# Revision of the Palaearctic Embolemidae (Hymenoptera)

**C. van Achterberg & R.J.M. van Kats**

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The Palaearctic species of the family Embolemidae (Hymenoptera: Chrysidoidea) are revised. In all nine species are recognized in the genus *Embolemus* Westwood, 1833 s.l., two are new to science: *Embolemus reticulatus* spec. nov. from The Netherlands and *E. niger* spec. nov. from Bhutan. The genus *Ampulicomorpha* Ashmead, 1893, is synonymized with *Embolemus* Westwood, 1833 (syn. nov.) and a key to the Palaearctic species of Embolemidae is given. *Ampulicomorpha pecki* Olmi, 1998, is renamed as *Embolemus olmii* nom. nov.

## Introduction

Recently, the small and little known cosmopolitan family Embolemidae Foerster, 1856 (Hymenoptera: Chrysidoidea) has been revised by Olmi (1996, 1998); Olmi (1999) gives a review of the Palaearctic species and summarizes the scanty biological knowledge about the group. According to the checklist included below the family contains 33 valid species, mainly from the tropical and subtropical regions, but probably several remain to be discovered. Carpenter (1999) reviews the phylogenetic position of the group and the two genera known. The far better known family Dryinidae Haliday, 1833, is considered to be the sister-group of the Embolemidae. The oldest fossils known of Embolemidae (from the Cretaceous and described as *Baissobius* species) are about 140 million years old (A. Rasnitsyn, cited in Olmi, 1999).

During a survey of lowland peat marshes in The Netherlands near Amsterdam two species of Embolemidae were collected in *Sphagnum*/*Phragmites*-vegetation. One was *Embolemus ruddii* Westwood (new to the Dutch fauna) with wingless females and winged males. The other (with winged females) could not be identified with certainty. In the northern Palaearctic region two species of Embolemidae are recognized by Olmi (1996, 1998): *Embolemus ruddii* Westwood, 1844 (with *E. walkeri* Richards, 1951, from China, as synonym) and *Ampulicomorpha hachijoensis* (Hirashima & Yamagishi, 1975), with *A. thauma* Rasnitsyn & Matveev, 1989, as synonym. A problem is that *A. hachijoensis* was described from a male from an isolated Japanese island and that *A. thauma* is only known from a small series of females from European Russia, so the association can be only provisional. Examination of the holotype of *E. walkeri* showed it to be not only in colour but also structurally different from *E. ruddii*, so we prefer to keep the species separated until intermediates are known.

Only one species (*Embolemus confusus* (Ashmead, 1893) comb. nov.) from North America has been reared; it is a parasitoid of nymphs of Achilidae (Fulgoroidea; Bridwell, 1958), living on its host in a bulging sac attached between the second and third abdominal segments (Wharton, 1989; Olmi, 1996). The host lives beneath loose bark

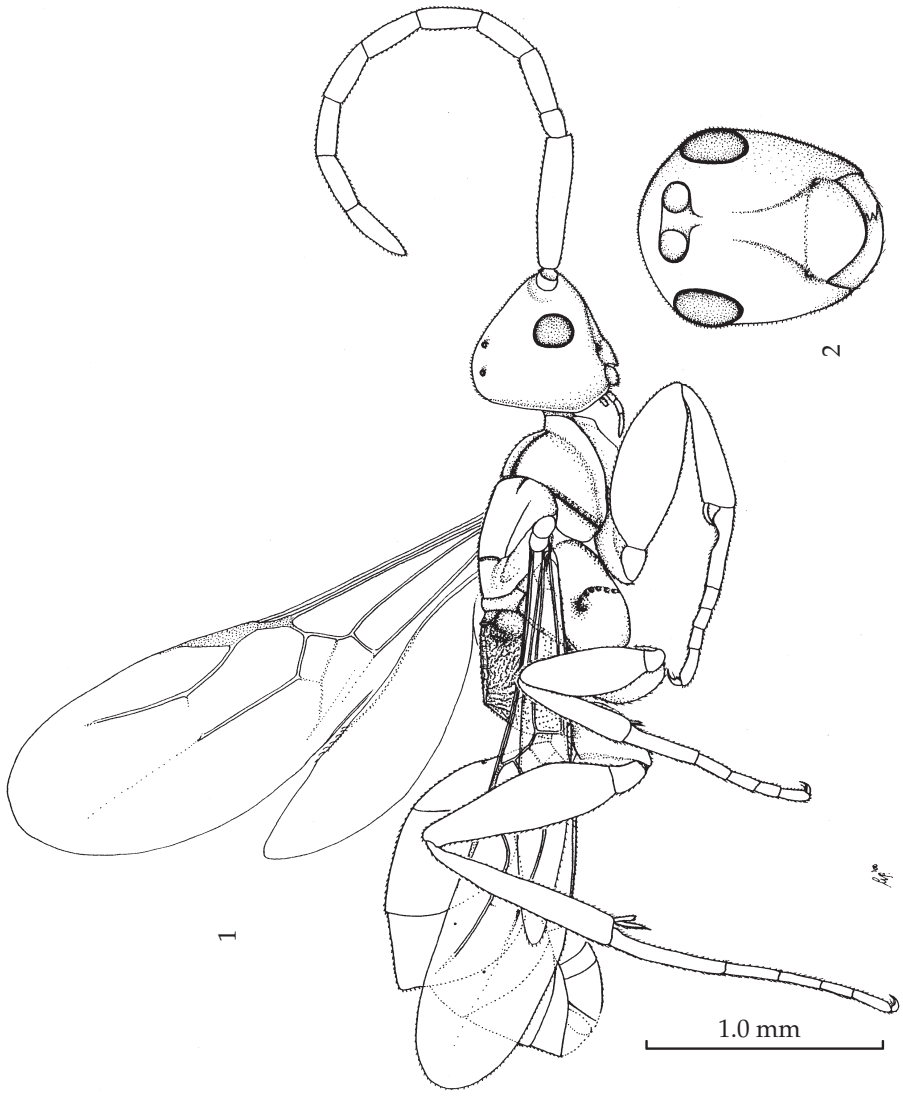
of rotting logs, where it feeds on fungal hyphae. It is likely that in the Palaearctic region both *Cixidia* species (Achilidae; Olmi, 1996) and soil inhabiting nymphs of Cixiidae (Rasnitsyn & Matveev, 1989) are involved as hosts. However, wingless females are found in mole and ant nests, or under stones in pastures and grasslands situated very far from trees and exhibit ant-like mimicry. There is an increasing number of observations in relation to ants. Donisthorpe (1927) found *Embolemus ruddii* together with *Formica fusca* Linnaeus and Consani (1948) with *Lasius flavus* (Fabricius). A Japanese specimen of *Embolemus walkeri* was taken in a nest of *Myrmica* spec. according to Hirashima & Yamagishi (1975). The Embolemidae collected during the survey of the lowland peat-marshes in 1992 were always found together with *Myrmica rubra* (Linnaeus) and *M. scabrinodis* Nylander. Also in the sister-group, Dryinidae, myrmecophilous species are known (Olmi, 1999).

The family Embolemidae can be recognized at once by the cone-like protruding upper part of the face (figs 1, 13, 19; but less so in males: fig. 17) combined with the antennal sockets situated near each other in a separate area (figs 2, 9). Winged specimens have the hind wing without closed cells and the fore wing with open marginal and first subdiscal cells (figs 1, 7). For the terminology used in this paper, see van Achterberg (1988). The new taxa decribed in this paper and changes in the generic division of the family should be credited to the first author.

## Is *Ampulicomorpha* a valid genus?

Olmi (1995) gave a key to the two recognized genera in the family Embolemidae: *Embolemus* Westwood, 1833, and *Ampulicomorpha* Ashmead, 1893. According to this key, males can only be separated on the basis of an open (*Embolemus*) or closed (*Ampulicomorpha*) first subdiscal cell of fore wing, not fully enclosed by pigmented veins. What is meant is the presence or absence of a spurious longitudinal vein ("s" in fig. 4); the vein is distinct and pigmented ("nebulous"; but still the cell is not completely closed!) or obsolescent, not pigmented ("spectral"). However, as might be expected because it is only based on the pigmentation of an extra vein, this character is not suitable for separation a genus as intermediates are common. This is obvious also from Olmi's descriptions, e.g. males of *Embolemus pecki* Olmi, 1998, should not have a "closed" cell because the species is included in *Embolemus*, but according to the original description they have it. Males of the type species of *Embolemus*, *E. ruddii* Westwood, may have the first subdiscal cell almost closed, presenting intermediate stages even in a single species.

According to Olmi (1996) females of *Embolemus* should be micropterous or brachypterous with small eyes, and females of *Ampulicomorpha* should be macropterous with large eyes. However, as demonstrated by e.g. *Ampulicomorpha australis* Olmi, 1996 (with an intermediate size of eye; fig. 12 in Olmi, 1996), *A. thauma* Rasnitsyn & Matveev, and *Embolemus reticulatus* spec. nov., the size of the eyes is not much different in wingless and winged females (figs 3, 18). This leaves only one character: having reduced wings or not, and only in one sex, which is unlikely to be a good character for the separation of a genus, because it is likely to occur in several species groups with similar biology and, in general, characters applicable to only one of the two sexes should in any case be avoided for the separation of genera. Comparison of the




Figs 1-2, *Embolemus reticulatus* spec. nov., ♀, holotype. 1, habitus, lateral aspect; 2, head, frontal aspect. 1: scale-line (= 1.0 ×); 2: 1.5 ×.

type species of both *Embolemus* and *Ampulicomorpha* shows one difference in the direction of the facial sutures in both sexes. In addition, in the male of *Ampulicomorpha* the median groove of the pronotum is deep anteriorly and the position of the pronotum is comparatively high. The latter two are characters which gradually change among other species and is not considered further here. The facial sutures are subparallel and complete (or nearly so) in the New World species *Ampulicomorpha confusa* Ashmead (fig. 33), *A. schajovskoyi* de Santis & Vidal Sarmiento, *A. suavis* Olmi, 1998, and *A. wilkersoni* Olmi, 1998, and the subgenus *Ampulicomorpha* may be used for this species group. The other species of *Ampulicomorpha* and *Embolemus* the grooves distinctly converging dorsad (figs 2, 9, 31) or largely absent.

Carpenter (1999) also argued *Embolemus* and *Ampulicomorpha* are valid genera. The apomorphic character-states given are the brachyptery or microptery of the females and the open first subdiscal cell of the fore wing of males for *Embolemus*, and for *Ampulicomorpha*, the elongate pronotum with a pronounced longitudinal median groove should be typical, combined with the transverse hind margin of the pronotum. The hind margin should be strongly concave in *Embolemus* (Carpenter, 1999). The latter statement is obviously wrong, because the concavity of the posterior margin of the pronotum is in *E. ruddii* (fig. 18) similar to that (fig. 15) of an *Ampulicomorpha* female sensu Olmi (1996, 1998). The median groove of the pronotum is shallowly developed in typical *Embolemus*, e.g. in *E. walkeri* Richards, which Olmi (1995, 1998) considered to be a synonym of the type species, *E. ruddii*. According to Olmi (1998) the groove is reduced in two Indo-Australian species belonging to *Ampulicomorpha*. In males of both "genera" the pronotum is very similar, at most the pronotum is slightly larger in *Ampulicomorpha* (fig. 16 versus fig. 25).

The extra spurious vein of the first subdiscal cell is an apomorphous state itself for the Embolemidae, it can be more or less reduced and as argued above, it is too variable (even within a species, and large specimens have more pigmented veins than small specimens) to be used as character-state for the separation of genera. The presence or absence of brachypterous or micropterous females is not considered to be a valid reason to separate a genus. Brachyptery occurs in many other genera (with accompanying change of the mesosomal structure) where it is not considered to be of any value to split up the genus (e.g. in the families Braconidae and Ichneumonidae). As this character-state, which is derived, seems likely to have arisen in several groups within the Embolemidae, recognition of higher taxa on this basis would risk leaving the remainder of the group paraphyletic. Certainty about this can only be gained after a thorough analysis of both sexes of the species involved, preferably including DNA-analysis. In conclusion, both genera are synonymised because of the lack of supporting derived character-states; at most *Ampulicomorpha* might be retained as a subgenus for a New World species-group of *Embolemus* possessing subparallel facial sutures.

## Key to Palaearctic species of *Embolemus* Westwood

1. Pronotum at same level as mesoscutum dorsally (figs 1, 6, 12); only females (unknown for the SW Palaearctic *E. huberi* Olmi, 1998 and *E. harteni* Olmi, 1998, and SE Palaearctic *E. pecki* Olmi, 1998) ..... 2
- Pronotum at much lower level than mesoscutum dorsally (figs 16, 25); only males

(unknown for the SE Palaearctic *E. niger* spec. nov., and W Palaearctic *E. reticulatus* spec. nov.) ..... 7

2. Ocelli absent (fig. 18) or present only as indistinct point-like elevations; mesoscutum distinctly shorter than pronotum in dorsal view (fig. 18); micropterous, wings about as long as tegula (fig. 18) ..... 3
- Ocelli normal (figs 15, 22); mesocutum somewhat longer than pronotum in dorsal view (figs 1, 3, 15, 22); macropterous, wings reaching apex of metasoma (fig. 1) .. 4

Note.— If the eyes in lateral view are about as long as temple (cf. fig. 34; fig. 3 in Rasnitsyn & Matveev, 1989) (temple 1.5-2.0 times length of eye in extant Palaearctic species), cf. the fossil *E. succinalis* (Brues, 1933) comb. nov. from Baltic Amber.

3. Hind femur distinctly convex dorso-basally (fig. 27); pronotum with fine carina laterally, in front of tegulum; head more robust in lateral view (fig. 26); eye larger and closer to antennal socket; head and metasoma dark brown; head finely granulate dorsally; pronotum with weak median groove; pedicellus in dorsal view 1.5-1.6 times longer than wide; E Palaearctic ..... ***E. walkeri*** Richards, 1951
- Hind femur weakly convex dorso-basally (fig. 19); pronotum without carina laterally, in front of tegulum; head less robust in lateral view (fig. 21); eye smaller and furthere removed from antennal socket; head and metasoma yellowish, rarely darkened; head largely smooth dorsally; pronotum without median groove (fig. 18), or obsolescent; pedicellus in dorsal view 1.8-2.0 times longer than wide; Palaearctic ..... ***E. ruddii*** Westwood, 1833
4. Head elongate (figs 9, 31); length of malar space 1.3-1.6 times maximum diameter of eye in lateral view (fig. 13); distance between posterior rim of head and posterior ocellus 2.5-3.5 times POL (fig. 15); scapus 1.9-2.1 times as long as third antennal segment (figs 13, 34); SE Palaearctic (Himalayas) ..... 5
- Head normal (fig. 2); length of malar space 1.1-1.2 times maximum diameter of eye in lateral view (fig. 6); scutellar sulcus smooth or nearly so (fig. 3); distance between posterior rim of head and posterior ocellus about equal to POL; scapus 2.1-2.2 times as long as third antennal segment (fig. 3); N & C Palaearctic ..... 6
5. Medio-basal areola of propodeum reversed trapezoid (fig. 32); pair of carinae of propodeum distinct and distinctly converging anteriad (fig. 32); scutellar sulcus smooth or nearly so; body brownish-yellow, but head and mesosoma (except pronotum) dark brown ..... ***E. nepalensis*** (Olmi, 1998)
- Medio-basal areola of propodeum distinctly transverse (fig. 15); pair of carinae of propodeum weak and weakly converging anteriad (fig. 15); scutellar sulcus distinctly crenulate (fig. 15); body completely black(ish) ..... ***E. niger*** spec. nov.
6. Medio-basal area of propodeum small, narrow, transverse (fig. 3), propodeum without distinct elliptical area medially; curved groove of mesopleuron distinctly crenulate (fig. 6); vein 1-M of fore wing straight (fig. 4); body largely yellowish- or reddish-brown; W Palaearctic ..... ***E. reticulatus*** spec. nov.

Note.— If the propodeum is largely smooth or superficially sculptured, it may concern the unknown females of SW Palaearctic *E. harteni* Olmi, 1998, and *E. huberi* Olmi, 1998.

- Medio-basal area of propodeum larger (fig. 29), propodeum with distinct elliptical area medially; curved groove of mesopleuron smooth or nearly so; vein 1-M of fore wing weakly curved (fig. 30); body largely blackish or dark brown; C & E Palaearctic (including Japan and montane Taiwan) ..... ..... ***E. hachijoensis*** Hirashima & Yamagishi, 1975

Note.— No females are known from the type locality (Japan, Hachijo Island). The association of the sexes is tentative and based on the female of the supposed junior synonym, *E. thaumus* (Rasnitsyn & Matveev, 1989) comb. nov. from European Russia (Rostov province).

7. Propodeum largely smooth and shiny, at most with a small rugose area anteriorly; SW Palaearctic ..... 8
- Propodeum largely reticulate or rugose (fig. 25) and dull ..... 9

Note.— If spurious longitudinal vein of first subdiscal cell of fore wing present and first discal cell parallel-sided (cf. fig. 4) and hind femur somewhat widened subbasally, it may concern the unknown male of the W Palaearctic *E. reticulatus* spec. nov.

8. Dorsal membranous process of paramere with papillae distally (fig. 35); first discal cell of fore wing largely absent; (Yemen) ..... ***E. harteni*** Olmi, 1998
- Dorsal membranous process of paramere without papillae distally (fig. 36); first discal cell of fore wing indicated; (Iran) ..... ***E. huberi*** Olmi, 1998
9. Dorsal membranous process of paramere with papillae and comparatively robust (figs 37, 41); pronotum somewhat more developed, dorsal rim above lower level of tegula (cf. fig. 17); third antennal segment 1.1-3.2 times as long as scapus; SE & C Palaearctic ..... 10

Note.— If metasoma black (brown or yellowish in other E. Palaearctic species) and head somewhat longer, it may concern the unknown male of *E. niger* spec. nov.

- Dorsal membranous process of paramere without papillae and comparatively slender (fig. 42); pronotum somewhat less developed, dorsal rim below lower level of tegula (fig. 25); third antennal segment (1.6-)1.8-2.6 times as long as scapus (fig. 22); N Palaearctic ..... 12
10. Dorsal membranous process of paramere with a few papillae submedially (fig. 41); third antennal segment 1.1-1.2 times as long as scapus ..... ..... ***E. hachijoensis*** Hirashima & Yamagishi, 1975
- Dorsal membranous process of paramere with numerous papillae (sub)apically (figs 38-40); third antennal segment 1.5-3.2 times as long as scapus ..... 11
11. Third antennal segment about 1.5 times as long as scapus; propodeum with a pair of distinct longitudinal carinae and a distinct transverse carina submedially ..... ..... ***E. nepalensis*** (Olmi, 1998)
- Third antennal segment about 3.2 times as long as scapus; propodeum without distinct longitudinal carinae and transverse carina submedially ..... ..... ***E. pecki*** Olmi, 1998
12. Third antennal segment 2.5-2.6 times as long as scapus; distance between posterior rim of head and posterior ocellus 5-6 times POL; hind tarsus about 0.9 times as long as hind tibia; first discal cell of fore wing parallel-sided (cf. fig. 4) ..... ..... ***E. walkeri*** Richards, 1951
- Third antennal segment 1.6-2.0(-2.2) times as long as scapus (fig. 22); distance between posterior rim of head and posterior ocellus 1.5-3 times POL (fig. 22); hind tarsus 0.7-0.8 times as long as hind tibia; first discal cell of fore wing slightly narrowed distad (fig. 23) ..... ***E. ruddii*** Westwood, 1833

*Embolemus reticulatus* van Achterberg, spec. nov.
(figs 1-6)

Material.— Holotype, ♀ (RMNH), "**Netherlands**: Z-H., Nieuwkoopse Plassen, peat-heathland,

2.vi.1992, pitfall 18, R.J.M. van Kats, RMNH'95". Paratype (2 ♀♀; Alterra): same locality, veenheide Z, 30.vi.1992 (missing right fore wing, fifth and sixth tergites) and veenheide N, 2.vi.1992.

Holotype, ♀, length of body 3.4 mm, of fore wing 2.4 mm.

Head.— Moderately elongate in frontal view (fig. 2), very finely and densely granulate and velvet-like short setose; antenna 0.9 times as long as body and 1.3 times fore wing (fig. 1); scapus 2.2 times as long as third segment; pedicellus 1.4 times as long as wide (figs 1, 3); area between antennal sockets subtriangular, anteriorly rather acute and medially distinctly depressed (fig. 3); temple in dorsal view 1.9 times as long as eye (fig. 3); maxillary and labial palpi with 4 and 2 segments, respectively; diameter of posterior ocellus:POL:distance between posterior ocellus and posterior rim of head = 2:4:4; face moderately elongate (fig. 2), with distinct submedial grooves, converging and remaining distinctly removed from antennal sockets (fig. 2); clypeus rather shiny and rather smooth; mandible robust, with 3 teeth, and the lower tooth longest; malar space 1.2 times maxium diameter of eye (fig. 6) and 3.2 times basal width of mandible.

Mesosoma.— Length of mesosoma 2.2 times its height; posterior part of pronotum nearly at the same level as mesoscutum (fig. 6); pronotum somewhat shorter than mesoscutum (fig. 3), with a deep median groove dorsally, and laterally with a deep oblique crenulate groove subposteriorly (fig. 6); groove between pronotum and mesoscutum deep, medium-sized (fig. 6); pronotum and mesoscutum very finely granulate, and velvet-like short setose; scutellar sulcus groove-like, smooth; propodeum with distinct elliptical medio-basal areola (fig. 3), no distinct longitudinal carinae but with irregular longitudinal rugae mixed with more superficial reticulate-rugosity (fig. 3); mesopleuron largely smooth, shiny, with a deep submedial pit connected to a curved punctate groove (fig. 6); metasternum with a pair of teeth; postpectal carina distinct medially, but absent in front of middle coxae.

Wings.— Fore wing: m-cu, 2-CU1 and 3-CU1 indistinct, hardly or not pigmented; 3-CU1 strongly oblique; spurious vein present, but indistinctly pigmented (bleached; fig. 4); 1-M and cu-a straight; 2-M+CU1 0.6 times as long as m-cu (figs 1, 4); first discal cell parallel-sided (fig. 4).

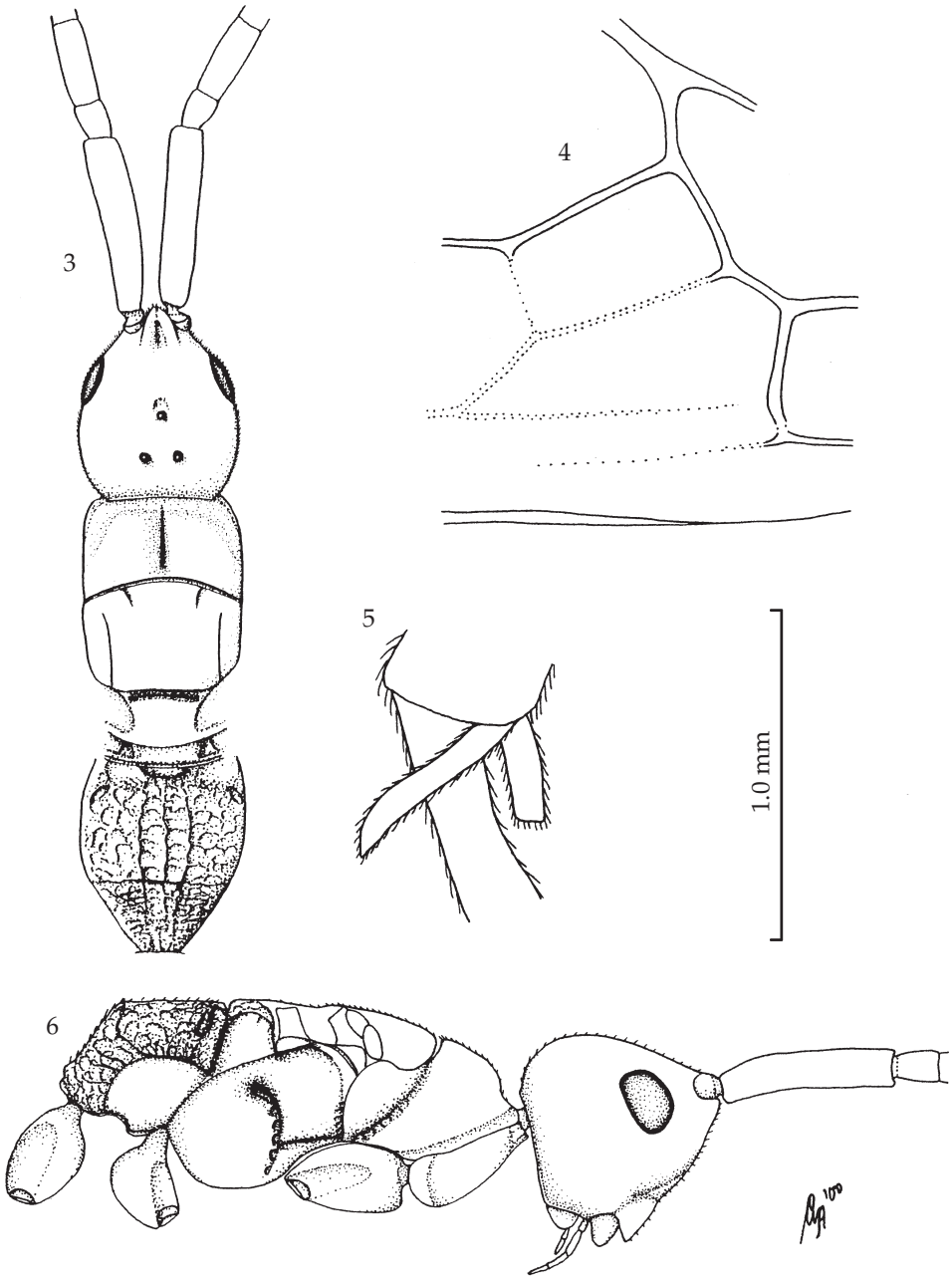
Legs.— Fore femur strongly swollen and compressed (fig. 1); hind femur distinctly swollen subbasally and compressed (fig. 1); length of femur, tibia and basitarsus of hind leg 3.1, 6.6, and 7.0 times their width, respectively; hind tarsus 1.4 times as long as hind tibia; hind tibial spurs widened (fig. 5), inner spur straight, 0.35 times as long as hind basitarsus and outer spur robust and 0.2 times hind basitarsus.

Metasoma.— Length of first tergite equal to its apical width, with some rugulosity basally; second and third tergites densely setose.

Colour.— Yellowish-brown; palpi and tegulae ivory; scapus, pedicellus, clypeus, mandible, legs, tergites posteriorly and pronotum ventrally pale yellowish; first tergite basally and propodeum infuscate; pterostigma and veins yellowish; wing membrane subhyaline.

Variation.— Length of fore wing 2.4-2.5 mm, of body 3.3-3.6 mm, of antenna 2.9-3.1 mm; scapus of all specimens 2.2 times length of third antennal segment; vein r-m of fore wing completely absent in paratypes.

Note.— Females of the only other European species of Embolemidae, *Embolemus*




Figs 3-6, *Embolemus reticulatus* spec. nov., ♀, holotype. 3, head and mesosoma, dorsal aspect; 4, detail of first discal and first subdiscal cells of fore wing; 5, hind tibial spurs; 6, head and mesosoma, lateral aspect. 3, 6: scale-line (= 1.0 ×); 4: 2.6 ×; 5: 3.0 ×.

*ruddii* Westwood, differ by having no distinct wings, no distinct median groove of the posterior part of the pronotum (fig. 18), the hind femur subparallel-sided subbasally (fig. 19), the hind tibial spurs less widened, the area between the antennal sockets truncate anteriorly (fig. 18) and no ocelli (fig. 18). Males of *E. ruddii* have the pronotum much smaller, and stituated much lower than the mesoscutum (fig. 24), the hind tibial spurs slender (fig. 23) and the first discal cell of the fore wing somewhat narrowed apically (fig. 22), vein 2-M+CU1 short, vein cu-a more or less inclivous (fig. 22), and the scapus shorter than the third antennal segment (fig. 21).

*Embolemus niger* van Achterberg, spec. nov.
(figs 7-15)

Material.— Holotype, ♀ (RMNH), "**Bhutan**, Thimphu, Lungtenphu, alt. 2300 m","13.xi.1998, H.R. Feyen".

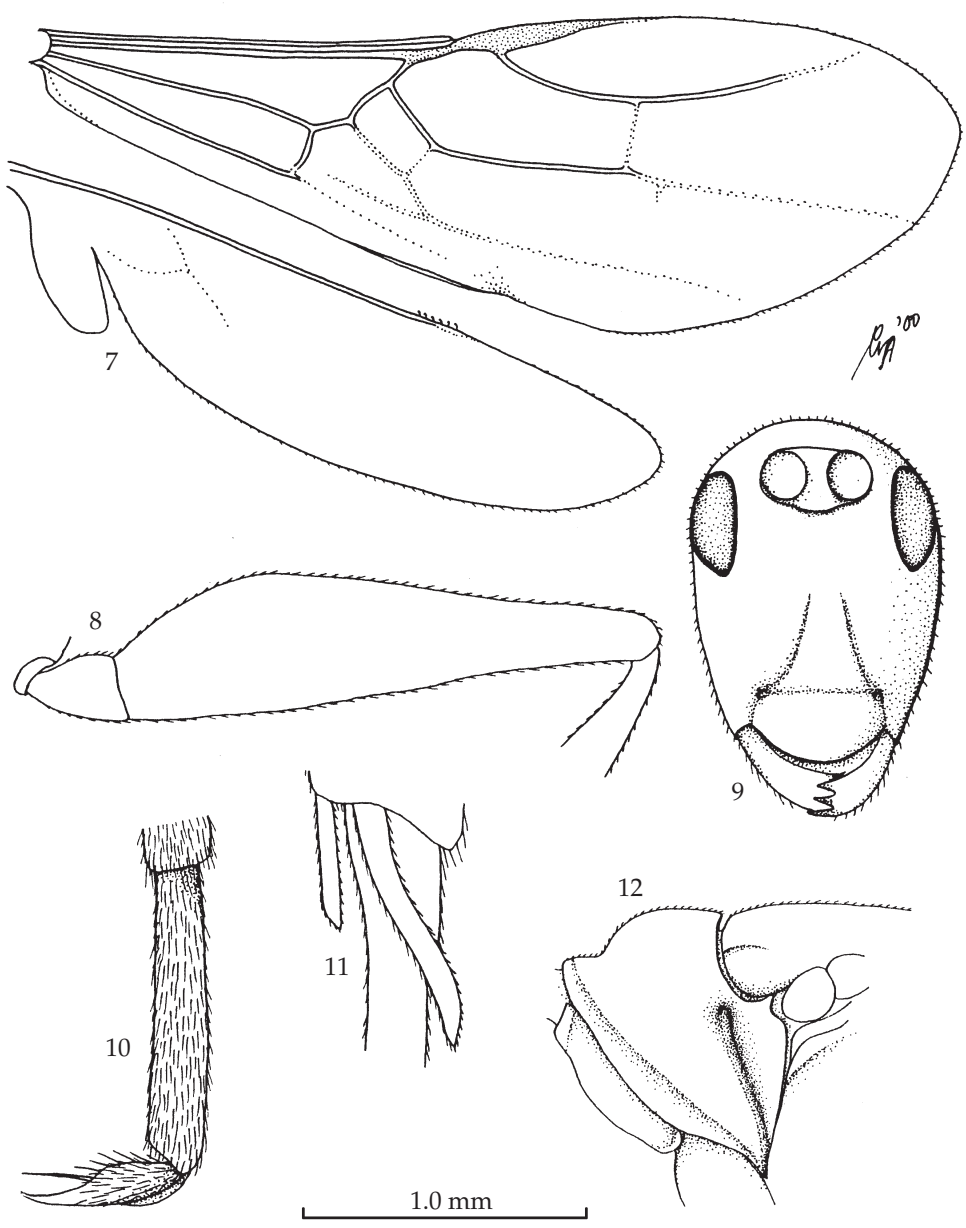
Holotype, ♀, length of body 5.5 mm, of fore wing 3.2 mm.

Head.— Head very elongate in frontal view (fig. 9), very finely and densely granulate, rather shiny and velvet-like short setose; antenna 0.9 times as long as body and 1.5 times fore wing (fig. 13); scapus 2.1 times as long as third segment; pedicellus 1.6 times as long as wide (fig. 13); area between antennal sockets subtriangular, anteriorly rather obtuse and medially distinctly depressed (fig. 15); temple in dorsal view 1.8 times as long as eye (fig. 15); maxillary and labial palpi with 4 and 2 segments, respectively; diameter of posterior ocellus:POL:distance between posterior ocellus and posterior rim of head = 2:4:10; face distinctly elongate (fig. 9), with distinct submedial grooves ventrally, weak dorsally, converging and remaining distinctly removed from antennal sockets (fig. 9); clypeus as shiny and sculptured as face; mandible robust, with 3 teeth, the lower tooth somewhat longer than other teeth; malar space 1.25 times maxium diameter of eye (fig. 13) and 2.9 times basal width of mandible.

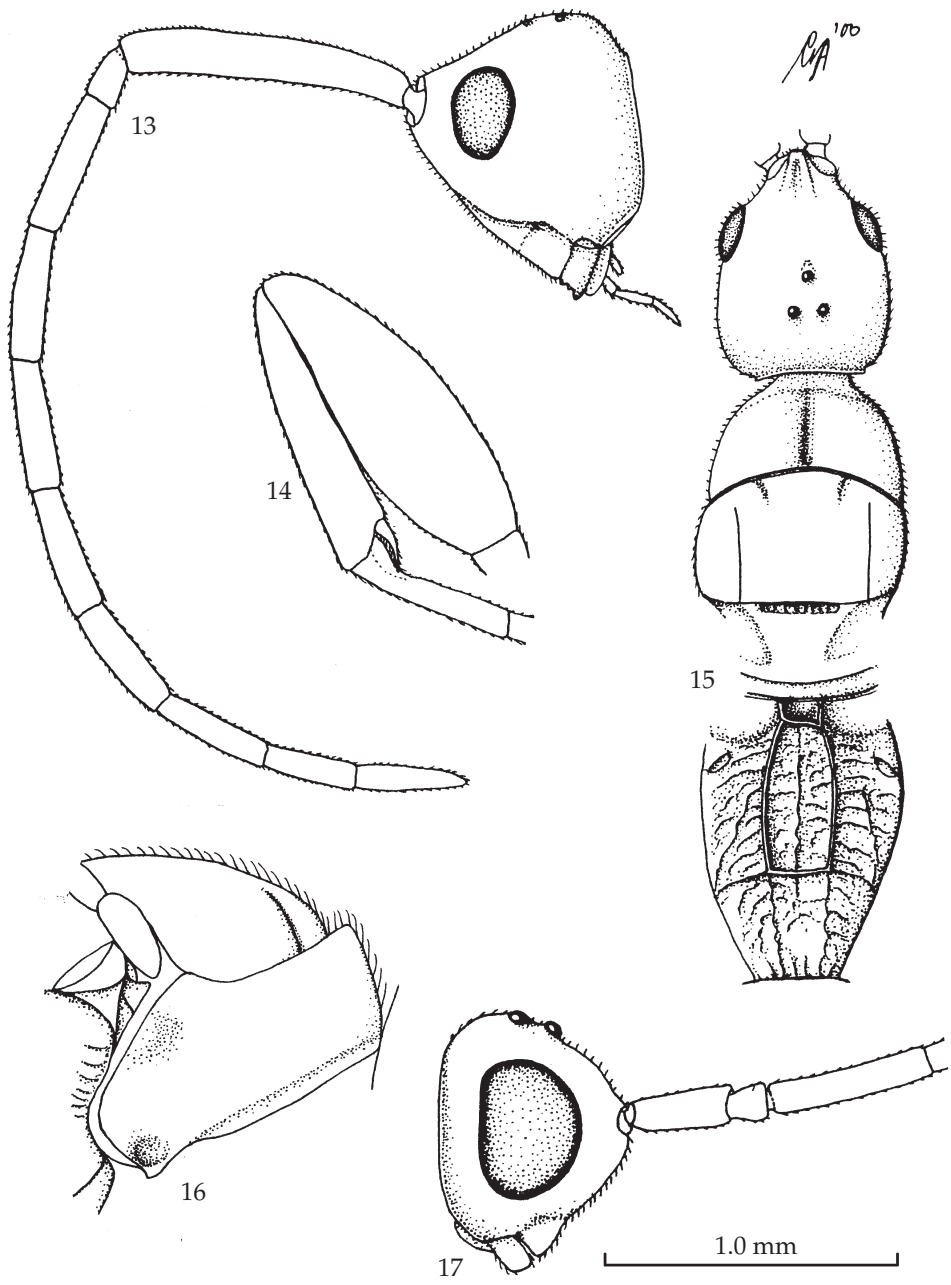
Mesosoma.— Length of mesosoma 2.0 times its height; posterior part of pronotum at the same level as mesoscutum (fig. 12); pronotum shorter than mesoscutum (fig. 15), with a deep median groove dorsally, and laterally with a deep oblique smooth groove subposteriorly (fig. 12); groove between pronotum and mesoscutum deep and medium-sized (fig. 12); pronotum and mesoscutum very finely granulate, and velvet-like short setose; scutellum with weaker sculpture than mesoscutum; scutellar sulcus distinct, crenulate (fig. 15); propodeum densely and distinctly rugose, with pair of coarse subparallel carinae, distinctly converging only anteriorly and medio-basal area distinctly depressed, squarish and bordered by strong carinae (fig. 15); meso- and metapleuron as in *E. reticulatus*, but the subvertical curved groove only narrowly punctate; metasternum with a pair of teeth.

Wings.— Fore wing: m-cu, 2-CU1 and 3-CU1 and spurious vein distinctly pigmented (fig. 7); 3-CU1 strongly oblique; 1-M slightly curved (fig. 7); 2-M+CU1 about as long as m-cu (fig. 7); cu-a largely straight, apically curved basad; first discal cell parallel-sided (fig. 7).

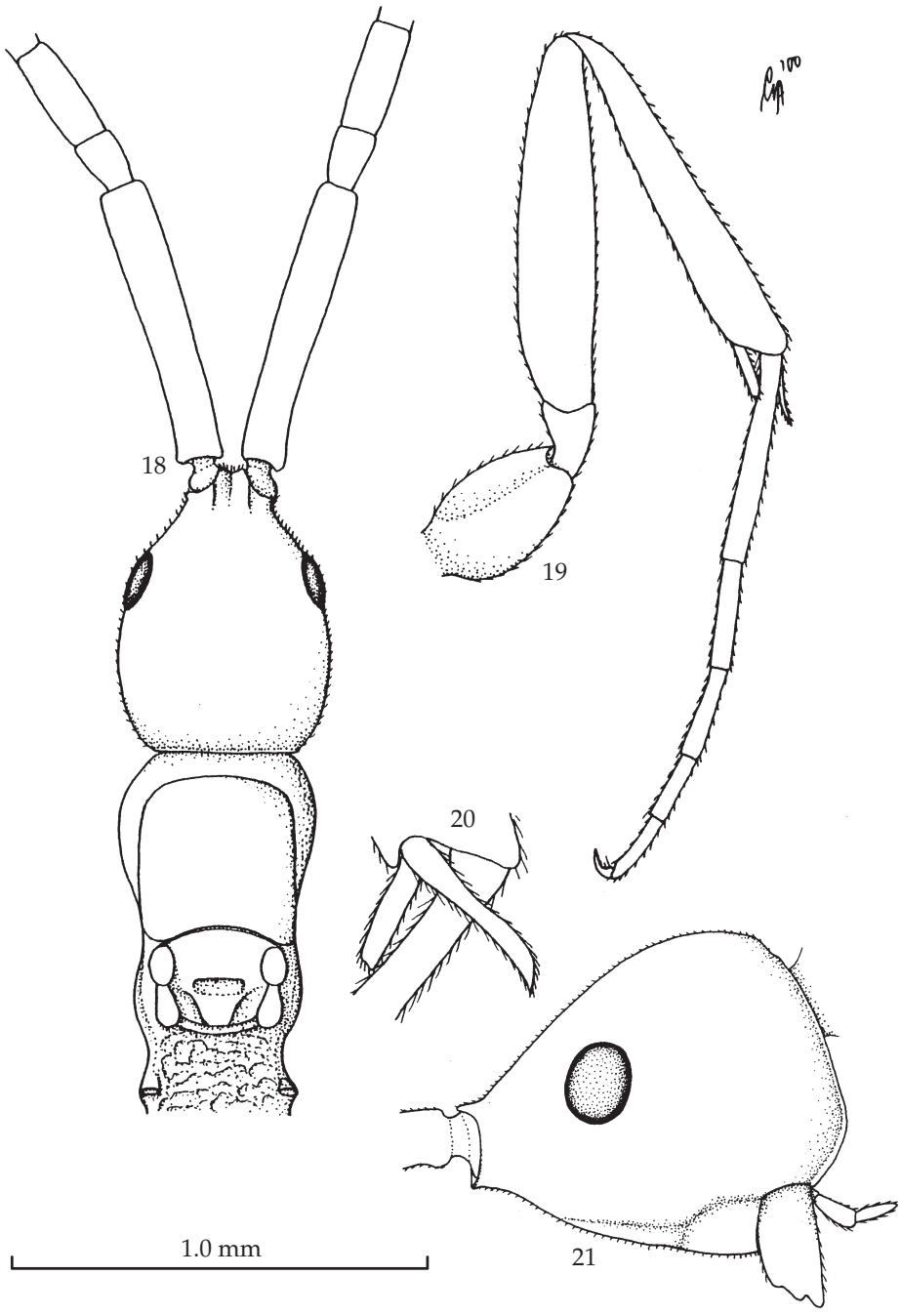
Legs.— Fore femur strongly swollen and compressed (fig. 14); hind femur strongly swollen subbasally and compressed (fig. 8); length of femur, tibia and basitarsus of



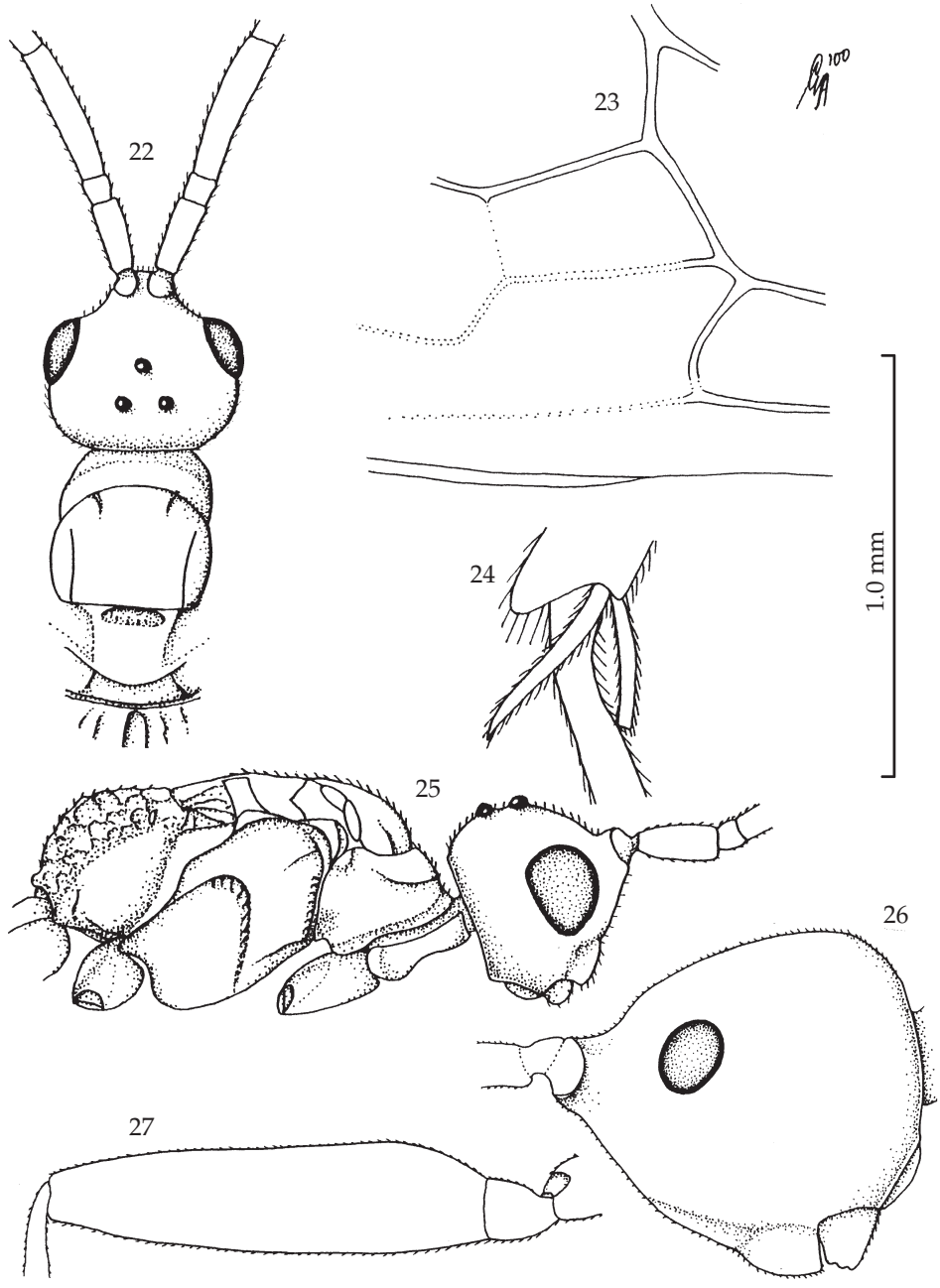

Figs 7-12, *Embolemus niger* spec. nov., ♀, holotype. 7, wings; 8, hind femur; 9, head, frontal aspect; 10, outer hind claw; 11, hind tibial spurs; 12, pronotum, lateral aspect. 7: scale-line (= 1.0 ×); 8, 9: 1.3 ×; 10, 11: 3.1 ×; 12: 1.2 ×.




Figs 13-15, *Embolemus niger* spec. nov., ♀, holotype; figs 16-17, *E. collinsi* (Olmi), ♀, E Malaysia, Sabah, Long Pa Sia. 13, head and antenna, lateral aspect; 14, fore femur and tibia, lateral aspect; 15, head and mesosoma, dorsal aspect; 16, pronotum, lateral aspect; 17, head, lateral aspect. 13-15: scale-line (= 1.0 ×); 16: 2.3 ×; 17: 1.4 ×.




Figs 18-21, *Embolemus ruddii* Westwood, ♀, Netherlands, Nieuwkoopse Plassen, but 19 and 21 from Schin op Geulle. 18, head and mesosoma (except posterior part of propodeum), dorsal aspect; 19, hind leg; 20; hind tibial spurs; 21, head and mesosoma, lateral aspect. 18-19: scale-line (= 1.0 ×); 20: 2.3 ×; 21: 1.2 ×.




Figs 22-25, *Embolemus ruddii* Westwood, ♂, Netherlands, Nieuwkoopse Plassen; 26-27, *E. walkeri* Richards, ♀, holotype. 22, head and anterior part of mesosoma, dorsal aspect; 23, detail of first discal and first subdiscal cells of fore wing; 24, hind tibial spurs; 25, head and mesosoma, lateral aspect; 26, head, lateral aspect; 27, hind femur, lateral aspect. 22, 25: scale-line (= 1.0 ×); 23: 1.8 ×; 24: 2.3 ×; 26-27: 1.2 ×.

hind leg 3.6, 8.7, and 10.4 times their width, respectively; hind tarsus 1.4 times as long as hind tibia; hind tibial spurs widened (fig. 11), inner spur sinuate, 0.30 times as long as hind basitarsus, and outer spur moderately robust and 0.15 times as long as hind basitarsus.

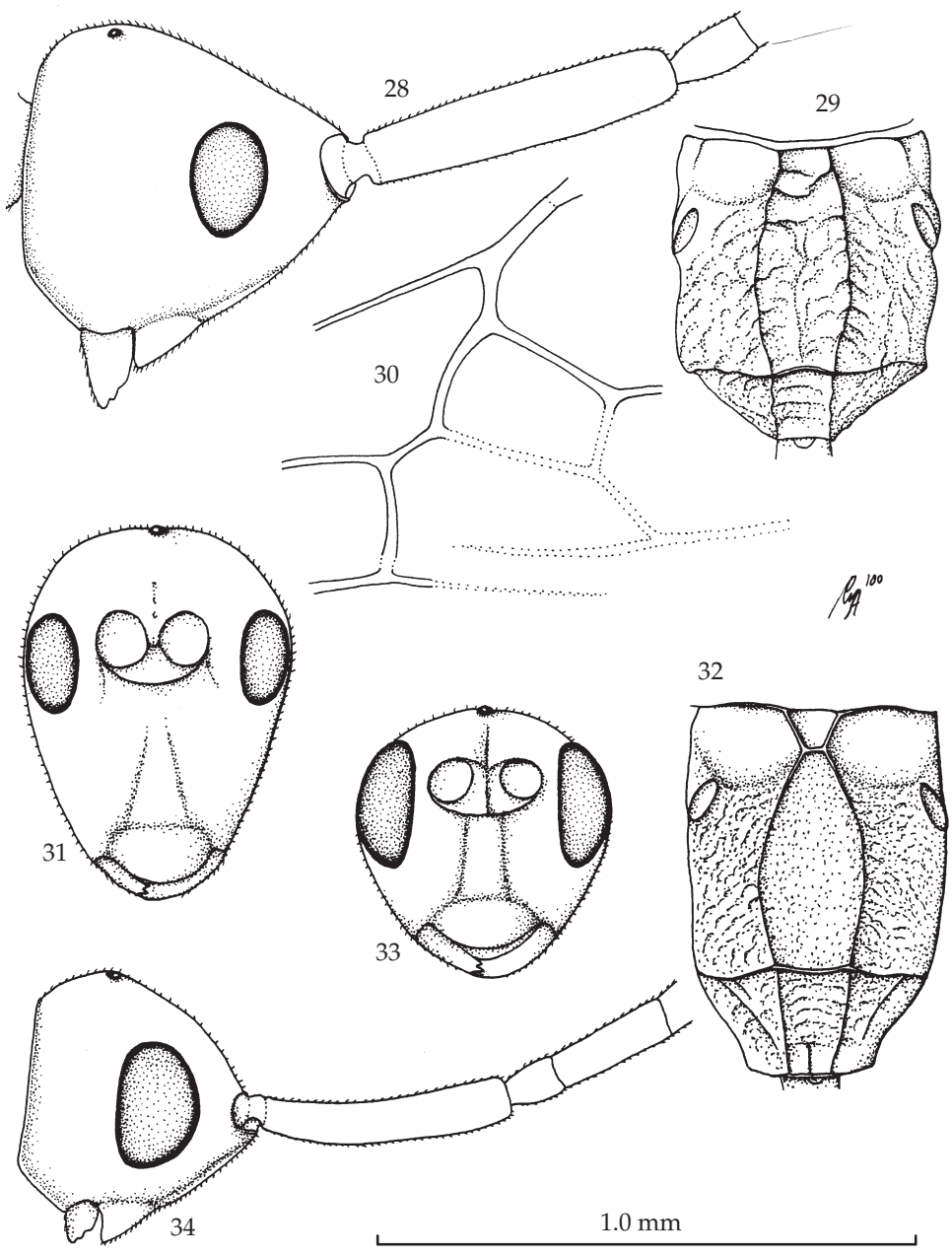
Metasoma.— Length of first tergite about equal to its maximum width, with some indistinct rugulosity basally; second and third tergites densely setose.

Colour.— Black or blackish-brown; clypeus, mandible, palpi, tegulae, pronotum ventrally, and apex of metasoma yellowish-brown; antenna, legs (but apices of coxae and trochanters rather yellowish), pterostigma and most veins largely dark brown; wing membrane somewhat infuscate.

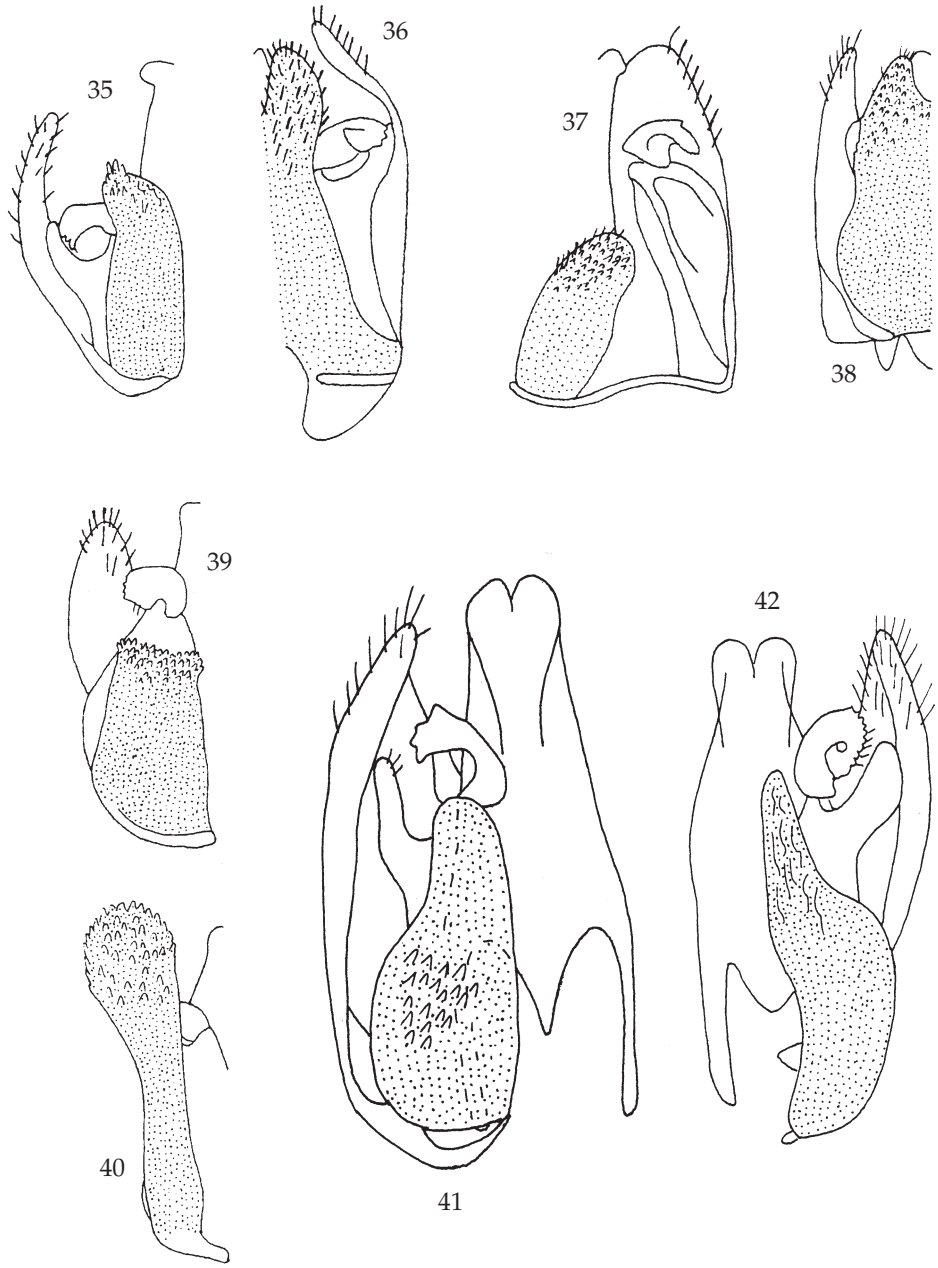
Note.— The combination of its colour, the shape of the propodeal areolae and the slender head allows separation of this species from other South Palaearctic species.

## Checklist of Embolemidae

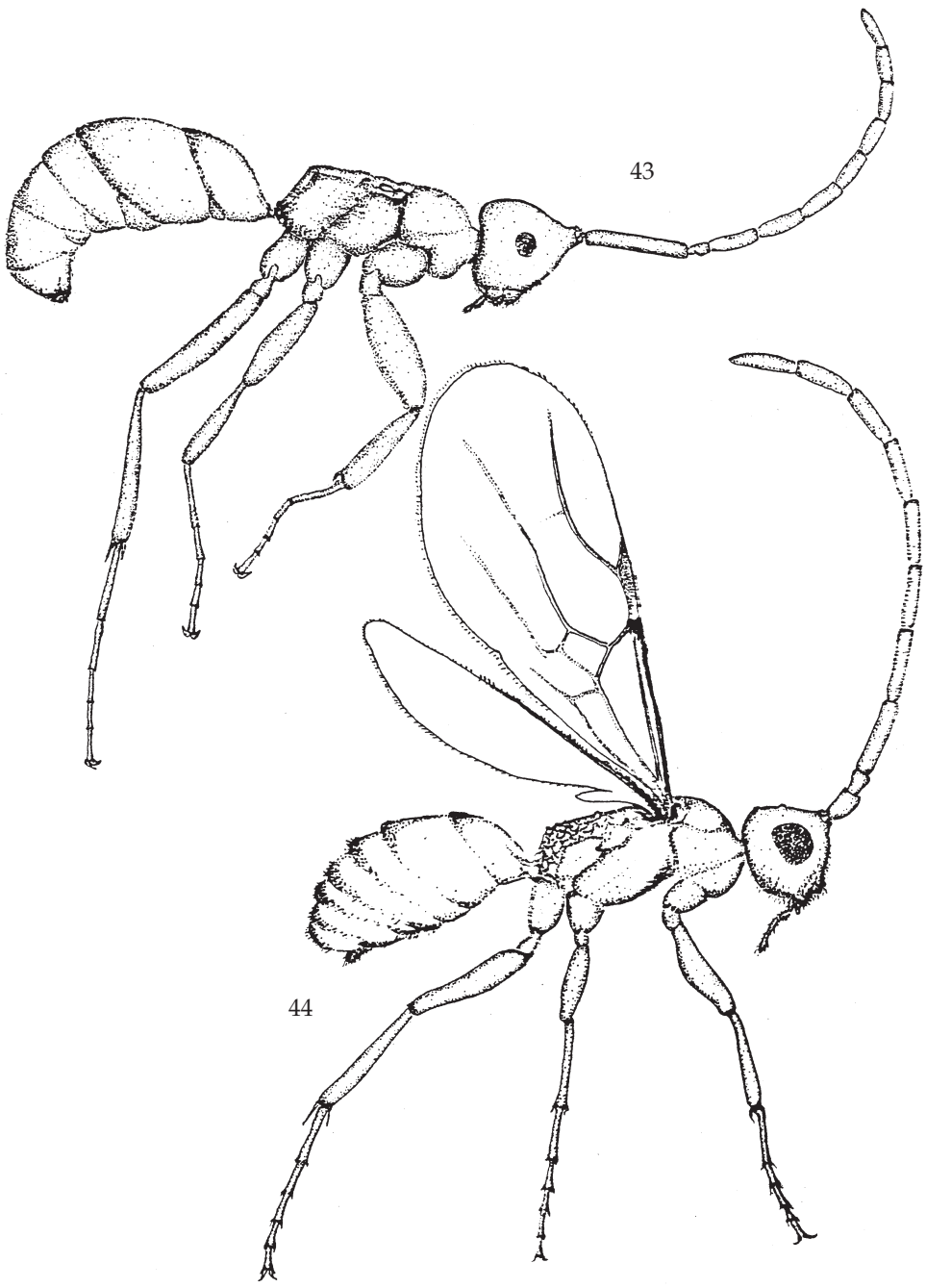
*Embolemus africanus* (Risbec, 1957): Afrotropical (C Africa)
*Embolemus andersoni* Olmi, 1998: Neotropical (C America)
*Embolemus angustipennis* (Kieffer, 1912): Neotropical)
    *Embolemus antennalis* (Kieffer, 1906): N Palaearctic. Synonym of *E. ruddii* Westwood, 1833.
*Embolemus australis* (Olmi, 1996) **comb. nov.**: Australian (NE and SW Australia)
*Embolemus bestelmeyeri* Olmi, 1998: Neotropical (Argentina)
    *Embolemus chevrolatii* (de Romand, 1846): N Palaearctic. Synonym of *E. ruddii* Westwood, 1833.
*Embolemus capensis* Olmi, 1998: Afrotropical (southern Africa)
*Embolemus collinsi* (Olmi, 1996) **comb. nov.**: Oriental (Sunda region, Philippines)
*Embolemus breviscapus* (Brues, 1933) **comb. nov.**: Baltic Amber (fossil)
*Embolemus gilli* (Olmi, 1998) **comb. nov.**: Neotropical
*Embolemus gressitti* (Olmi, 1998) **comb. nov.**: Australian (Papuan)
*Embolemus hachijoensis* Hirashima & Yamagishi, 1975: E Palaearctic
    *Embolemus holochlora* (Marshall, 1906): N Palaearctic. Synonym of *E. ruddii* Westwood, 1833.
*Embolemus harteni* Olmi, 1998: SW Palaearctic
*Embolemus huberi* Olmi, 1998: SW Palaearctic
*Embolemus krombeini* Olmi, 1996: Oriental (India, Sunda region, Wallacea, Philippines)
*Embolemus magnus* (Olmi, 1996) **comb. nov.**: Afrotropical (southern Africa)
*Embolemus nepalensis* (Olmi, 1998) **comb. nov.**: SE Palaeartic (the male paratypes may belong to others species because of aberrant propodeal sculpture!)
*Embolemus nearcticus* (Brues, 1922): Nearctic, N Neotropical (C America and northern S America)
*Embolemus neotropicus* Olmi, 1996: Neotropical
*Embolemus niger* spec. nov.: SE Palaeartic
*Embolemus notogeicus* Olmi, 1996: Australian (Australia)
*Embolemus olmii* van Achterberg, **nom. nov.** for *Embolemus pecki* (Olmi, 1998: 129-130) not Olmi, 1998: 139-140) **comb. nov.**: Afrotropical (southern Africa)
*Embolemus pecki* Olmi, 1998 (p. 139-140): E Palaearctic; Oriental (Wallacea)




Figs 28-30, *Embolemus hachijoensis* Hirashima & Yamagishi, ♀, paratype of *E. thaumus* (Rasnitsyn & Matveev); 31-32, *E. nepalensis* (Olmi), ♀, paratype (31) or holotype (32); 33-34, *E. confusus* (Ashmead), ♀, U.S.A., Montana, Williamsville. 28, 34, head, lateral aspect; 29, 32, propodeum, dorsal aspect; 30, detail of first discal and first subdiscal cells of fore wing; 31, 33, head, frontal aspect. 28-29: scale-line (= 1.0 ×); 30: 1.5 ×; 31-32: 1.2 ×; 33-34: 0.7 ×.




Figs 35-42, male genitalia; 35, *Embolemus harteni* Olmi; 36, *E. huberi* Olmi; 37, *E. nepalensis* (Olmi); 38-40, *E. pecki* Olmi; 41, *E. hachijoensis* (Hirashima & Yamagishi); 42, *E. ruddii* Westwood. 35-40 after Olmi (1998) and 41-42 after Olmi (1996).




Figs 43-44, *Embolemus ruddii* Westwood, Netherlands, Nieuwkoopse Plassen, ♀ (43) and ♂ (44), habitus, lateral aspect.

*Embolemus pecki* (Olmi, 1998: 129-130) **comb. nov.**, not *E. pecki* Olmi, 1998: 139-140): Afrotropical (southern Africa)

*Embolemus pucaraensis* de Santis & Vidal Sarmiento, 1977: Neotropical (Argentina). Synonym of *E. schajovskoyi* (de Santis & Vidal Sarmiento, 1977)

*Embolemus reticulatus* spec. nov.: W Palaeartic

*Embolemus ruddii* Westwood, 1833: N Palaearctic

*Embolemus rufescens* (Westwood, 1833): N Palaearctic. Synonym of *E. ruddii* Westwood, 1833.

*Embolemus sanbornei* Olmi, 1998: Afrotropical (southern Africa)

*Embolemus schajovskoyi* (de Santis & Vidal Sarmiento, 1977) **comb. nov.**: Neotropical (Argentina)

*Embolemus sickershusanus* (Nees, 1834): N Palaearctic. Synonym of *E. ruddii* Westwood, 1833.

*Embolemus stangei* Olmi, 1996: Neotropical

*Embolemus suavis* (Olmi, 1998) **comb. nov.**: Neotropical (C America)

*Embolemus subtilis* Olmi, 1996: Neotropical

*Embolemus succinalis* (Brues, 1933) **comb. nov.**: Baltic Amber (fossil)

*Embolemus thaumus* (Rasnitsyn & Matveev, 1989) **comb. nov.**: C Palaearctic. Provisionally synonymyzed with *E. hachijoensis* Hirashima & Yamagishi, 1975

*Embolemus walkeri* Richards, 1951 **stat. nov.** : E Palaearctic

*Embolemus wilkersoni* (Olmi, 1998) **comb. nov.**: Neotropical

*Embolemus zealandicus* Olmi, 1996: Australian (New Zealand)

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Alterra stands for Alterra, Green World Research (a combination of the Institute for Forestry and Nature Reseach (IBN-DLO) and the Winand Staring Centre (SC-DLO)), Wageningen, and RMNH for Nationaal Natuurhistorisch Museum, Leiden.

## References

Achterberg, C. van, 1988. Revision of the subfamily Blacinae Foerster (Hymenoptera, Braconidae).— Zool. Verh. Leiden 249: 1-324, figs 1-1250.

Birdwell, J.C., 1958. Biological notes on *Ampulicomorpha confusa* Ashmead and its Fulgoroid host.— Proc. ent. soc. Wash. 60: 23-26.

Carpenter, J.M., 1999. What do we know about Chrysidoid (Hymenoptera) relationships?.— Zool. Scripta 28: 215-231.

Consani, M., 1948. Interessante reperto su *Embolemus ruddii* Westwood (Hymenoptera, Bethyloidea, Embolemidae).— Redia 33: 123-125.

Donisthorpe, H., 1927. The ants (Formicidae) and some myrmecophiles of Sicily.— Ent. Record London 39: 6-9.

Hirashima, Y. & K. Yamagishi, 1975. Embolemidae of Japan, with description of a new species of *Embolemus* from Hachijo Island.— Esakia 9: 25-30.

Olmi, M., 1996. A revision of the world Embolemidae (Hymenoptera Chrysidoidea).— Frustula ento-

mol. 18(31) (1995): 85-146, figs 1-32.
Olmi, M., 1998. A contribution to the knowledge of the Embolemidae and Dryinidae (Hymenoptera Chrysidoidea).— Boll. Zool. agr. Bachic. 29(1997): 125-150, figs 1-19.
Olmi, M., 1999. Hymenoptera Dryinidae-Embolemidae.— Fauna Ital. 37: i-xvi + 1-425, figs 1-293, col. plts 1-64.
Rasnitsyn, A. P. & D.G. Matveev, 1989. First Palaearctic representative of the genus *Ampulicomorpha* Ashmead (Hymenoptera, Embolemidae).— Ent. Obozr. 68: 657-661 (in Russian).
Wharton, R.A., 1989. Final instar larva of the Embolemid wasp *Ampulicomorpha confusa* (Hymenoptera).— Proc. ent. Soc. Wash. 91: 509-512.

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