THE ACULEATE WASPS AND BEES (HYMENOPTERA: ACULEATA) OF SHIPLEY GLEN IN WATSONIAN YORKSHIRE WITH A "THEN" AND "NOW" COMPARISON

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Shipley Glen has been found to be a very good locality for aculeate wasps and bees, having 89 recorded species, three species of national importance, and 13 species of regional importance. It is an area of about 66 hectares, situated to the north west of Shipley, West Yorkshire (VC64, SE13). The locality, a partly wooded valley on millstone grit with open habitats of acid grassland, heather moorland, has a large disused quarry at the northern end.

Shipley Glen was surveyed extensively from the end of the 19th century until about the middle of the 20th century. The main collector was J. Wood whose specimens, which were largely undetermined, were found at Keighley and Manchester Museums (Wood sample). I am grateful to the curators of these museums, M. Hartley and C. Johnson, for permitting access to Wood's specimens. John ("Jack") Wood was well known to Keighley collectors for a long period of time both as a collector and recorder of many forms of insect life (Ogden 1968). He corresponded with W. D. Hincks of Manchester University Museum.

Between 1919 and 1949 I have been able to establish that Wood made 83 visits to Shipley Glen, distributed throughout the year as follows: March (2 visits), April (3), May (19), June (22), July (19), August (7), September (11).

Between 1979 and 1994, I made 16 visits centred on the northern part of the disused quarry. The visits were distributed throughout the year as follows: April (1 visit), May (3), June (3), July (5), August (3), September (1). Two of the visits during July were unsuitable for surveying aculeate wasps and bees because of poor weather conditions. During these approximately three hour visits all species of aculeate wasps and bees were recorded (Archer sample) and usually collected with a hand net for identification.

A comparison will be made between the Archer and Wood samples although the activities of these two recorders were not exactly the same, Archer being a specialist recorder of aculeate wasps and bees, while Wood was a generalist collecting many groups of free-living insects.

A few records were also found from R. Butterfield (collecting from 1907 until 1925); F. Rhodes (collecting from 1915 until 1920); one record each from J. W. Carter (before 1900) and J. A. Beck (before 1950); and three records (two from 1890, one from 1918) from unknown collectors. From more recent times the records of J. T. Burn were made available from a visit on 12 June 1988.

In the following account, biological names are according to Kloet and Hincks (1978).

SPECIES PRESENT

A full list of species with their collectors is given in the Appendix. The taxonomic distribution is given in Table 1, at the family level. The dominant solitary wasp family is the Sphecidae and the dominant solitary bee family the Andrenidae, closely followed by the Halictidae and Anthophoridae.

ARCHER-WOOD COMPARISON

Archer and Wood recorded the same number of species of solitary wasps (Table 1), although only seven species (26%) were common to both samples. Archer recorded more solitary bee species than Wood and 26 species (68%) were common to both samples.

Ten species (5 solitary wasps, 5 solitary bees) were recorded by neither Archer nor Wood.

Thirty-three solitary species were recorded by both Archer and Wood, 19 species only by Archer and 13 species only by Wood. These data can be compared by calculating similarity indices. Using the simple Jaccard index (Ludwig & Reynolds, 1988), which depends upon the presence or absence of species, gives an index of 50.8%. The Morisita-Horn index, which uses quantitative information on the relative abundance of species, is relatively independent of sample size but gives more importance to the more abundantly occurring species (Magurran, 1988). Abundance was determined from the number of days on which a species was observed. The Morisita-Horn index is 73.1% which is higher than the Jaccard index. This indicates that the Archer and Wood samples are more similar to one another in terms of the more abundant species. Of the 32 species found by only either Archer or Wood, only five species (16%) were more abundant species recorded on more than three days each. Twenty-seven species (84%) were less abundant, and recorded on one, two, or three days each.

TABLE 1
The number of species of aculeate wasps and bees recorded from Shipley Glen in the Archer and Wood samples and from all records.

	All	Archer	Wood
Solitary wasp			
Chrysididae	2	1	1
Mutillidae	1	0	1
Sapygidae	1	0	0
Pompilidae	5	2	2
Eumenidae	3	0	1
Sphecidae	20	14	12
Total solitary wasps	32	17	17
Solitary bees			
Colletidae	1	1	0
Andrenidae	17	12	13
Halictidae	13	10	8
Megachilidae	1	1	0
Anthophoridae	11	11	8
Total solitary bees	43	35	29
Total solitary wasps and bees	75	52	46
Social wasps and bees			
Vespidae	4	4	–
Apidae	10	10	–
Total social wasps and bees	14	14	–
Total aculeate wasps and bees	89	66	–

The five more abundant species were *Andrena barbilabris* recorded only by Wood and *Colletes succinctus, Andrena nigroaenea, Nomada goodeniana* and *N. rufipes* recorded only by Archer. The cleptoparasite of *C. succinctus, Epeolus cruciger*, was found by Wood which suggests that *C. succinctus* was present but not found by him. Wood also found the probable host of *N. rufipes, Andrena fuscipes*, which suggests *N. rufipes* could have been present.

N. goodeniana with its cleptoparasite *A. nigroaenea*, and *A. barbilabris* are common solitary bees in Watsonian Yorkshire so unlikely to be missed if present at Shipley Glen. To account for the presence or absence of these species it is suggested that these species migrate to Shipley Glen from time to time, reproduce successfully for a period, and then become extinct.

The 27 less abundant species would probably have been present during the observation periods of Archer and Wood but were not found because the probability of finding each species was so small. Even within the Archer and Wood samples many species were only found on one, two or three days: 27 species (52%) of the Archer sample and 27 species

(59%) of the Wood sample. The species not found by Archer or Wood were either found on one (eight species) or two days (two species), again indicating the small chances of finding many species.

SEASONAL PROGRESSION OF THE SOLITARY SPECIES

From both the Archer and Wood samples the solitary wasp species were recorded only during the summer months (Table 2). July was the most productive month for the number of species and new species. The species most evident were the subterranean nesters *Crossocerus ovalis, C. pusillus* and C. *quadrimaculatus* which are all small fly hunters.

TABLE 2
The number of species and new species of solitary wasps and bees recorded per month at Shipley Glen from the Archer and Wood samples.

		Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.
No. species								
Solitary wasps	– Archer	0	0	0	3	14	4	1
	– Wood	0	0	0	5	10	2	4
Solitary bees	– Archer	0	8	25	21	16	13	6
	– Wood	1	4	22	17	10	6	4
No. new species								
Solitary wasps	– Archer	0	0	0	3	12	2	0
	– Wood	0	0	0	5	9	1	2
Solitary bees	– Archer	0	8	18	4	5	0	0
	– Wood	1	3	18	3	1	2	0

From both the Archer and Wood samples the solitary bee species were recorded during the spring and summer (Table 2). May, June and July were the most productive months for the number of species, with May the most productive month for new species.

The solitary bee species can be divided into three groups. Group one consists of the spring bees which emerge during March or April with the adult stage completed either during May or June, e.g. *Andrena haemorrhoa, A. fulva, A. lapponica, A. nigroaenia* and *A. scotica*, or by July, e.g. *A. barbilabris* and *A. cineraria. A. lapponica* is associated with the flowers of *Vaccinium* as a food source. Group two are the summer bees emerging during July with the adult stage completed during August or September, e.g. *A. fuscipes* and *Colletes succinctus. A. fuscipes* and *C. succinctus* are associated with the flowers of *Calluna*. Group three are bees present during both the spring and summer probably either undergoing two bisexual generations, e.g. *A. saundersella*, or with a spring fertilized female emergence and a summer bisexual emergence, e.g. *Halictus rubicundus, Lasioglossum rufitarse, L. fratellum* and *L. calceatum*. Group three bees emerge during April and May and persist until September.

The cleptoparasites of the above bees are given in Table 3. The cleptoparasite of *L. rufitarse* is unknown but in the context of Shipley Glen *Sphecodes fasciatus* could be the cleptoparasite.

QUALITY ASSESSMENT OF THE SOLITARY SPECIES

Nomada lathburiana is a nationally rare or "Red Data Book" species (RDB3) (Falk, 1991) and is probably near the northern edge of its range. Two species, *Priocnemis schioedtei* and *Crossocerus walkeri*, are nationally scarce species (Falk, 1991) but are widely distributed in Great Britain. Regionally (Archer, 1993) *N. lathburiana* is a frequent species, *Priocnemis schioedtei* a common species, and *Crossocerus walkeri* a rare species. *C. styrius* also is a rare species in a regional context.

TABLE 3
Hosts and probable cleptoparasites of some solitary wasp and bee species from Shipley Glen.

Host	Cleptoparasite
Colletes succinctus	*Epeolus cruciger*
Andrena cineraria	*Nomada lathburiana*
Andrena fulva, A. fucata, A. lapponica	*Nomada panzeri*
Andrena fuscipes	*Nomada rufipes*
Andrena haemorrhoa	*Nomada ruficornis*
Andrena nigroaenia	*Nomada goodeniana*
Andrena saundersella	*Nomada flavoguttata*
Andrena scotica	*Nomada marshamella*
Andrena wilkella	*Nomada striata*
Andrena barbilabris	*Sphecodes pellucidus*
Halictus rubicundus	*Sphecodes monilicornis*
Lasioglossum calceatum	*Sphecodes monilicornis*
Lasioglossum fratellum	*Sphecodes hyalinatus*
Lasioglossum rufitarse	*Sphecodes fasciatus*

Eleven species have a local distribution in a regional context (Archer, 1994) being more-or-less restricted to sandy habitats. These local species are indicated in the Appendix.

By giving each of the 75 species of solitary wasp and bee a regional status (Archer, 1993) a regional quality score of 183 and a species regional quality score of 2.4 (183/75) can be calculated (Table 4).

TABLE 4
The regional status scheme of the 75 species of solitary wasps and bees recorded at Shipley Glen.

Status	Status value (A)	No. species (B)	Status score (A*B)
Common	1	47	47
Frequent	2	16	32
Occasional	4	8	32
Rare	8	1	8
Nationally scarce	16	2	32
Nationally rare	32	1	32

TABLE 5
The Archer national status scheme of the 75 species of solitary wasps and bees recorded at Shipley Glen.

Status	Status value (A)	No. species (B)	Status score (A*B)
Universal	1	45	45
Widespread	2	27	54
Restricted	4	0	0
Scarce B	8	2	16
Scarce A	16	0	0
Rare	32	1	32

Using a national status for each species (Archer, 1995), an Archer national quality score of 147 and an Archer national species quality score of 2.0 (147/75) can be calculated (Table 5).

Within the region of Watsonian Yorkshire the regional species quality score lies between that of Skipwith and Blaxton Commons. The Archer national species quality score is similar to that of Skipwith Common (Archer, 1995). Since Shipley Glen is about 44% the area of Blaxton Common and 21% the area of Skipwith Common its importance as a reserve for aculeate wasps and bees is demonstrated. The realisation of this importance is mainly due to the long period, in excess of 100 years, Shipley Glen has been surveyed for its aculeate wasps and bees.

Cleptoparasitic Load

The cleptoparasitic load (CL) is the percentage of aculeate species that are cleptoparasites (or parasitoids) on other host aculeates. A more-or-less complete list of species in a locality should be made before the CL is calculated to avoid bias of either host or cleptoparasitic species. The CL for the species of solitary bees is higher than the CL for the species of solitary wasps (Table 6). These CLs are similar to values from other sandy habitats (Archer, 1992).

TABLE 6
The relative frequency of the cleptoparasitic species among the solitary wasps and bees from Shipley Glen.

	No. hosts (H)	No. cleptoparasites (C)	Cleptoparasitic load CL = 100*C/(H+C)
Solitary wasps	27	5	15.6
Solitary bees	28	15	34.9

Aerial Nester Frequency

The aerial nester frequency (AF) is the percentage of host aculeate species that have aerial nest sites. Again a more-or-less complete list of species in a locality should be made before the AF is calculated to avoid possible bias of either aerial or subterranean nesters. The AF for the species of solitary wasps is higher than the AF for the species of solitary bees (Table 7).

TABLE 7
The nesting habits of the host solitary wasps and bees from Shipley Glen.

	No. aerial nesters (A)	No. subterranean nesters (S)	Aerial nester frequency AF = 100*A/(A+S)
Solitary wasps	15	12	44.4
Solitary bees	2	26	7.1

The wasp AF is similar to values from other sandy habitats but the bee AF is lower (Archer, 1992). The relative scarcity of dead wood in sheltered sunny situations could be the reason for the lack of aerial nesting solitary bees. Many of the aerial nesting solitary wasps could be nesting in stem cavities such as brambles so would be less affected by the lack of upstanding dead wood. It would be a useful management experiment to introduce upstanding dead wood into sheltered sunny situations to try and increase the species diversity of solitary bees. The wood would need to be drilled with holes of different diameters and depths.

REFERENCES

Archer, M. E. (1992). Aculeate wasps and bees (Hymenoptera: Aculeata) of Skipwith Common and a comparison of Skipwith Common with Allerthorpe and Strensall Commons. *Naturalist* **117**: 19-25.

Archer, M. E. (1993). Recorder's Fourth Report on the Aculeate Hymenoptera in Watsonian Yorkshire and the development of a quality scoring system. *Naturalist* **118**: 13-15.

Archer, M. E. (1994). Recorder's Fifth Report on the Aculeate Hymenoptera in Watsonian Yorkshire. *Naturalist* **119**: 73-77.

Archer, M. E. (1995). Aculeate wasps and bees (Hymenoptera: Aculeata) of Blaxton Common in Watsonian Yorkshire with the introduction of a new national quality scoring system. *Naturalist* **120**: 21-29.

Falk, S. (1991). *A Review of the Scarce and Threatened Bees, Wasps and Ants of Great Britain*. Nature Conservancy Council, Peterborough.

Kloet, G. S. and Hincks, W. D. (1978). A check list of British Insects. Part 4: Hymenoptera, revised by M. G. Fitton *et al. Handbooks Ident. Br. Insects* **11**(4): 126-140.

Ludwig, J. A. and Reynolds, J. F. (1988). *Statistical Ecology. A Primer on Methods and Computing*. J. Wiley, New York.

Magurran, A. E. (1988). *Ecological Diversity and its Measurement*. Croom Helm, London.

Ogden, J. (1968). *Keighley Naturalists. One Hundred Years, 1868-1968*. Borough of Keighley Leisure and Cultural Committee. Art Gallery and Museum, Cliffe Castle.

APPENDIX

Aculeate wasp and bee species recorded from Shipley Glen. *Yorkshire local species. Collectors: A = Archer, Be = Beck, B = Butterfield, Bu = Burn, C = Carter, R = Rhodes, W = Wood, U = Unknown.

Chrysididae: *Chrysis impressa* (A,W), *C. ruddii** (U).

Mutillidae: *Myrmosa atra* (B,W).

Sapygidae: *Sapyga quinquepunctata* (C).

Pompilidae: *Dipogon variegatus* (B), *Priocnemis schioedtei* (B,W), *Arachnospila anceps* (A), *A. spissa* (A), *Evagetes crassicornis* (W).

Eumenidae: *Ancistrocerus nigricornis* (B), *A. parietinus* (W), *A. scoticus* (B).

Vespidae: *Dolichovespula norwegica, D. sylvestris, Vespula rufa, Paravespula vulgaris.*

Sphecidae: *Trypoxylon attenuatum* (A), *Crossocerus elongatulus* (A,W), *C. ovalis* (A,Bu,W), *C. pusillus* (A,W), *C. tarsatus* (A), *C. annulipes* (W), *C. megacephalus* (A), *C. styrius* (W), *C. walkeri* (A), *C. quadrimaculatus* (A,W), *C. dimidatus* (A,W), *Ectemnius cavifrons* (A), *E. lapidarius* (W), *Lindenius albilabris* (A), *Rhopalum clavipes* (W), *R. coarctatum* (W), *Pemphredon lugubris* (A,W), *Passaloecus gracilis* (A), *Mellinus arvensis** (A), *Argogorytes mystaceus* (W).

Colletidae: *Colletes succinctus** (A).

Andrenidae: *Andrena clarkella** (A), *A. fucata* (A,W), *A. fulva* (A,B,R,W), *A. lapponica* (A,R,W), *A. scotica* (A,W), *A. bicolor* (W), *A. cineraria** (A,C,R,W), *A. nigroaenea* (A), *A. fuscipes* (A,W), *A. haemorrhoa* (A,B,Bu,R,W), *A. tarsata** (B), *A. barbilabris** (W), *A. chrysosceles* (A,W), *A. minutula* (U), *A. saundersella* (A,B,Bu,W), *A. subopaca* (W), *A. wilkella* (A,Bu,R,W).

Halictidae: *Halictus rubicundus* (A,R,W), *Lasioglossum albipes* (A,B), *L. calceatum* (A,R,W), *L. fratellum* (A,B,R,W), *L. rufitarse* (A,B,W), *L. cupromicans* (A.R.W), *L. leucopum* (B), *L. morio* (U), *Sphecodes fasciatus* (A,W), *S. gibbus* (A,B), *S. hyalinatus* (A,B,W), *S. monilicornis* (A,W), *S. pellucidus** (B).

Megachilidae: *Osmia rufa* (A).

Anthophoridae: *Nomada fabriciana* (A,B,R,W), *N. flavoguttata* (A,B,R,W), *N. goodeniana* (A), *N. lathburiana** (A,B,W), *N. marshamella* (A,B,R,W), *N. panzeri* (A,R,W), *N. rufucornis* (A,B,Be,R,W), *N. rufipes** (A), *N. striata* (A,R,W), *Epeolus cruciger** (A,W), *Anthophora furcata* (A).

Apidae: *Bombus lucorum, B. terrestris, B. lapidarius, B. jonellus, B. pratorum, B. hortorum, B. pascuorum, Psithyrus bohemicus, P. campestris, Apis mellifera.*

HEDGEROW DATING: A CRITIQUE

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There may have been no more popular topics for fieldwork in the environmental area in recent times than hedgerow dating. Botanists, ecologists, geographers and local historians have counted species in a multitude of hedgerows, and the results of many such surveys have frequently been published. One reason for the popular appeal of hedgerow dating is that it apparently produced important conclusions without any special expertise being demanded of the practitioner, other than the ability to recognise different shrub types.

If the notion of hedgerow dating first occurred to the great landscape historian, Hoskins (1967), it was refined and developed by Hooper (1970) of the Nature Conservancy Council and his associates, Pollard and Moore (1974). It was claimed that the age of a thirty-yard long section of hedge could be calculated by applying the following formula:

Age of hedge equals (99 x the number of shrub species) – 16

In practice, however, a simplified formula is commonly applied:

Age of hedge equals number of shrub species per 30 yards x 100

This produces "results" of a blissful simplicity, so that a three-species hedge would be 300 years old, a seven-species hedge, 700 years old, and so on.

It seems quite amazing that ecologists were so ready to embrace the theory, for the absence of any credible ecological mechanism to explain why new species should enter a fixed length of hedgerow at the strict rate of one per century was quite glaring. The hedgerow dating concept virtually invites us to imagine that in each thirty-yard section of hedgerow there dwells some sort of elfin gatekeeper, who will open the ecological doors to admit one new species each time a century has elapsed. No such gatekeeper exists: the concept of hedgerow dating is flawed, and it is vulnerable to attack on ecological, technical or logistical, and historical grounds.

ECOLOGICAL OBECTIONS

Given that the discipline of ecology places such high emphasis on the variations between environments and on the delicacy of the adjustment between plant species and their setting, it is surprising that hedgerow dating has enjoyed the uncritical support of so many workers in the environmental field since it seems to be essentially anti-ecological. For the hedgerow formula to work, each hedged field in the country should have the same number and types of potential colonists, and each colonist should enjoy an equality of opportunity to establish itself irrespective of where in the country it occurs. This is plainly not the case. If we compare, say, the chalk of Cambridgeshire with the grits and shales of Nidderdale we find that purging buckthorn (*Rhamnus catharticus*), wayfaring tree (*Viburnum lantana*), Midland hawthorn (*Crataegus oxyacanthoides*), spindle (*Euonymus europaeus*) and dogwood (*Cornus sanguinea*) are common on the southern calcareous soils but absent or very rare on the acidic northern soils. In short, the southern hedges have more potential colonists and so, other things being equal, they will be richer in different species than the northern hedges.