



Review of the genus *Odontembia* Davis, 1939 (Embioptera: Embiidae) with description of a new species

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Abstract

The genus *Odontembia* Davis is reviewed. Two species are recognized, *O. spinosa* (Navás) and *O. jacobi* Miller, new species. The genus is known from central and western Africa and is principally characterized by the hind basitarsus with two ventral papillae, MA forked in the meso- and metathoracic wings with the branches of the fork as long as the stem, the medial portion of the right basipodite produced posteriorly, and the presence of several large, distinct denticles on the first segment of the left cercus. A new species is described from Ghana and differs from *O. spinosa* in several characters of the male genitalia. The male head, left wings and genitalia are illustrated.

Key words: Webspinner, taxonomy, Embiidina, Ghana, Democratic Republic of the Congo

Introduction

The genus *Odontembia* Davis was established to include a single species, *O. spinosa* (Navás) (originally placed in *Dihyboecercus* Enderlein), from central Africa (Davis, 1939). The genus was not explicitly placed in a family, though it was regarded as closely related to *Dihyboecercus* (Davis, 1939), a genus in the family Embiidae. Other than the original description, few additional references to the genus occur in the literature.

Davis (1940a) regarded *Odontembia* as part of an Afrotropical group of genera closely related to *Rhagadochir* Enderlein. These taxa have MA forked in all wings, the first segment of the left cercus lobed and echinulate, the tenth abdominal tergite completely divided, and the process of the left hemitergite bifid or otherwise complex (1940a). He proposed that the Neotropical groups with a similar character combination were convergent with this Afrotropical group. Evidence presented in a cladistic analysis by Szumik (2004), however, suggests that *Odontembia* is not closely related to *Rhagadochir* which is, instead, a member of the primarily Neotropical family Archemiidae. In that analysis, *Odontembia* was resolved in a clade with other members of Afrotropical Embiidae. This analysis, however, included a relatively small sampling of taxa from the large and complex Old World Embiidae. Therefore, it is not yet clear how *Odontembia* is related to other genera in the family.

The goal of this project is to describe a previously unknown species of *Odontembia* and to review the two species now known in the genus.

Methods

Two male specimens and one female specimen of the newly described species were acquired from a culture of specimens from the remote type locality. In order to preserve as much of the specimens as possible, whole

genomic DNA was extracted from each specimen using the Qiagen DNEasy extraction kit by placing the specimen (with terminalia and wings removed) in extraction buffer and proteinase K solution. After incubation, the remaining portions of the specimen (cleared cuticle) were retrieved from the buffer and retained. Each specimen was mounted independently (along with terminalia and wings) on a microscope slide using Euparal. The DNAs are deposited in the Division of Arthropoda at the Museum of Southwestern Biology, University of New Mexico, Albuquerque, NM 87131 (KB Miller, curator) and will be used in a forthcoming analysis of the order.

Terminology for wing venation and structures association with the male genitalia has not been applied consistently even between papers by the same author. Partly this is because of changing views about homology, though tests of homology of many of these features with other insects are lacking and these changes are largely speculative. Nevertheless, the currently most thorough description of Embioptera morphology (and definitions of terms) is the extensive treatment by Ross (2000). This paper applies the terminology employed in that work.

Measurements were made using an ocular scale on a Wild M3C dissecting microscope. Measurements include: TL (total length measured from anterior margin of labrum to apex of cerci); HL (head length measured from anterior margin of labrum to posterior margin of head); HW (greatest width of head); EW (minimum distance between eyes); FWL (length of mesothoracic wing); HWL (length of metathoracic wing); FWW (greatest width of mesothoracic wing); HWW (greatest width of metathoracic wing). Several ratios are also presented to give an indication of relative sizes and shapes including HW/EW, FWL/FWW and HWL/HWW.

***Odontembia* Davis, 1939**

Odontembia Davis, 1939; Davis, 1940; Szumik, 2004.

Type species: *Odontembia spinosa* (Navás, 1931), by original designation.

Diagnosis: *Odontembia* are in the family Embiidae based on the following character combination: 1) male mandibles dentate, 2) tergite X entirely divided medially, 3) LC₁ echinulate medially, 4) vein MA forked (into veins MA₁₊₂ and MA₃₊₄ according to Ross (2000), but not forked in some Embiidae), and 5) mandibles not depressed, with molar and incisive regions not clearly delimited (this last distinguishing Embiidae from Archembiidae (Szumik, 2004)). The genus *Odontembia* is defined as Embiidae with the following character combination: 1) vein MA forked in meso- and metathoracic wings with branches of fork as long as stem (Figs 5,6; 12,13), 2) medial lobes of basal segment of left cercus (LC₁) with two prominent lobes and numerous large, acute teeth (Figs 2,3; 8,9), 3) medial portion of right basipodite produced posteriorly (Figs 2,3; 8,9), 4) process of left hemitergite bifid or broadly truncate (Figs 2–4; 8–11), and 5) hind basitarsus with two ventral papillae.

Odontembia is similar to *Metembia*, some *Pseudembia*, *Donaconethis* and, at least some species of *Dihybocercus* in having two medial lobes on the basal segment of the left male cercus, one basal and one apical, often with prominent dentition. In *Odontembia*, like the Indian *Metembia* and *Pseudembia*, vein MA is forked, and there are two ventral papillae on hind basitarsus. The genus differs from them in having the process of the left hemitergite bifid or broadly truncate instead of simple. From *Donaconethis* the genus differs in having a single ventral papilla on hind basitarsus. From *Dihybocercus* it differs in having vein CuA with two branches (Figs 5, 6, 12, 13) and with smaller and less conspicuous teeth on LC₁.

Distribution and taxon content: This genus currently includes two Afrotropical species, *O. jacobi* n. sp. from Ghana and *O. spinosa* from the Congo.

Discussion: The validity of this genus as a natural group, as with many Embioptera genera, is debatable and untested. There are numerous other genera of Embiidae (and, perhaps, Archembiidae) that are similar in

wing venation and the shape of structures in the male genitalia, characters on which these taxa are based. The new species described here and *O. spinosa* share the characters defining the genus, but they are not particularly similar in other features suggesting that it would be best to test these characters, and those defining other similar genera, in a greater cladistic analysis including new character systems.

In the only cladistic analysis to include *Odontembia*, Szumik (2004) found the genus to be sister to the clade *Metembia* + *Pseudembia*. According to the character optimization shown on the tree, this grouping is based on features of the “basal node” on LC_I (a complex character, 45 in her analysis (Szumik, 2004)). *Metembia* and *Pseudembia* are coded as having the lobe present, bearing setae, and oriented dorsad (Character 45, State 3) with *Odontembia* coded as having the lobe present, bearing setae, and oriented ventrad (Character 45, State 4). The orientation of this lobe may have been assessed incorrectly by Szumik (2004) (see Discussion below under *Odontembia spinosa*), but this, by itself, may not have affected the result that *Odontembia*, *Metembia* and *Pseudembia* are closely related at least relative to other taxa in her analysis. That analysis was not designed to examine comprehensively the relationships among Embiidae, and future analyses including several other related genera in Embiidae will be required to more definitively place *Odontembia* with respect to other genera in the family.

***Odontembia spinosa* Navás, 1931**

(Figs 1–6)

Dihyboercus spinosus Navás, 1931

Odontembia spinosa Davis, 1939; Szumik, 2004.

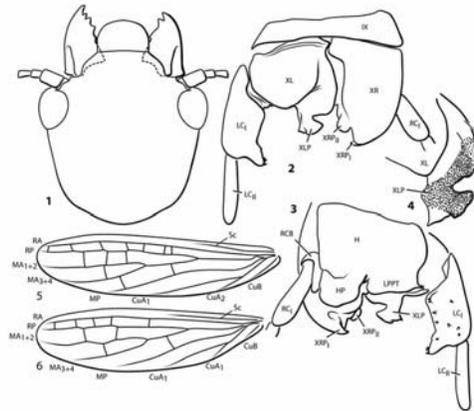
Type information: Holotype winged male on microscope slide in Musee Royal de l'Afrique Centrale, Turvoren labeled, “HOLOTYPE [red label with black line border]/ Typus [handwritten]/ *Dihyboercus spinosus* Nav. P. Navás S.J.det. [green label, handwritten]/ *Dihyboercus spinosus* Nav. [handwritten]/ MUSÉE DU CONGO Lulua: 1929 Dr Walker [“1929” handwritten]/ R. DÉT G 3518 [back of slide, “G” handwritten]/ R. DÉT. 1943 [back of slide]”. Only the holotype was examined of this species. This specimen is missing the left metathoracic leg and the right metathoracic tarsus is damaged with portions missing. The genitalia are compressed with some damage including a missing RC_{II}.

Type locality: The Democratic Republic of the Congo [“The Congo”], nr Lulua River [“Lulua”].

Diagnosis: This species differs from *O. jacobi* in having the process of the left hemitergite apically broad, truncate, flattened and covered with a field of small nodules (Figs 2–4). The right hemitergite is broadly triangular with the apical process directed medially and with a small ventral lobe directed anteromedially (Fig. 2). Finally, LC_I bears several prominent teeth, with none of them forming a distinct row (Fig. 3). Female unknown.

Description: *Measurements* (in millimeters): TL = 11.80; HL = 1.95; HW = 1.45; EW = 1.20; HW/EW = 1.21; FWL = 8.93; HWL = 8.59; FWW = 1.56; HWW = 2.34; FWL/FWW = 5.72; HWL/HWW = 3.67. *Coloration.* “General colour [sic] orange-brown, eyes black, wing-veins dark brown, bordered by mid-brown bands” (Davis, 1940b). *Structure.* Head moderately broad; eyes small; anterior margin of labrum evenly rounded (Fig. 1); mentum subrectangular, distance between lateral margins slightly greater than distance from anterior to posterior margins, anterior margin linear; mentum apparently absent. Male genitalia with tergite X entirely divided, left hemitergite similar in size to right hemitergite (Fig. 2); process of left hemitergite short, apically broad, with prominent dorsal and ventral acuminate lobes, dorsal lobe, left surface of process and dorsal base of process nodulose (Figs 2–4); right hemitergite moderately broad, elongate, right margin broadly rounded, process short, robust, acutely pointed, extending ventromedially, with an additional small ventral rounded lobe (Fig. 2), 10RP_{II} moderately broad, short (Fig. 2). LC_I with two lobes, a large subapical lobe and

a smaller subbasal lobe which may be directed ventrally (Fig. 2, see Discussion below); apical lobe bearing three prominent teeth, basal lobe with two prominent teeth (Figs 2,3); LC_I with numerous (seven) additional scattered teeth on dorsal surface (Figs 2,3). Right basipodite partially fused to RC_I along apicodorsal margin, medially extending in lobe directed posteriorly (Fig. 2). Left basipodite located laterally at base of LC_I (Fig. 2). Hypandrium with broad apical lobe (Fig. 3). Left paraproct with small, acute, curved process and large, broadly rounded lobe directed medially (Fig. 3).



FIGURES 1–6. *Odontembia spinosa* (Navás, 1931). 1 — head, dorsal aspect; 2 — male genitalia, dorsal aspect; 3 — male genitalia, ventral aspect; 4 — process of left hemitergite, left oblique aspect; 5 — left mesothoracic wing; 6 — left metathoracic wing. CuA₁ – first branch of cubitus anterior; CuA₂ – second branch of cubitus anterior; CuB – cubitus posterior; H – hypandrium; HP – process of hypandrium; IX – tergum nine; LCB – left cercus basipodite; LC_I – basal segment of left cercus; LC_{II} – apical segment of left cercus; LPPT – left paraproct; MA₁₊₂ – first branch of media anterior; MA₃₊₄ – second branch of media anterior; MP – media posterior; RA – radius anterior; RCB – right cercus basipodite; RC_I – apical segment of right cercus; RC_{II} – basal segment of right cercus; RP – radius posterior; SC – subcosta; XL – left tergite ten; XLP – process of left tergite ten; XR – right tergite ten; XRP_I – first process of right tergite ten; XRP_{II} – second process of right tergite ten.

Distribution and habitat: *Odontembia spinosa* is known only from the type locality, and nothing is known of its biology.

Discussion: The holotype of this species is cleared and mounted on a slide such that the natural coloration is impossible to assess; therefore, the description of color above is quoted from Davis (1939). In addition, the genitalia have been distorted and somewhat damaged based on a comparison with illustrations by Davis (1939). The apical segment of the right cercus has been removed and is apparently lost. Sclerites and membranes near the base of the right cercus have been damaged and distorted, and the entire genital region has been dorsoventrally compressed. The illustrations presented here (Figs 2–4) are taken from the specimen and not modified to match those by Davis (1939). As a result, there are some differences that may be important in future recognition of specimens belonging to this species. Davis's (1939) illustration shows the basal dentate lobe of the basal segment of the left cercus on the medial surface and directed medially, and he described this lobe as directed medially. On the type specimen, however, this lobe is directed ventrad, perhaps due to artificial compression and rotation of the cercus. Szumik (2004) coded ventral orientation of this lobe as a unique state in this taxon based on examination of the type specimen, and it resulted as an autapomorphy derived from a dorsal position of the lobe. The other species in the genus, *O. jacobi* n. sp., has this lobe directed mediad (Figs 2,3). Examination of additional material will be required to more accurately assess the orientation of the lobe in this taxon.

Also, Davis (1939) shows the process of the left hemitergite flattened with the surfaces facing laterally. On the slide-mounted type specimen, this process has the flattened surfaces facing dorsally and ventrally, again possibly due to dorso-ventral compression and resulting rotation of these structures. Other structures appear generally misaligned or distorted from Davis's (1939) illustrations.

***Odontembia jacobi* Miller, sp. nov.**

(Figs 7–13)

Type information: Holotype: male, slide mounted, in the Division of Arthropoda, Museum of Southwestern Biology (MSBC, K.B. Miller, curator) labeled “Ghana: Volta Region, Nkwanta nr Wldlf. Div. office, on tree 08°15.542'N 000°31.137'E 13 Jun 2005 K.B. Miller, colr. KBM1306051/ HOLOTYPE *Odontembia jacobi* Miller, 2008 [red label].” Paratypes, 1 male, 1 female, in MSBC, slide mounted, same data as holotype.

Type locality: Ghana, Volta Region, Nkwanta, near Wildlife Division office, 08° 15.542'N 000° 31.137'E.

Diagnosis: This species differs from *O. spinosa* in having the process of the left hemitergite apically bifid with each branch acute (Figs 8,10,11). The right hemitergite is broader and apically more rounded than *O. spinosa* (Fig. 8). Finally, LC₁ bears numerous very large teeth, several of which are arranged in a prominent carinate row along the dorsomedial side (Fig. 8).

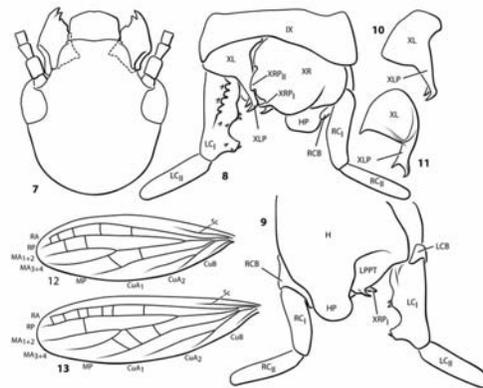
Description: *Measurements* (in millimeters): TL = 8.30; HL = 1.35; HW = 1.06; EW = 0.85; HW/EW = 1.25; FWL = 5.30; HWL = 6.11; FWW = 1.78; HWW = 1.92; FWL/FWW = 2.98; HWL/HWW = 3.18. *Coloration.* Head, meso- and metathorax, and abdomen yellow-brown; pronotum light yellow-brown; antennae, other head appendages and legs pale brown; wings gray. *Structure.* Head broad; eyes moderately large; anterior margin of labrum subtruncate (Fig. 7); submentum relatively broad, distance between lateral margins slightly greater than distance between anterior and posterior margins, male with lateral margins slightly rounded, female with lateral margins more straight and with submentum relatively smaller; mentum apparently absent in male, small, laterally elongate in female. Hind basitarsus in both male and female with extensive field of spinous setae around base and with dense, irregular series along each side; ventral papillae located anteriorly and submedially. Male genitalia with tergite X entirely divided, left hemitergite smaller than right hemitergite (Fig. 8); process of left hemitergite elongate, apically prominently bifid with each branch acutely pointed (Figs 8,10,11); right hemitergite broad and rounded, process short, lobe-like, extending medially, 10RP_{II} small, inconspicuous (Fig. 8). LC₁ with two medial lobes, a large subapical lobe and a smaller subbasal lobe (Figs 8,9); apical lobe bearing three prominent teeth, basal lobe with two prominent teeth (Figs 8,9); LC₁ with prominent dentate carina along dorsal surface with five conspicuous teeth (Fig. 8); LC₁ also with few other scattered teeth on dorsal surface (Fig. 8). Right basipodite partially fused to RC₁ along apicodorsal margin, medially extending in lobe directed posteriorly (Fig. 8). Left basipodite located laterally at base of LC₁ (Fig. 8). Hypandrium with broad apical lobe (Fig. 9). Left paraproct with small, acute, curved process directed laterally (Fig. 9). *Female.* Similar in coloration to male, body longer (TL = 10.69), head shorter and slightly broader (HL = 1.15, HW = 1.13) and eyes proportionately smaller (HW/EW = 0.89); female genitalia with lateral pigmented valvifers and medial pigmented plate separated by narrow unpigmented region, apical margin evenly rounded.

Etymology: This species is named *jacobi*, loosely named after philosopher Friedrich Heinrich Jacobi, a critic of the philosopher Benedictus de Spinoza, whose name is similar to the other specific epithet in the genus, *spinosa*.

Distribution: The species is known only from Nkwanta, Volta Region, Ghana.

Biology: The specimens were collected apparently as nymphs along with numerous nymphs of *Oligotoma saundersii* Westwood at the type locality 13 June 2005. They were found in the culture container on 04 June 2006 and on 01 August 2006. Numerous *O. saundersii* adults emerged in the culture at various times during

the previous year. All specimens were collected from colonies found in a small, remote village on the surfaces of small trees in loose bark and cracks in the bark.



FIGURES 7–13. *Odontembia jacobi*, new species. 7 — head, dorsal aspect; 8 — male genitalia, dorsal aspect; 9 — male genitalia, ventral aspect; 10 — left hemitergite, dorsal aspect; 11 — left hemitergite, left oblique aspect; 12 — left mesothoracic wing; 13 — left metathoracic wing. For abbreviations see caption for Figs 1–6.

Acknowledgment

Special thanks to S.L. Cameron, J.R. Cryan, T. Kondo, T.L. McCabe, G. Morse, G.J. Svenson, J.M Urban, and M.F. Whiting. Financial research support for came in part from National Science Foundation grants #DEB-0329115 and #DEB- 0738179.

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