously unpublished observations and European and Asian data.

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