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COLLECTIONS OF ICHNEUMONID WASPS (SUBFAMILIES DIACRITINAE, DIPLAZONTINAE, PIMPLINAE AND POEMENIINAE) FROM WOODLANDS NEAR YORK AND THEIR IMPLICATIONS FOR CONSERVATION PLANNING

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Introduction

Conservation planning is largely based on knowledge of the distribution and abundance of organisms. However, such knowledge is biased, taxonomically and hence functionally, particularly towards vertebrates and other large readily-identifiable organisms (Samways, 2005; IUCN, 2007). One possible consequence of this knowledge bias is that other taxa may be less well served by conservation planning. This situation is particularly problematic when it is considered that the latter category of organisms includes the majority of species, many of which provide essential ecosystem services (Samways, 2005).

Parasitic wasps comprise a sizeable component of terrestrial biodiversity, including 25% of all British insect species (Shaw & Hochberg, 2001). The vast majority develop as parasitoids, growing to maturity on the still-living body of another host arthropod, eventually killing it. Parasitoids are a substantial component of higher trophic levels in terrestrial ecosystems, and a major source of mortality in herbivorous insects (see Hawkins, 1994). Operating at higher trophic levels suggests an intrinsic vulnerability to extinction (Purvis *et al.*, 2000), and this may be exacerbated by the high degree of trophic specialization displayed by many species. Indeed, there is evidence that parasitoids are highly sensitive to several extinction threats, such as habitat fragmentation (Kruess & Tscharntke, 1994), and climate change (Stireman *et al.*, 2005). These facts collectively suggest a strong case for including parasitic wasps in conservation planning, but this has almost entirely failed to happen, a fact illustrated by the almost complete absence of any parasitoids from red data books in the UK or elsewhere (Shaw & Hochberg, 2001). Perhaps the greatest hindrance to this is a lack of species-level biological knowledge, for example on population status, detailed host ranges, habitat requirements, and geographic distribution, which has made it impossible to apply species-level conservation. This in turn may largely be due to a perceived lack of taxonomic tractability, something that is no longer the case for a number of groups (Shaw & Hochberg, 2001). Indeed, parasitic wasps, in addition to being highly collectable, provide excellent opportunities for amateur naturalists to make real advances in knowledge that could be of use to conservation.

In addition to the lack of species-level knowledge, is a general lack of knowledge of how parasitoid communities vary within and across habitats (Fraser *et al.*, 2007). In principle, such knowledge could enable parasitoids to be conserved effectively via the conservation of an appropriate range, quantity and connectivity of habitats. However, the relevance of habitat classifications used in conservation, such as the National Vegetation Classification in the UK, to parasitoid wasps is unknown; recent attempts to explicitly include insects in habitat classification schemes (e.g. Webb & Lott, 2006) fail to consider

parasitoids or parasitic wasps. The above information suggests that there may be real problems with parasitoid conservation that are widely unappreciated. The limited data on population declines also suggests this; for example, Shaw (2006), reviewing British Pimplinae and Poemeniinae (Ichneumonidae), noted a worrying absence of recent specimens of nine species (8% of British spp.), whilst Thirion (1981) was unable to find 32 (26%) spp. of Belgian Ichneumoninae during a 25-year collecting period, with another 30 species (25%) showing major declines.

The overall aim of our study was to provide some of the first information on habitat indicators of abundance and diversity for parasitoid wasps, which might hence allow parasitoids to be incorporated into conservation planning, particularly with respect to identifying priority habitats, to managing existing habitats, or to planning new habitat creation in appropriate ways. In order to accomplish this, we made extensive collections of four subfamilies of ichneumonids (Hymenoptera: Ichneumonidae) from 15 woods near York in 2003, and more intensive collections from two of the 15 in 2004.

Woodlands were chosen as the focus of our study for both practical and theoretical reasons. Practically, woodlands provide discrete and easily identifiable habitat patches to use as sampling units, which are relatively free from disturbance, with a broad range of vegetation types. Theoretically, they serve as major biodiversity reservoirs in agricultural landscapes (e.g. Petit & Usher, 1998), and are the subject of ongoing debate and change in conservation management practices (Forestry Commission, 2002, 2004; Rackham, 2006). We therefore felt that there was the potential to make immediate recommendations that might bring parasitoids into consideration. Although it was not the main focus of our study, our collections have provided information on the abundance, geographic distribution, and habitat preferences of many species. They may also have potential as baseline data for future monitoring. Our aim in this paper is to summarize the latter information.

Methods

Taxa Studied

Four moderately related ichneumonid sub-families (cf. Wahl & Gauld, 1998) were chosen for study: Diacritinae, Diplazontinae, Pimplinae, and Poemeniinae. These sub-families show a variety of life histories and have useable species level keys (Beirne, 1941; Fitton *et al.*, 1988). They have also been used as biodiversity indicators in diverse geographic locations (see Thirion, 1994; Gaston & Gauld, 1993; Sääksjärvi *et al.*, 2004).

The Diplazontinae is a relatively small sub-family with 56 species in 12 genera in the British Isles (Broad, 2008). All species encountered in our study are thought to be endoparasitoids of aphidophagous Syrphidae (Diptera). For further details of species' biology, Kerrich (1949) gives some details on English distributions, and Beirne (1941) some brief information on distribution and abundance. Nomenclature changes mean that the latter need to be used in conjunction with Broad (2008). Thirion (1994) provides an overview on species' biology in Belgium and includes world distribution data, habitats, and lists host records from the literature, many of which are likely to be erroneous. A more reliable, but less complete, source for the latter is Fitton and Rotheray (1982), which gives some other biological details.

The sub-family Pimplinae exhibits a wider range of life histories and hosts than any other sub-family of the Ichneumonidae (Fitton *et al.*, 1988). In the British Isles, there are 107 species in 31 genera (Broad, 2008). The sub-families Poemeniinae and Diacritinae were previously grouped within the Pimplinae (Fitton *et al.*, 1988) and were included in this study for that reason, although they are now recognised as distinct sub-families (Wahl & Gauld, 1998; Gauld *et al.*, 2002). The Poemeniinae contain six species in the British Isles (Broad, 2008). Members of the Poemeniinae develop as ectoparasitoids and are most often collected in association with dead and standing timber (Fitton *et al.*, 1988). Details on biology and British distribution of Pimplinae and Poemeniinae are given in Fitton et al. (1988), and Shaw (2006), which should be used in conjunction. Global distributions of European species are given by Zwakhals (2004).

Diacritinae is one of the few sub-families of Ichneumonidae for which the hosts are completely unknown (Wahl & Gauld, 1998). In Europe only one species is known, *Diacritus aciculatus* (Vollenhoven) (Fitton *et al.*, 1988).

Study Area

Fifteen woodlands in the Vale of York were chosen for extensive sampling at the landscape-scale in 2003 (see Fraser *et al.*, 2007) and two of these were selected for intensive patch-scale analyses in 2004 (see Fraser *et al.*, 2008a) (Fig. 1). The chosen woodlands were all larger than 2 ha since smaller patches of habitat may not be capable of supporting insect communities distinct from surrounding habitats (Levenson, 1981). Although no maximum size was determined for the selection of woodlands, selection was limited to farm woodlands which are relatively small with none of those used here exceeding 20 ha (Table 1). As can be seen (Fig. 1), the woods sampled span a fairly wide geographic area, although some woods are separated by only a few tens of metres.

Sampling

Malaise traps are a form of flight interception trap which are generally considered to be the best means of obtaining large, general samples of Ichneumonidae from most habitats (Fitton *et al.*, 1988), and which have been used extensively for this purpose (Owen & Owen, 1974; Noyes, 1989a, 1989b; Owen, 1991; Bartlett *et al.*, 1999; Sperber *et al.*, 2004). These traps sample the field-herb layer and only provide data on assemblages using or flying through this part of the woodland. The trap operates continuously and may be left unattended (Fitton *et al.*, 1988) therefore allowing the collection of multiple samples over the same time period. The traps used in this study were supplied by Marris House Nets (Bournemouth, UK) and follow the design of Townes (1972). The Malaise traps were all

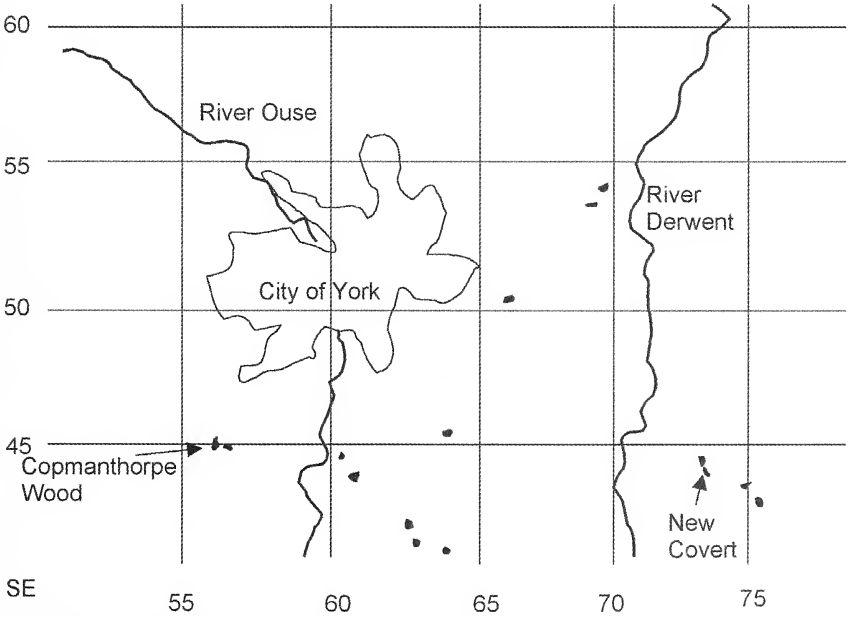

FIGURE 1. Locations of the two woods studied in 2003 and 2004 are labelled and grid cells (5 x 5km based on OS co-ordinates) provided.

TABLE 1. Details of study woodlands.

Woodland name	Grid reference	Size (ha)	Habitat†	Ground species richness*	Tree/ shrub species richness	Most common Tree/ shrub	Plant height diversity α **	Plant architect. diversity α **	Tree/ shrub density (m^{-2})	Canopy cover %	Ground cover %	Broadleaf content %	Wasp abundance 2003	Wasp species 2003
Copmanthorpe Wood	SE 562 450	6	Mixed	9	10	Silver birch	2.177	3.770	2.01	96.39	25.20	95.92	135	25
Fox Covert	SE 629 417	3.7	Mixed	14	9	Rhodod-endron	1.958	2.863	1.86	90.83	56.75	61.40	81	23
Greenland Wood	SE 563 449	2	Broadleaved	12	6	Silver birch	1.880	2.088	1.6	86.39	90	100	154	23
Grimstone	SE 660 501	4.9	Coniferous	17	6	Corsican pine	1.108	2.117	2.13	63.61	42.50	12.50	50	21
Hacking Wood	SE 644 408	6.6	Mixed	11	4	Sycamore	1.832	2.663	0.76	72.78	82	32	81	25
Harrop's Plantation	SE 629 413	5	Mixed	15	9	Elder	2.016	2.713	1.73	94.17	65.25	83.33	75	20
Many Gates Plantation	SE 693 537	2	Coniferous	10	4	Scots pine	1.707	3.025	1.71	80.28	76	0	29	12
Melbourne Hall	SE 749 433	3.5	Broadleaved	6	10	Rhodo-dendron	2.017	2.244	2.15	98.19	23	100	151	23
Naburn Wood	SE 609 438	18	Coniferous	16	9	Scots pine	1.893	3.219	0.95	75.14	66.25	22.81	59	23
New Covert	SE 732 442	3.3	Broadleaved	14	12	Silver birch	1.987	3.152	3.55	94.44	68.25	100	96	22
New Drive Plantation	SE 753 427	11.2	Coniferous	14	6	Corsican pine	1.271	2.275	1.91	82.36	51.50	15.89	37	19
Park Wood	SE 733 445	2.8	Broadleaved	10	4	Silver birch	1.992	2.445	2.23	89.03	78.25	100	45	20
Rush Wood	SE 603 443	2.4	Broadleaved	9	8	Sycamore	1.995	2.248	1.6	96.11	17.25	100	232	27
Wigman Wood	SE 644 453	4.5	Coniferous	10	7	Scots pine	1.862	2.712	0.76	73.06	90	4.55	111	25
Wilson's Plantation	SE 696 539	3	Mixed	8	7	Sycamore	1.935	3.298	1.6	77.78	59.50	18.87	207	31

†Habitat as given on 1:25 000 OS map *Includes tree/shrub species < 1m **In the field/shrub layer only (≤ 2m)

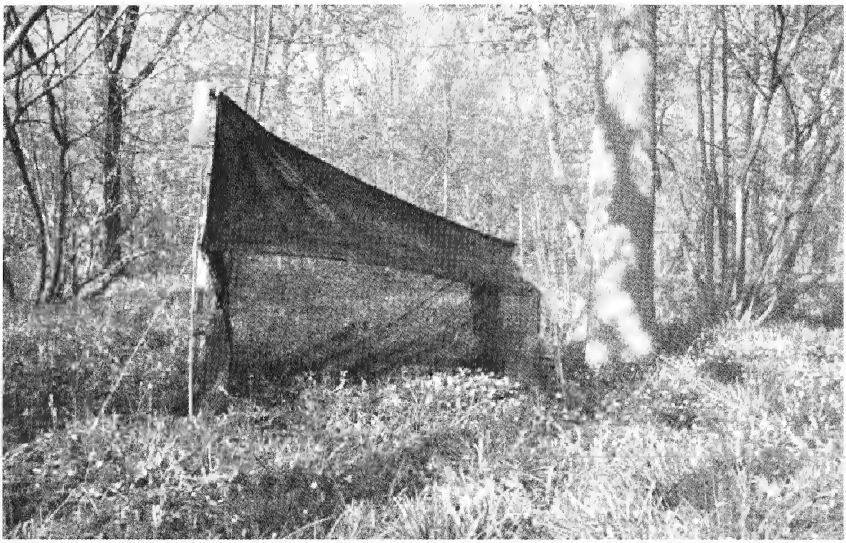

FIGURE 2. Malaise trap in Copmanthorpe Wood, 2003.

black in colour, 1.8 m high at the collection head end, tapering to 1 m high at the opposite end, and were 1.8 m in length (Figs 2 & 3).

In the extensive sample (2003), two Malaise traps, a minimum of 20 m apart, were set up 10-20 m in from the southern woodland edge either side of the midpoint of the edge of each wood (see Fraser *et al.*, 2007 for details). Fifteen woodlands (see Fig.1, Table 1) were sampled. In the intensive sample (2004), 16 and 14 Malaise traps respectively were used in two woodlands (Copmanthorpe Wood and New Covert, see Fig. 1), and these traps were divided into peripheral (southern edge as in 2003) and core locations (40-50 m from the woodland centre) (see Fraser *et al.*, 2008a for details). Again, traps were a minimum of 20 m apart. Traps were open for two weeks in July and two weeks in August, an important part of the flight season, in both 2003 and 2004. Samples were stored at room temperature in the dark in 70% ethanol. They were sorted by decanting the sample into a white tray and removing all ichneumonoids by eye: when no new individuals were observed in the sample for about 15 minutes, it was assumed that all individuals had been extracted. Ichneumonids were then keyed out to subfamily and finally all those in the four target subfamilies were individually dry mounted and keyed to species. Voucher specimens are deposited at the National Museums of Scotland, Edinburgh. The locations, numbers, sex and dates of each species collected are listed below.

FIGURE 3. Malaise trap in New Drive Plantation, 2003.

Species are said to be recorded "throughout the British Isles" if records for England, Scotland, Wales, Ireland and the Isle of Man all exist (i.e. covering all five of the distributional categories used by Broad, 2008). Sex ratio was not noted prior to the collection being dispersed. Subsequently (ix/08) the sex of all traceable specimens was recorded, but, because not every specimen could be traced, this does not always sum to the total number of specimens collected. Nevertheless, the number of untraceable specimens was a relatively small proportion of the total.

Habitat Survey

In order to identify possible habitat indicators of parasitoid abundance and diversity, a suite of habitat variables were measured for comparison with parasitoid data. The vegetation survey was carried out in late July/early August 2003 and 2004. Vegetation was sampled at the site of the Malaise trap and then more widely across each woodland using quadrats on two scales: 20 m x 20 m for the canopy trees and shrub layer and 2 m x 2 m for the field and herb layer. Each Malaise trap was at the centre of a 20 m quadrat to give a detailed record of the vegetation present around the trap. At random co-ordinates within this quadrat, five 2 m quadrats were surveyed. In 2003, two more 20 m quadrats were surveyed per wood, their location being determined by generating random co-ordinates within the north-east and north-west quarters of the woodland and using these as the south-west corner of a quadrat. Again, at random co-ordinates within the larger quadrats, five 2 m quadrats were surveyed.

In the 20 m quadrats all tree and woody shrub species taller than 1 m were counted and identified to species. All woody shrubs less than 1 m in height and herbs within the 2 m quadrats were identified to species. Ferns, fungi, (grasses + sedges), and (mosses + lichens + liverworts) were not identified to species level but were grouped thus. A visual estimate of the percentage total vegetation cover for the herb layer was made. An estimate of canopy cover was taken from the south-west corner of each 2 m quadrat. Canopy cover was estimated visually using a gridded acetate. The acetate was held up to the canopy and the number of grid squares in which canopy cover was seen were counted. This number was then divided by the total number of squares on the grid.

Plant height diversity and plant architectural diversity were measured within the field-herb layer using the method of Southwood *et al.* (1979). A 2 m high sampling pin was marked at height intervals of 5 cm, 5 cm, 10 cm and successive 20 cm until 1 m and 25 cm intervals thereafter. The total number of touches in each height category was recorded and used to provide a measure of plant height diversity. Plant architectural diversity was measured by recording the number and types of plant structures which were touching the pin. Five samples were taken using the pin at random co-ordinates within each 2 m quadrat. The diversity of both plant height and plant architectural diversity was estimated using the log series diversity index α, following Southwood *et al.* (1979). A summary of the vegetation characteristics for each wood is given in Table 1.

Results

Over the two years we collected 2,854 individuals in the target subfamilies representing one species of Diacritinae, 22 species of Diplazontinae, 41 species of Pimplinae and four species of Poemeniinae.

Systematic List

Subfamily Diacritinae

Diacritus aciculatus (Vollenhoven) (Fig. 4) – 327 (199♀♀, 128♂♂).

2003: 210 from all 15 sites, Copmanthorpe Wood 1-8/vii (3), 8-15/vii (25), 29/vii-5/viii (4), 5-12/viii (3); Fox Covert 1-8/vii (2), 8-15/vii (2); Grimstone 1-8/vii (2), 8-15/vii (1); Greenland Wood 1-8/vii (7), 8-15/vii (14), 29/vii-5/viii (5), 5-12/viii (3); Harrop's Plantation 1-8/vii (2), 8-15/vii (9); Hacking Wood 1-8/vii (2), 8-15/vii (10); Melbourne Hall 1-8/vii (4), 8-15/vii (24), 29/vii-5/viii (2), 5-12/viii (1); Many Gates Plantation 8-15/vii (2); Naburn Wood 8-15/vii (4); New Drive Plantation 8-15/vii (2); New Covert 1-8/vii (10), 8-15/vii (8); Park Wood 1-8/vii (4), 8-15/vii (4); Rush Wood 1-8/vii (11), 8-15/vii

FIGURE 4. *Diacritus aciculatus* ♂, length 6mm

(31), 29/vii-5/viii (2); Wilson's Plantation 1-8/vii (1), 8-15/vii (2), 29/vii-5/viii (1); Wigman Wood 1-8/vii (1), 8-15/vii (2).
2004: 117, with 57 at Copmanthorpe Wood, occurring in 14/16 traps, 15-29/vii (40); 29/vii-13/viii (17), and 60 at New Covert, occurring in all 14 traps, 15-29/vii (50), 29/vii-13/viii (10).
Described as "Rare but widely distributed" in Britain by Fitton *et al.* (1988), but Shaw (2006) notes that it is "much commoner than suggested by [Fitton *et al.*, 1988]".

Subfamily Diplazontinae
Diplazon laetatorius (Fabricius) – 14♀♀.
2003: Nine ♀♀, from 5 sites. Copmanthorpe Wood 29/vii-5/viii (1); Grimstone 8-15/vii (5), New Drive Plantation 8-15/vii (1); Park Wood 5-12/viii (1); Wilson's Plantation 5-12/viii (1).
2004: Five ♀♀, from both sites. Copmanthorpe Wood, 4, with 3 from a core trap and 1 from a peripheral trap, all 29/vii-13/viii. New Covert, 1 from a peripheral trap 29/vii-13/viii.
Recorded throughout the British Isles (Broad, 2008).

Diplazon pectoratorius (Thunberg) – Nine (6♀♀, 3♂♂)
2003: Six from 4 sites. Grimstone 5-12/viii (1); Greenland Wood 8-15/vii (2); Wilson's Plantation 8-15/vii (1), 29/vii-5/viii (1); Wigman Wood 8-15/vii (1).
2004: Three, from both sites. Copmanthorpe Wood, 1, core trap, 29/vii-13/viii. New Covert, 1, peripheral trap, 15-29/vii, 1, core trap, 29/vii-13/viii.
Recorded throughout the British Isles (Broad, 2008).

Diplazon scutatorius Teunissen.
2004: 1♀ Copmanthorpe Wood, 29/vii-13/viii, peripheral trap (det. Seraina Klopfstein).
Added to the British list by Thirion (1987), and so not mentioned by Beirne (1941), indeed at the time it would have been included in the concept of *D. tetragonus*. New record for Yorkshire.

Diplazon tetragonus (Thunberg) - 46 (12♀♀, 32♂♂).
2003: 37, from 9 sites. Fox Covert 29/vii-5/viii (2); Greenland Wood 29/vii-5/viii (1); Harrop's Plantation 5-12/viii (1); Hacking Wood 29/vii-5/viii (1), 5-12/viii (1); Melbourne Hall 29/vii-5/viii (5), 5-12/viii (5, 1) ; Park Wood 8-15/vii (1), 5-12/viii (1); Rush Wood 29/vii-5/viii (6), 5-12/viii (4); Wilson's Plantation 29/vii-5/viii (3), 5-12/viii (5); Wigman Wood 8-15/vii (1).
2004: Nine, from both sites. Copmanthorpe Wood, 8, 6 from 3 peripheral traps, 2 from 2 core. 15-29/vii (1), 29/vii-13/viii (7). New Covert, 1, core trap, 15-29/vii.
Recorded throughout the British Isles (Broad, 2008).

Enizemum ornatum (Gravenhorst) – 43 (9♀♀, 33♂♂).
2003: 21, from 9 sites. Copmanthorpe Wood 29/vii-5/viii (1), 5-12/vii (2); Grimstone 29/vii-5/viii (1), 5-12/vii (1); Greenland Wood 5-12/vii (2); Harrop's Plantation 5-12/vii (2); Hacking Wood 29/vii-5/viii (1), 5-12/vii (2); Naburn Wood 5-12/vii (1); Rush Wood 29/vii-5/viii (1); Wilson's Plantation 5-12/vii (6), Wigman Wood 5-12/vii (1).
2004: 22, all from Copmanthorpe Wood: 2 from 2 core, 20 from 7 peripheral traps, 15-29/vii (2), 29/vii-13/viii (20).
Recorded throughout the British Isles (Broad, 2008).

Promethes bridgmani Fitton.
2003: Two (1♀, 1♂) from Greenland Wood, 29/vii-5/viii. Both individuals recorded from the same site in which its congener *P. sulcator* was most common, suggesting similar habitat requirements or hosts.
Recorded from England, Scotland, Wales and Ireland (Broad, 2008). Hosts not known. Described (under *P. scutellaris*) by Beirne (1941) as "a rather rare species". Thirion (1994) notes only two Belgian records.

Promethes sulcator (Gravenhorst) – 32 (5♀♀, 27♂♂).
2003: 31, from 5 sites. Copmanthorpe Wood, 8-15/vii (1), Grimstone 5-12/viii (7); Greenland Wood 8-15/vii (11), 29/vii-5/viii (7), 5-12/viii (2); Melbourne Hall 8-15/vii (1). 29/vii-5/viii (1); Naburn Wood 29/vii-5/viii (1).
2004: One from Copmanthorpe Wood, peripheral trap, 29/vii-13/viii.
Recorded throughout the British Isles (Broad, 2008).

Sussaba cognata (Holmgren) – 143 (112♀♀, 26♂♂)
2003: 63 from 14 sites. Copmanthorpe Wood 29/vii-5/viii (2), 5-12/viii (2); Fox Covert 29/vii-5/viii (1); Grimstone 1-8/vii (1), 8-15/vii (1); Greenland Wood 29/vii-5/viii (2), 5-12/viii (2); Harrop's Plantation 5-12/viii (3); Melbourne Hall 8-15/vii (4), 29/vii-5/viii (10), 5-12/viii (8); Many Gates Plantation 8-15/vii (1), 29/vii-5/viii (1), 5-12/viii (1); Naburn Wood 8-15/vii (1), 29/vii-5/viii (1); New Drive Plantation 8-15/vii (1), 29/vii-5/viii (6); New Covert 8-15/vii (1), 29/vii-5/viii (1), 5-12/viii (2); Park Wood 8-15/vii (2), 29/vii-5/viii (3); Rush Wood 29/vii-5/viii (2), 5-12/viii (1); Wilson's Plantation 8-15/vii (1), 29/vii-5/viii (1), Wigman Wood 5-12/viii (1).
2004: 80. Copmanthorpe Wood: 52, 8 from 3 peripheral traps and 44 from 8 core traps, 15-29/vii (15), 29/vii-13/viii (37). New Covert: 28, 4 from 2 peripheral, 24 from 5 core traps, 15-29/vii (10), 29/vii-13/viii (18).
Recorded throughout the British Isles (Broad, 2008).

Sussaba flavipes (Lucas) – 178 (97♀♀, 81♂♂)
2003: 159, from 15 sites. Copmanthorpe Wood 29/vii-5/viii (2); Fox Covert 1-8/vii (1), 29/vii-5/viii (1); Grimstone 1-8/vii (1), 8-15/vii (5); Greenland Wood 1-8/vii (2), 8-15/vii (10), 29/vii-5/viii (1), 5-12/viii (2); Harrop's Plantation 8-15/vii (1), 5-12/viii (1); Hacking Wood 8-15/vii (1); Melbourne Hall 29/vii-5/viii (4), 5-12/viii (1); Many Gates Plantation 29/vii-5/viii (1); Naburn Wood 1-8/vii (1), 8-15/vii (8), 29/vii-5/viii (5); New Covert 29/vii-5/viii (4), 5-12/viii (2); New Drive Plantation 8-15/vii (1); Park Wood 8-15/vii (1); Rush Wood 8-15/vii (3), 29/vii-5/viii (10), 5-12/viii (5); Wilson's Plantation 8-15/vii (52), 29/vii-5/viii (14), 5-12/viii (10); Wigman Wood 1-8/vii (5), 8-15/vii (4).
2004: 19. Copmanthorpe Wood, 17, 12 from 4 peripheral traps, 5 from 3 core traps. 15-29/vii (8), 29/vii-13/viii (9). New Covert 2, peripheral and core trap, 29/vii-13/viii.
Recorded from England, Scotland, Wales and Ireland (Broad, 2008).

Sussaba placita Dasch
2003: 1♀, Harrop's Plantation, 29/vii-5/viii (det. Seraina Klopfstein).
2004: 1♀, Copmanthorpe Wood, 29/vii-13/viii, core trap (det. Seraina Klopfstein).
New to the British Isles; also recorded from Belgium, Austria, California and Canada (Thirion, 1994).

Sussaba pulchella (Holmgren) – 28 (1♀, 27♂♂)
2003: 27, from 7 sites. Fox Covert 8-15/vii (4) Grimstone 1-8/vii (1), 8-15/vii (1); Greenland Wood 1-8/vii (2), 8-15/vii (4); Many Gates Plantation 1-8/vii (1), 29/vii-5/viii (1); Rush Wood 5-12/viii (1); Wilson's Plantation 8-15/vii (3), 29/vii-5/viii (3), 5-12/viii (1); Wigman Wood 8-15/vii (5).

2004: One, Copmanthorpe Wood, core trap, 29/vii-13/viii.
Recorded throughout the British Isles (Broad, 2008).

Syrphoctonus crassicrus (Thomson) – 25 (25♀♀, 3♂♂).
2003: 13, from 10 sites. Copmanthorpe Wood 29/vii-5/vii (1); Greenland Wood 29/vii-5/viii (1); Harrop's Plantation 5-12/viii (1); Hacking Wood 29/vii-5/viii (1), 5-12/viii (1); Melbourne Hall 29/vii-5/viii (2); Naburn Wood 29/vii-5/viii (1), 5-12/viii (1); New Drive Plantation 5-12/viii (1); New Covert 29/vii-5/viii (1); Rush Wood 5-12/viii (1); Wilson's Plantation 5-12/viii (1).
2004: 12. Copmanthorpe Wood, 4 from 3 peripheral traps. 15-29/vii (2), 29/vii-13/viii (2). New Covert, 8, 5 from 3 peripheral, 3 from 2 core traps. 15-29/vii (5), 29/vii-13/viii (3).
Recorded from England, Scotland and Wales (Broad, 2008),

Syrphoctonus longiventris (Thomson) (Fig. 5) – 118 (43♀♀, 69♂♂)
2003: 102, from 15 sites. Copmanthorpe Wood 1-8/vii (4) 8-15/vii (7) 29/vii-5/viii (6) 5-12/viii (3); Fox Covert 8-15/vii (1), 29/vii-5/viii (1); Grimstone 8-15/vii (1); Greenland Wood 29/vii-5/viii (1); Harrop's Plantation 1-8/vii (2), 8-15/vii (9), 29/vii-5/viii (1); Hacking Wood 1-8/vii (4), 8-15/vii (2), 29/vii-5/viii (1); Melbourne Hall 1-8/vii (1), 8-15/vii (6), 29/vii-5/viii (1), 5-12/viii (2); Many Gates Plantation 1-8/vii (1), 8-15/vii (4), 29/vii-5/viii (2), 5-12/viii (1); Naburn Wood 8-15/vii (4) 5-12/viii (2); New Drive Plantation 8-15/vii (1), 5-12/viii (1); New Covert 1-8/vii (4), 8-15/vii (3), 29/vii-5/viii (1); Rush Wood 8-15/vii (1), 29/vii-5/viii (6), 5-12/viii (1); Wilson's Plantation 8-15/vii (2), 29/vii-5/viii (3); Wigman Wood 1-8/vii (5), 8-15/vii (6), 5-12/viii (1).
2004: 16: Copmanthorpe Wood, 4, 1 from core, 3 from 3 peripheral traps, 15-29/viii (2), 29/vii-13/viii (2). New Covert, 12, 4 from 4 core, 8 from 4 peripheral traps, 15-29/vii (3),29/vii-13/viii (9).
Recorded from England, Scotland and Ireland (Broad, 2008).

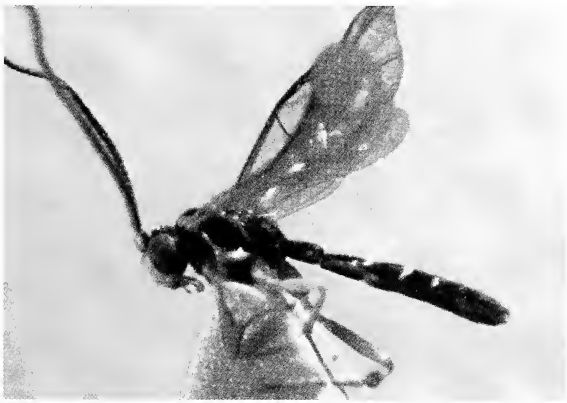

FIGURE 5. *Syrphoctonus longiventris* ♂, length 4mm

Syrphoctonus nigritarsus (Gravenhorst) – Five (4♀♀, 1♂)
2003: Three from 3 woods: Hacking Wood, 5-12/viii; Naburn Wood, 29/vii-5/viii; Rush Wood 5-12/viii.
2004. Two from Copmanthorpe Wood, 1 peripheral, 1 core, 29/vii-13/viii.
Recorded throughout the British Isles (Broad, 2008).

Syrphoctonus pallipes (Gravenhorst) – 27 (20♀♀, 3♂♂)
2003: 21, from 6 woods. Fox Covert 8-15/vii (1), 29/vii-5/viii (2), 5-12/viii (1); Naburn Wood 8-15/vii (1), 5-12/viii (1); New Covert 29/vii-5/viii (5), 5-12/viii (3); Park Wood 29/vii-5/viii (1), 5-12/viii (1); Rush Wood 8-15/vii (1), 5-12/viii (1); Wilson's Plantation 8-15/vii (1), 5-12/viii (2).
2004: Six. Copmanthorpe Wood: 5, 15-29/vii (2 from 1 peripheral, 1 core), 29/vii-13/viii (2 from 2 core). New Covert: 29/vii-13/viii (1 peripheral).
Recorded from England, Scotland, Ireland and the Isle of Man (Broad, 2008).

Syrphoctonus pictus (Gravenhorst) – 70 (23♀♀, 44♂♂).
2003: 63, from 10 woods. Fox Covert 8-15/vii (1), 29/vii-5/viii (1); Grimstone 8-15/vii (3); Greenland Wood 29/vii-5/viii (1), 5-12/viii (1); Hacking Wood 8-15/vii (2), 29/vii-5/viii (2), 5-12/viii (3); Many Gates Plantation 8-15/vii (3); Naburn Wood 8-15/vii (2); New Drive Plantation 29/vii-5/viii (1); Park Wood 29/vii-5/viii (1); Wilson's Plantation 1-8/vii (1), 8-15/vii (2), 29/vii-5/viii (8), 5-12/viii (3); Wigman Wood 1-8/vii (1), 8-15/vii (10), 29/vii-5/viii (14), 5-12/viii (3).
2004: Seven. Copmanthorpe Wood 29/vii-13/viii (6 from 5 peripheral, 1 from core trap).
Recorded throughout the British Isles (Broad, 2008).

Syrphoctonus signatus (Gravenhorst) – Nine (8♀♀, 1♂)
2003: Six, from 5 woods. Copmanthorpe Wood 8-15/vii (1); Hacking Wood 5-12/viii (1); Naburn Wood 29/vii-5/viii (1); New Drive Plantation 5-12/viii (1); Wilson's Plantation 29/vii-5/viii (1), 5-12/viii (1).
2004: Three: Copmanthorpe Wood 29/vii-13/viii (1, peripheral trap); New Covert 29/vii-13/viii (2 from 2 core traps).
Recorded from England, Scotland, Ireland and the Isle of Man (Broad, 2008).

Syrphoctonus tarsatorius (Panzer) – 29 (17♀♀, 12♂♂).
2003: 22, from 9 woods. Copmanthorpe Wood 29/vii-5/viii (1); Greenland Wood 29/vii-5/viii (2); Harrop's Plantation 29/vii-5/viii (2); Hacking Wood 29/vii-5/viii (1); Melbourne Hall 29/vii-5/viii (1); Naburn Wood 5-12/viii (1); Park Wood 29/vii-5/viii (1), 5-12/viii (1); Rush Wood 29/vii-5/viii (1), 5-12/viii (1); Wilson's Plantation 29/vii-5/viii (4), 5-12/viii (6).
2004: Seven. Copmanthorpe Wood 29/vii-13/viii (1, 3 and 2 from 3 periferal traps); New Covert 29/vii-13/viii (1, core trap).
Recorded throughout the British Isles (Broad, 2008).

Syrphophilus tricinctorius (Thunberg) – 13 (8♀♀, 2♂♂)
2003: 11, from 7 woods. Copmanthorpe Wood 8-15/vii (1); Greenland Wood (29/vii-5/viii (1); Hacking Wood 8-15/vii (3), 29/vii-5/viii (1); Naburn Wood 5-12/viii (1); Rush Wood 8-15/vii (1), 5-12/viii (1); Wigman Wood 8-15/vii (1); Wilson's Plantation 5-12/viii (1).
2004: Two. Copmanthorpe Wood 29/vii-13/viii (1, core trap); New Covert 15-29/vii (1, core trap).
Recorded throughout the British Isles (Broad, 2008).

Tymmophorus obscuripes (Holmgren). – 83 (at least 3♀♀, 7♂♂; it was difficult to establish the sex of most specimens because the abdomen was mis-shapen on drying and the oviposition apparatus of females and genital capsule of males was concealed).
2003: 81, from 10 woods. Fox Covert 29/vii-5/viii (1); Grimstone 8-15/viii (4); Greenland Wood 8-15/vii (30), 29/vii-5/viii (22); Hacking Wood 8-15/vii (2); Many Gates Plantation 29/vii-5/viii (1); Naburn Wood 8-15/vii (1); Park Wood 8-15/vii (1); Rush Wood 8-15/vii (1); Wilson's Plantation 8-15/vii (1), 29/vii-5/viii (4); Wigman Wood 8-15/vii (10), 29/vii-5/viii (3).
2004: Two: New Covert 29/vii-13/viii (2 from 2 core traps).
Recorded throughout the British Isles (Broad, 2008).

Woldstedtius citropectoralis (Schmiedeknecht) – 46 (38♀♀, 5♂♂)
2003: 34, from 14 woods. Copmanthorpe Wood 29/vii-5/viii (1); Fox Covert 8-15/vii (1); Grimstone 1-8/vii (1), 8-15/vii (2), 5-12/viii (1); Hacking Wood 29/vii-5/viii (1); Harrop's Plantation 8-15/vii (1); Melbourne Hall 8-15/vii (2), 29/vii-5/viii (4), 5-12/viii (1); Many Gates Plantation 8-15/vii (2); Naburn Wood (29/vii-5/viii (2); New Covert 29/vii-5/viii (1); New Drive Plantation 1-8/vii (1); Park Wood 8-15/vii (1); Rush Wood 8-15/vii (2), 5-12/viii (2); Wilson's Plantation 29/vii-5/viii (3), 5-12/viii (5).
2004: 12. Copmanthorpe Wood 15-29/vii (2 from 2 core traps), 29/vii-13/viii (1 each from core and peripheral trap). New Covert 15-29/vii (3 from 2 peripheral traps), 29/vii-13/viii (1 & 3 from 2 peripheral traps, 1 from core trap).
Recorded from England, Scotland and Ireland (Broad, 2008).

Woldstedtius flavolineatus (Gravenhorst) – Eight (1♀, 7♂♂)
2003: Four, from 3 woods. Copmanthorpe Wood 5-12/viii (1); Melbourne Hall 5-12/viii (2); Wilson's Plantation 5-12/viii (1).
2004: Four. Copmanthorpe Wood 15-29/vii (1, core trap), 29/vii-13/viii (3 from 3 core traps).
Recorded from England, Scotland and Wales (Broad, 2008).

Subfamily Pimplinae
Tribe Delomeristini
Delomerista novita (Cresson)
2003: One ♀, Naburn Wood 8-15/vii.
Recorded from England, Scotland and Ireland (Broad, 2008). Described by Fitton *et al.* (1988) as rare, previous English specimens from Devon and Cheshire. First record for Yorkshire. Hosts unknown (Shaw, 2006).

Perithous albicinctus (Gravenhorst)
2004: One ♀, New Covert, 15-29/vii (peripheral trap).
Added to the British list by Brock and Shaw (1997), and well established in S. England. This is the most northerly English record, new to Yorkshire (Shaw, 2006). Note that Shaw (2006) mistakenly dates this capture as 2003 not 2004.

Perithous septemcinctorius (Thunberg)
2003: Two ♀♀: Hacking Wood 29/vii-5/viii (1); Melbourne Hall 8-15/vii (1).
2004: One ♀, New Covert 15-29/vii.
Recorded from England and Ireland (Broad, 2008). Described by Fitton *et al.* (1988) under *Hybomischos septemcinctorius*, as uncommon, widely distributed in S. England as far north as Cambs, probably commonest in wetlands. Hosts probably sphecids, especially those nesting in twigs; first records for Yorkshire (Shaw, 2006).

Tribe Ephialtini
Acrodactyla carinator (Aubert)
2004: One ♂. Copmanthorpe Wood 29/vii-13/viii (1, peripheral trap).
Shaw (2006) notes that this species was overlooked amongst *A. quadrisculpta* recorded in Fitton *et al.* (1988). He describes it as widely distributed in England north to Yorkshire, and also Wales, commonest in wetlands and waterside habitat, and gives rearing records from tetragnathid spiders.

*Acrodactyla degene*r (Haliday) – 37 (36♀♀, 1♂)
2003: 18, from 8 sites. Fox Covert 1-8/vii (1), 8-15/vii (1), 29/vii-5/viii (5); Greenland Wood 5-12/viii (2); Hacking Wood 5-12/viii (1); Melbourne Hall 5-12/viii (1); Park Wood 29/vii-5/viii (1); Rush Wood 29/vii-5/viii (2), 5-12/viii (1); Wilson's Plantation 29/vii-5/viii (1♂); Wigman Wood 29/vii-5/viii (1), 5-12/viii (1).
2004: 19. Copmanthorpe Wood 15-29/vii (1 from peripheral trap), 29/vii-13/viii (10, 7 from 4 peripheral traps, 3 from 3 core traps). New Covert 15-29/vii (4 from 4 core traps), 29/vii-13/viii (4, 3 from 2 peripheral traps and 1 from a core trap).
Fitton *et al.* (1988) note that this morphospecies may comprise more than one biological species, and that some populations may be thelytokous. Recorded throughout the British Isles (Broad, 2008). Described by Fitton *et al.* (1988) as probably the commonest British polysphinctine, with hosts as linyphiid spiders.

Clistopyga incitator (Fabricius) – 39♀♀.
2003: 25, from 12 sites. Copmanthorpe Wood 29/vii-5/viii (1); Fox Covert 29/vii-5/viii (1); Greenland Wood 5-12/viii (1); Grimstone 29/vii-5/viii (1); Harrop's Plantation 1-8/vii (1), 29/vii-5/viii (1), 5-12/viii (1); Melbourne Hall 8-15/vii (1), 29/vii-5/viii (1); Many Gates Plantation 29/vii-5/viii (1), 5-12/viii (2); New Covert 8-15/vii (1), 5-12/viii (2); New Drive Plantation 5-12/viii (1); Rush Wood 29/vii-5/viii (1), 5-12/viii (2); Wilson's Plantation 29/vii-5/viii (2), 5-12/viii (1); Wigman Wood 29/vii-5/viii (1), 5-12/viii (2).
2004: 14. Copmanthorpe Wood 29/vii-13/viii (8 from 5 peripheral traps); New Covert 15-29/vii (1, peripheral trap), 29/vii-13/viii (5, 3 from 2 peripheral, 2 from 2 core).
Recorded throughout the British Isles (Broad, 2008). Fitton *et al.* (1988) describe it as common and widely distributed, citing a host record from *Segestria* spider egg sacs, though those of other spiders in crevices may also be used.

Dolichomitus ?agnoscendus (Roman)
2004: One ♀: New Covert, 15-29/vii (peripheral trap)
The specimen is somewhat less slender than usual, but the structure on the ovipositor is as for *D. agnoscendus* (K. Zwakhals, *pers. comm.*). Recorded from England, Wales and Ireland (Broad, 2008). Fitton *et al.* (1988) describe it as rare but widely distributed north to Norfolk. First Yorkshire record. Hosts are beetles boring in woody stems and thin branches (Shaw, 2006).

Dolichomitus pterelas (Say)
2004: One ♀. Copmanthorpe Wood 15-29/vii (peripheral trap).
Recorded from England and Ireland (Broad, 2008). Fitton *et al.* (1988) describe it as rare, recorded north to Hereford & Worcester. New record for Yorkshire (Shaw, 2006). Fitton *et al.* (1988) record a specimen reared from the cerambycid beetle *Stenostela ferrea*.

Dolichomitus terebrans (Ratzeburg)
2004: One ♀: Copmanthorpe Wood 29/vii-13/viii (peripheral trap).
Recorded from England, Scotland and Wales (Broad, 2008). New record for Yorkshire. Fitton *et al.* (1988) describe it as uncommon but widely distributed among conifers, in which it attacks wood boring beetles.

Dolichomitus tuberculatus (Geoffroy)
2003: One ♀. Harrop's Plantation 29/vii-5/viii.
Recorded from England, Scotland, Wales and Ireland (Broad, 2008). Fitton *et al.* (1988) describe it as uncommon but widely distributed, reared from wood-boring beetles of conifers and *Betula*, and also a sesiid moth *Synanthedon culiciformis* (Shaw, 2006).

Endromopoda detrita (Holmgren)
2003: Two ♀♀. Park Wood 1-8/vii (1); New Covert 8-15/vii (1).
2004: Two. Copmanthorpe Wood 29/vii-13/viii (1♀, peripheral trap); New Covert 29/vii-13/viii (1♂, peripheral trap).
Recorded throughout the British Isles (Broad, 2008). Fitton *et al.* (1988) describe it as common and widespread in fertile grassy habitat, with diverse hosts including sawflies, eurytomid wasps, noctuid moths and chloropid flies, all living internally in grasses.

Endromopoda nigricoxis (Ulbricht)
2003: One ♀, New Drive Plantation 8-15/vii.
Recorded throughout the British Isles (Broad, 2008). Fitton *et al.* describe it as uncommon but widely distributed in grassland habitat, particularly in the north. Hosts unknown.

Ephialtes manifestator (L.)
2003: Two ♀♀. New Covert 29/vii-5/viii (1), 5-12/viii (1).
Recorded from England and Wales (Broad, 2008). Fitton *et al.* (1988) describe it as uncommon, found as far north as Staffs and Suffolk. New records for Yorkshire (Shaw, 2006). Hosts probably always wood-inhabiting aculeate Hymenoptera, including those nesting in old beetle holes in wood (Fitton *et al.*, 1988; Shaw, 2006).

Exeristes ruficollis (Gravenhorst)
2003: One ♀. Fox Covert 29/vii-5/viii.
Recorded from England, Scotland and Wales (Broad, 2008). Fitton *et al.* (1988) describe it as uncommon but widely distributed amongst *Pinus* in mainland southern Britain as far north as Gwynedd, with Scottish populations centred on native *Pinus sylvestris* woods. New record for Yorkshire. Hosts are endophytic tortricid Lepidoptera on *Pinus* including *Rhyacionia buoliana* and *Petrova resinella* (Fitton *et al.*, 1988).

Gregopimpla inquisitor (Scopoli)
2004: One ♂. New Covert 29/vii-13/viii (peripheral trap).
Recorded from England and Scotland (Broad, 2008). Fitton *et al.* (1988) describe it as rare but widespread, and hosts including a wide range of cocooned Lepidoptera.

Liotryphon crassiseta (Thomson)
2004: Four ♂♂. Copmanthorpe Wood 29/vii-13/viii (1, core trap); New Covert 15-29/vii (3, 2 from 2 peripheral traps, 1 from core trap).
In the absence of females, species determination here is tentative. Recorded from England and Ireland (Broad, 2008). Fitton *et al.* (1988) describe it as uncommon but widely distributed in southern England as far north as Cumbria, with hosts mainly sesiids and other Lepidoptera in twigs and bark.

Megaetaira madida (Haliday) – 36 (16♀♀, 18♂♂)
2003: 19, from 9 sites. Greenland Wood 5-12/viii (1); Harrop's Plantation 29/vii-5/viii (1), 5-12/viii (1); Hacking Wood 29/vii-5/viii (3); Melbourne Hall 8-15/vii (3), 29/vii-5/viii (1), 5-12/viii (2); Naburn Wood 8-15/vii (1); New Drive Plantation 5-12/viii (1); Rush Wood 29/vii-5/viii (1); Wilson's Plantation 29/vii-5/viii (1), 5-12/viii (1); Wigman Wood 1-8/vii (2).
2004: 17. Copmanthorpe Wood 15-29/vii (2 from 2 core traps); New Covert: 15-29/vii (11, 10 from 5 core traps, 1 from a peripheral trap), 29/vii-13/viii (4 from 3 core traps).
This species was treated by Fitton *et al.* (1988) in the genus *Acrodactyla* but Gauld and Dubois (2006) erected a new genus, *Megaetaira*, to receive it (Shaw, 2006). Recorded from England, Scotland and Ireland (Broad, 2008). Fitton *et al.* (1988) describe it as uncommon but widely distributed, found in wooded habitats and parasitizing *Metellina* spiders.

Polysphincta tuberosa Gravenhorst
2004: One ♀. New Covert 15-29/vii (core trap).
Recorded throughout the British Isles (Broad, 2008). Fitton *et al.* (1988) describe it as common and widely distributed in bushy places and heathland, giving as hosts spiders in the genera *Araniella*, *Araneus* and *Zygiella*.

Scambus "*annulatus* group" ?*inanis* (Schrank)
Fitton *et al.* (1988) recognized that *S. annulatus* probably represented a species aggregate, and more recently Shaw (2006), following Horstmann (2005), listed overlapping characters that separate 80-90% of specimens into *S. inanis*, *S. signatus* and *S. tenthredinium*. Although it is possible that our specimens are *S. signatus*, on balance we believe them to be *S. inanis*.
2004: Two. New Covert 29/vii-13/viii (2♀♀, 1 from peripheral, 1 from core trap).
S. inanis is recorded from England, Scotland, Wales and Ireland (Broad, 2008). Shaw (2006) reports it as a common and widespread parasitoid of fairly small arboreal hosts, especially lepidopterous leaf-miners and rollers, including Gracillariidae and Tortricidae. *S. signatus* is also widespread (British records from England and Scotland), with hosts mainly in the field layer (Shaw, 2006).

Scambus brevicornis (Gravenhorst)
2003: One ♀. New Drive Plantation 5-12/viii.
Recorded throughout the British Isles (Broad, 2008). Fitton *et al.* (1988) describe it as common and widely distributed, parasitizing a large number of Lepidoptera and other species concealed in field layer vegetation, notably Asteraceae flower and seed heads.

Scambus foliae (Cushman)
2003: 1♀ New Covert 5-12/viii
2004: 1♀ New Covert 15-29/vii (peripheral trap).
Recorded from Scotland, the Isle of Man, and, as a result of present records, England (Broad, 2008). New records for Yorkshire and England (Shaw, 2006), only the third and

fourth records for the British Isles. Hosts are leaf-mining *Heterarthrus* sawflies (Fitton *et al.*, 1988; Shaw, 2006).

Scambus pomorum (Ratzeburg)
2004: One ♀, Copmanthorpe Wood 29/vii-13/viii (core trap).
Recorded from England, Scotland and Ireland (Broad, 2008). Fitton *et al.* (1988) describe it as an uncommon but widely distributed parasitoid of the apple blossom weevil *Anthonomus pomorum* (see also Shaw, 2006).

Scambus vesicarius (Ratzeburg)
2003: One ♀, Wigman Wood 1-8/vii.
Recorded from England, Scotland and Ireland (Broad, 2008). Shaw (2006) describes it as moderately common and widespread, especially where *Salix* is plentiful as it attacks primarily *Pontania* and *Euura* sawfly galls.

Schizopyga circulator (Panzer)
2003: One ♂, New Covert 5-12/viii.
Recorded from England, Scotland, Wales and Ireland (Broad, 2008). Fitton *et al.* (1988) remark that it is largely restricted to marshy habitats, becoming commoner in the north and give rearing records from *Clubiona* spiders.

Schizopyga frigida Cresson – 101♀♀.
2003: 46, from 13 sites. Fox Covert 8-15/vii (2), 29/vii-5/viii (1); Grimstone 8-15/vii (1), 5-12/viii (1); Greenland Wood 5-12/viii (1); Harrop's Plantation 8-15/vii (2); Hacking Wood 8-15/vii (1); Many Gates Plantation 8-15/vii (1), 29/vii-5/viii (1); Naburn Wood 8-15/vii (3) 29/vii-5/viii (1); New Drive Plantation 8-15/vii (5), 29/vii-5/viii (1); New Covert 1-8/vii (1), 8-15/vii (2), 29/vii-5/viii (1); Park Wood 8-15/vii (3); Rush Wood 8-15/vii (2), 29/vii-5/viii (2), 5-12/viii (2); Wilson's Plantation 8-15/vii (9); Wigman Wood 8-15/vii (3).
2004: 55. Copmanthorpe Wood 15-29/vii (7, 5 from 3 peripheral, 2 from 1 core trap), 29/vii-13/viii (4, 3 from 2 peripheral, 1 from core trap). New Covert: 15-29/vii (29, 18 from 5 peripheral, 16 from 6 core traps), 29/vii-13/viii (15, 5 from 1 peripheral, 10 from 3 core traps).
Recorded from England, Scotland, Wales and Ireland (Broad, 2008). Fitton *et al.* (1988) describe it as uncommon but widely distributed, seemingly a woodland species with rearings from *Clubiona terrestris* and *C. lutescens* spiders.

Townesia tenuiventris (Holmgren)
2003: One ♀, Wilson's Plantation 5-12/viii.
Recorded in England, Scotland and Ireland (Broad, 2008), in England from Somerset to Cheshire and Norfolk (Fitton *et al.* 1988), also Perthshire in Scotland (Shaw, 2006). New record for Yorkshire. Described as rare by Fitton *et al.* (1988), although Shaw (2006) lists it with several other species that have more recently proved to be more widespread and abundant in suitable habitat (woodland). Hosts are aculeate Hymenoptera in dead wood (cf. Fitton *et al.*, 1988).

Tromatobia lineatoria (Villers).
2003: One ♀, Rush Wood 5-12/viii.
This species was previously referred to as *T. oculatoria*. Recorded throughout the British Isles (Broad, 2008). Fitton *et al.* (1988) describe it as a common parasitoid of spider egg sacs on bushes, herbs and buildings.

Zaglyptus multicolor (Gravenhorst) (Fig. 6) – Nine ♀♀
2003: Two. Copmanthorpe Wood 5-12/viii (1); Melbourne Hall 5-12/viii (1)
2004: Seven. Copmanthorpe Wood 29/vii-13/viii (5, 4 from 3 peripheral, 1 from core trap); New Covert 15-29/vii (1, core trap), 29/vii-13/viii (1, core trap).
Recorded only from England in the British Isles (Broad, 2008). Fitton *et al.* (1998) describe it as uncommon but widespread in southern England as far north as Norfolk and Cheshire, as a parasitoid of the egg nests of spiders.

FIGURE 6. *Zaglyptus multicolor* ♀, length 8mm

Zatypota albicoxa (Walker) – Six ♀♀
2003: Five. Fox Covert 5-12/viii (1); Harrop's Plantation 8-15/vii (1), 5-12/viii (1); New Covert 5-12/viii (1); Rush Wood 5-12/viii (1).
2004: One. Copmanthorpe Wood 29/vii-13/viii (core trap).
Recorded from England (Broad, 2008). Fitton *et al.* (1988) describe it as a rare parasitoid of *Achaearanea* spiders, although Shaw (2006) lists it with several other species that have more recently proved to be reasonably widespread and frequent in suitable habitat (woodland). New records for Yorkshire (Shaw, 2006).

Zatypota bohemani (Holmgren)
2003: Two. Fox Covert 29/vii-5/viii (1♂); Wigman Wood 8-15/vii (1♀).
2004: Copmanthorpe Wood 29/vii-13/viii (1♀, core trap).
Recorded from England, Scotland and Wales (Broad, 2008). Fitton *et al.* (1988) describe it as uncommon but widely distributed as far north as the central lowlands of Scotland, occurring on tree trunks, walls and hedges where it parasitizes *Theridion mystaceum* spiders.

Zatypota percontatoria (Müller) – Nine ♀♀
2003: Four. Fox Covert 1-8/vii (1); Hacking Wood 8-15/vii (1); Melbourne Hall 8-15/vii (1); Wilson's Plantation 8-15/vii (1).
2004: Five. New Covert 15-29/vii (4, 3 from 1 peripheral, 1 from core trap), 29/vii-13/viii (1 from core trap).
Recorded from England, Scotland and Wales (Broad, 2008). Fitton *et al.* (1988) describe it as moderately common and widely distributed on bushes where it parasitizes *Theridion* spiders.

Tribe Pimplini
Apechthis compunctor (L.)
2003: One ♀. Greenland Wood 29/vii-5/viii.
2004: Three ♀♀. Copmanthorpe Wood 29.vii-13/viii (3 from 2 peripheral traps).
Recorded from England and Wales (Broad, 2008). Fitton *et al.* (1988) describe it as uncommon, occurring in more open situations than other congeners; widely distributed in S. Britain. Reared from a range of Lepidoptera pupae including butterflies.

Apechthis quadridentata (Thomson) – Five (4♀♀, 1♂)
2003: Two. Naburn Wood 8-15/vii (1); New Drive Plantation 29/vii-5/viii (1).

2004: Three. Copmanthorpe Wood 15-29/vii (1, core trap); New Covert 15-29/vii (1, peripheral trap), 29/vii-13/viii (1, peripheral trap).
Recorded from England, Scotland, Wales and Ireland (Broad, 2008). Fitton *et al.* (1988) describe it as locally common in deciduous woods and parks with rearing records from several tortricid and butterfly pupae.

Apechthis rufata (Gmelin) – 13 (5♀♀, 8♂♂)
2003: Two. Copmanthorpe Wood 1-8/vii (1); Fox Covert 8-15/vii (1).
2004: 11. Copmanthorpe Wood 15-29/vii (3, 1 from peripheral, 2 from 1 core trap), 29/vii-13/viii (6, 4 from 4 peripheral, 2 from 2 core traps); New Covert 15-29/vii (2, 1 from peripheral, 1 from core trap).
Recorded from England, Scotland, Wales and Ireland (Broad, 2008). Fitton *et al.* (1988) describe it as locally common in deciduous woods and parks as a parasitoid of the pupae of especially Oecophoridae and Tortricidae.

Itoplectis alternans (Gravenhorst) – 69 (66♀♀)
2003: 28, from 11 sites. Copmanthorpe Wood 8-15/vii (1) 29/vii-5/viii (1), 5-12/viii (1); Harrop's Plantation 5-12/viii (1); Hacking Wood 8-15/vii (1) 29/vii-5/viii (1); Melbourne Hall 8-15/vii (1), 29/vii-5/viii (1), 5-12/viii (1); Naburn Wood 5-12/viii (2); New Covert 8-15/vii (2), 29/vii-5/viii (1); New Drive Plantation 5-12/viii (1); Park Wood 8-15/vii (1), 5-12/viii (1); Rush Wood 8-15/vii (1), 29/vii-5/viii (3), 5-12/viii (1); Wilson's Plantation 8-15/vii (3); Wigman Wood 1-8/vii (1), 8-15/vii (1), 29/vii-5/viii (1).
2004: 41. Copmanthorpe Wood 15-29/vii (11, 5 from 4 peripheral, 6 from 4 core sites), 29/vii-13/viii (18, 15 from 6 peripheral, 3 from 2 core traps); New Covert 15-29/vii (6 from 3 peripheral traps), 29/vii-13/viii (6, 2 from 2 peripheral, 4 from 3 core traps).
Recorded from England, Scotland, Wales and Ireland (Broad, 2008). Fitton *et al.* (1988) describe it as widespread, becoming rarer northwards. Found especially in open bushy habitat and tree canopy, but also other habitats. Reared from many poorly concealed or exposed smallish Lepidoptera pupae, also sometimes occurring as a pseudohyperparasitoid.

Itoplectis maculator (Fabricius) – 13 (2♀♀, 10♂♂)
2003: One, Copmanthorpe Wood 29/vii-5/viii.
2004: 12. Copmanthorpe Wood 15-29/vii (1 from core trap), 29/vii-13/viii (10, 8 from 2 peripheral, 2 from 2 core traps); New Covert 29/vii-13/viii (1 from core trap).
Recorded throughout the British Isles (Broad, 2008). Fitton *et al.* (1988) describe it as very common, found in many habitats but exploiting particularly the spring flush of tortricid pupae from deciduous trees, but they also record it from many other Lepidoptera pupae, and Hymenoptera cocoons (as a pseudohyperparasitoid with respect to Lepidoptera) as well as one of Coleoptera.

Pimpla contemplator (Müller) – 315 (119♀♀, 187♂♂)
2003: 142, from 14 sites. Copmanthorpe Wood 8-15/vii (5), 29/vii-5/viii (6), 5-12/viii (9); Fox Covert 8-15/vii (8), 29/vii-5/viii (2), 5-12/viii (3); Grimstone 29/vii-5/viii (2); Greenland Wood 29/vii-5/viii (1), 5-12/viii (1); Harrop's Plantation 8-15/vii (1), 29/vii-5/viii (4); Hacking Wood 8-15/vii (2), 29/vii-5/viii (1), 5-12/viii (4); Melbourne Hall 8-15/vii (4), 29/vii-5/viii (2), 5-12/viii (2); Naburn Wood 5-12/viii (1); New Covert 8-15/vii (3), 29/vii-5/viii (2), 5-12/viii (3); New Drive Plantation 8-15/vii (1), 29/vii-5/viii (1); Park Wood 1-8/vii (1), 8-15/vii (1); Rush Wood 1-8/vii (1), 8-15/vii (26), 29/vii-5/viii (20), 5-12/viii (15); Wilson's Plantation 8-15/vii (1), 29/vii-5/viii (4), 5-12/viii (1); Wigman Wood 8-15/vii (2), 29/vii-5/viii (1), 5-12/viii (1).
2004: 173. Copmanthorpe Wood 15-29/vii (54, 30 from 8 peripheral traps, 24 from 6 core traps), 29/vii-13/viii (67, 48 from 7 peripheral, 19 from 6 core traps); New Covert 15-29/vii (40, 24 from 5 peripheral, 16 from 4 core traps), 29/vii-13/viii (12, 11 from 5 peripheral, 1 from 1 core trap).
Recorded from England, Scotland, Wales and Ireland (Broad, 2008). Fitton *et al.* (1988) describe it as common and widely distributed in wooded areas north to Gwynedd and Cumbria. Attacks smallish Lepidoptera pupae concealed in soil and litter.

Pimpla flavicoxis Thomson – 231 (43♀♀, 184♂♂)
2003: 51, from 12 sites. Copmanthorpe Wood 8-15/vii (1); Fox Covert 1-8/vii (1), 8-15/vii (6), 29/vii-

5/viii (1), 5-12/viii (1); Grimstone 5-12/viii (1); Greenland Wood 5-12/viii (1); Hacking Wood 8-15/vii (1); Harrop's Plantation 1-8/vii (1), 29/vii-5/viii (1), 5-12/viii (2); Melbourne Hall 8-15/vii (4), 29/vii-5/viii (2), 5-12/viii (4); New Covert 1-8/vii (2), 8-15/vii (2), 5-12/viii (2); New Drive Plantation 8-15/vii (1); Park Wood 29/vii-5/viii (1); Rush Wood 1-8/vii (2), 8-15/vii (6), 29/vii-5/viii (1), 5-12/viii (2); Wigman Wood 1-8/vii (2), 8-15/vii (2), 29/vii-5/viii (1).
2004: 180. Copmanthorpe Wood 15-29/vii (49, 4 from 2 peripheral, 45 from 7 core traps), 29/vii-13/viii (24, 3 from 3 peripheral, 21 from 6 core traps); New Covert 15-29/vii (75, 30 from 5 peripheral, 45 from 8 core traps), 29/vii-13/viii (32, 13 from 4 peripheral, 19 from 5 core traps).
Recorded throughout the British Isles (Broad, 2008). Shaw (2006) states it to be common and widespread in Britain, apparently attacking Lepidoptera pupae near the ground. Previously compounded with *P. insignatoria*.

Pimpla insignatoria (Gravenhorst) – 529 (232♀♀, 290♂♂)
2003: 171, from 15 sites. Copmanthorpe Wood 8-15/vii (7), 29/vii-5/viii (4), 5-12/viii (9); Fox Covert 8-15/vii (4), 29/vii-5/viii (8), 5-12/viii (5); Grimstone 29/vii-5/viii (1); Greenland Wood 8-15/vii (3), 5-12/viii (1); Harrop's Plantation 8-15/vii (8), 29/vii-5/viii (3), 5-12/viii (5); Hacking Wood 8-15/vii (8), 29/vii-5/viii (4), 5-12/viii (3); Melbourne Hall 1-8/vii (1), 8-15/vii (8), 29/vii-5/viii (1), 5-12/viii (3); Many Gates Plantation 29/vii-5/viii (1); Naburn Wood 1-8/vii (1), 8-15/vii (1), 29/vii-5/viii (2); New Covert 1-8/vii (1), 8-15/vii (8), 29/vii-5/viii (3), 5-12/viii (2); New Drive Plantation 8-15/vii (2), 29/vii-5/viii (2); Park Wood 1-8/vii (2), 8-15/vii (1), 29/vii-5/viii (4), 5-12/viii (2); Rush Wood 1-8/vii (1), 8-15/vii (13), 29/vii-5/viii (13), 5-12/viii (11); Wilson's Plantation 8-15/vii (4), 29/vii-5/viii (4), 5-12/viii (1); Wigman Wood 1-8/vii (3), 8-15/vii (2), 29/vii-5/viii (1).
2004: 358. Copmanthorpe Wood 15-29/vii (75, 31 from 8 peripheral, 44 from 5 core traps), 29/vii-13/viii (130, 75 from 8 peripheral, 55 from 8 core traps); New Covert 15-29/vii (96, 53 from 6 peripheral, 43 from 7 core), 29/vii-13/viii (57, 39 from 6 peripheral, 18 from 6 core).
Previously compounded with *P. flavicoxis* (cf. Shaw, 2006). Recorded from England, Scotland and Wales (Broad, 2008). Common especially in deciduous woodland and reared from a wide range of Lepidoptera pupae on exposed shrubs and trees (Shaw, 2006).

Pimpla rufipes (Miller) – 40 (6♀♀, 33♂♂)
2003: 8, from 4 sites. Copmanthorpe Wood 8-15/vii (1), 29/vii-5/viii (2), 5-12/viii (1); New Covert 8-15/vii (2); Park Wood 8-15/vii (1); Rush Wood 5-12/viii (1).
2004: 32. Copmanthorpe Wood 15-29/vii (1, peripheral trap), 29/vii-13/viii (9, 7 from 3 peripheral, 2 from 2 core traps); New Covert 15-29/vii (19, 7 from 3 peripheral, 12 from 6 core traps), 29/vii-13/viii (3 from 2 peripheral traps).
Previously known as *P. hypochondriaca* (cf. Shaw, 2006). Recorded throughout the British Isles (Broad, 2008). Fitton *et al.* (1988) describe it as very common, especially in hedgerows and gardens. Attacks a wide range of Lepidoptera pupae above ground.

Pimpla turionellae (L.) – Four (2♀♀, 2♂♂)
2003: Three, from three sites. Grimstone 5-12/viii (1♂); Wilson's Plantation 8-15/vii (1♀); Wigman Wood 29/vii-5/viii (1♀).
2004: One ♂ Copmanthorpe Wood 29/vii-13/viii, peripheral trap.
Recorded from England, Scotland, Wales and Ireland (Broad, 2008). Fitton *et al.* (1988) describe it as common, particularly where there are trees. Attacks a wide range of Lepidoptera pupae on trees and bushes.

Subfamily Poemeniinae
Deuteroxorides elevator (Panzer) – 39 (38♀♀)
2003: 20, from 9 sites. Copmanthorpe Wood 8-15/vii (1), 29/vii-5/viii (4), 5-12/viii (2); Grimstone 5-12/viii (1); Melbourne Hall 29/vii-5/viii (3), 5-12/viii (2); Naburn Wood 29/vii-5/viii (1); New Covert 29/vii-5/viii (2); New Drive Plantation 8-15/vii (1); Park Wood 8-15/vii (1); Rush Wood 29/vii-5/viii (1); Wigman Wood 8-15/vii (1).
2004: 19. Copmanthorpe Wood 15-29/vii (5, 1 from peripheral, 4 from 4 core traps), 29/vii-13/viii (3, 2 from 1 peripheral, 1 from core trap); New Covert 15-29/vii (7 from 3 peripheral traps), 29/vii-13/viii (4 from 1 peripheral trap).
Recorded from England and Ireland (Broad, 2008). Described as rare by Fitton *et al.* (1988), but Shaw (2006) includes it as one of several species that have since proved to be

more common in suitable habitat (woodland). First records for Yorkshire. Hosts are beetles in dead wood.

Poemenia collaris (Haupt) – 21♀♀
2003: 16, from 7 sites. Fox Covert 8-15/vii (2); Grimstone 8-15/vii (1); Hacking Wood 8-15/vii (1), 5-12/viii (1); Melbourne Hall 8-15/vii (2); Rush Wood 5-12/viii (1); Wilson's Plantation 8-15/vii (3), 29/vii-5/viii (1), 5-12/viii (2); Wigman Wood 8-15/vii (2).
2004: Five. Copmanthorpe Wood 15-29/vii (2 from 1 peripheral trap), 29/vii-13/viii (1 from 1 peripheral trap). New Covert 15-29/vii (1 from peripheral trap), 29/vii-13/viii (1 from peripheral trap).
Recorded from England (Broad, 2008). Fitton *et al.* (1988) mention only a single British record from Kent, but it has since proved to be widespread and sometimes abundant in southern England, parasitizing sphecid wasps nesting in dead wood (Shaw, 2006). New records for Yorkshire (Shaw, 2006).

Poemenia hectica (Gravenhorst) – 37♀♀
2003: 31, from 11 sites. Copmanthorpe Wood 8-15/vii (1), 29/vii-5/viii (2), 5-12/viii (1); Fox Covert 8-15/vii (1); Grimstone 8-15/vii (1); Harrop's Plantation 8-15/vii (1), 5-12/viii (2); Hacking Wood 1-8/vii (1), 8-15/vii (1); Melbourne Hall 8-15/vii (3), 29/vii-5/viii (2), 5-12/viii (1); Many Gates Plantation 29/vii-5/viii (1); Naburn Wood 8-15/vii (3); New Covert 29/vii-5/viii (1); Wilson's Plantation 8-15/vii (2), 29/vii-5/viii (3), 5-12/viii (2); Wigman Wood 8-15/vii (2).
2004: Six. Copmanthorpe Wood 15-29/vii (2 from 2 peripheral traps), 29/vii-13/viii (1 from peripheral trap); New Covert 15-29/vii (2 from 2 peripheral traps), 29/vii-13/viii (1 from peripheral trap).
Recorded from England and Ireland (Broad, 2008). Described as rare by Fitton *et al.* (1988), but Shaw (2006) lists it as one of several species that have since proved to be reasonably common in suitable habitat (woodlands), and gives rearing records from the sphecid wasp *Passaloecus monilicornis*. Found as far north as Cumbria, new records for Yorkshire (Shaw, 2006).

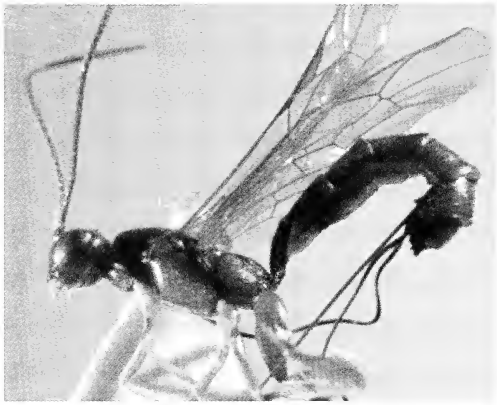

FIGURE 7. *Poemenia notata* ♂, length 7mm

Poemenia notata Holmgren (Fig. 7)
2003: Three ♀♀ from 2 sites. Hacking Wood 29/vii-5/viii (1); Wilson's Plantation 8-15/vii (2).
Recorded from England (Broad, 2008). Fitton *et al.* (1988) describe only a single British record, but Shaw (2006) lists it as one of several species that have since proved to be more common, especially in woodland. New records for Yorkshire. Shaw (2006) gives rearing records from dead wood containing cells of the sphecid wasp *Passaloecus eremite* and suggests that the spread of this host in Britain may have led to a recent increase in abundance of *P. notata*.

Discussion

Our results have several distinct implications for conservation. First, our collection has extended the distribution records of several British species, with 17 species new to Yorkshire, including one new to England, and one new to the British Isles. This is a large proportion of the total species we collected (25%) and suggests that the county as a whole is considerably under-recorded with respect to these taxa, particularly the Pimplinae and Poemeniinae. Some of the species recorded for the first time in Yorkshire were quite abundant in our samples, suggesting that the national status of several other species, such as they are known, may need to be revised after further collecting (see also Shaw, 2006).

Second, we have recorded, within a comparatively small area and in a narrow sampling window, a large proportion of British species, and the true species richness in the landscape is likely to be higher because the species accumulation curves fail to asymptote, especially for the Pimplinae (Fraser et al. 2007, 2008a). Specifically, we caught 68 species over the landscape as a whole, making 40% of British species in the taxa surveyed. In Copmanthorpe Wood alone, 46 species were collected, 27% of British species, and in New Covert, 43 species, 25% of British species.If such proportions are generally representative of parasitic Hymenoptera, a single wood might contain over 1500 species of parasitic Hymenoptera alone, and the landscape we have considered might contain over 2400 (assuming 6000 British species). This highlights the richness of insect life in woodlands in the agricultural landscape, and their value in biodiversity terms; something that is often underappreciated by focusing on more charismatic but species-poor taxa (see also Fraser *et al.*, 2008a).

Third, there was considerable variation in species' abundance and occupancy in our collections. Our previous analyses of the collections have shown that species that were collected from only a few sites or traps tended to be found in low abundance there, such that rare species (in our samples) tend to be rare in both senses (see Fraser *et al.*, 2008b). This is a small-scale illustration of the more widely known phenomenon of extinction-risk double-jeopardy whereby low abundance and restricted distributions can make species vulnerable to extinction from different sources of threat (Gaston, 1999). Parasitoid wasps are already expected to be especially vulnerable to extinction due to their host specificity and high trophic status (Shaw & Hochberg, 2001), and the double-rarity indicated in our data may add to this vulnerability. However, rarity in our catch might not necessarily mean that species are rare more generally: they might not be effectively sampled by Malaise traps, or might have peak flight seasons outside our sample period.

Of the 22 (32%) species only caught once or twice, three are Diplazontinae and 19 are Pimplinae, suggesting that Diplazontinae species may be less vulnerable to extinction. This suggestion is supported by Thirion's (1979) conclusion that this taxon has declined somewhat less than some other ichneumonid taxa in Belgium. Presumably this is at least partly an effect of their parasitizing aphidophagous syrphid larvae which often thrive in early successional and agricultural landscapes, rather than other hosts, such as the Lepidoptera parasitized by Ichneumoninae, which have declined more in Belgium (Thirion, 1981). Other features of our data that may support this suggestion include the fact that only four woods are required to include all Diplazontinae species found here, that the species accumulation curves are sometimes much closer to an asymptote than for the Pimplinae (Fraser *et al*, 2007, 2008a), the absence of sites as a factor explaining Diplazontinae abundance and richness (Fraser *et al.*, 2007), and the general absence of any associations with vegetation features (Fraser *et al.*, 2007, 2008a), perhaps suggesting that their habitat requirements are fairly general in comparison. The latter is also reflected in the generally large number of habitats described for each species by Thirion (1994).

Fourth, there was considerable variation in the number of individuals (but to lesser extent species) captured in different woods (Table 1). Our previous analyses of the collections have identified woodland tree/shrub richness as a variable that is associated with high wasp abundance and richness, particularly for the Pimplinae (Fraser *et al.*, 2007). This may be a useful surrogate to use when assessing the value of a site, or potentially when

managing a site to improve its conservation value. Tree/shrub richness also works well as a surrogate to maximize when selecting a portfolio of reserves (Fraser *et al.*, 2009), suggesting that some woodland sites may have value by adding species to the landscape even though they are not themselves particularly species-rich. Several other studies have suggested links between parasitoid diversity and measures of vegetation diversity (e.g. Sperber *et al.*, 2004; Saaksjarvi *et al.* 2006; Lassau & Hochuli, 2005), suggesting that such surrogates might be more generally applicable. Tree/shrub richness is presumably important because it governs the diversity of hosts and other resources that the parasitoids require.

Finally, there was some variation in the catch between core and edge traps in the two woods sampled in 2004. The Poemeniinae for example were more abundant and rich at edge compared to core traps (see Results above; Fraser *et al.* 2008a). Our previous analyses of these data have suggested that the composition of the parasitoid communities generally differs from core to edge, and thus that this taxon could be affected by habitat fragmentation which increases the proportion of edge habitat (Fraser *et al.* 2008a). There is, however, no indication that species richness or abundance is generally lower towards woodland edges. Thus, the practice of breaking up blocks of forestry with rides and clearings might be beneficial for some but not all taxa. In contrast, Noyes (1989b) found that parasitic wasp diversity was higher in the interior than edge of a Sulawezi forest.

In conclusion our collection demonstrates that Yorkshire's ichneumonid fauna is under-recorded and therefore that its richness is higher than records to date have suggested; that the status of many species nationally may need to be re-assessed after further collecting; that local and individual woodland richness is very high making small woodlands a valuable local biodiversity resource; that rare parasitic wasps may suffer double-jeopardy from extinction risks; that a higher proportion of Pimplinae species may be at risk than Diplazontinae species; and that tree/shrub species richness could be used as a surrogacy tool to identify or appropriately manage individual sites or a portfolio of sites for Pimplinae in the absence of direct sampling of the wasps themselves. Given their diverse life histories and the diversity of host taxa they utilize, it is possible that Pimplinae may be an appropriate surrogate taxon for parasitic wasps in general. At present the conservation of parasitic wasps relies to a large extent on the hope that the conservation of other species and habitats will be generally sufficient. Determining whether or not it is will depend on further field collections to establish and monitor the status of species over time.

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ADDITIONS AND CORRECTIONS TO THE YORKSHIRE DIPTERA LIST (PART 4)

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Over 200 species were added to the Yorkshire Diptera list during 2007, including two *Stilpon* species by Crossley (2007), and 9 species of Sciaridae by Grayson (2007). 187 species were added, or re-instated, to the list by Grayson (2007a), as were a further 24 by Grayson (2007b).

By 31 March 2008, the British Diptera list contained 6983 species (Chandler, 2008) and the provisional Yorkshire Diptera list contained 4187 species, including 1533 in the sub-order Nematocera. A numeric analysis of taxa in the Yorkshire list was as follows at 31

March 2008: 885 species had been recorded from only one locality; 99 species had been recorded from over 100 localities; the numbers of species recorded in each family were: Tipulidae (70 species) [2 species excluded from the list], Cylindrotomidae (4), Pediciidae (19), Limoniidae (174) [7], Bibionidae (17) [1], Bolitophilidae (11), Diadocidiidae (2), Ditomyiidae (1), Keroplatidae (20) [1], Mycetophilidae (300) [7], Sciaridae (91) [7], Cecidomyiidae (245) [7], Psychodidae (58) [2], Trichoceridae (9), Anisopodidae (4), Mycetobiidae (1), Scatopsidae (24) [1], Ptychopteridae (7), Dixidae (13), Chaoboridae (6), Culicidae (21) [3], Thaumaleidae (3), Simuliidae (24), Ceratopogonidae (91) [3], Chironomidae (319) [16], Xylophagidae (1), Athericidae (1), Rhagionidae (9), Spaniidae [ex Rhagionidae] (3), Tabanidae (12) [6], Xylomyidae (1), Stratiomyidae (37) [1], Acroceridae (1) [1], Bombyliidae (3), Therevidae (6) [1], Scenopinidae (1), Asilidae (15), Atelestidae (2), Hybotidae (135) [7], Empididae (170) [6], Microphoridae (4), Dolichopodidae (218) [6], Opetiidae (1), Platypezidae (17), Phoridae (177) [1], Lonchopteridae (6), Syrphidae (207) [22], Pipunculidae (59) [3], Psedopomyzidae (1), Micropezidae (7), Megamerinidae (1), Psilidae (23), Conopidae (15) [1], Lonchaeidae (21) [1], Pallopteridae (10), Piophilidae (9), Ulidiidae (13) [1], Platystomatidae (2), Tephritidae (57) [3], Lauxaniidae (43) [1], Chamaemyiidae (12), Coelopidae (2), Dryomyzidae (5), Phaeomyiidae (2), Sciomyzidae (59) [2], Sepsidae (25), Clusiidae (6) [2], Acartophthalmidae (1), Odiniidae (3), Agromyzidae (188) [12], Opomyzidae (16), Anthomyzidae (16) [1], Aulacigastridae (1), Stenomicridae (1), Periscelididae (1), Asteiidae (6), Milichiidae (2), Carnidae (5), Braulidae (1), Tethinidae (3), Canacidae (2), Chloropidae (120) [2], Heleomyzidae (49) [2], Chyromyidae (3), Sphaeroceridae (84) [2], Drosophilidae (37) [2], Campichoetidae (2), Diastatidae (5), Camillidae (4), Ephydridae (97) [4], Hippoboscidae (9), Nycteribiidae (2), Scathophagidae (39) [2], Anthomyiidae (148) [10], Fanniidae (37) [5], Muscidae (201) [12], Calliphoridae (28) [3], Rhinophoridae (6), Sarcophagidae (31) [3], Tachinidae (113) [10], Oestridae (4) [1].

The above analysis included the additions, re-instatements and exclusions given below. Many of these are based on data gleaned from material held in museum collections: [LM] = Leeds Museum Discovery Centre, [SM] = Weston Park Museum stores at Acres Hill, Sheffield, and [DM] = Doncaster Museum and Art Gallery, in some cases followed by the data code on pinned material, e.g. [DM '6.76a']. Initials used refer to the following: AB = A. Brackenbury, PJC = P. J. Chandler, RC = R. Crossley, ARG = A. R. Godfrey, and PS = P. Skidmore; em. = emerged.

Additions to Yorkshire Diptera List

LIMONIIDAE

Molophilus (*Molophilus*) *czizeki* Lackschewitz in Czizek, 1931. (64) Bolton Abbey, 18.5.1985 (♂), PS, [DM].

MYCETOPHILIDAE

Trichonta subfusca Lundström, 1909. (63) Fox Clough, SE1800, 1.8.2007 (♂), J. D. Coldwell; (64) Mackershaw, (by River Skell), SE290689, 19.6.1989 (♂), PS, det. PJC, [DM].

CECIDOMYIIDAE

Aprionus flavidus (Winnertz, 1870). (63) Sandall Beat Wood, (at light), 21.6.1974 (♂), PS, [DM].

SCATOPSIDAE

Ectaetia platyscelis (Loew, 1869). (62) Duncombe Park, 10.6.1980 (♂), PS, [DM].

CERATOPOGONIDAE

Ceratopogon niveipennis Meigen, 1818. (63) Cusworth Park, (at light), 28.5.1975 (2♂♂), 10.7.1975 (♂), 21.7.1975 (♂), 3.8.1975 (♂), PS, [DM].

Stilobezzia (*Stilobezzia*) *flavirostris* (Winnertz, 1852). (63) Campsall Park, 23.7.1977 (2♂♂,♀), PS, [DM '19.77'].
Culicoides (*Monoculicoides*) *parroti* Kieffer, 1922. (63) Blacktoft Sands, 8.1976 (6♂♂,13♀♀), A. Grieve, det. PS, [DM]; Cusworth Park, (at light), 6.8.1975 (♀), PS, [DM]; Pollington Camp, 7.1976 (♀), P. Kendall, det. PS, [DM]; Whitgift, (at light), 7.1976 (♂,12♀♀), A. Grieve, (5♀♀ det. R. P. Lane, 3♀♀ det. PS, ♂ + 4♀♀ det. PS 1994), [DM].
C. (*M.*) *riethi* Kieffer, 1914. (63) Mickletown Ings, (at light), 26-27.7.1976 (♀), 29-30.7.1976 (♀), R. L. Brook, det. PS 1994, [DM].
Bezzia (*Bezzia*) *flavicornis* (Staeger, 1839). (63) Bentley Common, (fishponds area), 23.6.1976 (♂♀), PS, [DM].
Mallochohelea inermis (Kieffer, 1909). (63) Denaby Ings, (embankment), 15.00 hr, 19.6.1982 (2♀♀), PS, [DM].

CHIRONOMIDAE
Corynoneura celtica Edwards, 1924. (63) Bentley Common, (fishponds area), 23.6.1976 (♂), PS, [DM '6.76a'].
Krenosmittia camptophleps (Edwards, 1929). (63) Sandall Beat Wood, (at light), 21.6.1974 (♀), PS, [DM].
Limnophyes habilis (Walker, 1856) [= *truncorum* Goetghebuer, 1921]. (63) Crookhill, 27.6.1974 (♂♀), PS, det. PS sub nom. *truncorum*, [DM].
Psectrocladius (*Monopsectrocladius*) *calcaratus* (Edwards, 1929). (63) Blacktoft Sands, 4.1976 (♀), A. Grieve, det. PS, [DM 'B.4.76'].

HYBOTIDAE
Oedalea oriunda Collin, 1961. (61) North Cave Wetlands, SE883330, 15.5.2007 (♂), RC.

DOLICHOPODIDAE
Dolichopus (*Dolichopus*) *lineatocornis* Zetterstedt, 1843. (61) North Duffield Carrs, SE697370, 6.6.2007 (♂), RC.

SYRPHIDAE
Platycheirus (*Platycheirus*) *aurolateralis* Stubbs, 2002. (65) Langton Wood, SE3095, 17.7.1996, R. K. A. Morris. This record is plotted as hectad SE39 on the British distribution map for *P.* (*P.*) *aurolateralis* on the Hoverfly Recording Scheme website (www.hoverfly.org.uk).

LONCHAEIDAE
Lonchaea tarsata Fallén, 1820. (65) Low Row, near Reeth, SD97579745, 2.7.2005, ARG.

AGROMYZIDAE
Aulagromyza fulvicornis (Hendel, 1935) [= *langei* (Hering, 1937)]. (63) Bilham Quarry, 28.7.1976 (♀), C. A. Howes, det. PS sub nom. *langei*, [DM '28.76'].

OPOMYZIDAE
Geomyza angustipennis Zetterstedt, 1847. (63) Levitt Hagg Wood, SE5300, 29.6.1987 (♀), C. A. Howes, det. PS, [DM].

CARNIDAE
Meoneura lacteipennis (Fallén, 1823). (63) Bell's Pond, Thorne Moor, 27.6.1985 (♀), PS, det. PJC, [DM].

CHLOROPIDAE
Chlorops adjunctus Becker, 1910. (63) Newton, near Doncaster, 19.6.1980 (♀), PS, [DM].

SPHAEROCERIDAE
Leptocera finalis (Collin, 1956). (63) Thorne, (waterside: old course of River Don), 14.5.1982 (2♂♂), PS, [DM].
Trachyopella (*Trachyopella*) *coprina* (Duda, 1918). (62) Ashberry Pasture, 18.5.1980 (♀), PS, det. PS 1990, [DM].

CAMILLIDAE
Camilla fuscipes Collin, 1933. (63) Hatfield Moor, SE709061, 20.7.1992 (♀), PS, det. PS 1993, [DM].

EPHYDRIDAE
Haloscatella dichaeta (Loew, 1860). (63) Thorpe Marsh Power Station, void (SE5909) and track (central point is SE609090) on 6.9.2006, track only on 20.9.2006, ARG.
Hyadina scutellata (Haliday, 1839). (63) Rother Valley Country Park, Rotherham, SK4510184119, 11.8.2004, ARG.
Philygria interrupta (Haliday, 1833). (65) Cotterdale, Hawes, SD828921, 22.9.1986, J. H. Cole.

ANTHOMYIIDAE
Anthomyia imbrida Rondani, 1866. (61) Spurn, 10.1978 (♂), J. Biglin, det. V. Michelson 1983, [LM].
Chirosia latipennis (Zetterstedt, [1838]). (63) Ecclesall Woods, Sheffield, SK325826, 15.6.1980 (♂), S. Watson, det. PS 1982, [SM]; Hatfield Moor, SE706069, 10.7.1991 (♂), PS, det. PS 1993, [DM].
Phorbia moliniaris (Karl, 1917). (63) Hatfield Moor, SE692069, 11.7.1991 (♀), PS, det. PS 1992, [DM]; Hatfield Moor, SE705068, 13.5.1992 (2♂♂), SE706069, 13.5.1992 (2♂♂), PS, [DM]; Thorne Moors, 20.6.1990 (♂), PS, det. PS 1992, [DM].
Zaphne nuda (Schnabl in Schnabl & Dziedzicki, 1911). (64) Cowbeck, Malham Tarn, (birch carr), 29.6.-2.7.1981 (♂), R. H. L. Disney, det. PS, [DM].
Alliopsis pilitarsis (Stein, 1900). (64) Mackershaw, (by River Skell), SE289690, 19.6.1989 (3♂♂), PS, det. PS 1993, [DM].

FANNIIDAE
Fannia vespertilionis Ringdahl, 1934. (61) North Ferriby, 5♂♂ 2♀♀ em. 3.1992 (ex droppings from Noctule Bat *Nyctalus noctula*), leg. A. C. Lane, det. PS, [DM].

MUSCIDAE
Spilogona aerea (Fallén, 1817). (63) Bell's Pond, Thorne Moor, 16.6.1993 (♂), PS, [DM].
Helina pulchella (Ringdahl, 1918). (63) Cusworth Park, ♀ ex puparium em. 30.4.1975, PS, [DM].
CALLIPHORIDAE
Lucilia bufonivora Moniez, 1876. (63) Sprotbrough, 17.7.1965 (♂), PS, [DM].

Re-instatements to Yorkshire Diptera List
LAUXANIIDAE
Sapromyza (*Sapromyza*) *obsoleta* Fallén, 1820. (61) Spurn Point, 19.7.1996, S. G. Ball, det. ARG. A record from Bishopdale (Cheetham, 1922) was withdrawn by Cheetham (1922a).

ANTHOMYIIDAE
Pegomya (*Phoraea*) *deprimata* (Zetterstedt, 1845). (63) Oughtibridge Signal Box, Wharncliffe Wood, SK311937, 17.11.1976 (♀), AB, det. PS 1977, [SM]; Oughtibridge Signal Box, Wharncliffe Wood, SK311937, 29.11.1976 (♀), AB, det. PS, [DM]. Grayson (2006) provisionally excluded this species from the Yorkshire list.

SARCOPHAGIDAE
Sarcophaga (*Sarcophaga*) *carnaria* (Linnaeus, 1758) sensu Richet, 1987 [= *vulgaris* Rohdendorf, 1937]. (63) Holmes Carr Great Wood, Rossington, 21.8.1985 (♂), PS, det PS sub nom. *vulgaris*, [DM]. '*S* (*S.*) *carnaria*' has often been recorded in Yorkshire, but a species review by Richet (1987) referred *carnaria* of previous authors to *S* (*S.*) *variegata* (Scopoli).

Exclusions from Yorkshire Diptera List

CULICIDAE
Ochlerotatus (*Ochlerotatus*) *flavescens* (Müller, 1764) and *O.* (*O*) *sticticus* (Meigen, 1838). Leeds Museum Discovery Centre contains Yorkshire material filed under these names, but the specimens are damaged and cannot be confidently identified to species level. These specimens were probably incorrectly filed during their removal from Chris Cheetham's cabinets, and he probably never identified them as *O.* (*O.*) *flavescens* and *O.* (*O.*) *sticticus*.

CHIRONOMIDAE
Cricotopus (*Isocladius*) *ornatus* (Meigen, 1818) [= *obscurimanus* (Zetterstedt, 1850)]. Records sub nom. *obscurimanus* in Ashworth and Cheetham (1920) refer to *Prodiamesa olivacea* (Meigen, 1818), not *C.* (*I.*) *ornatus*.

SYRPHIDAE
Cheilosia soror (Zetterstedt, 1843). The purported material in The Manchester Museum is a ♂ *C. pagana* (Meigen, 1822) (det. A. Grayson, 2006), collected from Robin Hood's Bay.

ANTHOMYZIDAE
Anthomyza anderssoni Roháãek, 1984. This species is not known from Britain. Skidmore (2006) recorded *A. anderssoni* from Thorne Moors, 2005; however, this was due to a transcription error, and refers to *A. collini* Andersson, 1976, (ARG, *pers. comm.* 28.4.2007).

CHLOROPIDAE
Cryptonevra nigritarsis (Duda, 1933). A Yorkshire record in Key (1987) resulted from a transcription error, and refers to *C. flavitarsis* (Meigen, 1830).

DROSOPHILIDAE
Drosophila (*Sophophora*) *helvetica* Burla, 1948. The purported material is not this species. The relevant specimen is in the E. C. Broadhead collection [LM], and was collected from a garden in Leeds on 21.3.1974.

ANTHOMYIIDAE
Egle inermis Ackland, 1970 [= *bicaudata* sensu Ackland, 1989, nec (Malloch, 1920)]. Included in circulated draft versions of the proposed Yorkshire Diptera list on the basis of a 1977 record [sub nom. *bicaudata* "(= *muscaria* auct.)"] from a provisional Thorne Moors list. This was a transcription error for *E. ciliata* (Walker, 1849) [= *muscaria* sensu auctt., nec (Fabricius, 1777)].

OESTRIDAE
Gasterophilus nasalis (Linnaeus, 1758). Grayson (2004) tentatively added this species to the Yorkshire list, stating that a specimen held in The Manchester Museum bears a label with undecipherable characters preceding "Doncaster". The probable labelling is "W + Doncaster", indicating Watkins and Doncaster, the well known entomological suppliers: hence, the specimen is without locality details.

Further Notes

HYBOTIDAE

Platypalpus albocapillatus (Fallén, 1815) was provisionally excluded from the Yorkshire list by Grayson (2006) pending verification of a record from Agden Bog. This record is no longer on the Sorby Natural History Society database, and was presumably a computer input error, now corrected (D. Whiteley, *pers. comm.* to RC).

TACHINIDAE

In Grayson (2006), *Cyzenis jucunda* (Meigen, 1838) was incorrectly spelt as *juncunda*.

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ENTOMOLOGICAL REPORT: DIPTERA *(TIPULOIDEA AND EMPIDOIDEA)*

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Since the last report covering these two Superfamilies (Crossley 2007), much fieldwork undertaken by a handful of dipterists has resulted in yet another interesting set of records. The more exceptional are detailed below, including 14 additions to the county list, of which several are nationally significant. Of the latter, the quite outstanding records of *Tachydromia* species call for special comment. These tiny flies often escape the attentions of most collectors as they are usually sought by laborious and physically uncomfortable searching on hands and knees on river shingle. However, fairly recent developments in portable suction equipment have enabled these hitherto obscure little flies to be much more collectable. Work undertaken by Mr Godfrey and others in recent years has highlighted the specialized faunal composition of river-side sand and shingle banks, and a growing body of published notes from different parts of the country is revealing the dipterological value of many sites, and records from such places feature prominently throughout this report. Most Yorkshire rivers have such habitats which have long been noted for their specialized beetle faunas and it is gratifying to note that their dipterological potential is now equally being recognized.

Thanks are warmly extended to W.R.Dolling (WRD), W.A.Ely (WEA) and A.N.R.Godfrey (ANRG) who have supplied records which appear in this report, and I am once again obliged to Andrew Grayson for drawing to my attention records which I would have otherwise overlooked All unattributed records are those of the author (RC).

The systematic order of the list and the nomenclature follow Chandler (1998), but sub-generic names have been omitted. The national rarity classifications which follow the species names (emboldened in brackets) are those provisionally recommended by Falk (1991) for Tipuloidea, and by Falk and Crossley (2005) for Empidoidea. Three species noted in this Report have only recently been described and their status nationally is unknown: *Tachydromia edenensis, Hilare woodiella and Sciapus basilicus*. † indicates a new county record and * indicates a new vice-county record.

LIMONIIDAE

Molophilus propinquus (Egger) (**Nb**). River-bank sand/shingle, Ox-Close Wood, East Keswick, (64), 6/5/2008. Apart from an 87-year old report from Austwick (*Trans. Ent. Soc.* 1921: 215), subsequent Yorkshire reports are post-1997 from riparian sites in the upper north-west Dales.

Rhabdomastix edwardsi Tjeder. Numerous on shingle by the River Wharfe at Ox-Close Wood, East Keswick (64) between 23/5/2008 and 24/6/2008. Found by the stream in Littlebeck Wood near Whitby (62), in 2002, all the numerous subsequent records have been from stream/river systems in the north-east of the county, mostly in Swaledale and Wharefedale. The current report, from Lower Wharfedale, is the farthest east of these to date.

Hexatoma fuscipennis (Curtis). Amongst mixed vegetation on a shingle/sand bank of River Wharfe, Ox-Close Wood (64), 6/5/2008; 'abundant' on 14/5/2008 and 'numerous' on 23/5/2008; none could be found on 24/6/2008.

Dicranomyia ornata (Mg.) (**Nb**). This species has a known association with Butterbur (*Petasites hybridus*), and several specimens were found amongst these plants on sand/shingle by the river at Ox-Close Wood (64), 14/5/2008. This constitutes the first record of the species from the River Wharfe.

ATELESTIDAE

† *Atelestus dissonans* Coll. (**Nb**). Pot Ridings Wood (63), 2003 ANRG. Nationally, records for this species are limited to sites across southern England bounded by a line from Bristol to Kent (Falk & Crossley, 2005). This solitary record from a well-worked South Yorkshire woodland is far to the north of the previously known range and is therefore of national significance.

HYBOTIDAE

†*Oedalea oriunda* Coll. (**RDBK**). A single male swept from a boundary hedge at North Cave Wetlands YWT reserve (61), 15/5/2007. Described from three males taken at Barton Mills, Suffolk in May 1938 (Collin, 1961), subsequent examples have been found in the Bristol area in June, 1983, at Barnham, Suffolk in 13/5/1995, and more recently in South Wales. The biology of this species is unknown, but the larvae of closely related species are known to develop in rotten wood, probably as predators of small invertebrates (Falk & Crossley, 2005).

†*Stilpon graminum* (Fall.). Askham Bog (64), 16/4/2005, leg. WRD, det. RC; Upper Dunsforth (64), 22/9/2005, ANRG; Seivedale Fen (*62), 1/7/2005, ANRG; Melbourne Ings (*61), 23/5/2007, leg.WRD, det. RC. This tiny fly, and others of the genus, are usually taken by sieving vegetation or by suction,

†*Stilpon subnubilus* Chvála. Grass Woods, 10/7/2005; East Keswick Fitts 11/7/2005 (both VC64); Beningborough (*62), 11/7/2005. All ANRG.

†*Platypalpus aeneus* (Macq.) (**RDB3**). Beningborough (62), 11/7/2005 ANRG. The few national records for this species are widely scattered across southern Britain, as far north as Huntingdonshire (Falk & Crossley, 2005).

†*P.ecalceatus* (Zett.) (**Nb**). Low Row (65), 2/7/2005 ANRG. This is a widespread but apparently local species in northern Scotland and the Hebrides, and there are two records from Wiltshire (Falk & Crossley, 2005).

†*P.rapidoides* Chvála. Pot Riding Wood (63), 29/6/1988, leg. & det. WAE, teste RC; there is also a more recent record for Pot Riding Wood: 23/6/2005 ANRG; Runswick Bay (*62), 9/6/1990, leg. & det. WAE, teste RC.

P.subtilis (Coll.) (**Nb**). North Cave Wetlands YWT reserve (*61), 15/8/2007. Widespread, but localized across Yorkshire; this is the first record for vc61.

†*Tachydromia acklandi* Chvála (**RDB3**). Great Langton (65), 3/7/2005, ANRG.

†*T.arrogans* (L.). Great Langton (65), 3/7/2005; East Keswick Fitts (*64), 11/7/2005, both ANRG.

†*T.edenensis* Hewitt & Chvála. Low Row (65), 2/7/2005, ANRG. A recently described species, first found on the River Eden in Cumbria (Hewitt & Chvála, 2002), its occurrence on the shingle banks of Yorkshire's higher dales rivers is not unexpected.

EMPIDIDAE

Empis prodromus Lw. (**RDB3**). North Cave Wetlands YWT reserve (61), June,2007. Previously reported from Allerthorpe Common, North Cliffe Wood and Calley Heath; all known Yorkshire sites are lowland East Riding reserves of the Yorkshire Wildlife Trust.

†*Hilara woodiella* Chvála. 1♂ and 2♀♀ were swept from bushes bordering a dyke at North Duffield Carrs, (61), (part of the Lower Derwent Valley National Nature Reserve),

18/6/2007, and were identified by Dr Adrian Plant, National Museum of Wales, Cardiff, where the specimens are now housed. This is the first British record of a species described less than ten years ago (Chvála. 1999). It closely resembles the widespread *H.pseudochorica* Strobl (syn. *H. woodi* Coll.), and *H. woodiella* may prove eventually to be relatively common, once its presence in Britain becomes widely known amongst dipterists. For a full account of this record see Plant and Crossley, 2007.

DOLICHOPODIDAE

Diaphorus oculatus (Fall.). Ellington Banks, (64) 14/6/2008, by small pools with emergent vegetation and surrounding shrubs. Athough not considered rare nationally, this species is very localized in Yorkshire, being known from only six localities, the earliest record being for Austwick and Lawkland Mosses in c.1919, from which it has not been subsequently reported. More recent (post-1980) records are from Askham Bog and Upper Dunsforth in vc64, and Sand Dale and Ashberry in vc62.

Melanostolus melancholicus (Lw.) (**Nb**). North Cave Wetlands YWT reserve (61) 28/7/2008. There are few Yorkshire records for this species: Sewerby Cliffs (61), Sand Dale (62) and Hatfield Moor (63). All are post-1996 and although it is possible that this minute fly has been overlooked in the past, it may be genuinely scarce.

Dolichopus agilis Mg. (**Nb**) North Cave Wetlands YWT reserve (61), 1♂, 26/7/2008. There are at least eight known post-1960 British sites for this species (Falk & Crossley, 2005), of which Blacktoft Sands RSPB reserve (63), July 1980 (probably from a water-trap) is the only other recent Yorkshire record. There is a Meade record for 'Bradford' in 1886, and one from Allerthorpe 2/7/1927 by Cheetham with a note on the record card in Cheetham's hand, 'given to Collin'. I am obliged to Dr Adrian Pont who has kindly confirmed that the latter specimen, a male, is housed in the Verrall-Collin collection at the University Museum, Oxford, and that the data label confirms the locality and date.

†*D. lineatocornis* Zett. (**RDB3**) A single ♂, North Duffield Carrs, (61), (part of the Lower Derwent Valley National Nature Reserve), 6/6/2007, in winter-flooded sedge/rank grassland. In spite of subsequent intensive searching of the area no more specimens have been found. Nationally there are few post-1950 records for this species, none of them further north than Huntingdon (Falk & Crossley, 2005).

Hercostomus fulvicaudis (Hal. in Walker) (**Nb**). A single ♀, North Cave Wetlands YWT reserve (*61) is only the second Yorkshire record, the first being 2♂♂ and 2♀♀ in water traps placed amongst *Phragmites* at Blacktoft Sands RSPB reserve (63), July 1978 (det. P.Skidmore). Nationally there have been recent records of this species from gravel pits in Huntingdonshire, so the North Cave habitat is not exceptional (Falk & Crossley, 2005).

H.parvilamellatus (Macq.). Several examples of both sexes in the vicinity of small pools at Ellington Banks (*64), 14/6/2008. A localised species in Yorkshire with all previous recorded sites being in the east or south of the county, the majority being subject to calcareous influence.

Tachytrechus insignis (Stann.). A single ♀ at the margin of a lagoon at North Cave Wetlands YWT reserve (61), 4/9/2007. Only the third Yorkshire record, previous ones being Beacon Ponds, Kilnsea (61) 2001 and Hatfield Moor (63), 2005. Outside Yorkshire, I found the species to be 'common' on bare sand at Little Paxton Gravel Pits (Hunts.) in 1994.

†*Sciapus basilicus* Meuffels and Grootaert. Specimens were found at three riverside sites in Swaledale by Mr Godfrey as follows: Low Row, 2/7/2005; Reeth, 2/7/2005 and Great Langton, 3/7/2005. This is a remarkable collection of records of a species which was

described as recently as 1990, the type specimens being from the Netherlands (Meuffels & Grootaert, 1990). The first British record was of a single ♂ collected in June 1997 by sweeping partially vegetated and stabilized exposed sediment banks on the River Usk at Llanwenarth, Gwent (Cole, 1998). Further specimens have been found subsequently in similar habitats along the River Usk (Plant, 2006).

†*Sciapus maritimus* Beck. Batchelor Hill, York (64), 2/7/2004, ANRG. Until the major revision of the *Sciapus contristans* species group (Meuffels & Grootaert, 1990), there had been much confusion as to the true identity and nomenclature of several *Sciapus* species in Britain. Amongst this confusion were some old records for *S.'maritimus'* in Yorkshire and in other regions. The first authentic *maritimus* (*sensu* Meuffels & Grootaert, 1990) was added to the British List from specimens found in dunes on the Ayrshire coast in 1995 (Crossley, 1998). This current record from a York suburb, of what is regarded as chiefly a coastal species (Meuffels & Grooteart, 1990), is believed to be the first to be published for England, although correctly named British specimens are said to have been examined, presumably in collections, but no details are available (Chandler, 1998: 94, note 10).

Campsicnemus marginatus Lw. North Cave Wetlands YWT reserve (*61), 15/8/2007 and 4/9/2007. This species is normally associated with sand and shingle-banks of upland rivers, but it also occurs at gravel pits, and there are records from Hay-a-Park (Knaresborough) and Nosterfield.

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CHARLES IAN MASSEY
1939 – 2008

Curator of Wood End Natural History Museum, Scarborough

Born in Morecambe on 1 May 1939, Ian moved with his family via Shipley, Bingley and Ilkley, finally settling in Hunmanby, East Yorkshire in 1945. He attended Bridlington Grammar School and after a short period working for the Yorkshire Water Authority in Leeds, moved to Sheffield as a trainee in the Natural Sciences section at Weston Park Museum where he worked with Mike Clegg. Here he commenced studying for the Museums Diploma. In January 1961 he became Trainee Assistant at Wood End Natural History Museum, Scarborough, working under the Curator, Geoffrey G. Watson. After completing the Museum Diploma and becoming an Associate of the Museums Association, Ian followed Geoffrey Stansfield as Assistant Curator. At Local Government Reorganisation in 1974, Geoffrey Watson moved to Middlesbrough to run the Museum service in Teesside and Ian became Senior Museums Officer in Scarborough, taking responsibility for Wood End together with the Rotunda Museum and the Art Gallery, a position he held until his retirement in April 1994.

Ian Massey during a lunch break on a Scarborough Field Naturalists' Society field trip to Wheeldale Gill in 2004 which he organised. (Photo: Jax Westmoreland)

At Wood End Museum, Ian became a focus for regional natural history recording, developing an extensive network of contacts not only with the natural history fraternity but with professionals in the Forestry Commission, North York Moors National Park and in the farming and commercial fishing communities. Over the years a constant stream of researchers beat a trail to Ian for access to and information on the extensive natural history collections at Wood End, acknowledgement of which is registered in numerous published papers. He was responsible for contributing details of these collections and their collectors to the *Register of Natural Science Collections in Yorkshire and Humberside* (1987). Although the exhibitions budget was limited, a number of fascinating displays were mounted, including Dinosaur footprints recently found on the Yorkshire coast and on the Northern Bluefin Tuna in the North Sea, and there were always topical or seasonal exhibits of tracks, trails and signs of birds and mammals and what you could find on the shore or in local woodland.

Ian joined the Yorkshire Naturalists' Union in 1968 and quickly became a leading contributor of mammal, herptile and fish records. He followed Colin Simms as Secretary of the YNU Mammals and Lower Vertebrates Committee and was a very active member of the section, contributing the marine and freshwater fish sections for the YNU Annual Vertebrate reports from 1971 to 1974. Ian regularly attended YNU excursions within the Scarborough region, contributing the 'Other Vertebrates' reports for several excursions between 1971 and 1974. As an authority on mammals, herptiles and fish, Ian also provided book reviews for *The Naturalist*.

An interest in sea mammals led to a series of important papers on notable Yorkshire

strandings and through a lifetime of collecting photographs, postcards and glass plate negatives, he amassed a remarkable archive of images of Yorkshire strandings from the 19th century onwards. This collection formed the basis of a memorable talk he presented to the YNU Vertebrates section, various YNU affiliated Societies and Scarborough district community groups. His interest in cetacean strandings and whalebone archways led to his providing information on a substantial number of Cleveland, North and East Yorkshire examples for the monumental *Whales' Bones of the British Isles* by N. Redman (2004). In annually providing extensive and meticulously presented hand written lists of mammals to the YNU, Ian was hugely influential in the compilation of the Atlas of Yorkshire Mammals (*Naturalist* **108** (1983): 42-82). Pioneer recording work on Barn Owl diets, and the monitoring of hedgehog and badger road traffic accidents as a means of understanding their distribution and seasonality, also entered the Yorkshire literature and influenced others to undertake similar studies, examples of which are as follows:

Massey, C. I. (1972) Prey taken by a barn owl. *Naturalist* **97**: 11-13.

Massey, C. I. (1972) A study of hedgehog mortality in the Scarborough district, 1966-1971. *Naturalist* **97**: 103-105.

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Massey. C. I. (1973) Sowerby's Whale stranded in Filey Bay. *Naturalist* **98**: 28.

Massey. C. I. (1973) Abnormal coloured moles in Upper Eskdale. *Naturalist* **98**: 57-58.

Massey. C. I. (1973) White-sided Dolphin stranded in Cayton Bay. *Naturalist* **98**: 90.

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Massey, C. I. and Howes, C. A. (2003) The Hooded Seal *Cystophora cristata* (Erxleben, 1777), a new mammal for the Yorkshire coast. *Naturalist* **128**: 37-38.

Ian maintained a close relationship with the Scarborough Field Naturalists' Society, serving as its Secretary for the periods 1972-1975, 1984-1987 and 1994-2006, and as its President in 1971 and again from 1978 to 1980. On behalf of the Society, Ian was recorder for mammals, reptiles and amphibians, précis of records being published in the Society Annual Reports from 1973 to 2005. For decades Ian organised the annual April/May monitoring of the spring migration of toads across the 800 yards of Lady Edith's Drive adjacent to Throxenby Mere, the monitoring team recording thousands of squashed specimens and rescuing thousands more. In addition to the annual reports, the following useful projects and investigations were published by the Society:

Massey, C. I. and Thompson, F. J. (1973) Gulls nesting on rooftops. *Scar. Fld Nats Soc. Ann. Rep. 1973*: 80-83.

Massey, C. I. (1979) Comments on the status of the Grass Snake in the Scarborough District. *Scar. Fld Nat. Soc. Ann. Rep. 1979*: 34-35.

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Massey, C. I. (2000) Local status of the Harvest Mouse. *Scar. Fld Nats Soc. Ann. Rep. 2000*: 39-40.

Massey, C. I. and Howes, C. A. (2005) Badger road casualties in the Scarborough district: Trends in distribution and seasonal frequencies as recorded from 1967 to October 2005. *Scar. Fld Nats Soc. Ann. Rep. 2005*. SFNS, Scarborough.

From 1977 Ian became Librarian/Archivist Scarborough Field Naturalists' Society, a long term aim being to write the history of the society. Based on researches through the society archives he compiled a fascinating series of papers in the *Scarborough Field Naturalists' Society Reports* between 2001 and 2004 which highlighted changes in seasonality, biodiversity and the social history of naturalists over the past century. His researches into the lives and works of notable local naturalists led to the invaluable series of illustrated papers in the same journal entitled 'Portrait of a Naturalist' which featured James (Jimmy) Percival Best (1883-1967), George Beckwith (Buggy) Walsh (1880-1957), Edward Robert Cross MPS (1866-1954), Harald Maud Hirst (1887-1956) and Alice Hibbert-Ware (1896-1944).

I first met Ian in the early 1960s when visiting Wood End as a schoolboy. From then on, no visit to Scarborough was complete without visiting Ian at Wood End to discuss current projects and hear the latest on the natural history front. Visits were usually delightfully interrupted by members of the public or council staff bringing in specimens to be identified or ringing in to report some observation or other. He was a most affable and humorous individual who clearly enthused generations of local people in the natural world.

Ian had suffered from leukaemia for two years but had looked forward to being well enough to attend the YNU 2008 AGM which the Scarborough Field Naturalists' Society was hosting in Scarborough. Tragically Ian died on 27 November, just two days before the event. A most fitting eulogy was given at the AGM by Brian Walker of the Forestry Commission and a past president of the Scarborough Field Naturalists' Society, who had met Ian on a school visit to Wood End and as a result had been inspired to take up a career in the natural sciences and wildlife conservation. Ian will be sadly missed but has left a lasting legacy in the literature and in inspiring the next generation of active naturalists.

CAH

BOOK REVIEW

Wild France, the Animals, Plants and Landscapes by **Bob Gibbons.** Pp.176, including numerous coloured photographs. New Holland Publishers, London. 2009. £29.99 hardback.

This book is essentially a whistle-stop tour through the landscapes, flora and fauna of France, including Corsica. Each type of lowland, montane and coastal landscape is described and areas of particular interest for wildlife are highlighted. In the chapter on flora the most prolific families are introduced and endemic species are given emphasis. Birds, mammals, invertebrates, reptiles and amphibians are dealt with in separate chapters and within each the different groups are described individually and, again, creatures of special interest are highlighted. The chapter on conservation informs us, with illustrative maps, that both national and regional reserves are funded and managed by the state with little voluntary input. Finally there is a list, with brief descriptions, of 41 sites of special interest and value.

There is little to quibble about except perhaps that France's "central position in Europe" is mentioned a few times. In my atlas it is towards the south-western end but we have to agree that its size and the different landscapes, altitudes, latitudes and climatic zones give rise to a wonderful diversity of wildlife. Considering the number of subjects covered in the book the style of writing is necessarily succinct but it is informal and friendly and gives enough detail to maintain one's interest and to give a feeling of wishing to be there and to see it all at first hand. The author's enthusiasm for his subject is infectious. He is a renowned photographer and every page is enhanced with one or more of his superb photographs. The book is a delight. Vive la France!

PAA

REVISITING THE SOLITARY WASPS AND BEES (*HYMENOPTERA: ACULEATA*) OF BRIMHAM ROCKS IN WATSONIAN YORKSHIRE

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A study of the aculeate wasps and bees of Brimham Rocks has been published (Archer, 2001). This study indicated that more recording was required to obtain a stable estimate of the number of solitary species. Therefore, the first aim of this paper is to report on further visits to obtain a stable estimate. With the first aim achieved, the second aim of further analysis of the data becomes possible.

Description of Brimham Rocks and sampling methods are given in Archer (2001). No noticeable changes have been found between the earlier visits (1974-1998) and the current visits (2001-2003). Seven current visits (28 Aug. 2001, 25 Apr. 2002, 2 June 2002, 23 June 2002, 29 July 2002, 28 May 2003, 24 June 2003) have been made. A further five solitary species were recorded (*Myrmosa atra* Panzer, 29 July 2002; *Andrena fulva* (Müller *in* Allioni), 25 Apr. 2002, 28 May 2003; *Lasioglossum smeathmanellum* (Kirby), 24 June 2003; *Sphecodes crassus* Thomson, 28 Aug. 2001; and *Epeolus cruciger* (Panzer), 28 Aug. 2001) now giving a total of 45 solitary species. With the 17 social wasps and bees previously recorded, the total of 62 species indicates that Brimham Rocks is a good site for conservation purposes within a Watsonian Yorkshire context.

The daily rate of recording species per month is shown in Table 1. The month with the highest mean number of species is July although on a good day during June and August a similar number of species might be found. Weather conditions can be very variable which accounts for the variability of the number of species recorded during June and August.

From the regression equation of the species-area relationship for 32 lowland sites from the north and north Midlands of England (Archer, 2006), it can be calculated that if Brimham Rocks was equally favourable for solitary species, on average, 80 species would be present. The lower number of species (45) is probably a consequence of the higher altitude of Brimham Rocks at about 260m. with its less favourable climate.

TABLE 1
Mean number and range of species of solitary wasps and bees recorded per month at Brimham Rocks

April	May	June	July	August	September
4.0	3.3	5.3	9.5	5.8	4.0
2-6	1-5	1-10	7-11	2-9	4

Estimating the Potential Number of Solitary Species

The non-parametric statistical procedures used were the presence/absence Chao (in Colwell & Coddington, 1994) and the first order Jackknife (Heltshe & Forrester, 1983) procedures The presence/absence quantitative estimate of Chao is based on the number of species that are recorded in one (singletons) or two (doubletons) samples. The Jackknife estimate of Heltshe and Forrester is based only on singletons only. Because some aculeate species are only active in the spring or summer it is advisable that sampling is distributed throughout the months of adult activity. The software to carry out these statistical procedures was provided by Pisces Conservation Ltd. In practice the software takes 1, 2, etc. samples at random, each time calculating a mean estimate of species richness. The procedures were repeated 50 times. With a small number of samples the estimates are erratic, but as more samples are selected these may stabilise, giving confidence in them.

The diversity estimates for the two statistical procedures for the 26 visits are shown in Figs 1, 2 and the final species diversity estimates from Archer (2001, 19 visits) and after the 26 visits in Table 2. After the 26 visits the species diversity stabilizes and the final estimates from the two statistical procedures are similar to each other. With this information, a decision could now be taken to cease further recording. However, with an estimated 71-75% of potential species recorded there is still an opportunity of finding new species.

Species Quality

Using the Archer national quality scoring system (Archer, 1999, 2002), Brimham Rocks has a Quality Score of 64 and a Species Quality Score (SQS.) of 1.4 (Table 3). Archer

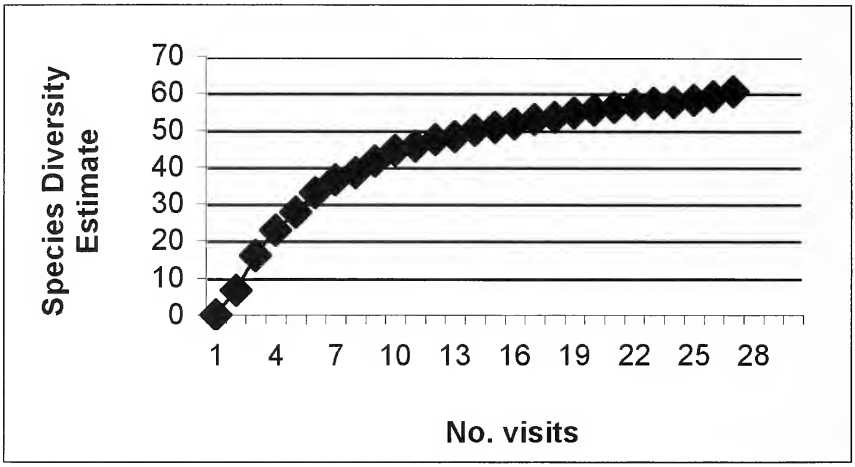

Figure 1.
The 1st order Jackknife estimate of species richness for Brimham Rocks.

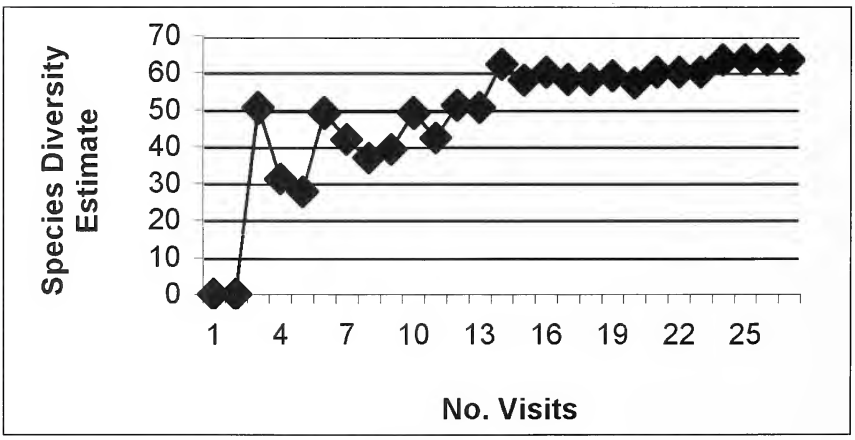

Figure 2.
The Chao presence/absence estimate of species richness for Brimham Rocks.

TABLE 2
Non-parametric estimates of species richness at Brimham Rocks

From Archer (2001)	Chao estimate	Jackknife estimate
No. species recorded	40	40
No. species estimated	70	58
95% confidence limits	40-100	48-68
% of estimated spp. found	57	69
Current paper	Chao estimate	Jackknife estimate
No. species recorded	45	45
No. species estimated	63	60
95% confidence limits	43-83	52-69
% of estimated spp. found	71	75

TABLE 3
The Archer national quality scores of the solitary species recorded from Brimham Rocks

National Status	Status Value (A)	No. Species (B)	Quality Scores (A x B)
Universal	1	32	32
Widespread	2	12	24
Scarce	8	1	8
Total		45	64
Species Quality Score (SQS) 64/45 = 1.4			

(1999) showed that although quality scores are influenced by the area of sites, the SQSs are relatively independent of site areas so SQSs can be used to compare sites without regard to site areas. Archer (2003) on the basis of their SQS divided Watsonian Yorkshire sites into first class (SQS 2.4-2.9), second class (SQS 1.8-2.3) and third class (SQS 1.2-1.7) sites. Brimham Rocks is a third class site with one nationally Scarce species, *Sphecodes crassus*.

Cleptoparasitic Load

The cleptoparasitic load (CL) is the percentage of aculeate species that are cleptoparasitic (or parasitoids) on other host aculeates, e.g. *Epeolus cruciger* on *Colletes succinctus* (Linn.), *Nomada lathburiana* (Kirby) on *Andrena cineraria* (Linn.), *N. marshamella* (Kirby) on *A. scotica* Perkins and *N. rufipes* Fab. on *A. fuscipes* (Kirby). Although *Argogorytes mystaceus* (Linn.) was found, its cleptoparasite, *Nysson spinosus* (Forster) was not found.

Wcislo (1987) showed that parasite behaviour among aculeate Hymenoptera correlated with geographical latitude. Thus the parasitic rates are higher in temperate regions, as host populations are more synchronised in their life-history characteristics than in tropical regions. This finding probably does not hold for desert regions where the occurrence of rainfall would tend to synchronise life-history characteristics. From a review of the literature Wcislo found that the CLs for bees in Europe varied between 16% and 33%, a range of 17%.

For 27 Yorkshire sites, the author found that CLs for solitary bees vary from 25.6%-40.0% giving a range of 14.4%, which is close to the range found by Wcislo. The CL value for the solitary bees (Table 4) falls within this range. Wcislo gave no CLs for solitary wasps but from 27 Yorkshire sites CLs vary from 10.3%-25.0% giving a range of 14.7%. The CL value for the solitary wasps (Table 4) falls within this range, and supports Wcislo's hypothesis.

TABLE 4
The relative frequency of the cleptoparasitic (or parasitoid) species among the solitary species recorded from Brimham Rocks

	No. hosts (H)	No. cleptoparasites (C)	Cleptoparasitic Load CL = 100 x C/(H+C)
Solitary wasps	13	2	13.3
Solitary bees	19	11	36.7

Aerial Nester Frequency

The aerial nester frequency (AF) is the percentage of host aculeate species that have aerial nest sites. Aerial nesters use old beetle burrows in dead wood, central stem cavities (e.g. bramble), crevices in old walls or exposed on the surface of rock or other hard material. Subterranean nesters nest in the soil, usually in burrows dug by themselves, but sometimes holes and crevices are used after being altered.

The AFs for the solitary species are given in Table 5. The AFs for all the British species of solitary wasps is 46.2% and solitary bees is 17.9%. From 30 Yorkshire sites (Archer, 2006), the AFs for solitary wasp varies between 0%-90% and for solitary bees between 6.7%-40.0%. The AFs for the solitary species from Brimham Rocks are well below the British AFs and the AF for the solitary bees is the lowest value for a Yorkshire site.

TABLE 5
The nesting habits of the solitary species from Brimham Rocks

	No. aerial Nesters (A)	No. subterranean Nesters (S)	Aerial nester frequency AF = 100 x A/(A+S)
Solitary wasps	3	10	23.1
Solitary bees	0	19	0.0

Summary About Brimham Rocks

1. With 62 species of social and solitary species recorded it is a good site in a Yorkshire context.
2. It has fewer solitary species than expected for its area probably due to its higher altitude with less favourable climate.
3. The two estimates of potential species richness are stable and closely agree with each other indicating that about 60-63 solitary species could be present.
4. It is a third class conservation site with one species of national importance.
5. All recorded solitary bee and about 75% of solitary wasps are subterranean nesters.

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REMARKS ON THE IDENTITY OF THE SUBAERIAL GREEN ALGA *CEPHALEUROS ENDOPHYTICUS* (F. E. FRITSCH) PRINTZ AND A NEW RECORD OF THE SPECIES FROM NORTHERN ENGLAND

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Introduction

Green algae belonging to the order Trentepohliales are responsible for much of the superficial brown and orange colour of sheltered rocks and tree trunks throughout the country. Several common species of *Trentepohlia* produce these colorations, but a smaller group of more specialised subaerial algae, belonging to two genera, *Phycopeltis* and *Cephaleuros*, also occur in these islands. Both are common in the tropics and usually found growing on the evergreen leaves of ferns, shrubs and trees and they have occasionally been reported in the British Isles in humid valleys, particularly near the western coast. *Phycopeltis* occurs as small green or brown discs a few millimetres across on the leaves of ivy, rhododendron and conifer needles (Scannell, 1965). The two species *P. arundinacea* and *P. epiphyton* are widely distributed and are probably often overlooked (John, 2000). *Cephaleuros* was first reported and described in Britain by Fritsch (1942) as *Chrooderma endophytica* Fritsch from material sent to him by the Rev. P. G. M. Rhodes. It was collected in April 1932 from the Bonython Plantations, Bochym, near Penzance, Cornwall on stems of *Rubus fruticosus* agg. A recent visit to the Natural History Museum revealed no British material of *Cephaleuros*, but in the *Phycopeltis* folder, the original Cornish material was discovered under the name of *P. epiphylla* 'No. 5127'. This was no doubt an error for *P. epiphyton*, mentioned above. Although Fritsch described the material as damaged, the herbarium material appeared to be in good condition, although sporangiophores were little developed. Fritsch provided a detailed and illustrated description of the Cornish plant. Although it strongly resembled a *Phycopeltis*, on closer examination he discovered that the plant was partially endophytic and consisted of multiple layers of cells. In *Phycopeltis* the cells are entirely epiphytic, and there are few taxa with multilayered cells. He placed the alga in a new genus *Chrooderma*. It was later recognised as belonging to the predominantly tropical genus *Cephaleuros* by Printz and was synonomised with *C. virescens* by Thompson and Wujek (1997).

The genus *Cephaleuros* was first described by Kunze in 1827 and is widely distributed in the warmer regions of the world. It currently contains twelve species, nine of which have been described from Java and tropical America. *Cephaleuros* forms small orange-brown or olive-green rosettes up to c. 5 mm in diameter on bark and leaves in sheltered, humid sites. It is distinguished from *Phycopeltis* by two important features, its predominantly

endophytic habit, and the presence of specialised 'head cells' supporting the sporangia when these are present. Some species of *Cephaleuros* such as *C. parasiticus* are known to parasitise the leaves of commercial crops such as tea, though most species, including *C. virescens* are regarded as opportunistic parasites and probably invade tissues that have been damaged or are moribund (Thompson & Wujek, 1997; John, 2003). These algae are normally reported from evergreen leaves that are 4-5 years old, but several taxa have been found growing on bark, including *C. virescens*; this is the most widespread of the species, especially in the tropics but it is also reported from Austria and Belgium. It has been found on 105 host species in 40 families.

A chance gathering of *Cephaleuros* was made from a single dead stem of *Rubus fruticosus* agg. measuring c. 9 mm in diameter in May 2007. The site was close to the coastguard's station at Arnside in Cumbria on a thin soil over Carboniferous limestone (34/451784, alt. 4 m). The site has a north-westerly aspect and looks out onto the Kent

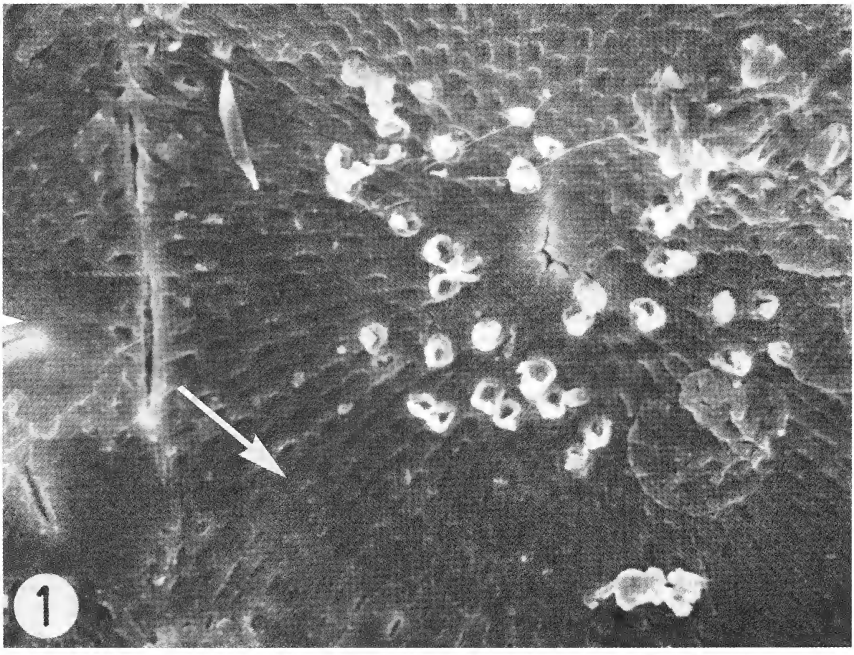

FIGURE 1. SEM micrograph of *Cephaleuros endophyticus* showing part of a bistratose prostrate system (arrow) and damaged/undeveloped sporangiosphores. Bar 50 μm.

estuary. It is sheltered to the north-east by a limestone cliff c. 20 m high and is situated on an old quarry floor with a generally open aspect with scattered small trees of ash and sycamore. Subsequent visits to the site and adjacent area failed to reveal any more material on either *Rubus* or *Rosa*, the latter being common and with similar stems.

This site is shaded from direct sunlight for most of the day and probably has a warm humid microclimate as it is also notable for the occurrence of *Adiantum capillus-veneris* on nearby rocks, one of the most northerly sites in mainland Britain for this thermophilic fern. Rainfall data obtained from the nearby Arnside nature conservation office gave a total of 1230 mm for 2006. There are no local temperature data but the annual mean air temperature at Morecambe, 20 km south is close to 10°C (Meteorological Office data).

This compares with the west Cornwall annual mean of 11.5°C. Rainfall in west Cornwall is about 10% lower than Morecambe according to Meteorological Office data.

The thalli of the *Cephaleuros* were orange-brown in colour and encircled the dead *Rubus* stem over a length of c. 10 cm. They ranged from 0.08-0.50 mm in diameter (av. 0.26 mm) and were smaller than the Cornish colonies described by Fritsch. They frequently coalesced, but were otherwise almost circular in shape and occurred at an average density of 280 colonies per cm^2. Thin vertical sections made with a razor though the thalli and underlying *Rubus* tissues revealed the frequent penetration of *Cephaleuros* into the upper epidermal cells of the host. Most sections revealed that the cells formed a single layer on the surface of the bark but in a few places the thalli were bistratose (Fig. 1). The prostrate system was parenchymatous, and cells near the margin of the colony averaged 7-9 μm in diameter. Fritsch recorded an average diameter of 7 μm in the Cornish material.

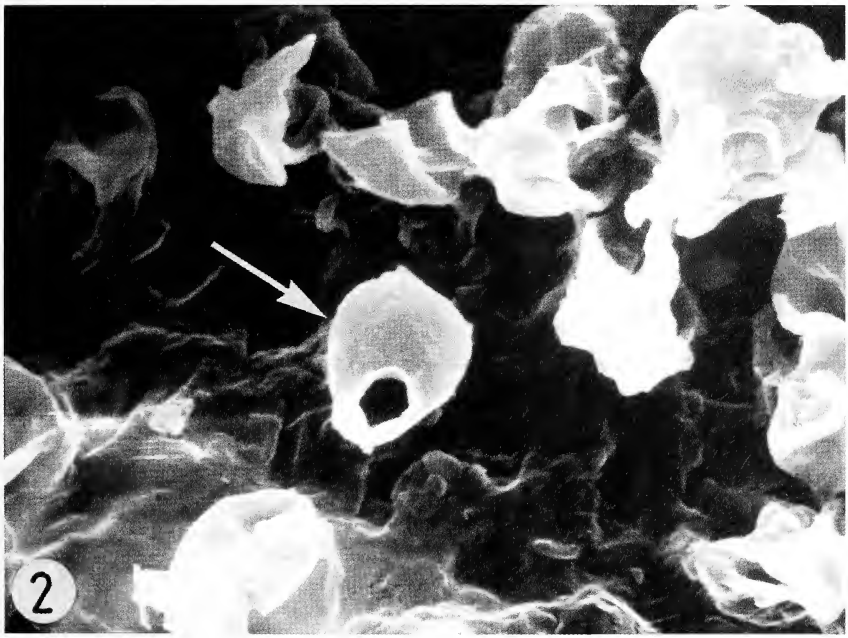

FIGURE 2. SEM image of *C. endophyticus* with detail of damaged sporangiophores and a possible dehisced sporangium (arrow). Bar 10 μm.

The erect system was found in this collection only on a few of the larger thalli. It consisted of small outgrowths mainly in the central areas of the discs, though the upper parts of the system were usually missing, presumably owing to fragmentation (Figs. 1 and 2). Whether this was caused by damage after collection, or the material was in this state when collected is not clear. This was unfortunate since the sporangia borne on these outgrowths provide important taxonomic information. A few possible dehisced sporangia may be present, however, in Figure 2. Blunt unicellular hairs have also been reported in *C. virescens* but they were not observed in the Cumbria material.

Two species of *Phycopeltis* were also discovered in Cumbria on the leaves of yew in the same year, namely *P. arundinacea* and *P. epiphyton*. The site is in Haverbrack Woods, 5 km NE of the new *Cephaleuros* site.

Conclusions

The Cumbria plant is identical to *C. endophyticus* as described by Fritsch. In common with that plant, well-developed sporangiophores are missing and it is only the endophytic habit that distinguishes it from *Phycopeltis*. In other respects it more closely resembles *Phycopeltis* in its general morphology and it does not agree well with *Cephaleuros virescens*. In this species, virtually all of the cells are endophytic and the discs consist of a well-defined series of flattened branches radiating from a central point. From these, numerous hair cells and sporangiophores arise, breaking through the epidermis, giving the plant a fuzzy appearance (Thompson & Wujek, 1997). Since the British plants are small compared with the typical lesions produced by tropical specimens of *Cephaleuros*, it is possible that the British plants are under-developed which may explain the lack of well-developed sporangiophores. Further collecting may help to resolve this issue, but for the present, the British plants should be referred to as *C. endophyticus*, and not *C. virescens*.

Acknowledgement

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BOOK REVIEW

Global Warming: a very short introduction by **Mark Maslin**. Pp. xix + 192. Second edition. Oxford University Press. 2009. £7.99 paperback.

This small, pocket-sized, attractively priced volume provides a stimulating broad view of global warming and its consequences. Though the specialist meteorologist might consider its account of the physics of global warming rather lightweight, it more than makes up for this by providing an up to date account of how global warming is modelled, the likely impacts arising from increased temperatures, possible solutions to the perceived problems and the political issues that will arise from attempts to control greenhouse gas emissions. Throughout most of the volume an attempt has been made to provide a balanced view of this controversial topic. However, occasionally there is a slight bias towards presenting the detrimental aspects of warming: for example, Table 2 is titled "Impacts of global warming…", but the table only covers adverse effects and fails to mention any of the positive benefits that are also likely to occur.

The book is packed with attractively presented data and provides an up to date picture of global warming in a clear, non- technical manner. As its title suggests, this little book provides a short introduction to global warming and as such is likely to prove very useful to A-level and undergraduate students of geography and environmental science and any laypersons who wish to become better informed about this important topic.

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