



New Oriental genus in the tribe Caliscelini (Hemiptera: Fulgoromorpha: Caliscelidae) from Pakistan

KAMRAN SOHAIL¹, MUHAMMAD USMAN², HASSAN NAVEED³ & YALIN ZHANG^{1,4}

¹Key Laboratory of Plant Protection Resources and Pest Management of the Ministry of Education, Entomological Museum, Northwest A&F University, Yangling, Shaanxi 712100, China

²Department of Entomology, The University of Agriculture Peshawar, Khyber Pakhtunkhwar, 25100, Pakistan

³College of Life Science, Leshan Normal University, Leshan, Sichuan 614004, China

⁴Corresponding author. E-mail: yalinzh@nwsuaf.edu.cn

Abstract

Formibelle gen. nov. is described based on the type species *Formibelle vladimiri* sp. nov. from Swat, Pakistan. This new genus represents the second species in the family Caliscelidae from Pakistan. A key to the known genera of Caliscelidae in Pakistan is provided.

Key words: Homoptera, Fulgoroidea, Caliscelinae, Taxonomy, *Formibelle*

Introduction

Caliscelidae Amyot & Serville is a widely distributed family of small fulgoroids with 76 genera and 235 described species (Bourgoin, 2019) divided into five tribes in two subfamilies (Gnezdilov, 2013). The Oriental members of Caliscelidae are diverse, and this family is considered to be originated in Southeast Asia as four of its tribes are present there (Gnezdilov, 2015a). Caliscelini Amyot & Serville is the largest tribe of the subfamily Caliscelinae Amyot & Serville with more than 40 described genera which are widely distributed in Oriental, Australian, Neotropical, Nearctic, Afrotropical and Palearctic regions of the world (Gnezdilov & Bourgoin, 2009). The Caliscelid fauna of Pakistan is poorly known, with only one species, *Chirodisca eximia* (Stål, 1859) recorded to date (Gnezdilov & Bourgoin, 2009; Gnezdilov, 2015b). The genus *Chirodisca* of the tribe Caliscelini widely distributed from India to Africa including Pakistan (Gnezdilov & Bourgoin, 2009).

In this study, a new genus, *Formibelle* gen. nov. with its type species *Formibelle vladimiri* sp. nov. is described, representing the second species in this family from Pakistan. It belongs to the tribe Caliscelini with the following characters: forewing usually covers only basal half of the abdomen, aedeagus reduced and first metatarsomere with single or two lateral spines (Gnezdilov & Bourgoin, 2009). Very little is known about the host plant of this new species.

Material and methods

This study is based on a single male specimen collected in Pakistan (Phytosanitary certificate Book No. A00392: Serial No. A039101, Government of Pakistan, Ministry of National Food Security and Research, Department of Plant Protection). External morphological terminology follows Emeljanov (1995), except those for male genitalia which follow Bourgoin (1987). Morphological characters were examined using a stereomicroscope Olympus SZX10. For genitalia dissections, the genital segment was removed from the holotype and boiled in 10% NaOH for ca. 6 minutes and then transferred to a depression slide with glycerin for further study. Photographs of the adult were taken using a Zeiss AxioCam ICc 5. Adobe Photoshop was used for labelling and plate composition. Measurements of characters are given in millimeters (mm).

The holotype is initially deposited in the Entomological Museum of Northwest A&F University (NWFU) Yangling, Shaanxi China.

Taxonomy

Family Caliscelidae Amyot & Audinet-Serville, 1843

Subfamily Caliscelinae Amyot & Audinet-Serville, 1843

Tribe Caliscelini Amyot & Audinet-Serville, 1843

Formibelle gen. nov. Sohail & Zhang

Type species: *Formibelle vladimiri* sp. nov., here designated.

Diagnosis. *Formibelle* gen. nov. can be differentiated from other caliscelid genera by convex coryphe; large bluish spot on forewing and genital style with hump-like process below capitulum.

Description. *External morphology* (Figs 1–4). Metope convex joining coryphe at more than 180° (in lateral view), longer than wide, narrowing towards clypeus with obscure carina. Pedicel long with short rounded apically process on the side of subapical flagellum. Compound eyes large supported by callus. Postclypeus convex wider than long. Anteclypeus short tubular. Rostrum long, second segment more than 1/3 length of third segment. Coryphe twice as wide as long medially deeply grooved. Pronotum wider than coryphe, anterior margin slightly convex, posterior margin nearly straight. Mesonotum nearly as long as pronotum. Forewing short reaching tergite four. Abdomen in lateral view medially concave and posteriorly raised. Legs long, one lateral spine situated in lower third basally on hind tibia. Apex of tibia with five spines. Metatarsomeres I and II with two lateroapical spines, tarsomere II is half the length of tarsomere I. Metatibiotarsal formula: 5/2/2.

Male genitalia (Figs 5–10). Pygofer with straight margins (in lateral view). Anal tube in lateral view long, narrowing apically. Phallobase in lateral view enlarged anteriorly, dorsal lobe concave beneath the aedeagal hooks. Genital styles posteriorly convex apically with long narrow capitulum.

Etymology. This new genus name is a combination of “Formica” for its ant shaped body with the French word “belle”, meaning -beautiful; as the type location is famous for its natural beauty. Gender: masculine.

Key to genera of Pakistani Caliscelini

1. Metope and clypeus flat with strong median and sublateral carina, fore and middle femora foliated (Gnezdilov & Bourgoïn (2009: Figs 5–6). *Chirodisca* Emeljanov
- Metope convex with obscure carina, fore and middle femora not foliated, forewing with distinct large bluish spot, abdomen concave medially (Figs 1–4) *Formibelle* gen. nov.

Formibelle vladimiri sp. nov. Sohail & Zhang

Description (male). Length: ♂4.6 mm (n=1). *Coloration* (♂): Dark brown to black. Metope black, lateroapical margins yellow or white. Genae black, with yellowish transverse stripe below the scape. Clypeus black, rostrum dorsally yellow apically brown. Eyes greyish brown. Antennae black having whitish sensory plate organs on and near the apical lobe. Coryphe yellow with black markings. Pronotum black. Mesonotum yellow with black markings or spots. Tegmina reddish brown with distinct large bluish spot on each side, wing base and lateral margins black. Abdominal tergites laterally and genital segments black. Tergite III (below the elytra) dirty white or ivory, and VI–VII medially yellow or brown. Anal segment black. Sternites black except segment III which has dirty white or ivory posterior margin. Abdominal sternites IV–VIII dorsomedially with dirty white or ivory bands. Legs black ventrally yellowish or white.



1



2



3



4

FIGURES 1–4. External morphology of *Formibelle vladimiri* sp. nov. (Holotype); 1, 2. Habitus, lateral and dorsal view; 3. Coryphe, pronotum and mesonotum, dorsal view; 4. Head, ventral view.

Metope convex centrally without keels, slightly concave near anterior margins of coryphae, longer than wide widest between antennae narrower towards clypeus (Figs 1, 4). Antennae long, short scape. Pedicel long tubular with short rounded apical process, flagellum long (Fig. 3, 4). Large compound eyes with relatively small nearly round area (callus) near base of antennae (Fig. 4). Rostrum reaching hind coxae (Fig. 4). Coryphe wider than long with black markings lacking carina deeply incised with strongly elevated yellow lateral margins, anterior margin convex posterior margin straight (Figs 2, 3). Pronotum wider than coryphe without keels extended transversely beyond eyes anterior and posterior margins straight. Mesonotum as long as pronotum without keels weakly grooved wider centrally, anterior margin straight (Figs 2, 3). Elytra short saddle-shaped reaching tip of fourth abdominal segment with obscure venation (Figs 1, 2). Abdomen centrally concave, posterior margin convex or raised (Figs 1, 2). Legs long not foliate with one lateral spine in basal one third and five apical spines on hind tibia. Tarsomere I and II each with two spines lateroapically, ventrally with short thick pad like structures. Tarsomere I twice the length of tarsomere II.

Male genitalia. In lateral view, pygofer longer than wide; both anterior and posterior margins of pygofer concave in middle, wider in basal third (Fig. 5). Anal tube oval in dorsal view, in lateral view tubular, narrower anteriorly and tapering posteriorly (Figs 7, 5). Epiproct short (Fig. 7). Phallobase narrowing to apex in lateral view and looks like woodpecker head (Fig. 9, 10). Aedeagus with a pair of hooks directed ventrally versus latero-externally (Figs 8, 9). Genital style long wider in apical half, posteriorly convex at apex smoothly curved towards base. Anterior margin of style concave near base of capitulum with hump-like processes dorsolaterally. Capitulum of style very long conical, apically and laterally spinose dentated ventrally (Fig. 6).

Female: Unknown.

Remarks. *Formibelle vladimiri* sp. nov. is close to *Formiscura indica* Gnezdilov & Viraktamath, 2011 but can be readily differentiated by its convex coryphe, two distinct large bluish spots on forewing, oval anal tube (in dorsal view) and gonostylus with hump-like processes on dorsolateral margin under the capitulum. This species is also similar to *Asarcopus palmarum* Horváth, 1921 in having convex coryphe but can be differentiated by carination on vertex; shape and spots of forewing; medially concave abdomen and male genitalia.

Host plants: Unknown.

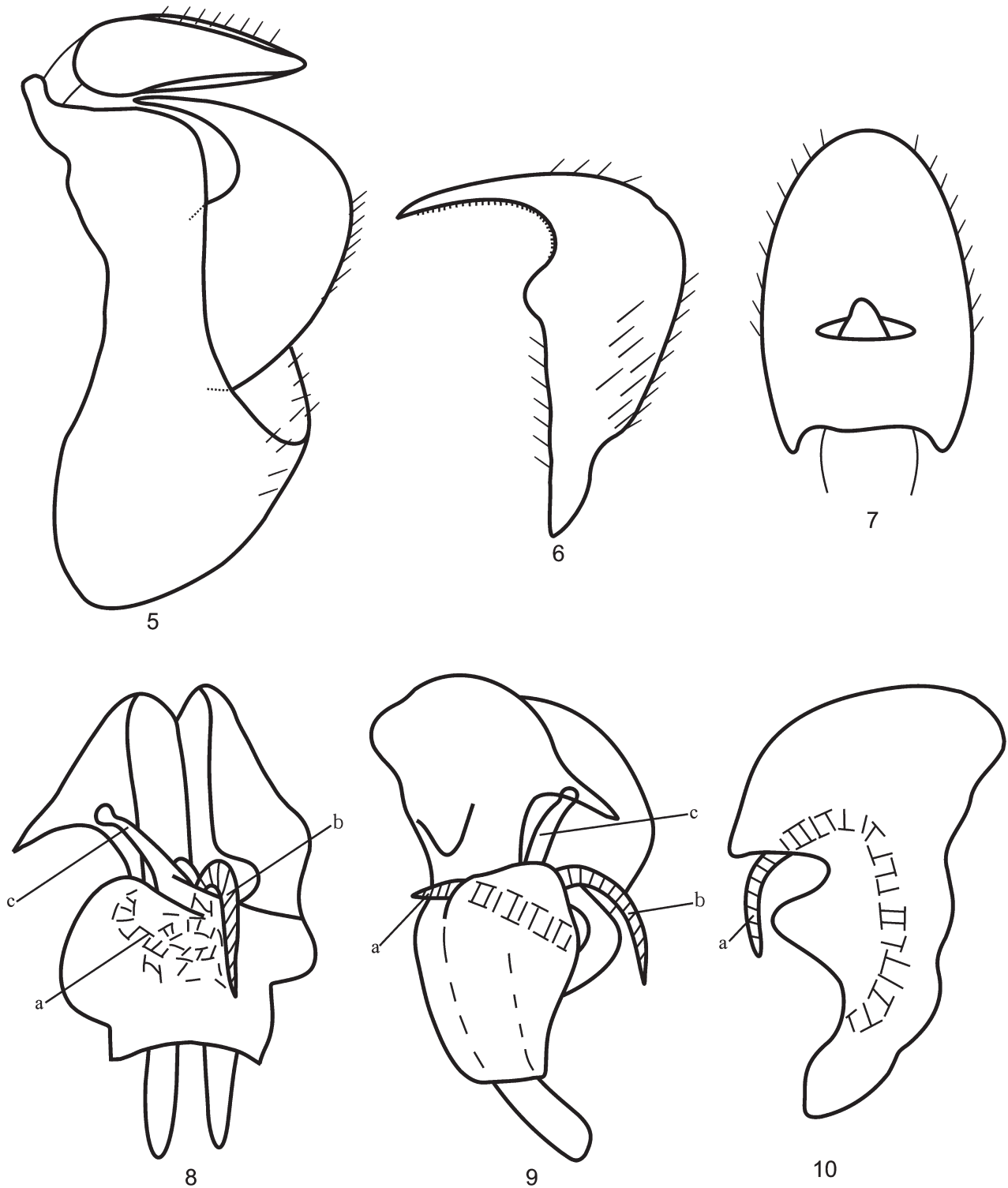
Type material: Holotype: ♂, Pakistan, Khyber Pakhtunkhwa Province, Swat, 35°13'21.76"N, 72°25'32.93"E, 2993.39 m, 5 vii 2018, sweeping grasses, coll. Kamran Sohail.

Etymology. This new species is named after Vladimir M. Gnezdilov (Russian Academy of Sciences, Zoological Institute, St Petersburg, Russia) for his valuable contribution to the taxonomy of the family Caliscelidae.

Discussion

Fulgoroidea fauna of Pakistan is very rich but unfortunately very little attention has been paid to this group and especially to Caliscelidae, which is poorly studied with only one record from the country (*Chirodisca eximia*). Caliscelid fauna of Pakistan is close to African and Indian one's as *Chirodisca eximia* is widely distributed in Eastern Africa, Nepal, India and Sri Lanka (Gnezdilov & Bourgoïn, 2009). *Formibelle vladimiri* sp. nov. share with the African species *Populonia curvata* (Melichar, 1908) a saddle-shaped forewing but looks more similar to the Indian genus *Formiscurra* Gnezdilov & Viraktamath, 2011 by its saddle shape forewing, its posteriorly convex abdomen and the aedeagus with a pair of ventral hooks. It can be distinguished by its head capsule without ball-shaped process (with large ball-shaped process in *Formiscurra*); its pedicel with short rounded apical process (long and acuminate in *Formiscurra*); its anal tube long and narrow in lateral view (short and wide in *Formiscurra*); its gonostyli with hump-like process below capitulum (straight in *Formiscurra*); (Gnezdilov & Viraktamath, 2011, figs. 1–11). This new genus is also close to *Asarcopus* Horváth, 1921 in having convex coryphe; forewing touching medially, fitted to the body (O'Brien, 1988, figs. 2–4) from which it can be differentiated by its thorax straight (humped shaped in *Asarcopus*); the absence of indentation at the junction of thorax and abdomen (present in *Asarcopus*) (O'Brien, 1988, figs. 2–4); its abdomen concave medially, convex posteriorly in *Formibelle* gen. nov. (medially straight, slightly convex posteriorly in *Asarcopus*) (Gnezdilov & Bourgoïn, 2009, figs. 21, 22); the large bluish spots on each forewing (dark veinless oval spot in contiguous to a small white oval spot in *Asarcopus*) and in lateral view its anal long tube narrowing apically (wedge shaped in *Asarcopus*) (O'Brien, 1988, fig. 5).

The species *Asarcopus palmarum* was collected in date palms in California and India while *Formibelle vladimiri* **sp. nov.** collected in grasses habitat having no date palm plantation in the area. *Chirodisca eximia* (both male and female) were also collected with the new species from the type locality. The area has a very diverse habitat and famous for Peach, Apricot and Plum production. Type locality is an understudied habitat for Fulgoroidea as many other planthopper families have been collected. The region reflects a true diversity of Caliscelidae for future prospects.



FIGURES 5–10. Male genitalia of *Formibelle vladimiri* **sp. nov.** (Holotype); 5. Pygofer, anal segment and genital style, lateral view; 6. Gonostyle, lateral view; 7. Anal tube, dorsal view; 8. Phallobase and connective, dorsal view; 9. Same, left lateral view; 10. Right lateral view; ‘a’ and ‘b’ aedeagal hooks and ‘c’ process of aedeagus.

Acknowledgments

We are sincerely thankful to Dr. Vladimir M. Gnezdilov (Russian Academy of Sciences, Zoological Institute, St Petersburg, Russia) and Prof. John Richard Schrock (Emporia State University, USA) for providing comments on an earlier draft of this manuscript. This study was supported by the National Natural Science Foundation of China (31420103911) and The Ministry of Science and Technology of the People's Republic of China (2005DKA21402).

References

- Amyot, C.J.B. & Audinet-Serville, J.G. (1843) *Homoptères. Homoptera Latr. Deuxième partie. Histoire Naturelle des Insectes. Hemiptères*. Librairie Encyclopédique de Roret, Paris, 676 pp.
- Bourgoin, T. (1987) A new interpretation of the homologies of the Hemiptera male genitalia, illustrated by the Tettigometridae (Hemiptera, Fulgoromorpha). *Proceedings of the 6th Auchenorrhyncha Meeting*, 1987, 113–120. [Turin, Italy, 7–11 September]
- Bourgoin, T. (2019) FLOW (Fulgoromorpha Lists On the Web): a World Knowledge Base Dedicated to Fulgoromorpha. Version 8. Updated 1 September 2018. Available from: <http://hemiptera-databases.org/flow/> (accessed 1 September 2019)
- Emeljanov, A.F. (1995) On the problem of classification and phylogeny of the family Delphacidae (Homoptera, Cicadina) taking into consideration larval characters. *Entomologicheskoe Obozrenie*, 74 (4), 780–794. [English translation published in *Entomological Review*, 75 (9), 134–150]
- Gnezdilov, V.M. (2013) Modern system of the family Caliscelidae Amyot et Serville (Homoptera, Fulgoroidea). *Zoologicheskyy Zhurnal*, 92 (10), 1309–1311. [English translation published in *Entomological Review*, 94 (2), 211–214. (2014)] <https://doi.org/10.1134/S0013873814020092>
- Gnezdilov, V.M. (2015a) A new genus and new species of the family Caliscelidae (Hemiptera: Auchenorrhyncha: Fulgoroidea) from Thailand with notes on evolution of the family. *Proceedings of the Zoological Institute RAS*, 319 (1), 120–125.
- Gnezdilov, V.M. (2015b) Review of the genus *Bolbonaso* Emeljanov with checklist and key to Indian Caliscelidae (Hemiptera: Fulgoroidea), *Journal of Natural History*, 50, 847–863. <https://doi.org/10.1080/00222933.2015.1103908>
- Gnezdilov, V.M. & Bourgoin, T. (2009) First record of the family Caliscelidae (Hemiptera: Fulgoroidea) from Madagascar, with description of new taxa from the Afrotropical Region and biogeographical notes. *Zootaxa*, 2020 (1), 1–36. <https://doi.org/10.11646/zootaxa.2020.1.1>
- Gnezdilov, V.M. & Viraktamath, C.A. (2011) A new genus and new species of the tribe Caliscelini Amyot & Serville (Hemiptera: Fulgoroidea: Caliscelidae: Caliscelinae) from southern India. *Deutsche Entomologische Zeitschrift*, 58 (2), 235–240. <https://doi.org/10.1002/mmnd.201100026>
- Stål, C. (1859) Novae quaedam Fulgorinorum formae speciesque insigniores descriptae. *Berliner Entomologische Zeitschrift*, 3, 313–327. <https://doi.org/10.1002/mmnd.18590030405>