January — March 1988

Number 984
Volume 113

The Naturalist

A QUARTERLY JOURNAL OF NATURAL HISTORY FOR THE NORTH OF ENGLAND

Published by the Yorkshire Naturalists' Union

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THE ACULEATE WASPS AND BEES (*HYMENOPTERA: ACULEATA*) OF MY LOCAL PATCH: STRENSALL COMMON, THE FIRST 70 VISITS

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Strensall Common has been found to be an excellent locality for aculeates, having 112 recorded species, two red data book category 3 species, two species unique to Watsonian Yorkshire and some 20 other rarities or local species.

Strensall Common is a site of 690 hectares situated about six miles north-east of York (V.C. 62; SE65). It is one of the few remaining lowland heathlands in the Vale of York. The site is overlain by fluvial sands which have probably been moved by the wind, and now forms a fossil sand dune landscape. The sandy heath was acquired by the Government in 1881 for military purposes (Wilkinson, 1906), and much drainage work was carried out by the army so that the heath could be used for training purposes. The sides of the drainage ditches and dug holes, when situated in sunny places, have provided excellent nesting sites for the soil-nesting aculeates. Silver birch, Scots pine and oak have invaded the drier parts of the heath but sheep-grazing and fires have kept much of the site open. The dead trees, particularly the Scots pine, when in sunny situations, have been used by the aerial-nesting aculeates. The Yorkshire Wildlife Trust owns about 42.5 hectares and its policy of removing trees and tall shrubs from time to time from the drier banked areas and of grazing sheep has had a beneficial effect on the aculeate assemblage.

From voucher specimens and written records it has proved possible to trace 22 visits by other entomologists (= the historical sample). J. H. Elliott made five visits, A. Smith five visits and J. Wood one visit during the 1940s and 1950s. J. H. Flint made ten visits during the 1960s and 1970s while C. J. Smith made one visit during 1980. My own 70 visits (= the Archer sample) cover the period from 1967 until 1985 but most visits were made during 1981, 1982 and 1983; they were distributed throughout the year as follows: April (5 visits), May (16), June (13), July (18), August (12) and September (6). The 22 other visits were also distributed from April until September. The total 92 visits have produced a list of 112 species of which 98 are present in the Archer sample. The apparent lack of records prior to the 1940s is curious, but probably reflects that at that time the main entomological interest was to the west of the county and the use of much of the Common as a firing range must have made access difficult. The collector W. J. Fordham, who lived in the Allerthorpe area and was active in the first part of this century, is perhaps the most notable exception, but there appears to be no record of his having visited Strensall Common.

At the family level the taxonomic distribution of the historical and Archer samples is given in Table 1. Ignoring the bethylid species, the remaining 111 species represent 41.1% of the Yorkshire (Archer, in press) and 21.4% of the British list (Kloet & Hincks, 1978). At the time of writing, Strensall Common is the Yorkshire locality with the largest number of recorded aculeates, although work in progress on localities in South Yorkshire, e.g. Blaxton Common, and other heathland sites, e.g. Allerthorpe Common, will no doubt prove the existence of equally rich sites.

In the following account biological names are according to Kloet and Hincks (1978). I am grateful to J. T. Burn for the bethylid record, *Cephalonomia formiciformis*. The ants (Formicidae) recorded were: *Myrmica rubra*, *M. ruginodis*, *Formica fusca*, *Lasius flavus* and *L. niger*. The social wasps (Vespidae) recorded were: *Dolichovespula norwegica*, *D. sylvestris*, *Vespula austriaca*, *V. rufa*, *Paravespula germanica* and *P. vulgaris*. The social bees (Apidae) recorded were: *Bombus lucorum*, *B. terrestris*, *B. lapidarius*, *B. jonellus*, *B. hortorum*, *B. muscorum*, *B. pascuorum*, *Psithyrus bohemicus*, *P. campestris* and *P. sylvestris*. Of the social species *V. austriaca*, *B. jonellus* and *B. muscorum* should be specially noted. *V. austriaca* is a cleptoparasite of *V. rufa* while *B. jonellus* and *B. muscorum* are widespread local species which since 1960 have suffered a 26% reduction in their distribution in Britain (Williams, 1982). The solitary species found in the historical sample but not in the Archer sample are: *Priocnemis schioedtei*, *Ancistrocerus*

TABLE 1

The number of species and records of aculeates in each family found at Strensall Common from the historical and Archer samples

Family	No. species	No. records (Archer sample only)
Bethylidae	1	0
Chrysididae	6	9
Tiphiidae	2	4
Formicidae	5	–*
Pompilidae	11	35
Eumenidae	4	4
Vespidae	6	–*
Sphecidae	28	122
Colletidae	3	6
Andrenidae	12	53
Halictidae	11	48
Megachilidae	6	10
Anthophoridae	7	27
Apidae	10	–*
Total	112	318

* Number of records not collected for the social families of Formicidae,Vespidae and Apidae.

oviventris, *Crossocerus nigritus*, *Gorytes tumidus*, *Colletes daviesanus*, *Hylaeus communis*, *Andrena fucata*, *A. subopaca*, *Lasioglossum albipes*, *Sphecodes ferruginatus*, *Megachile circumcincta* and *Epeolus variegatus*. Four of these solitary species are notable: *C. nigritus* and *G. tumidus* are Yorkshire rarities, with *G. tumidus* being at the northern end of its distribution in England; *G. tumidus*, *C. daviesanus* and its cleptoparasite *E. variegatus* are local species nesting in sandy areas. The 78 solitary species of the Archer sample, with their recorded frequency, are given in Table 2. *C. leucostoma* and *A. ruficrus* are red data book category 3 species. These two species have northern distributions with Yorkshire on their southern boundary. *C. leucostoma* and *C. fasciatellus* are only known in Yorkshire from Strensall Common. Five other species can be regarded as rarities in a Yorkshire context, while ten species can be regarded as local to open sandy habitats (Table 2).

For the Archer sample, the number of solitary species recorded each month and the new species seen each month are given in Table 3. The most productive months were from May until August, although a few species were collected in April and September; May and July were the important months for finding new species, with June and August being much less important. The number of solitary species recorded on each visit varied from one to 11, with ten or more species being recorded on only three days.

The Archer sample of solitary species consisted of 318 records (Table 1) where a record would be a specimen differing in one of the following three variables: name, sex and day of visit. Females were more numerous than males, representing 59.0% of the records, although the sex of three bethyloid species could not be determined.

The seasonal progression of the solitary species may be described as follows: in the first part of April, three species of mining bees, *A. clarkella*, *A. praecox* and *A. ruficrus*, are present with *N. leucophthalma*, the cleptoparasite of *A. clarkella*; late April and May see the presence of eight species of *Andrena* with four species of their cleptoparasitic *Nomada*, the males appearing just before the females or at least becoming more numerous before the females appear in numbers; also during May three species of *Lasioglossum* and *H. rubicundus* with three species of their cleptoparasitic *Sphecodes*

TABLE 2

The number of days on which each species of solitary wasp and bee was recorded at Strensall Common from the Archer sample

No. days	Species	No. species
1	*Elampus panzeri*[2], *Hedychridium ardens*[1,2], *Chrysis angustula*, *C. ruddii*, *Trichrysis cyanea*, *Arachnospila anceps*, *Evagetes crassicornis*, *Ancistrocerus parietinus*, *Symmorphus mutinensis*, *Tachysphex pompiliformis*[2], *Crossocerus wesmaeli*, *C. capitosus*[1], *C. leucostoma*[1], *Ectemnius cephalotes*, *Oxybelus uniglumis*, *Psen equestris*[2], *Passaloecus corniger*, *Andrena nigroaenia*, *A. wilkella*, *Lasioglossum villosulum*[1], *Sphecodes monilicornis*, *Osmia leaiana*, *Megachile centuncularis*, *Nomada fabriciana*, *N. rufipes*.	25
2	*Methocha ichneumonides*[1,2], *Myrmosa atra*, *Calliadurgus fasciatellus*[1], *Priocnemis exaltata*, *Anoplius nigerrimus*, *Odynerus spinipes*, *Crossocerus annulipes*, *Ectemnius lapidarius*, *Passaloecus monilicornis*, *Ammophila sabulosa*[2], *Andrena fulva*, *A. tarsata*[2], *Sphecodes gibbus*, *Coelioxys elongata*, *Nomada panzeri*, *Epeolus cruciger*[2].	16
3	*Chrysis impressa*, *Dipogon subintermedius (= nitidus)*[1], *Priocnemis parvula*, *Arachnospila spissa*, *Trypoxylon clavicerum*, *Crabro peltarius*, *Crossocerus tarsatus*, *Halictus rubicundus*, *Sphecodes fasciatus*, *Osmia rufa*, *Megachile versicolor*.	11
4	*Crossocerus megacephalus*, *Argogorytes mystaceus*.	2
5	*Crossocerus cetratus*, *Andrena ruficrus*[1], *Sphecodes hyalinatus*.	3
6	*Priocnemis perturbator*, *Crabro cribrarius*, *Pemphredon lugubris*, *Colletes succinctus*[2], *Andrena haemorrhoa*, *A. chrysosceles*.	6
7	*Andrena clarkella*, *A. praecox*[2], *Lasioglossum calceatum*.	3
8	*Ectemnius cavifrons*, *Andrena scotica*, *Nomada leucophthalma*.	3
9	*Crossocerus ovalis*, *C. pusillus*.	2
10	*Mellinus arvensis*.	1
11	*Lasioglossum rufitarse*, *Nomada marshamella*.	2
12	*Anoplius viaticus*, *Crossocerus quadrimaculatus*.	2
14	*Lasioglossum fratellum*.	1
15	*Ectemnius continuus*.	1

[1] Rarities in a Yorkshire context.
[2] Local to open sandy habitats.

TABLE 3

The number of species of solitary wasps and bees recorded per month and new species seen each month at Strensall Common from the Archer sample

	April	May	June	July	August	September
No. species	6	32	33	42	27	17
No. new species	6	26	11	24	6	4

appear, but only females are present; early in May the only long-tongue bee is *O. rufa*, and at first just two wasps are present, the spider-hunting wasps, *P. perturbator* and *A. viaticus*, but by the end of May the first sphecoid wasps are beginning to appear.

By early June the spring mining bees of *Andrena* are gone, to be replaced in the summer by *A. chrysosceles* and *A. wilkella*, which in turn are gone by mid-July; further *Lasioglossum* and *Sphecodes* bees appear and will remain until September with the males appearing from the middle of July. In June, but particularly in July, the long wait for the appearance of the sphecoid and pompiloid wasps is over and some of these species will continue into September. The megachilid bees with their cleptoparasitic *Coelioxys* also appear during the summer, as well as the scolioid and eumenid wasps with their parasitic chrysid wasps, although some chrysids were present at the end of May.

From early July until August *C. succinctus* appears as the heather starts to flower, with its cleptoparasite *E. cruciger*. By the middle of July, the appearance of the common wasp, *M. arvensis*, which can be taken as a marker, indicates that most, if not all, of the solitary species have now appeared. However, for some species their populations seem so low that continual searching well into September is likely to turn up new and unusual species.

Cleptoparasitic species, after invading the nest of their host, lay eggs, the larvae of which, on hatching, usually destroy the host's immature stage and eat its food reserves or in the case of the social species use the host's workers to rear further cleptoparasites. The cleptoparasitic load (CL) is the percentage of species that are cleptoparasites (Table 4). In calculating the CL two species have not been included as they are parasitic on non-aculeate species as follows: the bethyloid *C. formiciformis* on beetles of the family Ciidae and *M. ichneumonides* on tiger beetles, *Cicindela*. The CL of the solitary and social wasps are similar as are those of the solitary and social bees but the CL of the wasps is lower than that of the bees (Table 4). The solitary wasp cleptoparasites were the chrysid wasps, the scolioid wasp *M. atra*, the pompiloid wasp *E. crassicornis* and the sphecoid wasp *P. corniger* although this latter species builds its own aerial nest, stealing its prey of aphids from the nests of other *Passaloecus* species (Yeo & Corbet,

TABLE 4

The relative frequency of cleptoparasitic species in the historical and Archer samples from Strensall Common

	No. host species (H)	No. cleptoparasitic species (C)	Cleptoparasitic load (CL)*
Social wasps (Vespidae)	5	1	16.7
Social bees (Apidae)	7	3	30.0
Solitary wasps	41	9	18.0
Solitary bees	26	13	33.3

* $CL = 100 \times C/(H+C)$

1983). The bee cleptoparasites belong to the genera of *Sphecodes*, *Coelioxys*, *Nomada* and *Psithyrus*.

The aerial nester frequency (AF) is the percentage of the host or non-cleptoparasitic species that have aerial nest sites (Table 5). Aerial nests are often in old beetle burrows in dead wood or the central cavities of stems such as those of bramble. Non-aerial nesters nest in the soil, usually in burrows dug by themselves but sometimes in crevices or, in the case of some bumble-bees, in the moss or leaf-litter layers on the soil surface.

TABLE 5

The nesting habits of the host wasps and bees in the historical and Archer samples from Strensall Common

	Aerial nesters (A)	Soil nesters (S)	Aerial nester frequency (AF)*
Social wasps (Vespidae)	1	4	20.0
Social bees (Apidae)	0	7	0.0
Solitary wasps	17	24	41.5
Solitary bees	5	21	19.2

* $AF = 100 \times A/(A+S)$

All social bees are non-aerial nesters as are most social wasps, the only aerial nester being the Norwegian wasp, *D. norwegica*. Just under half of the solitary wasps and about one-fifth of the solitary bees are aerial nesters. The former are mainly sphecoid wasps, particularly *Crossocerus* and *Ectemnius* but also the pompiloid *D. subintermedius* (= *nitidus*) and most of the eumenid wasps. The main solitary bee aerial nesters are most of the megachilid bees of *Osmia* and *Megachile* and the primitive bee *H. communis*, although the latter is a crevice-nester.

Discussion

A site with 100 or more aculeate species may be regarded as an excellent or first-rate site in a Yorkshire context. The grading of a site in terms of the number of species is linked to the geographical locality of that site since an excellent site in a southern county would probably have in excess of 200 aculeate species. A grading based on the quality of the species has not yet been developed, but using the point system of the N.C.C. Invertebrate Site Register would give Strensall Common at least 400 points. Here each of the two Red Data Book species would get 100 points while ten species can be treated as Yorkshire rarities and probably, at least, as regionally notable species, so gaining 20 points each. A score of 200 points is required before a site can be considered as an S.S.S.I.

Archer (1985) divided the species of wasps and bees recorded at Pompocali into two groups, depending on how many days each species was recorded, the 'unusual' group when species were recorded on one, two or three days and the 'common' group recorded on more than three days. Such a division is relevant for the solitary species of the Archer sample (Table 2) with 52 species (66.7%) in the unusual group and 26 species (33.3%) in the common group. This division in percentage terms is very similar for that given by Archer (1985). The large size of the 'unusual' group probably indicates the low number of many solitary aculeate populations and hence the need to spend many hours in the field in order to find them.

Heithaus (1979) collected together the cleptoparasitic loads (CLs) as measured in several studies of bee species populations and showed that the load is relatively constant, with most values between 10% and 13%. The cleptoparasitic load for both the solitary

and social bees is higher (Table 4), as are the CLs for bees at Pompocali (Archer, 1985) and Bernwood Forest (Archer, unpublished), about 10 km north-east of Oxford. The range of the CLs in these three studies is from 14.3% to 30.0% for social bees and from 31.8% to 36.8% for solitary bees. The wider range for the social bees probably reflects the smaller number of species, so random effects are more likely to operate. The narrow range for the solitary bees requires confirmation from further studies before it can be accepted but it agrees with Heithaus (1979) in terms of its constancy. Similarly the CLs from the three sites studied by Archer for the solitary wasps are relatively constant, with values from 12.5% to 18.2%, although the CLs of the social wasps are rather variable and again very few species are involved. Why the CLs should be constant for the solitary species and higher for the bees compared with the wasps is unknown, but indicates the possible importance of the cleptoparasitic factor in determining the structure of wasp and bee assemblages, particularly for the bees.

Haeseler (1985) found that the aerial nester frequency (AF) for solitary wasps in a birch woodland on a sandy site was 74.0%. The lower AF of 41.5% for Strensall Common (Table 5) will be a consequence of a more open area so allowing the ground-nesting species to find sites in sunny situations. The even lower AF of 11.1% at Pompocali (Archer, 1985), an open grass and heather site on sandy soil, is due to an almost total absence of dead wood suitable for nesting. The AF at Bernwood Forest, a woodland site on clay soil, is high again at 70.7% due to the presence of suitable dead wood for nest sites (Archer, unpublished).

For the solitary bees, Haeseler (1985) found an AF of 19.5% which is similar to that for Strensall Common (Table 5). In contrast, the AF for Bernwood Forest is higher at 33.3%; presumably here, with a lack of sandy soil in which it is easier for the soil-nesters to burrow, greater prominence is given to the aerial nesters (Archer, unpublished). Again the AF at Pompocali at 0.0% is due to the lack of suitable dead wood.

At the woody sites of Haeseler (1985), Bernwood Forest and Strensall Common (Table 5) the number of solitary wasp species is greater than that of solitary bee species while at the relatively non-woody site at Pompocali the reverse is the case. Thus not only is the structure of the wasp and bee assemblages influenced by the presence or absence of aerial nesting sites and a clay or sandy soil but also the composition or absolute number of solitary wasp species is greatly influenced by the presence of aerial nesting sites.

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