A 'BEE-LOUSE' *BRAULA SCHMITZI* ÖRÖSI-PÁL (DIPTERA: BRAULIDAE) NEW TO THE BRITISH ISLES, AND THE STATUS OF *BRAULA* SPP. IN ENGLAND AND WALES

JOHN R. DOBSON

46 Elmwood Avenue, Kenton, Harrow, Middlesex HA3 8AH UK.

The Braulidae ('bee-lice') is a family of wingless and otherwise atypical acalyptrate flies living as inquilines or kleptoparasites (larvae) and as kleptoparasites (adults) in honey bee (*Apis* sp.) colonies. It is a family with a rather chequered taxonomic history, particularly regarding its proposed affinities with related groups (Grimaldi & Underwood, 1986; Peterson, 1987). The genus *Braula* comprises five species and one subspecies (Örösi-Pál, 1966b), and is associated exclusively with *Apis mellifera* L. The only other genus in the family, *Megabraula*, comprises two large species (*M. antecessor* and *M. onerosa*) described by Grimaldi & Underwood (1986) from Nepalese material, and which are both associated with the largest species of honey bee, *Apis laboriosa* Smith.

A map of the international distribution of *Braula* spp. is given by Nixon (1982), and Papp (1984) records three members of the genus as resident in the Palaearctic region: *B. coeca* Nitzsch, *B. orientalis* Örösi-Pál and *B. schmitzi* Örösi-Pál. International records of *B. coeca*, the most ubiquitous species, are detailed by Smith & Caron (1985). However, it is not always possible to gauge from the literature whether specimens recorded as *B. coeca* have been examined critically or have been recorded as that species by default. It is suspected that the latter is sometimes the case, and records of other members of the genus are therefore likely to be more reliable. Papp (1984) gives international records of *B. schmitzi*, which is widely distributed in Europe including France and Italy. *B. kohli* Schmitz, *B. pretoriensis* Örösi-Pál and *B. coeca* ssp. *angulata* Örösi-Pál are all Afrotropical in origin, but *B. coeca* ssp. *angulata* is recorded as an introduction to Italy, and there is a questionable record of *B. kohli* from Belgium. To date, only one member of the family, *B. coeca*, has been recorded from the British Isles (Kloet & Hincks, 1976).

Adults of *Braula* spp. are phoretic on adult honey bees (scanning electron micrograph, Muggleton, 1992; photograph, Morton & Brown, 1996) and disperse between bee colonies by this means. In addition they may be spread as a result of bee keeping practices. *Braula* spp. are not generally considered to cause any significant harm to honey bees, and the main impact of *B. coeca* occurs when the wax-lined larval tunnels spoil the appearance of honeycombs intended for show or sale.

Hive floor inserts and hive debris samples from England and Wales are submitted on a voluntary or statutory basis to the Central Science Laboratory National Bee Unit (NBU) for diagnosis of the Varroa mite, *Varroa jacobsoni* Oudemans, a serious pest of honey bees first discovered in the British Isles in South Devon (VC 3) in 1992 (Bew, 1993). In addition to Varroa, these samples contain specimens of other invertebrates, which have been either killed by varroacidal agents administered to the colony, or are present due to natural mortality. At the author's request, a number of specimens of *Braula* were taken from these hive samples in the period Autumn 1994–Spring 1995. The resulting pooled sample of *Braula* was given to the author (an employee of the NBU at that time) for detailed examination. 157 specimens were examined for characters described and illustrated by Örösi-Pál (1966a, 1966b) and it was apparent on the basis of external features that some specimens conformed to Örösi-Pál's 'schmitzi group' (comprising *B. schmitzi* and *B. orientalis*). Examination of the characteristic female cerci confirmed the presence of *B. schmitzi* in significant numbers in the sample, and it is added to the British fauna on this basis.

Subsequent examination of the male terminalia revealed clear differences between the aedeagi of *B. coeca* and *B. schmitzi* (Figs 3, 8), and the two species are distinguished on that basis for the first time.

The NBU sample comprised 116 *B. coeca* (80 males, 36 females; sex ratio (m/f) 2.2 : 1) and 41 *B. schmitzi* (22 males, 19 females; sex ratio 1.2 : 1). As these specimens were from a pooled sample, the data can only be given as England and/or Wales, autumn 1994–spring 1995. The specimens of *B. schmitzi* may have come from one bee colony or many, so the relatively high numbers of this species in the sample do not indicate whether it is local or widespread in England and Wales.

A sample from a hive at Hatch End, Middlesex collected on 2 March 1997, and kindly made available by J. Telfer, comprised 36 specimens of *B. coeca* (23 males, 13 females; sex ratio 1.8 : 1). The large excess of males in both samples of *B. coeca* may reflect the situation in nature. On the other hand it may be an artefact of the sampling method; for example if the sexes favour different areas within a hive, or exhibit a differential susceptibility to varroacidal agents.

The few UK specimens of *Braula* held by the Natural History Museum, London, and stored in alcohol are all *B. coeca*. Carded specimens, where the abdominal venter was inaccessible, were not examined.

B. schmitzi is almost certainly an introduced species. Active honey bees need to feed regularly, and it is thought extremely unlikely that they would be capable of flying across the English Channel (M. A. Brown, pers. comm.) and that phoretic *Braula* spp. adults could colonize England by this means.

The activities of bee keepers play an important role in determining the international, national and regional dispersal of *Braula* spp. Both commercial and amateur bee keepers seek to improve the honey yield and/or behaviour of their colonies *via* the introduction of strains of queen with the required characteristics. These strains of honey bee may originate from different countries, and the international transport of honey bees is regulated in Europe and elsewhere. In addition, very large numbers of honey bee colonies are transported long distances each year by road to act as pollinating agents for commercial crops, or to obtain honey derived from a specific source (e.g. heather). The international transport of bees within and into the EU is subject to restrictions and health checks under a variety of legislation implemented under the BALAI Directive (92/65/EEC) and the Veterinary Checks Directives (90/425 and 90/675/EEC), and in the UK through Orders under The Bees Act 1980. The import of honey bees into the UK is permitted only from a small number of approved countries, and the movement of bees to sites outside the Statutory Infected Area (SIA) in the UK (introduced to slow the spread of the Varroa mite) is permitted only under licence. Infestation with *Braula* is not, however, a notifiable bee disease, and an import/export or movement licence would not be withheld due to its presence. In spite of the existing regulations, there is some degree of illicit traffic in bees. Live queens may be successfully packaged and posted between countries, accompanied by a small number of attendant workers. Alternatively, queens of desirable strains may be carried between countries in hand luggage.

Historically, there has been importation of honey bee strains into the UK on a massive scale, particularly following the epidemic of the enigmatic 'Isle of Wight disease' early this century. These bees originated mainly from Europe but also, more recently, from Israel and the USA. Statutory controls on importation are a relatively recent development under the Bees Act 1980. In addition, invertebrates living largely within honey bee colonies such as *Braula* spp. are not subject to the same climatological constraints to their distribution as free-living species, since environmental conditions within a honey bee colony are closely regulated by the bees.

Thus there are a number of mechanisms by which human intervention may lead to the colonization of new areas, countries and continents by species of *Braula*, and for this reason Papp (1984) lists all known members of the genus as potential additions to the Palaearctic fauna. It is thought that these same mechanisms are also in part responsible for the spread of the Varroa mite. It is perhaps not surprising then that *B. schmitzi* has colonized the UK, and it is thought likely that additional species, such as *B. orientalis*, may be found here eventually.

Nothing is known of the distinction between the biology of *B. coeca* and *B. schmitzi*, although the biology of *B. coeca* has been discussed by a number of authors (e.g. Hassanein & Abd El-Salam, 1962; Grimaldi & Underwood, 1986; Morse, 1987; Smith & Caron, 1984; Ramírez & Malavasi, 1992). Örösi-Pál (1966b) states that *B. coeca* oviposits on the inner surface of the cappings of partially sealed honey cells, while *B. schmitzi* oviposits on the outer surface. Smith & Caron (1984) point out, however, that *B. coeca* has been observed to oviposit both on the underside and on the external surface of honey cell cappings. It would be convenient if the two species could be distinguished on the basis of a macroscopic characteristic of their larval tunnels, and it is hoped that future observations might clarify this possibility.

Örösi-Pál (1966a) records coexisting populations of *B. coeca* and *B. schmitzi* in hives in Yugoslavia and Sicily, as well as coexisting populations of *B. pretoriensis* and *B. coeca* ssp. *angulata* from colonies in Natal. It is not known whether two species of *Braula* are normally able to maintain a stable coexistence within a single bee colony, or whether the reported associations were, for example, artefacts of apiary management.

Adult *Braula* are found, normally singly, on the thorax or gaster of drones and workers. Mated (but not virgin) queens may, however, harbour large numbers of *Braula* about their body. Smith & Caron (1984) report various levels of infestation in the United States, up to 29 *B. coeca* on a queen in one case, and J. Morton (*pers. comm.*) has observed about 40 specimens of *Braula* on a queen in the UK. It is not known to what extent, if any, this level of infestation might affect a queen's behaviour and hence colony performance. It is of interest that 18 individuals of *Braula* were recorded on a drone in a queenless honey bee colony in South Africa by Skaife (1921).

The adults of *B. coeca* live as kleptoparasites on regurgitated material (protein- and fat-rich secretions fed to the queen and larvae), which is taken directly from the bee's mouth-parts, where it appears in response to stimulation by the fly. Skaife (1921) quotes a description by A. I. Root of *Braula* feeding on 'honey' regurgitated by a bee in response to stimulation of its mouthparts by the feet of the adult *Braula*. Argo (1926) describes *Braula* feeding on material regurgitated from the mouthparts of a bee in response to the fly 'frantically clawing' at the bee's clypeus with its two anterior pairs of tarsi. Skaife (1921) notes that the contents of the crop of dissected adults of *Braula* tasted of honey.

The period between hatching of ova and the emergence of adults in *B. coeca* (in Egypt) is 16–24 days (Hassanein & Abd El-Salam, 1962). The longevity of adults, and the period between emergence and oviposition is unknown, and Smith & Caron (1984) state that adults over-winter in bee colonies. Peak breeding in *Braula* is likely to coincide with periods of maximum nectar-flow, when most honey cells are capped by the bees. A number of authors (e.g. Argo, 1926; Örösi-Pál 1966a; Smith & Caron, 1984) and bee keepers (*pers. comms.*) note a pronounced autumn peak in the numbers of *Braula* adults, as well as a spring minimum, the latter, according to Smith

& Caron (1984), coinciding with the death of females following oviposition. Voltinism and adult longevity in *Braula*, and the seasonal relationship between fecundity in *Braula* and the activities of bees, requires further investigation.

The anatomy of the adult and larva of *B. coeca* is detailed by Peterson (1987), and the early stages of this species are described by Ferrar (1987) and Smith (1989). The ova of *Braula* spp. are equipped with a pair of membranous flanges, possibly associated with flotation in a viscous medium, and hence gas exchange. Characters described by Örösi-Pál's (1966b) distinguishing the ova of 'coeca group' from 'schmitzi group' species are based entirely on these flanges, and for this reason may appear questionable.

Authors differ in their interpretation of the larval pabulum of *B. coeca*, and Ferrar (1987) considers this problem unresolved. Imms (1942) states that the digestive system of the larvae contains wax and often pollen grains, and cites Örösi-Pál's (1938) suggestion that the micro-organisms present in the epithelial cells of the mid-intestine of the larvae are capable of digesting wax. Hassanein & Abd El-Salam (1962) describe larvae feeding on honey cell cappings, while Smith & Caron (1984) state that the larvae develop as commensals in the wax cappings of honey cells, obtaining nourishment from debris in the wax. Morse (1987) also reports larvae in cappings feeding on honey, pollen and perhaps wax. While it appears that the larvae of *B. coeca* ingest a variety of substance in cell capping material, which of these is/are required for larval development is unknown. Pupariation is generally held to occur within larval tunnels in cell cappings (e.g. Ferrar, 1987).

Skaife (1921) states that newly hatched lavae of '*B. coeca*' enter brood cells and obtain their nutrition from food supplied to the larvae by nurse bees. The same author reports finding puparia and exuvia exclusively in sealed drone cells following a search of a (queenless) bee colony in South Africa. These observations, which associate the immature stages with sealed brood cells rather than honey cell cappings, appear anomalous and deserve further comment. Skaife's illustrations of the dissected reproductive organs of both sexes of '*B. coeca*' (Figs 9 and 10 of that author) show terminalia which correspond most closely with those of *B. pretoriensis* as illustrated by Örösi-Pál (1966b) (*B. pretoriensis* was described as a new species by Örösi-Pál in 1938, on the basis of material from Natal Province (Papp, 1984)). In addition, Skaife's illustration of the ovum of his species corresponds most closely with that of *B. pretoriensis* as illustrated by Örösi-Pál (1966b), in that both authors illustrate an ovum with a well-defined rounded protrusion at each apex, a feature unique to that species according to Örösi-Pál's illustrations. Further, the larval cephalopharyngeal skeleton illustrated by Skaife differs from that of *B. coeca* as illustrated in Ferrar (1987) (Skaife specifies the length ('about 2 mm'), but not the instar of the larva illustrated. Comparison with dimensions of the larval instars of *B. coeca* cited by Hassanein & Abd El-Salam (1962) (second instar 1.24 mm, third instar 2.07–2.25 mm) is indicative, but does not establish, that Skaife's illustration is of a third instar larva). It appears then, that Skaife's pioneering study gives a useful and probably unique account of the biology and early stages of *B. pretoriensis*, and that, if Skaife's observations are repeatable, this represents the only published account enabling clear differences between the biology of species of *Braula* to be demonstrated. The early stages of *B. pretoriensis* appear to occupy an area in the bee colony (sealed brood cells) which is spatially distinct from that occupied by *B. coeca* (honey cell cappings). The larvae of *B. pretoriensis* are apparently kleptoparasitic on food supplied to the bee larvae, and their pabulum is thus closely related to that of the adult. The larvae of *B. coeca* seem to be strict inquilines in cell capping material. Any observations recording distinctions between the life-histories of *B. coeca* and *B. schmitzi* will be of particular interest.

It is probable that the erroneous descriptions of the larvae of *B. coeca* developing in brood cells, which appear widely in standard texts on Diptera (e.g. Colyer & Hammond, 1968; O'Toole, 1978; Cogan, 1980 (who incorrectly refers Skaife's species to *B. coeca* ssp. *angulata*) and Smith, 1989) are the result of propagation of Skaife's early description of the life-history of '*B. coeca*', which was published before *Braula* was resolved into several species.

STATUS OF *BRAULA* SP. IN ENGLAND AND WALES

The NBU has an extensive data-set of records of *Braula* sp. from England and Wales, and a map compiled from this unpublished data for the period 1 January 1992–13 July 1995, shows that it is recorded from every Vice-County, and from more than 90% of 10 km squares in the area. Paxton & Mwale (1993) conducted a survey by questionnaire of bee pests and diseases in England and Wales in 1991. Only *Braula* sp. and *Galleria mellonella* L. (greater wax moth) showed significant regional variation in incidence. The percentage of bee keepers reporting the presence of *Braula* in their colonies in the south-west region was 73%. The figures for other regions range from 34% ('west region' = Wales) to 50% (central England), and display no discernible geographical trend. The same authors identified a statistically significant higher reporting of *Braula* sp. from bee keepers practising migratory bee keeping, and suggest that the movement of colonies may be a stress factor favouring colonization by the fly. *Braula* is recorded from Scotland (G. E. Rotheray, *pers. comm.*) and from the Irish Republic (P. J. Chandler, *pers. comm.*), but there is no data available to the author regarding its prevalence in these areas. It probably occurs with honey bees throughout the British Isles, but does not often come to the attention of entomologists.

Varroosis indirectly affects the populations of honey bee-associated organisms such as *Braula*, both through the decline in numbers of managed and feral bee colonies, and through the toxicity of varroacidal agents to non-target species. While many bee keepers (*pers. comms.*) feel that the loss of bee colonies due to varroosis is likely to be dramatic, it will be some years before the actual impact becomes clear. The use of varroacides is currently the norm in all regions of the world subject to Varroa infestations, and the only major geographical regions in which Varroa is so far unrecorded are Australasia and southern Africa (J. Morton, *pers. comm.*).

The list of acaricides licensed as varroacides by the EU includes flumethrin (e.g. Bayvarol), fluvalinate (e.g. Apistan), amitraz (e.g. Apivar), formulations based on thymol and other essential oils, as well as a variety of other agents (Morton & Brown, 1996). In addition, treatment using unlicensed substances such as lactic- and formic acid is not uncommon. Flumethrin formulated as 'Bayvarol' strips is the only substance currently licensed for this use in the UK.

The toxicity of these substances to *Braula* and other honey bee-associated invertebrates remains largely uninvestigated, but Kulincevic *et al.* (1991) show that, while both fluvalinate and amitraz are effective against Varroa, fluvalinate has significantly greater toxicity than amitraz towards *Braula* adults 7 days post-treatment. The use of amitraz as a varroacide, however, is far less common overall than treatment with pyrethroids. While amitraz is a formamidine acaricide, both flumethrin and fluvalinate are synthetic pyrethroids and are therefore fat-soluble. Liu (1992) shows that fluvalinate is absorbed into beeswax, and the early stages of *Braula* are therefore likely to be exposed to it, although the effect of such agents on the early stages is unknown.

There is little doubt that *Braula* suffers significant mortality due to the widespread application of varroacidal agents, and that this is likely to be the case internationally.

Following conversations with bee keepers based in England and Wales, no clear consensus has emerged as to whether a noticeable decline in the population of *Braula* has occurred to date. Some have noted that *Braula* has become less common since the arrival of Varroa, while others have always regarded *Braula* infestation as an infrequent occurrence (*pers. comms.*). *Braula* was present in honey bee colonies in the same apiary in London, in both July 1997 and July 1998, where these colonies had received several (*c.* 3–6+) treatments against Varroa, mainly with Bayvarol (J. Morton, *pers. comm.*). While this might indicate that *Braula* has developed some resistance to flumethrin, both flumethrin and fluvalinate are unusual among pyrethroids in that they are significantly less toxic to insects than to mites, and this differential toxicity is probably a factor in determining the ability of *Braula* to persist in flumethrin-treated honey bee colonies.

The development of resistance to fluvalinate in the Varroa mite was first reported by Sugden *et al.* (1995) in the USA. Fluvalinate resistance in Varroa has subsequently been recorded in EU countries such as France and Italy, and these mites also show resistance to flumethrin (Morton & Brown, 1996). As resistance becomes more prevalent, and currently licensed pyrethroid varroacides lose their efficacy, there will be a switch to alternative treatments. These are likely to exhibit significantly greater toxicity to non-target species such as *Braula* than currently licensed compounds. While it is vital that Varroa infestation is managed by all appropriate means, it is also important to be aware of the indirect effects of varroosis on populations of honey bee-associated invertebrates such as *Braula*.

Notes on identification

Specimens derived from hive debris etc. are desiccated and brittle, and many are in relatively poor condition. Most males from this source have the aedeagus extended, and as a result it is often broken. Examination of a number of males may thus be necessary to locate those with the aedeagus entire. In practice, however, worn specimens can often be identified as long as the abdominal venter is clearly visible.

Subsequent to softening specimens for examination by soaking them overnight in 10% KOH, a brief (*c.* 30 seconds) boiling in this solution will dissolve adherent wax particles, which may otherwise obscure diagnostic features. The terminalia may sometimes be exerted in softened specimens of both sexes by gently 'pumping' the abdominal venter with a blunt object.

The shape of the abdominal sternites is rather variable between individuals of *Braula*. For example, the anteriolateral extensions of synsternite 1 + 2 may be either pointed (Figs 1, 5) or truncate in both sexes of *B. coeca* and *B. schmitzi*. Sternite 3 is often quite short with curved or divergent lateral margins in *B. coeca* (Fig. 1), and significantly longer with parallel lateral margins in *B. schmitzi* (Fig. 5). This feature is too variable, however, to reliably separate the species.

In a few specimens of both species from the NBU sample a 'false posterior margin' was present on synsternite 1 + 2 (Fig. 6). This weakly defined suture may or may not represent a partial reversion to the plesiomorphic state, in which sternites 1 and 2 are separate.

Nomenclature of abdominal sternites follows Peterson (1987), which differs from that adopted by Örösi-Pál (1966b).

Determining sex in *Braula*

Four fully formed and pigmented median ventral abdominal sclerites (sternites 1 + 2–5) clearly visible (Fig. 5). Sternite 6 is present, but it is very short and turned

under the posterior margin of sternite 5, where it is often visible as a crescent-shaped silhouette (Fig. 5). Aedeagus (Figs 3, 8) frequently extended in samples from hive debris, although sometimes broken in these specimens. Aedeagal apodeme/hypandrium normally visible in silhouette within the abdominal cavity.
. . . Males

Five entire and fully pigmented median ventral abdominal sclerites (sternites 1 + 2–6) clearly visible (Fig. 1) [*The posterior margin of sternite 6 may be darkened in some females, and this should not be confused with the silhouette of sternite 6 as seen in males*]. Cerci (Figs 4, 9) usually visible in part when the tip of the abdomen is viewed ventrally, although may be substantially obscured in some specimens.
. . . Females

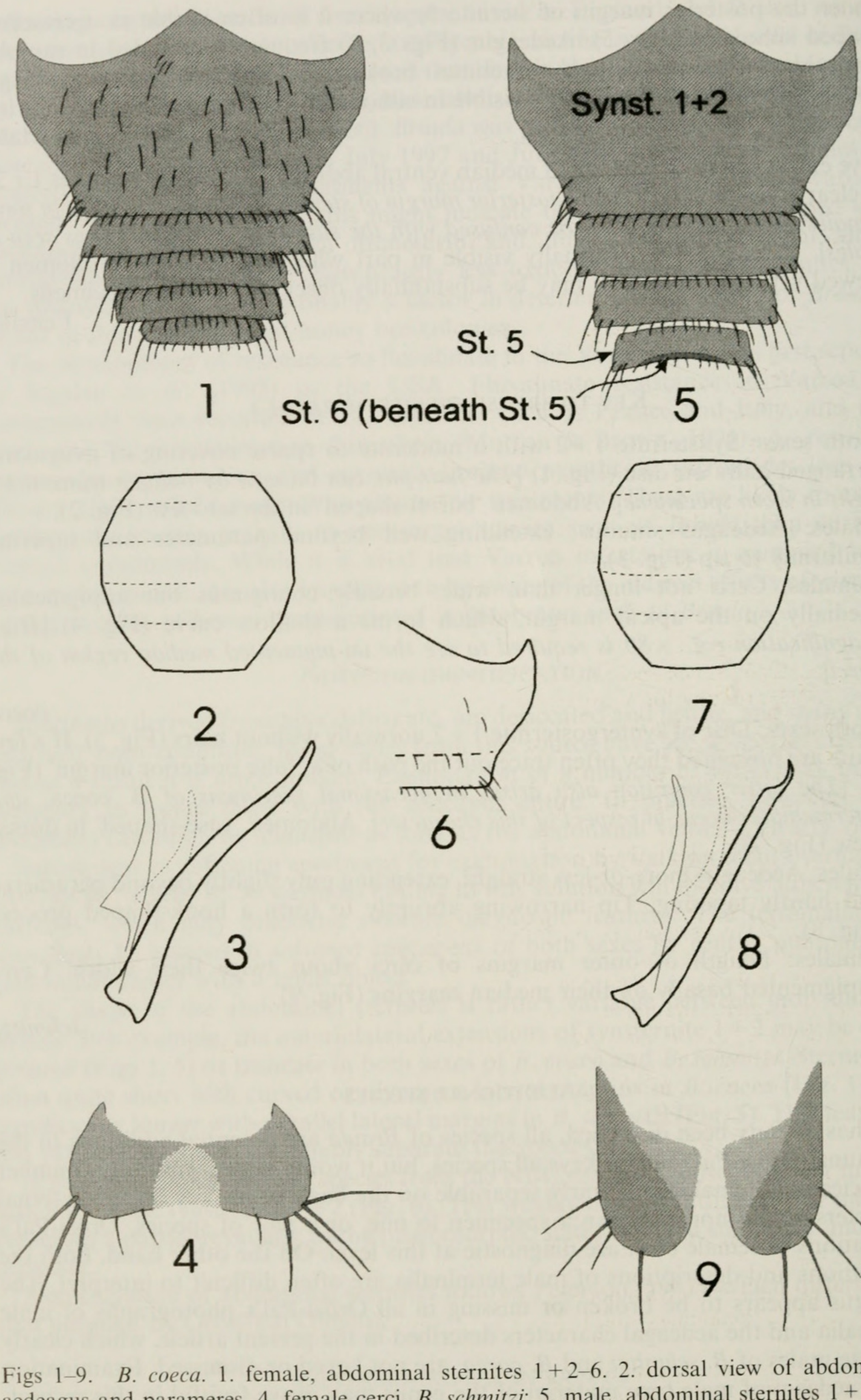
KEY TO BRITISH SPECIES OF *BRAULA*

1 Both sexes: Synsternite 1 + 2 with a moderate to sparse covering of irregularly arranged hairs on disc (Fig. 1) [*The hair-pits can be seen by oblique transmitted light in worn specimens*]. Abdomen 'barrel-shaped' in dorsal view (Fig. 2).
Males: Aedeagus sinuous, extending well beyond parameres and tapering uniformly to tip (Fig. 3).
Females: Cerci not longer than wide, broadly contiguous but unpigmented medially on the apical margin, which forms a shallow curve (Fig. 4) [*High magnification e.g. × 80 is required to see the un-pigmented median region of the cerci*]
. . . . *coeca*

2 Both sexes: Disc of syntergosternite 1 + 2 normally without hairs (Fig. 5). If a few hairs are presented they often trace out the path of a 'false posterior margin' (Fig. 6) [*The latter condition also arises in occasional specimens of* B. coeca, *and intermediates occur in respect of this character*]. Abdomen 'vase-shaped' in dorsal view (Fig. 7).
Males: Aedeagus more-or-less straight, extending only slightly beyond parameres and hardly tapering. Tip narrowing abruptly to form a hook-shaped process (Fig. 8).
Females: Length of outer margins of cerci about twice their width. Cerci unpigmented basally on their median margins (Fig. 9)
. . . . *schmitzi*

ADDITIONAL SPECIES

As has already been discussed, all species of *Braula* are potential additions to the UK fauna. Örösi-Pál (1966b) keys all species, but it would appear that for a number of species only females are clearly separable on the basis of his key. While external characters would normally run a specimen to one, or a pair of species, Örösi-Pál's illustrations of female cerci are diagnostic at this level. On the other hand, both the illustrations and descriptions of male terminalia are often difficult to interpret. The aedeagus appears to be broken or missing in all Örösi-Pál's photographs of male terminalia and the aedeagal characters described in the present article, which clearly separate males of *B. schmitzi* and *B. coeca*, are not keyed or discussed. Examination of the aedeagi of male type material of the genus may prove fruitful in this respect. The following notes (based on the key and illustrations in Örösi-Pál, 1966b) should highlight the possible presence of additional species in suspect female specimens.



Figs 1–9. *B. coeca*. 1. female, abdominal sternites 1 + 2–6. 2. dorsal view of abdomen. 3. aedeagus and parameres. 4. female cerci. *B. schmitzi*: 5. male, abdominal sternites 1 + 2–6. 6. synsternite 1 + 2 showing 'false' posterior margin. 7. dorsal view of abdomen. 8. aedeagus and parameres. 9. female cerci. *Abbreviations:* St.—Sternite. Synst.—Synsternite.

Syntergosternite 1+2 hairy, abdomen 'barrel-shaped' (as *B. coeca*). Female cerci distinctly broader at apex than at base.

?*B. pretoriensis* [or *B. kohli*]

Keys to *B. coeca* but sternite 3 hairy on disc and apical margin of female cerci forming a well defined angle of about 120° at the mid line.

?*B. coeca* ssp. *angulata*

Keys to *B. schmitzi* but female cerci deeply divided medially, the inner margins pigmented and setose as *per* the outer margins.

?*B. orientalis*

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SHORT COMMUNICATION

***Ulopa trivia* Germar (Homoptera: Cicadellidae) in Wales**—Two species of the cicadellid (leafhopper) genus *Ulopa* are found in Britain (Le Quesne, 1965). Both species are usually flightless, with convex thickened forewings, and are found near ground level. *Ulopa reticulata* (Fab.) is found commonly under *Erica* and *Calluna* over almost all Britain. *Ulopa trivia* Germar is a very local species (designated Notable B by Kirby, 1992) with scattered records in southern England (Morris, 1971; Kirby, 1992). It is a species of chalk and limestone grassland and calcareous dunes, although its hosts plants are not known with certainty. An association with *Plantago* is possible (Morris, 1971). It appears that the species is univoltine with females overwintering to lay eggs in the spring. A short visit on 4.ix.98 to Whiteford Burrows NNR (SN437944) on the north Gower coast in south Wales (VC 41, Glamorgan) produced 4 females of *U. trivia* by vacuum sampling. The site was a large, warm, south facing, dune slack with short, rabbit-grazed vegetation. Poor weather prevented further examination of other areas of the dunes on this occasion. This record appears to be the first for the species in Wales, and is some distance from other recorded sites (the nearest being Brean Down, nr Weston-super-Mare, N. Somerset, according to Morris, 1971).—M. R. WILSON, Department of Biodiversity and Systematic Biology, National Museums and Galleries of Wales, Cardiff CF1 3NP.

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