Dipterists Digest

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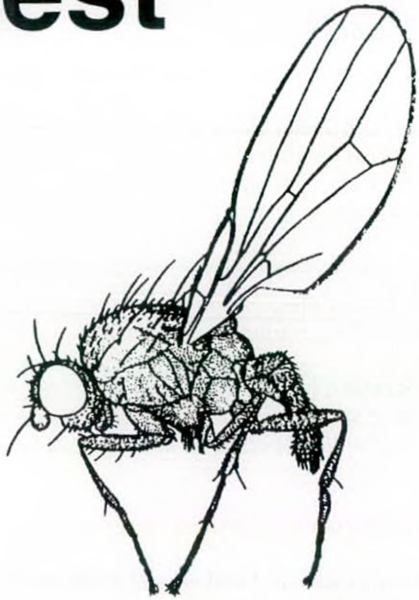
Cover illustration: *Rhagoletis cingulata* (Loew), (Tephritidae) female, © Paul Bowyer, see article on pp 97-98.

Dipterists Digest



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

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 must not have been accepted for publication elsewhere and should be written in clear and concise English. **Contributions should preferably be supplied either as E-mail attachments or on 3.5" computer disc or CD in Word or compatible formats**.

Articles should be supplied 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 considered. Figures and photographs should be supplied separately as jpeg files to fit in the above page format, or as hard copy. All jpegs should be supplied at 300 dpi.

Style and format should follow articles published in the most recent issue. 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 twenty separates of papers of two or more pages in length, and a pdf of their contribution if requested.

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The relative importance to Diptera of pasture and ditch margins on an English grazing marsh

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Summary

Adult Diptera were sampled by standardised sweep-netting along transects by ditches and in field centres on six visits from May to September 2012. Comparison of the fauna of field margins and centres was investigated using species-richness, rarity and assemblage composition. The fauna at field margins was markedly different to that in the field centres but the effect was largely restricted to the wetland component of the fauna. Wetland Diptera were more species-rich, more abundant and included more uncommon species at the margins than at the centres. They also formed a large proportion of the total dipteran fauna recorded on the grazing marsh. The numbers of species and the abundance of generalist Diptera and those associated with non-wetland habitats were almost unaffected by position in the fields. The main recommendation for management to enhance the fauna is to dig or restore more ditches rather than flood them.

Introduction

Ditches have long been known to support a valuable invertebrate fauna. Aquatic invertebrates are one of the principal features, along with wetland birds and plants, taken into consideration when notifying grazing marshes (wet grassland) as Sites of Special Scientific Interest (SSSI) in Britain. The response of this fauna to different types of ditches and to stages in the rapid hydrological succession that characterises them is well documented and understood, although reported largely in unpublished studies (Driscoll 2007) and thus giving the impression that ditches are little-studied (Armitage *et al.* 2003, Clare and Edwards 1983, Drake *et al.* 2010, Herzon and Helenius 2008, Painter 1999, Verdonschot *et al.* 2011, Williams *et al.* 2003). Most studies focus on aquatic species, leaving little published on groups like Diptera that are largely ignored by many freshwater ecologists who sample only the aquatic stages (Cranston *et al.* 2010, Drake 1988, 1998). In comparison, the invertebrate fauna of the fields themselves is relatively little known, and it is often assumed to have low interest since this land is working farmland providing pasture for cattle and sheep. Outside grazing marsh SSSIs this may be true but some marshes are managed sympathetically with nature conservation as the primary aim. These sites may therefore have an interesting and valuable invertebrate fauna associated with the pasture quite independently of the ditches.

Ditches have been shown to act as corridors linking patches of high quality wetlands separated by mundane farmland (Decleer *et al.* 2015). Corridors encourage a wide range of organisms to move between habitat patches, and there is more movement between habitat patches connected by corridors than between isolated habitat patches (Gilbert-Norton *et al.* 2010). These authors found exceptions which could be explained by organisms not perceiving any difference between corridors and the habitat matrix, and this may be true of some Diptera in wet grasslands. From unpublished work, it is clear that ditches in British grazing marshes are more than just corridors for adult flies but are important habitats in their own right. It would be useful to know how far into the pasture this interest extends, since management could be modified if necessary to enhance the fauna and aid movement across the landscape. A detailed study would be needed to quantify this, and this was beyond the resources available for the current study, but an estimate of the value to flies of ditch margins and field centres will help answer this question.

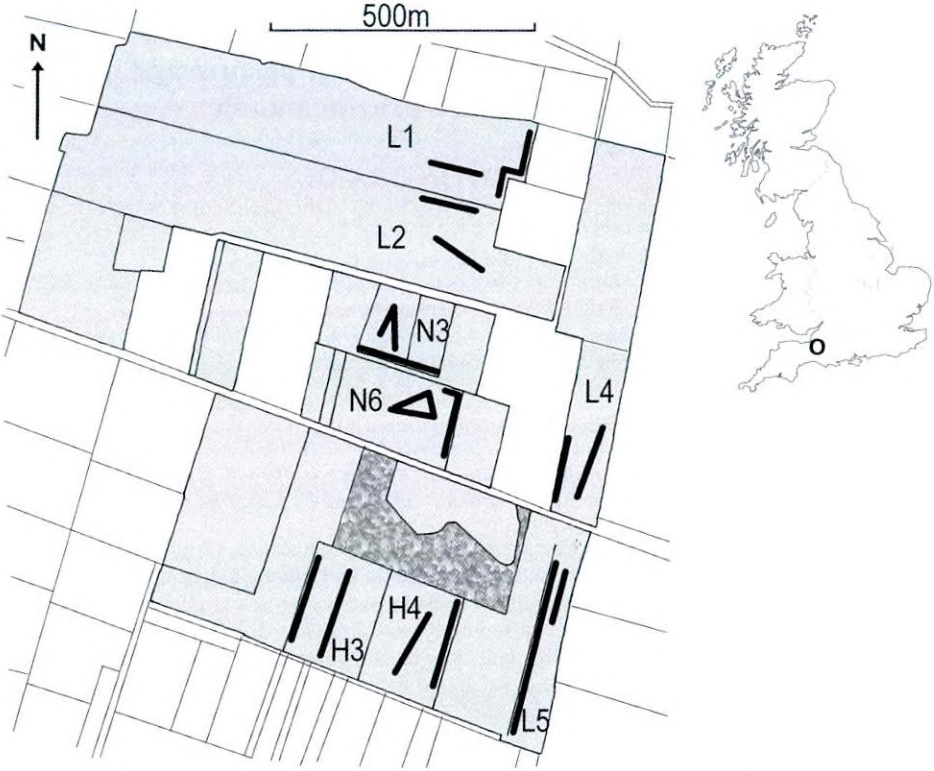

Fig. 1. Map of Catcott Reserve (shaded) showing transects (thick black lines) in May 2012 (positions varied between months). Old pasture field codes begin with H or N; new pasture codes begin with L. All boundaries are ditches; mottled area is wet woodland.

This paper describes a study undertaken to compare the relative importance to flies of pasture at field margins and centres. The work was an adjunct to a commissioned study investigating the use made by flies of flowers on grazing marsh (Drake 2012, and in prep.), and consequently the comparison was not of the emergent vegetation of the ditch itself but of the pasture sward at the bank top versus the similarly structured grassland of the field centre.

Methods

Site

Catcott Nature Reserve lies on the Somerset Moors (ST4041) and is part (92ha) of the much larger Catcott, Edington and Chilton Moors SSSI that covers about 1080 ha, and which in turn is part of the Somerset Levels and Moors Special Protection Area (35,000ha) in south-west England (Fig. 1). The reserve is predominantly grazing marsh on peat fed by base-rich water from the Polden Hills. Old and relatively undisturbed fields in the centre of the reserve have a species-rich neutral fen-grassland flora that is usually grazed between June and October or cut annually. To the north and east, these fields are the Lows which were arable fields before Somerset Wildlife Trust acquired them in 1990.

The Lows are so-called because deep-drainage for arable farming led to the peat drying and shrinking so that they are slightly lower-lying than the old pasture. Consequently they remain wetter and cattle cannot be turned out as early as on the old pasture. Grazing usually takes place from late June or early July, and mowing in July or August. As the Lows were until recently arable fields, they were less floristically rich than the old pasture.

The fields are divided by permanent drainage ditches about 2.5-5m wide; their total length within the reserve is about 14.5km. The dominant emergent plants at most ditch margins were *Glyceria maxima* and *Juncus effusus*, with locally abundant *Carex riparia*, *Iris pseudacorus*, *Typha latifolia* and *Sparganium erectum*. Being on peat and with cattle access, the margins at water level shelved gently, and in the wet conditions of 2012 were often swampy with dense shorter marginal plants such as *Mentha aquatica* and *Galium palustre*. Ditches were cleaned when necessary and piecemeal with maximising wildlife interest as the primary guideline on most ditches. Water levels in the ditches were kept as high as practicable and consistent with low intensity cattle grazing and annual mowing. Four old and four new fields were surveyed, selected to embrace the range of diversity of vegetation in fields still managed as traditional pasture, avoiding those with newly established reedbed and bird scrapes. Vegetation types varied widely. Among the more abundant conspicuous plants on the heterogeneous old pasture were *Centaurea nigra*, *Cirsium palustre*, *Filipendula ulmaria*, *Lotus pedunculatus*, *Ranunculus flammula* and *R. repens*. New pasture was often dense *Juncus effusus* with abundant *Cardamine palustre*, *Galium palustre*, *Mentha aquatica*, *Ranunculus flammula* and *R. repens*.

The weather in the spring and summer of 2012 was exceptionally wet and cold. The Lows remained flooded with at least 5cm of water throughout their extent on all visits until the final one in September, and the herb-rich old pasture fields were often similarly flooded in midsummer. This did not affect sampling, but the start of grazing was delayed and the cattle loitered on the drier bunds along some ditch margins, leading to severe poaching where transects had been established.

Sampling

Flies were sampled by sweep-netting along transects. Two transects were made in each field, one running along a ditch and the other across the field's centre, starting and ending well away from ditches and avoiding shallow drainage depressions where possible. The same ditch was used on all visits, although sometimes another section or side was used if emergent vegetation became too dense to sweep effectively. The position of the central transects was more haphazardly chosen on each visit but was usually a straight line passing through an apparently floriferous area of each field; sometimes in small fields the transect doubled-back in a 'V' shape (Fig. 1). A feature in the distance was used to keep a straight course and, once the direction was set, no attempt was made to vary it to encompass more flower-rich patches. Along ditches, the vegetation of both the field and immediate ditch bank was swept, without confining sampling to just the emergent vegetation. Sweeping, using a light-weight net of 40cm diameter, was standardised by making 20 back-and-forth strokes through the vegetation, removing all flies using a pooter, and repeating this another seven times, giving a total of 160 sweeps. This procedure was a more repeatable and standardised version of the author's long-established method of limiting sweep-netting to 10 minutes adopted to allow comparison between samples and confining sampling to a small moderately uniform area of habitat. While 160 sweeps produced a catch deemed adequate in about 10 minutes during a preliminary visit in early May when relatively few insects were flying, by midsummer 160 sweeps took 20-25 minutes to collect.

Six visits were made between mid May and mid September 2012, mostly at approximately 3-4 week intervals. Fieldwork took two days to complete after May. Visits were made on 16 May, 17 + 18 June, 29 June + 1 July, 17 + 19 July, 9 + 10 August and 13 + 15 September.

Exceptionally poor weather in late June resulted in only 13 samples being taken; 16 samples were taken on all other visits. Most (90%) sampling took place between 9:30 and 17:00 hours. Fields were not sampled in the same order on each visit, and most fields were sampled roughly equally before and after noon (1:00 BST), with the exception of one old field and one new field which were sampled, for no planned reason, markedly unequally either side of noon.

Flies in many families were identified and counted. Major omissions in the herb-rich habitat were Agromyzidae and several genera of Chloropidae (*Chlorops*, *Meromyza*, *Oscinella*) known to contain more species than can be confidently identified using current keys (John Ismay *pers. comm.*). Females of some families were not identified beyond family level, notably Anthomyiidae and Fanniidae in which females far outnumbered males.

Analysis

The analysis tested whether species-richness, abundance and assemblages differed between samples from the centres of fields and those from field margins next to ditches.

Flies were allocated to four broad ecological groups: (i) wetland species, (ii) species of open short dry habitat (grassland and scrub), (iii) species of shaded habitat (woodland) and (iv) common generalists with no obvious preference for wetter or drier ground. The sources of information used in this categorisation were the *Invertebrate Species-habitat Information System* (ISIS) developed by English Nature (Webb and Lott 2006) and unpublished accounts.

Assemblages at the margins and centres of fields were compared using analysis of similarity (ANOSIM) (Henderson and Seaby 2008). This method compares the similarity within groups with that between groups; if the groups are meaningful, samples within groups should be more similar in composition than samples from different groups. The test statistic, R, measures the difference between the mean of the ranked similarity between and within groups, using the Bray-Curtis similarity index as the measure, and its significance is judged using a Monte Carlo test. R ranges from 1 for complete similarity and 0 or negative for no similarity. As any difference in the entire assemblage could be due merely to 'terrestrial' species preferring the centres and wetland species preferring the margins, the test was repeated separately for each of the three largest assemblage types, wetland, 'terrestrial' and generalist. Removing infrequent species present in only one sample made almost no difference to the result so all were retained. Tests were made for each of the six visits, using both presence-absence and log-transformed abundance data.

The relationship between samples was shown graphically using ordination. Initial exploration of the data suggested that there was not much variation in the dataset as the turnover of species was relatively small, which was to be expected due to the close proximity of samples and the mobility of adult flies. Principal component analysis would normally be appropriate to such linear data (Lepš and Šmilauer 2003) but was rejected as the explanatory power of the eigenvalues of the first few components was poor. Non-metric multidimensional scaling (NMDS) therefore appeared to be a better option. NMDS was run using Sorensen's similarity index on presence-absence rather than on quantitative data, since the aim was to show that the centres and edges were different because each member of the whole suite of species had a preferred position in the fields. Had quantitative data been used, the influence of the relatively few abundant species may have swamped the contribution of infrequent species whose contribution was nevertheless important in this context.

Exploration using Shapiro-Wilk tests and Q-Q plots on the datasets for each treatment (date and position) indicated non-normality in a small proportion for species and a larger proportion for total individuals. No transformation improved the statistical distribution for species and the rare occasions when non-normality coincided with significant tests of mean values was considered an acceptable error. A logarithmic transformation (x+1) reduced but did not eliminate the incidence of non-normality for numbers of individuals, so parametric tests were likely to be invalid. Comparisons were made of mean numbers of species using Student's t-test and Fisher's F-test, and median numbers of individuals using a two-tailed Mann-Whitney U test.

Rarity was assessed using a Species Quality Index. Each species is allocated a score proportional to its national rarity and the average rarity for the sample obtained by dividing by the number of species in the sample (Foster *et al*. 1990). Scores were based on values in ISIS (2010 version), and those for missing species (mainly Anthomyiidae and Muscidae) were estimated from unpublished sources. The scores were based on a linear scale (common – 1; local – 2; nationally scarce – 3; etc) rather than the usual geometric scale (1, 2, 4, 8 ...) since this reduces the variance of the means estimated for several samples and thus increases the chance of detecting a real difference between means. Values were normally distributed and variances were nearly always equal, so allowing means to be compared using a t-test.

Results

Sweep-netting yielded about 26,000 specimens in 395 species in the 42 families that were identified consistently in all samples. Five families included half of the species, with Syrphidae (57 species) being the most species-rich family recorded. Families comprising a large number of wetland species were also well represented – Ephydridae (42 species), Dolichopodidae (41 species), craneflies (Cylindrotomidae, Limoniidae, Pediciidae, Tipulidae) (23 species) and Sciomyzidae (20 species). Appendix 1 lists all species.

Wetland species dominated the catch, with 221 species, followed by 'terrestrial' species of open but not wet habitat (predominantly species of grasslands) with 117 species. Generalists (39 species) were mainly very common species with no clear preferences. A few species (19) of woodlands or shaded places were presumably strays from the block of woodland or tall hedges along droves in the centre of the site.

Species-richness and abundance of individuals

The numbers of total species and individuals were always higher at field margins by ditches than at field centres, significantly so for species on four of the six visits but only once for individuals (Table 1). Two major wetland families showed different responses. Ephydridae and Sciomyzidae were always more species-rich at field margins compared to their centres, as would be expected (Fig. 2). However, the difference was never significant for Ephydridae whereas it was on four visits for Sciomyzidae (and also for their abundance on all visits). The difference between the margins and centres became less pronounced towards the end of summer. The responses of craneflies and Dolichopodidae were weaker versions of that shown by Sciomyzidae, with larger and sometimes significant differences in species-richness in spring but none by midsummer.

In contrast to these predominantly wetland families, Syrphidae showed no consistent differences in species-richness or abundance of individuals between margins and centres (Table 1, Fig. 2). Most other families also behaved in this way, as shown for Muscidae with only occasional significant differences that, given the large number of tests undertaken, could be due to chance alone. Some apparently large but non-significant differences between margins and centres were a consequence of the small number of samples and low numbers at some times of year.

The results of the broad ecological groups followed expectation. Wetland species were always more species-rich at field margins than in their centres, significantly so on the first four of the six visits (Fig. 3). Generalist species were also marginally more speciose by ditches but never significantly so, whereas terrestrial species showed a mixed response with no consistent trend, there being significantly more by ditches in May but fewer in August. Fig. 3 also shows that wetland species far outnumbered terrestrial species, even in their less preferred location in the field centres. Median abundance of individuals in each of the assemblage types followed a similar pattern: wetland flies were always more numerous and often significantly so at field margins but there was no consistent pattern to generalists or terrestrial species, which were found in similar abundances in both positions (data not presented).

Table 1. Mean number (with 95% confidence limits) of species and median abundance (individuals) for all species recorded, and median abundances of six large families at the margin and centre of fields on each visit. Pairs of significantly different values are in bold and the level of significance for the t-test and Mann-Whitney test given below (* = p<0.05; ** = p<0.01; ***=p<0.001).

Visit	Position significance level (p)	Mean number of species	Median number of individuals						
		All species	All species	Craneflies	Dolichopodidae	Ephydridae	Muscidae	Sciomyzidae	Syrphidae
May	margin	**44** (27-61)	**134**	**17**	20	6	13	**6**	23
	centre	**26** (16-37)	**80**	**7**	7	2	7	**1**	22
	p	***	**	**				***	
mid June	margin	**55** (37-73)	251	11	27	24	12	**9**	13
	centre	**39** (23-54)	192	6	15	20	8	**2**	30
	p	***						**	
late June	margin	**45** (32-58)	232	3	21	20	5	**3**	35
	centre	**34** (13-54)	201	1	11	4	6	**0**	48
	p	*						**	
July	margin	**46** (21-72)	224	3	13	**28**	11	**12**	97
	centre	**32** (15-49)	215	3	12	**5**	12	**1**	117
	p	*				*		**	
August	margin	51 (32-70)	387	7	13	129	6	**24**	**28**
	centre	44 (23-64)	309	20	8	174	7	**8**	**43**
	p							*	*
September	margin	55 (27-83)	376	21	8	83	14	**30**	18
	centre	44 (18-70)	335	41	9	40	10	**17**	23
	p							*	

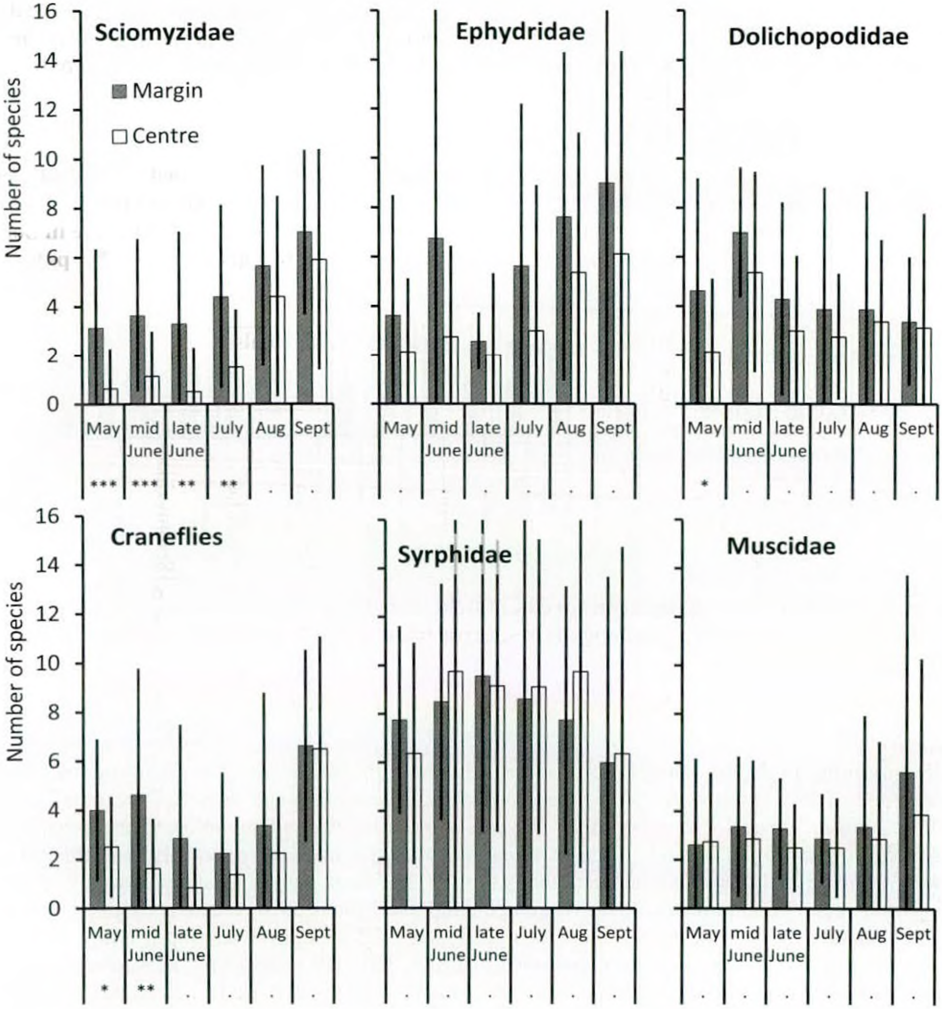

Fig. 2. Mean number of species in field margins (shaded) and centres (white) for speciose groups in each of six visits in 2012, with 95% confidence limits. The significance of the Student t-test of the difference in the means for each pair of samples is shown below the X axis labels: * = $p<0.05$; ** = $p<0.01$; *** = $p<0.001$. N=8 for each pair of treatments on each date except for late June (N=6). Upper confidence limits are curtailed for Ephydridae (mid June = 18, Sept = 22) and Syrphidae (mid June = 20; July = 20; Aug = 18).

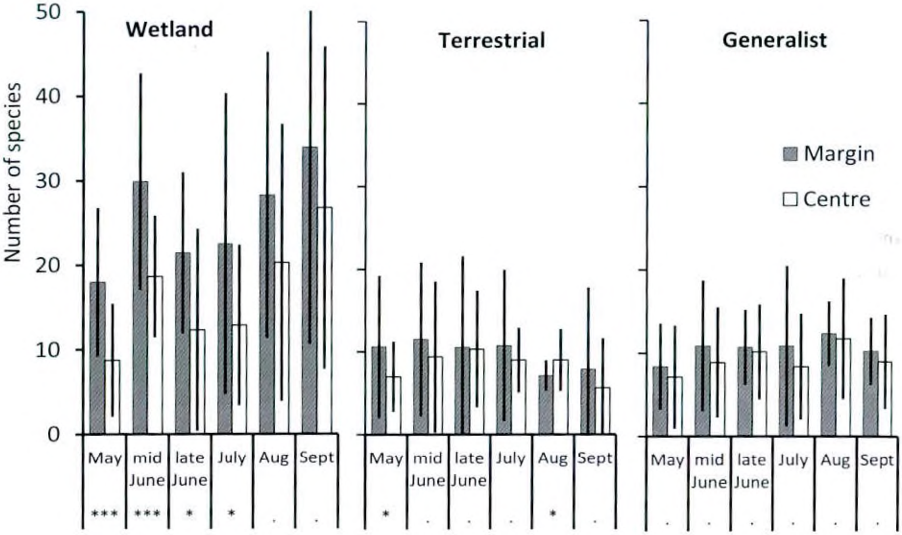

Fig. 3. Mean number of dipteran species at field margins and centres in each of six visits in 2012 for the three main assemblage types; error bars are 95% confidence limits. See Fig. 2 for significance levels.

Rarity

Twenty-nine species of conservation concern (that is, with a rarity status or deserving one) were recorded (Table 2) but many of these are probably more widespread than was presumed when these statuses were allocated more than 20 years ago (Falk 1991 and unpublished manuscripts by Adrian Pont and John Ismay). Some families recorded at Catcott were recently re-evaluated, or were in process of being re-evaluated, using the IUCN criteria and this resulted in many species in better recorded families being down-graded (Ball and Morris 2014, Drake *et al.* in prep., Falk and Chandler 2005, Falk, Ismay and Chandler in prep., Falk and Pont in prep.). They included *Dixella serotina*, *Beris fuscipes*, *Odontomyia tigrina*, *Vanoyia tenuicornis*, *Lejogaster tarsata*, *Melanogaster aerosa* and *Neoascia geniculata* which are retained in Table 2 since the rank order of rarity was probably approximately correct when the original statuses were given. The dolichopodid *Thrypticus intercedens* has been known for some time in Britain but has not been formally added to the British list. One specimen of an ephydrid in the genus *Hyadina* is new to Britain and possibly undescribed.

Table 2. Species of conservation concern, with the number of samples containing the species at the margin and centre of fields for all visits. Statuses: LRns - IUCN status Lower Risk nationally scarce, DD - data deficient (but likely to be rare), RDB3 - JNCC Red Data Book rare, N - JNCC status nationally scarce in a pre-2005 review, Local (N) - JNCC status of nationally scarce in a pre-2005 review but since downgraded, Local - possibly under-rated scarce species.

Family	Species	Status	Margin	Centre
Anthomyiidae	*Zaphne divisa* (Meigen)	Local	1	3
Anthomyzidae	*Anagnota bicolor* (Meigen)	Local (N)	1	
	Typhamyza bifasciata (Wood)	LRns	1	
Aulacigastridae	*Stenomicra cogani* Irwin	LRns	1	
Chloropidae	*Lasiochaeta pubescens* (Thalhammer)	Local (N)	2	2
Cylindrotomidae	*Phalacrocera replicata* (Linnaeus)	N	1	
Dixidae	*Dixella serotina* (Meigen)	Local (N)	1	
Dolichopodidae	*Campsicnemus pumilio* (Zetterstedt)	LRns	1	
	Thrypticus intercedens Negrobov	DD		1
Ephydridae	*Hyadina* [new]	(DD)	1	
Lauxaniidae	*Sapromyza opaca* Becker	LRns	1	
Limoniidae	*Pilaria scutellata* (Staeger)	N	2	1
Lonchopteridae	*Lonchoptera scutellata* Stein	LRns	2	
Muscidae	*Phaonia atriceps* (Loew)	Local (N)	1	
Sarcophagidae	*Sarcophaga sinuata* Meigen	LRns	2	8
Scathophagidae	*Conisternum decipiens* (Haliday in Curtis)	LRns	2	
Sciomyzidae	*Dichetophora finlandica* Verbeke	RDB3		1
	Pherbellia dorsata (Zetterstedt)	N	1	
	Pherbellia griseola (Fallén)	N	12	14
	Sciomyza simplex Fallén	N	1	
Stratiomyidae	*Beris fuscipes* Meigen	Local (N)	2	
	Odontomyia tigrina (Fabricius)	Local (N)	6	1
	Vanoyia tenuicornis (Macquart)	Local (N)	1	1
Syrphidae	*Eristalis similis* (Fallén)	Migrant	1	
	Lejogaster tarsata (Megerle in Meigen)	Local (N)	9	5
	Melanogaster aerosa (Loew)	Local (N)		1
	Neoascia geniculata (Meigen)	Local (N)	1	
	Parhelophilus consimilis (Malm)	LRns	3	1
Tephritidae	*Dioxyna bidentis* (Robineau-Desvoidy)	N	1	2

All these are wetland species. Margins supported 26 of the 29 species whereas the centres supported only 13 of them. Only a few were frequent: *Sarcophaga sinuata, Pherbellia griseola* and *Lejogaster tarsata*, and these showed mixed preferences for the margin or centres.

The mean Species Quality Index was always marginally greater for the whole suite of flies at margins than at the centres of fields on all visits, but no differences were significant (Fig. 4).

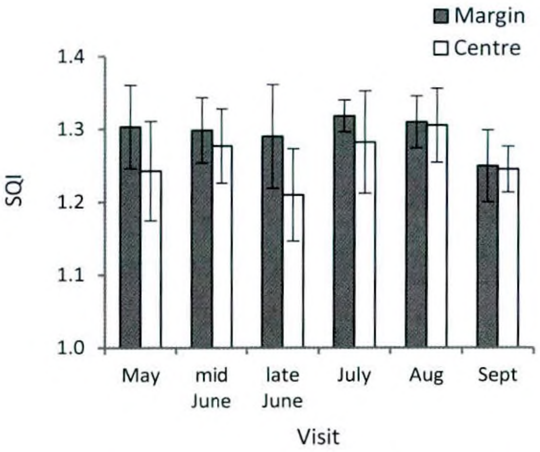

Fig. 4. Mean Species Quality Index (SQI) with 95% confidence limits for the margins and centres of fields on each visit from May to September.

Assemblages

ANOSIM results indicated that the suite of all species differed significantly between the margins and centres of fields on all visits except that in September, and the size of the difference given by the ANOSIM R-statistic declined through the year (Table 3). An identical result was obtained using presence-absence or quantitative data, and only the former are presented.

As this result may have been expected, since it may have been caused by terrestrial species preferring the centres of fields and wetland species preferring the margins, the analysis was repeated for each of the large assemblage types separately. Wetland species showed the same pattern as all species together, but with larger differences in the dissimilarity between margins and centres.

In comparison, neither the terrestrial nor the generalist assemblages showed significant differences between positions in the fields using presence-absence data, and the size of the R-statistic was markedly smaller than for most values shown by the wetland species. Quantitative data gave significant differences for these two assemblages on two dates each in May and June but these may have been strongly influenced by large disparities in the abundance of a few common species such as *Scathophaga stercoraria*, *Chrysotus gramineus* and *Hydrellia maura*. ANOSIM is prone to giving false positive results owing to its sensitivity to variability within samples since higher variation leads to significant dissimilarity even when it may not be true (Anderson and Walsh 2013). Given this limitation, the absence of significant differences in terrestrial and generalist assemblages indicated that species in these groups showed no response to their position in the fields. In contrast, species in the wetland assemblages were more likely to locate themselves according to the presence of open water and presumably damper marginal conditions.

The distribution of the more frequently recorded species showed that results for whole families was mirrored to some extent by the behaviour of individual species. Species for which at least 100 individuals were found in the whole survey and were present on at least four visits were grouped by whether they were consistently more, less or indifferently associated with the margins, based on the total numbers found at either the margins or centres of fields on each visit. Seven species were consistently more abundant at ditches (Table 4, group A) and another four species appeared to switch their preference later in the year from the margins to the centres (group B) although the preferences of several species in group A also became less pronounced in late summer. Half of the species showed no consistent preference (group C) and only *Helophilus pendulus* was recorded more consistently in centres (group D). Frequently recorded species in the terrestrial assemblage showed inconsistent patterns of distribution. These values were not tested statistically so they must be considered indicative only.

Table 3. Results of ANOSIM comparing field centres and margins for all species together and for the three main assemblage types, using presence-absence data. R = ANOSIM test statistic; p = probability of significance; significant R-values in bold.

Assemblage type	Visit	R	p	Number of species	Number of samples
Total species	May	**0.365**	0.001	138	16
	mid June	**0.370**	0.001	206	16
	late June	**0.303**	0.001	143	12
	July	**0.213**	0.040	168	16
	August	**0.192**	0.048	184	16
	September	-0.011	0.501	158	16
Wetland	May	**0.428**	0.001	70	16
	mid June	**0.443**	0.001	129	16
	late June	**0.462**	0.001	78	12
	July	**0.227**	0.023	93	16
	August	**0.248**	0.020	116	16
	September	-0.004	0.470	98	16
Terrestrial	May	0.119	0.080	46	16
	mid June	0.073	0.156	51	16
	late June	-0.058	0.683	38	12
	July	0.035	0.280	45	16
	August	0.035	0.282	42	16
	September	-0.053	0.735	38	16
Generalists	May	0.033	0.284	17	16
	mid June	0.059	0.205	21	16
	late June	-0.056	0.709	20	12
	July	-0.032	0.564	22	16
	August	0.081	0.190	23	16
	September	-0.039	0.667	19	16

Table 4. Number of individuals from all margin (m, shaded) and centre (c) samples on each visit for species for which at least 100 individuals were recorded altogether in wetland and terrestrial assemblages. Species groups A - D are described in the text.

		May		early Jun		mid Jun		Jul		Aug		Sep	
	Wetland Assemblage	m	c	m	c	m	c	m	c	m	c	m	c
A	*Erioptera fuscipennis*	2	0	8	0	3	0	0	0	3	0	98	16
	Culex pipiens	0	0	0	0	1	0	34	2	65	11	13	6
	Elgiva solicita	2	0	8	1	9	0	14	2	26	1	55	20
	Sepedon sphegea	14	0	15	0	11	0	10	1	24	1	25	17
	Sepedon spinipes	16	0	6	0	2	0	20	2	109	13	55	7
	Tetanocera ferruginea	10	0	10	0	4	0	18	1	26	3	88	15
	Notiphila riparia	0	0	96	1	68	1	205	1	302	1	15	0
B	*Tipula oleracea*	1	0	2	0	1	0	20	6	6	5	37	152
	Molophilus obscurus	27	0	42	3	3	0	0	1	43	113	61	40
	Chrysopilus cristatus	0	0	423	230	165	76	34	29	5	7	0	0
	Pherbina coryleti	0	0	18	1	20	0	19	1	14	7	7	23
C	*Erioconopa trivialis*	28	18	15	35	4	8	7	24	7	80	75	331
	Haematopota pluvialis	0	0	28	65	15	14	8	20	4	10	0	0
	Dolichopus plumipes	25	6	35	59	7	13	9	4	21	69	31	64
	Sympycnus pulicarius	27	23	22	48	7	5	1	1	33	13	46	15
	Lejogaster metallina	0	0	1	7	0	3	6	2	7	78	0	1
	Neoascia tenur	39	18	14	20	9	2	58	34	68	101	19	20
	Themira minor	0	0	1	0	0	0	4	0	1	1	90	118
	Notiphila cinerea	6	0	14	0	0	0	1	4	11	16	66	46
	Notiphila graecula	9	0	5	1	0	0	3	17	13	25	392	221
	Scatella tenuicosta	0	0	1	1	0	0	20	2	1160	1949	774	682
	Scatella stagnalis	8	20	2	0	0	0	1	2	5	25	99	189
	Coenosia pumila	32	13	18	26	15	20	26	35	7	23	12	34
	Lisocephala erythrocera	57	82	56	95	9	34	94	53	14	46	72	46
D	*Helophilus pendulus*	1	4	5	14	7	14	1	1	9	13	14	49
	Terrestrial Assemblage												
	Platycheirus clypeatus	36	24	27	24	38	100	142	264	7	26	6	7
	Herina frondescentiae	0	0	8	10	18	51	1	16	0	5	0	0
	Opomyza petrei	0	0	6	8	10	11	51	6	35	12	23	62
	Sepsis fulgens	0	0	7	0	3	8	24	24	78	23	1	2
	Sepsis punctum	0	0	3	0	0	0	3	5	36	50	15	17
	Scaptomyza pallida	0	0	1	4	53	45	42	40	124	57	7	0
	Scathophaga stercoraria	43	19	261	236	183	169	82	127	62	129	165	133

NMDS ordination plots are presented for four of the six visits (Fig. 5) to show the range of distribution patterns from moderately clear separation of samples from the centres or margins of fields (late June, July) to no distinction (August; mid-June and September were similar) or intermediate (May). Care is needed with these interpretations as the stress values (a measure of how well the data could be fitted) ranged from 0.16 to 0.25, which are higher than recommended for a two-dimensional plot, although there is no accepted level of significance equivalent to the 95% probability of many statistical tests (Zuur *et al.* 2007). All species regardless of their frequency were included in the ordinations but an attempt to reduce variance by excluding species found only in single samples resulted in higher less satisfactory stress values.

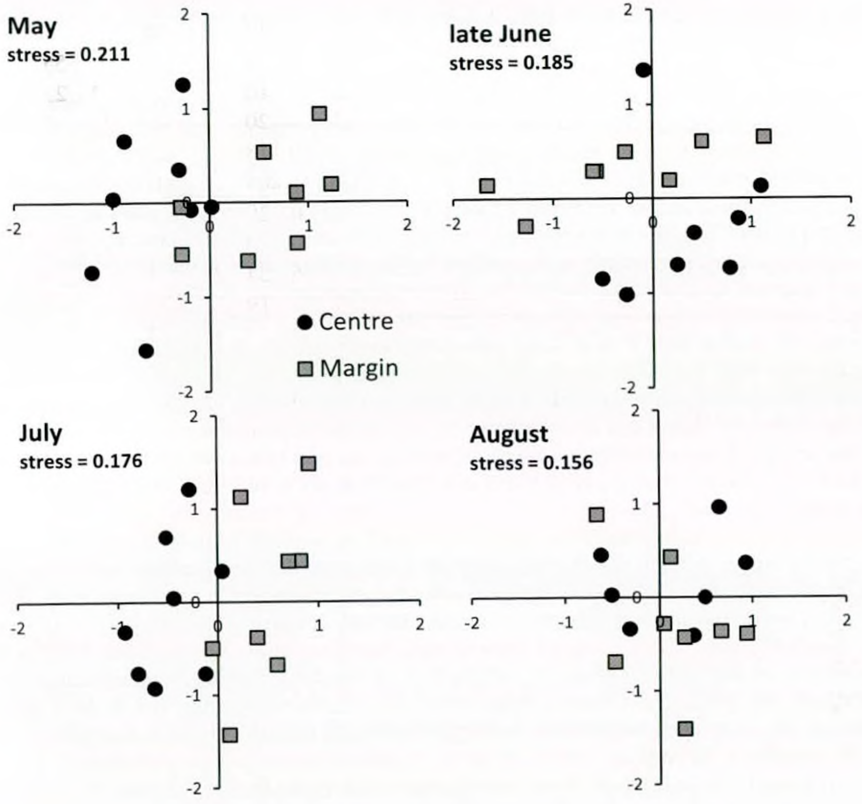

Fig. 5. Non-metric Multidimensional Scaling plots for samples from the centre or margin of fields in four of the six visits.

Discussion

The study found that the dipteran fauna at field margins adjacent to ditches was markedly different to that in the field centres although the effect was restricted to the wetland component of the fauna. Wetland Diptera were more species-rich, more abundant and included more uncommon species at the margins than at the centres. They also formed a large proportion of the total dipteran fauna recorded on the grazing marsh. In contrast, the numbers of species and the abundance of

Diptera associated with drier habitats and generalists were almost unaffected by position in the fields. A consequence of the differential distribution of species was that assemblages at margins could sometimes be clearly distinguished from those in field centres. The strength of the effect of position declined through the season, being strong in May to July but effectively eliminated in September. The enhancing effect of ditches is similar to the disproportionately beneficial impact on insects in hedges and beetle banks compared to the adjacent fields (Barker and Reynolds 1999, Evans *et al.* 2011, MacLeod *et al.* 2004).

The conclusions from the study were thought to be sound despite evident shortcomings of study design, due mainly to the contract specification and low budget. A robust design would have included more fields at greater spacing and with more uniform vegetation types, stricter timing of sampling to the middle of each day, and inclusion of a second sampling method to collect tussock-dwelling species poorly sampled by sweep-netting and to overcome the inefficiency of sweeping in dense tall marginal vegetation.

The result is particularly noteworthy in view of the high conservation quality of the pasture in this reserve, which, quite independently of the ditches, might have been expected to support a large dipteran fauna. The two unusually well-developed qualities of high botanical value of the old herb-rich pasture and particularly wet conditions of the young pasture would benefit the fauna, particularly wetland species. The size of the difference between the field margins and centres was almost surprising in the very wet spring and summer, when from May to July the Lows remained splashy with at least 5cm of water across their entire surface, making them superficially indistinguishable from the shallowly flooded margins next to ditches. If such a marked effect was found in this exceptional reserve, then on the drier and considerably less herb-rich pasture of much of the Somerset Moors one would expect to find far more pronounced distinctions in the insect fauna of ditch margins and field centres. It would seem very likely that, on grazing marshes outside SSSIs and even within many of them, the pasture really is of rather low interest for its dipteran fauna.

In this study is was assumed that larvae developed where their adults were caught. This may be true for many wetland species but some do move from dry development sites to water during their adult phase. Delettre *et al.* (1998) compared species caught in emergence traps with those in water traps, and showed that several species moved to water (ponds, in this case) from drier development sites. Another set of species were found as adults by the ponds but not in emergence traps at any of the contrasting nearby habitats, and the authors assumed that adults were moving to the ponds from much further away. It is therefore possible that in the Catcott study some of the differences between the centres of fields and the margins were exaggerated by short-scale migratory movement. An indication of such movement was provided by some frequently recorded wetland species found at margins earlier in the year where they most likely emerged or were engaged in mating and oviposition but moved to the centres later in summer. A satisfactory explanation for why flies would find the centres more attractive than the margins is not obvious, especially as those with similar larval ecologies behaved apparently differently, for example, in the ephydrid genus *Notiphila*, whose larvae are completely aquatic, *N. riparia* was scarcely recorded away from ditches whereas *N. cinerea* and *N. graecula* were sometimes numerous in centres late in the season, and none is strongly associated with flowers that may have been a possible lure.

Whatever local movement may have occurred over tens of metres from ditch to field centre, the observed strong preference of wetland species for the field margins next to ditches suggests that they were less likely to move away from the ditches, even when shallowly flooded or saturated field centres provided apparently suitable habitat nearby. This is relevant to the issue of whether ditches serve primarily as corridors between patches of less obviously anthropogenic habitats, such as reedbeds or swamp, or as development sites in their own right. The study cannot resolve this, but it is highly probable that most of the recorded wetland species developed in or at the edge of the ditches, so the ditches did not represent merely linking features. While there is extensive reedbed in the nearby Shapwick National Nature Reserve, this is unlikely to be an important source, as the dipteran fauna of Catcott grazing marshes was similar in 1983 when Shapwick was grazing marsh or extensive peat workings (Drake, Foster and Palmer, unpublished report).

The area of land available for larval development of wetland species is small in relation to the matrix of fields and ditches. For instance, if it is assumed that wetland Diptera are confined to a 10m-wide corridor that includes the ditch, their habitat represents about 15% of the area of Catcott reserve, leaving much of the reserve of low interest for this assemblage. There are two corollaries for management. Firstly, populations of wetland Diptera will be served better by digging or restoring more ditches following advice given in, for example, Benstead *et al*. (1997), rather than by raising water levels to flood fields as is current practice on this and many other wet grassland reserves. While flooding can increase the abundance of some widespread opportunists invertebrates, which is one reason why such management sometimes works for wetland birds that feed on them (Ausden *et al*. 2001, Plum 2005), the present results suggest that it is not the best technique for conserving wetland Diptera since wet field centres supported a smaller fauna than field margins. The expensive option of increasing the number of ditches may be limited to nature reserves but this is already being successfully implemented by the Royal Society for the Protection of Birds, for example at Greylake Reserve in the nearby Somerset moor of King's Sedgemoor where newly dug ditches on previously arable land supported a rich water-beetle fauna (Drake, unpublished report). The second implication for management is that ditches are almost certain to act inadvertently as corridors in intensively farmed grasslands since the flies' behaviour keeps them near the ditches. Rather than acting as possible sinks, as has been recorded for some organisms using corridors (Gilbert-Norton *et al*. 2010), ditches in mundane farmland are more likely to be beneficial.

Results for the influence of field type on the fauna were not presented since this is a rather parochial issue of concern to the reserve managers but of little application in a wider context. However, field type did influence the fauna and the conditions special to each field type appeared to explain some of the observed behaviour. More wetland species were present on all visits at the recently created pasture of the Lows and with an increasing disparity in August and September, whereas terrestrial species were more frequent from May to July on the old pasture. Ephydridae were always more species-rich on the Lows (significantly so on all but one visit) whereas there was almost no difference for Sciomyzidae. This difference in response may be explained by the large differences in their larval ecology: many Sciomyzidae feed on aquatic or amphibious snails (Knutson and Vala 2011) so are almost confined to ditches, and it was irrelevant whether the ditch was next to a herb-rich or herb-poor field. The diminishing difference between ditch and centre towards the end of the summer could be attributed in part to the large increase in *Pherbellia cinerella*, *P. griseola* and *Pherbina coryleti* whose larvae are not confined to completely aquatic snails (Bratt *et al*. 1969, Rozkošný 1984). In comparison, the larvae of many wetland Ephydridae behave more amphibiously and graze micro-organisms and algae from saturated mud surfaces (Foote 1995). These species would have benefited greatly from the shallowly flooded conditions on the Lows. Other Ephydridae were mainly confined to the ditches, for example, *Notiphila maculata* and *N. riparia* with completely aquatic larvae. So Ephydridae showed a mix of ecologies but, on balance, were favoured by both the saturated conditions of the Lows and the permanent aquatic habitat at ditch margins.

The study confirmed that ditches on grazing marshes support a large dipteran fauna, even if the number of nationally uncommon species is not remarkable. This component of the wetland fauna is too often ignored despite having been investigated by entomologists working for the

Nature Conservancy Council in the 1980s in preparation for SSSI notification of many Somerset grazing marshes. There is still almost no published information on the assemblages or species-richness of Diptera in British ditch systems. Drake (1988) recorded 530 species from sweep-netting 65 ditches on the Gwent Levels, south Wales, of which only a few species are now regarded as having conservation importance. The small subset of aquatic Stratiomyidae recorded on many grazing marshes was discussed by Drake (2005). Autio and Salmela (2010) found high species-richness of Nematocera in four ditches when compared with other types of wetland on a large Finnish island. In a Belgian wetland complex, ditches dominated by reed supported a large proportion of the 55 species of Dolichopodidae recorded, including rare species, found in areas of high quality reed fen that the ditches linked, leaving only a small number found only in the fen but absent from the ditches (Decleer *et al.* 2015). Despite their highly artificial origin, it is clear that ditch systems support an important wetland Diptera fauna.

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Appendix. Species recorded at Catcott in 2012, with the assemblage type and total number of individuals caught at the margin and centre in all samples combined through the year. Assemblage types: G - generalist, T - terrestrial, W - wetland, F - woodland.

ANTHOMYIIDAE	
Anthomyia liturata (Robineau-Desvoidy)	G, 7:1
Botanophila brunneilinea (Zetterstedt)	G, 0:1
Botanophila fugax (Meigen)	T, 10:5
Botanophila striolata (Fallén)	G, 6:10
Delia echinata (Séguy)	T, 1:0
Delia lamelliseta (Stein)	W, 1:0
Delia platura (Meigen)	G, 13:16
Hydrophoria ruralis (Meigen)	G, 33:0
Hylemya urbica van der Wulp	T, 0:1
Hylemya vagans (Panzer)	T, 1:1
Hylemya variata (Fallén)	T, 7:3
Pegoplata aestiva (Meigen)	T, 15:34
Pegoplata infirma (Meigen)	T, 3:2
Zaphne divisa (Meigen)	W, 1:3
ANISOPODIDAE	
Sylvicola punctatus (Fabricius)	G, 26:8
ANTHOMYZIDAE	
Anagnota bicolor (Meigen)	W, 2:0
Anthomyza collini Andersson	W, 38:10

Anthomyza gracilis Fallén	G, 70:21
Typhamyza bifasciata (Wood)	W, 1:0
ASILIDAE	
Dioctria rufipes (De Geer)	T, 0:1
ASTEIIDAE	
Asteia amoena Meigen	G, 3:2
AULACIGASTRIDAE	
Stenomicra cogani Irwin	W, 1:0
BIBIONIDAE	
Dilophus febrilis (Linnaeus)	T, 7:1
CALLIPHORIDAE	
Bellardia vulgaris (Robineau-Desvoidy)	G, 1:4
Lucilia illustris (Meigen)	G, 0:2
Lucilia silvarum (Meigen)	G, 0:1
Melinda viridicyanea (Robineau-Desvoidy)	G, 0:1
Pollenia angustigena Wainwright	T, 1:1
Pollenia labialis Robineau-Desvoidy	T, 4:0
Pollenia pediculata Macquart	T, 1:2
Pollenia rudis (Fabricius)	T, 4:0

CHAMAEMYIIDAE	
Chamaemyia aridella (Fallén)	T, 0:1
CHAOBORIDAE	
Chaoborus pallidus (Fabricius)	W, 3:0
CHLOROPIDAE	
Calamoncosis glyceriae Nartshuk	W, 100:0
Calamoncosis minima (Strobl)	W, 17:0
Camarota curvipennis (Latreille)	T, 1:0
Diplotoxa messoria (Fallén)	W, 70:0
Elachiptera cornuta (Fallén)	W, 19:2
Lasiochaeta pubescens (Thalhammer)	W, 4:4
Rhopalopterum anthracinum (Meigen)	W, 6:0
Thaumatomyia notata (Meigen)	T, 1:0
CULICIDAE	
Coquillettidia richiardii (Ficalbi)	W, 3:0
Culex pipiens Linnaeus	W, 113:19
CYLINDROTOMIDAE	
Phalacrocera replicata (Linnaeus)	W, 1:0
DIASTATIDAE	
Diastata adusta Meigen	W, 6:15
DIXIDAE	
Dixella amphibia (De Geer)	W, 1:0
Dixella autumnalis (Meigen)	W, 16:0
Dixella martinii (Peus)	W, 0:1
Dixella serotina (Meigen)	W, 2:0
DOLICHOPODIDAE	
Anepsiomyia flaviventris (Meigen)	W, 1:0
Argyra diaphana (Fabricius)	W, 3:0
Argyra perplexa Becker	W, 3:0
Argyra vestita (Wiedemann)	W, 3:0
Campsicnemus curvipes (Fallén)	W, 3:2
Campsicnemus loripes (Haliday)	W, 1:1
Campsicnemus picticornis (Zetterstedt)	W, 0:1
Campsicnemus pumilio (Zetterstedt)	W, 1:0
Campsicnemus scambus (Fallén)	W, 30:28
Chrysotimus molliculus (Fallén)	G, 63:9
Chrysotus blepharosceles Kowarz	T, 0:1
Chrysotus cilipes Meigen	W, 25:25
Chrysotus gramineus (Fallén)	G, 387:201
Diaphorus oculatus (Fallén)	W, 66:8
Dolichopus brevipennis Meigen	W, 1:0
Dolichopus campestris Meigen	W, 1:0
Dolichopus claviger Haliday	W, 0:1
Dolichopus latilimbatus Fallén	W, 3:12
Dolichopus pennatus Meigen	W, 67:4
Dolichopus picipes Meigen	W, 1:1
Dolichopus planitarsis Fallén	W, 109:73
Dolichopus plumipes (Scopoli)	W, 128:215
Dolichopus popularis Wiedemann	W, 1:2
Dolichopus simplex Meigen	W, 9:20
Dolichopus ungulatus (Linnaeus)	W, 0:1
Gymnopternus aerosus (Fallén)	W, 49:9
Gymnopternus cupreus (Meigen)	W, 2:1
Hercostomus nanus (Macquart)	W, 0:1
Hercostomus nigripennis (Fallén)	T, 0:1
Hydrophorus bipunctatus (Lehmann)	W, 0:1
Hydrophorus litoreus Fallén	W, 0:1
Micromorphus sp	W, 1:1
Poecilobothrus chrysozygos (Wiedemann)	W, 4:0
Sciapus longulus (Fallén)	W, 1:0
Sympycnus pulicarius (Fallén, 1823)	W, 136:105
Syntormon denticulatus (Zetterstedt)	W, 1:0
Syntormon pallipes (Fabricius)	W, 0:1
Syntormon pumilus (Meigen)	W, 2:0
Teuchophorus spinigerellus (Zetterstedt)	W, 5:0
Thrypticus intercedens Negrobov	W, 0:1
DROSOPHILIDAE	
Drosophila picta Zetterstedt	W, 1:0
Lordiphosa andalusiaca (Strobl)	T, 0:1
Scaptomyza flava (Fallén)	T, 1:1
Scaptomyza graminum (Fallén)	T, 1:0
Scaptomyza pallida (Zetterstedt)	T, 227:146
EMPIDIDAE	
Dolichocephala irrorata (Fallén)	W, 0:2
Empis caudatula Loew	T, 1:0
Empis livida Linnaeus	T, 2:0
Empis nigripes Fabricius	T, 2:1
Empis stercorea Linnaeus	T, 2:1
Hilara maura (Fabricius)	F, 4:1
Hilara pseudocornicula Strobl	W, 2:0
Phyllodromia melanocephala (Fabricius)	F, 0:1
Rhamphomyia barbata (Macquart)	T, 1:0
Rhamphomyia crassirostris (Fallén)	T, 4:4
Rhamphomyia geniculata Meigen	T, 4:2
Rhamphomyia subcinerascens Collin	F, 1:0
Rhamphomyia tibiella Zetterstedt	F, 1:0
EPHYDRIDAE	
Axysta cesta (Haliday)	W, 4:1
Coenia curvicauda (Meigen)	W, 17:9
Coenia palustris (Fallén)	W, 30:19
Discocerina obscurella (Fallén)	W, 11:0
Ditrichophora fuscella (Stenhammar)	W, 3:0
Gymnoclasiopa plumosa (Fallén)	W, 2:0
Hyadina guttata (Fallén)	W, 6:23
Hyadina humeralis Becker	W, 2:3
Hydrellia albilabris (Meigen)	W, 1:0
Hydrellia flaviceps (Meigen)	W, 0:1
Hydrellia griseola (Fallén)	G, 43:35
Hydrellia ischiaca Loew	W, 1:0
Hydrellia maculiventris Becker	W, 1:0
Hydrellia maura Meigen	G, 255:674
Hydrellia nigricans (Meigen)	W, 6:4
Hydrellia obscura (Meigen)	W, 17:18
Hydrellia thoracica Haliday	W, 17:1
Ilythea spilota (Haliday in Curtis)	W, 1:0
Limnellia fallax (Czerny)	W, 1:0
Limnellia quadrata (Fallén)	W, 3:2
Limnellia surturi Andersson	W, 2:0
Notiphila caudata Fallén	W, 8:0

Notiphila cinerea Fallén	W, 98:66
Notiphila dorsata Stenhammar	W, 5:0
Notiphila graecula Becker	W, 422:264
Notiphila maculata Stenhammar	W, 33:1
Notiphila nubila Dahl	W, 1:0
Notiphila riparia Meigen	W, 686:4
Ochthera mantis (Fabricius)	W, 16:1
Parydra coarctata (Fallén)	W, 5:2
Parydra fossarum (Haliday)	W, 21:3
Parydra pusilla (Meigen)	W, 2:0
Pelina similis Papp	W, 26:4
Philotelma nigripenne (Meigen)	W, 2:1
Philygria picta (Fallén)	T, 0:2
Scatella paludum (Meigen)	W, 1:0
Scatella stagnalis (Fallén)	W, 115:236
Scatella tenuicosta Collin	W, 1955:2634
Setacera aurata (Stenhammar)	W, 0:1
Setacera micans (Haliday)	W, 0:3
Trimerina madizans (Fallén)	T, 3:3
Hyadina [new]	W, 1:0
FANNIIDAE	
Fannia genualis (Stein)	F, 1:0
Fannia postica (Stein)	F, 1:0
Fannia serena (Fallén)	F, 14:0
Fannia similis (Stein)	F, 3:1
HYBOTIDAE	
Bicellaria simplicipes (Zetterstedt)	F, 1:1
Bicellaria vana Collin	T, 14:3
Drapetis ephippiata (Fallén)	G, 2:0
Hybos femoratus (Müller)	T, 8:0
Ocydromia glabricula (Fallén)	F, 2:2
Platypalpus agilis (Meigen)	G, 5:2
Platypalpus calceatus (Meigen)	T, 6:4
Platypalpus cursitans (Fabricius)	T, 14:3
Platypalpus longiseta (Zetterstedt)	G, 6:1
Platypalpus minutus (Meigen) / *australominutus* Grootaert	F, 4:1
Platypalpus notatus (Meigen)	T, 2:0
Platypalpus pallidicornis (Collin)	W, 14:0
Platypalpus pallidiventris (Meigen)	G, 19:5
Platypalpus ruficornis (von Roser)	G, 0:1
Stilpon graminum (Fallén)	T, 0:1
Tachydromia aemula (Loew)	G, 0:1
Tachydromia umbrarum Haliday	F, 1:0
LAUXANIIDAE	
Meiosimyza decipiens (Loew)	W, 1:0
Minettia fasciata (Fallén)	W, 16:0
Sapromyza opaca Becker	W, 1:0
Trigonometopus frontalis (Meigen)	W, 6:0
LIMONIIDAE	
Dicranomyia autumnalis (Staeger)	W, 7:3
Dicranomyia modesta (Meigen)	W, 25:9
Dicranomyia morio (Fabricius)	W, 1:0
Erioconopa trivialis (Meigen)	W, 136:496
Erioptera flavata (Westhoff)	W, 14:0

Erioptera fuscipennis Meigen	W, 114:16
Erioptera lutea Meigen	W, 2:0
Erioptera squalida Loew	W, 14:0
Helius flavus (Walker)	W, 1:0
Helius longirostris (Meigen)	W, 1:0
Molophilus medius de Meijere	W, 1:0
Molophilus obscurus (Meigen)	W, 176:157
Molophilus occultus de Meijere	W, 0:1
Molophilus pleuralis de Meijere	W, 3:7
Ormosia hederae (Curtis)	W, 1:0
Phylidorea ferruginea (Meigen)	W, 62:16
Phylidorea fulvonervosa (Schummel)	W, 1:1
Pilaria discicollis (Meigen)	W, 1:0
Pilaria scutellata (Staeger)	W, 3:1
Rhipidia maculata Meigen	F, 0:5
Symplecta hybrida (Meigen)	W, 0:1
Symplecta stictica (Meigen)	W, 2:1
LONCHOPTERIDAE	
Lonchoptera bifurcata (Fallén)	G, 53:41
Lonchoptera lutea Panzer	G, 106:89
Lonchoptera scutellata Stein	W, 2:0
MICROPEZIDAE	
Neria cibaria (Linnaeus)	W, 0:1
Neria commutata (Czerny)	W, 1:0
Neria ephippium (Fabricius)	W, 1:0
MUSCIDAE	
Azelia cilipes (Haliday)	G, 2:0
Azelia triquetra (Wiedemann)	T, 4:1
Coenosia pedella (Fallén)	W, 1:0
Coenosia pumila (Fallén)	W, 110:151
Coenosia tigrina (Fabricius)	W, 11:10
Graphomya maculata (Scopoli)	W, 6:4
Graphomya minor Robineau-Desvoidy	W, 5:1
Haematobosca stimulans (Meigen)	T, 9:0
Hebecnema nigra (Robineau-Desvoidy)	T, 8:6
Hebecnema umbratica (Meigen)	T, 74:20
Hebecnema vespertina (Fallén)	F, 1:1
Helina evecta (Harris)	G, 1:0
Helina impuncta (Fallén)	T, 0:1
Helina maculipennis (Zetterstedt)	G, 0:1
Helina obscurata (Meigen)	T, 34:23
Helina reversio (Harris)	G, 0:2
Hydrotaea armipes (Fallén)	F, 2:0
Hydrotaea dentipes (Fabricius)	T, 1:0
Hydrotaea diabolus (Harris)	T, 7:0
Hydrotaea militaris (Meigen)	T, 2:0
Lispe pygmaea Fallén	W, 4:3
Lispe tentaculata (De Geer)	W, 0:2
Lispocephala erythrocera (Robineau-Desvoidy)	W, 302:356
Morellia hortorum (Fallén)	T, 8:1
Morellia simplex (Loew)	T, 3:1
Musca autumnalis De Geer	T, 4:2
Muscina levida (Harris)	G, 2:2
Mydaea nebulosa (Stein)	G, 1:0

Mydaea urbana (Meigen)	T, 0:1
Myospila meditabunda (Fabricius)	T, 11:14
Neomyia cornicina (Fabricius)	T, 1:1
Phaonia atriceps (Loew)	W, 2:0
Phaonia incana (Wiedemann)	T, 5:6
Phaonia tuguriorum (Scopoli)	G, 0:1
Polietes lardarius (Fabricius)	T, 5:0
Schoenomyza litorella (Fallén)	W, 0:4
Stomoxys calcitrans (Linnaeus)	T, 1:1
OPOMYZIDAE	
Geomyza balachowskyi Mesnil	T, 3:0
Geomyza tripunctata Fallén	T, 5:0
Opomyza florum (Fabricius)	T, 1:0
Opomyza germinationis (Linnaeus)	T, 5:9
Opomyza petrei Mesnil	T, 125:99
OTITIDAE	
Herina frondescentiae (Linnaeus)	T, 27:82
Melieria crassipennis (Fabricius)	W, 11:5
PEDICIIDAE	
Tricyphona immaculata (Meigen)	W, 139:43
PLATYSTOMATIDAE	
Rivellia syngenesiae (Fabricius)	T, 6:0
PSILIDAE	
Chamaepsila rosae (Fabricius) group	T, 1:0
Loxocera albiseta (Schrank)	W, 0:2
PTYCHOPTERIDAE	
Ptychoptera albimana (Fabricius)	W, 0:9
Ptychoptera contaminata (Linnaeus)	W, 55:0
Ptychoptera minuta Tonnoir	W, 24:0
RHAGIONIDAE	
Chrysopilus cristatus (Fabricius)	W, 627:342
Rhagio lineola Fabricius	F, 1:0
Rhagio scolopaceus (Linnaeus)	T, 28:36
Rhagio tringarius (Linnaeus)	T, 9:2
RHINOPHORIDAE	
Melanomya nana (Meigen)	G, 164:35
SARCOPHAGIDAE	
Sarcophaga sexpunctata (Fabricius)	F, 2:0
Sarcophaga sinuata Meigen	W, 2:11
Sarcophaga vagans Meigen	W, 1:0
SCATHOPHAGIDAE	
Chaetosa punctipes (Meigen)	W, 13:14
Cleigastra apicalis (Meigen)	W, 23:6
Conisternum decipiens (Haliday in Curtis)	W, 2:0
Cordilura albipes Fallén	W, 1:1
Cordilura ciliata Meigen	W, 6:0
Cordilura impudica Rondani	W, 4:1
Nanna fasciata (Meigen)	T, 3:0
Nanna flavipes (Fallén)	T, 2:0
Nanna tibiella (Zetterstedt)	T, 4:0
Norellisoma spinimanum (Fallén)	T, 2:0
Scathophaga furcata (Say)	T, 21:5
Scathophaga inquinata Meigen	T, 2:0
Scathophaga spurca Meigen	T, 16:4
Scathophaga stercoraria (Linnaeus)	T, 796:813
Spaziphora hydromyzina (Fallén)	W, 0:1
Trichopalpus fraternus (Meigen)	W, 42:9
SCIOMYZIDAE	
Dichetophora finlandica Verbeke	W, 0:1
Elgiva cucularia (Linnaeus.)	W, 2:1
Elgiva solicita (Harris)	W, 114:24
Ilione albiseta (Scopoli)	W, 0:1
Limnia paludicola Elberg	W, 5:4
Limnia unguicornis (Scopoli)	W, 0:3
Pherbellia cinerella (Fallén)	T, 2:22
Pherbellia dorsata (Zetterstedt)	W, 1:0
Pherbellia griseola (Fallén)	W, 31:37
Pherbellia schoenherri (Fallén)	W, 17:15
Pherbellia ventralis (Fallén)	W, 1:0
Pherbina coryleti (Scopoli)	W, 78:32
Pteromicra angustipennis (Staeger)	W, 3:2
Sciomyza simplex Fallén	W, 2:0
Sepedon sphegea (Fabricius)	W, 99:19
Sepedon spinipes (Scopoli)	W, 208:22
Tetanocera arrogans Meigen	W, 48:35
Tetanocera elata (Fabricius)	T, 5:8
Tetanocera ferruginea Fallén	W, 156:19
Tetanocera robusta Loew	W, 12:5
SEPSIDAE	
Saltella sphondylii (Schrank)	T, 0:3
Sepsis cynipsea (Linnaeus)	T, 22:71
Sepsis flavimana Meigen	T, 16:54
Sepsis fulgens Meigen	T, 113:57
Sepsis punctum (Fabricius)	T, 57:72
Themira annulipes (Meigen)	W, 17:55
Themira lucida (Staeger in Schiødte)	W, 2:0
Themira minor (Haliday)	W, 96:119
Themira superba (Haliday)	W, 26:14
STRATIOMYIDAE	
Beris chalybata (Forster)	W, 3:0
Beris fuscipes Meigen	F, 2:0
Beris vallata (Forster)	T, 20:9
Chloromyia formosa (Scopoli)	T, 17:12
Microchrysa flavicornis (Meigen)	T, 1:0
Nemotelus pantherinus (Linnaeus)	W, 2:30
Odontomyia tigrina (Fabricius)	W, 6:1
Oplodontha viridula (Fabricius)	W, 30:28
Sargus flavipes Meigen	T, 1:0
Vanoyia tenuicornis (Macquart)	W, 1:1
SYRPHIDAE	
Anasimyia contracta Claussen & Torp	W, 2:1
Anasimyia lineata (Fabricius)	W, 15:21
Cheilosia albitarsis (Meigen)	T, 8:10
Cheilosia fraterna (Meigen)	T, 7:6
Cheilosia latifrons (Zetterstedt)	T, 2:0
Cheilosia urbana (Meigen)	T, 0:1
Cheilosia vernalis (Fallén)	T, 2:0
Episyrphus balteatus (De Geer)	G, 17:16
Eristalinus sepulchralis (Linnaeus)	W, 2:1

Eristalis abusiva Collin	W, 23:70
Eristalis arbustorum (Linnaeus.)	W, 50:29
Eristalis horticola (De Geer)	W, 2:3
Eristalis intricaria (Linnaeus)	W, 4:3
Eristalis nemorum (Linnaeus)	W, 15:21
Eristalis pertinax (Scopoli)	W, 15:11
Eristalis similis (Fallén)	W, 1:0
Eristalis tenax (Linnaeus)	W, 8:13
Eupeodes corollae (Fabricius)	G, 4:5
Eupeodes luniger (Meigen)	T, 1:0
Helophilus hybridus Loew	W, 14:12
Helophilus pendulus (Linnaeus)	W, 37:95
Helophilus trivittatus (Fabricius)	W, 1:4
Lejogaster metallina (Fabricius)	W, 14:91
Lejogaster tarsata (Megerle in Meigen)	W, 11:9
Melanogaster aerosa (Loew)	W, 0:2
Melanogaster hirtella (Loew)	W, 30:75
Melanostoma mellinum (Linnaeus)	G, 679:1169
Melanostoma scalare (Fabricius)	G, 11:5
Neoascia geniculata (Meigen)	W, 1:0
Neoascia meticulosa (Scopoli)	W, 5:1
Neoascia podagrica (Fabricius)	G, 4:5
Neoascia tenur (Harris)	W, 207:195
Parhelophilus consimilis (Malm)	W, 3:1
Parhelophilus frutetorum (Fabricius)	W, 1:0
Platycheirus albimanus (Fabricius)	G, 28:13
Platycheirus angustatus (Zetterstedt)	T, 11:6
Platycheirus clypeatus (Meigen)	T, 256:445
Platycheirus europaeus Goeldlin de Tiefenau, Maibach & Speight	T, 2:0
Platycheirus fulviventris (Macquart)	W, 7:5
Platycheirus granditarsus (Forster)	W, 36:13
Platycheirus manicatus (Meigen)	T, 1:2
Platycheirus occultus Goeldlin de Tiefenau, Maibach & Speight	W, 9:33
Platycheirus peltatus (Meigen)	T, 1:4
Platycheirus peltatus Meigen group	T, 1:0
Platycheirus rosarum (Fabricius)	W, 1:0
Rhingia campestris Meigen	T, 19:32
Sericomyia silentis (Harris)	W, 0:2
Sphaerophoria interrupta (Fabricius)	T, 18:15
Sphaerophoria scripta (Linnaeus)	T, 3:2
Sphaerophoria taeniata (Meigen)	W, 5:4
Syritta pipiens (Linnaeus)	F, 3:2
Syrphus ribesii (Linnaeus)	G, 1:1
Tropidia scita (Harris)	W, 5:2

TABANIDAE

Chrysops relictus Meigen	W, 1:1
Haematopota pluvialis (Linnaeus)	W, 55:109

TEPHRITIDAE

Chaetostomella cylindrica (Robineau-Desvoidy)	T, 0:1
Dioxyna bidentis (Robineau-Desvoidy)	W, 1:2
Sphenella marginata (Fallén)	T, 7:14
Tephritis formosa (Loew)	T, 0:1
Tephritis matricariae (Loew)	T, 0:2
Tephritis neesii (Meigen)	T, 0:2
Tephritis vespertina (Loew)	T, 4:5
Terellia ruficauda (Fabricius)	T, 28:15
Terellia serratulae (Linnaeus)	T, 1:1
Trupanea stellata (Fuessly)	T, 0:1
Urophora stylata (Fabricius)	T, 0:1
Xyphosia miliaria (Schrank)	T, 1:1

TIPULIDAE

Nephrotoma flavescens (Linnaeus)	T, 1:0
Nigrotipula nigra (Linnaeus)	W, 1:0
Prionocera turcica (Fabricius)	W, 5:12
Tipula fascipennis Meigen	T, 6:0
Tipula lateralis Meigen	W, 5:0
Tipula luna Westhoff	W, 5:0
Tipula oleracea Linnaeus	W, 67:163
Tipula paludosa Meigen	T, 0:1
Tipula pierrei Tonnoir in Goetghebuer & Tonnoir	W, 37:5
Tipula unca Wiedemann	W, 7:0
Tipula vernalis Meigen	T, 0:5

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Sciomyzidae (Diptera) of Portugal with new records and description of a new species of *Pherbellia* Robineau-Desvoidy, 1830

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Summary

The Sciomyzidae of Portugal is reviewed and records for 20 additional species for the continental part of the country are added to the previously known 12 species. A new species, *Pherbellia inornatifrons,* is described, illustrated and compared with closely related species.

Introduction

The Sciomyzidae (Figs 1-6) is a family of acalypterate flies found in all zoogeographic regions. Many species have patterned wings, and striking markings on the head and antennae rendering them appealing to dipterists. However, it is their biology that makes them subjects of intense research.

Perris (1850) was the first to rear adult Sciomyzidae. He reared *Salticella* (=*Lucina*) *fasciata* (Meigen, 1830) from larvae found in dead snails. He stated that the larvae fed upon the snail probably after the mollusc had died. Several subsequent workers published similar observations but it was Berg (1953) who, having observed sciomyzid larvae predating molluscs, commenced a long series of studies on the biology of these snail-killing flies. Much biological and faunistic work has been published since, culminating in a comprehensive review in the book by Knutson and Vala (2011). The considerable interest that has been shown in these flies is mainly owing to their potential for biological control of molluscs.

Although much of Europe has been well-surveyed for its sciomyzid fauna, Portugal seems to have been largely overlooked. There are no apparent reasons for this, other than a lack of field-work with systematic sampling. Two of us (RA and AG) began studying the Diptera of Portugal a few years ago, paying attention to sampling in diverse habitats and forwarding species from selected families to several taxonomists.

The Azores have no record of Sciomyzidae (Borges *et al.* 2010). Madeira and the Selvagens archipelago have only the widespread *Hydromya dorsalis* (Fabricius, 1775) and the endemic *Pherbellia inclusa* (Wollaston, 1858) listed (Borges *et al.* 2008). Twelve species have hitherto been recorded for continental Portugal. Knutson *et al.* (1970) reported *Salticella fasciata* (Meigen, 1830). In a study of Iberian, Balearic and Canary Island Sciomyzidae, Leclercq and Báez (1980) listed 40 species, but none was from Portugal. Carles-Tolrá (2001a, 2001b, 2009) recently recorded from Portugal *Elgiva cucularia* (Linnaeus, 1767), *Euthycera cribrata* (Rondani, 1868), *Euthycera zelleri* (Loew, 1847), *Pherbellia cinerella* (Fallén, 1820), *Sepedon femorata* Knutson & Orth, 1984, *Tetanocera montana* Day, 1881 and *Trypetoptera punctulata* (Scopoli, 1763). He noted another species of *Pherbellia* but was unable to identify it for lack of males (Carles-Tolrá 2001a). In the catalogue of Iberian Diptera (Carles-Tolrá and Báez 2002) the authors also listed *Ilione albiseta* (Scopoli, 1763), *Pherbina mediterranea* Mayer, 1953 and *Sepedon sphegea* (Fabricius, 1775). Rozkošný (1987) added no records for continental Portugal.

Figs 1-6. Adult sciomyzids: 1, *Colobaea distincta* (Meigen); 2, *Euthycera alaris* Vala; 3, *Pherbellia dorsata* (Zetterstedt); 4, *Psacadina verbekei* Knutson, Rozkošný & Berg; 5, *Sepedon spinipes* (Scopoli); 6, *Tetanocera arrogans* (Meigen).

The Phaeomyiinae is once again considered a subfamily of the Sciomyzidae (Vala *et al.* 2012). Over the years, it has been excluded and re-included a number of times based on the latest morphological cladistic analyses at the time. Various authors used suites of character states that were not the same from one study to another. Among the major obstacles to including the Phaeomyiinae within the Sciomyzidae were the larval structure and biology. More recent studies (Tóthová *et al.* 2012) supported by molecular work have resulted in a better consensus of opinion among investigators of this problem. The first studies on the biology (Baker 1985) of *Pelidnoptera nigripennis* (Fabricius, 1794) were based on a large sample of this species collected in Portugal. However, Baker reported the species under the name *Eginia ocypterata* (Meigen, 1826) which belongs to the family Muscidae. Bailey (1989) corrected this misidentification.

Methods

RA and AG used water-filled pan traps, Malaise traps and (most often) hand-held sweep nets to collect Diptera, but the Sciomyzidae were collected only by sweep nets. This is in keeping with the observations on best collecting methods reviewed in Knutson and Vala (2011). RA and AG preserved their specimens in alcohol, whereas MJE, who also collected using hand-held sweep nets, dry pinned his specimens. The 266 specimens listed in this article were examined and identified using mainly the works of Vala (1989) and Rivosecchi (1992), supplemented by recent literature for those species described since the publication of those works. A few specimens (indicated in the data below) were extracted from alcohol, passed through ethyl acetate and dry mounted to be kept in the reference collection of MJE. The remaining specimens in alcohol are preserved in RA's and AG's personal collections unless otherwise indicated by alternative initials in parenthesis at the end of each data entry.

Results

We found 29 species of Sciomyzidae, of which 20 are new records and one is a new species. All 32 species that are now known from Portugal are listed below in alphabetical order with their data, where not previously published, entered in chronological order.

Phaeomyiinae

***Pelidnoptera nigripennis* (Fabricius, 1794)**

Known from Portugal, but we have not encountered it in our fieldwork.
Distribution: a rather patchy distribution from Scandinavia to Iberia and the Balkans.

Salticellinae

***Salticella fasciata* (Meigen, 1830)**

Reported by Knutson *et al.* (1970) but not found in this study.
Distribution: a widespread species in Europe, it is found also in North Africa, Turkey and Iran.

Sciomyzinae

***Colobaea distincta* (Meigen, 1830)**

1♀, Castelo Branco, Castelo Branco, Monforte da Beira, Monte Barata (Parque Natural do Tejo Internacional), 39°42'33.5"N, 7°18'59.3"W, elev. 250m, 11.iv.2014, RA.
Distribution: a mainly north European species; its finding in Portugal is one of the most southerly records.

***Ditaeniella grisescens* (Meigen, 1830)**

2♂♂, Castelo de Vide, Póvoa e Meadas, Barragem de Nisa, 39°28'33"N, 7°33'20"W, elev. 314m, riparian Mimosa forest and scrub, 25.ix.2014, MJE.
Distribution: widespread in Europe, North Africa, the Middle East, Mongolia, China and parts of the Oriental Region.

***Elgiva cucularia* (Linnaeus, 1767)**

2♂♂1♀, Braga, Esposende, Fonte Boa e Rio Tinto (Marachão), 41°30'16.9"N, 8°43'10.6"W, elev. 23m, 2.vi.2015, RA.
Distribution: widespread in Europe and the Maghreb countries of North Africa.

***Euthycera alaris* Vala, 1983**

1♀, Porto, Vila Nova de Gaia, Gulpilhares, 41°04'27.8"N, 8°39'23.6"W, elev. 5m, 21.ix.2010, RA; 1♀, Porto, Vila Nova de Gaia, Canidelo (Reserva Natural Local do Estuário do Douro), 41°08'20.7"N, 8°39'55.2"W, elev. 10m, 14.x.2010, RA; 1♂, Porto, Vila Nova de Gaia, Canidelo (Reserva Natural Local do Estuário do Douro), 41°08'20.7"N, 8°39'55.2"W, elev. 10m, 4.v.2011, RA; 2♂♂, Setúbal, Grândola, Carvalhal, 38°23'38.1"N, 8°48'13.6"W, elev. 0m, 15.iv.2011, RA; 1♂, Porto, Póvoa de Varzim, Estela, 41°27'52.73"N, 8°45'54.18"W, elev. 12m, 30.iv.2013, RA; 1♂, Porto, Vila do Conde, Mindelo (Reserva Ornitológica de Mindelo), 41°19'13.9"N, 8°44'07.5"W, elev. 5-20m, 13.v.2013, RA; 1♂, Guarda, Figueira de Castelo Rodrigo, Algodres, Vale de Afonsinho e Vilar de Amargo, 40°57'36.5"N, 7°02'09.6"W, elev. 525m, 17.vi.2013, RA; 2♀♀, Viseu, Moimenta da Beira, Leomil, 41°00'16.9"N, 7°40'13.4"W, elev. 830m, 9.x.2013, RA; 1♀, Guarda, Fornos de Algodres, Algodres, 40°38'8.40"N, 7°31'7.28"W, elev. 518m, 28.vii.2014, AG; 1♀, Guarda, Seia, Seia, São Romão e Lapa dos Dinheiros (Parque Natural da Serra da Estrela), 40°24'38.38"N, 7°40'10.87"W, elev. 1025m, 29.vii.2014, AG; 1♀, Guarda, Seia, Alvoco da Serra (Parque Natural da Serra da Estrela), 40°18'20.45"N, 7°41'13.91"W, elev. 900m, 30.vii.2014, AG; 1♀, Bragança, Bragança, França, Lama Grande (Parque Natural de Montesinho), 41°58'41.3"N, 6°47'26.1"W, elev. 1345m, 7.viii.2014, RA; 1♂, Guarda, Seia, Loriga, Lagoa da Francelha (Parque Natural da Serra da Estrela), 40°19'45.86"N, 7°37'59.99"W, elev. 1770m, 5.ix.2014, AG; 1♂1♀, Bragança, Vinhais, Vinhais, 41°51'01.3"N, 6°59'21.6"W, elev. 983m, 10.ix.2014, RA; 1♀, Portalegre, Marvão, Santa Maria de Marvão (Parque Natural da Serra de São Mamede), 39°23'49.2"N, 7°21'51.4"W, elev. 607m, 20.ix.2014, AG; 2♂♂, Seia, Aldeia da Serra, 40°25'03"N, 7°40'38"W, elev. 893m, roadside grassy scrub, 28.ix.2014, MJE; 1♀, Braga, Esposende, Apúlia e Fão (Parque Natural do Litoral Norte), 41°28'16.4"N, 8°46'27.2"W, elev. 2m, 19.iv.2015, RA; 1♀, Bragança, Bragança, Castrelos e Carrazedo, 41°45'56.9"N, 6°54'43.5"W, elev. 980m, 19.vi.2015, RA; 1♀, Bragança, Bragança, França, Lama Grande (Parque Natural de Montesinho), 41°58'41.3"N, 6°47'26.1"W, elev. 1345m, 20.vi.2015, RA; 1♂, Coimbra, Cantanhede, Tocha, 40°23'15.9"N, 8°49'21.6"W, elev. 9m, light trap, 22.ix.2015, AG.

Distribution: widespread in south west Europe and the Maghreb countries of North Africa.

***Euthycera chaerophylli* (Fabricius, 1798)**

1♂1♀, Braga, Esposende, Apúlia e Fão (Parque Natural do Litoral Norte), 41°28'16.4"N, 8°46' 27.2"W, elev. 2m, 23.vii.2010, RA.

Distribution: widespread in Europe from Scandinavia to Turkey and Cyprus.

***Euthycera cribrata* (Rondani, 1868)**

1♂1♀, Lisbon, Parque Forestal do Monsanto, 25.vii.1962, J. Abraham & L. Horacsek (BMNH); 1♀, Braga, Barcelos, Gilmonde, 41°30'43.0"N, 8°38'57.0"W, elev. 25-50m, 3.ix.2008, RA; 1♂1♀, Braga, Esposende, Apúlia e Fão (Parque Natural do Litoral Norte), 41°28'16.4"N, 8°46'27.2"W, elev. 2m, 15.v.2011, RA; 2♀♀, Viana do Castelo, Viana do Castelo, Vila Nova de Anha, 41°40'08.9"N, 8°49'25.7"W, elev. 10m, 6.ix.2011, RA; 1♀, Braga, Barcelos, Gilmonde, 41°30'43.0"N, 8°38'57.0"W, elev. 25-50m, 19.vi.2012, RA; 1♀, Leiria, Alcobaça, São Martinho do Porto, 39°31'09.6"N, 9°08'34.4"W, elev. 80m, 16.ix.2012, RA; 1♂, Coimbra, Sé Nova, Jardim Botânico, 40°12'20.0"N, 8°25'15.0"W, elev. 85m, 6.v.2013, AG; 1♂1♀, Porto, Vila do Conde, Malta e Canidelo, 41°18'17.25"N, 8°39'38.10"W, elev. 65m, 14.vi.2013, RA; 1♂, Porto, Póvoa de Varzim, Aver-o-Mar, Amorim e Terroso (Passo), 41°25'08.34"N, 8°44'19.77"W, elev. 50m, 12.vii.2013, RA; 2♂♂, Entroncamento, Vila Nova da Barquinha, Rio Tejo, 39°27'24"N, 8°24'25"W, elev. 25m, riparian *Arundo* dominated vegetation, 1.x.2014, MJE; 1♂, Braga, Esposende, Fonte Boa e Rio Tinto (Marachão), 41°30'16.9"N, 8°43'10.6"W, elev. 23m, 2.vi.2015,

RA; 1♂, Bragança, Vimioso, Algoso, Campo de Víboras e Uva, 41°27'17.6"N, 6°35'35.2"W, elev. 340m, 16.vi.2015, RA.
Distribution: a western Mediterranean species found also in North Africa.

Euthycera seguyi **Vala, 1990**
1♀, Porto, Valongo, Campo, 41°09'33.4"N, 8°29'05.6"W, elev. 50-100m, 16.viii.2010, RA; 1♂, Porto, Valongo, Campo, 41°09'33.4"N, 8°29'05.6"W, elev. 50-100m, 2.x.2010, RA; 1♂, Porto, Vila Nova de Gaia, Avintes (Parque Biológico de Gaia), 41°06'00.0"N, 8°33'35.3"W, elev. 50m, 20.vi.2011, RA (MJE coll.); 1♂, Porto, Valongo, Campo, 41°09'33.4"N, 8°29'05.6"W, elev. 50-100m, 10.x.2011, RA; 1♀, Guarda, Guarda, Corujeira e Trinta (Parque Natural da Serra da Estrela), 40°30'31.1"N, 7°22'21.7"W, elev. 750m, 22.ix.2013, AG; 1♂, Faro, Loulé, Querença, Tôr e Benafim (Paisagem Protegida Local da Fonte Benémola), 37°12'29.2"N, 8°00'29.7"W, elev. 153m, 12.vii.2014, RA (MJE coll); 1♀, Guarda, Gouveia, Folgosinho (Parque Natural da Serra da Estrela), 40°30'32.92"N, 7°31'56.48"W, elev. 784m, 28.vii.2014, AG; 1♀, Guarda, Gouveia, Vila Cortês da Serra (Parque Natural da Serra da Estrela), 40°33'8.40"N, 7°31'7.28"W, elev. 443m, 28.vii.2014, AG; 1♂, Guarda, Seia, Alvoco da Serra (Parque Natural da Serra da Estrela), 40°18'20.45"N, 7°41'13.91"W, elev. 900m, 30.vii.2014, AG; 1♂, Faro, São Brás de Alportel, São Brás de Alportel, 37°12'35.0"N, 7°53'32.6"W, elev. 436m, 11.iv.2015, AG; 1♂, Bragança, Bragança, Parâmio (Parque Natural de Montesinho), 41°53'54.0"N, 6°51'16.3"W, elev. 780m, 21.vi.2015, RA.
Distribution: this species was discovered relatively recently in the East Pyrenees and described from a single female (Vala 1990). The male was discovered in north east Spain and described later (Carles-Tolrà and Vala 1993). It appears to be more common in Portugal and it is likely to be more widespread in south-west France and Iberia than current records suggest.

Euthycera vockerothi **Rozkošný, 1988**
1♀, Bragança, Bragança, França (Parque Natural de Montesinho), 15.vii.2010, RA; 2♂♂, Porto, Vila do Conde, Mindelo (Reserva Ornitológica de Mindelo), 41°19'13.9"N, 8°44'07.5"W, elev. 5-20m, 13.v.2013, RA (1♂ MJE coll); 1♀, Porto, Vila do Conde, Mindelo (Reserva Ornitológica de Mindelo), 41°19'13.9"N, 8°44'07.5"W, elev. 5-20m, 25.v.2013, RA; 1♀, Guarda, Sabugal, Aldeia Velha, 40°21'08.6"N, 6°51'39.7"W, elev. 867m, 23.vii.2015, AG.
Distribution: a species known only from Iberia.

Euthycera zelleri **(Loew, 1847)**
2♂♂1♀, Lisbon, Parque Forestal do Monsanto, 25.vii.1962, J. Abraham & L. Horacsek (BMNH). This species was recorded by Carles-Tolrá (2001b). We have not found this species in any of our samples but LVK examined the specimens given above.
Distribution: a western Mediterranean species which overlaps the distribution of and may coexist in the same habitats as *E. cribrata*.

Hydromya dorsalis **(Fabricius, 1775)**
1♀, Porto, Valongo, Campo, 41°09'33.4"N, 8°29'05.6"W, elev. 50-100m, 26.xi.2010, RA; 1♂, Porto, Valongo, Campo, 41°09'33.4"N, 8°29'05.6"W, elev. 50-100m, 10.x.2011, RA; 2♀♀, Vila Real, Montalegre, Viade de Baixo e Fervidelas, 41°43'42.2"N, 7°52'18.6"W, elev. 750m, 9.ix.2012, RA; 1♀, Setúbal, Grândola, Azinheira dos Barros e São Mamede do Sádão (Lousal), 38°03'06.5"N, 8°24'45.1"W, elev. 50m, 7.ix.2013, AG; 2♂♂, Faro, Silves, São Bartolomeu de Messines, 37°16'28.7"N, 8°18'37.3"W, elev. 101m, 12.vii.2014, AG; 2♂♂1♀, Beja, Barrancos, Barrancos, Noudar, 38°09'46.8"N, 7°03'08.7"W, elev. 165m, 4.iv.2015, AG & RA; 2♀♀, Faro, São Brás de Alportel, São Brás de Alportel, 37°12'35.0"N, 7°53'32.6"W, elev. 436m, 11.iv.2015,

AG; 1♂, Bragança, Bragança, Espinhosela (Parque Natural de Montesinho), 41°53'08.2"N, 6°49'37.4"W, elev. 793m, 16.v.2015, RA; 1♀, Bragança, Vinhais, Tuizelo (Parque Natural de Montesinho), 41°54'20.3"N, 7°01'47.4"W, elev. 935m, 21.vi.2015, RA; 1♂, Viana do Castelo, Melgaço, Castro Laboreiro e Lamas de Mouro (Parque Nacional da Peneda-Gerês), 42°00'14.2"N, 8°09'55.0"W, elev. 753m, 9.viii.2015, AG; 2♂♂, Guarda, Manteigas, São Pedro (Parque Natural da Serra da Estrela), 40°22'59.9"N, 7°32'46.4"W, elev. 827m, 29.viii.2015, RA; 1♀, Vila Real, Vila Real, Borbela e Lamas de Olo (Parque Natural do Alvão), 41°22'27.6"N, 7°48'23.7"W, elev. 975m, 4.ix.2015, RA.
Distribution: a very common species found from the north of Scandinavia and some Atlantic islands to North Africa, the Middle East, Central Asia and Japan.

***Ilione albiseta* (Scopoli, 1763)**

2♀♀, Porto, Vila do Conde, Mindelo (Reserva Ornitológica de Mindelo), 41°19'13.9"N, 8°44'07.5"W, elev. 5-20m, 13.v.2013, RA; 1♂, Porto, Vila do Conde, Mindelo (Reserva Ornitológica de Mindelo), 41°19'13.9"N, 8°44'07.5"W, elev. 5-20m, 25.v.2013, RA; 1♂, Coimbra, Coimbra, Taveiro, Ameal e Arzila (Reserva Natural do Paul de Arzila), 40°10'45.0"N, 8°33'18.7"W, elev. 25m, 5.vi.2013, RA; 2♂♂, Braga, Esposende, Fonte Boa e Rio Tinto (Marachão), 41°30'16.9"N, 8°43'10.6"W, elev. 23m, 16.vi.2013, RA; 1♀, Braga, Esposende, Fonte Boa e Rio Tinto (Marachão), 41°30'16.9"N, 8°43'10.6"W, elev. 23m, 3.vii.2014, RA; 1♀, Bragança, Bragança, Espinhosela (Parque Natural de Montesinho), 41°53'08.2"N, 6°49'37.4"W, elev. 793m, 8.viii.2014, AG; 1♂1♀, Bragança, Bragança, Espinhosela (Parque Natural de Montesinho), 41°53'08.2"N, 6°49'37.4"W, elev. 793m, 16.v.2015, RA.
Distribution: widespread in Europe, the Maghreb countries of North Africa, Iran and Mongolia.

***Ilione trifaria* (Loew, 1847)**

1♂, Porto, Valongo, Campo, 41°09'33.4"N, 8°29'05.6"W, elev. 50-100m, 20.x.2010, RA; 1♀, Porto, Valongo, Campo, 41°09'33.4"N, 8°29'05.6"W, elev. 50-100m, 26.xi.2010, RA; 1♂1♀, Porto, Valongo, Campo, 41°09'33.4"N, 8°29'05.6"W, elev. 50-100m, 22.ii.2012, RA; 1♀, Porto, Valongo, Campo, 41°09'33.4"N, 8°29'05.6"W, elev. 50-100m, 23.v.2013, RA; 1♂, Santarém, Ourém, Seiça (Fontainhas), 39°39'55.4"N, 8°30'45.1"W, elev. 160m, 20.vii.2013, AG; 1♂, Castelo Branco, Castelo Branco, Monforte da Beira, Monte Barata (Parque Natural do Tejo Internacional), 39°42'33.5"N, 7°18'59.3"W, elev. 250m, 13.iv.2014, RA; 2♂♂, Castelo Branco, Castelo Branco, Monforte da Beira, Monte Barata (Parque Natural do Tejo Internacional), 39°42'33.5"N, 7°18'59.3"W, elev. 250m, 13.iv.2014, AG; 1♂, Faro, Silves, São Bartolomeu de Messines, 37°16'28.7"N, 8°18'37.3"W, elev. 101m, 12.vii.2014, AG; 2♀♀, Guarda, Seia, Vide e Cabeça, 40°19'02.96"N, 7°43'54.11"W, elev. 460m, 3.ix.2014, AG; 2♂♂2♀♀, Castelo de Vide, Ribeira de Nisa, 2.9km west of Carreiras, 39°21'56"N, 7°27'56"W, elev. 400m, riparian wood and grasses, 24.ix.2014, MJE; 2♂♂2♀♀, Castelo de Vide, Póvoa e Meadas, Barragem de Nisa, 39°28'33"N, 7°33'20"W, elev. 314m, riparian Mimosa forest and scrub, 25.ix.2014, MJE; 1♂, Beja, Barrancos, Barrancos, Noudar, 38°09'46.8"N, 7°03'08.7"W, elev. 165m, 15.iii.2015, AG & RA; 1♂2♀♀, Faro, São Brás de Alportel, São Brás de Alportel, 37°12'35.0"N, 7°53'32.6"W, elev. 436m, 11.iv.2015, AG; 1♂, Bragança, Vimioso, Algoso, Campo de Víboras e Uva, 41°27'17.6"N, 6°35'35.2"W, elev. 340m, 16.vi.2015, RA.
Distribution: a predominantly western Mediterranean species also found in the Maghreb countries of North Africa.

***Ilione unipunctata* (Macquart, 1849)**

1♂, Santarém, Ourém, Seiça (Fontainhas), 39°39'55.4"N, 8°30'45.1"W, elev. 160m, 20.vii.2013, AG.

Distribution: a Mediterranean species including the Maghreb countries of North Africa and reaching Syria.

***Limnia unguicornis* (Scopoli, 1763)**

1♂, Bragança, Bragança, Espinhosela (Parque Natural de Montesinho), 41°53'08.2"N, 6°49'37.4"W, elev. 793m, 8.viii.2014, AG; 1♀, Bragança, Vimioso, Algoso, Campo de Víboras e Uva, 41°29'32.2"N, 6°31'36.1"W, elev. 470m, 18.vi.2015, RA.
Distribution: widespread in Europe reaching Turkey.

***Pherbellia cinerella* (Fallén, 1820)**

1♀, Aveiro, Estarreja, Canelas e Fermelã, 40°43'22.7"N, 8°34'20.6"W, elev. 4m, 25.ii.2011, RA; 1♂, Santarém, Abrantes, Mouriscas, 39°28'02.0"N, 8°04'41.0"W, elev. 50m, 29.iii.2011, RA; 1♂, Viana do Castelo, Viana do Castelo, Vila Nova de Anha, 41°40'08.9"N, 8°49'25.7"W, elev. 10m, 6.ix.2011, RA; 1♂, Porto, Vila Nova de Gaia, Avintes (Parque Biológico de Gaia), 41°06'00.0"N, 8°33'35.3"W, elev. 50m, 1.vi.2013, RA; 1♂, Aveiro, Estarreja, Salreu, 40°44'04.4"N, 8°34'51.9"W, elev. 5m, 3.vi.2013, RA; 1♀, Braga, Esposende, Fonte Boa e Rio Tinto (Marachão), 41°30'16.9"N, 8°43'10.6"W, elev. 23m, 16.vi.2013, RA; 1♀, Vila Real, Mondim de Basto, Ermelo e Pardelhas, Fisgas de Ermelo (Parque Natural do Alvão), 41°22'48.9"N, 7°52'38.6"W, elev. 525m, 25.vi.2013, RA; 1♀, Vila Real, Vila Real, Borbela e Lamas de Olo (Parque Natural do Alvão), 41°22'27.6"N, 7°48'23.7"W, elev. 975m, 26.vi.2013, RA; 1♂1♀, Guarda, Manteigas, São Pedro, Poço do Inferno (Parque Natural da Serra da Estrela), 40°22'21.7"N, 7°31'00.1"W, elev. 1100m, 29.vi.2013, AG; 6♂♂3♀♀, Guarda, Seia, Sabugueiro, Lagoa Comprida (Parque Natural da Serra da Estrela), 40°21'54.3"N, 7°38'32.5"W, elev. 1620m, 21.ix.2013, RA; 2♂♂, Guarda, Manteigas, São Pedro, Nave de Santo António (Parque Natural da Serra da Estrela), 40°19'07.0"N, 7°34'37.4"W, elev. 1550m, 29.ix.2013, AG; 1♂1♀, Braga, Barcelos, Gilmonde, 41°30'43.0"N, 8°38'57.0"W, elev. 25-50m, 25.xi.2013, RA; 1♂, Castelo Branco, Castelo Branco, Monforte da Beira, Monte Barata (Parque Natural do Tejo Internacional), 39°42'33.5"N, 7°18'59.3"W, elev. 250m, 11.iv.2014, RA; 1♀, Castelo Branco, Castelo Branco, Monforte da Beira, Monte Barata (Parque Natural do Tejo Internacional), 39°42'33.5"N, 7°18'59.3"W, elev. 250m, 12.iv.2014, AG; 1♂1♀, Castelo Branco, Castelo Branco, Monforte da Beira, Monte Barata (Parque Natural do Tejo Internacional), 39°42'33.5"N, 7°18'59.3"W, elev. 250m, 13.iv.2014, AG; 1♀, Castelo Branco, Castelo Branco, Monforte da Beira, Monte Barata (Parque Natural do Tejo Internacional), 39°42'33.5"N, 7°18'59.3"W, elev. 250m, 13.iv.2014, RA; 2♂♂1♀, Guarda, Gouveia, Aldeias e Mangualde da Serra (Parque Natural da Serra da Estrela), 40°27'16.31"N, 7°35'51.22"W, elev. 1060m, 29.vii.2014. AG; 2♂♂, Guarda, Seia, Alvoco da Serra (Parque Natural da Serra da Estrela), 40°18'20.45"N, 7°41'13.91"W, elev. 900m, 30.vii.2014, AG; 1♂, Bragança, Bragança, França, Lama Grande (Parque Natural de Montesinho), 41°58'41.3"N, 6°47'26.1"W, elev. 1345m, 7.viii.2014, RA; 1♀, Bragança, Bragança, Espinhosela (Parque Natural de Montesinho), 41°53'08.2"N, 6°49'37.4"W, elev. 793m, 8.viii.2014, AG; 1♂, Castelo Branco, Covilhã, Unhais da Serra (Parque Natural da Serra da Estrela), 40°18'12.2"N, 7°35'21.8"W, elev. 1325m, 2.ix.2014, AG; 1♂, Guarda, Seia, Loriga (Parque Natural da Serra da Estrela), 40°19'41.26"N, 7°40'36.71"W, elev. 901m, 3.ix.2014, AG; 4♂♂1♀, Guarda, Seia, Seia, São Romão e Lapa dos Dinheiros (Parque Natural da Serra da Estrela), 40°23'04.19"N, 7°42'18.40"W, elev. 587m, 4.ix.2014, AG; 2♀♀, Bragança, Bragança, Espinhosela (Parque Natural de Montesinho), 41°53'08.2"N, 6°49'37.4"W, elev. 793m, 9.ix.2014, RA; 1♂3♀♀, Beja, Serpa, Vila Verde de Ficalho, 37°57'46.5"N, 7°17'58.5"W, elev. 280m, 16.xi.2014, AG & RA; 1♂, Bragança, Miranda do Douro, Silva e Águas Vivas, 41°31'50.5"N, 6°28'24.4"W, elev. 551m, 2.v.2015, AG; 1♀, Bragança, Bragança, Castro de Avelãs, 41°48'55.7"N, 6°48'56.7"W, elev. 737m, 10.v.2015, RA; 1♀, Bragança, Bragança, Espinhosela (Parque Natural de Montesinho), 41°53'08.2"N, 6°49'37.4"W, elev. 793m, 16.v.2015, AG; 1♀, Bragança, Vimioso, Algoso, Campo de Víboras e Uva, 41°27'17.6"N, 6°35'35.2"W, elev. 340m, 16.vi.2015, RA; 4♂♂1♀, Bragança, Bragança, Castro de Avelãs, 41°48'55.7"N, 6°48'56.7"W, elev. 737m, 9.viii.2015, AG; 2♂♂, Vila Real, Vila Real, Borbela e Lamas de Olo (Parque Natural do Alvão), 41°22'27.6"N, 7°48'23.7"W, elev. 975m, 4.ix.2015, RA; 1♂, Bragança, Bragança, Rabal (Parque Natural de Montesinho), 41°52'30.3"N, 6°44'44.2"W, elev. 616m, 3.x.2015, RA; 1♂, Bragança, Vimioso, Algoso, Campo de Víboras e Uva, 41°29'32.2"N, 6°31'36.1"W, elev. 470m, 6.x.2015, RA; 1♂, Bragança, Miranda do Douro, Vila Chã de Braciosa (Parque Natural do Douro Internacional), 41°25'29.8"N, 6°18'29.4"W, elev. 602m, 6.x.2015, RA.

Distribution: a very common and widespread species throughout Europe, including many Mediterranean Islands, through the Middle East, parts of Central Asia and parts of the Oriental Region.

Pherbellia dorsata **(Zetterstedt, 1842)**

1♂1♀, Aveiro, Estarreja, Canelas e Fermelã, 40°43'22.7"N, 8°34'20.6"W, elev. 4m, 13.iii.2012, RA; 1♀, Braga, Esposende, Fonte Boa e Rio Tinto (Marachão), 41°30'16.9"N, 8°43'10.6"W, elev. 23m, 16.vi.2013, RA; 1♂, Aveiro, Estarreja, Salreu, 40°44'04.4"N, 8°34'51.9"W, elev. 5m, 3.viii.2013, RA; 1♀, Leiria, Alcobaça, Cela, 39°30'21.3"N, 9°01'37.2"W, elev. 70m, 12.ix.2013, RA; 1♂, Aveiro, Estarreja, Canelas e Fermelã, 40°43'22.7"N, 8°34'20.6"W, elev. 4m, 10.vii.2014, RA; 1♀, Bragança, Bragança, Espinhosela (Parque Natural de Montesinho), 41°53'08.2"N, 6°49'37.4"W, elev. 793m, 9.ix.2014, RA; 1♂, Castelo de Vide, Póvoa e Meadas, Barragem de Nisa, 39°28'33"N, 7°33'20"W, elev. 314m, riparian Mimosa forest and scrub, 25.ix.2014, MJE.

Distribution: predominantly a north and central European species.

Pherbellia griseola **(Fallén, 1820)**

1♀, Porto, Valongo, Campo, 41°09'33.4"N, 8°29'05.6"W, elev. 50-100m, 28.v.2011, RA; 3♂♂2♀♀, Porto, Valongo, Campo, 41°09'33.4"N, 8°29'05.6"W, elev. 50-100m, 10.vii.2011, RA; 2♂♂, Braga, Vila Nova de Famalicão, Mouquim, 41°26'01.71"N, 8°31'32.71"W, elev. 105m, 16.viii.2013, RA; 1♂, Bragança, Bragança, Espinhosela (Parque Natural de Montesinho), 41°53'08.2"N, 6°49'37.4"W, elev. 793m, 8.viii.2014, RA; 1♀, 29.ix.2014, Manteigas, Serra de Estrela, Poço do Inferno, 40°19'33"N, 7°34'18"W, elev. 1515m, mixed forest, MJE.

Distribution: though fairly common, this Holarctic species has a patchy distribution.

Pherbellia schoenherri **(Fallén, 1826)**

1♀, Aveiro, Estarreja, Salreu, 40°44'04.4"N, 8°34'51.9"W, elev. 5m, 13.iii.2012, RA.

Distribution: predominantly a north and west Palaearctic species.

Pherbellia ventralis **(Fallén, 1820)**

1♀, Viana do Castelo, Melgaço, Castro Laboreiro e Lamas de Mouro (Parque Nacional da Peneda-Gerês), 42°00'14.2"N, 8°09'55.0"W, elev. 753m, 9.viii.2015, AG; 1♀, Guarda, Manteigas, São Pedro (Parque Natural da Serra da Estrela), 40°22'59.9"N, 7°32'46.4"W, elev. 827m, 29.viii.2015, RA.

Distribution: found mainly in Central Europe and reaches Turkey.

Pherbellia inornatifrons **Ebejer & Knutson sp. n.** (Figs 7–15)

Diagnosis: A medium-sized, almost completely yellow species having only the following structures black: apical 3/5 of basal flagellomere, in the fore leg apical 1/5 of femur, apical 1/4 of tibia, tip of very pale basitarsomere and distal 4 tarsomeres. Mid and hind legs with only apical two tarsomeres brownish. Frons and scutum unpatterned. Wing with a short posterior stump vein at middle portion of M1 after the posterior cross vein (dm-m); distinct black infuscations on the stump vein and both cross veins.

Fig. 7. ***Pherbellia inornatifrons,*** **holotype female, habitus.**

Description: female (habitus: Fig. 7)

Head: (Fig. 8) completely yellow without dark markings, black setae and about 24 black setulae on the anterior 1/3 of frons, which is paler yellow than posterior 2/3; frons, viewed in profile, somewhat convex, viewed from above as long as broad; mid-frontal stripe complete and parallel-sided for most of its length, narrowing to a point at anterior margin of frons, covered with thin greyish-yellow tomentum on basal half and on a very narrow shiny margin along its length and on apical half; frons not at all narrowed in female, very slightly narrowed in male; orbit narrowly greyish-white tomentose beyond a point between the two fronto-orbitals and continues on to face; dark orbito-antennal spot absent; face slightly concave; gena about half height of eye, barely protruding anteriorly and with scattered short black setulae on lower ½ of gena, above genal suture, these not extending on to face and with 2 or 3 strong setae posteriorly close to mouth margin; gena and face with greyish-white tomentum and posteriorly, where gena meets lower occiput, this tomentum is sharply demarcated from the yellowish occipital tomentum; eye bare and a little elliptical in its oblique diameter; occiput entirely yellow and covered with short black setulae laterally and mid-ventrally; well-developed proclinate ocellar setae, medial and lateral verticals well-developed; 2 pairs of fronto-orbitals (the anterior pair broken off, but their sockets clearly visible) short, less than half length of ocellars; ocellar triangle yellow with yellow tomentum leaving only lateral margin shiny; mouthparts yellow with black setulae on palpus; antenna (Fig. 8), scape and pedicel yellow each with black setulae on anterior margin of pedicel and dorsally on scape, longer below in pedicel, basal flagellomere densely fine pale pubescent and black on apical 2/3, slightly beyond insertion of arista, with well-defined border separating the black and yellow parts, twice as long as high, dorsal margin straight and ventral margin curved; arista finely setulose, longest setulae about equal to diameter of basal part of third aristal segment; two short basal aristal segments yellow, basal 1/6 of third segment even paler, contrasting with brown on the remainder of arista; lunule barely exposed, triangular, with whitish tomentum, ptilinal suture extending below anterior angle of eye.

Fig. 8. ***Pherbellia inornatifrons*, holotype, female head.**

Thorax: yellow, slightly deeper coloured almost orange on scutum, which is more or less uniformly, except for bare postpronotal angles, densely covered with short black setulae and with dull yellowish tomentum; pleura setulose only on posterior half of katepisternum; scutum with 4 narrow pale brown vittae, the middle pair commence at the neck and run parallel just medial to dorsocentral line as far as bases of prescutellar acrostichals, each lateral vitta runs from a point adjacent to presutural seta to base of upper postalar seta; chaetotaxy: 1 distinct propleural, 1 postpronotal, 1 presutural, 1 anterior and 1 posterior notopleural, 2 equally strong dorsocentrals, 1 pair well-developed prescutellar acrostichals (as strong as anterior of 2 dorsocentrals), 1 supra- and 2 postalars, scutellum yellow with 2 pairs of marginal bristles and a few fine setulae on disc, anepimeron anteriorly with 2 setae (one reduced to a setula on one side of the thorax in the holotype), with additional setula adjacent, katepisternum with 1 strong seta at extreme ventral corner.

Legs: yellow except foreleg where anterior apical 1/5 of femur, apical 1/5 of tibia, tip of very pale basitarsomere and distal 4 tarsomeres black; mid and hind legs with only apical two tarsomeres brownish; hind femur anteriorly at apex with a faint brown spot; front coxa, viewed anteriorly, with 1 strong black seta at middle and at apex, with also an apical fringe of about 9 black setae of variable length; fore femur dorsally with a row of 7-8 strong setae and adjacent posterior row of shorter setae; mid tibia in apical 1/3 with short seta, hind femur with two anterodorsal setae in apical third; posterior margin of hind coxa bare.

Wing (Fig. 9)**:** hyaline, a faint brownish infuscation becoming darker along costa from around apex of R_{2+3} to around apex of R_{4+5}; r-m cross vein lies over middle of discal cell and lies oblique with anterior end more basal; all veins, pale brown becoming darker at wing apex; cross vein dm-m straight and stump vein, situated at middle of apical section of M_1 and directed posteriorly, marked with distinct black infuscation; costa finely and densely black setulose to almost half way between apices of R_{2+3} and R_{4+5}. Small thoracic squama with fringe of pale golden-yellow setulae. Haltere pale yellow.

Abdomen: entirely yellow with only the posterior margins of tergites a little darker; tergum 1 bare antero-laterally, all other tergites covered with moderately long but fine black setulae, which, along posterior and lateral margins become progressively longer from tergite 3 to

6. Female postabdomen (Figs 10, 11): yellow, genital sclerite, viewed in profile, with notch on dorsal margin; cercus 4 times as long as wide and with long apical seta; epiproct with pair of long apical setae.

Fig. 9. ***Pherbellia inornatifrons*****, wing, female paratype.**

Male. Similar to female in external characters. Postabdomen (Figs 12–15): sternite 6 a narrow, curved sclerotised strap with left spiracle 6 in upper end and a small lobe on posterior surface near right end, anterior margin of synsternite 7+8 strongly, narrowly sclerotised; epandrium yellow as in preceding tergites, bare basally, otherwise heavily setulose; anterior surstylus elongate and narrow with several minute setulae on apical third; posterior surstylus a rhomboid plate setulose except apically and with a very short lobe-like extension on posteromedial margin bearing minute setulae; aedeagal apodeme weakly sclerotised with y-shaped apex; hypandrium rounded anteriorly and truncate posteriorly; pregonite consisting of two parts: dorsal process more or less rectangular with a tongue-like projection and ventral process rectangular basally with a large and strong recurved hook-like projection; postgonite consisting of two parts: dorsal process a membranous, rectangular plate with 6-8 setulae at posterolateral corner and ventral process of an L-shaped strongly sclerotised structure; basiphallus bearing bifurcate apically membranous distiphallus.

Body length. Male and female: 5.1 mm. Wing length 5 mm.

Variation. The two specimens from Spain are paler in both wing and leg markings. Neither of them have the dark area on the basitarsomere and the male fore femur has no darkening on the anterior surface. Both of them also have shorter aristal setulae than is the case with the holotype. The female from Spain is anomalous in that it has 3 fronto-orbital setae on one side and 2 (normal state) on the other; on the hind femur it has 4 anterodorsal setae in apical third.

Holotype: ♀, Portugal, Vila Real, Mondim de Basto, Ermelo e Pardelhas, Varzigueto, 41°22'44.0"N, 7°51'14.4"W, elev. 750m, 25.vi.2013, RA. **Paratypes:** 1♂1♀, Spain, Sierra de Guadarrama, swept around stream near Gudillos, elev. circa 1400m 19.viii.1963, A.C. Pont. Holotype deposited in the National Museum of Wales, Cardiff and paratypes deposited in Natural History Museum, London, UK (BMNH).

Etymology. The specific name is based on the absent ornamentation of the frons: a lack of dark orbito-antennal spot, and absence of dark spots at bases of fronto-orbital setae.

Distribution. Vila Real, Portugal and Sierra de Guadarrama, Spain.

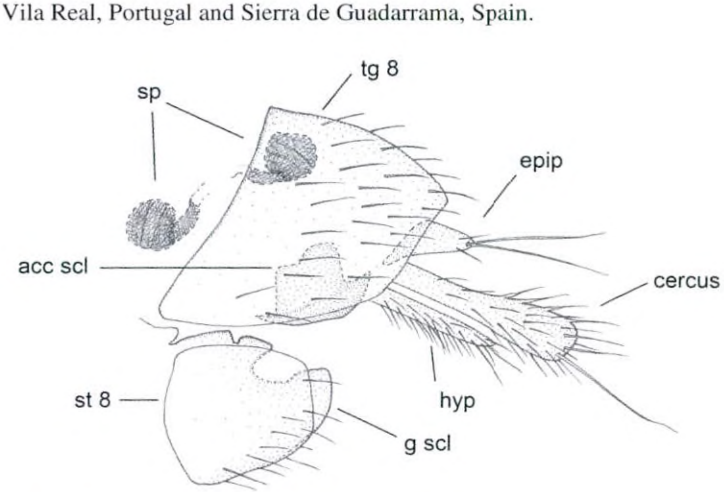


Fig. 10. ***Pherbellia inornatifrons*, holotype female, lateral aspect of postabdomen; sp – spermathecae, tg 8 – tergite 8, epip – epiproct, hyp – hypoproct, g scl – genital sclerite, st 8 – sternite 8, acc scl – accessory sclerite.**

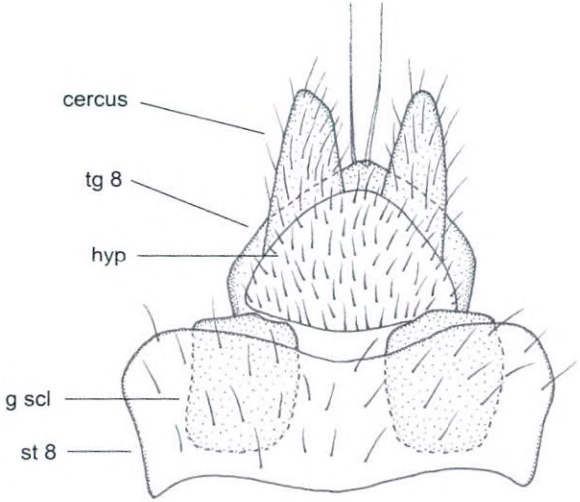


Fig. 11. ***Pherbellia inornatifrons*, holotype female, ventral aspect of postabdomen; abbreviations as in Fig. 10.**

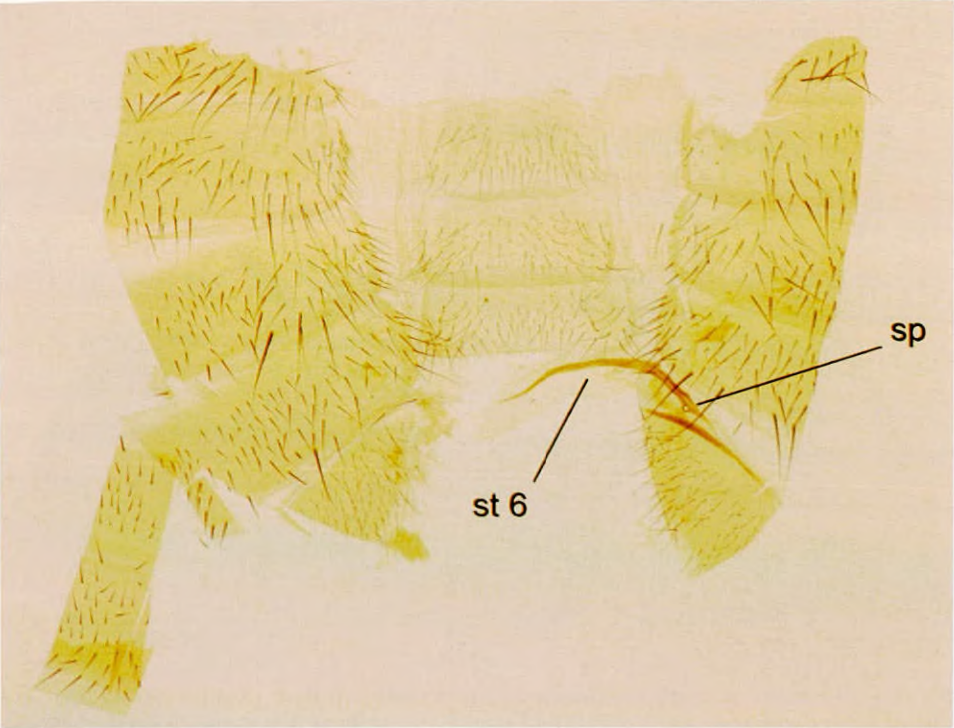
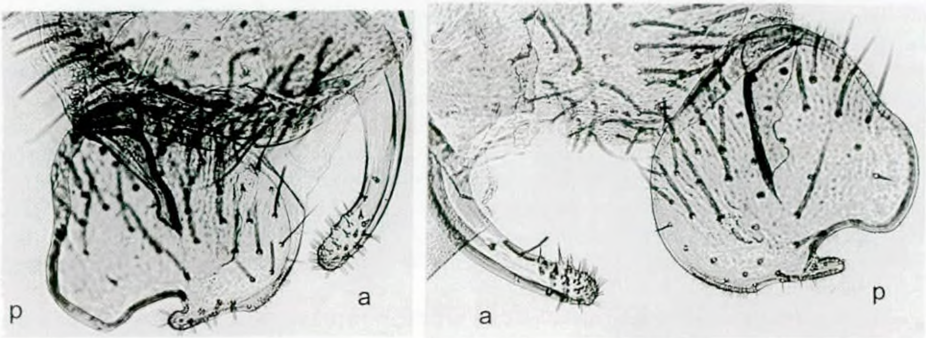


Fig. 12. ***Pherbellia inornatifrons*, abdomen of male paratype, ventral. Abbreviations: st 6 = sternite 6, sp = spiracle of segment 6 embedded in lateral end of sternite 6.**



Figs 13-14. ***Pherbellia inornatifrons*, surstyli of male paratype: 13, right side; 14, left side; a = anterior surstylus, p = posterior surstylus.**

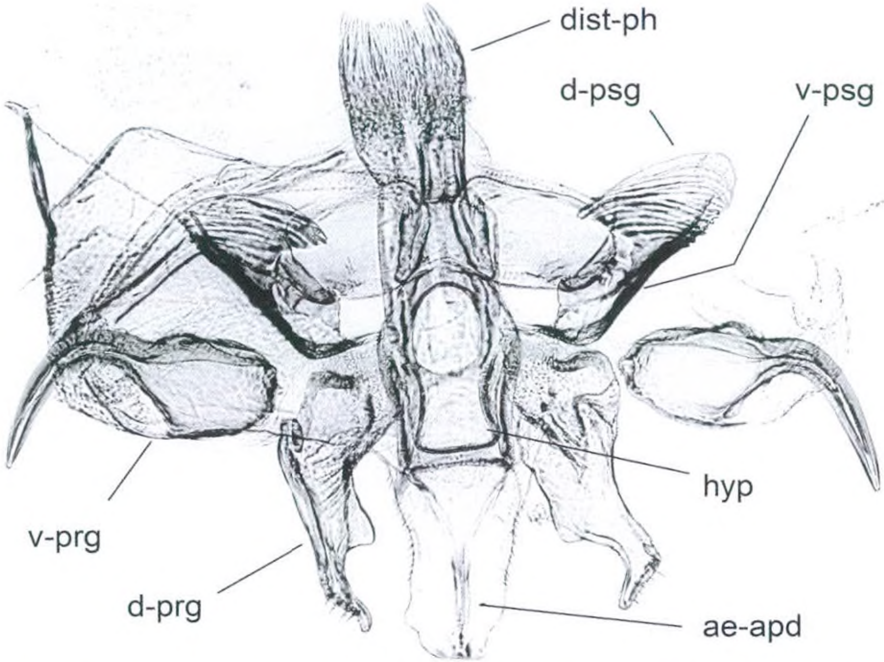


Fig. 15. ***Pherbellia inornatifrons*, hypopygium of male paratype. Abbreviations: *dist-ph* = distiphallus; *d-psg* and *v-psg* = dorsal and ventral processes of postgonite respectively; *d-prg* and *v-prg* = dorsal and ventral processes of pregonite respectively; *hyp* = hypandrium; *ae-apd* = aedeagal apodeme.**

Remarks. The new species belongs to the subgenus *Oxytaenia* and by presence of an accessory stump vein is near *P. mikiana* Hendel, 1900 (a coastal Mediterranean species), *P. priscillae* Knutson & Freidberg, 1983 (Middle East), *P. argyrotarsis* (Becker, 1908) (so far known only from the Canary Islands), *P. ditoma* Steyskal, 1956 (Far East Palaearctic) and *P. ozerovi* Rozkošný, 1991 (Far Eastern Russia). Among the many external characters, the following distinctive differences separate congeners: with *P. priscillae*, the yellow basal flagellomere, gena less than 1/3 height of eye and the apex of hind tibia darkened; *P. mikiana*, the poorly infuscated cross veins, the dark brown veins, palpus black-tipped, presence of one black fronto-orbital spot on each side near base of antenna, and all legs are yellow; *P. argyrotarsis*, subcostal infuscation reaches proximally to the apex of the subcostal vein, apex of hind femur and base of mid tibia and its apex with dark annulae; *P. ditoma,* presence of 2 accessory stump veins on apical portion of M_1, wing with anterior margin mostly infuscated. There are thus several distinguishing features to separate the new species from its congeners.

Partial modifications can be included easily in the keys to Palaearctic *Pherbellia,* published by Rozkošný (1987) and Vala (1989). The insertions consider all the species with recurrent accessory stump veins on M_1.

1. Distal section of M_1 with 1-2 short additional stump veins directed posteriorly 2
\- Distal section of M_1 without short additional stump veins .... other *Pherbellia* species

2. Distal section of M_1 with 2 stump veins .... ***ditoma* Steyskal** and ***ozerovi* Rozkošný** (East Palaearctic)
- Distal section of M_1 with 1 stump vein 3

3. Anepisternum setulose .... ***mikiana* Hendel**
- Anepisternum bare 4

4. Basal flagellomere yellow; legs mainly yellow, middle tibia yellow, apices of fore and hind femora with black spot, apex of hind tibia blackish ...... ***priscillae* Knutson & Freidberg**
- Basal flagellomere mainly black; legs yellow, middle tibia either yellow or with basal and apical dark annulae, hind femur without black spot 5

5. Dark orbito-antennal spot present; middle tibia yellow with black basal and apical annulae .... ***argyrotarsis* (Becker)**
- Orbito-antennal spot absent; middle tibia completely yellow .... ***inornatifrons* sp. n.**

***Pherbina coryleti* (Scopoli, 1763)**
1♀, Viana do Castelo, Viana do Castelo, Mazarefes, 41°41'32.7"N, 8°46'20.1"W, elev. 10m, 29.viii.2012, RA.
Distribution: a species that is common and widespread in Europe from Scandinavia to North Africa, Turkey and Afghanistan.

***Pherbina mediterranea* Mayer, 1953**
1♂1♀, Braga, Esposende, Apúlia e Fão (Parque Natural do Litoral Norte), 41°28'16.4"N, 8°46'27.2"W, elev. 2m, 23.vii.2010, RA; 1♂, Leiria, Caldas da Rainha, Tornada e Salir do Porto (Reserva Natural Local do Paul de Tornada), 39°26'53.1"N, 9°08'04.3"W, elev. 25m, 27.vii.2010, RA; 1♂, Viana do Castelo, Viana do Castelo, Vila Nova de Anha, 41°40'08.9"N, 8°49'25.7"W, elev. 10m, 6.ix.2011, RA; 2♀♀, Braga, Esposende, Apúlia e Fão (Parque Natural do Litoral Norte), 41°28'16.4"N, 8°46'27.2"W, elev. 2m, 11.viii.2012, RA; 1♀, Porto, Vila do Conde, Mindelo (Reserva Ornitológica de Mindelo), 41°19'13.9"N, 8°44'07.5"W, elev. 5-20m, 25.v.2013, RA; 1♀, Aveiro, Estarreja, Salreu, 40°44'04.4"N, 8°34'51.9"W, elev. 5m, 3.vi.2013, RA; 1♂, Coimbra, Coimbra, Taveiro, Ameal e Arzila (Reserva Natural do Paul de Arzila), 40°10'45.0"N, 8°33'18.7"W, elev. 25m, 5.vi.2013, RA; 1♂1♀, Braga, Esposende, Fonte Boa e Rio Tinto (Marachão), 41°30'16.9"N, 8°43'10.6"W, elev. 23m, 15.vi.2013, RA; 1♂, Faro, Silves, São Bartolomeu de Messines, 37°16'28.7"N, 8°18'37.3"W, elev. 101m, 12.vii.2014, RA; 3♀♀, Faro, Silves, São Bartolomeu de Messines, 37°16'28.7"N, 8°18'37.3"W, elev. 101m, 12.vii.2014, AG; 2♂♂, Coimbra, Figueira da Foz, Vila Verde, 40°07'59.6"N, 8°50'40.6"W, elev. 1m, 18.x.2014, AG; 1♂, Beja, Moura, Sobral da Adiça, 38°02'34.7"N, 7°15'52.7"W, elev. 173m, 15.xi.2014, RA; 1♂1♀, Braga, Esposende, Apúlia e Fão (Parque Natural do Litoral Norte), 41°28'16.4"N, 8°46'27.2"W, elev. 2m, 30.v.2015, RA.
Distribution: a west Mediterranean species reaching the east as far as Sicily and Tunisia.

***Psacadina disjecta* Enderlein, 1939**
1♂, Bragança, Vimioso, Algoso, Campo de Víboras e Uva, 41°29'32.2"N, 6°31'36.1"W, elev. 470m, 18.vi.2015, RA.
Distribution: a west Mediterranean species frequently found with the previous species.

***Psacadina verbekei* Knutson, Rozkošný & Berg, 1975**

1♂, Coimbra, Coimbra, Taveiro, Ameal e Arzila (Reserva Natural do Paul de Arzila), 40°10'45.0"N, 8°33'18.7"W, elev. 25m, 5.vi.2013, RA; 1♂, Bragança, Bragança, Espinhosela (Parque Natural de Montesinho), 41°53'08.2"N, 6°49'37.4"W, elev. 793m, 9.ix.2014, RA.

Distribution: widespread in Europe, more localised in the Mediterranean, recorded also from the north of Iraq and Iran, and from eastern Turkey.

***Sepedon femorata* Knutson & Orth, 1984**

2♂♂3♀♀, Aveiro, Estarreja, Canelas e Fermelã, 40°43'22.7"N, 8°34'20.6"W, elev. 4m, 13.iii.2012, RA; 1♀, Aveiro, Estarreja, Salreu, 40°44'04.4"N, 8°34'51.9"W, elev. 5m, 13.iii.2012, RA; 3♀♀, Vila Real, Montalegre, Viade de Baixo e Fervidelas, 41°43'42.2"N, 7°52'18.6"W, elev. 750m, 9.ix.2012, RA; 1♀, Bragança, Bragança, Espinhosela (Parque Natural de Montesinho), 41°53'08.2"N, 6°49'37.4"W, elev. 793m, 9.ix.2014, RA; 2♂♂, Castelo de Vide, Póvoa e Meadas, Barragem de Nisa, 39°28'33"N, 7°33'20"W, elev. 314m, riparian *Mimosa* forest and scrub, 25.ix.2014, MJE; 2♂♂3♀♀, Beja, Serpa, Vila Verde de Ficalho, 37°57'46.5"N, 7°17'58.5"W, elev. 280m, 16.xi.2014, AG & RA; 1♂, Portalegre, Marvão, Santa Maria de Marvão (Parque Natural da Serra de São Mamede), 39°23'49.2"N, 7°21'51.4"W, elev. 607m, 14.iii.2015, RA; 1♂1♀, Beja, Barrancos, Barrancos, Noudar, 38°09'46.8"N, 7°03'08.7"W, elev. 165m, 15.iii.2015, AG & RA; 1♂1♀, Beja, Barrancos, Barrancos, Noudar, 38°09'46.8"N, 7°03'08.7"W, elev. 165m, 4.iv.2015, AG.

Distribution: an Iberian species that extends to the south west of France.

***Sepedon sphegea* (Fabricius, 1775)**

1♀, Aveiro, Estarreja, Salreu, 40°44'04.4"N, 8°34'51.9'W, elev. 5m, 20.vii.2010, RA; 2♀♀, Aveiro, Estarreja, Canelas e Fermelã, 40°43'22.7"N, 8°34'20.6"W, elev. 4m, 13.iii.2012, RA; 1♀, Vila Real, Montalegre, Viade de Baixo e Fervidelas, 41°43'42.2"N, 7°52'18.6"W, elev. 750m, 9.ix.2012, RA; 2♀♀, Aveiro, Estarreja, Salreu, 40°44'04.4"N, 8°34'51.9"W, elev. 5m, 3.viii.2013, RA.

Distribution: common and widespread in Europe and North Africa, reaching the east Palaearctic (some Middle East and east Palaearctic records may refer to the very similar species *S. aenescens* Wiedemann, 1830).

***Sepedon spinipes* (Scopoli, 1763)**

1♂, Vila Real, Montalegre, Viade de Baixo e Fervidelas, 41°43'42.2"N, 7°52'18.6"W, elev. 750m, 9.ix.2012, RA.

Distribution: common and widespread in Europe from Scandinavia to the Maghreb countries of North Africa, and reaching Turkey and Iran.

***Tetanocera arrogans* (Meigen, 1830)**

1♂, Porto, Valongo, Campo, 41°09'33.4"N, 8°29'05.6"W, elev. 50-100m, 31.v.2012, RA; 1♂, Coimbra, Coimbra, Taveiro, Ameal e Arzila (Reserva Natural do Paul de Arzila), 40°10'45.0"N, 8°33'18.7"W, elev. 25m, 5.vi.2013, RA; 1♂, Porto, Vila do Conde, Malta e Canidelo, 41°18'17.25"N, 8°39'38.10"W, elev. 65m, 6.ix.2013, RA.

Distribution: a Palaearctic species as far as Japan.

***Tetanocera ferruginea* (Fallén, 1820)**

1♂, Porto, Valongo, Campo, 41°09'33.4"N, 8°29'05.6"W, elev. 50-100m, 30.vii.2011, RA; 2♂♂, Aveiro, Estarreja, Salreu, 40°44'04.4"N, 8°34'51.9"W, elev. 5m, 6.iv.2013, RA.

Distribution: a common and widespread species throughout the Holarctic Region.

***Tetanocera montana* Day, 1881**

This species is listed from Portugal in the catalogue of Iberian Diptera (Carles-Tolrá and Báez 2002), but we have not encountered it. It is very similar to *T. arrogans* and separable from it on examination of the male postabdomen.

Distribution: a Holarctic species found mainly in the northern countries of this region.

***Trypetoptera punctulata* (Scopoli, 1763)**

1♂, Braga, Barcelos, Gilmonde, 41°30'43.0"N, 8°38'57.0"W, elev. 25-50m, 19.vi.2012, RA; 1♀, Porto, Vila do Conde, Mindelo (Reserva Ornitológica de Mindelo), 41°19'13.9"N, 8°44'07.5"W, elev. 5-20m, 13.v.2013, RA; 1♂, Porto, Vila do Conde, Malta e Canidelo, 41°18'17.25"N, 8°39'38.10"W, elev. 65m, 14.vi.2013, RA; 1♀, Porto, Vila do Conde, Malta e Canidelo, 41°18'17.25"N, 8°39'38.10"W, elev. 65m, 6.ix.2013, RA.

Distribution: common and widespread in most Palaearctic countries.

Conclusions

A significant increase in the number of species of snail-killing flies recorded here in Portugal is the result of more intensive and planned sampling in a wide range of habitats. Of the 12 previously recorded species, we have not encountered four, namely *P. nigripennis, E. zelleri, S. fasciata* and *T. montana.* Except for *C. distincta* and *P. inornatifrons*, the remaining species recorded here were to be expected, given their distribution in adjacent countries. Fifty-five species are known from continental Spain and several widespread species that occur in Spain should also occur in Portugal. Notwithstanding the large number of new records in this study and the fact that we did not yet encounter four of the species previously known, we conclude that more fieldwork is likely to yield further species new to the country.

Acknowledgements

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Dipterists Digest 2016 **23,** 41-45

Merodon trochantericus (Costa) (Diptera, Syrphidae) new to the British Isles from Jersey

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Summary

The hoverfly *Merodon trochantericus* (Costa, 1884) is reported from the British Isles for the first time, based on a confirmed single male specimen and further sightings from Jersey in the Channel Islands.

Introduction

The arrival of this species within the British Isles was perhaps to be expected as it has since 2004 been recorded on the coast of northern France, which is only approximately 15 miles from Jersey. Only a single species of the genus *Merodon*, *M. equestris* (Fabricius, 1794), had been previously recorded within the British Isles (Stubbs and Falk 2002).

I captured a single male specimen at Portelet Common coastal heathland in the parish of St Brelade on the south-west coast of Jersey, Channel Islands on 17 August 2015. Three other individuals, a further male and two females, which I observed and photographed at the exact same location and on the same day, were very probably the same species indicating that a small colony of this species is present at this site.

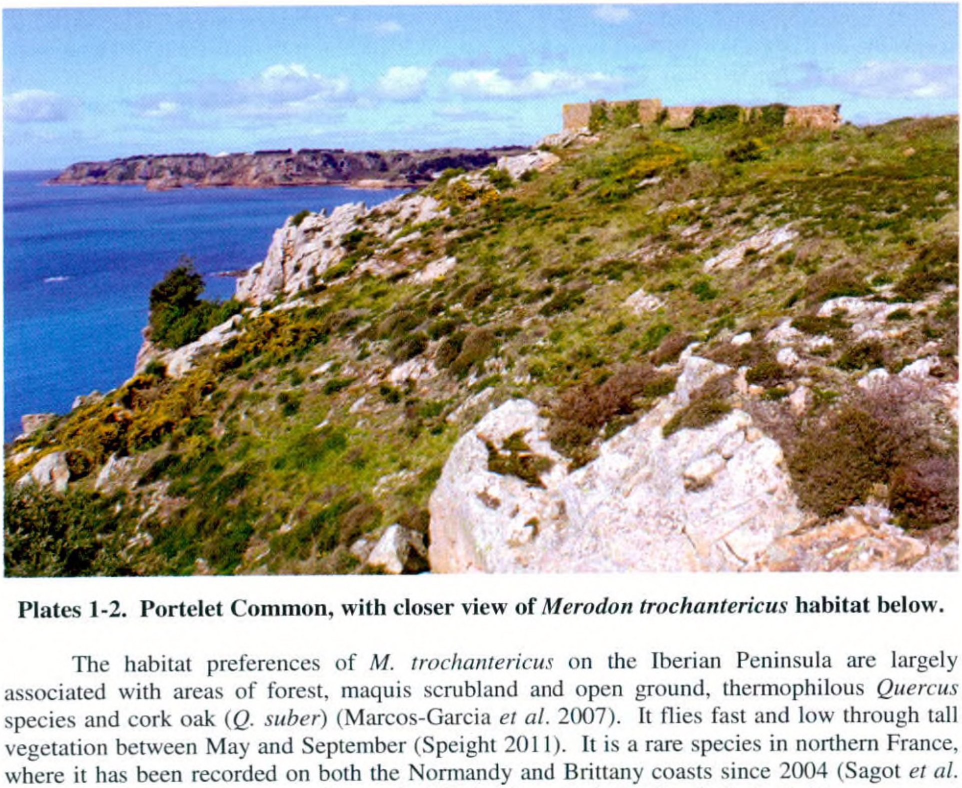
The male specimen was feeding at flowers of autumn squill (*Scilla autumnalis*) and other individuals were observed feeding at this plant and also at flowers of common heather (*Calluna vulgaris*). The specimen was initially identified as *M. trochantericus* using the European key for this genus (Van Veen 2010) and then, with the assistance of Steven Falk, it was subsequently forwarded to Dr Ante Vujić of the University of Novi Sad, Serbia, who definitively confirmed the identification.

Portelet Common is a coastal lowland dwarf-shrub heathland, which is located at 49.1731N 2.1865W and is a Site of Special Interest (SSI) administered by the Environment Department of the States of Jersey Government. The 31 hectare site consists of extensive common heather cover with abundant western gorse (*Ulex gallii*), interspersed with lichen-rich short turf grassland and with mixed wooded areas at the periphery of the site.

The specific area of the site where this species was observed and captured (Plates 1, 2) was on a south-facing coastal cliff slope at approximately 50 metres above sea level, with an inclination of approximately 35 degrees. The site has in recent years been carefully managed by the States of Jersey Environment Department to reduce the occurrence of invasive holm oak (*Quercus ilex*) and bracken (*Pteridium aquilinum*), in order to re-establish the natural local coastal heathland habitat of mainly heather, gorse and bare open ground.

Ecology and biology

There are about 160 species of *Merodon* worldwide, with about 50 species found in Europe alone (Vujić *et al.* 2016). *Merodon trochantericus* is mainly a Mediterranean species and is known from a few countries and islands in Europe and North Africa. It has been recorded from France, Italy, Spain, Sardinia and Corsica in Europe (Marcos-Garcia *et al.* 2007) and from Algeria in Africa (Djellab *et al.* 2013).



Plates 1-2. Portelet Common, with closer view of *Merodon trochantericus* habitat below.

The habitat preferences of *M. trochantericus* on the Iberian Peninsula are largely associated with areas of forest, maquis scrubland and open ground, thermophilous *Quercus* species and cork oak (*Q. suber*) (Marcos-Garcia *et al*. 2007). It flies fast and low through tall vegetation between May and September (Speight 2011). It is a rare species in northern France, where it has been recorded on both the Normandy and Brittany coasts since 2004 (Sagot *et al.* 2004), mainly in sand dune and coastal cliffs habitats (Lair 2012). It feeds in late summer at autumn squill, which is also considered to be the most likely larval plant in northern France cliff habitat populations (Xavier Lair *pers. comm.*).

Numerous potential monocotyledon larval food plants occur on Portelet Common including autumn squill, wild daffodil (*Narcissus pseudonarcissus*), grape hyacinth (*Muscari* spp) and common bluebell (*Hyacinthoides non-scripta*).

Identification

Van Veen (2010) provided a key to the European species of the genus *Merodon* in *Hoverflies of Northwest Europe* and Marcos-Garcia (2007) keyed the *Merodon* species of the Iberian Peninsula. Members of the genus *Merodon* are relatively large bee-mimic hoverflies with a triangular apical projection on the underside of the slightly swollen hind femur and a re-entrant upper outer crossvein on the wing.

Merodon trochantericus is a medium-sized species of the genus with typically a body length of 13.3-14.6mm. It has a short dense pile of erect brownish hairs on the mesoscutum and a reddish abdomen with greyish dust bands on tergites 2-4. There are longer semi-erect pale hairs at the apex of the scutellum, as well as along the lateral edge and apex of each of the abdominal tergites. The eyes have white hairs and the legs are partly pale (Marcos-Garcia 2007, Van Veen 2010) (Plate 3).

Plate 3. ***Merodon trochantericus*****, male on heather flowers.**

The definitive identification features of this species are the small ventral projection on the basal fifth of the ventral surface of the hind femur and a clear rounded projection on the hind trochanter (Marcos-Garcia *et al.* 2007, Van Veen 2010) (Plate 4 and Fig. 1).

Plate 4. ***Merodon trochantericus*, male hind femur.**

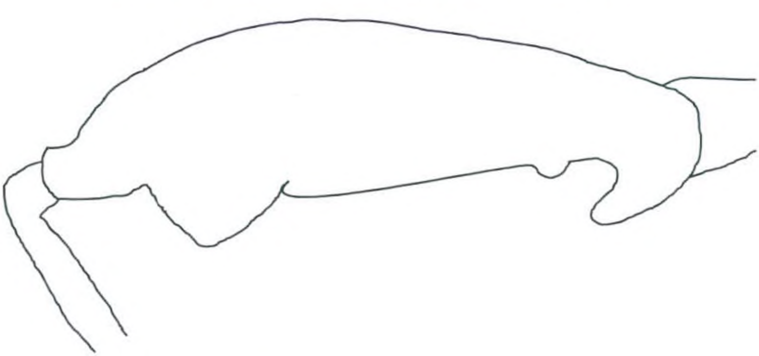


Fig. 1. ***Merodon trochantericus*, outline of male hind femur.**

Acknowledgements
Many thanks to Dr Ante Vujić (Novi Sad, Serbia) for his confirmation of the species identification, Steven Falk (Kenilworth, UK) for reading through and commenting on this paper, and Xavier Lair (Paris, France) for useful information on this species in northern France.

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Thripomorpha coxendix (Verrall) (Diptera, Scatopsidae) reared from a seedhead of teasel _Dipsacus fullonum_ collected at Highgrove, Gloucestershire – There are currently six species in the genus *Thripomorpha* Enderlein, 1905 known to occur in the British Isles. As far as I am aware, prior to that reported here none had been reared in the British Isles. Even in mainland Europe, the early stages of the genus are poorly known. Indeed, only two species (both occurring in the British Isles) have been reared there: *Thripomorpha paludicola* Enderlein, 1905 and *T. halterata* (Meigen, 1838) (Brunhes, J. and Haenni, J.-P. 1982. *Mitteilungen der Schweizerischen entomologischen Gesellschaft* **55,** 18-185; J.-P. Haenni, *in litt.*). In Brunhes and Haenni (*op. cit.*) these were recorded as *Rhegmoclema edwardsi* (Collin, 1954) and *R. halteratum* (Meigen, 1838) respectively.

On 26 and 27 June 2014, I attended a Bioblitz organised by the Royal Entomological Society at Highgrove, Doughton, Gloucestershire (V.C. 34), the family home of HRH Prince Charles. Amongst other things that I collected on the first day were two seedheads of *Dipsacus fullonum*, each with a small portion of the adjoining stem. One seedhead contained a lepidopterous pupa within the central, hollow part. Two species of Microlepidoptera (my main interest) have larvae that feed within this area and also the upper part of the stem adjoining the seedhead, and pupate within the central, hollow part: *Endothenia gentianaeana* (Hübner, [1799]) and *E. marginana* (Haworth, 1811), both in the Tortricidae. There is another species of Tortricidae, *Cochylis roseana* (Haworth, 1811), whose larva feeds on the seeds and pupates amongst them. There was no evidence of any feeding in the other seedhead, nevertheless it was collected as feeding signs can be cryptic. Each seedhead was kept in a separate, closed container.

The following day 23 small winged insects appeared in the container that had the apparently unoccupied seedhead. Wrongly believing that these were hymenopterous parasitoids, even though the remains of a host could not be found, in due course I sent them to Mark Shaw at the National Museums of Scotland, Edinburgh (NMS). I have been sending him hymenopterous parasitoids for over 30 years, but obviously I have not learnt to discriminate such from Diptera because he rightly considered that they were in that order, probably in the family Scatopsidae. Dr Shaw passed my material to Graham Rotheray, also at the NMS, who determined them as 10 ♂ and 13 ♀ of *Thripomorpha coxendix* (Verrall, 1912), a common species in that family. He commented that the pupa of this type of fly is often very flimsy and shrivels up post emergence of the adult, which probably explained why I found no evidence of exuviae and so do not know whether the larvae fed within the seedhead (and if so on what part) or within the stem.

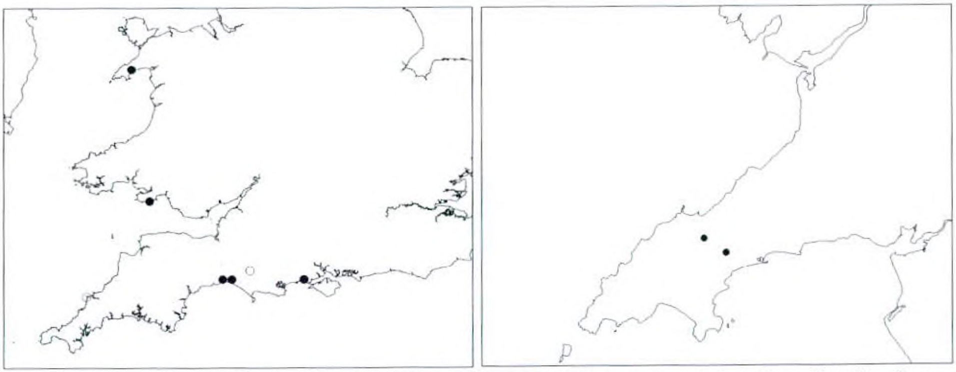
On the basis of this observation, the requirements of *Thripomorpha coxendix* appear to differ markedly from those of *T. halterata* and *T. paludicola*. The two latter species were reared from blocks of peat-bog collected at Cézallier, a vast basaltic volcanic plateau in the heart of the Massif Central, France. The area is distinctly acid with a pH of 4.9–5.7. The main vegetation where the peat blocks were collected comprises a number of low-growing plants: *Sphagnum* species, *Equisetum fluviatile*, *Comarum palustre*, *Menyanthes trifoliata*, *Carex limosa*, *C. lasiocarpa*, *Viola palustris*, *Salix lapponum* and *S. pentandra*.

At Highgrove, the only *Dipsacus fullonum* plants that I saw were all near the edge of a small pond. There were several seedheads and none was lying on the ground. Therefore the larvae must have resulted from ova laid somewhere on or in the seedhead or adjoining stem and not from ova laid either on the ground or on low-growing plants. One rearing record is not sufficient to show whether *Thripomorpha coxendix* is host specific to *Dipsacus fullonum* but at least it is a starting point in determining its biology. It might be of interest if samples of the seed-producing plants listed by Brunhes and Haenni (*loc. cit.*) were collected to see if *T. paludicola* and *T. halterata* result.

I am extremely grateful to Jean-Paul Haenni for providing a PDF of his paper cited above, for telling me of the change of nomenclature since that paper and that it contains the only prior information about the biology of the genus *Thripomorpha*, as well as encouraging the writing of this note. I also thank Peter Chandler for similar encouragement. Finally, of course, I am deeply indebted to Graham Rotheray, both for his identification of my material and observations, without which this note would not have been possible – **ROBERT J. HECKFORD,** 67 Newnham Road, Plympton, Plymouth, Devon PL7 4AW

A new Welsh locality for the cranefly *Idiocera sexguttata* (Dale) (Diptera, Limoniidae) in 2015 - Until 1999, the cranefly *Idiocera sexguttata* (Dale) was thought to be extinct in Britain, with records from Glanville's Wootton in Dorset in c.1860 and St. Merryn in Cornwall in 1912. However, Ivan Perry recorded several adults from open hillside seepages (Penmaen seepages) on Cefn Bryn Common on Gower in July 1999 and from exposed, bare calcareous seepages in a bog at Stony Moors in the New Forest in June 2000. In June 2005, a single adult was collected in a Malaise trap situated at the edge of a *Phragmites* reedbed at St. Gabriel's in Dorset during an invertebrate survey of coastal soft cliffs (Hunnisett, J. and Edwards, B. 2006. A survey of invertebrates and vegetation at selected soft rock cliff sites in Dorset. Report for Buglife). In July 2006, Martin Drake (*pers. comm.*) swept a single male from a base-rich seepage at the top on the beach on soft-rock cliff at Eype Mouth during survey work for English Nature.

Since its discovery at Penmaen seepages, attempts have been made to monitor the cranefly but with rather limited success. A single female was swept from sparsely-vegetated, gravelly seepages in June 2001, and three adults were recorded in June 2006 when two were swept from deeply-vegetated, sheltered seepages and a singleton was found along a linear seepage under tree canopy. There were no further observations, despite repeated visits, until a single female was recorded in June 2014, again from open seepages. Mark Winder (Winder, M. 2014. *Idiocera sexguttata* (Dale 1842) habitat re-assessment and site search. Report for Buglife) also recorded a single female in the same month. These open seepages have a peaty, gravelly or stony substrate, and vary from having no vegetation to carpets of mosses and liverworts, notably *Philonotis fontana* and *Pellia* species, to soakways dominated by fool's water-cress *Apium nodiflorum*. Other plants within or along the seepage lines include marsh St John's-wort *Hypericum elodes*, bog asphodel *Narthecium ossifragum*, creeping forget-me-not *Myosotis secunda*, short sedges such as *Carex demissa*, *C. echinata*, *C. nigra* and *C. panicea*, round-leaved sundew *Drosera rotundifolia* and the spike-rush *Eleocharis quinqueflora*. However, it appears that they also utilise more enclosed or tussocky seepages, which will offer more shelter for this rather small and delicate cranefly. A wider search of seepages on the south side of Cefn Bryn Common has failed to find any additional populations, perhaps because these tend to be much more acidic in nature.



Figs 1-2. British distribution of *Idiocera sexguttata*: left, hectads; right, 1km distribution at Cors Geirch.

During a visit to Cors Geirch National Nature Reserve near Pwllheli on the Llŷn peninsula on 12 June 2015, 30 adults of *Idiocera sexguttata* were swept along an open, calcareous seepage within tall fen (Table 1). A return visit on 22 June to document the vegetation recorded 8 adults although less sweeping was undertaken to prevent damaging the fly's population. The seepage is characterised by bare silty muds interspersed with carpets of brown moss and tussocks of black bog-rush *Schoenus nigricans*. Other associates include slender sedge *Carex lasiocarpa*, bogbean *Menyanthes trifoliata*, bog myrtle *Myrica gale* and short sedges such as *Carex panicea* and *C. demissa*. Ten adults were recorded on the northern part of the NNR on 27 June, again associated with open, base-rich seepages with sparse common reed *Phragmites australis*, *S. nigricans*, *M. trifoliata*, blunt-flowered rush *Juncus subnodulosus*, sedges including *Carex lepidocarpa* and *C. echinata*, and marsh lousewort *Pedicularis palustris*.

Table 1. British records of the cranefly *Idiocera sexguttata*.

Site	**VC**	**Grid Ref**	**Date**	**Abundance**	**Recorder**
St. Merryn	1	SW8775	June 1912		C.G. Lamb
Glanville's Wootton	9	ST60	1860		J.C. Dale
St. Gabriel's	9	SY398921	28 June 2005	1 adult	John Hunnisett
Eype Mouth	9	SY445910	11 July 2006	1♂	Martin Drake
Stony Moors, New Forest	11	SZ213995	19 June 2000	several adults	Ivan Perry
Penmaen seepages, Cefn Bryn	41	SS524887	14 July 1999	several adults	Ivan Perry
Penmaen seepages, Cefn Bryn	41	SS526886	21 June 2001	1♀	Mike Howe
Penmaen seepages, Cefn Bryn	41	SS525885	23 June 2006	1♂ + 2♀♀	Mike Howe
Penmaen seepages, Cefn Bryn	41	SS525885	25 June 2014	1♀	Mike Howe
Penmaen seepages, Cefn Bryn	41	SS526886	27 June 2014	1 ♀	Mark Winder
Cors Geirch	49	SH330350	12 June 2015	30 adults	Mike Howe
Cors Geirch	49	SH330350	22 June 2015	8 adults	Mike Howe
Cors Geirch	49	SH304379	27 June 2015	10 adults	Mike Howe

Given that the population on Cefn Bryn Common is very small, that the locality at St. Gabriel's has been lost to cliff slippages (Stubbs, A.E. 2015. Wildlife reports: flies. *British Wildlife* **27**(2)**,** 132-134) and recent searches at Stony Moors have failed to find the fly (Winder, *ibid*; Wolton, R. 2015. News from the Conservation Officer - UK BAP & Adopt a species. *Bulletin of the Dipterists Forum* **80,** 11-13), the need to retain the robust population on Cors Geirch is clear. British localities are mapped in Figures 1 and 2 - **MIKE HOWE,** Invertebrate Ecologist, Natural Resources Wales, Maes-y-ffynnon, Penrhosgarnedd, Bangor, Gwynedd LL57 2DW, michael.howe@cyfoethnaturiolcymru.gov.uk

Dipterists Digest 2016 **23,** 49

New distribution data of Bibionidae (Diptera) from Iran

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Faunistics of Diptera were studied in the Arak region and suburb (Markazi province) and specimens were collected on crop and non-crop plants by a standard sweep net. Two species of the family Bibionidae were verified by Dr John Skartveit (Norway). Both species, which are considered occasional horticultural pests in Europe, are newly recorded for Markazi province:

***Bibio hortulanus* (Linnaeus, 1758)**
Material examined: on *Medicago sativa* (Dominant plant community), Savar Abad, 13.v.2008.

Distribution: It is generally distributed at low altitudes in Europe as far north as southernmost Sweden, also in North Africa and the Middle East (Skartveit *et al.* 2013).

References. Farahbakhsh 1961; Kheyri 1989; Esmaili *et al.* 1991.

***Dilophus febrilis* (Linnaeus, 1758)**
Material examined: on *Medicago sativa*, Ghale no, 22.v.2008; Komal-e-hezave, 28.v.2008; Azad marz abad, 6.ii.2008; Ghaniarogh-e-bala, 7.i.2008. On *Hordeum* sp., Malek abad, 16v.2008. On *Medicago sativa*, Savar Abad, 13.v.2008. On *Brassica napus*, Majd abad-e-kohne, 28.v.2008. On *Triticum vulgare*, Eybak abad, 2.vi.2008. On weed, Mahdi abad, 19.viii.2008. On *Zea mays*, Eskan, 26.viii.2008.

Distribution: Recorded from large parts of Europe and also as far east as Iran. This species is frequently very numerous in grasslands and cultivated land. It has two annual generations, in April-May and in August-September (Skartveit *et al.* 2013).

Acknowledgements
We are grateful to John Skartveit for identifying our material and for information.

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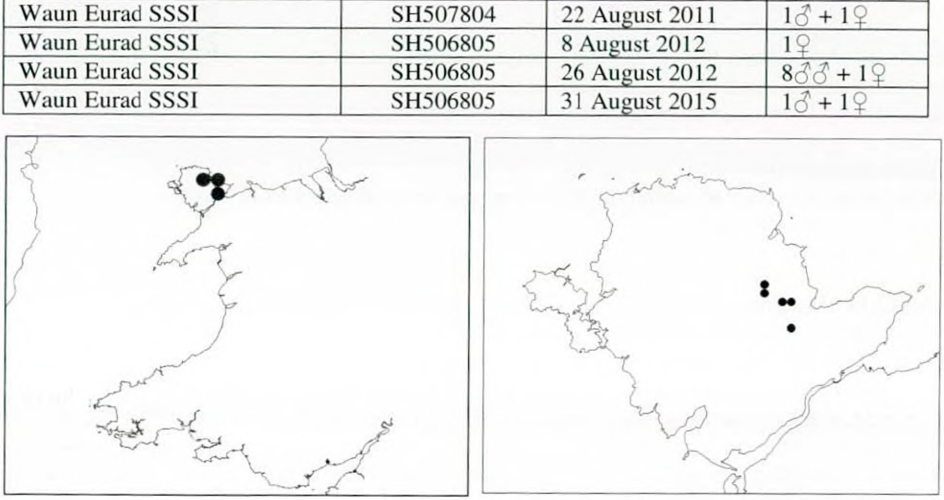
The status of the cranefly *Dicranomyia aperta* Wahlgren (Diptera, Limoniidae) on Anglesey from 2011 to 2015 – Following the first Welsh record of the RDB1 *Dicranomyia aperta* Wahlgren from Waun Eurad SSSI on Anglesey in 2011 (Howe, M.A. 2012. A first Welsh record of *Dicranomyia aperta* from Anglesey 2011. *Cranefly News* **24,** 1), a wider search of open calcareous seepages on Anglesey fens was undertaken in late summer 2012 and 2015. A combination of sweeping and the visual examination of the inflorescences of grass-of-Parnassus *Parnassia palustris*, with which the cranefly is associated (Crossley, R. 2007. *Dicranomyia aperta* Wahlgren, 1904 (Diptera, Limoniidae) - an association with grass of Parnassus (*Parnassia palustris* Linnaeus). *Dipterists Digest* (*Second Series*) **14,** 11-12), was used to locate adults. *Dicranomyia aperta* was found in small numbers at the original locality and at an additional three sites (Table 1; Figs 1 and 2). An initial visit to Waun Eurad on 11 July 2012, primarily to record adult numbers of the soldierfly *Stratiomys chamaeleon* (Linnaeus), failed to locate *D. aperta*, but adults were found on 8 and 26 August 2012, and again on 31 August 2015. An exhaustive search of over 300 flowering spikes of *Parnassia* on 26 August 2012 recorded a single female, but all males were swept from the open seepages. All specimens from Cors Bodeilio and Cors Erddreiniog were swept from seepages or adjacent vegetation, with (less thorough) searches of *Parnassia* failing to find adults on the inflorescences. Adults found at Craig Wen on 5 September 2012 were swept, but a single female was found in an inflorescence on 30 August 2015.

Table 1. Welsh records of the cranefly *Dicranomyia aperta*.

Site	Grid Reference	Date	Abundance
Cors Bodeilio NNR	SH500777	20 August 2012	1♀
Cors Bodeilio NNR	SH500777	2 September 2012	1♂ + 2♀♀
Cors Bodeilio NNR	SH500777	29 August 2015	1♂ + 1♀
Cors Erddreiniog NNR	SH475818	31 August 2012	2♀♀
Craig Wen (Cors Goch NNR)	SH492803	5 September 2012	1♂ + 2♀♀
Craig Wen (Cors Goch NNR)	SH492803	30 August 2015	1♂ + 2♀♀
Waun Eurad SSSI	SH507804	22 August 2011	1♂ + 1♀
Waun Eurad SSSI	SH506805	8 August 2012	1♀
Waun Eurad SSSI	SH506805	26 August 2012	8♂♂ + 1♀
Waun Eurad SSSI	SH506805	31 August 2015	1♂ + 1♀



Figs 1-2. Welsh distribution of *D. aperta*: left, hectads; right, 1km distribution on Anglesey.

No specimens were found in areas of open seepages with *Parnassia* at a second locality on Cors Goch NNR (SH503813) on 14, 20 and 27 August 2012 or on Cors Nant Isaf, part of Cors Erddreiniog NNR (SH474827) on 1 September 2012. A search of flushed *Parnassia*-rich grassland but drier and with a tight sward on Cors Goch NNR (SH494809) on 30 October 2015 also failed to locate the cranefly – **MIKE HOWE,** Invertebrate Ecologist, Natural Resources Wales, Maes-y-ffynnon, Penrhosgarnedd, Bangor, Gwynedd LL57 2DW, michael.howe@cyfoethnaturiolcymru.gov.uk

Odontomyia ornata (Meigen) (Diptera, Stratiomyidae) in Ely, Cambridgeshire

– In this, our second year of recording Diptera in the Ely area, we came upon two specimens of *Odontomyia ornata* (Meigen, 1822) within four weeks of each other. These were a male resting on a leaf in scrub bordering a meadow at Ely Common (TL55328092) on 29 May 2016, and a female at hogweed *Heracleum sphondylium* flowers on 25 June 2016, along a small drove cutting through rough pasture near Hurst Lodge Farm (TL52508119), 0.3km to the west of Ely city. This drove is lined by lush ditches and a hedgerow, and the track has umbel-rich verges bordering the ditches. The two occurrences are about 2km apart. The male was confirmed by Martin Harvey (iRecord 3258776) as being a first for Cambridgeshire (V.C. 29). The second occurrence (iRecord 3480342) raises the interesting possibility of a population of *Odontomyia ornata* in the Ely area. If this were the case, then it would be the most inland population of this species recorded so far. As such, could it represent a significant recent movement inland or a local population in the fens that has been overlooked in the past? There are no records from Wicken Fen NNR, 10km away. The nearest recorded populations are at coastal grazing marshes in Suffolk and east Norfolk over 90 km away.

A larval association with ivy-leaved duckweed *Lemna trisulca* has been documented (Stubbs, A.E. and Drake, C.M. 2014. *British Soldierflies and their Allies*, British Entomological and Natural History Society). However, this plant is rarely recorded in Cambridgeshire, although the latest record (2015) is of an occurrence in a water meadow ditch within 0.5 km of the location of the male of *Odontomyia ornata*.

We note that there are several records of *O. ornata* within 50km of coastal populations over the last 10 years (e.g. Gloucestershire, Hampshire, Worcestershire). The most inland record so far is of a female at Woodwalton Fen (Huntingdonshire, VC. 31) on 22 May 2016, a few days before the Ely male was recorded.

We would like to thank Tim Inskipp for providing information about records of *Lemna trisulca* in Cambridgeshire. We also thank Martin Harvey and Roger Morris for their comments on this note – **MARK WELCH and LUKE WELCH**, 32 Tennyson Place, Ely, Cambridgeshire CB6 3WE

Distribution and biology of *Palloptera scutellata* (Macquart) (Diptera, Pallopteridae) in south-east Scotland

– *Palloptera scutellata* (Macquart, 1835) was first identified as a Scottish insect by DH from the sweeping of single females on 20 and 27 June 2015 from a damp depression, partially shaded by trees, along the edge of woodland on the site of the old railway sidings near Orchard Farm, Alloa (NS8693, V.C. 87, 6m above sea level). An adult female of *P. scutellata* was subsequently recognised in a collection of Diptera taken by sweeping on 13 November 2014 by KB near Kirkhill Hotel (NT3261, V.C. 83, 90m a.s.l.).

Following the finding of adults, G.E. Rotheray and S. Hewitt (2016. Development site, feeding mode and early stages of *Palloptera scutellata* (Macquart) (Diptera, Pallopteridae). *Dipterists Digest* (*Second Series*) **22**(2015)**,** 157-170) discovered and described the larvae, found to be feeding in the basal half of stems of *Juncus effusus* (soft-rush) at the Alloa site. A quest for other sites for the species soon revealed it to be widespread in south-east Scotland. However, although *Juncus effusus* is very common, *P. scutellata* is selective in its choice of habitat. It prefers *Juncus effusus* growing in damp hollows and ditches in sheltered locations, especially in open woods, along woodland edges or at the edge of marshland with scattered trees. In such locations isolated clumps or small patches of its food plant are selected, especially if growing in water-logged ground or even in the edge of standing water. We did not find *P. scutellata* in open fields, moors or heaths, possibly due to the competition with the tortricid moth *Bactra lancealana* (Hübner), that such areas would carry. In September to October, occupied *Juncus effusus* stems were somewhat smaller than the surrounding stems and often showed more extensive yellowing or browning in the upper part of the stem. Due to weakening and decay at the base of the stem associated with larval feeding, infested stems come away readily if given a gentle pull. There is also a small, usually oval-shaped emergence hole, prepared by the larva, three to nine centimetres above the site of pupation. Soft-rush stems containing larvae or puparia of the species have been found in over 40 localities in the 14 Watsonian vice-counties of south-east Scotland. Those sites for which precise quantitative data were obtained are shown in Table 1.

Table 1. Total numbers of puparia plus larvae, vacated puparia and adult flies reared from *Juncus effusus* stems from localities in south-east Scotland

Date	Locality	Total puparia +larvae	Vacated puparia	Adult flies reared
8.ix.2015	Woodhall Dean (NT6873, V.C. 82)	17	0	9
10.ix.2015	Lochcote old loch (NS9874, V.C. 84)	14	0	14
17.ix.2015	Lake of Menteith (NN5800, V.C. 87)	4	0	3
24.ix.2015	Findatie, Loch Leven (NT1699, V.C. 85)	11	0	11
29.ix.2015	Godscroft (NT7363, V.C. 81)	3	0	3
29.ix.2015	Drakemire (NT7961, V.C. 81)	5	0	5
8.x.2015	Glenkinnon (NT4334, V.C. 79)	4	0	4
10.x.2015	Kirkburn (NT2938, V.C. 78)	21	3	7
10.x.2015	Bowdenmoor (NT5431, V.C. 80)	5	1	3
20.x.2015	East Plean Park (NS8286, V.C. 86)	37	22	4
20.x.2015	Plean Park (NS8386, V.C. 86)	14	10	3
20.x.2015	The Pineapple (NS8888, V.C. 86)	30	15	9
27.x.2015	Burnside, Methven (NO0125, V.C. 88)	19	15	3
29.x.2015	East Newton (NO2732, V.C. 89)	61	52	5
31.x.2015	Templeton Woods (NO3534, V.C. 90)	68	52	13
10.xi.2015	Fullarton Bridge (NT2856, V.C. 83)	23	4	13
12.xi.2015	Bowdenmoor (NT5431, V.C. 80)*	19	11	5
14.xi.2015	Bavelaw Moss (NT1663, V.C. 83)	18	11	6
22.xi.2015	Howden Burn (NT2267, V.C. 83)	8	3	1
26.xi.2015	Luffness (NT4780, V.C. 82)	41	33	6
6.xii.2015	Pomathorn (NT2459, V.C. 83)	19	17	0
8.xii.2015	Upper Woodhall Dean (NT6872, V.C. 82)	48	41	0

8.xii.2015	Woodhall Dean (NT6873, V.C. 82)*	40	30	2
15.xii.2015	Eaglescairnie Farm (NT5168, V.C. 82)	11	3	0
19.xii.2015	Bonnington (NT2538, V.C. 78)	21	15	0
22.xii.2015	Kirkhill Hotel (NT3361, V.C. 83)	56	55	0
27.xii.2015	Colinton Dell (NT2169, V.C. 83)	9	8	0
24.xii.2015	Plora Wood (NT3536, V.C. 79)	38	28	0
28.xii.2015	Roslin Glen (NT2762, V.C. 83)	13	12	0
29.xii.2015	Bertha Wood (NO0728, V.C. 88)	18	18	0
3.i.2016	Howden Burn (NT2267, V.C. 83)*	16	14	0
4.i.2016	Maggie Bowie's Glen (NT3960, V.C. 83)	95	66	0
4.i.2016	Morningside (NT2571, V.C. 83)	7	6	0
7.i.2016	Jock's Gill (NS8350, V.C. 77)	42	20	0
9.ii.2016	Petersmuir Wood (NT4866, V.C. 82)	51	28	0
10.iii.2016	Portmoak Moss (NO1801, V.C. 85)	18	15	0

(* revisit)

The above data indicates that emergence of adult flies in the wild does not occur until early October; vacated puparia were not found in stems collected before 10 October. The emergence period lasted until December, but no viable puparia were found in stems collected after 8 December.

Other sites where larvae and/or puparia of the species were found but from which quantitative data were not recorded were: Grantshouse (29.ix.2015, NT8066, V.C. 81), Pencaitland (25.x.2015, NT4369, V.C. 82), Saltoun Big Wood (4.ii.2016, NT4666, V.C. 82), Sheeppath Glen (8.xii.2015, NT7070, V.C. 82), Braidwood (24.i.2016, NT1959, V.C. 83), Bush (13.iii.2016, NT2463, V.C. 83), Hermitage of Braid (20.ix.2015, NT2570, V.C. 83), Blackford (3.xi.2015, NT2571, V.C. 83), Crichton Glen (6.ix.2015, NT3761, V.C. 83), Cambus (6.ix.2015, NS8493, V.C. 87), Mary Bridge Wood (5.ix.2015, NS9092, V.C. 87) and Methven Moss (27.x.2015, NO0123, V.C. 88).

The above sites vary in altitude from a few metres to 255m a.s.l; within this range there appeared to be no consistent differences in biology. Also the sex ratio of the emerged flies was almost 50:50.

Analysis of 476 worked stems showed that the commonest clutch size was 3 (21%), with clutch sizes of 2-4 accounting for 51% of the total. In 6% of stems, two clutches appear to have been deposited, possibly by the same female, resulting in 6-13 puparia being present together but usually with only a single emergence hole. Stems containing only a single puparium (12%) appear, at least in some cases, to be due to stem breakage occurring too high up; this also accounts for those worked stems (27%) that contained no flies. These figures agree with those of Rotheray and Hewitt (2016, *ibid*), in spite of different sampling procedures.

The enclosed feeding site within the stem seems to give good protection from parasitism. In 615 individuals there were only sixteen deaths (3%) due to parasitism. Two parasitoids were involved, *Theroscopus ochrogaster* (Thomson, 1888) [Cryptinae, Ichneumonidae] which emerges from the host puparium, also found by Rotheray and Hewitt (2016, *ibid*), and *Endromopoda detrita* (Holmgren, 1860) [Pimplinae, Ichneumonidae] which leaves the host prior to the pupation of the host. The former was by far the most abundant. We are grateful to Dr M.R. Shaw of Edinburgh for identifying the parasitoids – **KEITH P. BLAND and DAVID HORSFIELD,** National Museums Collection Centre, 242 West Granton Road, Edinburgh EH5 1JA

Corrections and changes to the Diptera Checklist (35) – 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 10 species, resulting in a new total of **7126** species (of which 40 are recorded only from Ireland).

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

Psychodidae. The following species is added in the present issue. In the checklist *Clogmia* is treated as a synonym of *Telmatoscopus*, which is generally split into several genera by some European authors. This is not explored further here as the position of other species not mentioned in the text is affected (i.e. the British species *T. rothschildii* and *T. tristis* are also included in *Clogmia* by European authors):
CLOGMIA Enderlein, 1937
Clogmia ***albipunctata*** (Williston, 1893 – *Psychoda*)

Hybotidae. The following species is added in the present issue:
Platypalpus ***aliterolamellatus*** Kovalev, 1971

Dolichopodidae. The following species is added in the present issue (C.M. DRAKE, pp 1-22):
Thrypticus ***intercedens*** Negrobov, 1967

Phoridae. The following species were added by R.H.L. DISNEY (2016. Three new species of *Megaselia* Rondani (Diptera: Phoridae) from England. *Entomologist's monthly Magazine* **152,** 103-110):
Megaselia ***forresteri*** Disney, 2016
Megaselia ***lacockensis*** Disney, 2016
Megaselia ***spirahypandrium*** Disney, 2016

Tephritidae. The following species is added in the present issue:
Rhagoletis ***cingulata*** (Loew, 1862 – *Trypeta*)

Sphaeroceridae. The following species is added in the present issue:
Rachispoda ***duplex*** Roháček, 1991

Drosophilidae. The following species is added in the present issue:
Leucophenga ***hungarica*** Papp, 2000

Muscidae. The following species is added in the present issue:
Phaonia ***tiefii*** (Schnabl, 1888 – *Aricia*)

Dipterists Digest 2016 **23**, 55-61

Platypalpus ochrocera (Collin) (Diptera, Hybotidae) from exposed riverine sediments with a description of the female

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Summary

The female of the hybotid *Platypalpus ochrocera* (Collin, 1961) is described and the relevant British and European keys are modified to take account of newly recognised characters. Distributional and ecological information on *P. ochrocera* is presented, and an apparent association with exposed riverine sediments discussed. *Platypalpus velocipes* Frey, 1943 is newly recorded for Slovakia.

Introduction

In 2015 I operated emergence traps set on exposed riverine sediments on the King Water (NY525635), a tributary of the River Irthing in north Cumbria. Four standard soil emergence traps with a footprint of 60cm by 60cm were each set on different substrate types. A valance around the base of each trap was buried in the substrate, ensuring that all insects emerging from the soil surface within the trap were retained. At the apex of each trap, a collecting bottle containing 50% antifreeze was used to kill and preserve emergent individuals. The traps were operated from 7 June to 19 July and serviced on a weekly basis, apart from the final sample which covered a two week period. One trap was installed on loose, vegetated sand deposited on the riverbank and in the sample from this trap for the period 3-19 July were 30 specimens of *Platypalpus ochrocera* (14 males and 16 females). There were also seven specimens of *P. interstinctus* (Collin), two of *P. niger* (Meigen) and a single female *P. articulatoides* (Frey). I also swept 10 specimens (5 males and 5 females) of *P. ochrocera* from vegetated sandy shingle on the Ettrick Water, Selkirkshire (NT275144) on 15.viii.2015.

Whilst the male specimens of *P. ochrocera* keyed out readily enough using Grootaert and Chvála (1992), the females were more problematic, running to *P. articulatoides* by dint of their darkened postpedicel, pale palpi and coxae, but lacking the distinctly annulated tarsi of that species. It is apparent that the key does not take account of the darkened postpedicel of female *P. ochrocera* and consequently female specimens of this species will not key out satisfactorily.

Collin (1961) described *P. ochrocera* new to science from just a single male and a later account of the species (Chvála 1989) also appears to be based on male specimens only. There are no female specimens of *P. ochrocera* in the Chvála Collection at the Oxford University Museum of Natural History, or in the collection of the Russian Academy of Sciences in Moscow (I. Shamshev *pers. comm.*). It seems worthwhile to provide here a description of the female of *P. ochrocera* and to adapt the relevant parts of the British and European keys to take account of this new information on the characters of female *P. ochrocera*.

Recognition

Characters which separate *P. ochrocera* from *P. articulatoides* are front tarsus without distinct dark annulations, at most tips of tarsomeres faintly dusky and apical tarsomere darkened above in *P. ochrocera*; postpedicel 1.5 times as long as deep (0.11 x 0.07 mm.) – twice as long as deep (0.12 x 0.06 mm.) in *P. articulatoides* (Fig. 1); wing crossveins more separated, distance between crossveins almost as long as vein bm-cu closing second basal cell (less than half the length of bm-cu in *P. articulatoides*).

Platypalpus articulatoides was reported new to Britain by Allen (1986), where he compared the species with *P. articulatus* Macquart and *P. maculimanus* (Zetterstedt), the latter species having not yet been recorded in Britain although likely to occur here. *Platypalpus articulatoides* and *P. ochrocera*, with their yellow palpi and posterior four coxae, are readily distinguishable from *P. articulatus* and *P. maculimanus* in which these structures are black-brown.

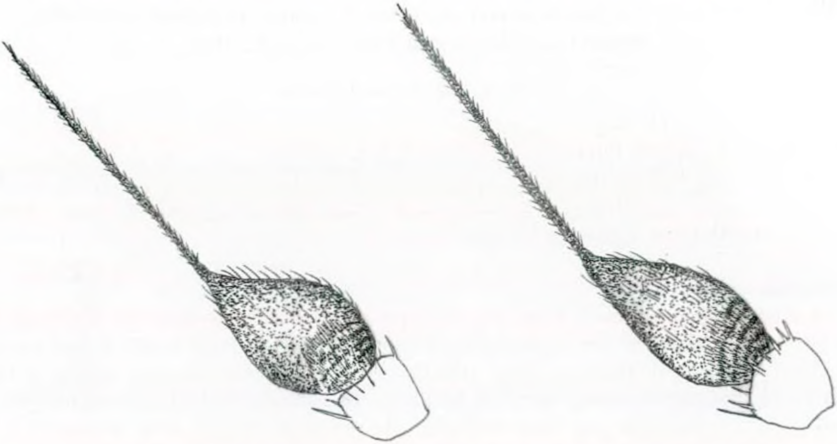

Fig. 1. Antennae of female *Platypalpus ochrocera* (left) and *P. articulatoides* (right).

Material examined of *Platypalpus ochrocera*. ENGLAND: 16 females, King Water (NY525635), Cumbria, 3-19.vii.2015, vegetated, flood-deposited sand on riverbank, soil emergence trap, S.M. Hewitt. SCOTLAND: 5 females, Ettrick Water (NT275144), 15.viii.2015, vegetated exposed riverine sediment, sweep-netted, S.M. Hewitt. All material is deposited in the National Museums of Scotland.

Description of female *Platypalpus ochrocera* (Collin, 1961)

Diagnosis. Small black species with one pair of vertical setae, belonging in the *P. pallidiventris-cursitans* group; antennae yellow with black postpedicel; thorax microtrichose apart from polished area on katepisternum, setae pale; wing with crossveins widely separated; legs entirely yellow apart from dusky apical tarsomeres and faint annulations on other tarsomeres, mid femur little thicker than fore femur and with long postero-ventral setae, mid tibia with short, blunt, trowel-shaped apical spur; abdomen black, shining. Differs from the male in having black postpedicel (usually at most only tip darkened in male).

Head. Black, grey microtrichose. Face and clypeus white microtrichose. Antenna yellow with postpedicel black. Postpedicel about 1.5 times as long as broad, stylus ≥ twice as long as postpedicel. Proboscis about 1/4 as long as depth of head. Palpus yellow, small (about half length of proboscis), 1.5 times as long as broad, covered in fine decumbent pale yellow hairs with a few longer pale setae, the longest as long as palpus. Ocellar setae pale yellow, anterior pair twice as long as posterior pair. One pair of yellow vertical setae. Occiput grey microtrichose with scattered fine, yellow setae.

Thorax. Black, covered in yellowish-grey microtrichia apart from shining black area on katepisternum. All setae pale yellow. Chaetotaxy: postpronotal seta long and strong (with 2 or 3 additional small, fine setae present), posthumeral seta absent, acrostichals biserial (5-9 per row) with gap between setae within and between rows about as long as setae; 6 dorsocentrals, anterior setae slightly longer than acrostichals, posterior 2 pairs much longer and stronger; 2 more or less equally strong notopleural setae; 1 long postalar and 2 pairs of scutellar setae, the inner pair longer and stronger than the outer.

Wing. Clear with pale yellow veins, 1 strong yellow costal seta near base. Veins R_{4+5} and M_1 nearly straight and almost parallel in apical half. Crossveins more widely separated, distance between them more than half length of outer crossvein bm-cu. Squama yellow with pale fringe. Haltere yellow.

Legs. Yellow, including all coxae. Tarsi at most faintly annulated; apical tarsomere dusky yellow. Fore femur slightly thickened. Fore tibia slightly thickened, weakly spindle-shaped, with fine yellow hairs slightly shorter than tibia is deep. Mid femur slightly thicker than fore femur with double row of very short black setae ventrally, accompanied by a sparse postero-ventral row of about 8 fine yellow setae almost as long as femur is deep. Mid tibia with single ventral row of short black setae and a short, trowel-shaped apical spur that is not longer than depth of tibia. Hind femur and tibia slender, covered in fine yellow hairs.

Abdomen. Blackish brown, entirely shining apart from small microtrichose patch laterally at anterior margin of tergites 1 – 6 (indistinct or absent on tergites 3 and 4), all of tergites 7 and 8 microtrichose. Sternite 6 microtrichose at base. Abdomen sparsely covered with fine yellow hairs.

Modification of Grootaert and Chvála (1992) to accommodate female *P. ochrocera*

147 (140)Antenna entirely yellow, at most third segment slightly darkened at extreme tip.....148
- Third antennal segment dark, at most narrowly yellowish at extreme base..............157

148 (147)Vein M very conspicuously bowed. Mid femur very thickened, about twice as thick as fore femora; mid tibia with a large, sharply pointed apical spur. Large species, body usually over 3mm in length..*major* **(Zetterstedt)**
- Veins R_{4+5} and M almost parallel. Mid femur slender, scarcely deeper than fore femur. Smaller species, body less than 3mm in length (*P. flavicornis*-complex).................149

149 (148)Palpi long and narrow, silvery-white. Wing distinctly yellowish, somewhat greyish clouded at tip. 3rd antennal segment completely pale in male, brownish in female, long, 2.5 times as long as deep; arista blackish, slightly longer. Tarsi yellow with last segment blackish, but fore tarsi with dark annulations beneath. Mid tibia with a sharp spur in male, blunt in female...***divisus* Walker**
- Palpi broadly ovate. Wings clear or uniformly faintly yellowish. 3rd antennal segment shorter, at most scarcely twice as long as deep...150

150 (149)Very small species, body 1.4-1.8mm in length. Mid tibia with a small blunt spur not longer than tibia is deep, or spur exceedingly short. Legs pale, including tarsi, only last tarsal segment darkened when viewed from above..151

- Larger species, body about 2.5mm in length. Mid tibia with a strong, sharply pointed apical spur; if blunt then longer than tibia is deep, or (*P. pallidicornis* male) tarsi with dark annulations 152

151 (150) Frons broader, as wide as second antennal segment. Mesonotum thinly dark grey dusted, rather subshining; dc distinct and less numerous, 6 to 7 in one row. Antenna deep yellow, palpus yellowish, rather smaller. Tibial spur yellow, trowel-like .... ***ochrocera* (Collin)** male

- Frons very narrow, as wide as front ocellus. Mesonotum densely whitish-grey dusted; dc biserial, numerous and rather inconspicuous. Antenna whitish-yellow; palpus whitish, large-ovate. Mid tibia with only a small black projection at tip ....***vegetus* Frey**

~ ~

157 (147) Mid tibia with a very small blunt spur which is much shorter than tibia is deep. Very small species, body about 1.5-2.0mm in length. Mid femur rather slender, scarcely stouter than fore femur 158

- Mid tibia with a large, sharply pointed apical spur, if blunt-tipped (*P. annulipes, P. subtilis* females), then long, at least as long as tibia is deep. Larger species (except for *P. calceatus* and *P. subtilis*) 162

158 (157) Third antennal segment small and short, 1.5 to 2 times as long as deep; arista much longer, more than twice as long 159

- Third antennal segment long, at least three times as long as deep; arista about as long 162

159 (158) Palpus and posterior four coxae yellow 160

- Palpus and posterior four coxae black 161

160 (159) All tarsal segments of front leg with distinct dark annulations, other tarsi also annulated but generally less obviously. 3rd antennal segment twice as long as deep. Wing crossveins closer together, distance between crossveins less than half length of outer crossvein bm-cu. Proboscis longer, one third as long as head is deep, palpus reaching to about a third the length of proboscis .... ***articulatoides* Frey**

- Front tarsus without sharp black annulations, at most tips of tarsomeres faintly dusky and apical tarsomere darkened above. 3rd antennal segment 1.5 times as long as deep. Wing crossveins more separated, distance between crossveins more than half as long as outer crossvein bm-cu. Proboscis shorter, one quarter as long as head is deep, palpus reaching to half the length of proboscis ....***ochrocera* (Collin)** female

161 (159) Male: tip of left periandrial lamella with about 4 long, black bristles; outer margin with short bristles ....***articulatus* Macquart**

- Male: tip of left periandrial lamella and outer margin with only short hairs ....***maculimanus* (Zetterstedt)**

….. The key then continues with couplet numbering increased by 1.

Plant (2012) provided a key to British species of *Platypalpus*. *Platypalpus ochrocera* is found in Key G – species with black thorax, one pair of vertical setae, scutum distinctly dusted, basal antennal segments yellow (at least dark reddish yellow), katepisternum polished, posthumeral setae absent and with tibia 1 and 3 not usually bearing short dark setae dorsally.

Plant (2012) Key G should be modified as follows to accommodate female *P. ochrocera*:

1. Antenna yellow; at most with tip of postpedicel and stylus darkened.............................**2**

- Antenna with postpedicel darkened, at most narrowly paler/yellowish basally **7**

2. Vein M very obviously bowed; F_2 strongly inflated, 2X as thick as F_1; usually large species but dwarf forms occur (2.8-5.5mm)....................................***major* (Zetterstedt)**

- Vein M almost parallel with R_{4+5}; usually smaller ($\leq$ 3mm)..**3**

3. Palpi long, narrow, silvery white; antenna with postpedicel pale (male) or brownish (female), long (2.5X as long as deep with stylus slightly longer); tarsi yellow with 5th segment blackish and basal three segments of front tarsus subannulate ventrally (i.e. with a small dark spot apicoventrally); wings distinctly yellowish........***divisus* Walker**

- Palpi broadly ovate; antenna with postpedicel $\leq$ 2X as long as deep; wings clear or faintly yellowish...**4**

4. Very small species (1.4-1.8mm); antenna deep yellow; T_2 with apical spur short, trowel-like; tarsi yellow, only 5th segment darkened .... ***ochrocera* (Collin)** male

- Larger species (usually c2.5mm); antenna paler yellow; T_2 with strong sharply pointed apical spur (if blunt then spur is longer than T_2 is deep or [*pallidicornis* male] tarsi dark annulated...**5**

~ ~

7 T_2 with apical spur blunt and shorter than limb is deep **8**

- T_2 with apical spur large and sharply pointed (if blunt tipped then at least as long as limb is deep)..**12**

8 Antenna with postpedicel $\geq$3X as long as deep, stylus shorter; stigma present at apex of R_1...***stigma* (Collin)**

- Antenna with postpedicel $\leq$2X as long as deep, stylus longer; stigma absent...............**9**

9 C2, C3 and palpi yellow...**10**

- C2, C3 and palpi dark brown to black...**11**

10 All tarsal segments of front leg with sharp black annulations, other tarsi also annulated but less strongly; postpedicel longer, 2X as long as deep; wing crossveins closer together, distance between crossveins distinctly shorter than half outer crossvein bm-cu. Proboscis longer, one third as long as head is deep, palpus reaching to about a third the length of proboscis..***articulatoides* Frey**

- Front tarsus without sharp black annulations, at most tips of tarsomeres faintly dusky and distal tarsal segment darkened above; postpedicel shorter, $\leq$1.5 times as long as deep; wing crossveins more separated, distance between crossveins more than half bm-cu. Proboscis shorter, one quarter as long as head is deep, palpus reaching to half the length of proboscis.. ***ochrocera* (Collin)** female

11 Male: tip of left periandrial lamella with about 4 long black bristles; outer margin with short bristles..***articulatus* Macquart**

\- Male: tip of left periandrial lamella and outer margin with only short hairs [not yet recorded in Britain but may occur].....................................***maculimanus* (Zetterstedt)**

….. The key then continues with couplet numbering increased by 1.

Distribution and status

The type of *P. ochrocera* was collected by Dr J.H. Wood in Mains Wood, Herefordshire [SO6438] on 13.vi.1911 (Collin 1961) and remained the only known British specimen until recent years. Falk and Crossley (2005) reclassified the species from RDB 1 to Data Deficient, remarking that it was possibly extinct in Britain. A specimen labelled *P. ochrocera* in the National Museum of Wales was collected by Andrew Godfrey on the Yorkshire Wildlife Trust reserve at Ripon Loop on the River Ure (SE317737) on 31.vii.2005. On 31.vii.2007, during a survey of ERS in Cheshire (Hewitt and Parker 2008), three male specimens of a *Platypalpus* from the River Bollin at Newton Hall (SJ877805) were tentatively identified as *P. ochrocera* and two females as *P. articulatoides*. These specimens are deposited at Tullie House Museum, Carlisle where I have recently re-examined them and confirmed the identity of the males and also re-determined the females as *P. ochrocera*. Interestingly, one of the three males has the apical half of the postpedicel darkened, whilst the other two had only the extreme tip of that segment darkened as with all other males of the species that I have examined.

The species is also rarely recorded in Europe; Merz and Chvála (1998) reported it only from Belgium, the former USSR, Germany and Switzerland. *Platypalpus ochrocera* is also known from Norway with six specimens flagged in the dataset of the "Diptera collection, Natural History Museum, University of Oslo" held by The Norwegian Biodiversity Information Centre (NBIC 2016). The Chvála collection in OUMNH has two males from the Czech Republic, Bilovice 'near river' (49°16'N 16°41'E), 13.vi.1981, leg. Barták. A further male in the Chvála collection labelled *P. ochrocera* is in fact *P. velocipes* Frey, 1943 from near the River Danube at Čenkov (47°47'N 18°33'E), 15.vii.1986, leg. Barták. This specimen has a brown postpedicel, which is not clearly darker than the rest of the antenna, leading to confusion with *P. ochrocera*. However the specimen differs from *P. ochrocera* in its much darker apical tarsomeres, wing crossveins closer together and has the distinctive genitalia of *P. velocipes*. This appears to be the first record of *P. velocipes* from Slovakia; it is otherwise reported only from Slovenia and Switzerland (Merz and Chvála 1998).

This new distributional and ecological information suggests that *P. ochrocera* has some affiliation with sandy exposed riverine sediments, although it is not necessarily restricted to this biotope.

Acknowledgements

I am grateful to Adrian Plant of the National Museum of Wales, who confirmed my identification and gave much helpful advice. I thank Zoe Simmons at Oxford University Museum of Natural History for allowing me access to the Chvála collection there and also Simon Jackson at Tullie House Museum, Carlisle for access to that collection. My thanks also go to Igor Shamshev for information on the collection of the Russian Academy of Sciences. Castlesteads Estate kindly gave permission to operate the traps on their land. Buglife funded the 2007 survey of Cheshire rivers. Finally, my thanks to Graham Rotheray for valuable comments on a draft of this article.

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Platypalpus aliterolamellatus Kovalev (Diptera, Hybotidae) new to Britain and Norway

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Summary

The hybotid *Platypalpus aliterolamellatus* Kovalev, 1971 is recorded as a species new to the British Isles and Norway based on material obtained from exposed riverine sediments. The key to British *Platypalpus* is modified to accommodate this species.

Introduction

Whilst collecting flies from river shingle on the River Tummel in 2015, I swept two female specimens of *Platypalpus aliterolamellatus* Kovalev, 1971, which were identified using the key by Grootaert and Chvála (1992). This is the first record of this species in Britain. Both specimens were swept from the vegetated sand and shingle toe of Ballinluig Shingle Island (NN9753, Mid-Perthshire V.C. 88) on 9.vii.2015. Ballinluig Island is an extensive deposit of cobble, shingle and sand with various stages of vegetational development from bare substrate to closed canopy woodland. The site is well-known for its diverse assemblage of specialist insects of exposed riverine sediments. Other species of *Platypalpus* collected from the immediate area were *P. candicans* (Fallén) and *P. interstinctus* (Collin), whilst a single *P. optivus* (Collin) was swept off thinly vegetated loose sand higher up the bar; *P. minutus* (Meigen), *P. notatus* (Meigen), *P. pallidiventris* (Meigen), *P. albifacies* (Collin) and *P. interstinctus* were collected off nearby cobbles with scattered vegetation.

Distribution and ecology

Platypalpus aliterolamellatus was described from the St Petersburg area of north European Russia (Kovalev 1971). Merz and Chvála (1998) illustrated the male genitalia (Fig. 1) and gave further records from the region of Styria in Austria, and from Switzerland where specimens were swept from undergrowth in moist forest on sandy soils subject to periodic riverine flooding. Chvála (1989) additionally reported the species from central parts of European Russia and it is also recorded from Sweden (Hellqvist 2013). In addition to the Ballinluig specimens, I also collected *P. aliterolamellatus* from two sites in Norway in 2015: a single female was swept from vegetation on a river sand/shingle bar near Rognes (63.0158, 10.3872) on 23.vii.2015, and a single male from rough grassland near Heligskogen (69.2712, 19.9324) on 29.vii.2015. These latter records appear to be the first for Norway.

Although habitat information is sparse, there is some indication that *P. aliterolamellatus* may have some affiliation with vegetated, exposed riverine sediments.

Identification

Platypalpus aliterolamellatus belongs in the *P. pallidiventris* – *P. cursitans* group of Chvála (1989 *op. cit.*), which have a black thorax, one pair of vertical bristles, mesonotum dusted, a single humeral bristle present and mid femora with posteroventral bristles. Using Plant (2012) one is taken to Key E – species with black thorax, one pair of vertical setae, scutum distinctly dusted and basal antennal segments dark. Specimens of *P. aliterolamellatus* then run to the couplet separating *P. cothurnatus* from *P. cryptospina*. *Platypalpus aliterolamellatus* differs from *P. cothurnatus* in not having a distinctly yellowish wing membrane and the tibial spur is pointed not blunt. *Platypalpus cryptospina* differs from *P. aliterolamellatus* in having tarsi with distinct annulations (yellow with apical two segments somewhat darkened in *P. aliterolamellatus*), the two rows of acrostichal bristles closer together and vertical bristles dark (yellowish in *P. aliterolamellatus*). Plant's key to British *Platypalpus* in group E is reproduced here with alterations made to accommodate *P. altiterolamellatus*.

Key to British species of *Platypalpus* with black thorax, one pair of vertical setae, scutum distinctly dusted and basal antennal segments dark (Plant 2012) modified to include *P. aliterolamellatus*.

1\. F_2 without *pv* bristles behind the double row of small black ventral spines; *acr* and *dc* minute; tarsi yellow or with only apical tarsomere dark.......... **2**
\- F_2 with distinct *pv* bristles behind the double row of small black ventral spines; *acr* and *dc* moderately long; tarsi distinctly annulated or with apical 1-2 tarsomeres darkened **3**

2\. T_2 with long sharply pointed apical spur about as long as limb is deep; postpedicel 3X as long as wide, stylus thickened; tarsi completely yellow.......... ***aristatus* (Collin)**
\- T_2 with blunt apical spur about as long as limb is deep; postpedicel 2-2.5X as long as deep, stylus slender; apical tarsomere black .... ***tonsus* (Collin)**

3\. T_2 with apical spur shorter than tibia is deep or if about as long, then blunt tipped.......... **4**
\- T_2 with apical spur large, sharply pointed, longer than limb is deep.......... **6**
[species with a blunt-tipped spur about as long as limb is deep are keyed both ways]

4\. Wing membrane distinctly yellowish; T_2 with apical spur about as long as limb is wide, blunt, male with tiny spine at tip; apical tarsomeres dark.......... ***cothurnatus* Macquart**
\- Wing membrane clear or faintly brownish; T_2 with apical spur very small and pointed; tarsi annulated or entirely yellow or with apical tarsomeres darkened.......... **5**

5\. Tarsi with distinct dark annulations; the two rows of *acr* close together; *vt* bristles dark .... ***cryptospina* (Frey)**
\- Tarsi yellow or with apical 1-2 tarsomeres darkened, no annulations; *acr* wider apart; *vt* bristles yellowish.......... ***aliterolamellatus* Kovalev**

6\. T_2 with apical spur only about as long as limb is wide, blunt, male with tiny spine at tip. Wing membrane distinctly yellowish; apical 1-2 tarsomeres of all legs dark .... ***cothurnatus* Macquart**
\- T_2 with apical spur long, sharply pointed (other characters various) **7**

7\. Larger thoracic bristles black **8**
\- Larger thoracic bristles yellowish to brownish.......... **9**

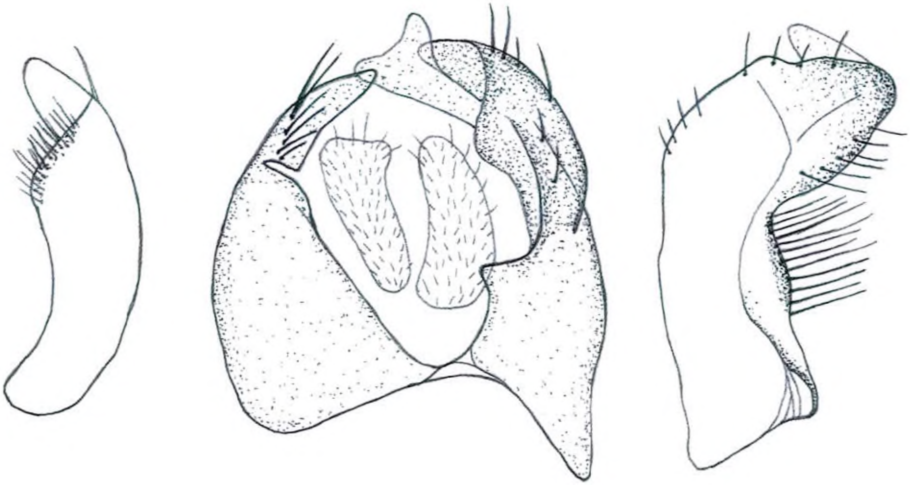

Fig. 1. Male genitalia of *Platypalpus aliterolamellatus* Kovalev 1971 (adapted from Merz and Chvála 1998) – left to right: right periandrial lamella, periandrum with cerci, left periandrial lamella.

8. Legs extensively darkened, coxae black; T_2 with apical spur sharply pointed (*acr* clearly 4-serial at front) .... ***melancholicus* (Collin)**
- Legs extensively yellowish, coxae yellow; T_2 blunter tipped with minute spine and even smaller hair apically (*acr* usually 4-serial but sometimes 2- or 3-serial in part) .... ***optivus* (Collin)**

9. Scutum with *acr* 4-serial, at least in front; legs usually extensively darkened; F_1 usually not much narrower than F_2 .... **10**
- Scutum with *acr* 2-serial [care! *P. notatus* can have a few extra *acr* and appear 4-serial in part]; legs yellowish or extensively darkened; F_1 sometimes obviously narrower than F_2 .... **11**

10. Large thoracic bristles yellowish; *acr* rather long; usually 4-serial throughout; legs usually paler with C_2, C_3, C_1 at base, rather broad rings on all femora and tip of T_1 and T_3 darkened; hind trochanter usually yellowish; tarsi very strongly dark annulated; wing membrane vaguely darkened; veins brown; smaller species (2.3-3.3 mm) .... ***annulatus* (Fallén)**
- Large thoracic bristles brownish to black; *acr* shorter, usually 2-serial about middle and posteriorly; legs more extensively darkened with all coxae and all femora (except at tip) strongly darkened; hind trochanter darkened; tarsi less strongly annulated (tarsomeres with dark apical part less abruptly divided from paler basal part); wing membrane distinctly brownish; larger species (2.9-3.8 mm) .... ***melancholicus* (Collin)**

11. Antenna with postpedicel at least 2.5X long as deep, stylus about as long or slightly longer than postpedicel..**12**

- Antenna with postpedicel shorter, no more than 2X long as deep, stylus obviously longer than postpedicel..**17**

12. Abdomen polished black, sometimes with small patches of grey dusting laterally on tergites 1 and 2..**13**

- Abdomen with distinct patches of grey dusting on all tergites basally..............................**15**

13. *Vt* setae closer together (hardly 1.5X width of frons by anterior ocellus); F_2 not much stouter than F_1; tergites 1 and 2 with small lateral patches of dusting; tarsi faintly annulated but apical tarsomere black; legs otherwise yellow with conspicuous black 'knees' ....***infectus* (Collin)**

- *Vt* setae wider apart (about 2X width of frons by anterior ocellus); F_2 not much stouter than F_1; abdomen entirely shining black; legs yellowish or extensively darkened but always with distinctly annulated tarsi..**14**

14. Legs extensively darkened; at least C_2, C_3, C_1 at base, F_2 and F_3 apically dark [paler individuals occur, their coxae are dark at least about the base, F_2 and F_3 have at least a dark dorsal patch or median ring]; face narrower than frons anteriorly; *vt* setae pale ....***notatus* (Meigen)**

- Legs extensively yellowish [pale yellow to orange]; C_2, C_3 at most dark basally, F_2 and F_3 sometimes with faintly dark ring or apex; frons broader, similar width as face; *vt* setae brownish..***strigifrons* (Zetterstedt)**
  [very pale examples of *P. notatus* can be confused with dark specimens of *P. strigifrons* and determination should be confirmed by genitalia examination; *P. notatus* is common and widespread whereas *P. strigifrons* is confined to sand dunes]

15. Legs yellow (including coxae); basal antennal segments sometimes dark reddish brown [some individuals recall dark examples of *P. pallidiventris* but in that species the anterior notopleural is developed] ....***praecinctus* (Collin)**

- Legs obviously darkened on coxae and femora..**16**

16. Antenna entirely dark; *acr* irregularly 2-3 serial; stylus of equal length to postpedicel (male) or slightly longer (female)..***carteri* (Collin)**

- Antenna with basal segments reddish yellow; *acr* regularly 2 serial; stylus 1.5X length of postpedicel ....***latemi* Grootaert**
  [specimens conforming with *P. latemi* have been found in Britain. It has not been admitted formally to the British list and since first describing the species, Grootaert has expressed doubts that it is a valid species. It may be a dark form of *P. praecinctus*]

17. Smaller (1.5-2.6 mm); palpi smaller, greyish yellow [can be quite dark]; clypeus polished black; antenna with postpedicel only slightly longer than wide; legs yellow (including coxae and femora), tarsi annulated; *vt* setae wider apart; dusting on scutum tinged golden yellow ....***clarandus* (Collin)**

- Larger (2.4-3.6 mm); palpi quite large, brownish; clypeus dusted silvery grey; antenna with postpedicel 1.5X as long as wide; legs usually with dark markings on femora; *vt* setae closer together; dusting on scutum tinged brownish grey **18**

18. Palpi clearly longer than broad; *acr* less numerous, the 2-serial rows conspicuously wide apart; male T_1 not spindle-shaped, with short ventral hair .... ***interstinctus* (Collin)**
- Palpi broadly ovate, hardly longer than broad; *acr* more numerous, the 2-serial rows closer together; male T_1 spindle-shaped, with longer *pv* bristles and a few bristly hairs dorsally ....***pseudofulvipes* (Frey)**

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I am grateful to Zoe Simmons at Oxford University Museum of Natural History for allowing me access to comparative material in the Chvála collection there. I also wish to thank Adrian Plant of the National Museum of Wales for confirming my identification and much helpful advice. Finally, my thanks to Graham Rotheray for useful comments on a draft of this paper.

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New observations on the mating-related behaviours of the dolichopodid fly *Poecilobothrus nobilitatus* (Linnaeus)

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Summary

Field observations of mating behaviour in *Poecilobothrus nobilitatus* are described from two sites. Male mating success was associated with defence of leks and feeding resources at low population densities. Mating strategies may have evolved to show plasticity to enable exploitation of changeable environments.

Introduction

The dipteran fauna is rich with examples of sexual dimorphism. Female choice (intersexual selection) and male competition (intrasexual selection) are important components in the evolution of male secondary sexual characteristics and as drivers towards reproductive isolation and speciation. Male adornments such as wing markings or front leg adaptations are often used in courtship displays which themselves can be complex. Courtship behaviour, sexual selection and speciation in Hawaiian drosophilids has been studied in particular detail (Boake 2005, Singh and Singh 2014).

Figs 1-2. *Poecilobothrus nobilitatus*: left male, right female in a hunting stance.

Closer to home, many European Dolichopodidae exhibit similar characteristics (Alderman and Smith 2010). Of these, *Poecilobothrus nobilitatus* (Linnaeus) has received the most detailed attention. It is a widely distributed species in England and Wales, frequently occurring in large numbers at the margins of still, often temporary, waters from June to August. Males are easily identified, both by their white apical wing patches with contrasting subapical dark banding (Fig. 1) in contrast to the unmarked wing of the female (Fig. 2), and their energetic wing movements and pursuit flights. Colyer and Hammond (1951) described 'vast numbers on duckweed, rising in a cloud, with an audible noise, when disturbed'. Carnivorous feeding by adult flies on chironomid and culicid larvae and cladocerans (water fleas) has been described by d'Assis-Fonseca (1978), Smith and Empson (1955) and Ulrich (2004).

Smith and Empson (1955) provided the first detailed description of courtship in *P. nobilitatus.* They noted both male-female and male-male interactions. Males displayed to females by initial wing-raising and waving followed by a stereotyped pattern of slow flights behind, then rapidly over, the female with continuous wing-fanning, giving the appearance of males bouncing from side to side and over the females ('fly-overs'). Male-male interactions started similarly with raised wings but progressed to pursuit or combat. Lunau (1992) determined that males established and defended territories (leks), which were visited by feeding females to which the males displayed. Morphometrics and quantification of the different elements of courtship behaviour indicated that male size, and particularly wingspan, was positively correlated with territorial and mating success. This suggested that female choice played a significant role in mating behaviour. Land (1993a, 1993b) has also provided a detailed account of courtship behaviour and described the different elements of visuo-motor coordination involved in achieving intra-species recognition and orientation, fixation and tracking during display and pursuit flights.

Despite the many hours of observations and many hundreds of individual interactions witnessed in these studies of mating-related behaviours, direct observations of copulation are rare. Lunau (1992) used sweeping to capture flies for morphometric analysis and counted 26 out of 103 *in copula.* Again, the moment of copulation was not observed during 176 male-female interactions. Lunau *et al.* (2006) used video recording at experimental feeding stations to examine the effects of fly density and food resources on courtship behaviour. They demonstrated that as population density increased, courtships became shorter as males interrupted each other. During 135 courtships, copulation was observed just once. Zimmer *et al.* (2003), whilst reviewing the evolution of visual signals amongst the Empidoidea, suggested that the small number of observed copulating pairs relative to courtship displays implies the existence of strong female choice, but in all studies, male-male interactions were more common. Smith and Empson (1955) drew attention to the absence of observed mating in *P. nobilitatus* and other dolichopodids which exhibit similar male behaviour, and Land (1993b) questioned the function of the display in the absence of observed copulation.

The relative importance of female choice and male contest competition to mating success and fitness may therefore be influenced by a number of factors. Interestingly, the species inhabits both permanent and temporary waters, and the population density of adult flies in a given location is likely to show considerable variation over time. The majority of previous studies have described established colonies where existing populations were dense and where many females may already have mated. Experimental evidence suggests that population density affects mating-related behaviour (Lunau *et al.* 2006). The present study describes and compares mating-related behaviours, including copulation, in an established and a newly forming colony of *P. nobilitatus* and considers the implications of the observed differences.

Methods

Two populations of *P. nobilitatus* at different sites in Norfolk, UK, were observed during July and August 2012. Photographs were taken using a Canon 400D digital camera fitted with a Tamron 70-300mm Tele-Macro lens.

Site 1

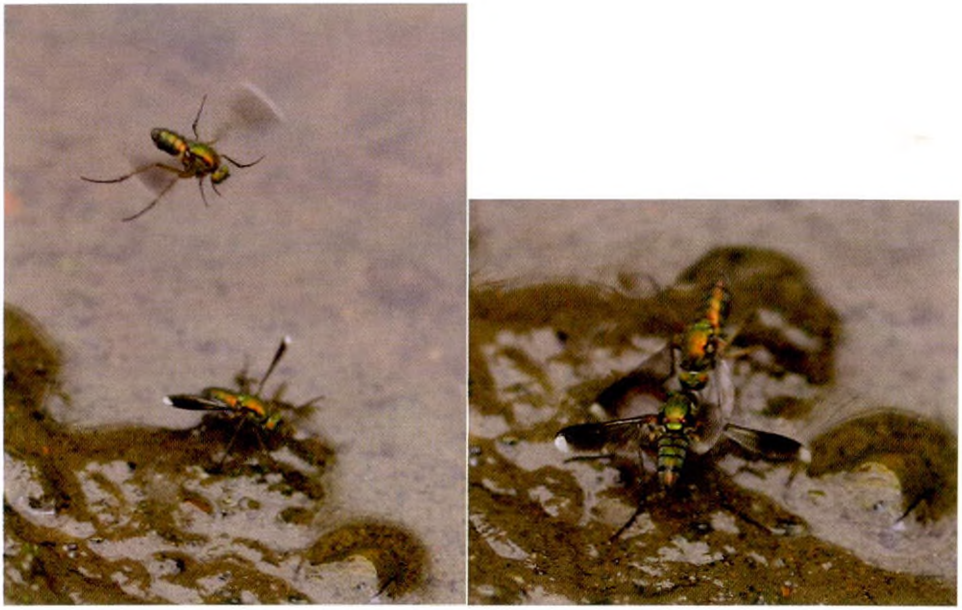
The first site comprised six adjacent temporary puddles created by tractor tyre ruts along a muddy farm track bordered by grass verge and hawthorn hedging (grid ref. TG383252). Large numbers of adult *P. nobilitatus* were already present at the start of the study period. Observations totalling

15 hours took place for periods of up to 3 hours between 14 and 24 July during warm, sunny weather when flies were active. Records were made of isolated female and male behaviours and of male-female, male-male and female-female interactions at both high and low population densities. Interactions with other species were also noted.

Figs 3-4. Courtship displays of *Poecilobothrus nobilitatus*.

Site 2

The second site was created from a densely overgrown garden pond (grid ref. TG380250) to test the hypothesis that different behaviours may be observed when temporary waters are first colonised; *P. nobilitatus* had not previously been observed on or around the pond which was heavily shaded and cool at all times, but adults had been observed in sunnier parts of the same garden. Over-hanging vegetation was cleared to admit sunlight. Surface and low marginal vegetation was left *in situ*. The water was shallow over a thick layer of muddy detritus, and prey species including cladocerans and chironomid larvae were present. Observations took place for periods of 2 hours on the first four successive days after site preparation (10-13 August) and records made of the number of flies of both sexes and of individual and interactive behaviours as per Site 1.



Figs 5-6. Combat between males of *Poecilobothrus nobilitatus*.

Observations

Site 1

The distribution of flies across the site was variable. The highest densities (15-20/100cm²) occurred on the sunniest puddle margins where the water was shallow and clear, adjacent to soft mud and prey species were plentiful. Dappled areas with denser marginal vegetation and deeper water had the lowest densities (0-2/100cm²). The approximate ratio of males to females was 5:1.

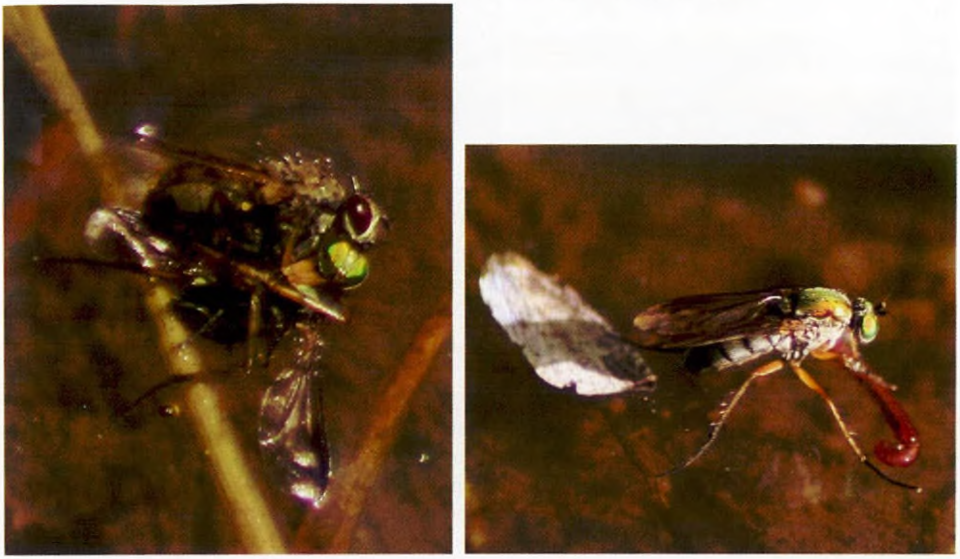
Male behaviour

Male behaviour varied with fly density. At lower densities, males established leks of up to 20cm diameter, chased off other males by short pursuit flights and displayed to, and attempted to copulate with, females entering the lek. Courtship displays (including wing-waving, fanning and 'fly-overs') occurred on the surface film, adjacent mud or floating vegetation (Figs 3-4).

As fly density increased and lek size reduced to less than 6cm diameter, pursuits frequently led to direct combat between males (Figs 5-6). At high densities there were no discernible leks. Between 3 and 5 males would display to one female and in the frenzy, sometimes to other males. Initial wing-waving was more frequent at low densities when males were initiating courtship. Wing-fanning and 'fly-overs' were the norm at higher densities with frequent interruptions for pursuit and combat with other males. Males were rarely observed feeding.

No mating was witnessed at high densities during the 15 hours of observations. Two pairs *in copula* were seen in marginal vegetation at low fly density in established leks.

Male activity at high densities was conspicuous and attracted predators. Predation by birds (starling, *Sturnus vulgaris* (Linnaeus)), dragonflies (brown hawker, *Aeshna grandis* (Linnaeus)) and other dipterans (*Coenosia tigrina* (Fabricius)) was observed (Fig. 7).



Figs 7-8. *Poecilobothrus nobilitatus*: 7, male as prey of *Coenosia tigrina*; 8, female with chironomid larva as prey.

Female behaviour

Females spent a large proportion of their time sunning themselves on surrounding vegetation up to 60cm away from the water margin. Upon flying down to the water margin, and whilst in the proximity of males, feeding was the most frequently observed behaviour. Prey items included chironomid larvae (Fig. 8) and cladocerans. Feeding continued regardless of the presence of large numbers of displaying males, which females either ignored or escaped from by flying-off if copulation was attempted. No female-female interactions were observed.

Site 2

This newly established site had no *P. nobilitatus* present on the first day of observations. The numbers of males and females, and the number of copulations observed on subsequent days, are shown in the table below.

Day	**No. of males**	**No. of females**	**No. of matings**
1	**0**	**0**	**0**
2	**0**	**1**	**0**
3	**5**	**2**	**2**
4	**7**	**3**	**3**

Figs 9-10. *Poecilobothrus nobilitatus*: left courtship (fanning from behind) and right copulation.

Males established leks of 15-30cm diameter. Females visited different leks whilst traversing the environment, but no specific pattern could be determined. Unlike site 1, matings were observed following relatively short courtship displays of up to 30 seconds. Wing-waving by males with occasional 'fly-overs' was quickly followed by fanning from behind and copulation (Figs 9-10). Copulation took place for 20-30 seconds after which the female returned to marginal vegetation and the male continued to patrol his lek. All 5 females present during the 2 hour observation periods copulated. Conflict between males was brief and confined to short pursuits at lek boundaries.

Females did not appear to prefer larger males. Females were observed feeding both before and after copulation.

Discussion

Whilst this was an observational study without sufficient data for quantitative analysis, it was conducted in the field for long periods relative to the length of behavioural events. Key behavioural components such as lekking and courtship displays were consistent with previous accounts. There were important differences in the mating-related behaviours of *P. nobilitatus* both within a large, established aggregation and when compared to a newly established habitat in the process of being colonised. The density of flies was an important determinant of behaviour.

From the perspective of male adaptations, mating success (and hence fitness) was enhanced when leks could be maintained. This was the case at both sites, although females appearing at the newer site were more receptive and males spent less time in pursuit or combat with other males. This pattern changed as the density of flies, and particularly the proportion of males, increased. Both the shrinking temporary habitat (due to evaporation) and increased arrival or emergence of new flies will have contributed to rising density. Under these circumstances, lekking broke down and was replaced by a different form of male competition comprising increased pursuit and combat. These observations concur with those of Lunau *et al.* (2006). Whilst the densities from their experimental study were not as great as the maximum reported here, they suggest a trend within a spectrum that exists in differing environmental circumstances. For males, aggregation and high visibility also carries a cost. A variety of predators exploited this resource. Indeed, one of the earliest British accounts of courtship in *P. nobilitatus* by J.W. Yerbury at Bridgend (Yerbury 1918, Chandler 2015) includes a description of the capture of a male by a solitary wasp of the genus *Crabro* (Hymenoptera: Crabronidae), which provisions its nest with Diptera.

The most commonly observed female behaviour was feeding. Wilkinson and Johns (2005) reviewed sexual selection in several dipteran species and divided male encounter strategies into 4 types: swarm, male searching, resource defence and substrate lek. They concluded that aggregations of displaying males can occur on or away from food or oviposition sites at different times and that the link between the distribution of these resources and the type of mate encounter is strong. In *P. nobilitatus*, it seems likely that resource defence forms the basis of a lek strategy at low population densities and, therefore, that types of encounter strategy are not mutually exclusive. It is in these conditions that males achieve the greatest mating success. This inevitably changes as the density, particularly of males, increases and most time is spent in combat. Male size also does not have a simple association with mating success. Lunau (1992) found that larger males were better able to defend leks and chase-off rivals. Studies of the yellow dung fly, *Scathophaga stercoraria* (Linnaeus), in which males defend oviposition sites, have shown that an increase in resource availability lowers the mean size of copulating males (Borgia 1979). And several studies on factors favouring lek mating in the medfly, *Ceratitis capitata* (Wiedemann), show no consistent association between male size and mating success (Wilkinson and Johns 2005).

Variable results in previous studies of *P. nobilitatus* in relation to mating success, male size, failure to observe copulation and the debate around female choice *versus* male competition are perhaps now easier to explain. Mating strategies and success show plasticity and are density-dependent. One explanation for the evolution of these traits is that they represent adaptations to enable the exploitation of temporary habitats which may have shortened periods of resource availability depending on a number of environmental factors. Not enough is known about the life history, physiology or dispersal of this species to draw any further conclusions, but the topic is ripe for further contributions. Stubbs (1988) described courtship behaviour in the related dolichopodid *Dolichopus plumipes* (Scopoli). As well as describing male adornments and display, he encouraged readers to record and report their field observations of courtship behaviour. In a comprehensive review of lek behaviour in insects, Shelly and Whittier (1997) highlighted the need for research into the dynamic nature of lek mating systems and the potential impact of environmental conditions. I echo these sentiments, particularly for *P. nobilitatus* which is a common, easily identifiable species in which sexual selection and environmental factors enjoy a complex relationship.

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Rachispoda duplex Roháček (Diptera, Sphaeroceridae) new to Britain

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Summary

Rachispoda duplex Roháček, 1991 is added to the British list on the basis of a single female, collected in South Essex in 2015.

A single female of *Rachispoda duplex* Roháček, 1991 was collected on Foulness Island (TR022948) on 1 September 2015 by PH. The location is part of SSSI unit 15 and has substantial areas of non-tidal saltmarsh-influenced vegetation and seasonally wet saline and brackish lagoons or scrapes, as well as some areas of sea club-rush *Bolboschoenus maritimus* (see Figs 1-3). The individual was almost certainly swept from these saltpan or seasonally wet brackish habitats. The specimen is deposited in the collection of the Essex Field Club.

DS's initial identification was confirmed by Jindřich Roháček. He commented that "It is an important record situated far from the known distribution (Bulgaria, Serbia, Hungary, Slovakia, Spain). The species may have some affinity to salty habitats as some type specimens from Hungary were collected in salty habitats although the majority of them originated from muddy habitats in floodplain forests."

In the handbook by Pitkin (1988), the species keys to *Rachispoda cryptochaeta* (Duda, 1918), from which it is distinguished by details of the genitalia in both sexes as well as in the armature of the mid tibia. These features are described and illustrated by Roháček (1991), and this work is essential for the identification of British *Rachispoda*.

Fig. 1. Seasonally wet saline lagoon with sea club-rush in Unit 15 in June 2015.

Figs 2-3. Seasonally wet saline lagoon in Unit 15 in September 2015.

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Dipterists Digest 2016 **23**, 77-82

New records of lesser dung flies (Diptera, Sphaeroceridae) from Morocco

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Summary

The lesser dung fly fauna (Diptera, Sphaeroceridae) of Morocco remains poorly known, with 45 recorded species, and no new records added since 2006. Collecting data for 25 species, 22 of which could be identified to species, is presented, bringing the total number of named species to 67. The material includes one new species of *Phthitia* Enderlein and one new species of *Minilimosina* Roháček, but their description is deferred pending collection of further material. Thirteen records are also new for the whole of North Africa.

Introduction

The sphaerocerid fauna of Morocco remains poorly known. The World Catalogue of Sphaeroceridae (Roháček *et al.* 2001) listed a total of 21 species from the country. Gatt (2006) added 24 species to the list, bringing the total to 45. These were added in an update to the World Catalogue (Marshall *et al.* 2011). Since that time, no further new records have been published.

The material referred to in this work comes from two main sources. The first is a large collection of several thousand specimens in alcohol, mostly hand swept from river banks and riparian vegetation by Kawtar Kettani and others from 105 localities in the Rif region of Northern Morocco. A few specimens were collected in a Malaise trap. The second is a smaller, but equally important, collection consisting of a few hundred dry (pinned and layered) specimens collected by Martin J. Ebejer in more varied habitats (including a dairy farm) from the Rif (8 localities), and also from the Atlas Mountains of Central Morocco (14 localities). In addition, the collections of the Oxford Museum of Natural History and the National Museum of Wales, Cardiff were searched for material of Moroccan provenance and provided interesting material from one locality in the South, close to the North-western Sahara.

All identifications were carried out by the first author, and confirmed by examination of the genitalia in at least one specimen of every species. The material is largely deposited with the respective collector.

To avoid repetition of collecting data and in the interest of space, collecting localities are presented in a numbered list. The numbers in parentheses after each specimen or specimens in the species account refer to the corresponding number in this list. The names of collectors, nature reserves and institutions are abbreviated as follows: AT (Ahmed Taheri), FZB (F.Z. Bahid), HB (H. Belhaj), KK (Kawtar Kettani), MJE (Martin J. Ebejer), NMWC (National Museum of Wales Cardiff), PCM (P.C. Matheson), PG (Paul Gatt), PNB (Parc Naturel de Bouhachem), PNT (Parc National de Talassemtane)

Taxa are arranged alphabetically following the nomenclature used in Marshall *et al.* (2011). An abbreviated geographical distribution is given for each species. For a more detailed global distribution the reader is referred to Roháček *et al.* (2001) and Marshall *et al.* (2011).

LIST OF COLLECTING LOCALITIES

Specimens were collected by sweep netting or, unless otherwise indicated, by Malaise trap. Abbreviations are explained above.

1. Rif, Chefchaouen, Zaoueit et Habtiyène (PNT), Maggou, 35°04'48"N, 5°02'49"W, 1213m, mixed forest, 12.xii.2008, KK.
2. Rif, Tétouan, Yagrhit, Zarka Waterfall, 35°31'16"N, 5°20'30"W, 135m, mixed forest, 27.iv.2009, KK.
3. Rif, Tétouan, Mokdassen Oulya, River Azla, 35°30.5'545"N, 5°18.30'508"W, 186m, pine forest, 5.vii.2009, KK.
4. Rif, Chefchaouen, Talembote (PNT), River Talembote, 35°15.041'N, 5°11.717'W, 320m, mixed forest, 25.i.2003, KK.
5. Rif, Chefchaouen, El Khizana, River El Khizana, 35°2'615"N, 5°14'16"W, 980m, mixed forest, 15.vi.2001, KK.
6. Rif, Tétouan, Nwawel, River Azla, 35°32'548"N, 5°17'509"W, 57m, cork oak forest, 28.iii.2010, KK.
7. Rif, Chefchaouen, Beni Zid, River Ouara, 35°05'12"N, 5°13'35"W, 440m, mixed forest, 20.iv.2007, KK.
8. Rif, Tétouan, Tamuda, River Mhannech, 35°33'38"N, 5°24'44"W, 18m, riparian vegetation, 11.vii.2010, KK.
9. Rif, Chefchaouen, Talassemtane (PNT), Jbel Kelaa, 35°06'47"N, 5°08'03.59"W, 1554m, mixed forest, 13.ix.2009, AT.
10. Rif, Al Hoceima, Bni Boufrah, Oued Tabandout, 35°3'108"N, 4°26'170"W, 540m, riparian vegetation, 23.v.2011, HB.
11. Rif, Al Hoceima, Bni Boufrah, River Guallet, 35°2'03”N, 4°25'57”W, 946m, mixed forest, 25.v.2011, KK.

12a. Rif, Chefchaouen, Jnane Niche, River Jnane Niche, 35°17'14.68"N, 4°51'25.30"W, 27m, riparian vegetation, 2.xii.2011, KK.
12b. same as 12a, but 19.iv.2013.

13. Rif, Al Hoceima, Bni Boufrah, River Jnane Azaghar, 35°01'54"N, 4°26'05"W, 997m, oak forest, 21.v.2011, HB.
14. Rif, Tétouan, Rbahi, River Mhannech, 35°35'11"N, 5°17'56"W, 125m, riparian vegetation, 11.vii.2010, KK.
15. Rif, Al Hoceima, Beni Boufrah, Oued Guallet, 35°2'03"N, 4°25'57"W, 946m, flowery meadow, 25.v.2011, HB.
16. Rif, Chefchaouen, Afertane, River Afertane, 35°21'65"N, 5°11'36"W, 56m, riparian vegetation, 5.i.2013, KK.
17. Rif, Fahs Anjra, Bine El Ouidane (Ksar Sghir), Taghramt, 35°47'17.48"N, 5°28'14.67"W, 276m, riparian vegetation, 12.vi.2011, FZB.
18. Rif, Tétouan, (PNB), Onsar Akboul, 35°14'389"N, 5°26'350"W, 1315m, oak forest, 10.ix.2013, FZB.
19. Rif, Chefchaouen, Maggou (PNT), Maggou Waterfall, 35°06'73"N, 5°11'30"W, 786m, mixed forest, 3.v.2013, KK.
20. Rif, Chefchaouen, El Anasser, Tariouma, 1383m, 35°00'59.8"N, 4°59'59.77"W, 1383m, riparian vegetation, 11.v.2012, FZB.
21. Rif, Chefchaouen, Ametrasse, River Ametrasse, 35°05'01"N, 5°05'03"W, 841m, mixed forest, 11.v.2012, KK.
22. Rif, Tétouan, Bni Moussa, River Arozane, 35°23'18"N, 5°21'54"W, 317m, *Cistus monspeliensis*, 31.v.2014, KK.

23. Rif, Tétouan, Amsa, River Amsa, 35°31'34"N, 5°13'50"W, 14m, riparian vegetation, 13.xi.2013, KK.
24. Rif, Tétouan, Smir, Smir Lagoon, 35°43'14"N, 5°20'20"W, 5m, riparian vegetation, 3.i.2012, KK.
25. Rif, Tétouan, Dar Akobaa, River My Bouchta, 35°13'42"N, 5°19'20"W, 285m, riparian vegetation, 23.xi.2012, KK.
26. Rif, Tanger, Tahaddart, River Tahaddart, 35°40'24"N, 5°53'37"W, 87m, 13.iv.2012, FZB.
27. Rif, Al Hoceima, Issaguen, 34°91'665"N, 4°98'086"W, 1543m, cedar forest, Malaise trap, 16.v.-20.vi.2014, KK.
28. Rif, Larache, Taghzoute (PNB), Adrou, 35°22'564"N, 5°32'343"W, 556m, mixed forest, Malaise trap, 14.vii.-15.viii.2013, KK.
29. Rif, Tétouan, Beni Leit (PNB), Lemtahen, 35°16'22"N, 5°26'14"W, 1088m, swamp and pine forest, 27.iv.2012, KK.
30. Rif, Chefchaouen, Talassemtane (PNT), 35°13'503"N, 5°13'835"W, 1696m, fir forest, 7.vi.2014, KK.
31. Rif, Chefchaouen, Azilane (PNT), Aïn Tissemlal, 35°11'3.67"N, 5°15'20.21"W, 1200m, mixed forest, Malaise trap, 4.vii.-13.viii.2013, KK.
32. Rif, Tétouan, Larache, Loukkos Marsh, 35°09.445'N, 6°06.220'W, 4.vi.2013, MJE.
33. Rif, Tétouan, Ksar el-Kebir, 35°09.445'N, 6°06.220'W, 20m, marsh, 5.vi.2013, MJE.
34. Rif, Chefchaouen, 5 km W. of Dardara, 35°06.015'N, 5°20.324'W, 730m, flowery meadow, pond, pine forest, 5.vi.2013, MJE.
35. Rif, Oued Laou, 35°21.462'N, 5°10.781'W, 30m, sandy river bank, 9.vi.2013, MJE.
36. Rif, Chefchaouen, Dardara, 35°06.354'N, 5°17.971'W, 484m, oak forest, light trap, 13.vi.2013, MJE.
37. Rif, Tétouan, Martil, beach and dunes, on human faeces, 1.v.2004, PG.
38. Rif, Chefchaouen, Talassemtane, Jebel Lakra, 35°06.913'N, 5°08.034'W, 1541m, meadow in mixed forest, 14.vi.2013, MJE.
39. Rif, Tétouan, M'diq, 35°42'05"N, 05°21'17"W, 5m, dairy farm, dung mixed with straw and flowering ruderal vegetation, 24.iv.2015, MJE.
40. Rif, Oued Laou, Tamrabete, 35°19'26"N, 05°10'48"W, 203m, mixed forest, 11.vi.2011, KK.
41. Khenifra, Lac Aguelmame Sidi Ali, Middle Atlas, 33°03.238'N, 5°01.615'W, 2050m, 7.v.2012, MJE.
42. Ifrane, Lac Aguelmame Afenourrir 30km SW of Azrou, Middle Atlas, 33°17.108'N, 5°15.058'W, 1760m, 9.v.2012, MJE.
43. Ifrane, 3.5km S. of Azrou, Middle Atlas, 33°25.49'N, 5°12.393'W, 1450m, cedar forest, 8.v.2012, MJE.
44. Khenifra, 17km NW of Zaida, Middle Atlas, 32°57.179'N, 5°04.514'W, 1878m, 6.v.2012, MJE.
45. Errachidia, Merzouga, 31°05.715'N, 4°00.687'W, 698m, 29.iv.2012, MJE.
46. Errachidia, 13 km N. of Erfoud, Ziz River, 31°31.558'N, 4°11.174'W, 800m, 1.v.2012, MJE.
47. Errachidia, 12km S of Rissani, Ziz River, 31°15.914'N, 4°09.350'W, 737m, 29.iv.2012, MJE.
48. Errachidia, 30 km N. of Erfoud, Ziz River, 31°40.108'N, 4°11.471'W, 894m, 1.v.2012, MJE.
49. Errachidia, SE High Atlas, 14 km N of Errachidia, 32°02.355'N, 4°29.308'W, 1214m, 3.v.2012, MJE.
50. Goulimine/Bou Jarif, 29.05'N, 10.20'W, 22.ii.1992, NMW.Z 1992-022, PCM.

Results

Subfamily COPROMYZINAE

Crumomyia glabrifrons **(Meigen, 1830).** Material examined: 1♂ (41); 1♂ (20).

A west Palaearctic, psychrophilous, predominantly highland forest species with easternmost records from Tadjikistan. First record for North Africa.

***Norrbomia sordida* (Zetterstedt, 1847).** Material examined: 1♂ (32); 1♂ (11).
Widely distributed in the Palaearctic, also recorded from the Nearctic, Neotropical, Oriental and Australasia/Oceania regions. First record for North Africa.

Subfamily SPHAEROCERINAE

***Ischiolepta pusilla* (Fallén, 1820).** Material examined: 1♂ (11); 2♂♂ (31).
Widely distributed in the Holarctic, also recorded from the Neotropical region and Australasia. In North Africa, known from Egypt and Tunisia.

Subfamily LIMOSININAE

***Coproica hirticula* Collin, 1956.** Material examined: 1♀ (34); 1♂ (35); 1♂ (2); 2♀♀ (2); 1♂ & 2 ♀♀ (7); 10♂♂ & 5♀♀ (13); 1♀ (14); 1♂ & 2♀♀ (28); 1♂ (12b); 1♀ (15).
A subcosmopolitan species. First record for North Africa.

***Coproica hirtula* (Rondani, 1880).** Material examined: 1♀ (49); 1♀ (2).
A subcosmopolitan species, known in North Africa from Egypt and Tunisia.

***Coproica pusio* (Zetterstedt, 1847).** Material examined: 1♂ (40); 1♀ (24).
Widely distributed in the Palaearctic, also known from the Oriental region (Pakistan). First record for North Africa.

***Coproica rohaceki* Carles-Tolrá, 1990.** Material examined: 1♂ (23); 1♀ (25).
A poorly known Palaearctic and Oriental species, recorded in the Mediterranean from Spain, Italy, Malta and Cyprus. First record for North Africa.

***Coproica rufifrons* Hayashi, 1991.** Material examined: 1♂ (27).
A cosmopolitan or subcosmopolitan species of unknown origin. Known in North Africa from Tunisia.

***Coproica vagans* (Haliday, 1833).** Material examined: 1♂ (45); 1♂ (46); 1♂ (49).
A cosmopolitan species, known in North Africa from Algeria, Tunisia and Egypt.

***Elachisoma* Rondani, 1880 sp.** Material examined: 3♀♀ (12b).
Species in the genus *Elachisoma* can only be reliably identified in the male sex. The genus is here newly recorded from North Africa.

***Eulimosina ochripes* (Meigen, 1830).** Material examined: 1♀ (42); 1♂ (33); 2♀♀ (27).
A Holarctic and Oriental species known in North Africa from Tunisia.

***Leptocera caenosa* (Rondani, 1880).** Material examined: 1♀ (36).
A very widely distributed synanthropic species known from all zoogeographic areas except the Oriental. First record for North Africa.

***Limosina silvatica* (Meigen, 1830).** Material examined: 1♀ (27); 1♀ (30); 1♂ & 3♀♀ (43); 1♂ (44).

A west Palaearctic woodland species. In North Africa (Tunisia) and the Levant (Israel, Cyprus) it is a rare species that occurs in the highlands (Roháček 2004).

***Minilimosina* (*Allolimosina*) sp. nov.** Material examined: 1♂ (18).

***Minilimosina* (*Svarciella*) *vitripennis* (Zetterstedt, 1847).** Material examined: 1♂ (43).
A widely distributed Holarctic species, with scarce Mediterranean records that originate from highland areas (Roháček 2004). First record for North Africa.

***Paralimosina fucata* (Rondani, 1880).** Material examined: 1♀ (34); 1♀ (36); 1♂ (3); 1♀ (4), 1♂ (5); 1♂ (9); 1♂ (28).
A Palaearctic species, known in North Africa from Algeria and Tunisia.

***Phthitia* (*Kimosina*) sp. nov., *longisetosa* group.** Material examined: 1♂ (10).

***Phthitia* (*Kimosina*) *ciliata* (Duda, 1918).** Material examined: 1♂ (50).
A poorly known Mediterranean species, known from Algeria, Tunisia, Sicily, Cyprus and Israel.

***Phthitia* (*Kimosina*) *plumosula* (Rondani, 1880).** Material examined: 1♀ (38); 1♂ (1); 1♂ (9); 1♂ (22); 1♂ & 3♀♀ (27); 1♀ (2); 1♀ (17).
A widespread Holarctic species, known in North Africa from Tunisia.

***Phthitia* (*Kimosina*) *pteremoides* (Papp, 1973).** Material examined: 2♂♂ (50).
A poorly known Palaearctic species, recorded from Spain, Afghanistan, Iran, Tadjikistan, United Arab Emirates, Mongolia and China. First record for North Africa.

***Rachispoda lagura* (Roháček, 1991).** Material examined: 1♂ (47); 1♂ (33); 1♂ & 1♀ (46); 1♀ (48).
A poorly known but widely distributed halophilous species, recorded in North Africa from Algeria, Egypt and Tunisia.

***Spelobia clunipes* (Meigen, 1830).** Material examined: 1♂ (34); 1♀ (37); 1♂ & 1♀ (8); 2♂♂ & 2♀♀ (16); 5♂♂ & 5♀♀ (19); 1♂ (18); 3♀♀ (21); 1♂ & 4♀♀ (26); 3♂♂ & 1♀ (27); 1♀ (29).
A very widely distributed Holarctic species, known in North Africa from Tunisia.

***Telomerina pseudoleucoptera* (Duda, 1924).** Material examined: 1♂ (19).
A widely distributed European species. First record for North Africa.

***Trachyopella* (*Trachyopella*) *coprina* (Duda, 1918).** Material examined: 1♀ (12a).
A widely distributed European species that has been introduced into the USA. First record for North Africa.

***Trachyopella* (*Trachyopella*) *melania* (Haliday, 1836).** Material examined: 1♀ (6); 1♂ & 2♀♀ (39).
A widely distributed Palaearctic species that extends as far East as Mongolia. First record for North Africa.

Discussion

A total of 56 species were present in the collected material, 25 of which are new records for Morocco. Twenty-two of these could be named, bringing the total number of species known from the country to 67. Thirteen of these records are also the first for North Africa. Carles-Tolrá *et al.* (2002) recorded 125 species from peninsular Spain, and a comparable number is reasonably expected to occur in Morocco.

By and large, most of the records are of common species with a wide geographical distribution and merely underscore the need for more intensive investigation of the fauna, including sampling in a wider variety of habitats (e.g. farms, beach wrack, caves, animal burrows, leaf litter, pasturing meadows) and the use of baited traps.

Of particular interest is the finding in the Rif of single, damaged male specimens of two undescribed species, one in the genus *Phthitia* Enderlein (1938), belonging to the *longisetosa* group as defined by Marshall *et al.* (1992), and another in the genus *Minilimosina* Roháček, 1983. These species will be described pending the discovery of further material.

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New distribution data of Conopidae (Diptera) from Iran

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Summary

The sampling of Diptera was investigated using a standard sweep net in the Arak region and suburb, Markazi province, Iran. Three genera and three species, *Zodion cinereum* (Fabricius, 1794), *Thecophora distincta* (Wiedemann, 1824) and *Myopa pellucida* (Robineau-Desvoidy, 1830), were identified and new distribution data were presented.

Introduction

Conopidae is a large and widespread family of parasitic flies, and the known larvae of all Conopinae, Myopinae and Dalmanniinae are internal parasites of aculeate Hymenoptera. Conopidae are well known solitary koinobiont endoparasitoids of social bumblebees (Apidae: Bombinae) (Melo *et al.* 2008). During 2008 and 2009 the authors used a standard sweep net for collecting flies in the Arak region and suburb, Markazi province, Iran. Three genera and three species (*Zodion cinereum*, *Myopa pellucida*, and *Thecophora distincta*) were identified. The material examined is deposited at the insect collection of the Entomology Department, Islamic Azad University, Arak Branch, Iran.

MYOPINAE Macquart, 1834

Myopa pellucida (Robineau-Desvoidy, 1830)

Material examined: Eybak Abad, 2.vi.2008, (1♂), 34°14'N, 55°41'E, 1700m.

Distribution: evidently widespread in the Palaearctic region, with records from throughout western Europe (Austria, Cyprus, Belgium, Bulgaria, Denmark, Ireland, France, Germany, Great Britain, Greece, Hungary, Macedonia, Mallorca, Menorca, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Spain, and Switzerland), North Africa (Morocco, Tunisia), the Near and Middle East (Afghanistan, Chechnya, Iraq, Kirgizstan, Turkey and Turkmenistan) and from the Far East (Eastern Russia and China) (Stuke and Clements 1998).

Reference: Khaghaninia and Kazerani (2014) from Qaradagh Forests (located in East Azerbaijan province, north-west of Iran).

Thecophora Rondani, 1845

Thecophora distincta (Wiedemann, 1824)

Material examined: Gavar, 26.ix.2008, (1♀), 33°42'N, 49°35'E, 2000 m; Haji Abad, 5.x.2008, (1♂), 34°02'N, 49°25'E, 1668m.

Distribution: Europe, Russia, Turkey, Iran, Mongolia (Anonymous 2013).

References: Zimina (2000), Ňarčuk and Baganachova (2008), Khaghaninia and Kazerani (2014, as *T. melanopa* Rondani, 1857).

ZODIONINAE Rondani, 1856

Zodion cinereum (Fabricius, 1794)

Material examined: Hafteh, 22.ix.2008, (1♀), 33°51'N, 49°33'E, 2004m.
Distribution: Widely distributed in the Palaearctic region (Stuke *et al.* 2008).
Reference: Khaghaninia and Kazerani (2014) from Qaradagh Forests (located in East Azerbaijan province, north-west of Iran).

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Fieldcraft and closing the knowledge gap between immature and adult stages of Diptera Cyclorrhapha

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Summary

A wide gap persists between our knowledge of the immature and adult stages of Diptera Cyclorrhapha. Major factors limiting the closure of this gap appear to be neglectful attitudes towards immatures and poorly developed fieldcraft i.e. the knowledge needed to find immatures in the field. To motivate more concerted attempts to close this gap, fieldcraft for finding immatures is assessed. The prospects for identifying immatures and using them in estimates of species status and distribution are also considered.

Introduction

The late 1980s was a significant time for the study of immature Diptera. A worldwide monographic review of the breeding habits and immature stages of cyclorrhaphan Diptera was published (Ferrar 1987) and an account of the British fauna also appeared (Smith 1989). A primary aim of these publications was to motivate an improving state of knowledge. That improved knowledge was needed was revealed by the fact that in 1989, less than 2% of fly species worldwide were known from their immatures (Smith 1989).

Both publications have been influential, and over the intervening period knowledge of immatures has certainly progressed, but the gap remains large. Such a knowledge gap is not, however, confined to the Diptera, but is a long-standing feature affecting the immatures of most endopterygote insects (Emden 1957, Meier and Lim 2009). In this paper I consider the benefits and difficulties of closing this gap and extend some of the information provided in Chandler (2010) on techniques of finding immatures. I use cyclorrhaphan examples because they are the immatures I know best, but the approach can probably be applied to other groups.

Adult flies are usually obtained using a net, trap or bait. These techniques work because they match the characteristics of adult movement. To match the movement characteristics of immatures a more focused approach is required, of which the most informative is hand-searching development sites (the places where larvae feed and grow). Immatures vary in the ease with which they and their development sites can be found, but rarely are the details reported in the literature of the fieldcraft that facilitates finding them reliably. For instance, Coe (1938) discovered that the development site of the rare hoverfly *Callicera rufa* Schummel (Syrphidae) is rot holes in living pine trees (*Pinus*). Unfortunately, Coe gave no information about how he made his discovery, frustrating attempts to find them again. They were eventually rediscovered in 1987 and the Malloch Society then developed the fieldcraft needed to find them (Rotheray and MacGowan 1990). Rot holes in pine trees occur most frequently at the junction between major branches and the main trunk of large trees. Unlike similar rot holes in broad-leaved trees, those in pine are almost always concealed beneath a thick, dense covering of pine needles. To get to the water (and *C. rufa* larvae), this 'thatch' must be removed or dug through, taking care in the process as puparia are often within it. *Callicera rufa* larvae are also found in water-filled holes at the cut surface of pine stumps. Once these characteristics were recognised, *C. rufa* development sites and immatures became routine discoveries (MacGowan and Rotheray 2006).

Acquiring fieldcraft to locate development sites and immatures in them is beneficial for several reasons. By increasing the probability of finding immatures, using them to record species becomes feasible (MacGowan and Rotheray 2000a), and often results in the discovery of new and rare taxa (MacGowan and Rotheray 2000b). Developing fieldcraft extends knowledge of both flies and their habitats (Rotheray *et al.* 2001) and enables resources critical to their survival to be recognised and monitored (Rotheray *et al.* 2009). Fieldcraft is not, however, an organised body of knowledge and is usually acquired from searching by trial and error, the experience of others, chance and opportunism.

The priority advocated here for developing and sharing fieldcraft is aimed at motivating others to discover immatures in their natural development sites. Following their discovery, some individuals of each type will usually need rearing to check their identity. This is because for most immatures species-level keys have yet to be developed. Others can be preserved to provide material for description and production of key works. Advice on rearing and describing immatures can be found in Ferrar (1987), Smith (1989), Chandler (2010) and Rotheray (2016). An alternative method of obtaining immatures is inducing gravid females to oviposit in captivity, but this can be difficult when oviposition cues and larval food are unknown. Also, no data are gained of natural development sites. Nevertheless, for certain Anthomyzidae and Lauxaniidae, Roháček and Barber (2011) and Semelbauer and Kozánek (2012) respectively provide examples of the technique.

Immature values

In the nineteenth century an extensive and vigorous debate was initiated that continues today, concerning the origin, role and significance of immature stages (Hall and Wake 1999, Williamson and Vickers 2007, Minelli 2010, Rotheray 2016). An early aspect of this debate was whether immatures were capable of evolving or whether their various forms were fixed. Today this aspect is no longer an issue and immature evolution is accepted (Hall and Wake 1999, Truman and Riddiford 1999). Immatures on their own evolutionary trajectories are data sources independent of the adult stage which means potentially that they have a role in, for example, taxonomy and phylogenetic systematics. Indeed, across the Endopterygota, character data from immatures has, albeit patchily and with mixed success due primarily to gaps in knowledge, been used to supplement, test and resolve taxonomic hierarchies and phylogenies based on adult and molecular characters (Meir and Lim 2009).

Another aspect of the debate about immatures involves possible difficulties of finding species-level identification characters (Ferrar 1987, Meir and Lim 2009). Indeed, the taxonomic value of immatures will be low if they cannot be identified at family, genus and species levels. If distinguishing characters cannot be found then the status quo of neglect will probably continue, although other options for identification include rearing them to the adult stage or using DNA barcodes (Meier and Lim 2009). At one extreme, Ferrar (1987) suggests that cyclorrhaphan larval morphology has converged according to diet, locomotion, respiration and protection, resulting in larvae looking so alike they are hard to identify. At the other extreme, immature characters can appear so idiosyncratic that it is difficult to work out how they have originated. For example, the schizophoran larval 'mandible' seems so different from the mandible of other Diptera, it has been viewed as a completely new structure (Snodgrass 1953, Courtney *et al.* 2000). Due to the uncertain origin of this structure, the ad hoc but descriptive term, 'mouthhook', is often used for it.

Actually, the schizophoran mandible is not so different that it cannot be derived from precursor states found in outgroups, such as the Aschiza (= lower Cyclorrhapha) (Rotheray 2016). Furthermore, it is a highly diverse structure and a valuable source of taxonomic characters (Rotheray and Lyszkowski 2015, Rotheray and Wilkinson 2015). In a detailed examination of 22 larvae from 10 families across the Cyclorrhapha, trophic, locomotive and protective structures were not so similar that taxonomic affinities and origins were lost, i.e. any similarities present were superficial (Rotheray and Lyszkowski 2015, Rotheray 2016). Similarity so complete that morphological origins are obscured is, however, known. Using molecular data, it has been found in four characters modified in identical ways that are associated with three separate, aquatic to terrestrial habitat shifts in the larvae of certain species of the sciomyzid genus *Tetanocera* (Sciomyzidae) (Chapman *et al.* 2006). A lesson from these studies is that cyclorrhaphan larval morphology is still poorly understood, and much remains to be done before true states and relationships are known.

Of particular help in understanding larval morphology is the monitoring of movement in live specimens alongside studies of preserved material (Rotheray and Lyszkowski 2015, Rotheray 2016). Using movement to explain morphology is an established technique but for cyclorrhaphan larvae the approach is practically untried. This is because movement is often too rapid and components too small or concealed to see what is going on (Tinkeu and Hance 1998). However, digital films made using cameras attached to binocular microscopes and examined using programmes that allow films to be viewed at different speeds have largely overcome these limitations, and have enabled new and revealing insights into a little-explored world (Rotheray and Lyszkowski 2015, Rotheray and Wilkinson 2015). One of these insights is that larvae are considerably more diverse morphologically and behaviourally than appearances suggest; even among congeners there can be striking differences. Consequently, the prospect for finding key characters and recognising species-level differences is almost certainly greater than generally supposed (Rotheray 2016).

Immatures have potential value in species surveys and assessments of status or rarity, but they are poorly utilised in these roles (Rotheray 2016). The exception is certain Diptera that, due to their conspicuousness when immature, for example galls and leaf mines, are easier to record than the adult stage, although care is necessary in their identification. For different reasons the same is also true of certain saproxylic Diptera, such as the hoverflies *Blera fallax* (Linnaeus), *C. rufa* and *Hammerschmidtia ferruginea* Schummel (MacGowan and Rotheray 2000a). Apart from being rare and having relatively short flight periods, adults of these species spend most time in places not often or easily surveyed, such as high in tree canopies (*B. fallax*, *C. rufa*) or close to development sites (*H. ferruginea*). In contrast the immatures of these species are readily found and throughout the year. Adults of other Diptera with habits that affect catchability, and with immatures that can be found over most months of the year, include Lonchaeidae (adults in tree canopies: McAlpine and Munroe 1968), Clusiidae (adults on fallen wood: Stubbs 1982, Rotheray and Horsfield 2013) and Pallopteridae (adults often near the ground in thick vegetation: Rotheray 2014), and doubtless many other examples exist.

If adults are problematic to catch and these difficulties are not allowed for, their distribution will be under-estimated and their rarity over-estimated. On adult records, for instance, *C. rufa* was assessed by Shirt (1987) as a category 1 'Endangered' species, known only from a handful of sites. As noted above, once fieldcraft was developed to locate immatures, this species was found widely and abundantly in Scotland (MacGowan and Rotheray 2006). Currently, it is not endangered and its status is Nationally Scarce (Ball and Morris 2014). How frequently the assessment of status and distribution of other 'rare' Diptera has been misled by difficulties in recording adults is unclear.

Surveying immatures provides a means of testing apparent rarity, and for more accurate assessment immature and adult stages should be surveyed together. Furthermore, immatures are direct evidence of that significant biodiversity feature, a breeding population. Using immatures to test and correct adult-based estimates of distribution and status relies on developing fieldcraft to find them and on the ease of applying it. For example, relative to the recording of adults, it can take a disproportionate time to find immatures of saproxylic syrphids in habitats such as Mediterranean forest (Ricarte and Marcos-García 2008). The need for further work on this subject is clearly indicated. Over and above this, the need exists to discover the development sites of putative rare, threatened and endangered flies. This is not only to help confirm their status, but also because knowledge of where their immatures develop identifies habitat features of biodiversity interest and is critical for conservation programmes aimed at species recovery (MacGowan and Rotheray 2000a, Ismay and Stubbs 2010).

Fieldcraft generally

Being able to find cyclorrhaphan immatures reliably is the aim of the fieldcraft considered here. The requirements of fieldcraft for any particular species depend on a variety of factors, such as the extent immatures and their development sites are concealed and their frequency. Developing and using fieldcraft to find immatures is like any other skill or technique; success improves with practice and experience. For example, practice and experience reduces the difficulties of finding immatures of saproxylic taxa (MacGowan and Rotheray 2000a, Rotheray *et al.* 2001, MacGowan and Rotheray 2008).

Initial practice and experience can be gained by searching for immatures at development sites that are relatively easy to find, such as leaf litter. Alternatively, information from publications containing rearing records can be used as a practice guide. When the intention is the confirmation of old and uncertain records, working from publications is scientifically valuable, such as the example of *C. rufa* referred to in the introduction. Even led by fieldcraft, finding immatures involves an element of trial and error and a level of persistence is required, especially in the face of repeated failures to find development sites or immatures in them. There is also the need to be 'conservation aware' so that when searching, disturbance and damage is limited and local populations are not compromised by taking too many specimens. Judging the latter is difficult, so caution is needed and only a low proportion of encountered immatures should be removed.

An important aspect of searching development sites is understanding them, so that searching is thorough and includes the various situations in which they occur and the forms they take. For example, sap runs vary in form. They are usually noticed as conspicuous wet patches of oily material on tree trunks. They can, however, be less obvious; for instance they may be hidden among loose flaps of bark, such as occur in fissures on the trunks of yew (*Taxus*) trees, and revealed by probing with a knife. They may be concealed under moss at the base of a tree, and indicated by small amounts of moss turned brown. Some of the most extensive and productive sap runs have small to tiny amounts of sap extruding from inconspicuous cracks; behind these cracks, there can be 'blisters' between the bark and the sapwood, full of decaying sap. They are revealed by probing near small leakages or listening for a hollow sound by tapping the bark with the base of a knife or similar utensil. They can even be located by their smell or by numerous adult flies flying near and landing on what appears to be a dry area of bark.

Success in finding immatures is also affected by when development sites are searched; for instance the most productive period for leaf litter is autumn through to spring. In general, this period favours saprophages of decaying plants because in the summer these species are in the adult stage and new generations are just beginning or will start later in the autumn when plants die back. In contrast, early spring to late autumn is a productive period for phytophages, carrion-developing species and many zoophages (predators and parasites).

Development sites that are more or less continuous are straightforward to find, such as leaf litter, mud, decaying seaweed, etc. So are many discrete development sites, especially at high densities, such as can occur with fallen trees and branches, aggregations of ant nests, monocultures of plants, etc. The difficulty then lies in choosing where to search in these habitats. A rule of thumb is that immatures will be found in the most extensive volumes of a continuous development site or in the largest of the available range of discrete ones. Otherwise 'spot-checking' across the range of environmental circumstances and conditions is probably as effective as any strategy – until that is, the presence of immatures can be more accurately correlated to particular environmental indicators, enabling fieldcraft to be further developed. Being able to recognise such indicators requires an understanding of development sites and an ability to perceive what is different or special about those containing immatures relative to the surrounding environment or habitat. For example, success in finding cyclorrhaphan immatures in leaf litter suggests that they occur most frequently in quite wet conditions and where the leaf litter is deepest and least disturbed. These indicators are most prevalent in relatively protected places such as in shaded hollows and slight dips or undulations in the ground. Within the litter, larvae may move up and down according to conditions of moisture, but in general they seem to prefer the middle layers where leaves are compacted, not loose as at the surface and not decayed and fragmented nearer the soil.

Well-dispersed discrete development sites that are at low density and concealed are obviously the most difficult to find, although some may be locally common, such as old bird nests, tree holes, etc. Development sites can also be created and set out to attract colonisation. For example, the hoverfly lagoons project run by the University of Sussex that has the aim of enticing hoverflies into gardens by providing artificial development sites (the Buzz Club 2016).

Finding development sites and immatures of species where these are unknown is the greater and more difficult challenge, and a priority for advancing knowledge. Clues as to where they might be found come from closely related species whose immatures are known and which are likely to share the same type of development site, and also from the places frequented by gravid females (Rotheray 2010). Examples include predatory syrphines that develop in association with aphids, and saproxylic species that develop in fallen wood. Unknown syrphines and saproxylics were found by searching an ever-widening range of aphid colonies and tree species respectively (Rotheray 1993, Rotheray *et al.* 2001). Many cyclorrhaphan lineages have probably diversified relative to a particular type of resource, and their immatures can be found by extensive sampling across its various ecological and taxonomic forms.

The more difficult immatures to find are those belonging to taxonomic groups that use diverse development sites, and more so if they belong to rare species. The Pallopteridae are an example; this small family is remarkable for its range of development sites, with larvae of different species found in the stems of monocotyledons, in the stems and flowerheads of dicotyledons, and under bark. Clues to the whereabouts of immatures of species in such a group can be obtained from various sources. For the Pallopteridae, immatures were tracked down by studying the literature, labels associated with museum specimens, word of mouth from other dipterists and field-searching likely places (Rotheray 2014, Rotheray and Hewitt 2015). With clues to hand, finding immatures is then down to careful, methodical searching (and good luck). Another rule of thumb is to assume that immatures will be in the most unexpected, awkward and difficult of positions in their development sites, and to adjust the searching strategy accordingly. Despite this, exhaustive searching of development sites is often undesirable and difficult to achieve, and a balance has to be struck between continuing with any particular search and moving to the next.

Exceptions to such difficulties include immatures that leave an obvious indicator of their presence. Phytophagous larvae often leave signs such as feeding tracks, plant tissue stained brown, entry/exit holes, or plant parts distorted in shape, etc. These indicators vary from the obvious to the subtle. Species leaving subtle signs include the tephritid *Tephritis vespertina* (Loew) whose foodplant is catsear *Hypochoeris radicata* (Asteraceae) and the anthomyiid *Botanophila seneciella* (Meade) whose foodplant is ragwort *Senecio jacobaea* (Asteraceae). The larva of both species tunnels down between the florets in the flowerhead and the resulting slight brown staining disturbs the otherwise perfect symmetry at the surface. Once seen a few times, this staining and disturbance is straightforward to spot. Disturbed and stained florets are, however, produced by a variety of agents in addition to these larvae. Larval presence can be confirmed by gently pulling apart the florets.

Fieldcraft specifically

A useful technique for determining the material that contains immatures is to collect it and to wait to see what emerges. For example, in one of the most comprehensive investigations of its kind E.B. Basden and R.J. Spittle reared during the period 1931 to 1935 over 20,000 Diptera of 250+ species from nearly 230 nests of 48 bird species. Basden and Spittle placed nests in gauze-covered, earthenware jars and 'harvested' adults as they emerged (Rotheray 1989). The problem with emergence techniques like these is that few immatures are obtained. To obtain them, hand-searching material is needed and at least a proportion of immatures reared individually to associate puparia with emerged adults, and thus identify the species.

Many microhabitats, such as bird nests, fungal fruiting bodies, leaf litter, seaweed, sand, soil and mud etc., contain within them more than one development site. In fallen trees and branches, for example, development sites appear and disappear relative to the stage of decay reached by the wood. The first to appear are associated with decay of the bark; others occur much later, when the sapwood and heartwood (= whitewood) start to soften. A less significant but still important influence is the species of tree. Fieldcraft for fallen trees and branches, and aspects of fieldcraft for live and dead herbaceous plants are used here as examples to demonstrate the depth of knowledge required to reduce time-consuming trial and error searches and to find immatures reliably.

Fallen trees and branches

When examining a fallen tree or branch, the stage of decay needs to be recognised. Two decay stages involving the bark are significant for cyclorrhaphan immatures, and both take several months to develop following the death of the wood and last for 1-2 years. The most significant of these stages is the build-up of an oily layer under the bark; this is a product of microbial action on cambial tissue and many larvae feed on this material (Rotheray *et al.* 2001). The other stage is fungal growth under the slit-like lenticels of dead branches.

Similar in form to the material comprising sap runs, decaying cambium can also develop under the bark of stumps and snags (standing trees with the tops broken off). Decaying cambium is usually deeper where the bark is thickest, variable in colour from pale yellow to black according to tree species, and often has a distinctive odour. It can also be produced by the action of Coleoptera and Lepidoptera larvae tunneling under the bark. In conifer trees and branches this decay stage is indicated by the presence of pine needles that are still attached to branches, but are dead and brown. The state of cambial decay can be assessed by levering up small pieces of bark along the length of fallen trees and branches that are about 5cm and above in diameter. Trees and branches smaller than this are not usually colonised by cyclorrhaphans. If the wood is white underneath then it is too early for the decay. If the bark is heavily cracked, peeling and comes away easily, then this stage has been and gone. The oily material under bark is often patchy in occurrence, so it is worth levering up bark in several places. Furthermore, decaying cambium can be dry or wet, shallow or deep, soaked into bark fibres, etc. Cyclorrhaphan larvae exhibit a range of specialised feeding mechanisms for coping with these circumstances (Rotheray and Lyszkowski 2015) and searching needs to be thorough in order not to miss them. The best time to search is February to April as at this time larvae are larger, having developed since the previous summer, and puparia are forming.

Fungal growth under lenticels is particularly frequent in trees such as birch (*Betula*) and poplars (*Populus*), and is due to growth of sooty fungi (Ascomycetes). On this material develop immatures of species of *Stegana* (Drosophilidae), *Lonchaea* and *Palloptera*. To access this development site, the paper-thin outer epidermis of the bark can be peeled back to expose black patches of powdery fungal growth that surround the lenticels within which immatures can be found. The best time for this is the same as for decaying cambium and for the same reasons. Due to their short duration, however, most dead wood is beyond these two early stages. Hence dead wood with decaying bark is relatively scarce and takes longer to find.

More persistent decay stages follow the drying out of oily decay and growth of sooty fungi. They build up as the whitewood becomes soft under the influence of saproxylic fungi and insects and weathering and can take 2+ years to develop and last for 3+ years. Softened whitewood is used by clusiids, certain lonchaeids and a range of other cyclorrhaphans which, if they are not predators, feed in association with fungi and the biofilm coating the whitewood. Examples of the latter include the saprophage *Neophyllomyza acyglossa* (Villeneuve) (Milichiidae), which has a remarkably long and flexible head skeleton for inserting into and sucking up biofilm from tiny cracks and crevices. Such a mechanism contrasts with that of the spot-sucking feeding mechanism of clusiid larvae which is better suited to flat substrates (Rotheray and Lyszkowski 2015). A range of other cyclorrhaphans can be found in softened whitewood. They originate from other development sites, such as fungal fruiting bodies, moss and nests of birds, mammals and social insects. Many of these either overwinter in whitewood or use it as a place to form the puparium.

Whitewood is most productive when entire sections of a fallen tree or branch have softened and are saturated with water (but not lying in water). The bark at this stage of the decay process has usually separated from the whitewood, but nonetheless still protects it. It can usually be turned aside to allow access to search through the whitewood with a knife or similar utensil for pale-coloured larvae or red-brown puparia. Equally productive is softened whitewood in stumps and snags. After searching, the whitewood should be gathered together and the bark replaced. As with other decay stages, the best time for searching is February through to April.

Two other development sites can sometimes be found in fallen wood: tree holes and decaying whitewood at the root plate of upturned trees. If a tree hole exists in the wood prior to it falling down, it will remain a functioning development site as long as the hole faces upwards. Additional cavities in fallen wood that may accumulate water and decay and thereby attract tree-hole Diptera, are bark furrows and cracks. Advice on searching tree holes is provided by Rotheray (2010). The other development site is decay that softens the whitewood of the main trunk and extends underground into the roots. This is an important development site for xylotines, such as *Criorhina* and *Xylota* (Syrphidae). Decay is apparently initiated by saproxylic fungi with secondary decay by microbes; with the retention of water, this turns the whitewood into a soft, fibrous or porridge-like state (Rotheray 2010). Accessing this material in live trees, snags and stumps can be a time-consuming process (The Malloch Society 2015). In upturned trees, however, this material is exposed at the root plate and in remnants of the tree left in the ground; gravid female xylotines can often be seen flying on or near such areas of exposed decay. The simplest method of searching for immatures in this material is to look for wet, decayed whitewood by probing the exposed root plate and remnants of the tree left in the ground with a knife or trowel, especially those areas where adults have been seen. Be prepared to penetrate up to a metre or more into the wood to find immatures, and be aware that puparia may be closer to the surface.

Herbaceous plants

A helpful start to finding immatures associated with live herbaceous plants is the list of phytophagous species and the plants and plant parts with which they are associated in Uffen and Chandler (2010). Also helpful is Redfern and Shirley (2011) for gall-forming flies and the British leafmines website (2016) for leafminers.

Rarely are all the individuals in a population of plants equally likely to be infested. This is because female cyclorrhaphans are selective about the places or individual plants used for oviposition, and even with conspicuous signs of presence, such as galls and mines, fieldcraft is helpful in narrowing searches to places and plants most likely to have immatures. Selection for place is suggested by the distribution of the immatures of *Palloptera scutellata* (Macquart) (Pallopteridae) which develop inside the stem base of soft rush *Juncus effusus* (Juncaceae) (Rotheray and Hewitt 2015). Soft rush is especially abundant in open habitats such as fields and moorlands (Fitter *et al*. 1984). Despite this, immatures of *P. scutellata* seem to be most frequent in soft rush growing mixed with herbaceous vegetation in damp places (Bland and Horsfield 2016). This suggests that ovipositing females preferentially select plants growing in these circumstances. Whether this is due to environmental conditions specific to mixed vegetation or to other factors, such as a preponderance of large stems, is unclear.

A clear example of selection for particular plants is *Cheilosia illustrata* (Harris) (Syrphidae), which develops in the roots of hogweed *Heracleum sphondylium* (Apiaceae) (Rotheray 1999). Hogweed populations consist of mixed biennial and scarcer perennial individuals that can be distinguished by the shape of the root. Perennial plants have large, onion-shaped roots, while those of biennials are carrot-shaped. Onion-shaped roots, which contain greater amounts of tissue and therefore provide more resource for larval development, are the ones used by *C. illustrata* (Rotheray 1999). Explaining this preference mechanistically, gravid females of *C. illustrata* search for oviposition sites at ground level, where perennial roots may be selected due to a greater amount of more concentrated odour issuing from these larger roots.

Time of year is also an important factor in locating immatures in live plants. For instance, a surprisingly rich community of immatures develops in association with buttercup *Ranunculus* spp (Ranunculaceae) roots, of which a member is *Cheilosia albitarsis* (Meigen) (Syrphidae) (Rotheray 1991). During the early summer flight period of this syrphid, buttercup roots are small, but they grow and reach their largest size in the autumn. From eggs placed low on buttercup stems, the first stage *C. albitarsis* larva moves down to the root, excavates a short tunnel and stops feeding. It remains there in a quiescent state until the autumn, then resumes tunneling and completing growth after which it tunnels out of the root and into the soil to pupate and overwinter. It seems that this species has adapted the larval growth period to coincide with the time when the root contains most food. This also occurs in the related syrphid *Portevinia maculata* (Syrphidae) that feeds in *Allium* bulbs (Alliaceae) (Speight 1986). Delayed larval growth overcomes the problem of a mismatch between adult flight periods and optimum levels of larval resource in the foodplant. This may be a common feature of phytophagous species exploiting plant storage organs, such as roots and bulbs, and means that the autumn/winter period is the appropriate time to search for these larvae, which are anyway small and inconspicuous in the summer.

Generalising from these examples, a key to developing successful fieldcraft for phytophagous immatures is understanding the foodplant relative to the requirements and characteristics of the phytophage. Acquiring this knowledge takes time and effort, but is worthwhile as the experience gained is a helpful guide to finding related phytophages whose immatures are unknown.

When infested plants are found it is often tempting to open them up, but this needs to be done with care as it can result in mortality of the immatures. Although some, such as root and stem borers and leaf miners, are readily transferred to another plant others, such as gall-forming larvae, are more difficult to transfer. Before collecting, leaf mines can be easily checked for immatures by gently running the mine between finger and thumb; any slight bump or raised area is likely to be a larva or puparium. Alternatively, look through the mine from below against the sky. It is not necessary to remove the mine from the plant to do this. Stems and roots often need to be cut open at least partially and, if necessary, cut sections can be held together with wire or string.

Although herbaceous plants may die throughout the spring and summer, dead plants are most numerous in the autumn to the spring of the following year. Hence saprophages of such material face the same problem as some phytophages, of being mismatched between the flight periods of gravid females and optimum larval resources. To overcome the problem (rather than having quiescent larvae), many of these saprophages use the strategy of delayed emergence from the egg. Females oviposit on or into tissue that is alive and green; for herbaceous plants the outer stem tissue is often selected, especially at stem or leaf nodes. In the autumn and winter this outer epidermal tissue begins to decay and probably triggers emergence in time for larvae to feed on the microbial populations responsible for the decay. Examples include the anthomyzid *Paranthomyza nitida* (Meigen) (Anthomyzidae) on red campion *Silene dioica* (Caryophyllaceae) stems (Rotheray *et al*. 2014) and Pallopteridae developing in Apiaceae stems (Rotheray 2014).

Decaying epidermal tissue is, in fact, richly colonised by Nematocera (= lower Diptera), Stratiomyidae, Lauxaniidae, Pallopteridae, Lonchaeidae, Drosophilidae, Sphaeroceridae and more, probably utilising the same strategy of delayed larval emergence, although the levels of specificity between fly and plant species have yet to be assessed. This development site is little-explored and it may be as important to Diptera as dead wood. Some stems seem more susceptible to colonisation than others, due perhaps to greater stem size and the decay characteristics of the outer epidermis, e.g. minimal in *Rumex* (Polygonaceae), deep and extensive in *Angelica* (Apiaceae). The time to collect stems is when the plants have flowered and dispersed their seeds; usually this is September to December. Stems can be cut at ground level and then sliced into convenient lengths, stored in plastic bags and, critically, must be kept moist but not wet by regular sprays of water until about mid-February to mid-March. Under these conditions the outer stem tissue slowly decays and provides the medium for larval development.

During the period December to the end of January, lifting dead herbaceous plants with a soil core, and breaking up the soil over a white or plastic sheet, will expose immatures that have developed under the epidermal tissue and have descended into the soil to pupate. It may also reveal other immatures that develop in association with other parts of the plant and overwinter in the soil. An alternative and more effective method of collecting these immatures is to insert a large mesh garden sieve into an insect net. Soil is placed on the net-covered sieve and water poured over it. Larvae and puparia are revealed by carefully searching through the material left on the sieve. Larvae are usually spotted via their movements, and puparia by their red-brown or white colour.

Conclusions

The environmental roles of immatures and their contributions to Dipteran ecology and evolution would, under most circumstances, ensure they were a priority for investigation. There is, however, a huge gap in our knowledge of immatures compared to that of adult Diptera. The existence of this gap alone should provide all the motivation needed to find and rear immatures and close the gap. Few subjects in the Diptera can offer so high a potential for making new discoveries, nor are so central to understanding their biology.

Despite this the gap persists suggesting that, for progress to be made, attitudes towards immatures need to change. Although the adult is no more or less significant to the species than any other stage, for practical reasons greater emphasis is given to it. The adult stage is used to describe and identify fly species and it is relatively straightforward to collect, handle and preserve. An emphasis on collecting adults is also explained by the need for quick results, such as professional contractors undertaking site surveys, and the wish to cover as many sites and hectads as possible during field meetings and when contributing to recording schemes. Under these circumstances, little if any time is available for immatures. A further barrier is that in most cases immatures have to be reared because they cannot be identified. Rearing involves being patient over weeks and months before adults emerge and it can be risky due to frequent and inexplicable mortality. For these and other reasons neglect of immatures persists (Rotheray 2016). Given a willing attitude, however, none of this is unsurmountable and, when species are known from their immatures, identification keys can be devised and rearing will not be necessary. DNA barcodes may also become more widely available, similarly reducing the need to rear immatures (Meier and Lim 2009). It will then be easier to capitalise on immature potential, such as using them to record species and to check estimates of their status and distribution.

Apart from lack of attention given to the study of immatures and the consequent lack of identification keys, one of the most significant barriers to working with immatures is poor knowledge of how to find them. Fieldcraft is a tool for short-cutting what might otherwise be lengthy processes involved in finding immatures. Fieldcraft not only leads to the discovery of immatures, but it can also result in important data being acquired that improves understanding of Dipteran roles, biology and requirements. Developing and using fieldcraft to find immatures is also an invaluable way of investigating and learning about the environment itself.

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Rhagoletis cingulata (Loew) (Diptera, Tephritidae) in Britain

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Summary

Rhagoletis cingulata (Loew, 1862) is added to the British list from a female collected in Dorset.

Introduction

The genus *Rhagoletis* was erected by Loew (1862a) to accommodate Linnaeus' *Musca cerasi* and is a moderately large genus of Tephritidae with over sixty described species distributed throughout the New World, Europe and temperate Asia (White and Elson-Harris 1992, Norrbom *et. al.* 1998). The Fauna Europaea website (*www.faunaeuropaea.org* accessed 24 July 2016) gives nine species for the area under its remit while Chandler (2014) listed two native and two occasionally imported species from the British Isles. White (1988) keyed three British species, Merz (1994) seven Swiss species and Smit (2010) five Dutch species.

Occurrence in Britain

While moth trapping at Tout Quarry, Portland, Dorset (SY 68422 72459; V.C. 9) on the night of 19-20 July 2016 an unknown species of Tephritidae was attracted to an actinic light. The specimen was retained and subsequently identified as *Rhagoletis cingulata* (Loew, 1862), a North American species that is widely established in Europe. Its occurrence in Britain coincides with an arrival of warm air brought about by High Pressure over Eastern Europe creating a south-easterly airflow, bringing an influx of migrant Lepidoptera to Britain.

Identification

Rhagoletis cingulata was keyed and described by Foote *et al.* (1993) and Smit (2010). While the two native British species, *R. alternata* (Fallén, 1814) and *R. meigenii* (Loew, 1844) have a yellow-brown scutum, scutellum and pleura, in *R. cingulata* the thorax and abdomen are predominantly black and the scutellum is yellow with a black base. The wing bands are black with an isolated dark spot at the tip (Fig. 1).

Biology

Larvae of *Rhagoletis cingulata* develop in fruit of a range of *Prunus* species, and it is a pest of cultivated cherries. There are few if any *Prunus* species in Tout Quarry so two possibilities of its origin are considered, either elsewhere on Portland or directly from continental Europe.

Global distribution

Rhagoletis cingulata was described by Loew (1862b) as *Trypeta cingulata* from material collected by C.R. Osten-Sacken in the "Middle States" of the USA. Later Loew (1873) gave the locality as "Middle States, Long Branch, N.J., in July (Osten-Sacken)". Foote *et. al.* (1993) mapped the species as occurring mainly in the eastern States of the USA and stated that it had also been found in Canada and central Mexico. While Smit (2010) gave the European distribution as Belgium, Germany, Hungary, the Netherlands, Italy and Switzerland, CABI (2016) states that its occurrence in Italy is not confirmed and adds Austria, Croatia, the Czech Republic, France and Slovenia. The chronology of its appearance in European countries is given in the British Food and Environment Research Agency document *Rhagoletis cingulata* – summary report (https://Secure.fera.defra.gov.uk/phiw/riskRegister/plant-health/documents/rhagoletisCingulata PRAsummary.pdf) as 1983 Switzerland, 1999 Germany, 2001 Netherlands, 2004 Belgium, 2006 Croatia and Hungary, 2007 Austria and Slovenia, 2010 France.

Fig. 1. ***Rhagoletis cingulata*** **female (photo: Paul Bowyer).**

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A note on the taxonomic status of *Parochthiphila ruderalicola* Beschovski & Merz (Diptera, Chamaemyiidae) and a key for the identification of the Palaearctic species of the genus

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Summary

Parochthiphila ruderalicola Beschovski & Merz, 1998 is proposed as a junior synonym of *P. frontella* (Rondani, 1875). A key to the Palaearctic species of the genus is provided.

Introduction

Parochthiphila ruderalicola Beschovski & Merz, 1998 was described from a single male collected in Croatia. The authors drew attention to the similarity of this species to *Parochthiphila frontella* (Rondani, 1875) noting only one difference in the external characters, namely that *P. ruderalicola* lacked dark tibial rings. They acknowledged that the male postabdomen of *P. frontella* was unknown at the time.

Rondani's description of *P. frontella* appeared in 1875, not 1874 as has been given in the literature until recently. The dates of Rondani's publications and their correct citation have been elucidated by Poggi (2008) and O'Hara *et al.* (2011).

Raspi (2006) located the type, a female, of *P. frontella* in Rondani's collection housed in La Speccola Zoological Museum in Florence. He and colleagues also reared many specimens of the same species collected as immatures in Tuscany not so far from the type locality in Parma. On the basis of all this material, Raspi prepared a detailed redescription and illustrations of the male and female postabdomen as well as the immature stages, including the puparium and cephalopharyngeal skeleton. However, he made no reference to *P. ruderalicola* when he made comparisons with other species of *Parochthiphila*. Raspi's illustrations of the male postabdomen are almost identical to the illustrations of the same structures illustrated by Beschovski and Merz (1998). Of particular importance is the apical third of the aedeagus, showing the characteristic curvature and the dilated truncation of the tip. This and the detailed descriptions given in both papers demonstrate that these two taxa are identical. The posterior extension of the base of the aedeagus is drawn differently in the two articles, but this is a particularly difficult part to examine in the composite postabdomen because of overlapping structures and in any case it varies as is amply demonstrated by Tanasijtshuk (1986) in many of the species he described. Furthermore, the oblique lamina connecting the base of the aedeagus with the hypandrium may appear as an extension of the aedeagus itself, depending on the extension or otherwise of the aedeagus relative to the rest of the hypopygium. An examination of the holotype of *P. ruderalicola* confirms this. Although the postabdomen was badly stored, dry and stuck to the inside wall of a plastic tube with mountant, the aedeagus and its basal attachments are intact. Thus, the correct interpretation of this structure is as given in Fig. 22, which is based on Raspi (2006).

Tanasijtshuk (1986), in his introductory section dealing with this genus, indicated that he did not study material of *P. frontella* but, based on the description, he did not consider that it matched any of the species he described. Nevertheless, he did not include it in his key to species.

When I re-examined the specimen collected by me in Turkey, one I had identified as *P. ruderalicola* and published as such (Raspi and Ebejer 2008), I found that it is in fact *P. frontella*.

I have been able to compare this specimen with a number of specimens of *P. frontella* collected in Greece, Italy, Lebanon, Malta and Spain. It fits well within the small range of variation of *P. frontella* and particularly with regard to the coloration of the male abdomen, which is distinctly shimmering silvery-grey pollinose and the tibiae, which are always yellow, but the hind tibia often has a dark ring basally and only sometimes a dark ring at the apex. Raspi (2006) had already noted that the apical dark ring of the hind tibia is not present in all specimens and later (Raspi 2013) wrote: "The posterior tibia in the females of Sardinia is sometimes grey-dark under the dark ring close to the base. The males of Sardinia and Corsica have often small dorsal and lateral spots on abdomen and/or posterior tibia with two well visible dark rings." This degree of variability in the coloration of the legs is common in many Chamaemyiidae and cannot be relied upon as the sole character to differentiate species.

On this basis, I propose that *P. ruderalicola* Beschovski & Merz, 1998 is a junior synonym of *P. frontella* (Rondani, 1875).

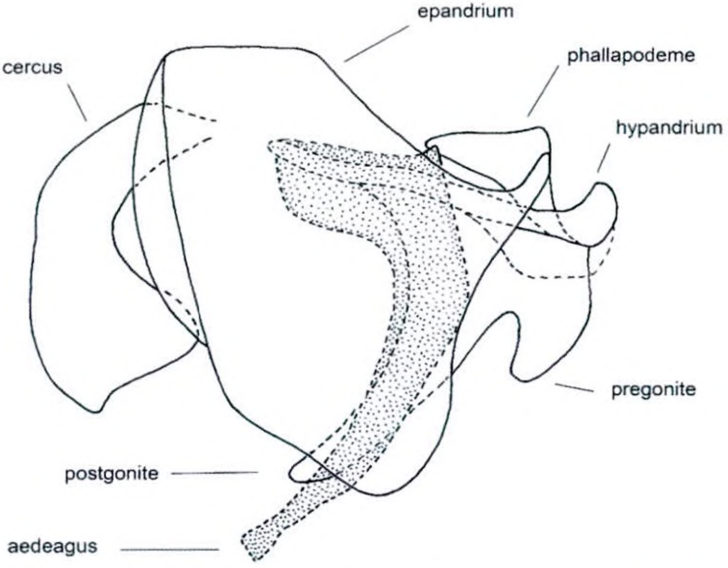
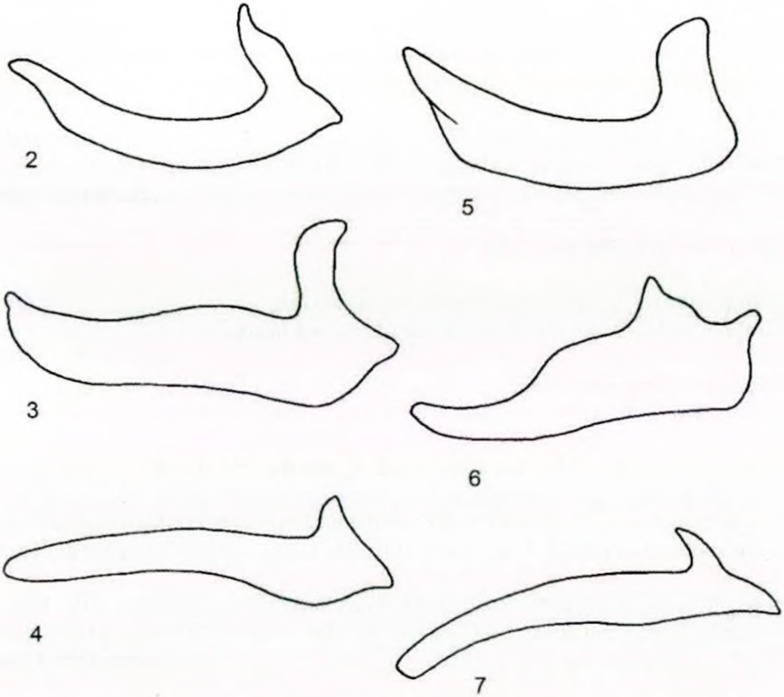


Fig 1. ***Parochthiphila frontella*** **Rondani, postabdomen redrawn from figure of** ***P. ruderalicola*** **in Beschovski and Merz (1998) to illustrate the orientation and relationships of the aedeagus.**

The identification of all Palaearctic Chamaemyiidae is difficult owing to the great similarity of external characters among closely related species and much of the literature being in Russian and not easy to obtain. However, there are external characters to help narrow down the species, which can then have their identity confirmed by careful examination of the dissected male postabdomen. Fig. 1 (after Beschovski and Merz 1998) is here redrawn, simplified and re-orientated in order to show the aedeagus in a semi-natural position for the interpretation of the terms anterior/posterior and basal/apical as used in the key. The recognition of *P. frontella* from among the 24 currently accepted species of Palaearctic *Parochthiphila* may be facilitated by the following keys and figures, modified from Tanasijtshuk (1986, 2004) to include a few more characters and the species described since. For further supporting characters the reader should consult the original texts where structures such as epandrium, pre- and postgonite, phallapodeme and sometimes the dorsal aspect of the aedeagus are illustrated.

Separation of subgenera

- Anepisternum with a seta near the posterior margin just below the middle .... subgenus ***Parochthiphila***
- Anepisternum without such seta .... subgenus ***Euestelia***



Figs 2–7. Aedeagi of *Parochthiphila* species of the subgenus *Parochthiphila* sensu stricto: 2, *P. nartshukella*; 3, *P. luppovae*; 4, *P. transcaspica*; 5, *P. inconstans*; 6, *P. spectabilis*; 7, *P. kirilli.*

Key to species of subgenus *Parochthiphila*

1. Scutum with broad vittae 2
- Scutum without vittae 3

2. Scutum with 1 + 3 dorsocentral setae; carina narrow and sharp at anterior end; aedeagus, in profile with basal posteriorly directed part almost as wide as distal part and apex of aedeagus curved slightly anteriorly (Fig. 2) .... ***nartshukella* Tanasijtshuk**

\- Scutum with 1 + 2 dorsocentral setae; carina broad and flat at anterior end; aedeagus, in profile with basal, posteriorly directed part at most half as wide as distal part and apex of aedeagus curved slightly posteriorly (Fig. 3) .... ***luppovae* Tanasijtshuk**

3\. Carina anteriorly broad; epandrium, in profile almost rectangular; aedeagus (Fig. 4) .... ***transcaspica* Frey**
\- Carina anteriorly narrow; epandrium, in profile round, oval or elongate oval 4

4\. Scutum with 1 + 2 dorsocentral setae; in dorsal view, apex of aedeagus with distinct notch (Fig. 5) .... ***inconstans* (Becker)**
\- Scutum with 1 + 3 dorsocentral setae; in dorsal view, apex of aedeagus without notch ... 5

5\. Both sexes with broad black transverse frontal band; viewed in profile, apical one third of aedeagus half as wide as basal two thirds and apex curved slightly posteriorly (Fig. 6) .... ***spectabilis* (Loew)**
\- Frons unbanded; aedeagus of almost uniform width, apex curved anteriorly (Fig.7) .... ***kirilli* Tanasijtshuk**

Key to species of subgenus *Euestelia*

1\. Scutum with 1 + 3 well-developed dorsocentral setae 2
\- Scutum with 0 + 2 to 1 + 2 well developed dorsocentrals 10

2\. Hind tibia in large part black 3
\- Hind tibia yellow, often with narrow dark ring at base and sometimes also at apex 5

3\. Tergites 3-5 of abdomen each with a pair of distinct dorsal and lateral large black spots 4
\- Tergites either unspotted or with only small dorsal spots on tergites 4–5 and small elongate lateral spots on tergites 3–5; aedeagus (Fig. 8) .... ***reichardti* Tanasijtshuk**

4\. Frons in both sexes with broad black transverse band; aedeagus with long posterior extension at base and apical part bends at an angle of about 90 degrees from the basal part (Fig. 9) .... ***kimmerica* Tanasijtshuk**

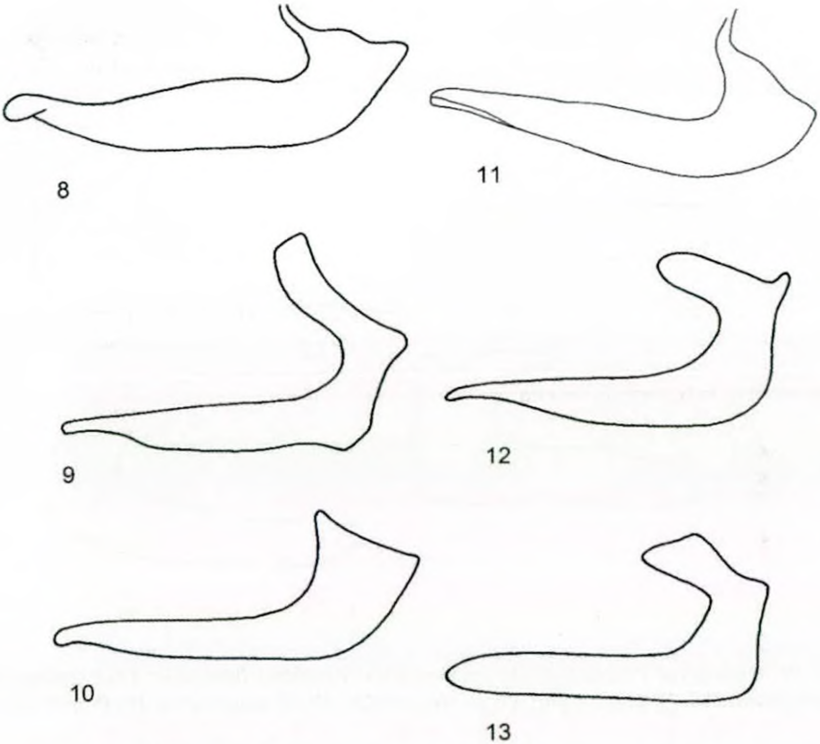
\- Frons with dark transverse band only in the female; aedeagus with very small posterior extension at base and apical part bends at an angle of much more than 90 degrees from the basal part, giving a smooth curve (Fig. 10) .... ***ephesi* Raspi**

5\. Scutum with distinct black vittae along the dorsocentral lines beneath the three posterior setae; aedeagus (Fig. 11) .... ***nigrolineata* Beschovski & Merz**
\- Scutum without vittae along the dorsocentral lines 6

6\. Pedicel of antenna black 7
\- Pedicel of antenna yellow 8

7\. Frons with dark transverse band in both sexes, broader in females; aedeagus viewed in profile with apex narrow, almost pointed and curved anteriorly (Fig. 12) .... ***coronata* (Loew)**

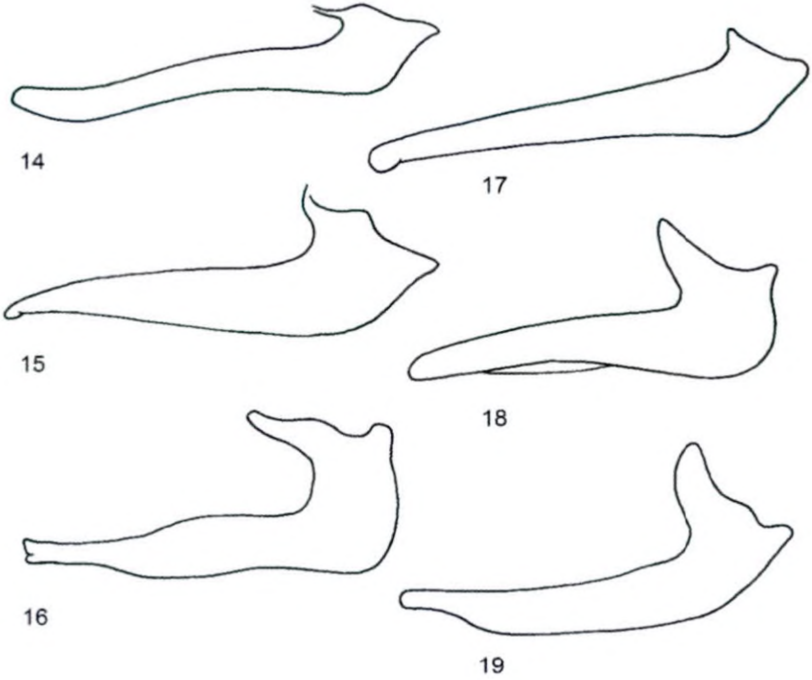
- Frons without dark transverse band; aedeagus at apex not curved and with tip more blunt (Fig. 13) ... . *lucidifrons* **Tanasijtshuk**



Figs 8–13. Aedeagi of *Parochthiphila* species of the subgenus *Euestelia*: 8, *P. reichardti*; 9. *P. kimmerica*; 10, *P. ephesi*; 11, *P. nigrolineata*; 12, *P. coronata*; 13, *P. lucidifrons*.

8. Frons without dark transverse band; hind tibia without dark ring at base; viewed in profile, aedeagus narrow, more or less parallel sided, slightly undulating and angle with basal part very obtuse, tip curved slightly posteriorly (Fig. 14) .... ***pallidovittata*** **Tanasijtshuk**
- Frons with dark transverse band; hind tibia with or without dark ring at base; aedeagus not parallel sided, distinctly broader towards base 9

9. Hind tibia with distinct dark bands; aedeagus with very obtuse angle between apical and basal parts and short posterior extension at base (Fig. 15) .... *trjapitzini* **Tanasijtshuk**
- Hind tibia without dark rings at base; aedeagus with almost 90-degree bend between apical and basal parts and with long extension posteriorly at base (Fig. 16) .... *argentiseta* **Ebejer & Raspi**



Figs 14–19. Aedeagi of *Parochthiphila* species of the subgenus *Euestelia*: 14, *P. pallidovittata*; 15, *P. trjapitzini*; 16, *P. argentiseta*; 17, *P. elegantella*; 18, *P. transversa*; 19, *P. nigripes*.

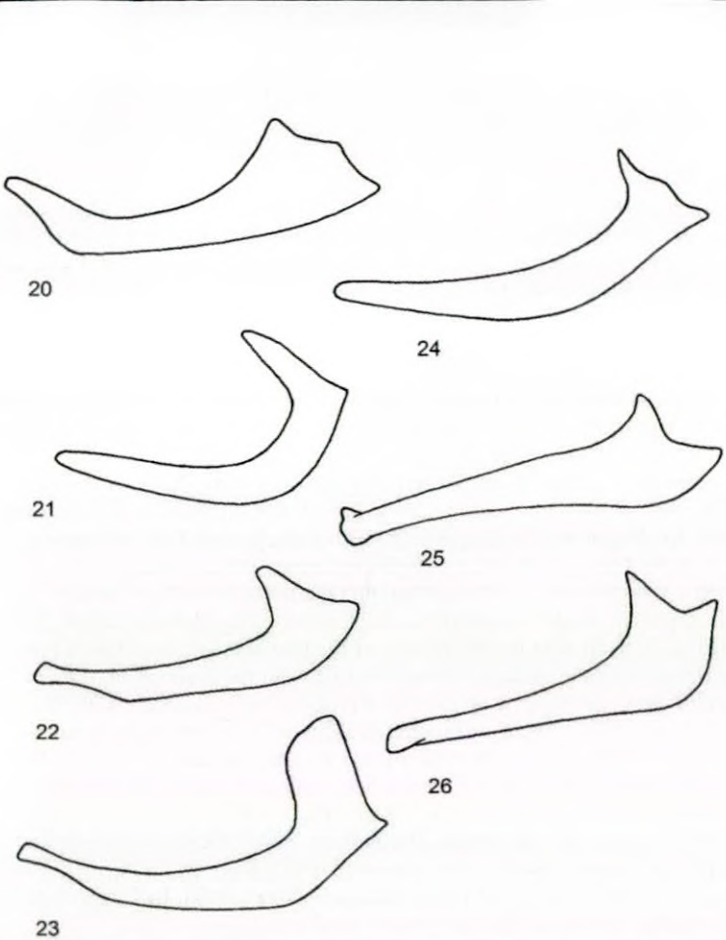
10. Paired spots on abdominal tergites 3–5 very large and frequently join to form transverse bands 11
- Paired spots on abdominal tergites 3–5, when present, small and well-separated from each other 12

11. Pedicel of antenna and tibiae yellow; aedeagus (Fig. 17) .... ***elegantella* Tanasijtshuk**
- Pedicel of antenna and tibiae black; aedeagus (Fig. 18) .... ***transversa* Hennig**

12. Hind tibia black, at least over more than middle third 13
- Hind tibia yellow, sometimes with dark ring at base 15

13. Frontal transverse band broad and complete; viewed in profile, aedeagus at apex half as broad as at curvature near base (Fig. 19) .... ***nigripes* Strobl**
- Frontal transverse band faint or absent; aedeagus more uniform in width 14

14. Apex of aedeagus narrower than middle section and curved dorsally; posterior extension at base short (Fig. 20) .... ***intermedia* Tanasijtshuk**



Figs 20–26. Aedeagi of *Parochthiphila* species of the subgenus *Euestelia*: 20, *P. intermedia*; 21, *P. freidbergi*; 22, *P. frontella* (after Raspi); 23, *P. frontella* (after Beschovski and Merz); 24, *P. gracilipyga*; 25, *P. stackelbergi*; 26, *P. decipia*.

\- Apex of aedeagus not narrower than middle section and not curved dorsally; posterior extension at base long (Fig. 21) ....*freidbergi* **Tanasijtshuk**

15. 0 + 2 dorsocentral setae (a weak presutural dc sometimes present); male abdomen distinctly silvery-grey and without spots; aedeagus (Figs 22, 23) ....***frontella* (Rondani)**
\- 1 + 2 dorsocentral setae; abdomen with spots on tergites 3–5 16

16. Pedicel of antenna black; hind tibia with dark ring at base; aedeagus with broad curve near middle (Fig. 24) ....***gracilipyga* Tanasijtshuk**
\- Pedicel of antenna yellow; hind tibia yellow with only weak ring at base 17

17 Frons with narrow dark transverse band; hind tibia with weak ring at base; base of aedeagus with weak bend (Fig. 25) ....***stackelbergi* Tanasijtshuk**

- Frons with broad dark transverse band; hind tibia with weak ring at base; base of aedeagus with a marked bend (Fig. 26) .... *decipia* **Tanasijtshuk**

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I would like to thank Prof. Alfio Raspi (University of Pisa, Italy) for kindly reading an earlier draft of this paper and making valuable suggestions and corrections. I am also grateful to Dr. Michael Greeff, ETH Entomological Collection, Swiss Federal Institute of Technology, Zurich, Switzerland for kindly arranging the loan of the holotype of *P. ruderalicola*.

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Dipterists Digest 2016 **23**, 107-110

Leucophenga hungarica Papp (Diptera, Drosophilidae) new to Britain

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Summary

Leucophenga hungarica Papp, 1991 is added to the British list on the basis of seven specimens from four localities in southern England.

Introduction

Leucophenga Mik, 1886 is a large genus worldwide, but with only four species in Europe, to which Bächli *et al.* (2004) provide a key. Only one of these species, *L. maculata* (Dufour, 1839) has previously been known in Britain. It is a frequent species in woodland and develops in saproxylic fungi, the recorded hosts including a wide range of polypores but also oyster mushrooms (*Pleurotus*); records from gill fungi and boletes require confirmation. It is very distinctive among European Drosophilidae in having a silvery thorax in the male. Its female has the thorax brownish yellow without any silver coloration, but both sexes have a distinctive pattern of large dark spots on the yellow abdomen. Such sexual dimorphism (males with silvery areas on frons, mesonotum and abdomen) is common in the genus, but the other three European species have no sexual differences in coloration.

On 4 June 2015, in Windsor Great Park, Berkshire, I swept a female *Leucophenga*, which clearly differed in coloration from *L. maculata* in having the abdominal markings restricted to a dark median stripe and posterior margins to tergites 2-4. This was readily identified using Bächli *et al.* (2004) as *L. hungarica* Papp, 2000. Further searches were unsuccessful until 30 June 2016, when another female was found in the same area, the vicinity of a partly shaded stream between the Bishops Gate entrance and the Cow Pond. This stream borders a *Rhododendron* thicket on the east side and has open mixed broad-leaved woodland on the west side.

Then, during the Dipterists Forum summer field meeting based at Canterbury in July 2016, a male of this species was caught by Martin Drake at Ham Street Woods NNR on 6 July. This was swept in mixed broad-leaved woodland, probably in one of the wetter areas but the precise location was not noted. I accompanied him at this site, but did not find this species then or on a return visit two days later.

In the same week, on 8 July 2016, David Gibbs swept two males of *L. hungarica* from the trunk of a large beech tree at Dell Park, Englefield Green, Surrey, located very close to the Windsor site (the county boundary intervening), suggesting that the species is well established in that area. Ivan Perry was alerted to these findings before a trip to the New Forest later in the month. It was perhaps not a surprise when he found *L. hungarica* at Pondhead Inclosure on 19 and 20 July, sweeping a female on each of these days from a shaded drainage channel in coppiced mixed woodland.

For such a distinctive species to be found in these widely separated areas in such quick succession, it seems likely to be the result of a recent spread, and it is concluded that it may be another recent arrival in Britain. László Papp (*pers. comm.*) informed me that he found it for the first time in Hungary in 1999, although he had collected Drosophilidae on a large scale for many years previously. It had, however, been found in the Czech Republic in 1990 and in Slovakia as early as 1973 (Papp 2000), so it was possibly a very rare species that had enjoyed a recent local increase in Central Europe that enhanced the chance of its discovery by dipterists.

British records of *L. hungarica*

Kent: Ham Street Woods NNR (TR0034), 6.vii.2016, 1♂ (C.M. Drake). **Berkshire:** Windsor Great Park, near stream north of Cow Pond (SU976718), 4.vi.2015, 1♀; same location, 30.vi.2016, 1♀ (P.J. Chandler). **Surrey:** Englefield Green, Dell Park (SU98037159), 2♂, 8.vii.2016 (D.J. Gibbs). **Hampshire:** New Forest, Pondhead Inclosure (SU300074), 19.vii.2016, 1♀; same location, 20.vii.2016, 1♀ (I. Perry).

European distribution

Papp (2000) described this species from 35 males and 79 females collected at several localities in Hungary, the Czech Republic and Slovakia. Máca (2009) and Máca *et al.* (2013) included further records from the Czech Republic; Máca and Roháček (2009) gave further records from Slovakia. Bächli *et al.* (2002) and Merz *et al.* (2001) recorded it from Switzerland, on two females found near Zürich in 1998. Bächli *et al.* (2006) reported a second record for Switzerland, collected by trapping at the edge of a beech forest. A male was recorded from Bavaria, Germany in 2006 (Schacht *et al.* 2007). Carles-Tolrá (2009) recorded two males and 11 females trapped in 2006 and 2007 by Dr Santiago Pagola-Carte in the Aiako Harria Natural Park, Guipúzcoa province, Spain. Máca (2011) recorded one female trapped in 2008 from the Lake Kerkini region of Greece. These records may indicate a recent increase in range, although the regions involved in Spain and Greece have been poorly investigated until recently, and are adding many national records.

Identification

Leucophenga hungarica is a medium-sized drosophilid; the type series had the wing length range 3.8-4.7mm (male), 4.0-5.0 (female). It is easily recognised by its mainly yellow coloration, with an entirely yellow thorax and a distinctive abdominal pattern, similar in both sexes but with some variation. Bächli *et al.* (2004) figured the abdominal patterns of the four European species. The specimens examined have the marginal bands broader than illustrated by them for this species, as shown in Fig. 1, and a median spot on the apical margin of tergite 5 shown in their figure is absent.

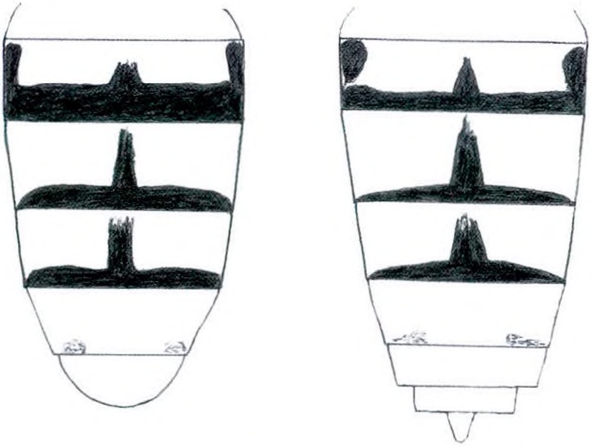

Fig. 1. Abdominal pattern of *Leucophenga hungarica*: left, male from Ham Street Woods NNR; right, female from Windsor Great Park.

Papp (2000) considered that its closest relative is the Korean species *L. sorii* Kang, Lee & Bahng, 1965, which has small differences in the abdominal pattern, including a medially interrupted marginal band on tergite 5. He figured the male genitalia of both species for comparison. Subsequently Bächli *et al.* (2002) described a further member of the same species group, *L. helvetica* Bächli, Vilela & Haring, 2002, from a single male collected in Ticino, Switzerland. They figured the male genitalia of both *L. hungarica* and *L. helvetica*. The latter species differs from *L. hungarica* in having the median abdominal stripe broader posteriorly on each tergite and the posterior marginal band on tergites 2-4 expanded forwards laterally, thus appearing intermediate with the pattern of three separate spots on each of these tergites in *L. maculata*. The fourth European species, *L. quinquemaculata* Strobl, 1893 has a similar pattern to *L. helvetica* but with the apical bands less expanded laterally and it is easily distinguished by the presence of brownish shades over the crossveins and at the tips of the radial veins, while the other three European species have the wings clear and unmarked.

The male from Ham Street Woods has been dissected and compared with the figures in Bächli *et al.* (2002), and agrees in structure with those of *L. hungarica*. The genitalia are quite small and entirely pale yellow in colour, with the surstyli short, broader than long and blunt apically as in *L. quinquemaculata*, while they are distinctly longer than broad and apically rounded in side view in the other two European species; *L. sorii* has the surstyli blunt-ended as in *L. hungarica* but longer than broad. In *L. maculata* the surstyli are distinctly larger and longer than half the height of the epandrium (shorter than half its height in the other species).

Biology

This is unconfirmed but it is considered likely that it is a fungus feeder like the other British species *L. maculata*; *L. quinquemaculata* has also been reared from a fungus, the birch polypore *Piptoporus betulinus*, in Norway (Bächli and Thunes 1992). Papp (2000) found 10 males and 23 females of *L. hungarica*, including the holotype, on a 'tinder fungus on mouldy oak'; these and most specimens from other Hungarian localities were found above or adjacent to brooks. The Czech and Slovak material collected by Jindřich Roháček was from 'rotting tree trunks', on unnamed 'tree fungi' or swept from undergrowth in deciduous forests. László Papp (*pers. comm.*) has informed me that "one can find it on old trees fallen over shaded streamlets", and that the fungus on which he found it was a species of *Pleurotus* (oyster mushrooms).

Acknowledgements

I am grateful to László Papp for information on his experience of this species in Hungary and for comments on a draft of this paper, and to Martin Drake, David Gibbs and Ivan Perry for enabling me to include their records here. Gerhard Bächli also commented on a draft and kindly provided literature references to the occurrence of this species in other parts of Europe.

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Dipterists Digest 2016 **23,** 111-115

Clogmia albipunctata (Williston) (Diptera, Psychodidae) in London

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Summary

Clogmia albipunctata (Williston, 1893) has been recorded at a number of sites in London. Globally this species is common and widespread and its arrival in Britain is a predictable continuation of a recent range expansion across Europe. Here we describe characters that can be used to identify *Clogmia albipunctata* and we discuss the implications of this species becoming established in Britain.

Introduction

Clogmia albipunctata (Williston, 1893) is a common species around most of the world, particularly in the tropics and subtropics, but also extending into temperate regions (Duckhouse 1978, Wagner 1991, Werner 1997, Ibáñez-Bernal 2008, Marshall 2012). The first European record of *C. albipunctata* was made in Spain nearly a hundred years ago (Barcelona, August 1920) under the synonym *Telmatoscopus meridionalis* (Eaton, 1894) (Tonnoir 1920). *Clogmia albipunctata* had become established in southern France by at least 1955, when Mirouse described it as the new species *Telmatoscopus haranti* (Mirouse 1958) (Wagner 1991). It is in recent decades that the spread of *C. albipunctata* across mainland Europe seems to have accelerated. This species was first reported from Germany in 1993, Belgium in 2004, the Netherlands and Slovakia in 2005 and the Czech Republic in 2011, and it is known to occur in Italy, Slovenia, Sardinia, Turkey, Greece and Croatia (Werner 1997, Boumans *et al.* 2009, Oboňa and Ježek 2012, Wagner *et al.* 2013, Šuláková *et al.* 2014).

Although Psychodidae are not as well recorded as other Diptera families, the large size and distinctive wing pattern of *Clogmia albipunctata* makes it possible to recognise this species in the field. This implies that this species has not been overlooked and the recent increase in European records represents a genuine range expansion. Boumans *et al.* (2009) suggested that *C. albipunctata* was probably well-distributed across Europe, with the possible exclusion of Britain and Scandinavia. Interestingly, Wagner *et al.* (2013) make a passing reference to *C. albipunctata* occurring in England, but they do not mention dates or locations.

Records

The first London (and British) record we are aware of came in 2012 from a brewery (TQ325802) near Borough Market, where this fly was reported in abundance. A single specimen was sent to Tony Irwin for identification. Unfortunately, the specimen lacked an abdomen but could be recognised as *Clogmia albipunctata* by its wing markings and large size. The brewery in question no longer operates, but this part of London should have plenty of synanthropic habitats that would support *C. albipunctata*, so it is likely that populations persist in this area.

More recently *Clogmia albipunctata* was identified by DS from a pest-monitoring trap in the Natural History Museum in South Kensington (TQ2679). The trap (Fig. 1) was set in a mammal storage room from 28 July to 24 September 2015, then passed to the Diptera section to identify the flies that had been caught. Most of these flies were *Muscina stabulans* (Fallén) and *M. prolapsa* (Harris) (Muscidae), but the trap had also caught some large psychodids which looked like *C. albipunctata*, based on their size and wing pattern (Figs 2-3). These specimens were slide mounted and their identification confirmed using genitalia and other characters (Figs

4-5). At around the same time, in September and October 2015, DS also collected and slide-mounted *C. albipunctata* from an industrial basement in west London (TQ17) (Figs 6-9). More recently in 2016 DS has found this species at Paddington Station (TQ265812) and in central Woolwich (TQ437789).

Additional London records of *Clogmia albipunctata* have been made by Max Barclay (Natural History Museum) in the past two years, with identifications confirmed by Jan Ježek (Prague Museum). The details of these records will be published by Max and Jan in a separate note.

Identification

The size, resting habit and colour pattern of *C. albipunctata* are significantly distinct amongst European Psychodidae to make this species recognisable in the field (Boumans *et al.* 2009, Oboňa and Ježek 2012). The wings of *C. albipunctata* are 3-4 mm long, which is much larger than most British psychodids, and the adults splay their wings away from the abdomen while holding them parallel to the substrate. The wings are not held tent-like, at an angle over the abdomen, which is a common stance for many British psychodids at rest.

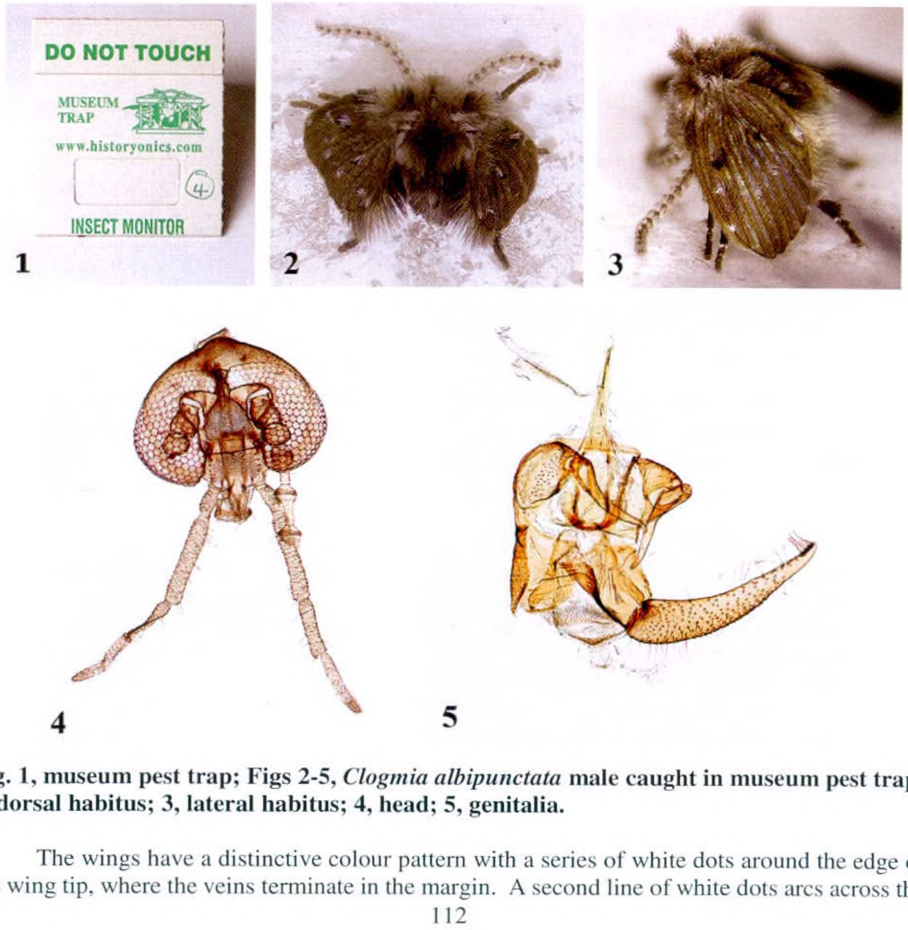

Fig. 1, museum pest trap; Figs 2-5, *Clogmia albipunctata* male caught in museum pest trap: 2, dorsal habitus; 3, lateral habitus; 4, head; 5, genitalia.

The wings have a distinctive colour pattern with a series of white dots around the edge of the wing tip, where the veins terminate in the margin. A second line of white dots arcs across the middle of the wing and two black dots lie basal of this line near the forks of veins R_2 and R_3, and M_1 and M_2. In addition, a line of reddish-brown macrotrichia runs along vein R_{1+2}, nearly meeting the anterior of these black dots. Caution is required when examining old or worn specimens that have lost some of their macrotrichia. Specimens kept in alcohol quickly shed their macrotrichia, so the wing pattern should be examined before specimens are preserved in spirit.

Although these field recognition characters are available, it is still advisable to slide mount voucher specimens to confirm identification. *Clogmia albipunctata* tends to be abundant where it occurs, so collecting specimens should not be difficult. The genus *Clogmia* does not feature in the current key to British Psychodidae (Withers 1989). Specimens of *C. albipuncata* should run to the genus *Mormia*, but will then fail at the first species couplet. Alternatively, specimens may key out as *Telmatoscopus* if the antennal ascoids are obscure, but these will then run to the end of the species key where male genitalia will not match the options available. At either point *C. albipuncata* should be suspected, if it wasn't already, and the genitalia compared against the photographs we present here (Figs 5-7). Ibáñez-Bernal (2008) also provides good illustrations of *C. albipuncata* morphology.


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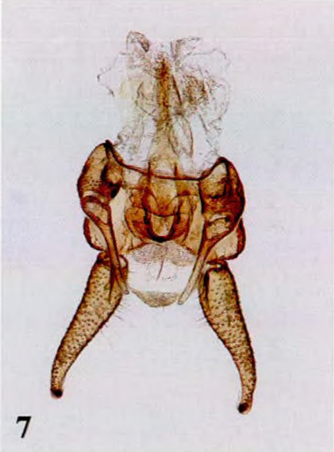
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Fig. 6, female cerci and genital plate. Fig. 7, genitalia of male *C. albipunctata* caught in west London.

Ecology

Clogmia albipunctata occurs naturally in water-filled rot-holes in trees, particularly in the tropical and subtropical parts of its range (Boumans *et al.* 2009, Oboňa and Ježek 2012). This fly is also very common and abundant in synanthropic habitats and is one of the most widespread drain flies across the globe (Ibáñez-Bernal 2008, Marshall 2012). The vast majority of European records for *C. albipunctata* are from synanthropic sites. In Slovakia *Clogmia albipunctata* has been recorded from the same rot-hole in an oak tree in two consecutive years (Ježek *et al.* 2012); however, as *C. albipunctata* appears unable to survive the winter outdoors at this latitude it is assumed this rot hole must have been recolonised from nearby synanthropic populations (Oboňa and Ježek 2012).

There are potential health and hygiene implications associated with the arrival of *C. albipunctata* in Britain. Drain flies such as this are indicative of sources of rotting organic matter in synanthropic situations. Although typically a symptom rather than a cause of poor hygiene, *C. albipunctata* adults do have the potential to spread infection mechanically, which is a concern as outbreaks of the fly have occurred in hospitals in Belgium and Germany (Faulde and Spiesberger 2012). Larvae of *C. albipunctata* have been reported in cases of nasal, enteric and urogenital myiases in humans (Singh and Singh 2015). However, as with many other Diptera species that have the potential to cause myiasis, such occurrences would only be likely in Britain in circumstances of very poor hygiene or extreme neglect.

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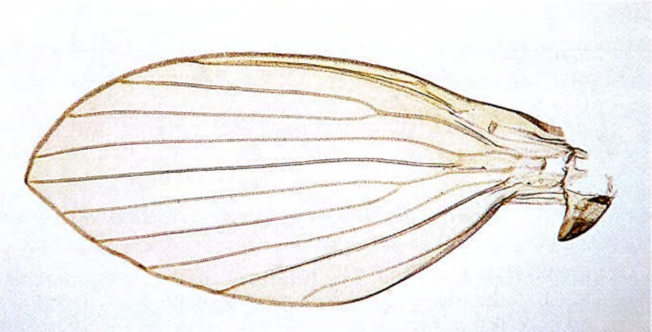

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Figs 8-9, *Clogmia albipunctata* male caught in west London (the same individual as Fig. 7): Fig. 8, head and antennae of male; Fig. 9, wing of male.

Conclusions

Clogmia albipunctata appears to be well-established in London and we suspect that this fly will soon extend its range outside the city, if it has not done so already, especially considering this species' ability to thrive in synanthropic environments. The large size and distinctive wing pattern of this fly should enable us to monitor any range expansion that might occur in future years. Photographs can be used to generate records of this species, provided the images are clear and the individuals are not too worn. Outdoor records of *C. albipunctata* will be of particular interest, however, as they will show whether this fly is capable of breeding in the wild in Britain and at what times of the year.

The generic status of *Clogmia* needs to be reviewed, however, as it is currently treated as a synonym of *Telmatoscopus* in the British checklist (see checklist changes, p. 54 in this issue). Here we have followed the wider European convention of treating *Clogmia* as a full genus; we do so without prejudice, merely to remain consistent with the bulk of literature that is available.

Acknowledgements

We would like to thank Martin Warren for sending the original specimen of *Clogmia albipunctata* to Tony Irwin and making us aware of this species' presence in London. Thanks also to Max Barclay for sharing information on his own *C. albipunctata* records for London. All images (Figs 1-9) are copyright of the Trustees of the Natural History Museum.

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Phaonia tiefii (Schnabl) (Diptera, Muscidae) new to Britain

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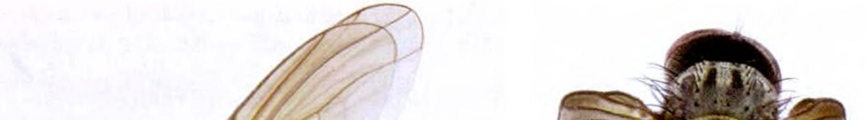
Summary

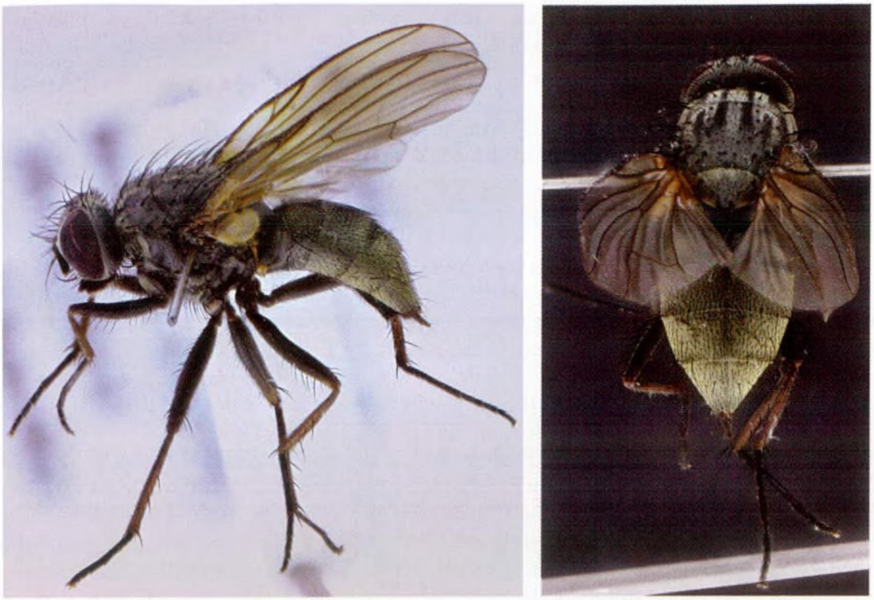
Phaonia tiefii (Schnabl, 1888) is added to the British list from three localities in southern England.

Introduction

Since 2011, IP has been finding males that he identified as *Phaonia tiefii* (Schnabl, 1888) at the Warburg Reserve, Oxfordshire. In 2015 PJC found a female at Windsor Great Park, Berkshire that also appeared to belong this species. In both cases they ran to *P. tiefii* in the keys by Gregor *et al.* (2002); in the British handbook (d'Assis-Fonseca 1968) they run close to *P. palpata*, which they resemble in leg coloration. The female and a 2011 male were referred to Adrian Pont, who compared them with specimens of *P. tiefii* in the collections of the Natural History Museum, London, and confirmed the identification. It was later realised that a male collected by PJC at Bushy Park, Middlesex in 2013, and recorded by Chandler (2015) as *P. palpata*, was also *P. tiefii*. It cannot be confirmed whether the earlier records of *P. palpata* (1 male, 3 females) reported by Chandler (2015) from Bushy Park, trapped at Round Plantation in September – October 2010 by Nigel Reeve, also relate to *P. tiefii*. A further male was found at Windsor on 14 July 2016.



Figs 1-2. *Phaonia tiefii*, male, Warburg Reserve, 1.vi.2011, lateral and dorsal views.



Figs 3-4. ***Phaonia tiefii*, female, Windsor Great Park, lateral and dorsal views.**

It could have previously been confused with *P. palpata* in collections but James McGill kindly checked all the British specimens under *P. palpata* at the Natural History Museum, London and Adrian Pont similarly checked the collection at the Oxford University Museum of Natural History. They found no further examples of *P. tiefii*.

Material examined

Oxfordshire: Warburg Reserve (SU715879), 1.vi.2011 1♂, 3.ix.2011 1♂, 13.v.2012 1♂, 23.vi.2012 1♂, 11.vii.2015 1♂ (all I. Perry). **Berkshire:** Windsor Great Park, Cow Pond area (SU9771) 28.viii.2015 1♀ swept from heather *Calluna vulgaris* flowers; 14.vii.2016 1♂ around fallen beech wood (P.J. Chandler). **Middlesex:** Bushy Park, Waterhouse woodland garden (TQ1469), 20.viii.2013 1♂ (P.J. Chandler).

Recognition

The characters in the keys by Gregor *et al.* (2002) enable *P. tiefii* (Figs 1-4) to be recognised. The leg colour, with the tibiae yellow in contrast to the dark femora and tarsi, is as in *P. palpata*. It differs from that species in the complete absence of posterior bristles on the front tibia, while a single median posterior bristle is present in *P. palpata*. There are four postsutural dorsocentrals (usually three in *P. palpata*) with the first two a little shorter than the rear two. The presutural acrostichals in *P. tiefii* are denser in 6-8 rows and all approximately similar in length (3-4 rows with some noticeably longer than others in *P. palpata*). The median stripe on the abdomen is less expanded posteriorly on each tergite than in *P. palpata*; it varies in colour according to view, becoming more distinct and appearing dark brown in posterior view, but becoming indistinct and merging into the background dusting in anterior view. The abdominal markings are more irregular and shifting in extent between dorsal and posterior views in *P. palpata*. Overall the dusting is brownish, while in *P. palpata* it is greyish.

The males examined vary in size, wing length in the range 5.9-8.0mm and body 6.6-9.0mm. The one female is wing 7.3mm, body 8.5mm.

Biology and distribution

Our specimens were from relatively dry woodland, in the case of the Berkshire and Oxfordshire sites dominated by beech (absent from the Middlesex site). This suggested that the required habitat for *P. tiefii* is drier than that of *P. palpata*, which is principally found in wet woodlands although it has also been recorded from the Warburg Reserve, from the Highstanding Hill woods at Windsor and on 14 July 2016 a female was caught by the streams between Bishops Gate and the Cow Pond, near where *P. tiefii* has been found. However, Krivosheina (2013) reared both *P. tiefii* and *P. palpata* from decaying beech (*Fagus sylvatica*) wood in the Transcarpathian Mountains of the Ukraine, suggesting an overlap in habitats. She also reared *P. tiefii* from lime wood (*Tilia*, as linden) in the Tula province of southern European Russia, and also mentioned birch (*Betula*) wood but without further details. She described the larvae and puparia of both species and provided keys to separate them. The larvae of *P. tiefii* were said to develop in "moist soft wood of deciduous trees" and to feed on larvae of Clusiidae (Diptera).

Phaonia tiefii is widespread in Europe. In addition to the mentioned occurrence in Russia and the Ukraine, there are records from France (including Corsica), Germany, Denmark, Sweden, Finland, Poland, Austria, Hungary, the Czech Republic, Slovakia, Bulgaria and Greece, and it also reaches the Eastern Palaearctic and the Near East (Pont 2005). Its occurrence in Britain is not therefore surprising. However, its absence from older collections and its recent appearance at three localities in southern England suggest that it may be another new arrival in this country although, as a saproxylic species, it is apparently restricted to areas of ancient woodland. It will be interesting to see if it is subsequently found more widely.

Acknowledgements

We are grateful to Adrian Pont for confirming the identity of our specimens, to James McGill for checking the British collection at the Natural History Museum, London, and to Dawn Painter for kindly supplying the photographs to illustrate this article. IP thanks BBOWT for permission to record at the Warburg Reserve; PJC thanks the Crown Estates for permission to survey the Diptera of Windsor Forest and Great Park, and the Royal Parks ecologists for enabling his visits to Bushy Park.

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