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The First Cretaceous Sclerogibbid Wasp (Hymenoptera: Sclerogibbidae)

MICHAEL S. ENGEL¹ AND DAVID A. GRIMALDI²

ABSTRACT

The first record of a fossil sclerogibbid wasp (Aculeata: Chryridoidea) is reported. *Sclerogibbodes embioleia*, new genus and species, is described from a female preserved in Early Cretaceous (Neocomian) amber from Lebanon. The genus is sister to all other members of the Sclerogibbidae and is therefore placed in a monogeneric subfamily, **Sclerogibbodinae**, new subfamily. Sclerogibbids are obligate parasitoids of web-spinners (order Embioidea = Embiidina, Embioptera), and thus the recovery of this lineage from Lebanese amber implies that web-spinners were perhaps also present in the paleofauna.

INTRODUCTION

Wasps of the chrysidoid family Sclerogibbidae are obligate ectoparasitoids of web-spinners (order Embioidea). Sclerogibbid females move adeptly through the silken tunnels of the web-spinner's galleries and oviposit on the abdomen of the host. The newly emerged larva attaches itself to exposed membranes of its victim and feeds until the host is consumed. When feeding is complete, the larva detaches from the dead embiid and spins a cocoon near the host's carcass (Callan, 1939; Yokoyama

and Tsuneyoshi, 1958; Ross, 2000). As it is presently understood, the family is rather poor in species (table 1) although many authors have hinted at an as yet unrecognized and undescribed diversity, with potentially dozens of new taxa awaiting description (e.g., Riek, 1970; Argaman, 1988, 1993; Ross, 2000). The scarcity of material, however, has generally impeded work on the family, and a new monographic treatment of sclerogibbids is desperately needed.

Herein we present the description of the first fossil of the family Sclerogibbidae, discovered

¹ Division of Invertebrate Zoology, American Museum of Natural History; Division of Entomology (Paleoentomology), Natural History Museum, and Department of Ecology and Evolutionary Biology, Dyche Hall, 1345 Jayhawk Boulevard, University of Kansas, Lawrence, Kansas 66045-7163 (msengel@ku.edu).

² Division of Invertebrate Zoology, American Museum of Natural History (grimaldi@amnh.org).

TABLE 1
Current Hierarchical Classification of Family Sclerogibbidae
 (The family is in need of a new monographic treatment)

Taxon	Spp. (no.)	Distribution
Family SCLEROGIBBIDAE Ashmead		
Subfamily †Sclerogibbodinæ, n. subfam.		
Genus † <i>Sclerogibbodes</i> , n.gen.	1	Lebanese amber (Cretaceous)
Subfamily Sclerogibbinae Ashmead		
= Probethylinæ Argaman (n. syn.)		
= Caenosclerogibbinae Argaman (n. syn.)		
= Tanynotini Argaman (n. syn.)		
= Parasclerogibbini Argaman (n. syn.)		
Genus <i>Caenosclerogibba</i> Yasumatsu	1	China, India, Japan.
Genus <i>Neosclerogibba</i> Koch (syn. of <i>Sclerogibba</i> ?)	1	Namibia
Genus <i>Probethylus</i> Ashmead	4	Arizona (USA), Brazil, Mexico, Trinidad.
Genus <i>Parasclerogibba</i> Hamann	1	India, Java, Madagascar, Myanmar, Sri Lanka.
= <i>Mystrocnemis</i> Kieffer		
Genus <i>Sclerogibba</i> Riggio and Stefani-Perez	8	Afghanistan, Congo, Eritrea, Gabun, Guinea, Hawaii, ^a India, Italy (Sardinia, Ustica), Israel, Somalia, South Africa, Sri Lanka, Togo, Tunisia, Yemen.
= <i>Tanynotus</i> Cameron		
= <i>Prosclerogibba</i> Kieffer		
= <i>Cryptobethylus</i> Marshall		
= <i>Lithobiocerus</i> Bridwell		
= <i>Poggiana</i> Argaman (n. syn.)		
Incertae sedis		
" <i>Sclerogibba</i> " <i>embioptrae</i> Dodd		Queensland (Australia) ^b

^a Perhaps an introduction.

^b Riek (1970) also figures an enigmatic sclerogibbid from Australia.

in Neocomian amber from Lebanon. This fossil is significant not only as the earliest record of its family but also for its implications for understanding evolution within Sclerogibbidae, implying a minimum age for the family as well as for that of its host.

SYSTEMATIC PALEONTOLOGY

FAMILY SCLEROGIBBIDAE ASHMEAD, 1902

Sclerogibbodinæ, new subfamily

TYPE GENUS: *Sclerogibbodes*, new genus.

DIAGNOSIS: Antenna 14-segmented; compound eyes comparatively large, with scattered minute setae, well separated in dorsal view from preoccipital ridge, separated by at least one-quarter of compound eye length (e.g., similar in this respect to *Caenosclerogibba*, although in this living genus the eyes are more reduced and even more distantly

separated from the preoccipital ridge); ocelli present (difficult to discern among debris on head), median and lateral ocelli well developed; anterior head process strongly developed and projecting beyond lower tangent of compound eyes at least one-half of compound eye length (similar in this respect to *Neosclerogibba*); preoccipital ridge carinate; head slightly longer than pronotum. Pronotum not tapering posteriorly in dorsal view, posterior margin distinctly wider than anterior margin (pronotum in extant females tapers posteriorly such that the anterior margin is typically slightly wider than the posterior margin); propleuron obscured in dorsal view by pronotum; female with wings completely developed; hind wing apparently without venation; forewing mostly obscured in ventral view by body and in dorsal view by fractures and debris in amber, only extreme anterior margin (i.e., C, Sc + R, pterostigma, basal portion of r-rs, and R anteriorly

bordering marginal cell evident) visible from behind body in ventral view, marginal cell apparently long, extending slightly more than half the distance between pterostigma and forewing apex; procoxa apparently dorsal furrow weakly developed; profemora greatly expanded, ventral margin with thin lamella along outer margin; protibia not widened; only a single mesotibial spur evident (second may indeed be absent, or exceedingly small and difficult to discern); pretarsal claws with short, subapical tooth.

COMMENTS: This subfamily is immediately recognizable for the retention of wings in females; females of Sclerogibbinae are apterous. The specimen is unfortunately dorsally obscured by fractures and debris posteriorly from the mesoscutum to the abdomen rendering observation of wing-venation details impossible.

Sclerogibbodes, new genus

TYPE SPECIES: *Sclerogibbodes embioleia*, new species.

DIAGNOSIS: As for the subfamily (vide supra).

ETYMOLOGY: The new genus-group name is a combination of *Sclerogibba* (type genus of the family) and *-odes* (Gr., suffix meaning "looking like"). The name is feminine.

COMMENTS: At present, the genus contains a single species occurring in Early Cretaceous (Neocomian) amber from Lebanon (table 1).

Sclerogibbodes embioleia, new species

Figures 1–2

DIAGNOSIS: As for the genus (vide supra).

DESCRIPTION: As in those characters provided in the diagnosis for the subfamily, with the following additions: **Female**. Total body length 2.29 mm; apparent forewing length 1.2 mm (measured along leading edge that is visible just beyond the body of the insect). Head length 0.47 mm, width 0.36 mm. Frontal prominence strongly pronounced, head tapering strongly beyond lower tangent of compound eyes. Compound eye with short, scattered setae; inner margins of compound eyes widely separated, separated by distance slightly less than compound eye length.

Antenna with 14 antennomeres, flagellomeres of approximately same shape except distal two flagellomeres distinctly wider than long; apex of distalmost flagellomere tapering. Mesosoma elongate and narrow, approximately three times as long as wide. Profemur greatly swollen, width slightly more than three times protibial width. Metasoma narrow (sting extruded in holotype: fig. 2). Integument black and appearing imbricate except antennae and tarsi dark brown; body with scattered short setae, those of mesosoma and metasoma arising from setigerous punctures; wings hyaline. **Male**. Unknown.

HOLOTYPE: Female, Lebanese amber (Early Cretaceous: Neocomian). Deposited in the Amber Collection, Division of Invertebrate Zoology, American Museum of Natural History, New York.

ETYMOLOGY: The specific epithet is a combination of *embios* (Gr., meaning "lively"; origin of *Embia*, type genus of the webspinner order Embiodea) and *lestes* (Gr., meaning "plunderer"). The name is a reference to the obligate parasitism of embiodeans by this family of wasps.

DISCUSSION

As already noted, *Sclerogibbodes* is the sole fossil known for the family thereby extending the lineage back at least 125 million years. This age is intuitively pleasing because of the phylogenetic position of Sclerogibbidae as the extant sister group to the Dryinidae + Embolemidae lineage (Carpenter, 1986, 1999; Brothers, 1999; Brothers and Carpenter, 1993). Given the well-documented occurrence of dryinids and embolemids in the Cretaceous (Rasnitsyn, 1975, 1996; Ponomarenko, 1981a, 1981b; Olmi, 1998; Engel, 2003, 2005), it follows that Sclerogibbidae must be of a similar age. Indeed, most chrysidoid families extend well into the Early Cretaceous, with the sole exception of Plumariidae. Plumariidae are presently unknown from the fossil record,³ but given that they are the adelphotaxon of all other Chryridoidea, their lineage was un-

³ The Late Cretaceous amber plumariid reported by Grimaldi et al. (2000) appears to belong to an extinct family between Plumariidae and Scolebythidae (D.J. Brothers, personal commun.).



Fig. 1. Photomicrograph of holotype female of *Sclerogibbodes embioleia* (AMNH), new genus and species.

doubtedly present in the earliest Cretaceous as well. The exploration of amber deposits throughout the world is imperative for additional material of this family. The hosts of sclerogibbids (i.e., Embiodea) are similarly rare in the fossil record. Webspinner fossils have been recovered from the mid-Cretaceous amber of Myanmar (Cockerell, 1919; Davis, 1939; Grimaldi et al., 2002; Engel and Grimaldi, 2006), Eocene Baltic amber (e.g., Ross, 1956), Miocene Dominican amber (Szumik, 1994, 1998), as well as a compression fossil from the Eocene-Oligocene boundary of Florissant, Colorado (Cockerell, 1908; Ross, 1984). As discussed elsewhere the mid-Cretaceous Embiodea are not basal members of the order and the origin and radiation of the group must have been significantly earlier (Grimaldi et al., 2002; Engel and Grimaldi, 2006). The embiodeans in Burmese amber have swollen proboscitarsi, indicating that the mid-Cretaceous is a minimal age for the habit of constructing silken galleries. In lieu of

a Lebanese amber webspinner the presence of *Sclerogibbodes* further strengthens the notion that Embiodea were present in the Early Cretaceous (and likely even earlier: vide Engel and Grimaldi, 2000; Grimaldi and Engel, 2005). The earliest age of Sclerogibbidae is constrained by the earliest aculeates/stem-group aculeates (Bethylonyimidae: latest Jurassic).

The galleries of webspinners impose some physical constraints on the construction of wings for Embiodea, and thereby for sclerogibbids as well. Most Embiodea are apterous or shed their wings, thereby avoiding complications by which wings become entangled or damaged by gallery fibers. However, Embiodea have developed an intriguing evolutionary novelty allowing alates to move through their galleries unhindered. The wings of Embiodea are collapsible, allowing them the flexibility to bend when the webspinner reverses in a tunnel. A series of blood sinuses allow the wings to be filled by turgor pressure

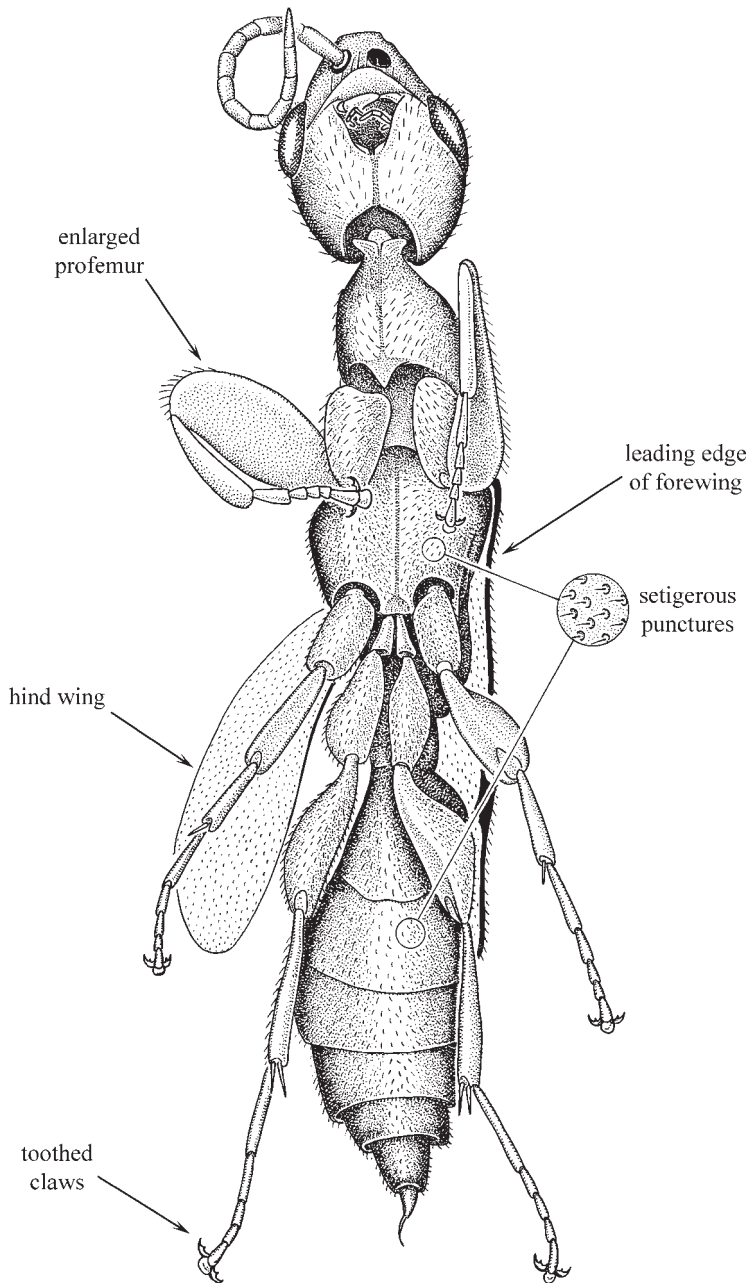


Fig. 2. Ventral habitus of *Sclerogibbodes embioleia* (AMNH), new genus and species.

once the gallery has been exited, thereby producing a more rigid structure that is useful, albeit in a limited capacity, as a flight foil. Just as it is for the natural occupants, reversing in the tunnels for the parasitoid is hampered by wings. Aptery in modern sclerogibbids pre-

sumably aids females who enter the silken galleries to oviposit and then must eventually retreat from the nests. The plesiomorphic presence of wings in the female of *Sclerogibbodes* is thus of great significance. Their presence may indicate that *Sclerogibbodes* was

an ectoparasitoid of some other lineage of insects (perhaps of wood-boring beetles as is generally primitive for Aculeata and other parasitoid lineages), and that the specialization on Embioidea had not yet occurred. Alternatively, Embioidea may have constructed looser, more vulnerable webs in the Early Cretaceous. For now, however, we do not consider the simple presence of wings to preclude the possibility that *Sclerogibbodes* was a parasitoid of webspinners like its modern relatives.

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