

First host record for the rogadine genus *Pholichora* van Achterberg (Hymenoptera: Braconidae) with description of a new species and notes on convergent wing venation features

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Abstract

The wasp genus *Pholichora* is recorded as parasitic on geometrid moth larvae on the basis of a new species, *P. subscleroma* Quicke and Shaw from South Africa (Natal), reared from *Ascotis reciprocaria* (Walker) (Lepidoptera: Geometridae, Ennominae). The discovery of this new species necessitates a reassessment of the characters separating *Pholichora* from *Hemigyron*. An association between wing venation features (ovoid cells and scleromes) and nocturnality is discussed.

Keywords: *Hemigyron*, host relationships, new species, ophionoid facies, *Rectivena*, Rogadinae, Rogas, systematics, venation

Introduction

The Rogadinae *sensu stricto* is a moderate-sized subfamily of braconid wasps dominated by the cosmopolitan genus *Aleiodes*, but it also includes about 35 other genera, some of which have been described only recently (e.g. van Achterberg 1991; Chen and He 1997). However, host records are only available for about half of these, despite the fact that since rogadines mummify the larvae of their lepidopteran hosts they often provide unusually accurate host data (Shaw and Huddleston 1991; Shaw 1994, 2003). Relationships between the genera of Rogadinae have hardly been discussed in the literature, but recent work on venom apparatus morphology (Zaldivar-Riveron et al. 2004) and current molecular work (M. Mori et al. in preparation) indicate some major groupings, and these appear to accord well with known host associations. Here we provide the first host record for a member of the Afrotropical genus *Pholichora* van Achterberg, and discuss its implications in the light of what is known about hosts of other rogadine genera and their putative relationships. A new

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species is described and distinguished from the previously described species of *Pholichora*, and implications for the diagnosis of the genus, and in particular its separation from *Hemigyron* Baker, are discussed.

Zaldivar-Riveron et al. (2004) provided a set of new characters, based on the detailed anatomy of the venom apparatus, to help resolve genus-level relationships within the Rogadinae. Several putative synapomorphies were found, mostly concerning the structure of the valve connecting the venom gland's secondary duct with the venom reservoir (see also Quicke et al. 1992, 1997). These data suggest that within the Rogadinae s. s. there is a monophyletic group characterized by a hard, narrow and not-recessed secondary venom duct with a distinct exterior flange, which comprises *Pholichora*, *Bulborogas* van Achterberg, *Canalirogas* van Achterberg and Chen, *Colastomion* Baker, *Conspinarina* Schulz, *Cystomastacoides* van Achterberg, *Myocron* van Achterberg, *Macrostomion* Szépligeti, *Rectivena* van Achterberg, *Triraphis* Ruthe, *Rogas* Nees, *Spinaria* Brullé, *Batotheca* Enderlein, and *Batothecoides* Watanabe. This feature is absent in *Hemigyron*, suggesting that the similarities in wing venation that it shares with *Pholichora* may be convergent.

Hemigyron is a principally Indo-Australian genus with a single known Afrotropical representative, *H. certum* van Achterberg, from Madagascar. Van Achterberg (1991) indicated that *H. apicale* Brues, from Natal, South Africa was probably a species of *Pholichora*, and transferred it to that genus, based on its very thorough original description (Brues 1926), which clearly indicates the presence of two yellowish scleromes in the subbasal cell of the fore wing. He suggested on this basis that it was probably closely related to *P. bipanna* van Achterberg, though it differs from it in a number of other features. *H. apicale* differs from the new species described here in having: (1) two scleromes in the subbasal cell, (2) the fore wing vein C+SC+R yellow-brown, (3) the head 3 × wider than long, (4) the pterostigma entirely "bright fulvous", and (5) the propodeum without a carina or anterolateral angulations. It is also somewhat larger, 10 mm long compared with 7.8 mm in the new species. *Hemigyron* differs from *Pholichora* by having: (1) no sclerome or dense patch of setae in the fore wing subbasal cell, (2) vein cu-a of fore wing long, neither curved nor swollen, thus making the first subdiscal cell higher, (3) the occipital carina fully developed and abruptly curved ventrally towards the hypostomal carina. The other characters given in van Achterberg's (1991) generic key (couplet 20) no longer work in the light of the discovery of the new species described below.

Terminology

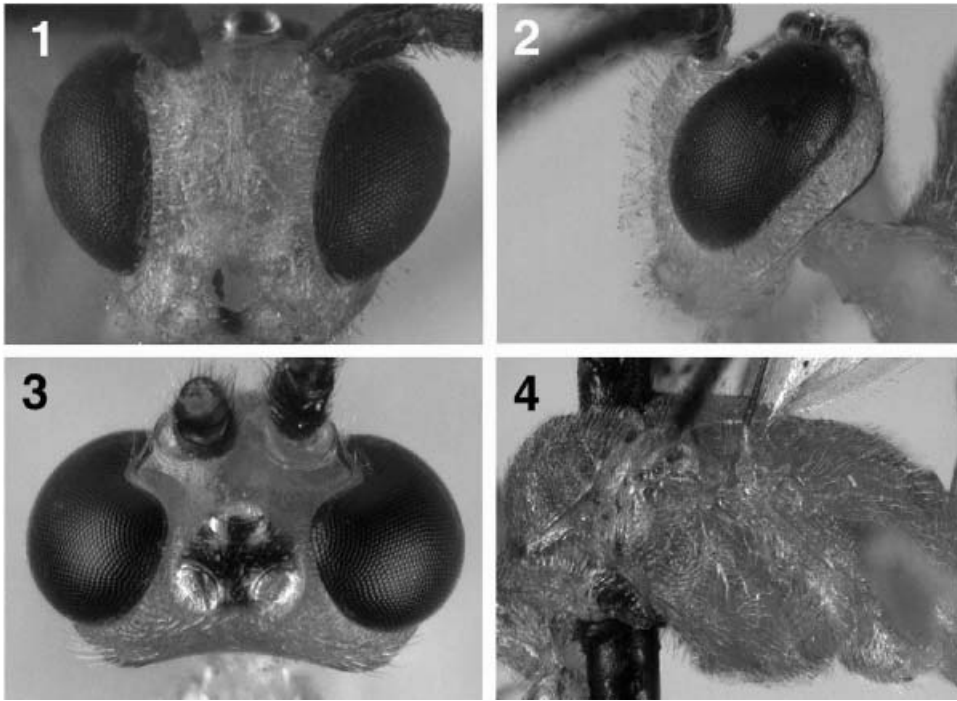
Terminology follows van Achterberg (1979c, 1993a). Descriptions of sculpture follow Harris (1979). The following abbreviation is used: BMNH, The Natural History Museum, London.

Description of new species

Pholichora subscleroma Quicke and Shaw, sp. nov.

(Figures 1–8)

Type material. Holotype: female [South Africa] "Idem No: ZEB HP.2, Ref. No. 30.4.1956, A. RT Ltd Zebediela", "Locality Zebediela Transvaal, O. P. Schoeman



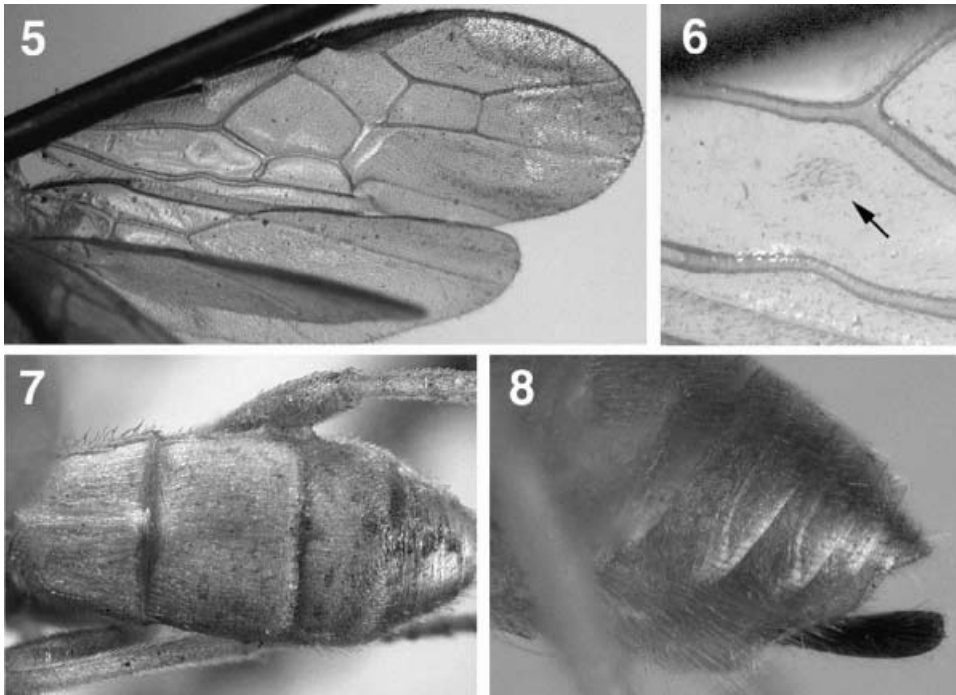
Figures 1–4. *Pholichora subscleroma* n. sp., Automontage® light micrographs. (1) Head, facial aspect to show transverse sculpture; (2) Head, lateral aspect; (3) Head, dorsal aspect; (4) Mesosoma, lateral aspect.

30.4.1956, A. RT Ltd Zebediela”, and “Ex *Ascotis selenaria reciprocaria* Schiff, C. I. E. 15771” (BMNH). Paratypes: two males, same data as holotype, one specimen lacking head, most legs and fore wings (BMNH).

Length. Length of body 7.8 mm and of fore wing 6.9 mm.

Head (Figures 1–3). Antenna with 55 flagellomeres (male; incomplete in available female specimen). Terminal flagellomere acuminate (male). Basal flagellomere (female) $1.15 \times$ longer than wide, rather oblique apically, approximately as long as second flagellomere laterally and $1.15 \times$ longer than third. Height of clypeus: inter-tentorial distance: tentorio-ocular distance = $1.0:2.7:1.0$. Head transverse, $1.5 \times$ wider than maximally long in dorsal view. Width of head $2.7 \times$ shortest distance between eyes. Eyes strongly emarginate. Height of eye $1.7 \times$ shortest distance between eyes. Posterior ocellar line: transverse diameter of posterior ocellus: shortest distance between posterior ocellus and eye = $1.3:3.3:1.0$. Occiput rugulose to finely transversely striate.

Mesosoma (Figure 4). Mesoscutum coriaceous-rugulose and densely short-setose. Notauli weakly impressed. Mesopleuron with a large, slightly concave, area of fine dorso-ventral striation. Scutellar sulcus with five carinae between the outer ones, though the medial one is rather weak. Scutellum entirely with fine longitudinal striation, and with lateral carinae (as extensions of lateral carinae of scutellar sulcus) largely complete. Propodeum with moderately developed protuberances laterally; mid-longitudinal carina of propodeum complete.



Figures 5–8. *Pholichora subscleroma* n. sp., Automontage® light micrographs. (5) Wings; (6) Part of subbasal cell showing patch of dense setae on thickened area of wing membrane (arrow); (7) Most of metasoma, dorsal aspect; (8) Apex of metasoma showing ovipositor sheath, lateral aspect.

Wings (Figures 5, 6). Fore wing: vein 1-M moderately curved posteriorly. Length of veins r:3-SR:SR1=1.0:1.76:3.64. Vein r-m $0.67 \times$ vein 2-SR. Lengths of veins m-cu:2-SR+M=2.25:1.0. Subbasal cell largely glabrous apically, with a distinct patch of dense setae on a small, slightly thickened area of wing membrane, but without a distinct sclerome. Vein 1-CU1 $0.78 \times$ length of vein 2-CU1.

Hind wing: vein 2-SR+M longitudinal, $0.42 \times$ length of vein 1-M. Vein M+CU $1.1 \times$ length of vein 1-M.

Legs. Length of hind femur (excluding trochantellus): tibia: tarsus=42:61:52. Hind femur (excluding trochantellus), tibia, and basitarsus 3.9 , 9.0 , and $6.15 \times$ longer than maximally deep, respectively. Hind tibial spurs 0.42 and $0.33 \times$ length of hind basitarsus.

Metasoma (Figures 7, 8). Densely clothed with short setae. First metasomal tergite $1.1 \times$ wider posteriorly than medially long; with longitudinal striation and complete strong mid-longitudinal carina. Second metasomal tergite $1.36 \times$ wider posteriorly than medially long; largely finely longitudinally striate, with a distinct but fine mid-longitudinal carina but without a mid-basal triangular area. Third tergite largely finely striate becoming densely punctate posteriorly. Ovipositor sheaths distinctly up-curved and expanded distally.

Coloration. Largely yellowish. Antennae black except medial part of scapus which is dark brown. Stemmaticum and ovipositor sheath black. Telotarsi darkened apico-dorsally.

Wings hyaline with apical 0.4 distinctly grey; venation yellow-brown except for fore wing vein C+SC+R, anterior half of pterostigma and parastigma which are nearly black.

Notes. The new species does not run easily in the key to *Pholichora* species by van Achterberg (1991). It can be distinguished from all other species in that key by the longitudinal hind wing vein 2-SC+R (transverse in *inopina* van Achterberg, *bipanna* van Achterberg and *madagascarensis* (Granger)).

Unfortunately, no host remains are associated with the three available specimens, so it is possible that the associated data are incorrect. However, the putative host, the giant looper, *Ascotis reciprocaria* (Walker) (Lepidoptera: Geometridae, Ennominae), is an important pest of a variety of commercial crops including citrus fruits, and therefore we feel that making this identification known may have some value for biocontrol. *A. selenaria* Denis and Schiffermüller (type locality Austria) was treated as a senior synonym of *A. reciprocaria* (type locality Congo/South Africa) in Janse (1932), but the African taxon is now treated as a separate species, under the name *A. reciprocaria*, as in the recent checklist of Geometridae (Parsons et al. 1999), though there are apparently still some taxonomic issues to resolve (L. Pitkin, personal communication). When feeding on citrus crops, the host larva eats the outer layer of the fruit and causes a great deal of both cosmetic and actual damage.

Discussion

Pholichora appears to belong to the *Rogas* group of genera (namely *Rogas*, *Rectivena*, *Colastomium*, *Macrostomium*, *Canalirogas*, *Myocron*, *Megarhogas*, *Cystomasticoides*, *Conspinarina*, *Trirhaphis*, and *Bulborogas*) which, together with the putatively related *Spinariina*, can be recognized by their hardened insertion of the secondary venom duct on to the venom reservoir (Zaldivar-Riveron et al. 2004). Within this group, a subset of genera appears to be specific parasitoids of Zygaenoidea (Limacodidae and Zygaenidae), namely *Rogas*, *Rectivena*, *Trirhaphis*, *Conspinarina*, *Spinaria*, and *Batotheca* (Quicke et al. 2004). The apparent use of Geometridae as hosts by *Pholichora* suggests that it may be more closely related to other members of the *Rogas* group which share the modified secondary venom duct with a flange, but attack non-zygaenoid hosts.

Hemigyron lacks the modified secondary venom duct (Zaldivar-Riveron et al. 2004) and the possibility exists therefore that the similarity in wing venation (a distally expanded and at least partly glabrous fore wing subbasal cell) to that of *Pholichora* is homoplastic. Further, *Hemigyron* is reported in the literature as parasitizing Lasiocampidae (Chen and He 1997), and so host associations do not provide any support for a relationship. The existence of another rogadinine genus with very similar modified venation, *Gyroneuron* Kokujev, may also be an indication that the expansion of the subbasal cell is homoplastic within the subfamily. *Gyroneuron* differs from both *Hemigyron* and *Pholichora* in many external features (van Achterberg 1991). Unfortunately the venom apparatus of *Gyroneuron* has not been investigated and its host relationships are unknown. If indeed these represent three independent origins of very similar modifications of wing venation, this raises the question as to what purpose they serve and why they occur so frequently among the Rogadinae. Interestingly, similar modifications, involving either apical expansion of the subbasal cell bordered by curved and rather thickened veins, or an expanded, ovoid second subdiscal cell, both of which often also contain scleromes, are found in a number of other groups of Braconidae, including the *Aphrastobracon* Ashmead group of Braconinae (Quicke 1987; Quicke et al. 2000) and several species of Macrocentrinae (van Achterberg 1993b).

In the nocturnal Xiphozelinae, there is a sclerome in the fore wing subbasal cell (van Achterberg 1979b). In the nocturnal Amicrocentrinae the fore wing is normal but the hind wing basal cell is distally strongly ovoid (van Achterberg 1979a). Scleromes in other parts of the wing membrane are also predominantly found in nocturnal and crepuscular taxa, perhaps the best known being in the ophionine ichneumonid genera *Enicospilus* Stephens and *Dicamptus* Szépligeti (though they are known in at least a few species in many other ophionine genera—I. D. Gauld, personal communication). As indicated above, all of these are predominantly nocturnal or crepuscular taxa (Quicke 1992), and the question can thus be posed “what is it about being nocturnal or crepuscular that also leads to the tendency to have ovoid wing cells formed of thickened veins and also, perhaps, scleromes?” Gauld and Huddleston (1976) emphasized the existence of an “ophionoid facies”, a suite of characters that are typically found in nocturnal parasitic wasps (see also Quicke 1997), but did not mention wing features. One of the more obvious aspects of the ophionoid facies is the largely yellow-brown colour, and such pale cuticle is typically softer than dark, more heavily sclerotized cuticle. Thus, one very tentative explanation of the occurrence of oval cells, usually with markedly thickened veins, and scleromes, predominantly in nocturnal taxa, is that they may compensate for otherwise less rigid venation.

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