

HYMENOPTEROUS PARASITES OF EMBIOPTERA.

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Family BETHYLIDAE

Subfamily SCLEROGIBBINAE

This small subfamily is distinguished by the fact that the antennae contain from 22 to as many as 40 joints, compared with 12 to 13 joints in the large subfamily Bethylinae. In his 1914 monograph of the Bethylidae (*Das Tierreich*, 41, Berlin), Kieffer lists six described and two undescribed species of Sclerogibbinae, which are divided between six genera; four of the genera are based on females, and two are erected for undescribed males. Of the eight species, four are from Africa, two from Europe, and one each from Asia and North America. The known females are wingless; the males are fully winged. They appear to be rare insects; in no case have both sexes of the one species been recognized.

While the discovery of the subfamily in Australia is of interest, the record of the species as an ectoparasite of an Embiid deserves particular notice, since nothing seems to have been known previously concerning the host relations of these insects.

The single Australian example is a female. It disagrees with the characters given for the four genera based on this sex, viz., *Sclerogibba* Riggio and T. Stefaní, *Tanymotus* Cameron, *Mystrocnemis* Kieffer and *Prosclerogibba* Kieffer, in the possession of ocelli. However, in view of the small amount of knowledge of the group and of the limited number of species, I have preferred to place the insect in the type genus rather than to erect a new genus for its reception.

SCLEROGIBBA EMBIOPTERAE, n. sp.

♀. Length 4 mm. Body black, except as follows: the produced anterior margin of the head between the antennae is clear testaceous, to agree with the colour of the antennae; the declivous anterior shoulders of the pronotum are pale ferruginous; there is a similar pale area across the posterior margin of the pronotum; posteriorly on the propodeum against the base of the abdomen is a ferruginous spot. Antennae clear testaceous for basal two-thirds, the apical third brown. Coxae black, the intermediate and posterior pair with a pale spot at apex; anterior femora black, the other femora blackish; tibiae dusky-brown; tarsi ferruginous.

Head flattened; from dorsal aspect slightly longer than its greatest width, which is at one-third its length from the posterior margin, somewhat narrowed anteriorly where it is produced in the form of a broad, very transverse 'beak', the anterior margin of which is straight; posterior margin of head gently but definitely concave, not margined but sharp, since the occiput falls away very precipitously; mouth parts and antennal insertions on the underside, the mouth

parts just beyond the middle, the antennae near the anterior margin; eyes very wide apart, moderately large, rather narrow, extending for two-thirds the length of the head almost to the posterior margin, with a pubescence of very short fine hairs; ocelli present, small, in a triangle, the posterior pair close to the occipital margin, separated from the eyes by almost their own distance apart; dorsal surface of head with fine close polygonal reticulation and very fine short dense pubescence, and with a scattered pubescence of moderately long hairs arising from indefinite punctures. Antennae 26-jointed; scape moderately stout, $2\frac{1}{2}$ times as long as wide, excavated for its dorsal third where it fits underneath the head, the margin of the excavation armed with several stout hairs or bristles; pedicel short, transverse, half hidden in the scape; flagellum curved, very gradually tapering to apex; joint 1 as long as wide; 2 and the following joints distinctly wider than long, but the several apical joints are as long as wide, and the ultimate joint is almost twice as long as its basal width. Thorax distinctly narrower than the head and abdomen, four times as long as its width, almost parallel-sided, the dorsal surface of pronotum and propodeum flat; pronotum twice as long as wide, narrowly impressed at the median line, rounded anteriorly, not margined laterally, the posterior border rather deeply concave; mesoscutum small, shorter than its width; scutellum convex, twice as long as the scutum, fully as long as its greatest width, which is at two-thirds its length; propodeum without carinae or carinated margins, its surface flat, scarcely as long as the pronotum, widening gradually toward the posterior margin, thence narrowing very sharply; sculpture of thorax of fine close reticulation and fine short dense pubescence, but without the long hairs and indefinite punctures of the head. Front femora very greatly swollen; middle and posterior tibiae as long as their femora, each with a stout apical spur; posterior tarsi longer than their tibiae, with two tarsal claws, one of which has a short broad inner tooth. Abdomen somewhat shorter than the thorax, with the same fine sculpture and pubescence; convex dorsally, pointed at apex; segments 1 and 2 together occupying fully one-half the length; 1 somewhat longer than 2; 3 transverse, one-half as long as 2; 4 narrower and a little longer than 3; 5 narrower and shorter than 4; 6 triangular, somewhat longer than 5 or than its basal width.

One female reared by Mr. B. A. Smith on 8th October, 1935, at Chinchilla, Queensland, from a larva of *Oligotoma gurneyi gurneyi* Frogg., var., as determined by Consett Davis. Mr. Smith has supplied the following notes on this insect: "The legless larva, which was nearly full-grown when found, was attached between the prothorax and mesothorax dorsally of the Embiid larva which was in the last instar and was quite active. The parasite spun a cocoon, after the manner of other Bethyids."

Holotype in the Queensland Museum.

It is of interest to record that a Hymenopterous larva attached to a female of *Oligotoma gurneyi gurneyi* Frogg., was collected by Consett Davis at Bagdad Valley, Tasmania, 31.1.37.

Family SCYLLIONIDAE.
Subfamily SCYLLIONINAE.
EMBIIDOBIA Ashmead.

This genus was erected by Ashmead in 1895 (*Journ. Trinidad Club*, Vol. 2, No. 11, pp. 264-266) with the type species, *E. urichi* Ashmead, which had been reared from Embiid eggs in the island of Trinidad, West Indies. No other members of the genus have been described. However, Imms (1913) has recorded the existence of a species attacking the eggs of *Embia major* Imms in the Himalayas, India.

The discovery of these interesting egg-parasites in Australia is associated with the recent investigations of our Embioptera by Consett Davis, to whom I am indebted for the opportunity to study and describe the parasite material, which contains three species.

In addition to the Australian species, Consett Davis has submitted a female of another species, collected by himself at Colombo, Ceylon, in a nest of *Oligotoma greeniana* End., in bark, 7.1.39.

Ashmead's diagnosis of the characters of *Embidobia* gives the female antennae as 12-jointed. He states: "Antennae inserted just above the clypeus, 12-jointed, in the female terminating in a 4-jointed club, the funicular joints all very minute, except the first, transverse; pedicel obconical, stouter and longer than the first three or four funicular joints united." In the four species I have examined, the female antennae are 11-jointed; the funicle is either 5- or 6-jointed and the club 3- or 4-jointed, depending upon the eighth antennal joint being counted as a funicle or club joint; this joint is wider than the seventh joint, but is much smaller than the ninth; however, in this paper, it is considered as the small first segment of a 4-jointed club.

Whether *E. uricæ* has 11- or 12-jointed antennae in the female cannot be determined without an examination of the type material. Ashmead's description may be correct. On the other hand, it would have been a simple mistake to have miscounted the small funicle joints.

Despite the 11-jointed female antennae, which might suggest the subfamily Telenominae, the fringed or carinate lateral margins of the abdomen are typical of the Scelloninae.

The four species recognized in this paper can be distinguished by the following key:

1. Segment 2 of abdomen finely reticulate, without striae; metanotum hidden by the raised posterior margin of the scutellum *orientalis*
Segment 2 striate for the greater part; metanotum short, but not hidden under the posterior margin of the scutellum 2
2. Abdomen narrower at base, especially in the female; wings extending well beyond apex of abdomen in both sexes *longipennis*
Abdomen more broadly sessile at base, especially in the female; wings not reaching beyond apex of abdomen in the female, and very little beyond abdomen in the male 3
3. Postmarginal vein long, much longer than the stigmal vein; frons without longitudinal rugae and striae *australis*
Postmarginal vein short, scarcely longer than the stigmal vein; frons with longitudinal rugae and striae *metoiligotomæ*

EMBIDOBIA AUSTRALICA, n. sp.

♀. Length 0.95 mm. Head, mesoscutum and scutellum, and the greater part of the abdomen, dull-black or blackish; thorax, except scutum and scutellum, deep red-brown; first segment, base of second segment, margin between second and third segments, and lateral margins ventrally, of abdomen red-brown; antennal scape yellow, the pedicel and funicle joints brown, the club dusky; coxae red-brown, the femora rather dusky-brown, the tibiae and tarsi testaceous.

Head, from dorsal aspect, transverse, no wider than the thorax, the occiput gently concave and with a complete occipital carina; from lateral aspect, the vertex and frons are regularly convex, the cheeks are moderately broad and slope sharply ventro-posteriorly; from frontal aspect, the head is regular in outline, and is one-half wider than deep; frontal impression absent, but a carina extends above the antennal prominence and the face is depressed on either side of the carina; eyes moderately large, wide apart, densely pubescent; ocelli moderately small, very

wide apart, the lateral pair separated by their own diameter from the eye margins; head with fine pubescence and with fine dense reticulate or rugose sculpture. Antennae 11-jointed; scape moderately long; pedicel almost twice as long as its greatest width; funicle joints small, much narrower than the pedicel, 1 a little longer than wide, 2 quadrate, 4 and 5 much wider than long; club compact, 4-jointed, joint 1 rather small, 2 and 3 each a little wider than long, the terminal joint as long as its basal width. Thorax short, no longer than its greatest width or height; pronotum declivous, scarcely visible from above; scutum very broadly rounded anteriorly, the parapsidal furrows absent; scutellum semicircular, margined posteriorly; scutum and scutellum with fine dense pubescence and fine raised scaly reticulation; metanotum very short, unarmed; propodeum very short, visible laterally only. Forewings rather short, failing to reach apex of abdomen; moderately narrow, rounded at apex; distinctly brownish but paler toward base; marginal cilia moderately long; discal cilia fine and dense; venation deep brown, thick, very distinct; submarginal vein joining the costa at one-half the wing length; marginal vein one-half as long as the stigmal vein, which is moderately oblique, straight, with a distinct terminal knob; postmarginal vein long, three times as long as the stigmal vein and fully one-half as long as the submarginal. Fore and middle legs short, the posterior pair longer; tarsi 5-jointed, the posterior tarsi no longer than their tibiae. Abdomen as long as the head and thorax united, one-half longer than its greatest width, which is somewhat greater than that of the thorax; broadly sessile at base, its lateral margins gently convex; segment 1 transverse, less than one-half as long as its basal width, transversely impressed at one-half its length so that the base is broadly and shortly raised; 2 two-thirds longer than 1, with a foveate transverse line at base; 3 the longest, one-third longer than 1 but much wider than long; 4-6 each transverse, together two-thirds as long as wide; 1 strongly striate; 2 more finely striate but smooth toward posterior margin, while laterally the striae fail and are replaced by fine reticulation and pubescence; 3-5 with fine impressed polygonal reticulation and fine pubescence, the sculpture stronger and the pubescence less pronounced medially on 3.

♂. Agrees very closely with the female, except in sexual characters. The forewings are longer, extending for a short distance beyond the abdomen, and are wider, with the apex more broadly rounded. Antennae 12-jointed, the scape yellow, the pedicel dusky yellow or brown, the flagellum black; scape moderately long; pedicel slender, nearly twice as long as its greatest width; flagellar joints moniliform; 1 somewhat shorter than the pedicel, one-half longer than wide; 2 and 3 slightly shorter than 1; 4-9 quadrate or slightly wider than long, their basal and posterior margins truncate; apical joint about twice as long as the penultimate.

A large series included with *E. metoligotomae* and labelled "From nests of *Metoligotoma ingens* Davis, Black Mountain, Canberra, F.C.T., 25.1.35, R. V. Fyfe". Two females labelled "From eggs of *Metoligotoma illawarrae illawarrae* Davis, Austinmer, N. S. Wales, C. Davis; eggs collected 1.3.36, parasites emerged 27.3.36". The holotype and allotype have been selected from the Canberra series.

Holotype female and allotype male in the Queensland Museum. Paratypes retained by the author and returned to Consett Davis.

EMBIDOBIA METOLIGOTOMAE, n. sp.

♀. Length 0.90 mm. Head, thorax and abdomen wholly black, except that the lateral line or flange of the abdomen ventrally is reddish; coxae dusky black, the femora dusky brown, the tibiae and tarsi clear testaceous; antennae brownish-yellow, the club dark fuscous.

Frons rather less convex than in *austratica*, its median carina stronger and extending to the frontal ocellus; sculpture of vertex definitely but finely rugose in irregular raised lines; upper half of frons irregularly longitudinally rugose, the lower half regularly longitudinally striate. Antennae as in *austratica*. Mesoscutum with fine scaly reticulation and fine pubescence; scutellum shining, with the sculpture weak and indefinite. Forewings just reaching or falling by a little to reach apex of abdomen; broader than in *austratica*, the apex more broadly rounded; lightly stained brownish, not appreciably paler toward base; venation very distinct, marginal vein one-third as long as the stigmal, the postmarginal short, very little longer than the stigmal. Abdomen one-half longer than its greatest width, broadly sessile at base; segment 1 one-half as long as its basal width; strongly striate, but medially at base irregularly rugose; 2 very narrowly smooth at base, followed by the foveate line, the striate sculpture stronger than in *austratica* but giving way to reticulate sculpture latero-posteriorly, smooth along posterior margin; 3 very slightly longer than 2, medially with a close polygonal reticulation and without pubescence; 4 and 5, 3 laterally, and lateral margin of 2 with fine pubescence and fine indefinite reticulation.

♂. Abdomen rather more slender and narrower at base than in the female, almost twice as long as its greatest width; segment 1 almost as long as its basal width, strongly striate but not rugose medially at base. Forewings a little broader and longer, extending a short distance beyond apex of abdomen. Antennae black, the scape and pedicel dusky-brown; pedicel one-half longer than wide; flagellar joint 1 subquadrate or slightly longer than wide; 2-9 each somewhat wider than long, their basal and apical margins sharply truncate.

At once differing from *austratica* in the short postmarginal vein, and in the sculpture of the head; the frons and vertex in *austratica* are finely reticulate-rugose, without the longitudinal striae or rugae on the frons; the scutellum is definitely sculptured like the scutum in *austratica*, whereas in *metoligotomae* it is shining and the sculpture is indefinite.

A series included with *E. australica* and labelled "From nests of *Metoligotoma ingens* Davis, Black Mountain, Canberra, F.C.T., 25.1.35, R. V. Fyfe". A small series bred from eggs of *Metoligotoma intermedia* Davis, Nowra, N. S. Wales, Consett Davis; eggs collected 8.10.37, parasites emerged 31.12.37. Three females bred from eggs of *Metoligotoma extorris* Davis, Brush Island, near Ulladulla, N. S. Wales, 6.9.38, Consett Davis. One female in nests of *Metoligotoma pentanesiana* Davis, Five Islands, N. S. Wales, 12.3.36, Consett Davis. The holotype and allotype have been selected from the Canberra series.

Holotype female and allotype male in the Queensland Museum. Paratypes retained by the author and returned to Consett Davis.

A female from Lady Barron, Flinders Island, Bass Strait, collected by Consett Davis in a web of *Metoligotoma tasmanica* Davis, subspecies ?, 9.1.38, should be referred to this species, although it differs in minor particulars. The legs are darker, with the tibiae and tarsi brownish-yellow, not clear yellow. The antennae are darker, the scape being fuscous like the club, and the pedicel and funicle joints dusky-brown. Segment 2 of the abdomen is not narrowly smooth at base; the striation is not so strong, and on the posterior half there is polygonal reticulation between the striae.

EMBIOPTERUS LONGIPENNIS, n. sp.

♀. Length 0.95 mm. Black, the base of the abdomen dull reddish; antennae dark, the joints, except the club, somewhat brownish; coxae and femora dusky-black, the tibiae and tarsi dusky ferruginous.

Frons rather less convex than in *austratica*; the median carina extending to the anterior ocellus; sculpture much as in *metoligotomae*, the lower half of frons regularly longitudinally striate, the upper frons irregularly longitudinally rugose, the vertex irregularly transversely rugose. Antennae as in *austratica*. Mesoscutum with fine pubescence and fine raised reticulation; scutellum shining, without sculpture, with scattered pubescence. Forewings extending well beyond apex of abdomen, moderately broad, the apex rather broadly rounded; lightly and uniformly stained brownish; venation light brown, moderately distinct; marginal vein one-half as long as the stigmal vein, the postmarginal twice as long as the stigmal. Abdomen not wider than the thorax, almost twice as long as its greatest width; segment 1 much more narrowed at base than in *austratica* and *metoligotomae*, as long as its basal width, very distinctly raised and convex at base medially; 1 rather strongly striate; 2 rather strongly striate, the striae becoming finer posteriorly, smooth posteriorly, laterally with fine sculpture and pubescence; 3 for the greater part with raised polygonal reticulation and scattered hairs, the sculpture finer and the pubescence denser laterally, smooth along the posterior margin; 4 and 5 with fine sculpture and pubescence.

♂. Forewings very long, extending beyond the abdomen for almost the length of the latter. Antennae black, the scape and pedicel dusky brown; flagellar joint 1 as long as the pedicel, twice as long as wide, 2 and 3 somewhat longer than wide, 4-9 each slightly longer than wide; flagellar joints not so compact, and less quadrate in outline than in the other two species, gradually narrowing at base and apex.

This species differs from the two preceding forms in the longer wings and the narrower base of the abdomen; both of these differences are more pronounced in the females. The flagellar joints of the male antennae are longer and taper somewhat to the ends, so that the basal and apical margins are not truncate, thus giving the flagellum a less compact appearance than in *austratica* and *metoligotomae*.

One female (holotype) and one male (allotype) labeled "In webs of *Oligotoma gurneyi gurneyi* Frogg., Hobart, Tasmania, 29.1.37, G. and C. Davis". One female in web of *Notoligotoma nitens* Davis, Sylvania, George's River, New South Wales, C. Davis, 11.8.35.

Holotype and allotype in the Queensland Museum. Paratype in the author's collection.

EMBIDOBIA ORIENTALIS, n. sp.

♀. Length 0.35 mm. Head and thorax black; abdomen dusky black, the basal segment clear testaceous; antennal scape yellow, the remaining joints dusky brown; legs clear yellow, the anterior coxae fuscous.

Head, from lateral aspect, distinctly convex; lower half of frons rather deeply impressed, the median carina not extending for more than one-half the distance to the anterior ocellus; occipital border of the vertex not margined or carinate; frons and vertex with close scaly reticulation and with a pubescence of rather long fine hairs; mandibles rather long, bidentate. Funicle joints very small, 1 as long as wide, the others wider than long; 1st club joint small, not much wider than the funicle, very transverse, 2 quadrate, 3 somewhat wider than long. Scutum and scutellum with similar reticulation and the rather long pubescence of the head; scutellum semicircular, but rather longer than in the Australian species, somewhat raised posteriorly and from dorsal aspect completely hiding the short metanotum. Forewings just reaching apex of abdomen; rather narrow, the apex

rather sharply rounded; lightly stained brownish, the infuscation deepest at one-half the length; marginal vein two-thirds as long as the stigmal, which is rather short and very oblique; postmarginal long, almost as long as the submarginal, fully three times as long as the stigmal. Abdomen two-thirds longer than its greatest width; very broadly sessile, its base as wide as the posterior margin of the thorax; segment 1 very little wider posteriorly than across the base, one-third as long as its basal width, faintly raised at base medially; 2 one-half longer than 1, more than twice as wide as long, without a foveate line at base; 3 slightly shorter than 2; 1 with fine close striae; 2-4 with a network of fine impressed reticulation; 4 and 5, and 2 and 3 laterally, with numerous hairs forming a rather scattered pubescence.

♂. Unknown.

This species differs from the three Australian forms in the following characters: the absence of striae on the second abdominal segment; the raised posterior margin of the scutellum hiding the metanotum; the non-carinate occipital border of the vertex. The abdomen is even wider at its base in *orientalis* than in *australis* and *metoligotomae*.

One female labelled "Colombo, Ceylon; in nest of *Oligotoma greeniana* End., in bark; 7.1.39, Consett Davis".

Holotype in the Queensland Museum.