



Revision of the South American grassland leafhopper genus *Cortona* Oman (Hemiptera: Cicadellidae: Deltocephalinae: Deltocephalini) with description of four new species from Argentina

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Abstract

The South American leafhopper genus *Cortona* is moved from Macrostelini to Deltocephalini and is reviewed. Its type species and four new species, *C. catanachae* sp. n., *C. concordica* sp. n., *C. otamendiensis* sp. n., and *C. silvai* sp. n., are illustrated and described from Argentina. A checklist and a key to species are provided.

Key words: Auchenorrhyncha, morphology, taxonomy, new species

Introduction

Oman (1938) established the leafhopper genus *Cortona* with type species *Cortona minuta* from Argentina, including it in subfamily Jassinae. The genus originally comprised only the type species, known solely from the holotype male specimen. Subsequently, Linnavuori (1959) illustrated the male genitalia of *C. minuta* and placed *Cortona* in the deltocephaline tribe Macrostelini based on the presence of only two anteapical cells in the forewing. In their checklist of world leafhopper genera, Oman *et al.* (1990) listed *Cortona* as belonging to tribe Deltocephalini but did not provide explicit justification for this placement. In the morphology-based phylogeny of Knight and Webb (1993), *Cortona* nested well within a clade comprising other genera of Macrostelini. Knight and Webb (1993) considered this placement "anomalous" while tentatively retaining the genus in Macrostelini. Zahniser and Dietrich (2013) also listed the genus under Macrostelini. In the present paper, *Cortona* is moved to Deltocephalini based on characteristics of the male genitalia, particularly the linear connective fused to the aedeagus, and is reviewed. The type species of *Cortona* and four new species are illustrated and described from Argentina. A checklist and a key to species are provided.

Material and methods

The material studied here is deposited in the Museo de La Plata, La Plata, Buenos Aires, Argentina [MLP] and the Illinois Natural History Survey [INHS]. Morphological terminology follows Dietrich (2005). Digital photographs were taken with a QImaging Micropublisher 3.3 digital camera mounted on an Olympus BX41 stereo microscope and with a Nikon D1x digital SLR camera configured with lenses by Microptics, Digital Lab XLT system. Photographs were modified with Adobe Photoshop CS.

Taxonomy

Subfamily Deltocephalinae

Tribe Deltocephalini

Cortona Oman

Cortona Oman, 1938: 390. Type species: *Cortona minuta* Oman, 1938.

Coloration and morphology. Overall coloration pale yellowish to orange, with darker markings, if present, restricted to legs and sternites, variable intraspecifically. Face mostly pale brown to orange with paired white arcs corresponding to muscle scars of frontoclypeus. Forewing hyaline. Mesosternum pale brown to orange. Legs and abdomen mostly pale, with or without small, symmetrically arranged dark maculae.

Head much wider than pronotum, crown flat, distance between eyes slightly narrower than eye width, anterior margin distinctly angulate in dorsal view, rounded to face, glabrous medially, finely granulose laterally; ocellus small, separated from eye by approximately one ocellar diameter on anterior margin. Face relatively flat, shagreen, width greater across eyes than length; frontoclypeus relatively narrow; clypeal suture usually well-developed, slightly arcuate; eye emarginate adjacent to antenna; antenna longer than width of head; gena obtusely emarginate below eye; lorum semicircular, narrower than anteclypeus, well separated from lateral and ventral margins of face; anteclypeus flat, slightly to moderately tapered from base to apex, apex truncate and even with lower margin of gena.

Pronotum with fine transverse striations, lateral margin very short, eye nearly touching forewing base. Forewing of male macropterous, with two anteapical cells, vein R usually with 3 branches (second branch sometimes missing), crossvein r-m1 long and oblique, m-cu2 absent (inner anteapical cell open), second apical cell narrower than first and third, clavus with crossvein connecting 1A with claval suture; appendix well-developed but narrow. Hind wing of male well-developed with venation complete. Forewing of female rarely as in male, usually brachypterous with apex obliquely truncate and not extended beyond posterior margin of abdominal segment IV, venation well delimited and as in male except apical cells extremely short and other cells also relatively short. Hind wing of female rarely as in male, usually vestigial. Front femur row AV with 5 setae moderately large and widely spaced in basal half, intercalary row with 7–8 fine setae; tibia with dorsal macrosetal formula 1+4. Middle femur relatively wide compared to front femur, with 7 stout AV setae in basal half and AV1 present. Hind femur macrosetal formula 2+2+1; tibia with ca. 15, 10, and 12 macrosetae in rows PD, AD, and AV, respectively, PD macrosetae alternating short and long, AD with short setae between macrosetae; tarsomere I with two rows of plantar setae, pecten with 3 platellae, medial and lateral setae of pecten tapered and slightly longer than platellae; tarsomere II with 2 platellae and 2 tapered flanking setae of same length.

Male genitalia. Pygofer weakly sclerotized dorsally, incised dorsally to or beyond midlength, without appendages, apex of lobe rounded, with numerous macrosetae in distal half. Segment X short and unsclerotized dorsally. Valve subtriangular with posterior margin sharply angulate. Subgenital plates articulated to valve, lateral margin concave, with uniseriate macrosetae arising laterally, apex acute, with several long, fine setae. Style with articulating arm short to long; preapical lobe distinct; apophysis fingerlike. Connective arms close to each other, stem long, fused to aedeagus. Aedeagus with shaft tubular or depressed, sinuate or curved dorsad in lateral view, with pair of appendages arising at or beyond midlength and extended distally (vestigial in *C. concordica*), gonopore preapical on ventral surface.

Female abdomen. Tergite VIII with grouped macrosetae near lateral margin. Pygofer with numerous macrosetae laterally near base forming continuous band with larger group of macrosetae in distal half. Sternite VIII membranous or very weakly sclerotized, concealed by sternite VII in repose. Sternite VII truncate with median lobe arising preapically, overlapping posterior margin, varying in shape interspecifically. First valvula evenly tapered from near base to acuminate apex, dorsal sculpturing imbricate, extended to dorsal margin, ventral sculpturing reticulate. Second valvula very slightly broadened distad of dorsal cleft, then tapered to acuminate apex, dorsal margin irregularly serrate in distal half with teeth small and somewhat widely spaced.

Distribution. Argentina.

Remarks. Linnavuori (1959), Knight and Webb (1993), and Zahniser and Dietrich (2013) placed the genus

Cortona in Macrostelini based on the forewing having only two anteapical cells, however, Oman *et al.* (1990) listed it under Deltocephalini. We place this genus in Deltocephalini based on characteristics of the male genitalia, particularly the linear connective fused to the aedeagus. In Linnavuori's (1959) key to genera, most species here included in *Cortona* key out to couplet 9 (aedeagus with long appendages). However, *Cortona* may be easily separated from genera that key to the same couplet in Linnavuori (1959), as well as other South American Deltocephalini, by the presence of only two anteapical cells in the forewing, the absence of a claw-like pygofer appendage (present in *Tumupasa*), and absence of a distinct socle (present in *Loreta* (*Bahitella*) and *Haldorus*). Overall, *Cortona* may be separated from other Deltocephalini by the following combination of characteristics: head much wider than pronotum; forewing with two anteapical cells; males macropterous and females usually brachypterous.

Cortona was previously known solely from the male holotype of the type species collected in 1931 from Loreto, Misiones Province, northern Argentina. Recent samples collected in Argentina, mostly by vacuum sampling in native grasslands, yielded additional specimens of the type species including the first females, as well as specimens of four new species, all represented by both males and females. In contrast to the males, which have fully developed wings, all but one of the female specimens studied are brachypterous (see remarks under individual species below). Brachypterous females of *Cortona* resemble those of *Lonatura*, a North American genus of Deltocephalini in which both males and females are usually brachypterous, but may be distinguished by the larger eyes, shorter lateral pronotal margin, and the presence of macrosetae on the tergum of the pregenital abdominal segment.

Checklist of species of *Cortona* Oman

Cortona catanachae sp. n. Argentina.

Cortona concordica sp. n. Argentina.

Cortona minuta Oman, 1938. Argentina.

Cortona otamendiensis sp. n. Argentina.

Cortona silvai sp. n. Argentina.

Key to species of *Cortona* Oman

1. Aedeagus in ventral view distinctly broadened at or beyond midlength (Fig. 2G); female sternite VII median lobe with distinctly contrasting dark pigment and occupying less than half total width of sternite (Fig. 11E–G). 2
- Aedeagus in ventral view evenly tapered through most of length, at most only slightly broadened preapically (Fig. 8E); female sternite VII median lobe without distinctly contrasting dark pigment and occupying more than half total width of sternite (Figs 11H–I). 4
2. Aedeagal shaft in ventral view broad apically with deep emargination (Fig. 2G); female sternite VII median lobe trilobed at apex (Figs 11E–F). 3
- Aedeagal shaft in ventral view slender and tapered apically (Figs 6E–F); female sternite VII with median lobe narrow and elongate (Fig. 11G). *Cortona silvai* sp. n.
3. Aedeagus with lateral appendages not extended to apex (Figs 2F–G). *Cortona minuta*
- Aedeagus with lateral appendages extended nearly to apex (Figs 4F–G). *Cortona catanachae* sp. n.
4. Aedeagus with apical appendages distinct, apex of shaft appearing bifid (Fig. 8E). *Cortona otamendiensis* sp. n.
- Aedeagus with apical appendages vestigial, apex appearing acuminate (Figs 10C–D). *Cortona concordica* sp. n.

Cortona minuta Oman

(Figs 1–2, 11A–E)

Cortona minuta Oman, 1938: 390.

Length. Male: 2.1–2.3 mm (n=4); female: 2.8–3.0 mm (n=3).

Morphology. Crown longer than distance between eyes (Fig. 1A–B). Male anteclypeus distinctly tapered distally (Fig. 1E).

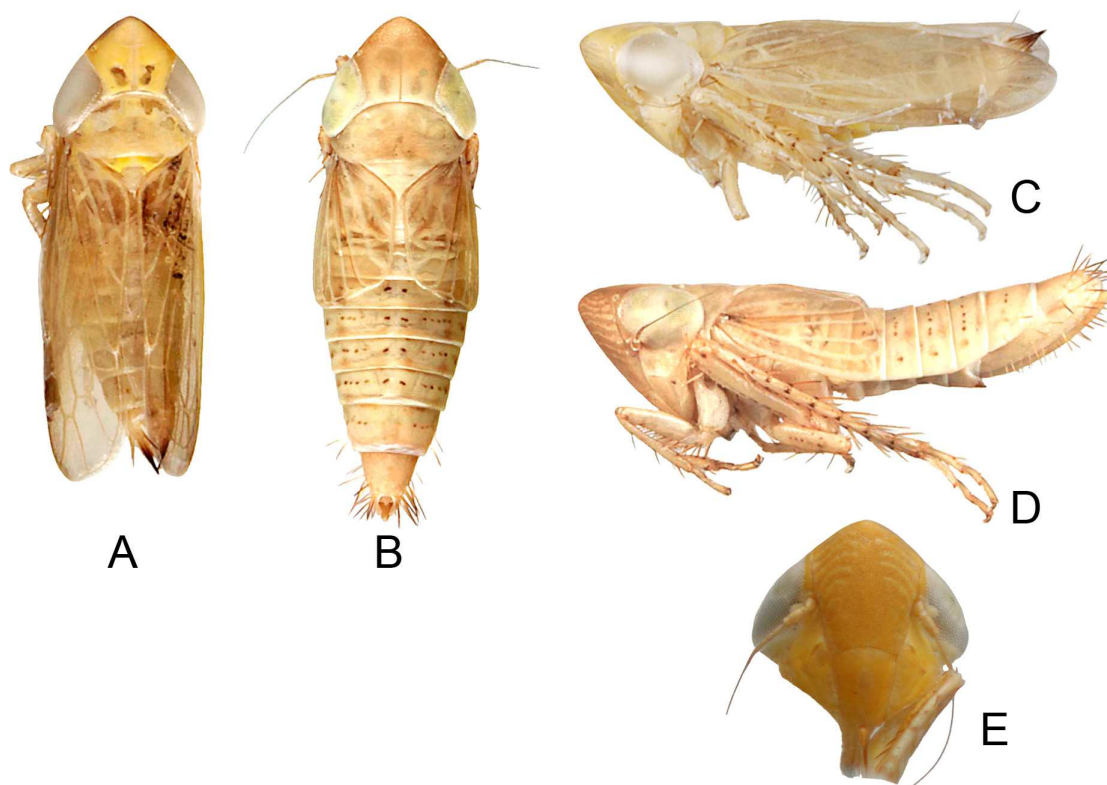


FIGURE 1. *Cortona minuta* A, male habitus, dorsal view; B, brachypterous female habitus, dorsal view; C, male habitus, lateral view; D, brachypterous female habitus, lateral view; E, male face.

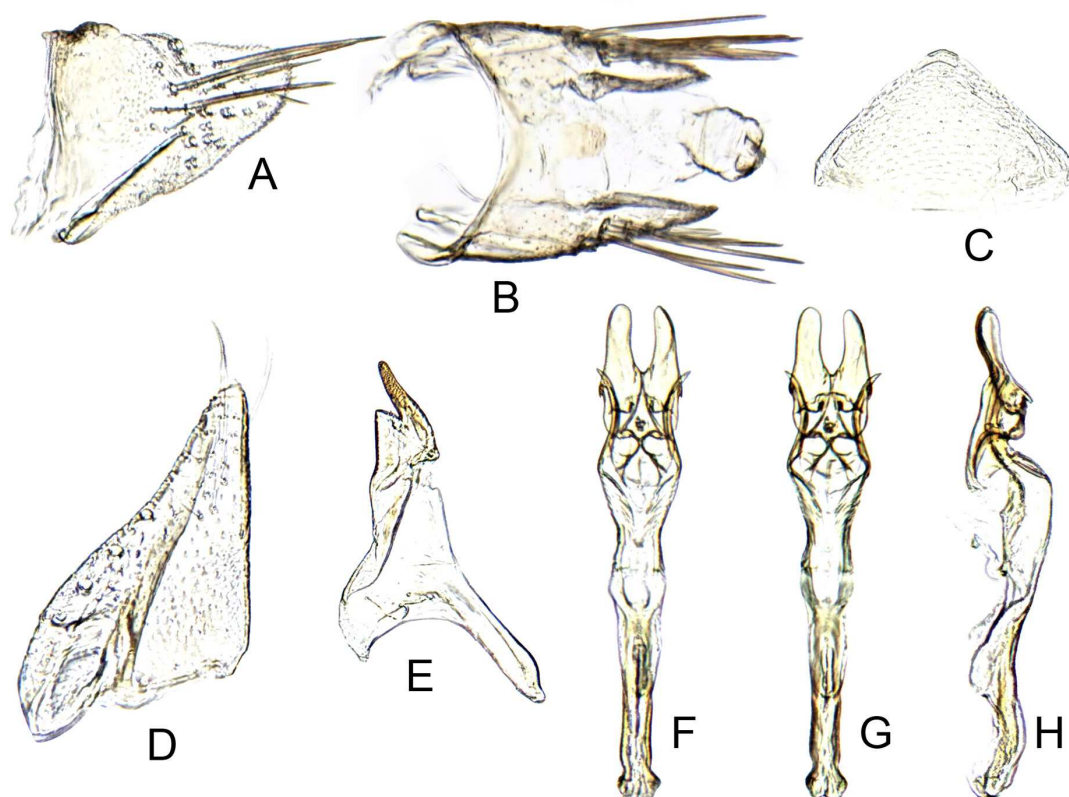


FIGURE 2. *Cortona minuta* A, male pygofer lobe, lateral view; B, male pygofer and segments X–XI, dorsal view; C, valve, ventral view; D, subgenital plate, ventral view; E, style, dorsal view; F, G, H, connective and aedeagus, dorsal, ventral and lateral view, respectively.

Male genitalia. Subgenital plate short, lateral margin distinctly concave (Fig. 2D). Style with articulating arm long; preapical lobe angulate; apophysis short, strongly laterally curved (Fig. 2E). Connective shorter than aedeagus. Aedeagus broadly and deeply bifid apically, with pair of slender appendages directed apicad on dorsal surface, curved away from each other and not extended to shaft apex, distal depressed portion of shaft with pair of small lateral teeth directed basad subapically (Fig. 2F–H).

Female abdomen. Sternite VII with median lobe overlapping slightly more than half total width of posterior margin, trilobed, median lobe acutely pointed and slightly longer and narrower than lateral lobes, darkly pigmented (Fig. 11E).

Material examined. 2 males, Argentina: Entre Rios, Federación Siriri Campgd, 30 m, 30° 58'6" S, 57° 56'38" W, 4 January 2008, C. H. Dietrich, Hg vapor lights, AR2–1; 2 males, 3 females, Argentina: Entre Rios, P.N. El Palmar, Calera del Palmar, 38 m, 31° 52'27" S, 58° 12'34" W, 14 February 2014, C. H. Dietrich, vacuum, AR14–20–2 [INHS].

***Cortona catanachae* sp. n.**
(Figs 3–4, 11F)

Length. Male: 2.4–2.8 mm (n=6), female: 3.6–3.7 mm (n=5).

Morphology. Crown nearly as long as distance between eyes (Fig. 3A). Male anteclypeus slightly tapered, nearly parallel-sided (Fig. 3D).

Male genitalia. Subgenital plate long, lateral margin slightly concave (Fig. 4C). Style with articulating arm long; preapical lobe angulate; apophysis short, laterally curved (Fig. 4D). Connective shorter than aedeagus. Aedeagus broadly and deeply bifid apically, with pair of long slender appendages extended nearly to apex on dorsal surface, close to each other, distal depressed section of shaft with pair of lateral teeth directed basad subapically (Fig. 4F–H).

Female abdomen. Sternite VII with median lobe covering approximately half of posterior margin, trilobed, median lobe subtruncate and approximately same width as lateral lobes, with pair of arcs of dark pigment (Fig. 11F).

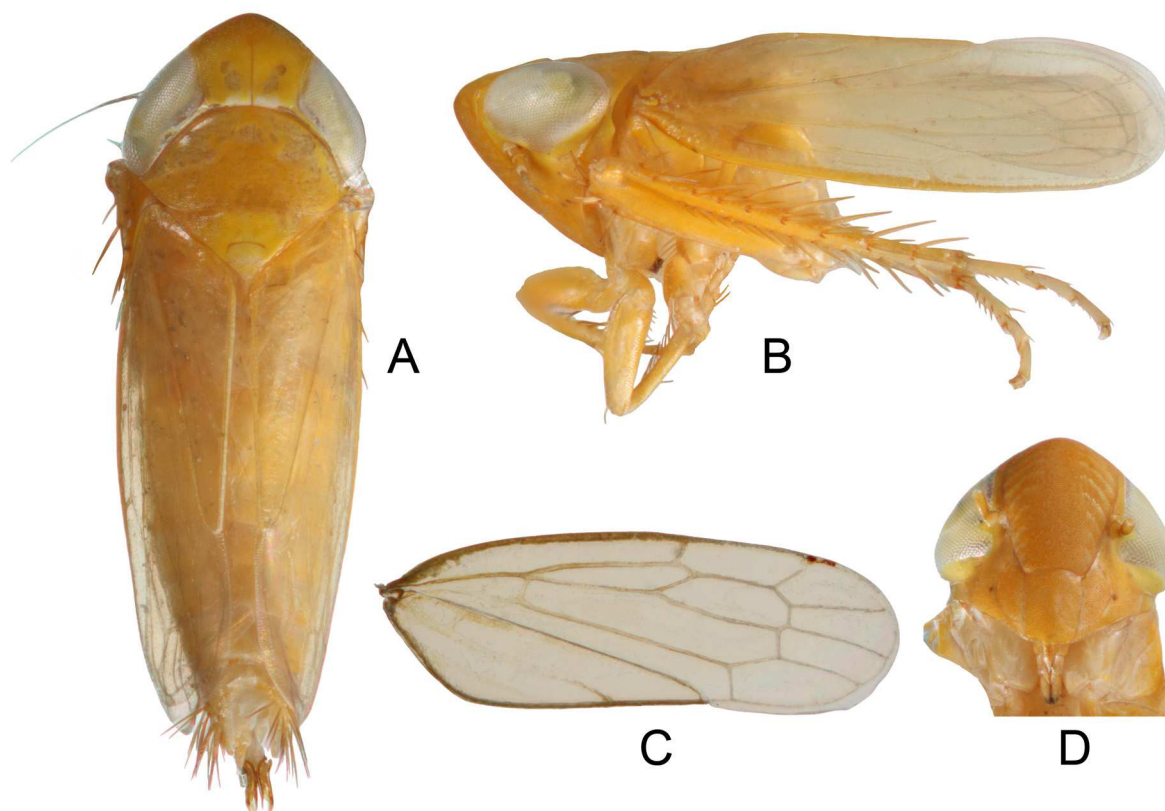


FIGURE 3. *Cortona catanachae* sp. n. male: A, habitus, dorsal view; B, habitus, lateral view; C, forewing; D, face.

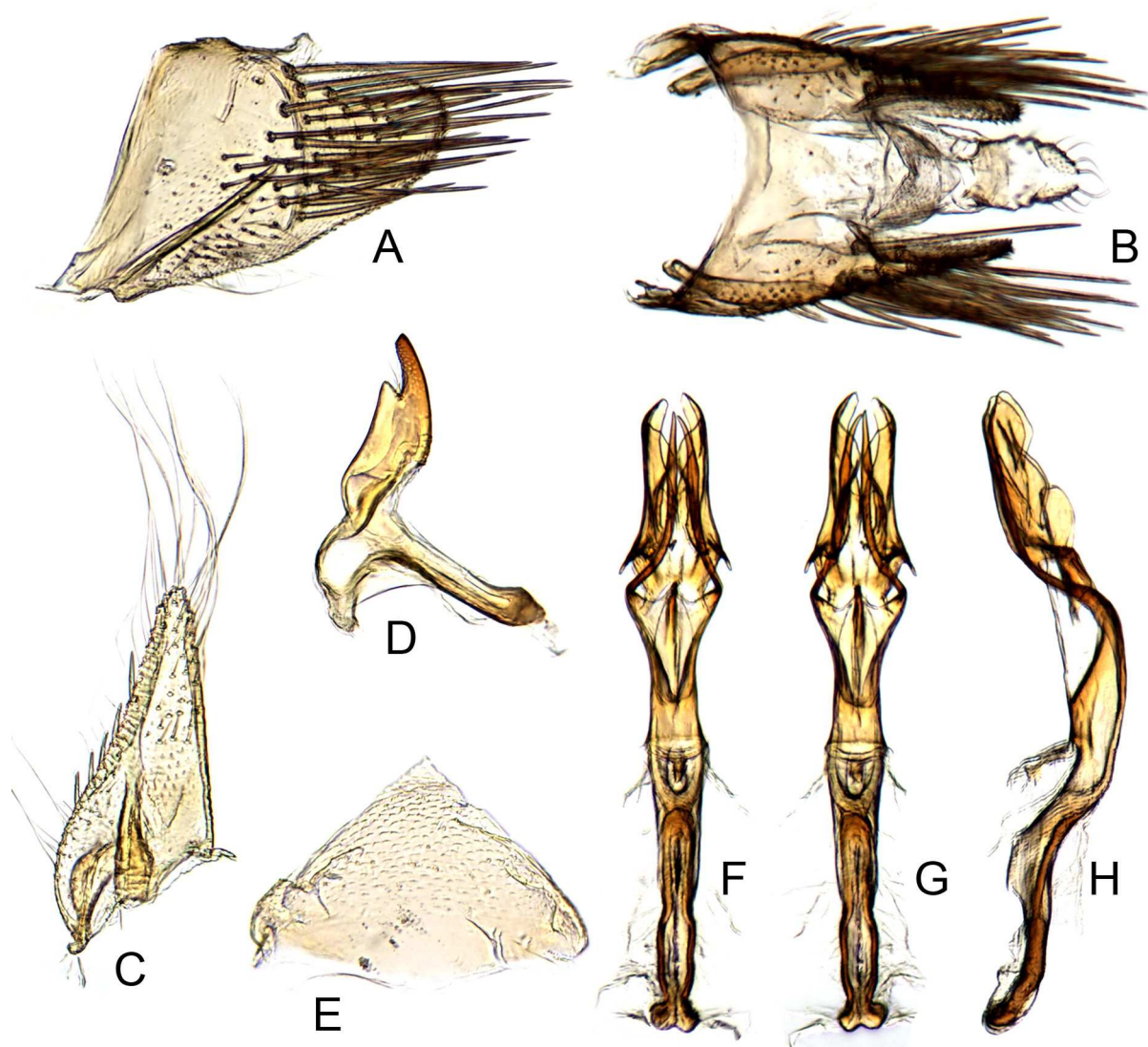


FIGURE 4. *Cortona catanachae* sp. n. A, male pygofer lobe, lateral view; B, male pygofer and segments X–XI, dorsal view; C, subgenital plate, ventral view; D, style, dorsal view; E, valve, ventral view; F, G, H, connective and aedeagus, dorsal, ventral and lateral view, respectively.

Material examined. Holotype: male, Argentina: Chaco, P.N. Chaco, 70 m, 26° 48'50" S, 59° 36'52" W, 12 Jan 2008, T. Catanach, vacuum, AR10–14 [MLP]. **Paratypes:** 2 males, same data as holotype; 1 male, Argentina: Chaco P.N. Chaco, 70 m, 26° 48'50" S, 59° 36'52" W, 10 Jan 2008, C. H. Dietrich, vacuum, AR10–5; 1 male, 5 females, Argentina: Chaco, P.N. Chaco, 70 m, 26° 48'50" S, 59° 36'52" W, 10 Jan 2008, C. H. Dietrich, vacuum, AR10–9; 1 male, Argentina: Chaco P.N. Chaco, 70 m, 26° 48'50" S, 59° 36'52" W, 10 Jan 2008, A. Gonçalves, vacuum, AR10–10 [INHS].

Etymology. This species is named for T. Catanach who collected the holotype.

Remarks. This species closely resembles *C. minuta* but differs in having the distal cleft portion of the aedeagus more elongate with concave lateral margins and lateral spines near the base, and the aedeagal appendages extended nearly to the apex (Fig. 4F–H).

Cortona silvai sp. n.

(Figs 5–6, 11G)

Length. Male: 2.6–2.8 mm (n=3); female: 3.7–3.8 mm (n=3).

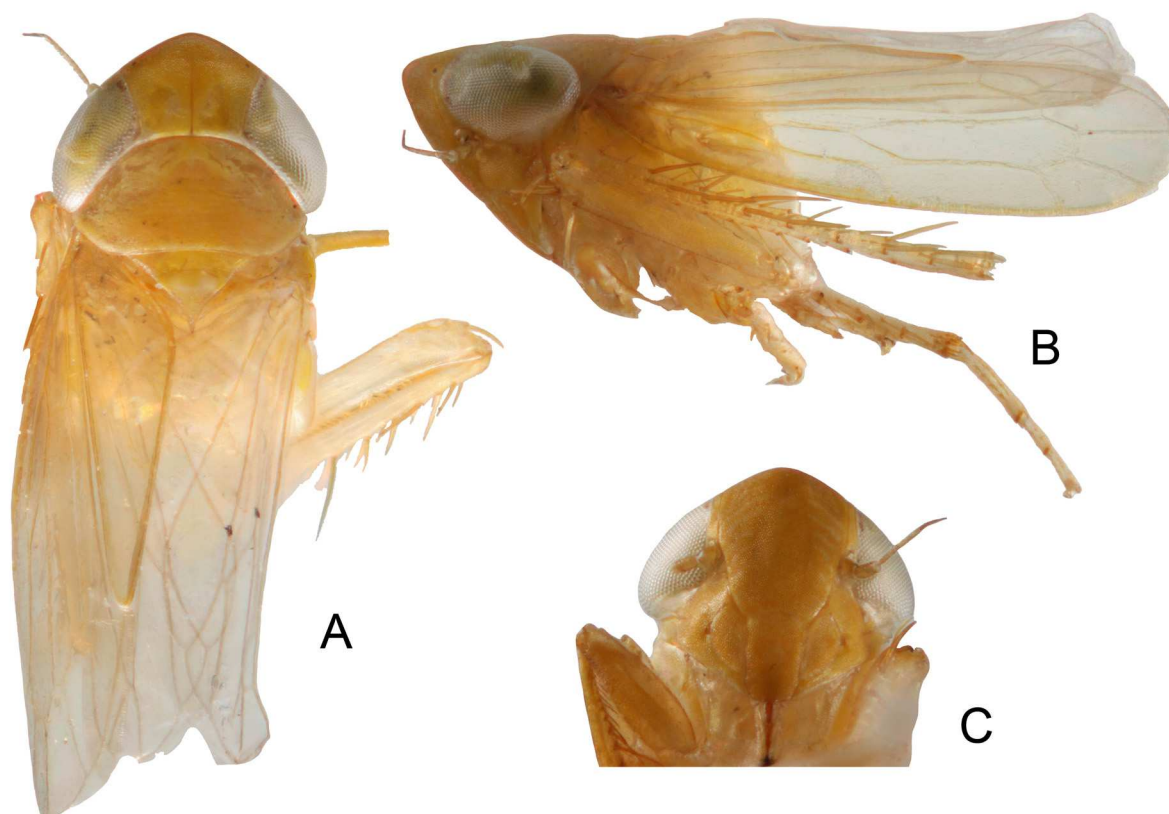


FIGURE 5. *Cortona silvai* sp. n. male: A: habitus, dorsal view; B: habitus, lateral view; C: face.

Morphology. Crown nearly as long as distance between eyes (Fig. 5A). Male anteclypeus nearly parallel-sided (Fig. 5C).

Male genitalia. Subgenital plate long, lateral margin slightly concave (Fig. 6C). Style with articulating arm long; preapical lobe rectangle; apophysis very short, laterally curved (Fig. 6D). Connective as long as aedeagus. Aedeagus not bifid apically, a pair of long subbasal appendages directed apicad on the dorsal surface (Fig. 6E–F).

Female abdomen. Sternite VII with median lobe very narrow and digitiform, darkly pigmented in distal two-thirds (Fig. 11G).

Material examined. Holotype: male, Argentina: Corrientes P. N. Mburucuyá 1.4 km W campgd, 80 m, 28° 1'795" S, 58° 5'20" W, 8 January 2008, L. Silva, vacuum, AR9–2 [MLP]. **Paratypes:** 2 males, same data as holotype; 3 females, Argentina: Corrientes, P.N. Mburucuyá, 1.8 km W campgd., 80 m, 28° 1'11" S, 58° 3'18" W, 8 January 2008 C. H. Dietrich, vacuum, AR9–4 [INHS].

Etymology. This species is named for L. Silva who collected the holotype.

Remarks. This species is readily distinguishable from all others within *Cortona* by the aedeagus with the apex tubular rather than cleft and with a pair of robust appendages arising near the midlength of the shaft and directed posterolaterad (Fig. 6E–F).

***Cortona otamendiensis* sp. n.**
(Figs 7–8, 11H)

Length. Male: 2.4 mm (n=5); female: 3.1 mm (n=4).

Morphology. Crown longer than distance between eyes (Fig. 7A). Male anteclypeus tapered distally (Fig. 7C).

Male genitalia. Subgenital plate long, lateral margin distinctly concave (Fig. 8C). Style with articulating arm short; preapical lobe rectangular; apophysis thick fingerlike, apex subtruncate (Fig. 8D). Connective shorter than aedeagus. Aedeagus slender, tapered from base to apex, curved dorsad with pair of slender apical appendages directed distad (Fig. 8E–F).

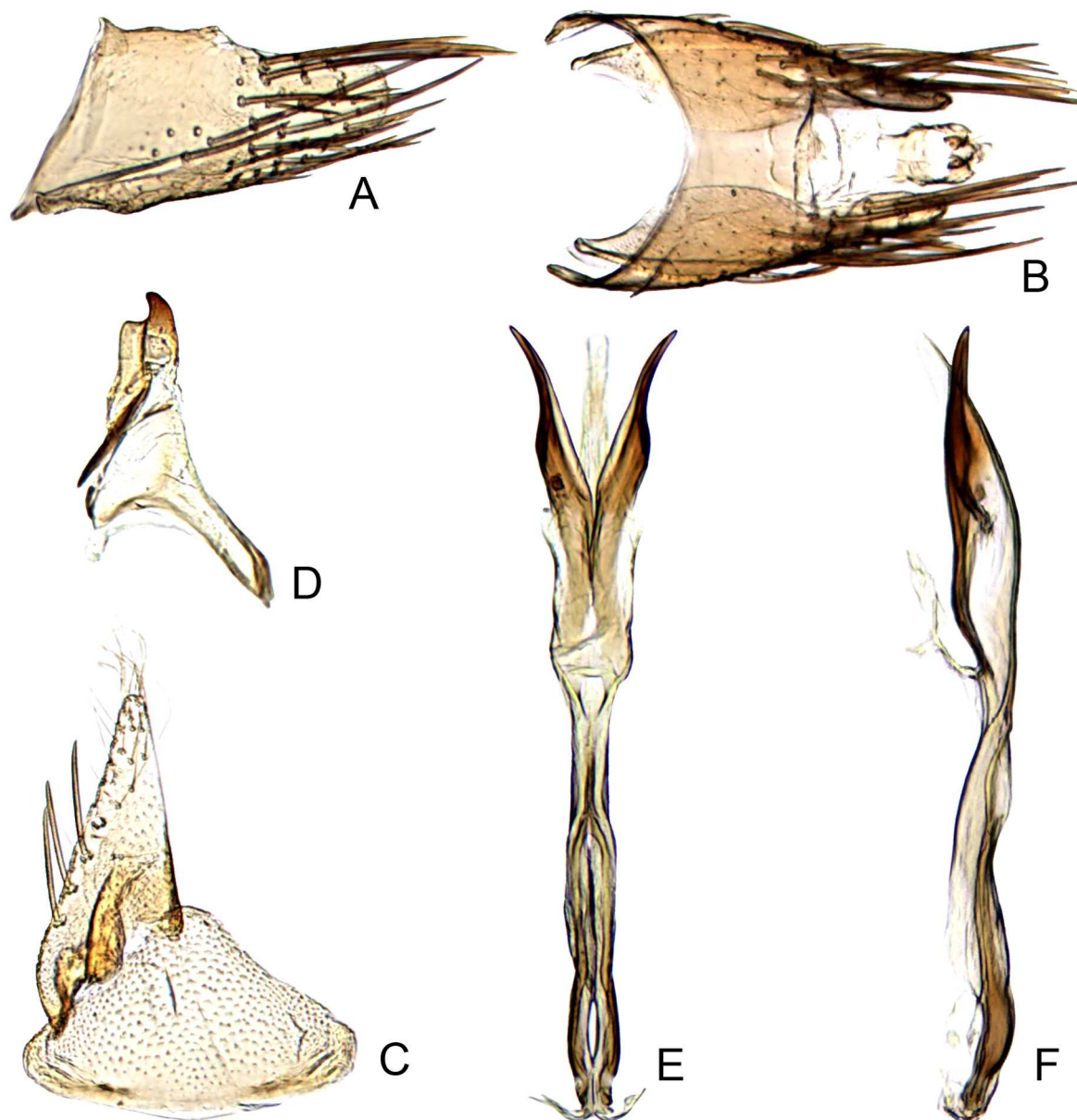


FIGURE 6. *Cortona silvai* sp. n. A, male pygofer lobe, lateral view; B, male pygofer and segments X–XI, dorsal view; C, valve and subgenital plate, ventral view; D, style, dorsal view; E, F, connective and aedeagus, dorsal and lateral view, respectively.

Female abdomen. Sternite VII with median lobe covering approximately two-thirds of posterior margin, trilobed, median lobe slightly narrower and more produced than lateral lobes, with dark pigment indistinct (Fig. 11H).

Material examined. Holotype: male, Argentina: Buenos Aires ca. Reserva Otamendi, 10 m, 34° 13'57" S, 58° 53'50" W, 23 Jan 2008, C. H. Dietrich, vacuum, AR37–4 [MLP]. **Paratypes:** 4 females, same data as holotype; 1 male, same data except lot #AR37–8; 3 males, Argentina: Entre Rios, Rt. 14 5 km N Guayaguaychu, 20 m, 32° 58'0" S, 58° 35'18" W, 16 February 2014, 16 February 2014, C. H. Dietrich, vacuum, AR14–30–1 [INHS].

Etymology. The name is an adjective derived from the holotype locality.

Remarks. This species is readily distinguishable from all others within *Cortona* by the aedeagus with a pair of short apical appendages directed apicad, and shaft curved 70° dorsad with a slim apex in lateral view (Fig. 8E–F).

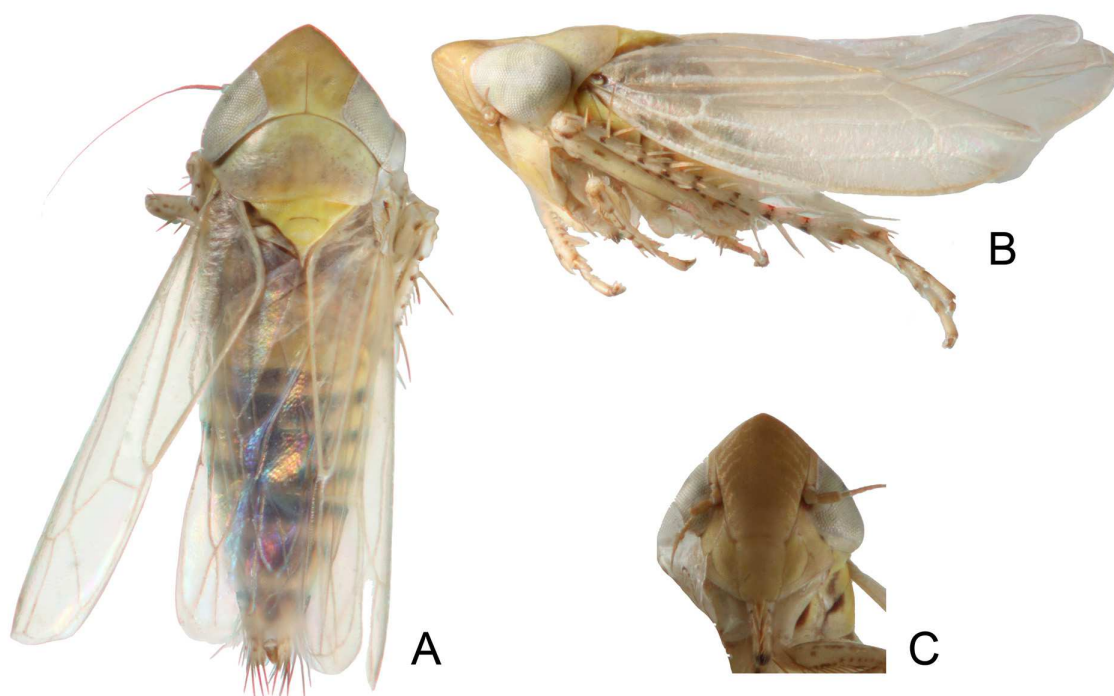


FIGURE 7. *Cortona otamendiensis* sp. n. male: A, habitus, dorsal view; B, habitus, lateral view; C, face.

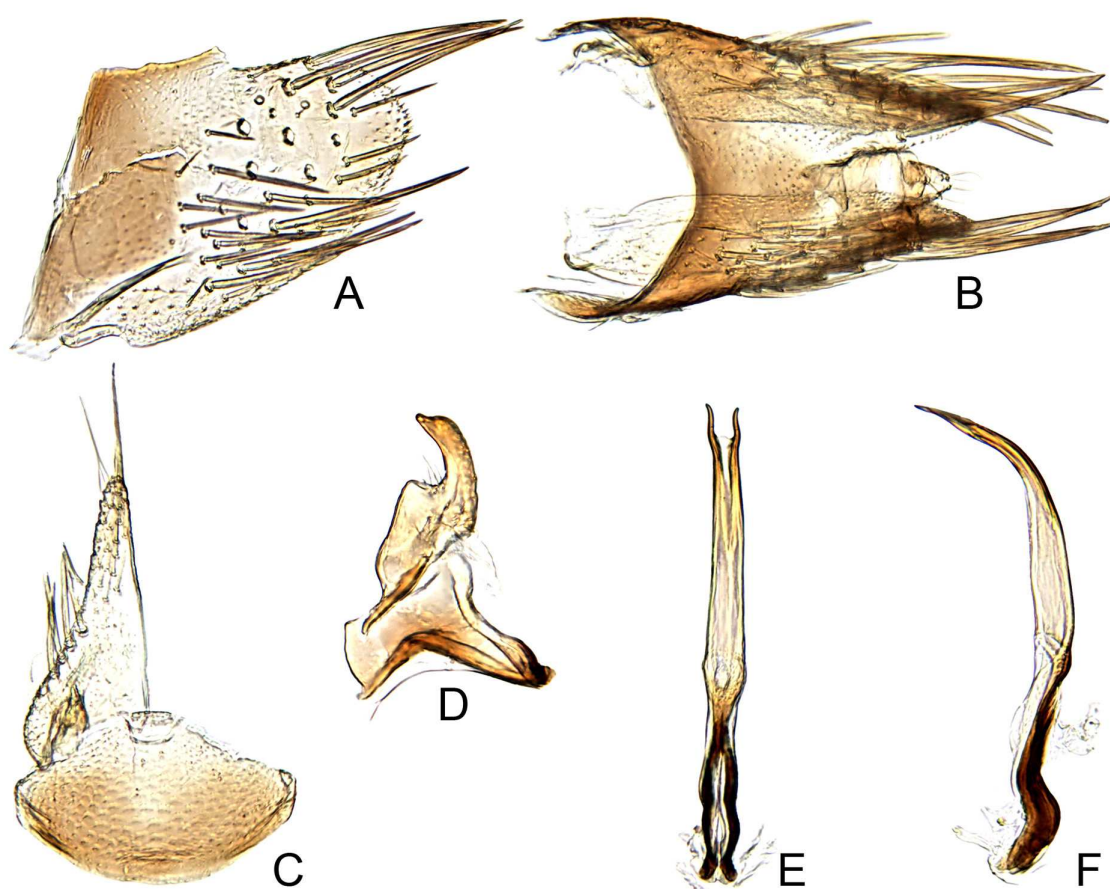


FIGURE 8. *Cortona otamendiensis* sp. n. A, male pygofer lobe, lateral view; B, male pygofer and segments X–XI, dorsal view; C, valve and subgenital plate, ventral view; D, style, dorsal view; E, F, connective and aedeagus, dorsal and lateral view, respectively.

***Cortona concordica* sp. n.**

(Figs 9–10, 11I)

Length. Male: 2.6 mm (n=1); female: 2.9–3.5 mm (n=4).

Morphology. Crown longer than distance between eyes (Fig. 9A–C). Male anteclypeus tapered distally.

Male genitalia. Subgenital plate long, lateral margin distinctly concave. Style with articulating arm short; preapical lobe rectangular; apophysis slender, strongly curved, apex acuminate with small preapical tooth (Fig. 10B). Connective shorter than aedeagus (Fig. 10C, 10E). Aedeagus slender, tapered from base to strongly acuminate apex, curved dorsad with distal appendages vestigial (Fig. 10C–E).

Female abdomen. Sternite VII with median lobe covering approximately two-thirds of posterior margin, trilobed, median lobe slightly narrower and more produced than lateral lobes, with dark pigment indistinct (Fig. 11I).

Material examined. Holotype: male, Argentina: Entre Rios, Rt. 14 km 275, ca. Concordia, 50 m, 31° 19'15" S, 58° 5'8" W, 4 January 2008, C. H. Dietrich, vacuum, AR1–1 [MLP]. **Paratypes:** 4 females, same data as holotype [INHS].

Etymology. The name is an adjective derived from the type locality.

Remarks. This is the only member of the genus without distinct appendages on the aedeagus, although vestiges of distal appendages are visible when the apex of the shaft is examined at high magnification (Fig. 10D). The lack of distinct aedeagal appendages and the acuminate shape of the aedeagus give the aedeagus of this species a resemblance to the condition commonly present in the Old World genus *Maiestas*. This species is placed in *Cortona* because it is nearly identical to other *Cortona* species in external morphology and male and female genital morphology. One of the examined females is macropterous.

Discussion

The five species here included in *Cortona* are remarkably similar in nearly all aspects of their external morphology, but the aedeagus of the male exhibits variation that would normally cause some of these species to be placed in a different genus. They are here retained in the same genus because the different species exhibit an apparent morphological transition series, either from simple to complex or vice versa. The most complex forms are represented by *C. minuta* and *C. catanachae*, both of which have the apical portion of the aedeagus broad and depressed with a deep apical cleft, similar to that observed in species of *Graminella*. Both of these species also have a pair of slender lateral appendages arising from the aedeagal shaft and extended distad. In *C. silvai*, the distal part of the shaft is present but simple and tubular, without a medial cleft, while the lateral appendages are relatively large and robust. In *C. otamendiensis*, the distal portion of the shaft is completely vestigial and only the lateral appendages are present. In *C. concordica*, the appendages are absent and the aedeagal shaft is a simple, tubular structure that appears strongly tapered to an acuminate apex, similar to the condition found in the Old World genus *Maiestas*. Phylogenetic analysis will be needed to test the hypothesis that these different forms represent a linear transformation series.

All the specimens examined for this study were collected in mesic native grasslands typical of the Pampas biome of northeastern Argentina, and nearly all were obtained by vacuuming although two males of the type species were collected at lights. The apparent rarity of species of the genus and absence of records from other parts of South America may be because vast areas of South American native grasslands have never been sampled by vacuuming. Presumably, like other species of *Deltocephalini* for which ecological data are available, *Cortona* species feed deep within the tussocks of native perennial bunch grasses and are difficult to capture using other collecting methods. The second author has sampled by vacuuming in several other grassland regions of South America including the tropical grasslands of the Brazilian cerrado and high altitude grasslands in Chile and Peru but *Cortona* has, so far, only been collected in Argentina, suggesting that the genus is endemic to the temperate grasslands of the Argentinean pampas.

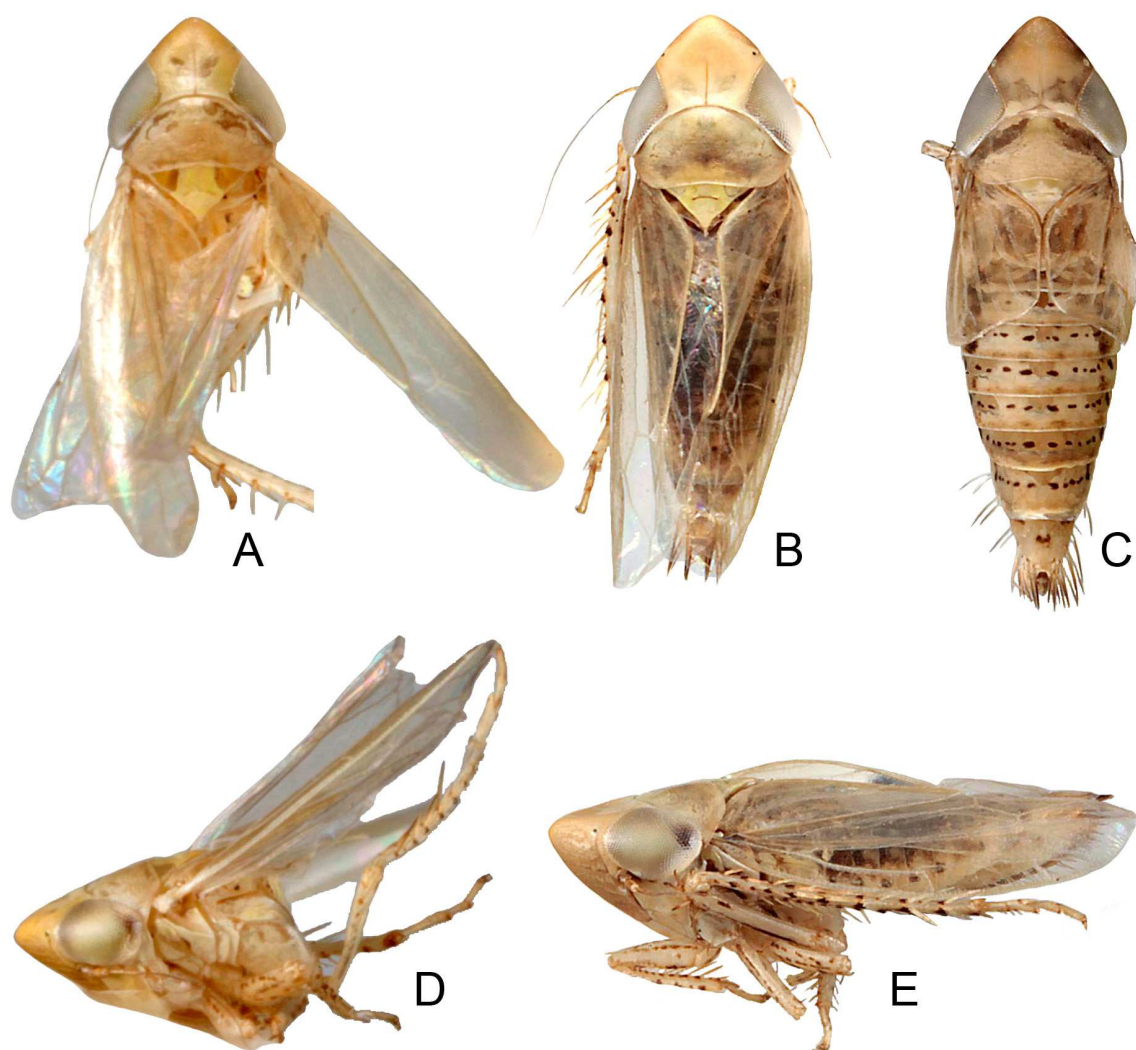


FIGURE 9. *Cortona concordica* sp. n. A, male habitus, dorsal view; B, macropterous female habitus, dorsal view; C, brachypterous female habitus, dorsal view; D, male habitus, lateral view; E, macropterous female habitus, lateral view.

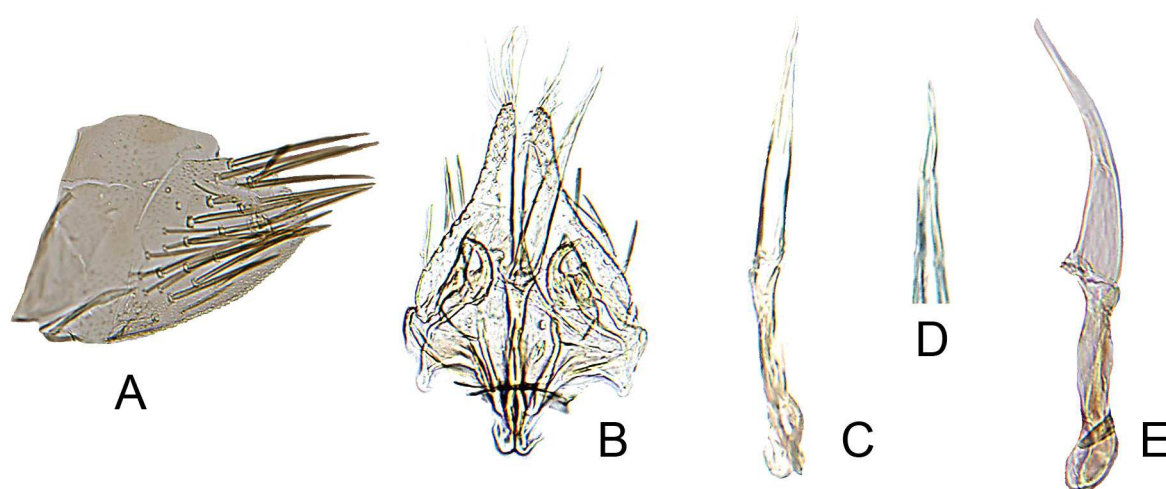


FIGURE 10. *Cortona concordica* sp. n. A, male pygofer lobe, lateral view; B, valve, subgenital plates, styles, connective, and aedeagus, ventral view; C, E, connective and aedeagus, ventral view and lateral view, respectively; D, detail of apex of aedeagus, ventral view.

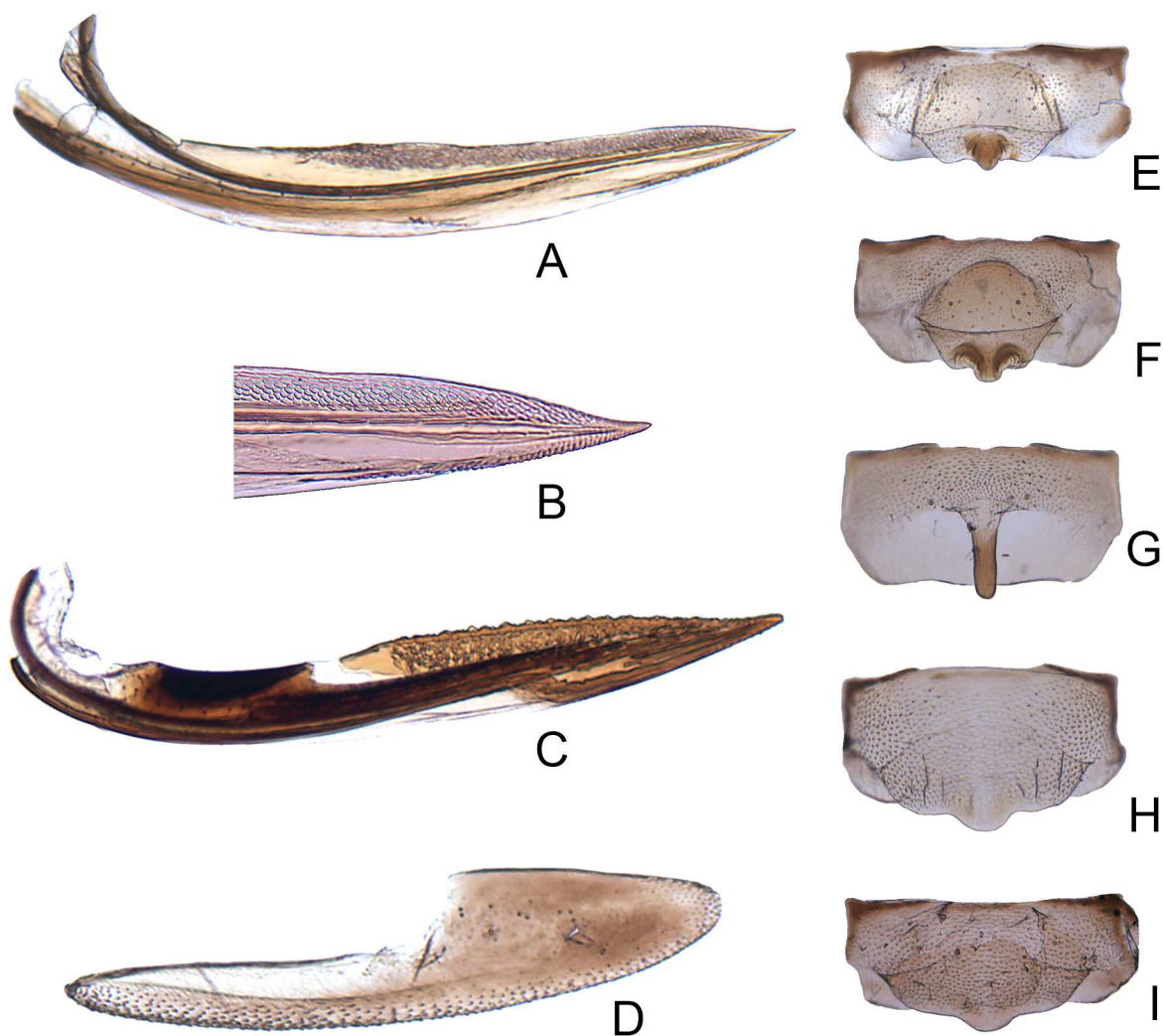


FIGURE 11. Females of *Cortona*: A–D, *Cortona minuta*: A, first valvula; B, detail of first valvula apex; C, second valvula; D, third valvula. E–I, abdominal sternite VII: E, *C. minuta*; F, *C. catanachae*; G, *C. silvai*; H, *C. otamendiensis*; I, *C. concordica*.

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