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Taxonomic revision of *Calamister* Kirkaldy, 1906 (Fulgoromorpha: Cixiidae) with the description of a new species

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Abstract

Calamister obscurus Kirkaldy, 1906 is redescribed, illustrated and a lectotype designated from the type series. A new species, *C. cougalensis*, is added to the genus. An identification key is provided and morphological characters discussed. Doubts are raised about a specimen published as *C. obscurus* by Jacobi (1928).

Key words: Australian endemic planthopper, identification, morphology, Jacobi, lectotype

Introduction

Calamister Kirkaldy, 1906 is a genus endemic to Australia. Previously it was thought to be monotypic, with *C. obscurus* Kirkaldy, 1906 as the only species known. However, material from Queensland examined in this study contained five specimens of a new species in this genus which is described in this paper.

Material and methods

The morphological terms applied here follow Löcker *et al.* (2006). The following is a list of the measurements taken in this study:

Body length—tip of head to posterior margin of forewing

Length of vertex—distance between basal emargination and apical carina in midline

Width of vertex—at level of basal emargination

Length of basal compartment of vertex—distance between basal emargination and subapical carina in midline

Length of apical compartment of vertex—distance between apical transverse carina and subapical carina in midline

Length of frons—apical transverse carina to frontoclypeal suture, in midline

Width of frons—at level of frontoclypeal suture

Width of forewing—at level of apex of clavus

Length of forewing—base to posterior margin of forewing

Abbreviations

BPBM	Bernice Pauahi Bishop Museum, Honolulu, United States of America
MLM	Melinda Moir, private collection, Perth, Australia
NSW	New South Wales
Qld	Queensland
QM	Queensland Museum, Brisbane, Australia

The type specimens of the new species described in this paper were originally in the Entomological Collections of the University of Queensland (UQIC) and were relocated to the Queensland Museum in June 2011.

Results

Genus *Calamister* Kirkaldy

Calamister Kirkaldy, 1906: 402

Type species: *Calamister obscurus* Kirkaldy, by monotypy.

Diagnosis. *Calamister* is endemic to Australia. It can be distinguished from all other genera of Australian Cixiini by the following character. In *Calamister* CuA2 either ends well before it reaches the margin of the forewing (Figs 1, 3B) or it reaches the margin but with slightly reduced thickness. In all other Australian Cixiini CuA2 reaches the margin in its entire thickness. For more details see Remarks section of *Calamister*.

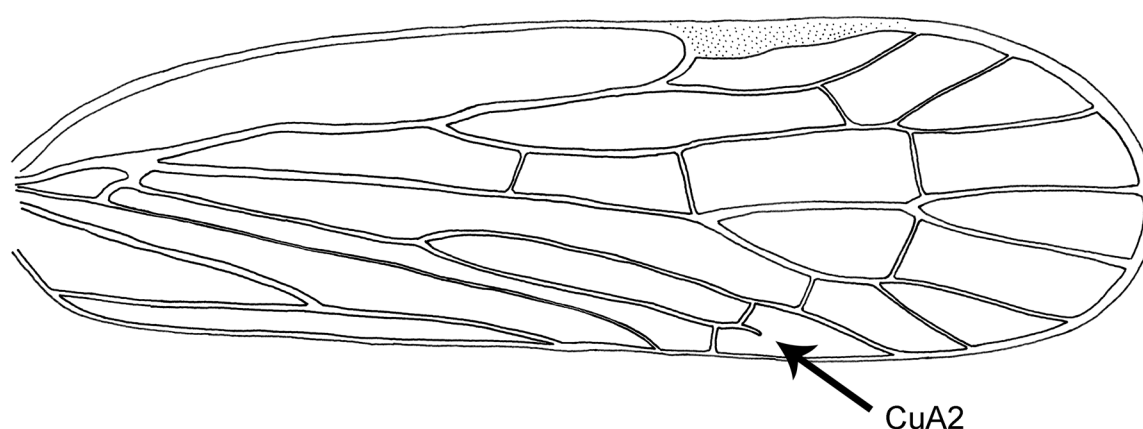


FIGURE 1. *Calamister cougalensis*: forewing.

Morphology. Body length: ♂ 4.3–5.3 mm; ♀ 4.7–5.7 mm.

Head: Vertex widest at base, narrowest at subapical carina and widening again towards apical carina; at level of basal emargination 1.2–1.4 x wider than at subapical carina; angle formed by caudal border of vertex broadly obtuse. Frons not visible in dorsal view; without median ocellus; maximum width no more than 2x apical width; position of maximum width distinctly dorsad of centre of frontoclypeal suture; median carina complete but evanescent near frontoclypeal suture, unforked; lateral carinae slightly elevated; lateral carinae in facial view convex, rectilinear apically. Frontoclypeal suture slightly semicircular, bent upwards, median part not reaching lower margin of antennal scape. Rostrum very short, reaching mid coxa or mid femur but not reaching hind coxa.

Thorax: Pronotum much wider than head (including eyes); median carina present but inconspicuous; submedian/lateral carinae short, not following contour of eyes; angle formed by hind margin of pronotum rectangular to slightly obtuse. Mesonotum with well developed median and lateral carinae. Forewing surpassing tip of abdomen by far; no concavity at costal border; tubercles on costal margin in single row; tubercles on forewing running along veins, never within cells, concolorous with veins; pterostigma more or less triangular; transverse veinlet M3+4 to Cu1a much shorter than M3+4 from M fork to this veinlet and much shorter than transverse veinlet r-m; transverse veinlet M3+4 to Cu1a inserting at M3+4 distad of r-m; icu inserting at CuP very distad of apex of clavus; RP apically bifid; MA apically bifid; CuA1 apically unforked; CuA2 ending well before it reaches margin of wing or fading (reaching margin of wing with reduced thickness); nodus of y-vein more or less central within clavus to basad; distance from base of pterostigma to apex of forewing longer than width of forewing at level of clavus. Hind leg: tibia without lateral spines, with 6 apical spines, all in one row, without a gap, outermost spine distinctly larger than other spines; 1st tarsomere generally with 7 apical teeth and no platellae; 2nd tarsomere in general with 8 apical teeth and 4 platellae; the 4 platellae are situated in the middle flanked by two teeth without platellae on each side.

Male genitalia: Anal tube symmetrical in caudal view. Ventromedian process of pygofer triangular.

Female genitalia: Ovipositor sword-shaped; wax plate large, circular or oval-shaped; anal tube trapezoid.

Distribution. NSW, Qld.

Remarks. The following character state has been observed in *Calamister* Kirkaldy but not in any other Australian cixiid: In most specimens of *Calamister* CuA2 ends well before it reaches the margin of the forewing (Figs 1, 3B). In some specimens of *C. obscurus* it reaches the margin but with slightly reduced thickness. Further studies on a worldwide scale are needed to clarify if this character state is unique within Cixiidae.

In case this character is not unique within Cixiidae *Calamister* can be distinguished from all other Cixiini by the following combination of characters: median carina of frons unforked; submedian/lateral carinae short, not following contour of eyes; rostrum very short (not reaching hind coxae); icu inserting at CuP very distad of apex of clavus; second hind tarsomere usually with 8 apical teeth and 4 platellae.

No host plants are known for this genus. The male holotype and the female paratype of *C. cougalensis* were collected in a rainforest. Two females of *C. obscurus* have been collected by beating understorey plants in a Coastal blackbutt (*Eucalyptus pilularis*) forest.

Calamister is restricted to the easterly parts of Queensland and NSW. Further collecting may, however, increase its known distribution.

Key to species of *Calamister* Kirkaldy

- 1 Forewing hyaline, colourless throughout. Pterostigma light brownish-yellow (testaceous) (Figs 2A,B). Phallotheca ventrally to right-laterally with two spines, about equal in length (Figs 4A,B). *Calamister obscurus* Kirkaldy
- Forewing hyaline, colourless with darkened areas along the posterior margin of the forewing, i.e. distad of apex of clavus. Pterostigma mid to dark brown (Figs 3A,B). Phallotheca ventrally to left-laterally with two spines, one of which is almost twice as long as the other (Figs 5A,B) *Calamister cougalensis* sp. nov.

Calamister obscurus Kirkaldy

(Figs 2, 4, 6A–C)

Calamister obscurus Kirkaldy, 1906: 403.

Types. *Lectotype* (designated here, examined), ♂, AUSTRALIA, Qld: Bundaberg, ix.–xii.1904 (Koebele) (BPBM). *Paralectotypes*, 2 ♀, same data as holotype (BPBM).

Notes: The original description does not mention the designation of a holotype, therefore these specimens are regarded as syntypes. A lectotype is designated to provide a diagnostic reference for the species.

Other material examined. AUSTRALIA, Qld: 11 ♂, 6 ♀, 1 ♂ or ♀ (abdomen missing, body length indicates male), Bundaberg, 20.viii.1919 (F. Muir) (BPBM); 1 ♂, 1 ♀, Coolool, 22.ix.1956 (Kirkpolnik) (QM). NSW: 2 ♀, Bullsground [state forest], Port Macquarie, beating understorey plants, xi. 2005 (M.L. Moir MLM01135-6).

Diagnosis. This species can be distinguished from *C. cougalensis* by its colouration which is entirely yellow with hyaline forewings and a whitish or yellowish pterostigma. Further the phallotheca bears two spines ventrally to right-laterally, about equal in length.

Colour. Body light brownish-yellow (testaceous), eyes and antennae darker; rarely lateral parts of mesonotum slightly darker. Forewing hyaline with testaceous veins and tubercles; pterostigma testaceous.

Morphology. Body length: ♂ 4.3–4.5 mm; ♀ 4.7–5.1 mm.

Head: Vertex 1.5–1.7 x wider than long; apical carina v-shaped, subapical carina u-shaped; median carina of vertex absent or if present, covering up ¼ of basal compartment of vertex; basal compartment 3.7–9.0 x longer than apical compartment. Frons 1.1–1.4 x longer than wide. Postclypeus with median carina absent or evanescent; lateral carinae absent. Anteclypeus with median and lateral carinae absent. Rostrum very short, reaching mid coxa or mid femur; apical segment of rostrum shorter than or as long as subapical segment.

Thorax: Forewing 2.7–3.5 x longer than wide; costal margin with about 1–4 tubercles; Sc+R+M near basal cell fused, forming a minute common stem Sc+R+M; fork of ScRA+RP basad or at same level as fork CuA1+CuA2;

position of r-m at same level as or slightly basad of fork MA+MP; MP apically unforked or bifid; vein delimiting subapical cell C4 more or less at same level as vein delimiting C5; subapical cell C5 distinctly longer than C4; CuA2 ending well before it reaches margin of wing or fading (reaching margin of wing with reduced thickness); 7–8 apical cells; 3 anteapical cells. Hind leg: 1st tarsomere with 7 apical teeth (rarely 6 or 8) and no platellae; 2nd tarsomere with 8 (rarely 9) apical teeth and 4 (rarely 5) platellae (Fig. 2E).

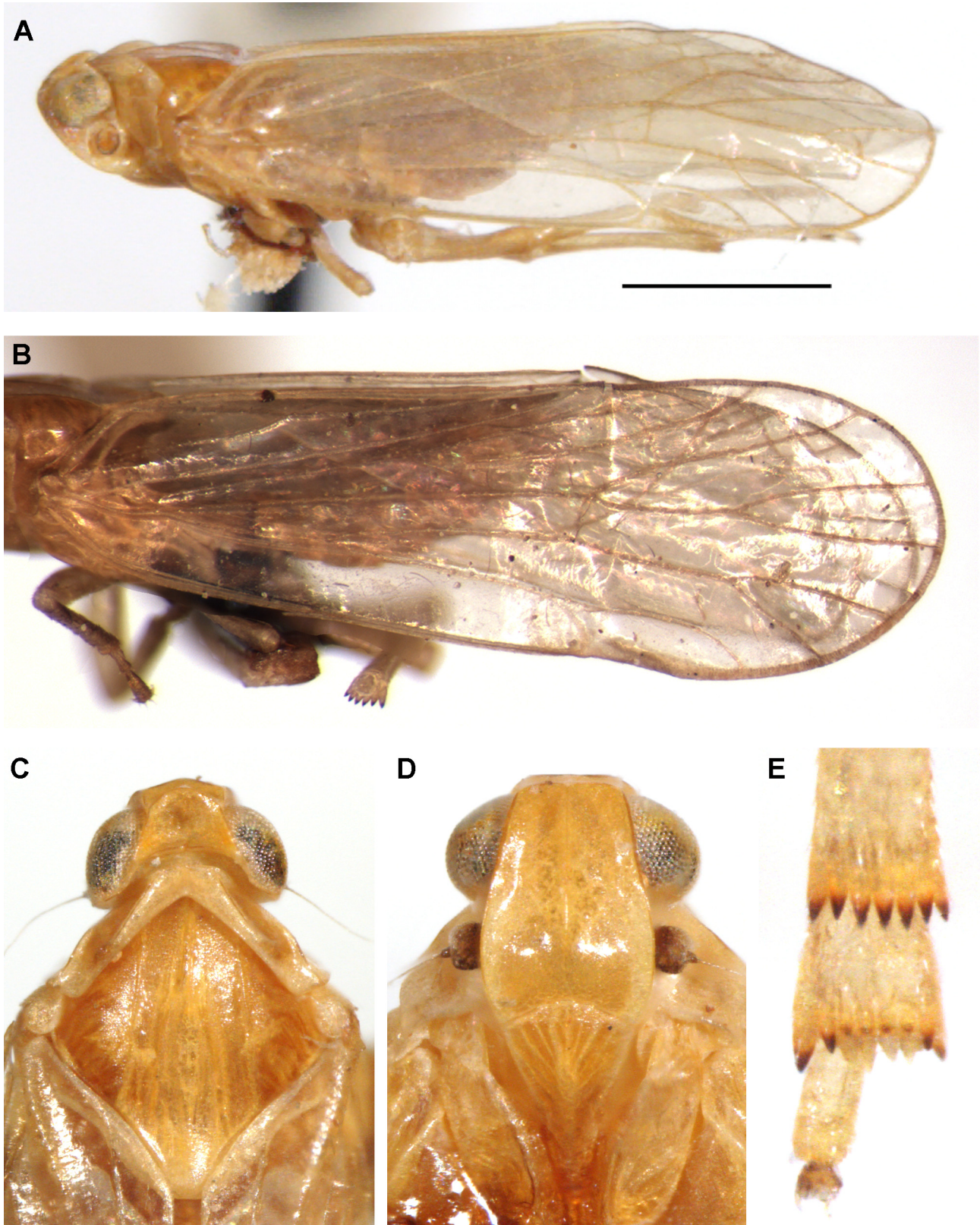


FIGURE 2. *Calamister obscurus*: A habitus; B forewing; C–D head; E first and second tarsomere. Scale bar 1mm.

Male genitalia: Anal tube as in Figs 4C,D. Pygofer and genital styles as in Figs 4E,F. Aedeagus (Figs 4A,B): Phallosome ventrally to right-laterally with two large, curved spines (a, b), about equal in length; spine (a) arising near apex of aedeagus and spine (b) arising right underneath spine (a). Flagellum unarmed.

Female genitalia: Ovipositor, wax plate and anal tube as in Figs 6A–C: wax plate oval-shaped; anal tube trapezoid, widening towards apex.

Remarks. In general *C. obscurus* has 7 apical teeth and no platellae on the 1st tarsomere and 8 apical teeth and 4 platellae on the 2nd tarsomere. The following deviations from this formula appear to be aberrations as they only occurred on one leg of the specimen: One male from Bundaberg had only 6 and another male from the same location 8 apical teeth on the 1st tarsomere; the female from Coolum had 9 apical teeth and 5 platellae on the 2nd tarsomere.

Kirkaldy's original descriptions of the genus and species are not very specific and lack illustrations. Muir (1908) provided a dichotomous key to the genera of Cixiidae which includes *Calamister*. Based on this identification key Jacobi (1928) identified a female specimen from the 'Blackall Range' (this appears to be the 'Blackall Range' in South East Queensland) to be *C. obscurus*. Jacobi mentions features such as a minute stem of Sc+R+M; a long common stem of Sc+R and the fact that fork Sc+R and fork CuA1+CuA2 are at about the same level, situated in the basal half of the forewing; and transverse carina of vertex slightly u-shaped. These features can be found in the type specimens of *C. obscurus* and/or the other material examined. Jacobi (1928) noted that apical veins (towards the margin) and crossveins were darker brown in the Blackall Range specimen. In *C. cougalensis* sp. nov. the apical veins are darker but not the crossveins. In *C. obscurus* all veins are uniformly coloured throughout (Figs 2A,B). Jacobi included an illustration of the forewing in his redescription of *C. obscurus* Kirkaldy. The specimen depicted varies considerably from the wing venation found in *Calamister*, e.g. the specimen pictured has a trifold RP, MA and MP, however in *Calamister* these veins are bifid (Figs 1, 3A), or even in some cases MP unforked (Fig. 2B). Further, Jacobi's specimen shows CuA1 and CuA2 rejoining which does not occur in any of the types. This means there is considerable doubt that the specimen from the Blackall Range is *C. obscurus*—examination of the specimen is needed to clarify this.

***Calamister cougalensis* sp. nov.**

(Figs 1, 3, 5, 6D–F)

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Types. *Holotype*, ♂, AUSTRALIA, Qld: Cougal Creek, Upper Tallebudgera, 80m, 28°12'S 153°21'E, rainforest, 12–14.x.1990 (G. Daniels) (UQIC55277 QM). *Paratypes*, Qld: 1 ♀, same data as holotype (QM); 1 ♂, Nagarijooon Falls, Lamington Nat. Park, S. Qld, 28.x.1955 (J. Stoodley) (QM); 1 ♀ and 1 ♂ or ♀ (abdomen missing, body length indicates female), Lamington Nat. Park, 29.x.1955 (F.A. Perkins) (QM).

Etymology. Named after the type locality, Cougal Creek.

Diagnosis. This species can be distinguished from *C. obscurus* by the presence of darkened areas around the pterostigma, along the hind margin of the forewing and in most cases on the mesonotum, a brown pterostigma and a phallosome bearing two spines ventrally to left-laterally, one of which is almost twice as long as the other.

Colour. Body light brownish-yellow (testaceous), sometimes with an orange or greenish tinge; lateral parts of mesonotum, abdominal sternites, eyes and antennae slightly to distinctly darker. Forewing hyaline with testaceous veins and tubercles; pterostigma mid to dark brown; posterior margin including apical veins and cells darker i.e. distad of apex of clavus.

Morphology. Body length: ♂ 4.7–5.3 mm; ♀ 5.2–5.7 mm.

Head: Vertex 1.5–1.8 x wider than long; apical carina v-shaped, subapical carina u- or v-shaped; median carina of vertex absent or if present, covering up ½ of basal compartment of vertex; basal compartment 2.3–5.3 x longer than apical compartment. Frons 1.4–2.0 x longer than wide. Postclypeus with median carina evanescent; lateral carinae absent or evanescent. Anteclypeus with median carina absent or evanescent; lateral carinae absent. Rostrum very short, reaching mid femur but not hind coxa; apical segment of rostrum shorter than subapical segment.

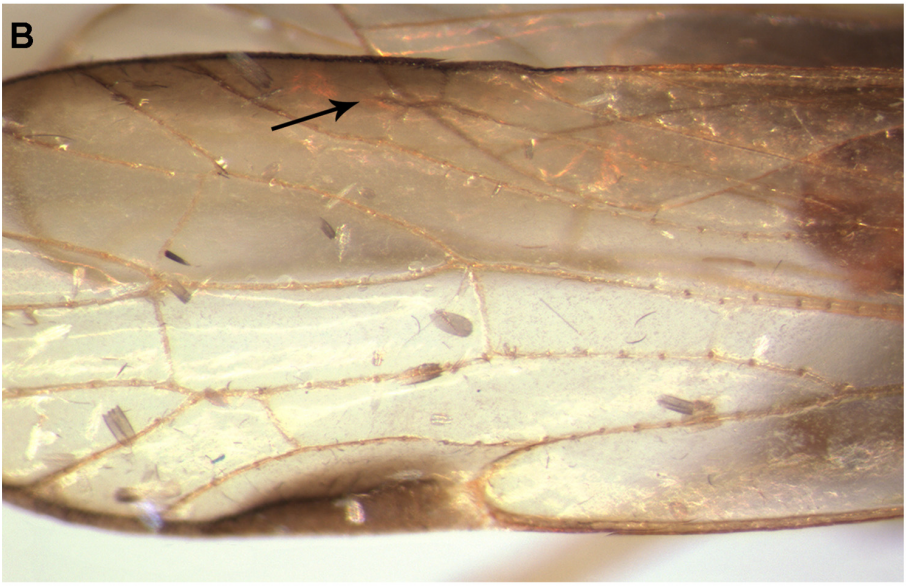


FIGURE 3. *Calamister cougalensis*: A habitus; B forewing with CuA2, highlighted by arrow; C–D head. Scale bar 1mm.

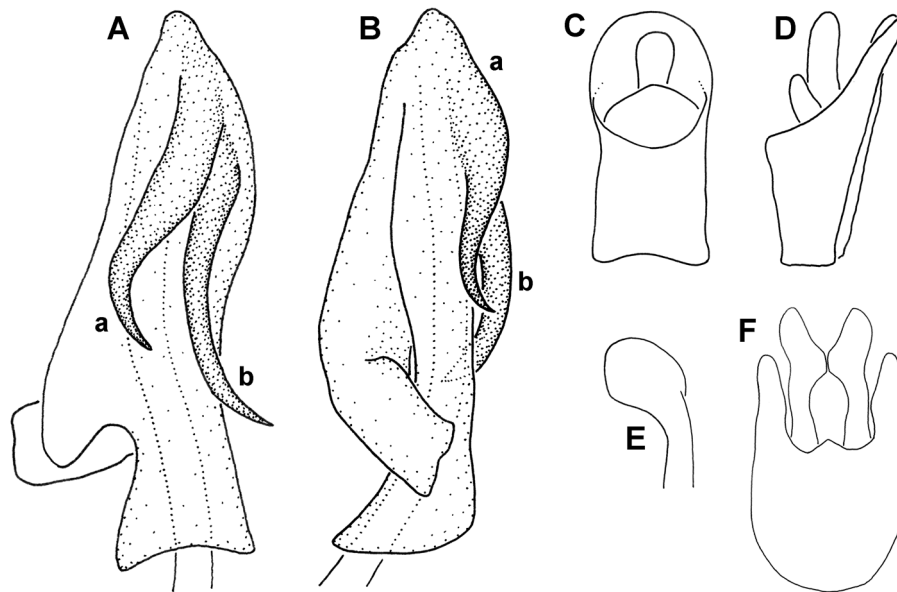


FIGURE 4. *Calamister obscurus*: A aedeagus ventral; B aedeagus left lateral; C–D anal tube; E–F genital styles.

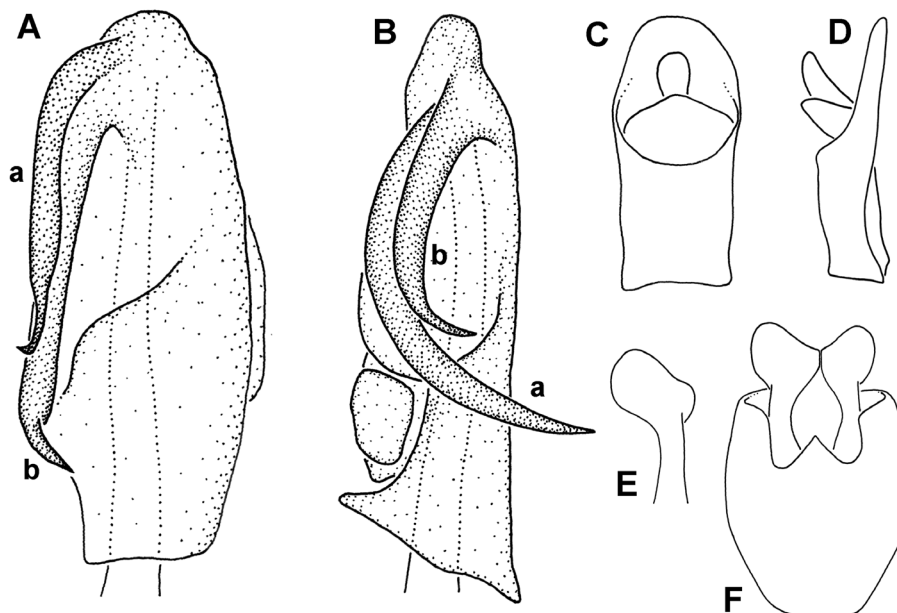


FIGURE 5. *Calamister cougalensis*: A aedeagus ventral; B aedeagus left lateral; C–D anal tube; E–F genital styles.

Thorax: Forewing 3.3–3.4 x longer than wide; costal margin with about 3–7 tubercles; Sc+R+M near basal cell fused, forming a minute common stem Sc+R+M or Sc+R fused, M emerging separately from basal cell; fork of ScRA+RP distad or at same level as fork CuA1+CuA2; position of r-m basad of fork MA+MP; MP apically bifid; vein delimiting subapical cell C4 distinctly distad of vein delimiting C5; subapical cell C5 shorter than C4; CuA2 ending well before it reaches margin of wing; 8 apical cells; 5 anteapical cells. Hind leg: 1st tarsomere with 7 apical teeth and no platellae; 2nd tarsomere with 8 apical teeth and 4 platellae.

Male genitalia: Anal tube as in Figs 5C,D. Pygofer and genital styles as in Figs 5E,F. Aedeagus (Figs 5A,B): Phallosome ventrally to left-laterally with two large, curved spines, unequal in length, with spine (b) almost twice as long as spine (a); spine (a) arising near apex of aedeagus and spine (b) arising right underneath spine (a). Flagellum unarmed.

Female genitalia: Ovipositor, wax plate and anal tube as in Figs 6D–F: wax plate circular to oval shaped; anal tube trapezoid, apex much wider than base.

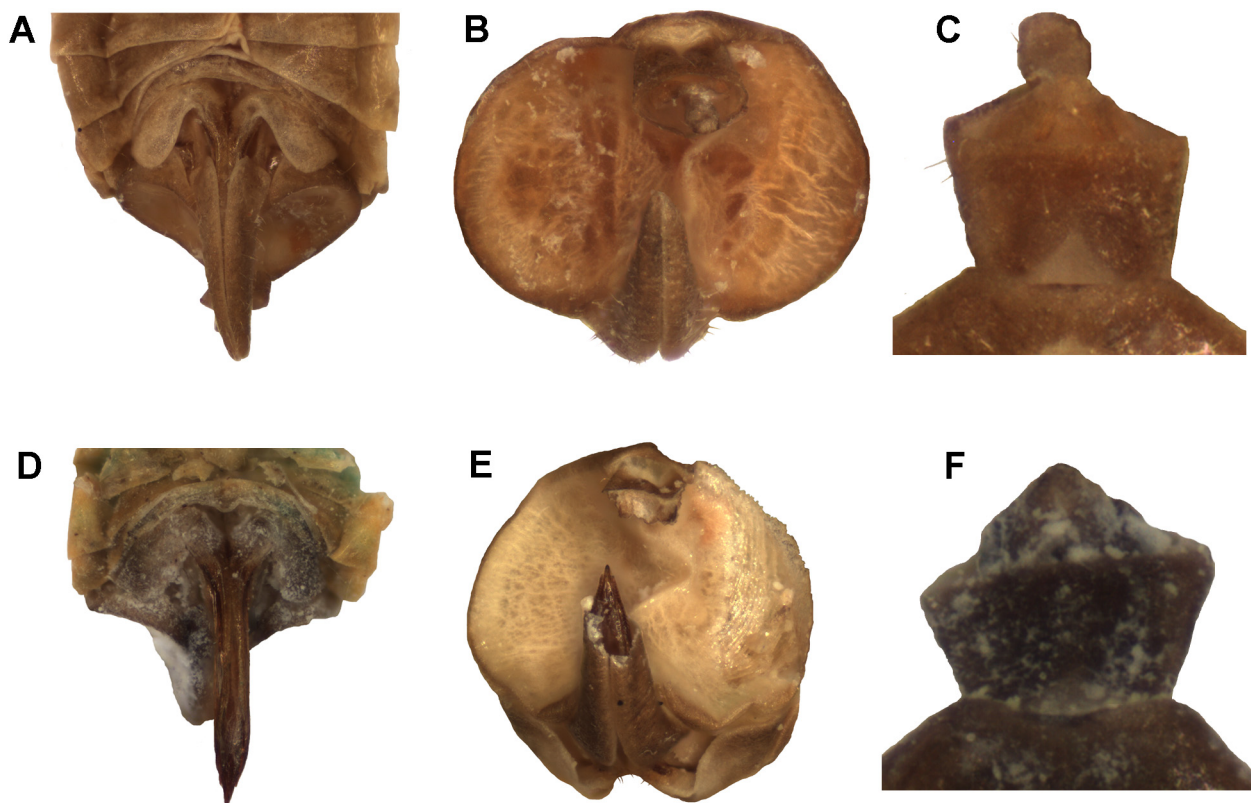


FIGURE 6. Female genitalia. *Calamister obscurus*: A ventral; B caudal; C dorsal. *Calamister cougalensis*: D ventral; E caudal; F dorsal.

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