

SHORT COMMUNICATION

A new species of the myrmecomorphic planthopper genus *Formiscurra* (Fulgoroidea: Caliscelidae) from Ethiopia

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Abstract. *Formiscurra atlas* sp. nov. is described from southwestern Ethiopia. It represents the first record of the genus *Formiscurra* Gnezdilov & Viraktamath, 2011 (Hemiptera: Fulgoroidea: Caliscelidae) from Africa. The relationships of *Formiscurra* to other African taxa of Caliscelidae as well as myrmecomorphy in Auchenorrhyncha are discussed. A photograph of a live specimen of *Formiscurra indicus* Gnezdilov & Viraktamath, 2011 and an identification key to both species are given.

Key words. Hemiptera, Fulgoromorpha, Caliscelini, planthoppers, morphology, taxonomy, myrmecomorphy, Ethiopia, Afrotropical Region

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Introduction

Seven years ago a unique species representing a monotypic genus of the planthopper family Caliscelidae (Hemiptera: Fulgoroidea), *Formiscurra indicus* Gnezdilov & Viraktamath, 2011, was described from Bangalore in southern India (GNEZDILOV & VIRAKTAMATH 2011). The genus *Formiscurra* Gnezdilov & Viraktamath, 2011 belongs to the tribe Caliscelini Amyot & Serville, 1839 known only from the Old World (GNEZDILOV 2013). It is easily distinguished from other caliscelid genera by a peculiar ball-shaped process on the metope of the male and a long cylindrical process on the metope of the female. The genus was initially thought to be endemic to the Indian subcontinent. However, a second representative of *Formiscurra* was recently recognized in the Museo di Zoologia, Università degli Studi di Roma by Jérôme Constant (Brussels, Belgium) from specimens collected in southwestern Ethiopia, Omo National Park, nearly 70 years ago. Thanks to the information on this species kindly provided by J. Constant and efforts by Emanuele Piattella (Rome, Italy) to send the specimens for my study, it is described below.

Material and methods

The morphological terminology follows GNEZDILOV (2003) and GNEZDILOV et al. (2014). Male genital segments were macerated for 1 min in boiling 10% KOH solution. The

drawings were made using a Leica MZ95 stereomicroscope with a camera lucida attachment. The photographs were taken using a Leica DFC 290 camera mounted on the same stereomicroscope. Images were produced using Helicon Focus 5.3 image stacking software and composed into plates using Adobe Photoshop CS6 software.

The type series of the new species described below was divided between the Museo di Zoologia, Università degli Studi di Roma “Sapienza”, Rome, Italy (MZUR) and the Zoological Institute of the Russian Academy of Sciences, Saint Petersburg, Russia (ZIN).

Taxonomy

Formiscurra Gnezdilov & Viraktamath, 2011

Formiscurra Gnezdilov & Viraktamath, 2011: 235.

Type species. *Formiscurra indicus* Gnezdilov & Viraktamath, 2011, by original designation.

Formiscurra atlas sp. nov.

(Figs 1–19)

Type locality. Southwestern Ethiopia, Bench Maji Zone, Omo National Park, Uesca Ueca, ca. 5°49'N, 35°36'E.

Type material. HOLOTYPE: ♂, ‘Uesca Ueca / Basso OMO / III – 40 Patrizi’ (MZUR; dry-mounted, glued on a card label). PARATYPES: 2 ♂♂ (missing some parts of the body and legs) 3 ♀♀, same locality label as holotype (MZUR – 1 ♂ 2 ♀♀, ZIN – 1 ♂ 1 ♀).



Description. Body length. Male – 5.3 mm; females – 5.6–5.7 mm.

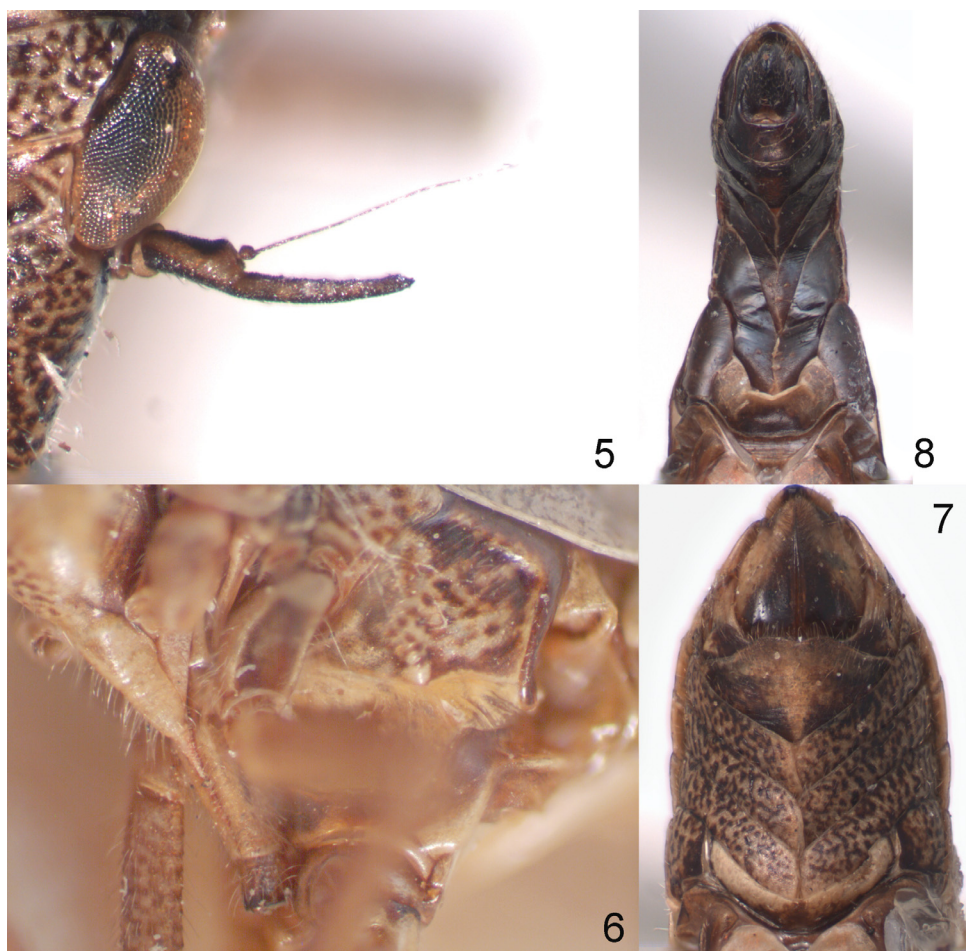
Male (Figs 1, 2, 8). **Coloration.** General coloration dark brown. Lateral margins of metope above eye level, median carina and margins of coryphe light yellow. Postclypeus medially and anteclypeus yellowish light brown. Rostrum light brown, with apex nearly black. Pedicel light yellow on the inner side. Pronotum with light yellow median carina and light yellow spots. Paranotal lobes with light yellow lower margins. Fore wings with wide ivory band medially (Figs 1, 2). Apices of leg spines black. Abdominal tergite III whitish light yellow except for dark brown lateral margins. Abdominal tergites IV–V yellowish light brown except for dark brown lateral margins. Abdominal tergites VI–VII brownish light yellow medially, except for dark brown median line, with lateral parts dark brown to black. Abdominal sternite III straw yellow with basal part dark brown (Fig. 8). Abdominal sternites VI–VII dark brown to black with yellowish margins. Fore and middle legs brown to dark brown. Hind femora with light yellow areas in upper third on inner edge. Pygofer and styles dark brown to black. Anal tube dark brown, with lateral margins yellowish brown.

Structure. Head and body with fore wings covered by sparse long setae (Fig. 1). Coryphe transverse, three times as wide as long at midline, without carinae; anterior margin four-angled; posterior margin weakly concave (Fig. 2).

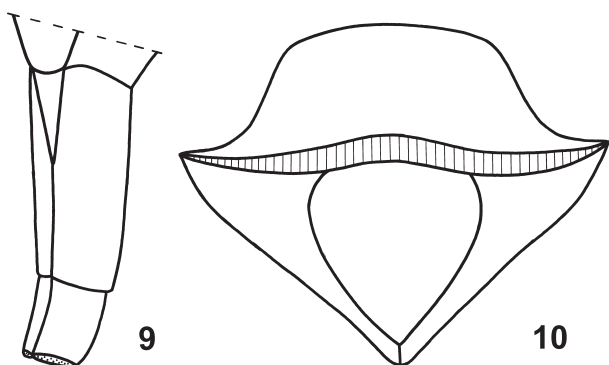
Lower part of metope and upper part of postclypeus forming ball-shaped projection which is smooth and covered by long setae (Figs 1, 2). Ball-shaped projection with narrow basal part, enlarged apically, slightly flattened laterally. Metope wide, with lateral margins convex, weak and short median carina and very weak sublateral carinae only visible in its upper angles. Metopoclypeal suture convex, resting against base of ball-shaped projection. Postclypeus large and swollen. Coryphe and metope, in lateral view, joining at an obtuse angle (Fig. 1). Scape cylindrical, with one-side edge above the other. Pedicel cylindrical, with sensory organs and very long knife-shaped projection, flattened and pointed apically (Fig. 2). Flagellum twice as long as the knife-shaped projection of pedicel. Rostrum reaching hind coxae; third segment short and cylindrical; second segment three times as long as third one. Pronotum slightly longer than coryphe at midline, with short median carina extending from its posterior margin, but not reaching anterior margin. Paradiscal fields of pronotum narrow behind eyes. Paranotal lobes of pronotum wide, nearly triangular. Posterior margin of pronotum concave. Mesonotum large, 1.5 times longer than pronotum, with peculiar lateral carinae joining on scutellum (Fig. 10). Fore wings saddle-shaped, not reaching posterior margin of abdominal tergite III, with only radial veins visible. Femora and tibiae very long – combined length of femur + tibiae is comparable to length of head + body. Fore and hind legs longer than middle ones.



Figs 1–4. *Formiscurra atlas* sp. nov. 1 – male, holotype, lateral view; 2 – same, dorsal view; 3 – female, paratype, lateral view; 4 – same, dorsal view. Total length: male – 5.3 mm, female – 5.7 mm.



Figs 5–8. *Formiscurra atlas* sp. nov. 5 – female, paratype, antenna, dorsal view; 6 – female, paratype, rostrum, lateral view; 7 – female, paratype, abdomen, ventral view; 8 – male, holotype, abdomen, ventral view.



Figs 9–10. *Formiscurra atlas* sp. nov. 9 – female, paratype, rostrum, lateral view; 10 – male, holotype, pro- and mesonotum, dorsal view.

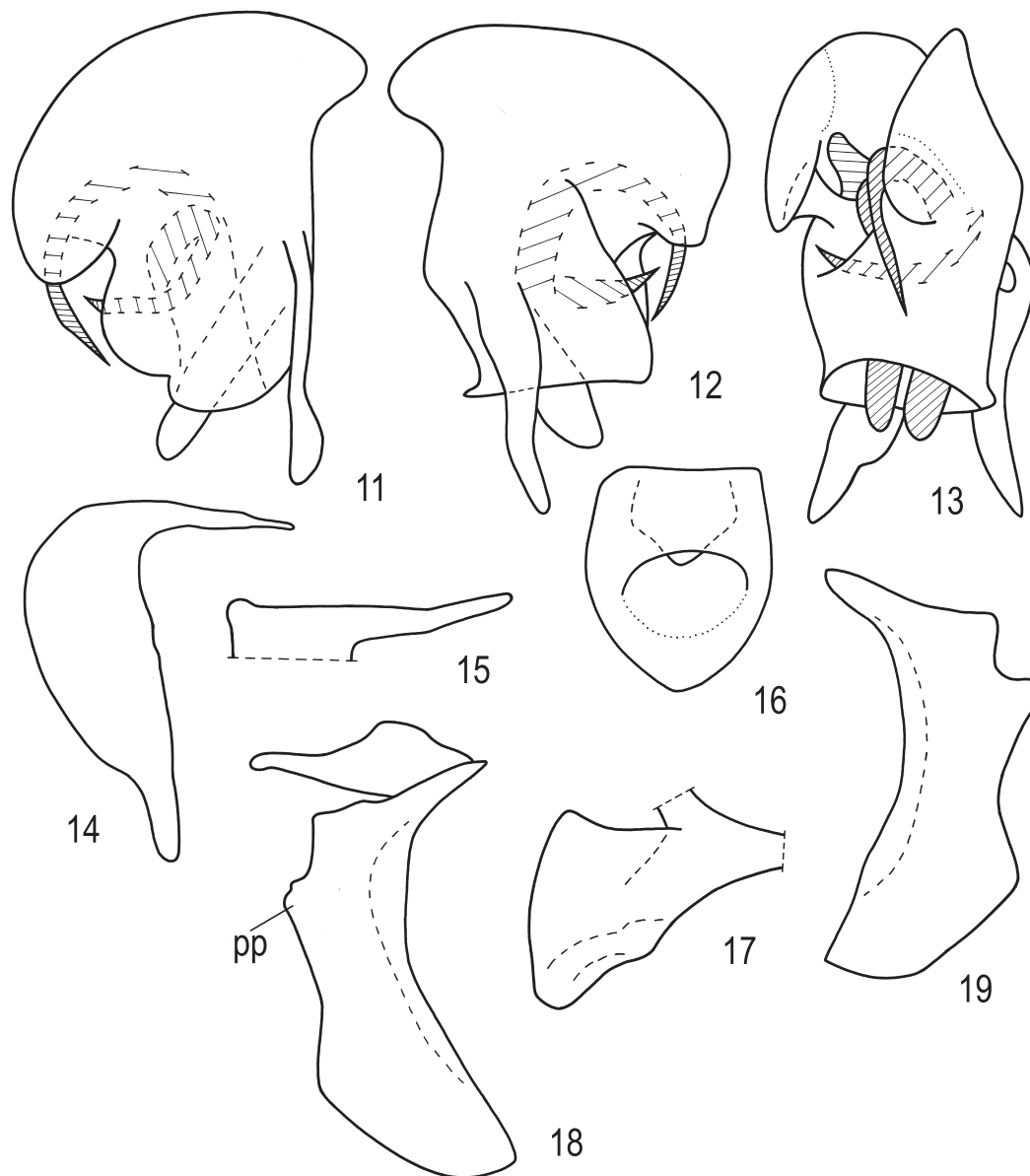
Fore tibiae slightly flattened laterally. Hind tibia with single lateral spine nearly at mid length and five apical spines. First metatarsomere as long as second and third ones combined, with two latero-apical spines and pad of hair-shaped setae. Abdomen, in lateral view, strongly curved posterior to tergite III; tergite V strongly convex; sternite III with concave trapezoidal posterior margin (Fig. 8); sternites IV–VI with wedge-shaped posterior margins.

Genitalia (Figs 11–19). Anal tube, in dorsal view, wide, clearly narrowing apically (Fig. 16); in lateral view, apex slightly turned down (Fig. 18). Pygofer with thick process on hind margins in its upper half (Figs 18, 19: *pp*). Penis wide, enlarged apically with drawn tip of apex, in lateral view, mushroom-shaped, and a pair of curved aedeagal hooks –

right one turned down and left one turned up (Figs 11–13). Connective with wide cup (Fig. 17). Style with narrow and long capitulum, without lateral tooth (Figs 14, 15).

Female. Coloration. General coloration of head and body including fore wings yellowish light brown with dense dark brown to black dots fused into tiny longitudinal stripes on abdominal tergites (Figs 3, 4). Metopial projection dark brown to shiny black apically and laterally (Fig. 3). Post-clypeus yellowish light brown to black, with dark brown dots medially below metopial projection. Rostrum black apically. Scape dark brown. Pedicel dark brown to black outside and light yellow inside. Fore wings with whitish yellow costal margins. Legs with dark brown dots fused into marginal longitudinal stripes clearly visible on flattened fore tibiae. Tarsi dark brown to black. Abdominal tergites IV–VII with light yellow lateral margins. Abdominal sternite VII with dense dark brown dots fused into wide dark brown areas (Fig. 7). Anal tube light yellow, with wide dark brown median longitudinal stripe dorsally and ventrally. Gonoplocs dark brown from base to middle. Gonocoxae VIII dark brown except for light yellow proximal parts.

Structure. Head and body including fore wings covered by sparse long setae. Metope and metopial projection dorsally with dotted grooves. Metope with weak sublateral carinae. Metopial projection wide and thick, in dorsal view, with weak constriction, slightly flattened laterally from the base towards its apex, smooth ventrally and laterally (Figs 3, 4). Pedicel cylindrical, with very long knife-shaped projection, flattened and pointed apically, and sensory organs



Figs 11–19. *Formiscurra atlas* sp. nov., paratype, male genitalia. 11 – penis, left lateral view; 12 – penis, right lateral view; 13 – penis, ventral view; 14 – style, lateral view; 15 – capitulum of style, dorsal view; 16 – anal tube, dorsal view; 17 – connective, lateral view; 18 – pygofer, left lateral view; 19 – pygofer, right lateral view. Abbreviation: pp – process of hind margins of pygofer.

covering also inner side of projection (Fig. 5). Rostrum reaching hind coxae; third segment short and cylindrical; second segment three times as long as third one (Figs 6, 9). Pronotum with smooth median carina. Mesonotum without carinae. Fore wings straight, not saddle-shaped, venation obscure (Figs 3, 4). Abdomen not curved in lateral view. Fore wings not reaching hind margin of abdominal tergite III. Fore tibiae slightly flattened. Hind tibiae with single lateral spine above their mid-length and five apical spines. First and second metatarsomeres as in males. Arolium, in dorsal view, not surpassing apices of claws. Abdominal sternite III massive, convex vertically (Fig. 7); sternites IV–VI deeply concave; sternite VII wide, with hind margin convex bearing median concavity (Fig. 7).

Diagnosis. See the key below.

Etymology. The species name is derived from the name of the Greek mythological character “Ατλας” – Titan support-

ing the pillars that separate the Earth from the Sky – and should be treated as a noun in apposition.

Key to species of *Formiscurra*

Males:

- 1 Fore wings brown to dark brown or black, each with an opalescent green (in live specimens, Fig. 20) or whitish (in dry specimens) large spot (GNEZDILOV & VIRAKTAMATH 2011: Figs 3, 5). Apices of both aedeagal ventral hooks directed downwards (GNEZDILOV & VIRAKTAMATH 2011: Fig. 10). Total body length 4.6–5.1 mm. *F. indicus* Gnezdilov & Viraktamath, 2011
- Fore wings dark brown to black, with a wide ivory band (Figs 1, 2). Right aedeagal hook directed upwards, left one turned downwards (Figs 11–13). Total body length 5.3 mm. *F. atlas* sp. nov.

Females:

- 1 Metopial projection, in dorsal view, smoothly narrowing apically; in lateral view, 1.5 times as long as wide (GNEZDILOV & VIRAKTAMATH 2011: Figs 6, 7). Generally darker, head and body with a broad longitudinal pale stripe along midline dorsally (GNEZDILOV & VIRAKTAMATH 2011: Figs 6, 7). Total body length 5 mm. *F. indicus* Gnezdilov & Viraktamath, 2011
- Metopial projection, in dorsal view, with weak constriction (Fig. 4); in lateral view, 1.15–1.25 times as long as wide (Fig. 3). Generally lighter, head and body without longitudinal pale stripe dorsally (Fig. 4). Total body length 5.6–5.7 mm. *F. atlas* sp. nov.

Discussion

Formiscurra atlas sp. nov. was collected in the Omo National Park which is situated in southwestern Ethiopia near the border with Kenya. With their curved body, saddle-shaped fore wings, and long, not flattened legs, both currently known *Formiscurra* species are close to *Populonia curvata* (Melichar, 1908) known from Tanzania and Kenya (GNEZDILOV & BOURGOIN 2009: Fig. 16). Both *Formiscurra* species and *P. curvata* are characterized also by robust females differing externally from the males (GNEZDILOV & BOURGOIN 2009: Fig. 18). However, *P. curvata* does not display any ball-shaped metopial projection in the male and possesses only a very short and rounded projection of the pedicel in both sexes. In the structure of male genitalia, *P. curvata* differs from both *Formiscurra* species in the phallobase which is widely rounded apically, with one of the phallobase lateral lobes possessing a large hook-shaped

projection and the other lobe with a row of small teeth, and the pygofer lacking a process on its hind margins.

Live males of *F. indicus* display a large opalescent green spot on each fore wing (Fig. 20) which turns whitish in dry specimens. Similar opalescent green spots are found in live males of *Caliscelis (Cerepa) carnavalis* Emeljanov, 2015 and *C. (C.) gnezdilovi* Emeljanov, 2015 from Vietnam (EMELJANOV 2015: Figs 7–10). The ivory-coloured band on the fore wings of *F. atlas* sp. nov. is similar to that of *Caliscelis (Bambula) swazi* Gnezdilov & Bourgoin, 2009 from southern Africa (GNEZDILOV & BOURGOIN 2009: Figs 7, 8). The male of *C. swazi* is similar to *F. atlas* sp. nov. also in the saddle-shaped fore wings. *Formiscurra* species and *C. (B.) swazi* are close in the structure of the asymmetrical, mushroom-shaped phallobase, with drawn tip of phallobase apex and two lateral folds of dorso-lateral lobes covering the aedeagal hooks (Figs 11, 12) (GNEZDILOV & BOURGOIN 2009: Figs 63, 65). However, *Formiscurra* species have aedeagal hooks directed both upwards and downwards, while in *C. (B.) swazi* both hooks are directed downwards.

So far, only two genera of Caliscelidae are known to be distributed from India to tropical Africa – *Rhinogaster* Fennah, 1949 and *Chirodisca* Emeljanov, 1996. *Rhinogaster* comprises two Indian and one South African species. *Chirodisca* includes two species of which *C. eximia* (Stål, 1859) is widely distributed in India, Sri Lanka, Pakistan, Nepal, Sudan, Eritrea, and Tanzania (GNEZDILOV & BOURGOIN 2009, GNEZDILOV 2011). I hypothesized (GNEZDILOV 2011) that these genera originated in Eurasia and spread to Africa between Miocene and Pliocene (5–7 million years ago) after the Tethys sea closed and would thus represent remnants of the Hipparion fauna which was



Fig. 20. *Formiscurra indicus* Gnezdilov & Viraktamath, 2011. Photograph by Shyamal Lakshminarayanan, 23th June 2013 south Bangalore, India, 12.8093026 N 77.4796312 E.

widely distributed in Eurasia in Miocene (MEKAEV 1987). *Formiscurra* may be also added to this group of taxa.

More than 2000 species of myrmecomorphic arthropods are known (McIVER & STONEDAHL 1993). According to McIVER & STONEDAHL (1993: 351) myrmecomorphy "... forms a subset of ant mimicry, which includes all species that resemble ants through behavioral, chemical, or textural characters." Within Auchenorrhyncha, bright examples of taxa mimicking bees and wasps were described among sharpshooters (Cicadomorpha: Cicadellidae: Cicadellinae; MEJDALANI et al. 2002) but myrmecomorphy seems to be rare. McIVER & STONEDAHL (1993) listed just the treehopper genus *Heteronotus* Laporte, 1832 (Cicadomorpha: Membracidae) referring to POULTON (1898: fig. 6) who described the resemblance of a large process on pronotum of *H. trinodosus* Butler, 1878 to the body of an ant. Other myrmecomorphic taxa of Membracidae include *H. flavolineatus* Laporte, 1832 (reported by BOULARD 1999), *Cyphonia clavata* (Fabricius, 1787) with a process of pronotum imitating an ant of the subfamily Myrmicinae "... facing towards the back of the treehopper" (MADERSPACHER & STENSMYR 2011) and the genus *Stegaspis* Germar, 1833 the larva of which imitates a leaf-cutting ant (according to POULTON 1898: fig. 7). The case described by POULTON (1898) for *H. trinodosus* is a "concealment of the body behind a mask" according to COTT (1957: 409): "... the pronotum is immensely enlarged, being similar in form to the body of the ant, and extending backwards so as completely to cover, like a shield, the otherwise unaltered body". By analogy I assume that the ball-shaped process on the head of *Formiscurra* species conceals the head of the planthopper behind a mask of an ant abdomen. The similarity of the metopial bulb in males of *Formiscurra indicus* to an ant abdomen was already mentioned as a case of morphological convergence by GNEZDILOV & VIRAKTAMATH (2011: 239). Apparently, only males of *Formiscurra* mimic ants. Why females do not? This question remains open and cannot be answered without observations in nature. Similar sexual dimorphism, with one of the sexes mimetic and the other one non-mimetic, was reported in Heteroptera (Miridae) and spiders (Araneidae) (McIVER & STONEDAHL 1993). Another potentially myrmecomorphic African species of Caliscelidae, *Myrmissus bellicosus* Linnavuori, 1973, was described only from males, while females are still unknown (LINNAVUORI 1973, GNEZDILOV & BOURGOIN 2009). The behaviour of Caliscelidae and their potential predators is almost unknown. O'BRIEN (1988: 867) mentioned that specimens of *Asarcopus palmarum* Horváth, 1921 "... were found in the axils of the leaf fronds [of the palm *Caryota urens* L.], as many as three in a group, being guarded by ants *Camponotus* sp." in India. However, this is rather an indication of myrmecophily than myrmecomorphy.

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