HEDYCHRUM NOBILE (SCOPOLI): A JEWEL-WASP NEW TO BRITAIN AND DISTINCT FROM *H. NIEMELAI* LINSENMAIER (HYMENOPTERA: CHRYSIDIDAE)

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ABSTRACT

The separation of *Hedychrum nobile* (Scopoli) into two distinct species, *H. nobile s.s.* and *H. niemelai* Linsenmaier, is provisionally accepted and characters distinguishing the two species are given. *Hedychrum niemelai* is a long-term resident of Britain while *H. nobile* is a recent arrival that has spread rapidly since its first record from Surrey in 1998. Distributional data and field observations suggest that the preferred host of *H. nobile* is *Cerceris arenaria* (L.) and that the hosts of *H. niemelai* are *C. quinquefasciata* (Rossi) and *C. ruficornis* (F.).

HISTORY IN EUROPE

In the late 1940's the Dutch entomologist P. M. F. Verhoeff was working on the genus *Hedychrum* in order to make a clear separation of the three species, *H. gerstaeckeri* Chevrier, *H. rutilans* Dahlbom and *H. nobile* (Scopoli), that were present in the Netherlands. Little attention had previously been paid to the the genitalia of Chrysididae but he dissected males and was surprised to find two distinct forms of the genitalia of *H. nobile*. He then received a letter from a Finnish entomologist, P. Niemelä, who had made the same discovery, and then a further letter in which Niemelä reported finding two corresponding forms of the female based on a single small but significant underside character.

Verhoeff needed to publish his work urgently in order to make it available to a comprehensive study of the Chrysididae of the Netherlands, and these were duly printed on consecutive pages of the same journal (Verhoeff, 1950; Benno, 1950). He deferred to Niemelä's greater part in the discovery by merely calling the new taxon the 'new form' of *H. nobile* and leaving it to Niemelä to determine its status and give it a name. Niemelä announced his intention to publish the new form as a new species using the name *Hedychrum verhoeffi* (Niemelä, 1950), but he died in the following year without further publication, so his new name is a *nomen nudum* because given without description.

At that time the leading European specialist on Chrysididae was a Swiss, Walter Linsenmaier, and in the supplement to his first major work (Linsenmaier, 1951) he commented extensively on Verhoeff's publication. After examining specimens from all over Europe, he agreed that there were two distinct forms of *nobile* but found that one of Verhoeff's characters was not completely reliable, and he suggested other characters, based on puncturation. In this supplement he considered the two forms to be ecological races of the same species, but in a later revision of the European fauna (Linsenmaier, 1959) he placed Verhoeff's new form as a subspecies, *niemelai*, of a different species, *H. aureicolle* Mocsáry, found in Cyprus and the Middle East. He retained this name, *H. aureicolle niemelai*, in his final work on the Swiss Chrysididae (Linsenmaier, 1997), although D. Morgan had stated, in his handbook

to the British species (Morgan, 1984), that there were sufficient differences from *H. aureicolle* to regard *H. niemelai* Linsenmaier as a distinct species.

It was already known that the new form, or *niemelai*, was the only one of the two forms present in Britain, since Verhoeff (1950) had quoted a letter from O. W. Richards stating that the only British specimens available to him were 34 males and 22 females of the new form, apart from a single female of the true *nobile* from the Channel Island of Jersey which is politically linked to the United Kingdom but geographically closer to France.

In a study of the Chrysididae of the south-west German state of Baden-Württemberg, Kunz (1994) commented on this history, but in his own collecting he found both male and female specimens that were intermediate in character between the two forms, so he concluded that *H. nobile* was a single variable species. He also noted that the two forms were almost always found together.

The view of Kunz has not been universally accepted, since some more recent authors such as Niehuis (2001), Rosa (2006) and Winiowski (2015) have continued to regard *H. niemelai* as a distinct species. We understand that genetic studies of this problem have been made but not yet published, although they are believed to support the recognition of *H. niemelai* as a valid species (Paukkunen *et al.*, 2014).

History in Britain

The single British species of *Hedychrum* (disregarding the extinct *rutilans*) was formerly known as *H. nobile*, but, after being identified as the new form of that species in 1950, it was renamed *H. aureicolle niemelai* in 1959 and then *H. niemelai* in 1984, following the publications quoted above.

On 7 July 1998 David Baldock (DB), in only his third season of studying aculeates, went to Horsell Common, a dry lowland heath just north of Woking, Surrey, in order to collect bees and wasps. He started his search in the Old Sandpit, a site made famous not only by Edward Saunders and his friend Frederick Morice for the number of rarities they found there in the late 19th Century, but also by H. G. Wells as the place where the Martians landed in his book 'War of the Worlds'. DB found there about 15 to 20 large, brightly-coloured jewel-wasps on the flower-heads of yarrow, *Achillea millefolium*. At home he examined the four specimens that he had collected; the large females had a metallic blue-green head and thorax with a broad band of metallic red across the front of the thorax, the abdomen being very bright red. The males were rather smaller and lacked the red band on the thorax. Using Morgan (1984) they keyed out to *Hedychrum niemelai* although he described the same colour pattern for both sexes, for some reason forgetting to add that the female has a red thoracic band. Because Morgan did not include *Hedychrum nobile* in his list of British species, and having never seen a genuine specimen of *niemelai* or of *nobile*, DB was entirely convinced that his specimens were *niemelai*. His conviction was supported by the fact that both Morice and Saunders had found *niemelai* at Horsell Common in 1890 although it had never been recorded since that year either at Horsell or at any other site in Surrey. He assumed, in his ignorance, that *H. niemelai* had survived there for over 100 years, although he found it difficult to believe that such a relatively large and brightly coloured jewel-wasp could have remained unnoticed for so long in a place frequently visited by hymenopterists.

Later in 1998, on 2 September, DB found a large number of the same species at Ham Common, adjoining Richmond Park; these were at a mixed nesting aggregation of *Cerceris arenaria* (L.) and *C. rybyensis* (L.), both of which are mentioned by Morgan as hosts of *H. niemelai*. In July 2000 he found it in numbers at three sites on

Barnes Common, south-west London, around nests of *C. arenaria*. In 2001 he found it at three new sites on Horsell Common, various sites in south-west London (Kew Gardens at three places, Wimbledon Common at three places, and Ditton Common at four places) as well as at Priest Hill, Ewell, which is on the chalk but its host was nesting on a small area of introduced sand, and further west at Ockham Common, Wisley. Over the next four years it was found by DB and other recorders at many new sites including Ham House; Nonsuch Park; Brooklands at Weybridge; Chobham Common; Oxshott Heath; Oxted; Priory Park, Reigate; and all over Reigate Heath. In 2006 it was being seen at new sites in the west of the county, such as Albury Heath, Blackheath Common (south-east of Guildford), Hambledon, Witley and Mare Hill Commons; all these sites had been heavily recorded over the past ten years and there had been no sign of this insect. It was clear that, as suspected, the jewel-wasp was spreading westwards rapidly from its stronghold around London. By 2007 it had reached as far west as Hankley Common and in the following year it appeared at Ash Ranges, almost on the boundary with North Hampshire and in 2009 it was found on Frensham Common in the far south-west of the county. At the vast majority of the sites mentioned above the jewel-wasps were seen around nest sites of *C. arenaria*, and can still be seen today in large numbers at most of these sites.

Meanwhile we had both purchased a copy of Kunz (1994) in which *H. niemelai* was sunk into *nobile s.l.*, a European species not found in Britain. Roger Hawkins (RH), who reads German, was impressed by Kunz's arguments and decided to dissect his five male specimens. The result was so surprising that he took about 15 further males from DB and dissected these as well. Assuming that the two forms were distinct, most were clearly *nobile*, a few matched the intermediates illustrated by Kunz, but there were no *niemelai* at all.

This study was still in its early stages when *Wasps of Surrey* (Baldock, 2010) was being prepared for publication. Since we were unsure about the validity of the separation of *niemelai* and *nobile*, and about the extent of the distribution of *nobile* in Britain, we decided for this book to retain the name *niemelai* that was familiar and had been used for the British species for the previous 25 years.

The issue needed further investigation and we resolved to re-examine all British specimens of the species, both historic and modern. Firstly, we obtained copies of the relevant European literature and found that the problem of males with apparently intermediate genitalia had already been discussed by Linsenmaier (1951), who reported that the genitalia of *nobile* varied more towards the new form, that he later named *niemelai*, than shown in the drawing of Verhoeff (1950), which represented an extreme case.

It seemed likely that the 56 British specimens examined by Richards in 1950 would now be in the museums of London and Oxford. In 2013 we both, separately, visited the Natural History Museum in London and, with the help of David Notton, looked at the collection of *Hedychrum* which included male and female specimens of both *nobile* and *niemelai* from Austria, Switzerland and the Netherlands that had been determined by Verhoeff. The drawer of *H. niemelai* contained about 300 specimens: 200 British and 100 continental. All the former appeared to be fairly small and likely to be *niemelai* except for one large female (9 mm long) collected by Richards at Gorey, Jersey, on 6.7.1946. Although standing under *niemelai*, it bore no determination label and, when examined closely, was clearly *nobile* and the specimen mentioned by Richards in his letter to Verhoeff. Only one British male had the genitalia extracted, so David Notton dissected two more which appeared to be the largest in the drawer. All three were *niemelai*: from Backways Cove, Tintagel, East

Cornwall, in 1965; from Tuddenham, Suffolk, in 1921; and from Colchester, Essex, in 1902, one of 35 males from the Harwood collection that had previously been determined as *niemelai* by Linsenmaier without dissection.

RH also visited the Oxford University Museum of Natural History and was shown the *Hedychrum* collection by James Hogan. The specimens came mostly from two sites near Oxford, Cothill from 1922 to 1955 and Tubney from 1906 to 1922, and from Bude in Cornwall in 1926. With the help of Ivan Wright, all specimens were checked and determined as *H. niemelai* on external characters, since only one had been dissected and its genitalia had unfortunately been mounted upside-down. We named 22 males and 21 females, while the critical characters could not be observed on a further eight specimens, all within the size range of *niemelai*. Both museums also held a few Surrey specimens taken by DB and initially assumed to be *niemelai*; all these were redetermined as *H. nobile*.

Most Surrey specimens had been retained, so these were also checked, including the females that are generally more numerous in collections than the males. However, this also involved the dissection of another 16 males. Most specimens had been taken by DB but RH had five females and Graham Collins supplied eight specimens along with two *niemelai* from Kent and Cornwall that provided a useful comparison. All the Surrey specimens were *nobile*, so we now had the strange situation that all *Hedychrum* from Surrey and just across the River Thames in Middlesex were *nobile*, while all those from elsewhere in southern England were *niemelai*.

DB then contacted various members of the Bees, Wasps and Ants Recording Society who lived in the south-east of England, asking them to let him have details of any records of large *niemelai* in recent years. He received a few records of likely *nobile* from almost all the vice-counties surrounding London and from a few vice-counties further out, such as East Kent, West Sussex, Hampshire, Oxfordshire, Bedfordshire and Suffolk. DB examined some of the specimens involved in these records and was able to confirm that they were all *nobile*. All these records and a few subsequent ones are set out by vice-county in the Appendix, and shown on the map (Fig. 1). Most of these additional records come from the last five years, but those from West Suffolk in 2002 and South Essex in 2003 go back almost to the discovery of the species in Surrey. In a few sites *nobile* and *niemelai* can now be found together.

Conversely, the search in Surrey was for small examples of *nobile*, and these were targeted during field work. The most likely candidates for showing that *niemelai* is still present in Surrey are two females taken by DB at Witley Common in 2014. These are 5.8 mm and 6.5 mm long but have not yet been positively identified. We are still looking for a male Surrey *niemelai* to confirm the issue.

Conclusions

It seems that the sole host of *H. nobile* is *C. arenaria*, since many have been taken from around nesting aggregations of this species and there is no suggestion in any of the records that any other host is used. It is clear that *H. nobile* is now widespread throughout south-east England and is probably still spreading westwards and northwards. It is particularly common around London and in Surrey where there is abundant suitable habitat of dry sandy soils, mainly on heathland and dry acid grassland, favoured by its host. But it is still not known where or when it first arrived in England or how it got there. It must have been present, probably in the London area, for a few years before it was discovered in 1998 at Horsell Common. We shall probably never know where it first arrived because in spite of it being so conspicuous

it must have been overlooked for so long; many hymenopterists take little notice of jewel-wasps, perhaps because most of them are difficult to identify.

Looking at the distribution map of *C. arenaria* (Edwards, 1997), it can be seen that it is well distributed over much of southern Britain as far north as Yorkshire but only in sandy areas. It is most abundant in the south-east, but there are strongholds in the Brecks and Norfolk as well as in the New Forest and Dorset and along the western coasts wherever there are sand dunes. *Hedychrum nobile* is likely to colonise these areas and it should be looked for at *C. arenaria* nesting sites. It is less likely that it will colonise smaller, isolated areas of sand, at least in the near future. The distribution map of *H. nobile* (Fig. 1) shows that it has already reached areas well outside its core area and that it can fly large distances to reach sites where *C. arenaria* is nesting. Just before this paper went to print, *H. nobile* was in fact found at Wareham in Dorset, approximately 70 km west of the previously westernmost site of Wickham in South Hampshire.

The distribution map of *H. niemelai* (Fig. 2) shows it to have a very patchy range in southern England, similar to that of its presumed host *C. quinquefasciata* (Rossi) (Edwards, 1997). The hosts for *H. niemelai* are given by Morgan (1984) as C. *ruficornis*, *C. arenaria*, *C. rybyensis* and *C. quinquefasciata*, but it is not known whether this list was derived from the British literature and thus be applicable to *niemelai*, or from the Continental literature which might be applicable to *nobile* before the species were separated. The observation and collection of large numbers of *nobile* and few if any *niemelai* from around colonies of *C. arenaria* suggests that this species is not a significant host for *H. niemelai*. In Surrey *C. rybyensis* has a wider distribution than *C. arenaria*, being also found at sites on chalk and clay, but no *Hedychrum* of either species has ever been taken in these additional areas, so this *Cerceris* also can hardly be considered a host. Away from Surrey, *H. niemelai* is present at localities where the only species of *Cerceris* is *quinquefasciata*, and sites around the Cornish coast where only *C. ruficornis* occurs, so it seems that these two species are the main hosts for *H. niemelai* in Britain.

In conclusion, *Hedychrum nobile* and *H. niemelai* have distinct populations in Britain, where the former is a recent arrival and the latter a long-term resident. The main host for *nobile* is certainly *Cerceris arenaria*, and the hosts for *niemelai* are presumed to be *C. quinquefasciata* and *C. ruficornis*. The ranges of the two *Hedychrum* species have been largely separated until the last few years. The key characters of male genitalia, male mid-tibia and female underside apply consistently to the different populations, so it seems reasonable to treat *H. nobile* and *H. niemelai* as distinct species.

In south-west Germany Kunz (1994) found that the two forms almost always flew together and that intermediate specimens were present in both males and females. This is not the case so far in Britain but may happen if interbreeding occurs when *H. nobile* moves into areas occupied by *H. niemelai*. In this case the initial opinion of Linsenmaier (1951), that the two forms are ecological races of a single species, should be considered.

IDENTIFICATION

Hedychrum nobile is a larger species than *H. niemelai*, but the size ranges overlap. Verhoeff (1950) gives 5–8 mm for his new form and 6–9 mm for *nobile*, both for males and for females, while Linsenmaier (1959) extends these ranges to 4–8 mm for *niemelai* and 6–10 mm for *nobile*, treating males and females together. Our measurements of British specimens fall within these ranges but differ slightly. It is

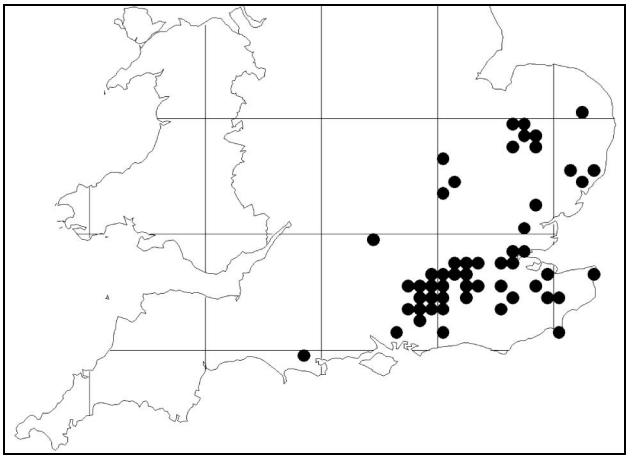

Fig 1. British distribution by 10-km square of *Hedychrum nobile*, 1998–2016.

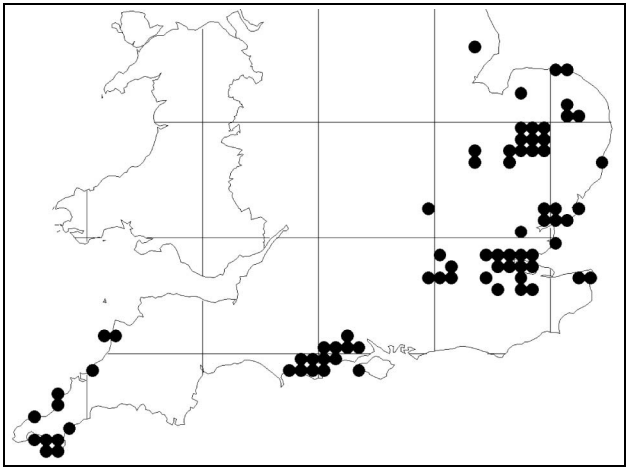

Fig 2. British distribution by 10-km square of *Hedychrum niemelai*, post-1969.

clear that female *nobile* are larger than males, since our specimens, all modern and mostly from Surrey, are 6-8 mm long for males (mean 6.9 mm, n = 39) and 7–9 mm long for females (mean 7.9 mm, n = 17). On the other hand, the size ranges of male and female *niemelai* are almost identical, being 5–7 mm for males (mean 6.25 mm, n = 20) and 4.5–7 mm for females (mean 6.27 mm, n = 30). These measurements for *niemelai* were mostly made from historic specimens held in museums, but with a few modern ones, and all coming from widely scattered sites in southern England and East Anglia.

In females, the end of sternite 3 is gently incurved with a small projection at its centre that is broad, rounded and shovel-shaped in *nobile* but smaller, narrower and slightly notched in *niemelai* (Figs. 3a and 3b). Although the photographs show this

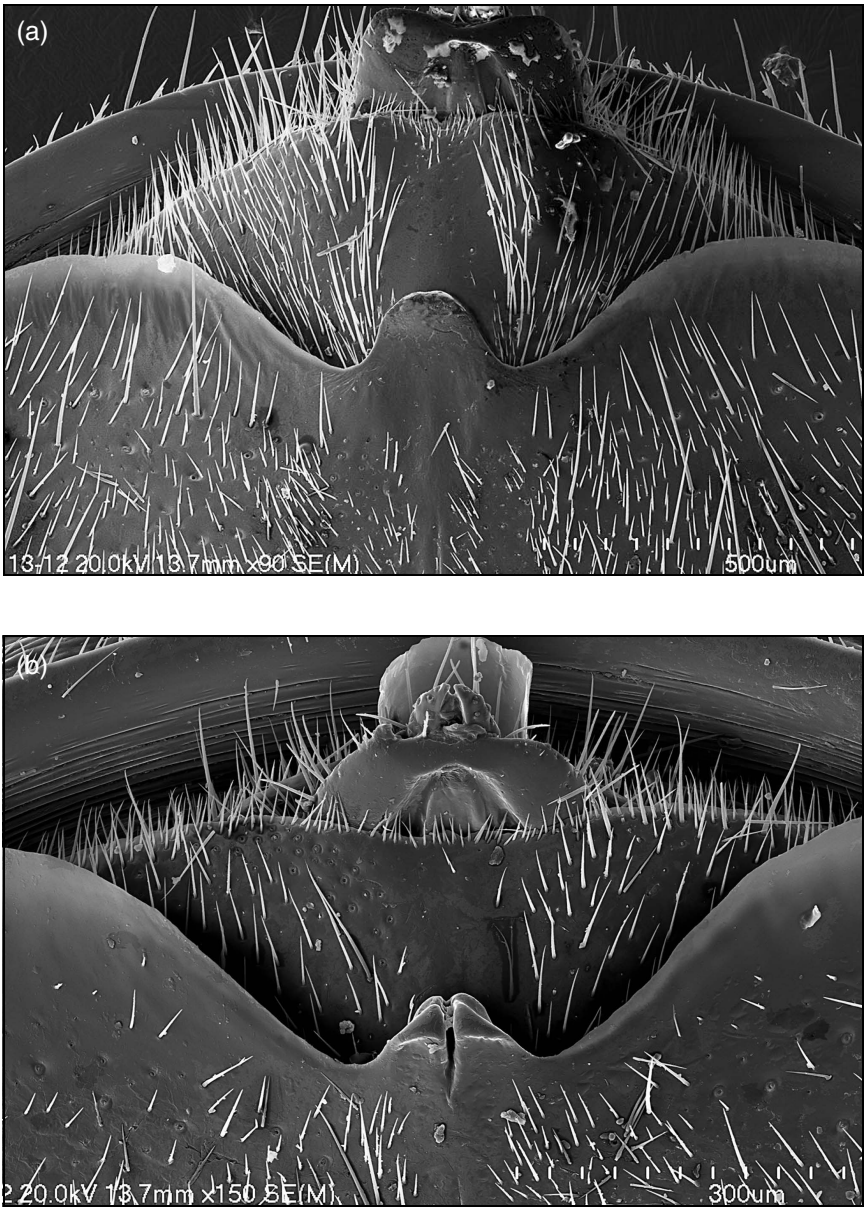

Fig 3. (a) Tip of female abdomen, ventral view, *Hedychrum nobile*; (b) Tip of female abdomen, ventral view, *Hedychrum niemelai*.

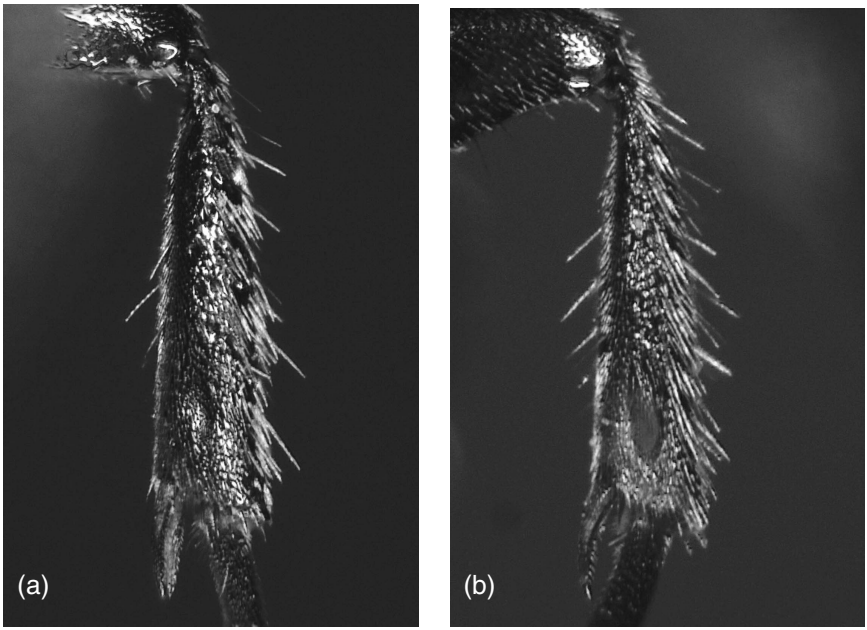

Fig. 4. (a) Male mid-tibia, posterior view, *Hedychrum nobile*; (b) Male mid-tibia, posterior view, *Hedychrum niemelai*.

feature very clearly, it is difficult to check on dry specimens, even when the insect is mounted with the underside visible. The black sternite 3 is closely appressed to the black sternite 4, and a high magnification is required, in particular to determine small specimens of *niemelai*.

On the mid tibia of males, towards its apex, there is a small depression that is shallow and scarcely visible in *H. nobile* but deep and broadly oval in *H. niemelai* (Figs. 4a & 4b). This pit is often difficult to see on dry specimens, unless the middle legs are spread outwards. Some specimens of *nobile* have a narrow pit, so this character needs treating with caution.

Snodgrass (1941) is followed in naming the parts of the male genitalia. The central bifid **aedeagus** has not been used to separate these two species, although it is broader than in some other species of *Hedychrum*. The main part of the capsule is a multi-pronged rigid structure, loosely attached to a rounded base. The dorsal outer prongs are the **parameres**. Projecting ventrally on each side is the pointed **cuspis** and the slender **digitus**, coloured black for most of its length and movable through an articulation at its base.

In *H. nobile* the paramere of the genital capsule appears straight, broad and usually constricted before the slightly incurved tip, whereas in *H. niemelai* the paramere is narrower and smoothly tapering towards the incurved tip (Figs. 5a and 5b). The cuspis in *nobile* is long, extending to about five-sixths of the length of the paramere, whereas in *niemelai* it is shorter, extending only to about two-thirds of the length of the paramere (and even shorter in *H. rutilans* and *H. gerstaeckeri*, should these be encountered). In *nobile* the digitus is as long as the cuspis or a little shorter,

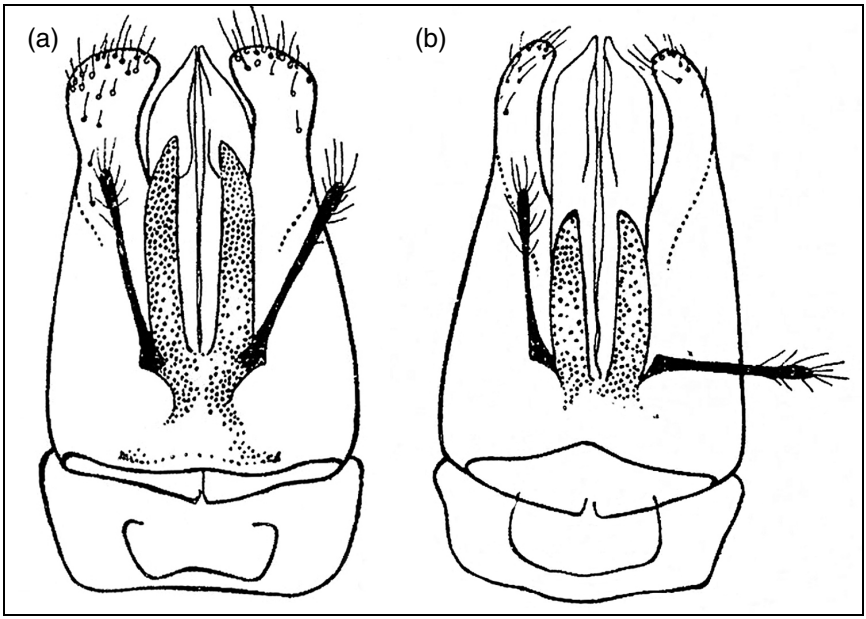

Fig. 5. Male genital capsule (after Verhoeff), (a) *Hedychrum nobile*, (b) *Hedychrum niemelai*.

whereas in *niemelai* it may be as long as the cuspis but is usually noticeably longer. A combination of these three characters is usually sufficient to give a name to the specimen.

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References

Baldock, D. W. 2010. *Wasps of Surrey*. Surrey Wildlife Trust, Pirbright.

Benno, P. 1950. De nederlandse Goudwespen en haar verspreiding (Hym., Chrysididae, Cleptidae). *Publicaties van het Natuurhistorisch Genootschap in Limburg* **3**: 9–48.

Edwards, R., ed. 1997. *Provisional atlas of the aculeate Hymenoptera of Britain and Ireland. Part 1*. Biological Records Centre, Huntingdon.

Kunz, P. X. 1994. *Die Goldwespen Baden-Württembergs*. Landesanstalt für Umweltschutz, Karlsruhe.
Linsenmaier, W. 1951. Die europäischen Chrysididen (Hymenoptera). *Mitteilungen der Schweizerischen Entomologischen Gesellschaft* **24**: 1–110.
Linsenmaier, W. 1959. Revision der Familie Chrysididae. *Mitteilungen der Schweizerischen Entomologischen Gesellschaft* **32**: 1–232.
Linsenmaier, W. 1997. *Die Goldwespen der Schweiz*. Natur-Museum, Luzern.
Morgan, D. 1984. *Cuckoo-wasps*. Handbooks for the Identification of British Insects, Vol. 6, Part 5. Royal Entomological Society, London.
Niehuis, O. 2001. Chrysididae. In: Dathe, H. H., Taeger, A. & Blank, S. M. (Eds.), Verzeichnis der Hautflügel Deutschlands (Entomofauna Germanica, 4). *Entomologische Nachrichten und Berichte* 7: 119–123. [Dresden]
Niemelä, P. 1950. [Meeting report: *Hedychrum verhoeffi* n. sp. and *H. gersteckeri* Chevr. new to Finland.] *Annales Entomologici Fennici* **16**: 132.
Paukkunen, J., Rosa, P., Soon, V., Johansson, N., & Ødegaard, F. 2014. Faunistic review of the cuckoo wasps of Fennoscandia, Denmark and the Baltic countries (Hymenoptera: Chrysididae). *Zootaxa* **3864**: 1–67.
Rosa, P. 2006. *I Crisidi della Valle d'Aosta*. Monografie del Museo regionale di Scienze naturali, 6. St.-Pierre, Aosta, 368 pp + xvi + xxxii pls.
Snodgrass, R. E. 1941. Male Genitalia of Hymenoptera. *Smithsonian Miscellaneous Collections*, vol. 99, no. 14, pp. 42–43, plate 13.
Verhoeff, P. M. F. 1950. Taxonomie der niederländischen *Hedychrum*-Arten (*Hedychrum* Latr., Hym. Chrys.). *Publicaties van het Natuurhistorisch Genootschap in Limburg* **3**: 3–8.
Winiowski, B. 2015. *Cuckoo Wasps (Hymenoptera: Chrysididae) of Poland. Diversity, identification, distribution*. Ójcow, Poland.

APPENDIX

All known British records of *Hedychrum nobile* are listed below, arranged by vice-county, apart from those from Surrey (VC17) which were mapped in *Wasps of Surrey* (Baldock, 2010) under the name of *H. niemelai*.

VC9. Dorset
Wareham Forest, SY89, 21.vii.2016, 1f, leg. & det. I.C. Cross.

VC11. South Hants
North of Wickham, West Walk, SU600121, 30.vii.2015, many females seen at *C. arenaria* nests by G.R. Else.

VC12. North Hants
North Hants Golf Course, Fleet, SU8155, 24.vii.2007, 1m, leg. & det. M. Edwards.
Hazeley Heath, SU764576, 26.vii.2012, 1f, leg. & det. M. Edwards.
Bordon, Marwood Quarry (off Hogmoor Road), SU784354, 28.viii.2013, 1f, leg. G. R. Else, det. M. Edwards.
Hazeley Heath, SU765578, 18.vii.2014, 1m, 1f, with *Cerceris arenaria*, leg. & det. M. Edwards.

VC13. West Sussex
Hurston Warren Golf Course, Pulborough, TQ075168, 29.vii.2010, 1f, leg. & det. M. Edwards.
Stedham, SU867225, 10.vii.2011, 1f, leg. & det. M. Edwards.
Stedham Common, SU867225, vii.2014. M. Edwards and B. Rogers saw it at *Cerceris arenaria* colony.

Pulborough Brooks, TQ0616, 5.viii.2014, 1f, leg. R. Earwaker, det. Baldock.
Midhurst, garden of Leaside, SU882215, 30.vi.2015, 1m, leg. & det. M. Edwards.

VC15. East Kent
Hothfield Heathlands Reserve, TQ9746, 24.vii.2011, leg. R. Moyse, det. G. Allen.
Dungeness RSPB (Walkers Outland), TR06821907, 23.vii.2012, 1f, leg. G. Allen, det. Baldock.
Lenham Quarry, TQ8851, 8.vii.2013, leg. L. Clemons, det. G. Allen.
Pegwell Bay, TR3564, 3.vii.2015, leg. & det. G. Hazlehurst.
Swanscombe, west pit, TQ600749, 23.vii.2015, 1m, leg. & det. M. Edwards.
Swanscombe Marshes south, TQ605760, 31.vii.2015, 1m, leg. & det. M. Edwards.
Ashford, TR004423, 30.vii.2015, 1m, leg. & det. G. A. Collins.
Bysing Wood, Faversham, TQ9961, 3.viii.2015. leg. & det. A. Witts.

VC16. West Kent
Sevenoaks KWT Reserve, TQ5256, 10.vii.2010, leg. & det. G. Hazlehurst.
Tunbridge Wells Common, TQ5739, 3.vii.2011, leg. & det. I. Beavis.
Sandhill Farm, Pembury, TQ6141, 9.vii.2011, leg. & det. I. Beavis.
Calverley Grounds, Tunbridge Wells, TQ5839, 3.viii.2012, leg. & det. I. Beavis.
Denny Bottom, Rusthall Common, TQ5639, 9.viii.2012, leg. & det. I. Beavis.
Blackheath, London, TQ3876, 11-28.vii.2013, 1m, 7f, leg. D. Notton, det. Hawkins.
Wellington Rocks, Tunbridge Wells, TQ5739, 10.vii.2015. leg. & det. I. Beavis.
Northfleet Landfill, TQ612740, 31.vii.2015, 1m, leg. & det. G. A. Collins.
Bamber Pit, TQ609745, 6.viii.2015, 1m, leg. J. F. Kaunang, det. G. A. Collins.

VC17. Surrey
Nearly 200 records from 1998 to 2015.

VC18. South Essex
West Thurrock PFA Lagoons, North Lagoon,TQ585770, 7.vii.2003, 2m, leg. & det. P. R. Harvey. Two very large groups of females seen at nesting area. Also 1m *H. niemelai*.
Orsett quarry, TQ6680, vii.2003, 1f, leg. A. Knowles. *C. arenaria* & *quinquefasciata* present.
Rainham Marshes, TQ542798, 3.viii.2007. 1f, leg. & det. T. Strudwick. *C. arenaria* & *quinquefasciata* present.
Sandon Pits, South Pit, near Chelmsford, TL7404, 23.vii.2008, 4f, leg. & det. P. R. Harvey. *C. quinquefasciata* was also recorded there with *H. niemelai* but the *nobile* specimens came from an active aggregation of *C. arenaria* on one side of the pits.
Canvey Wick, TQ7683, 8.viii.2012, 2 large females, and 22.viii.2012, 6 large females around *Cerceris arenaria* nesting area by path, P. R. Harvey.
Rainham Marshes, TQ54287975, 21.viii.2012, 1m, leg. R. Earwaker, det. Baldock.
Chafford Hundred, Mill Wood Pit, New SM Cliff (NS), TQ594787, 15.vii.2014, 2m, leg. & det. P. R. Harvey. Associated with *C. arenaria*.
Chafford Hundred, Mill Wood Pit, Mill Wood (GW) southern edge, TQ596787, 15.vii.2014, 1m, leg. & det. P. R. Harvey. Associated with *C. arenaria*.

VC19. North Essex
Near Halstead, Marks Hall Estate, TL843261, 28.vii.2012. 1f, leg. & det. P. R. Harvey. Others seen around *Cerceris arenaria* nest holes in footpath.

VC21. Middlesex
Bushy Park, TQ165702, 14.viii.2003, 1f, leg. & det. D. W. Baldock.
Bushy Park, TQ165699, 15.vi.2004, 1f, leg. & det. D. W. Baldock.
Sunbury Park, TQ105687, 24.vii.2008, 1f, leg. & det. R. D. Hawkins.

VC23. Oxford
Frilford Heath at Hitchcopse Pit Reserve, SU452995, 2011, 3 large females, leg. & det. M. N. Smith. *C. quinquefasciata* and *arenaria* occur here.

VC25. East Suffolk
Great Blakenham, Ipswich, TM1050, vii.2011, 1f, leg. A. Knowles.
Blaxhall Common, south of Snape, TM3856, viii.2014, 1f, det. A. Knowles.
Ipswich, Purdis Heath, TM2142, 29.vii & 3.viii.2015, leg. D. Basham, det. A. Knowles.

VC26. West Suffolk
Red Lodge, TL698703, 18.vii.2002, 1m, leg. M. Edwards, det. Baldock.
Red Lodge, TL695699, 25.vii.2013, 1m, leg. A. Knowles, det. Baldock.
Lackford Lakes, TL8070, 2.viii.2015, 1m, det. A. Knowles.

VC27. East Norfolk
Norwich, TG280089, 4.viii.2014, 1f, leg. & det. T. Strudwick. *C. arenaria* and *quinquefasciata* present.

VC28. West Norfolk
Stoke Ferry, TL695989, 16.vii.2015, 15m, 3f, leg. N. Owens det. Baldock.
C. arenaria and *quinquefasciata* present.
Thetford Warren Lodge, TL840841, 2.viii.2015, 1f, leg. & det. T. Strudwick. *C. arenaria* and *quinquefasciata* present.
Cranwich Heath, Breckland, TL7794, 6.vii.2016, 1m, leg. N. Owens, det. T. Wood & Baldock.

VC30. Bedford
The Lodge, Sandy. TL193477, 30.viii.2012. 1f, leg. R. Earwaker, det. Baldock.
Sandy Heath Quarry, TL197490, 12.vii.2014, 1f, 1m, leg. R. Cartwright, det. Baldock.
Redborne Upper School, nr Ampthill, TL03176771, 16.vii.2014, 1f with *C. arenaria*, leg. P. Sutton, det. Baldock.