

Research Article

A review of the leafhopper tribe Deltcephalini (Hemiptera: Cicadellidae: Deltcephalinae) from Pakistan

Revisión de la tribu Deltcephalini
(Hemiptera: Cicadellidae: Deltcephalinae) de Pakistán

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ZooBank: urn:lsid:zoobank.org:pub: 754F0CD8-F1B5-44C9-A6D0-72AB2388DB41
<https://doi.org/10.35249/rche.45.2.19.16>

Abstract. Species of the tribe Deltcephalini Dallas, 1870 (Hemiptera: Cicadellidae: Deltcephalinae) occurring in Pakistan are revised. Three genera and nine species are reported. *Deltcephalus* Burmeister with two new records: *Deltcephalus vulgaris* Dash & Viraktamath, 1998 and *Deltcephalus infirmus* Melichar, 1903; *Maiestas* Distant with five species of which two are new records: *Maiestas albomaculata* (Dash & Viraktamath, 1998) and *Maiestas samuelsoni* (Knight, 1976); and *Paramesodes* Ishihara, with one species. Male-based keys are provided along with habitus photographs and illustrations of male genitalia of examined species.

Key words: Auchenorrhyncha, taxonomy, new records, Pakistan.

Resumen. Se revisan las especies de la tribu Deltcephalini Dallas, 1870 (Hemiptera: Cicadellidae: Deltcephalinae) que ocurren en Pakistán. Se reportan tres géneros y nueve especies. *Deltcephalus* Burmeister con dos nuevos registros: *Deltcephalus vulgaris* Dash y Viraktamath, 1998 y *Deltcephalus infirmus* Melichar, 1903; *Maiestas* Distante con cinco especies, de las cuales dos son nuevos registros: *Maiestas albomaculata* (Dash y Viraktamath, 1998) y *Maiestas samuelsoni* (Caballero, 1976); y *Paramesodes* Ishihara, con una especie. Se proporcionan claves basadas en los machos junto con fotografías del habitus e ilustraciones de los genitales masculinos de las especies estudiadas.

Palabras clave: Auchenorrhyncha, taxonomía, nuevos registros, Pakistán.

Introduction

The leafhopper tribe Deltcephalini includes 68 genera and more than 587 species; these are small to medium sized leafhoppers with great variability in color and mainly

Received 20 April 2019 / Accepted 24 May 2019 / Published online 7 Jun 2019

Responsible Editor: José Mondaca E.



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confined to grassland ecosystems (Zahniser & Dietrich 2013). It is mainly characterized by: the clypellus with sides tapering or parallel, lorum narrow; linear connective with anterior arms close together distally, fused to the aedeagus; first valvula dorsal sculpturing imbricate.

The grassland leafhopper genus *Deltcephalus* was established by Burmeister (1838) with the type species *Cicada pulicaris* Fallén from the Palaearctic Region. Genus *Deltcephalus* belongs to the *Deltcephalus* group, as reviewed by the Webb & Viraktamath (2009), with more than 94 described species. According to Webb & Viraktamath (2009) and the Zhang & Duan (2011) revision, members of the genus *Deltcephalus* differ from *Maiestas* Distant & *Recilia* Edwards by the aedeagal shaft short, robust, without processes, strongly curved dorsally and apical gonopore.

The genus *Maiestas* was established by Distant (1917) with the type species *Maiestas illustris* Distant from the Seychelles. Up till now the genus comprises 99 described species (Duan *et al.* 2017). It can be differentiated from *Deltcephalus* Burmeister and *Recilia* Edwards by the aedeagal shaft at most only slightly curved dorsally, apex not notched and may be produced into a thin process or spine with the gonopore apical on the dorsal surface.

Species-level identification of females in *Deltcephalus* group (*Deltcephalus* & *Maiestas*) is very difficult because of the uniform shape of seventh sternum across many different species, as well as the sculpture pattern of the first and the shape of the second valvulae (Dash & Viraktamath 1998; Webb & Viraktamath 2009; Zhang & Duan 2011). Hence, identification of these species is mainly confined to male genital structures. Genus *Paramesodes* was erected by Ishihara (1953) from Japan and can be differentiated from species of *Deltcephalus* group by having pale yellowish to brown species with broad, flattened body, forewing with veins always pale or white and crown with a prominent transverse black sub marginal band between eyes (Wilson 1983; Duan & Zhang 2012). In this paper, the genus *Deltcephalus* Burmeister is reported for the first time from Pakistan with two species: *Deltcephalus vulgaris* Dash & Viraktamath, 1998 and *Deltcephalus infirmus* Melichar, 1903. Another two species, *Maiestas albomaculata* (Dash & Viraktamath, 1998) and *Maiestas samuelsoni* (Knight, 1976) are also reported first time from Pakistan.

The material examined in this work is deposited in the Entomological Museum of Northwest A and F University (NWAFU), Yangling, Shaanxi, China.

Materials and Methods

Morphological terminology follows Dietrich (2005). Digital images were taken with a Q-Imaging 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. Line drawings were made with an Olympus PM-10AD microscope with a drawing tube. All images and line drawings were compiled and photo edited using Adobe Photoshop CS.

Taxonomy

Deltcephalus Burmeister, 1838, new record to Pakistan

Jassus subgenus *Deltcephalus* Burmeister, 1838: 15; Ribaut, 1952: 246. Type species: *Cicada pulicaris* Fallén, by subsequent designation.

Deltcephalus Webb & Viraktamath, 2009: 12.

Deltcephalus Zhang & Duan, 2011: 3.

Distribution. Old World.

Key to Pakistan species (males)

1. Crown with six brown spots on anterior margin (Fig. 1A); aedeagal shaft with shallow apical notch (Figs. 3A, 3C).....*D. vulgaris* new record
- Crown only with single brown spot on anterior margin adjacent to eyes (Fig. 1C); aedeagal shaft without apical notch (Fig. 3E).....*D. infirmus* new record

***Deltocephalus vulgaris* Dash & Viraktamath, 1998, new record to Pakistan**

(Figs. 1A-1B, 3A-3D)

Deltocephalus (Deltocephalus) vulgaris Dash & Viraktamath, 1998: 4, Figs. 1-11 (India); Zhang & Duan, 2011: 3, Fig. 3A-H.

Male: 2.9 mm; female: 3.4 mm.

Material examined. 2♂♂, 1♀, Pakistan, Azad Jammu & Kashmir, Muzaffarabad City, 737m, 30-VI-2016, coll. Hassan Naveed.

Distribution. India, China, Pakistan.

Remarks. This species is collected from the grassland in Muzaffarabad Mountains and is also known to be the vector of glassy shoot disease in sugarcane. This species may contain two forms of aedeagus (Figs. 3A-3B, 3C-3D) as recorded by Dash & Viraktamath (1998) from India and Zhang & Duan (2011) from China respectively. Here we found the specimens from Pakistan to have the short form of aedeagal shaft. This species can easily be identified by the color pattern and the aedeagus with a shallow apical notch.

***Deltocephalus infirmus* Melichar, 1903, new record to Pakistan**

(Figs. 1C-3D, 3E-3G)

Deltocephalus infirmus Webb & Viraktamath, 2009: 13, Fig. 10.

Deltocephalus infirmus Melichar, 1903: 203, pl. V, Fig. 11 (Sri Lanka).

Jassargus infirmus (Melichar) by Ishihara, 1961: 244, Figs. 53-58, misidentification.

Male: 2.2 mm.

Material examined. 1♂, Pakistan, Azad Jammu & Kashmir, Muzaffarabad City, 737 m, 30-VI-2016, coll. Hassan Naveed.

Remarks. A similar species to *D. vulgaris* but with the aedeagal shaft lacking an apical notch. The placement of this species in *Jassargus* Zachvatkin by Ishihara (1961: 244) is erroneous as it is based on a different (unknown) species.

Genus *Maiestas* Distant, 1917

Maiestas Distant, 1917: 312. Type species: *Maiestas illustris* Distant, by monotypy.

Key to Pakistan species (males), excluding *Maiestas setosa* (Ahmed, Murtaza & Malik)

1. Vertex dark brown with white milky spots (Fig. 1E); aedeagal shaft with laminate serrations (Fig. 3H).....*M. albomaculata* new record
- Vertex without white milky spots; aedeagal shaft without laminate serrations.....2
2. Style with apophysis bidentate ventrally; aedeagal shaft apically rounded in lateral view (Fig. 3O).....*M. tareni*

- Not as above.....3
- 3. Subgenital plates narrow.....4
- Subgenital plates broad.....5
- 4. Aedeagal shaft with bifurcated ventral process short.....*M. indica*
- Aedeagal shaft with bifurcated ventral process long (Figs. 3L-3M).....*M. samuelsoni* new record
- 5. Aedeagal shaft broad at base and tapering towards apex upturned.....*M. subviridis*
- Aedeagal shaft tubular (Figs. 3J-3K).....*M. pruthii*

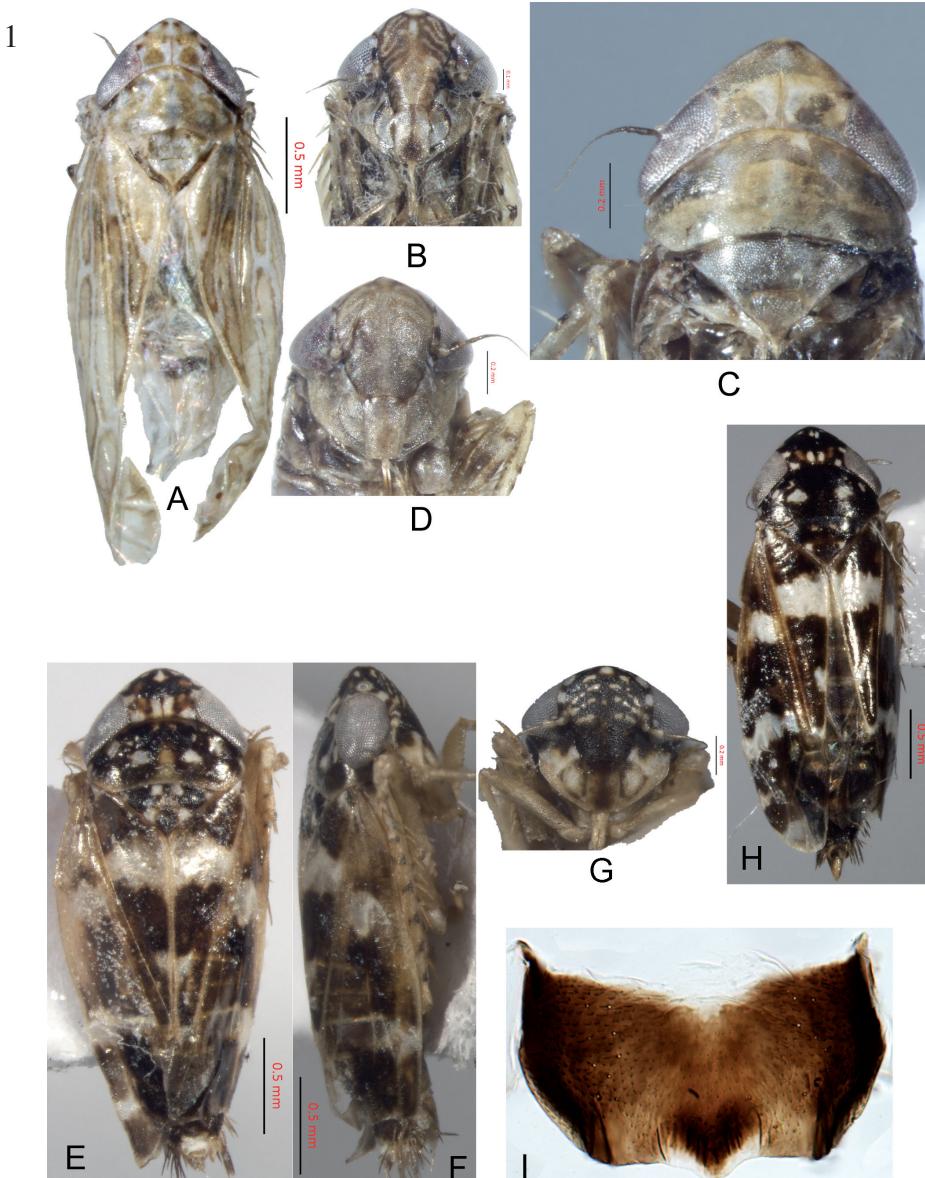


Figure 1. *Deltcephalus vulgaris* Dash & Viraktamath, 1998. A. Habitus, dorsal view; B. Face; *Deltcephalus infirmus* (Melichar, 1903). C. Habitus, dorsal view; D. Face; *Maiestas albomaculata* Dash & Viraktamath, 1998. E. Habitus, dorsal view; F. Habitus, lateral view; G. Face; H. Female, dorsal view; I. Female seventh sternum, ventral view.

***Maiestas albomaculata* (Dash & Viraktamath, 1998), new record to Pakistan**

(Figs. 1E-1I, 3H-3I)

Deltococephalus (Recilia) albomaculatus Dash & Viraktamath, 1998: 12, Figs. 29-34 (India).

Maiestas albomaculata, Webb & Viraktamath, 2009: 21 **comb. nov.**

Male: 2.7-2.9 mm; female: 3.3 mm.

Material examined. 3♂, 1♀, Pakistan: Punjab: Forest area of Lalian City, 4-VIII-2017, coll. Hassan Naveed; 2♀, Bhakkar City, 13-VII-2017, coll. Hassan Naveed.

Remarks. This species differs from other *Maiestas* species in coloration, genital morphology and the aedeagal shaft with dorsolateral laminate serrations.

***Maiestas indica* (Pruthi, 1936)**

Allophleps indicus Pruthi, 1936: 120-121, plate IX, Fig. 3, text Fig. 132; (Pakistan); Webb & Viraktamath (2009).

Allophleps delhiensis Rao & Ramakrishnan, 1990: 111. Synonymised by Dash & Viraktamath, 1998: 35.

Deltococephalus (Recilia) indicus Dash & Viraktamath, 1998: 35-36, Fig. 305.

Maiestas indica, Webb & Viraktamath, 2009: 22. **comb. nov.**

Material examined. No material examined.

Distribution. India, Pakistan.

***Maiestas setosa* (Ahmed, Murtaza & Malik, 1988)**

Recilia setosa Ahmed, Murtaza & Malik, 1988: 412-414, Fig. 2 (Pakistan).

Maiestas setosa Webb & Viraktamath, 2009: 20.

Material examined. No material examined.

Distribution. Pakistan.

Remarks. The identity of this species cannot be ascertained due to the poor original description and figures, so it was excluded from the key.

***Maiestas subviridis* (Metcalf, 1946)**

Stirellus subviridis Metcalf, 1946: 125 (Guam). Synonymised with *M. hopponis* (Matsumura) by Linnauvori, 1975: 617, in error.

Deltococephalus (Recilia) subviridis Dash & Viraktamath, 1998: 24, Figs. 166-172.

Maiestas subviridi Webb & Viraktamath, 2009: 19 comb. nov., Fig. 40; Khatri & Webb, 2010: 11, Plate 2b-c, Fig. 12; Zhang & Duan, 2011: 19.

Material examined. No material examined.

Distribution. Pacific, India, Pakistan, China.

Remarks. *M. subviridis* is close to *M. veinatus* (Pruthi) and *M. bispinosus* Dash & Viraktamath. Earlier, *M. subviridis* was only known to occur in the pacific region (Wilson & Claridge 1991).

***Maiestas pruthii* (Metcalf, 1967)**

(Figs. 2A-2C, 3J-3K)

Deltcephalus notatus Pruthi, 1936: 128-129, Fig. 139, plate IX, Fig. 10 (Pakistan). Preoccupied, not Melichar, 1896.

Maiestas pruthii Metcalf, 1967: 1173, new name; Webb & Viraktamath, 2009: 20.

Male: 2.6 mm; female: 3.2 mm.

Material examined. 3♂, 4♀, Pakistan: Punjab: Kalri, 19-V-2016, coll. Hassan Naveed; 2♂, 1♀, Lalian City, 23-VIII-2016; 2♀, Bhakkar City, 13-VII-2017, coll. Hassan Naveed.

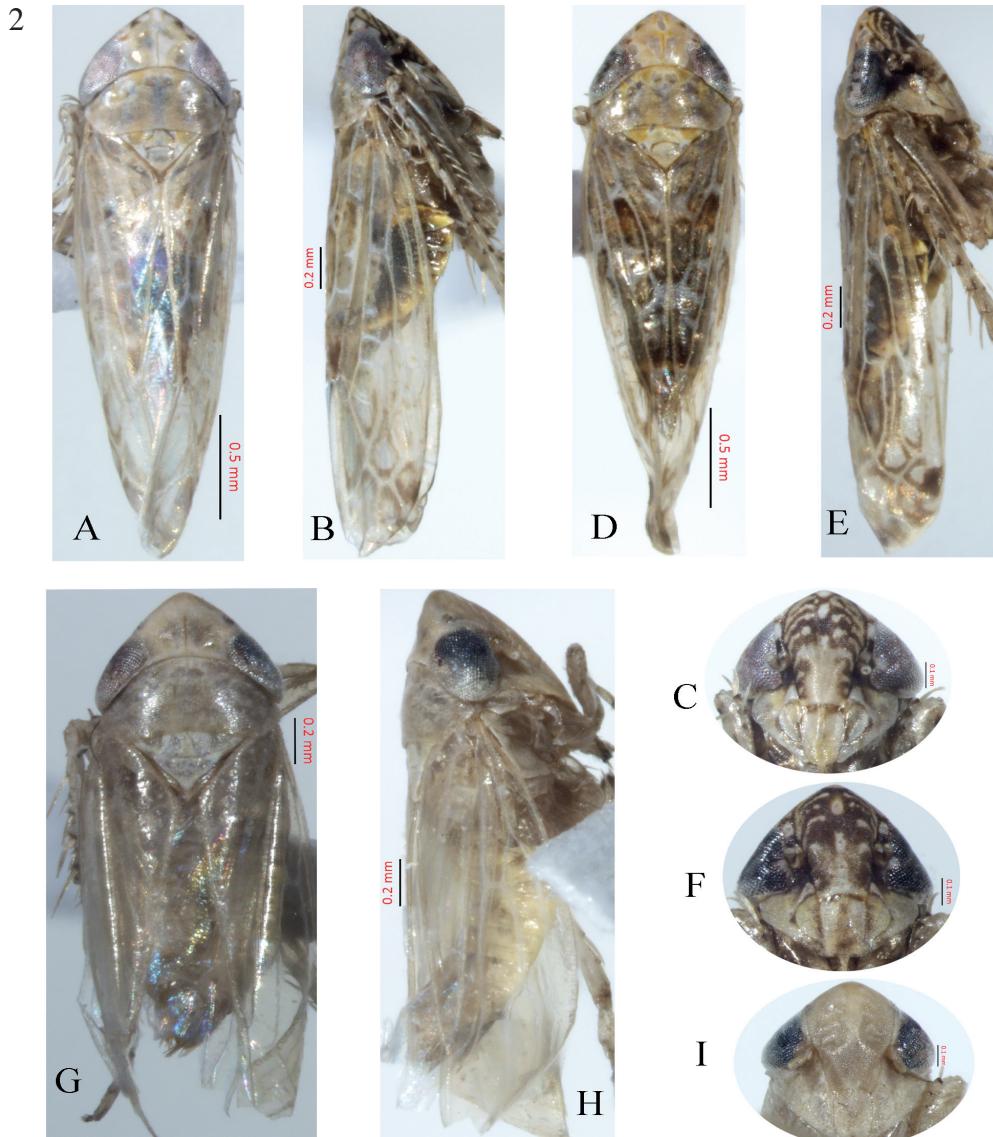


Figure 2. A-C. *Maiestas subviridis* (Metcalf, 1946), A. Habitus, dorsal view; B. Habitus, lateral view; C. Face; D-F. *Maiestas samuelsoni* (Knight, 1976), D. Habitus, dorsal view; E. Habitus, lateral view; F. Face; G-I. *Maiestas tareni* (Dash & Viraktamath, 1998), G. Habitus, dorsal view; H. Habitus, lateral view; I. Face.

Distribution. India, Pakistan.

Remarks. It is related to *M. subviridis* by having rounded apex of the aedeagal shaft, but *M. pruthii* differs from *M. subviridis* in the ventral extension of the aedeagal shaft reaching beyond gonopore.

Maiestas samuelsoni (Knight, 1976) new record to Pakistan

(Figs. 2D-2F, 3L-3M)

Deltocephalus samuelsoni Knight, 1976: 96-97, Figs. 4a-c (Norfolk and Kermadec islands).

Maiestas samuelsoni, Webb & Viraktamath, 2009: 19, Fig. 41; Zhang & Duan, 2011: 18.

Male: 2.7 mm.

Material examined. 3♂, Pakistan: Khyber Pakhtunkhwa: Mansehra, 1088 m, 3-VIII-2016, coll. Hassan Naveed.

Distribution. Pacific islands (Kermadec, Norfolk Is., Fiji, Philippines), China, Pakistan.

Remarks. This is the first record of this species from Indian subcontinent and can be distinguished by the long and slightly concave outer margin of subgenital plates.

Maiestas tareni (Dash & Viraktamath, 1995)

(Figs. 2G-I, 3N-3O)

Deltocephalus (Recilia) tareni Dash & Viraktamath, 1995: 74-76, Figs. 1-15 (India); Dash & Viraktamath, 1998: 16, Figs. 78-84.

Maiestas tareni, Webb & Viraktamath, 2009: 22 comb. nov.; Khatri & Webb, 2010: 11, Plate 2d, Fig. 11; Zhang & Duan, 2011: 20.

Male: 2.2-2.7 mm; female: 2.9 mm.

Material examined. 2♂, 1♀, Pakistan: Azad Jammu and Kashmir: Muzaffarabad, 737 m, 30-VI-2016, coll. Hassan Naveed; 1♂, 3♀, Pakistan: Punjab: Kalri, 19-V-2016, coll. Hassan Naveed; 6♂, 8♀, Pakistan: Punjab: Chowk Azam, 17VII-2016, coll. Hassan Naveed.

Distribution. India, Pakistan, China.

Remarks. It can easily be distinguished by the style stouter and the style apophysis and aedeagal shaft rounded in lateral view.

Genus *Paramesodes* Ishihara, 1953

Paramesodes Ishihara, 1953: 45. Type species: *Athysanus albinervosus* Matsumura, 1902.

For genus description see Wilson (1983); Duan & Zhang 2012.

Paramesodes lineaticollis (Distant, 1908)

Paramesodus lineaticollis Distant, 1908: 294 (India).

Paramesodes ishuridii Mahmood & Meher, 1973: 135 (Pakistan). Synonymised by Wilson, 1983: 21.

Paramesodes lineaticollis Wilson, 1983: 21-22, Figs. 23-29.

Material examined. No material examined.

Distribution. Bangladesh, India, Pakistan.

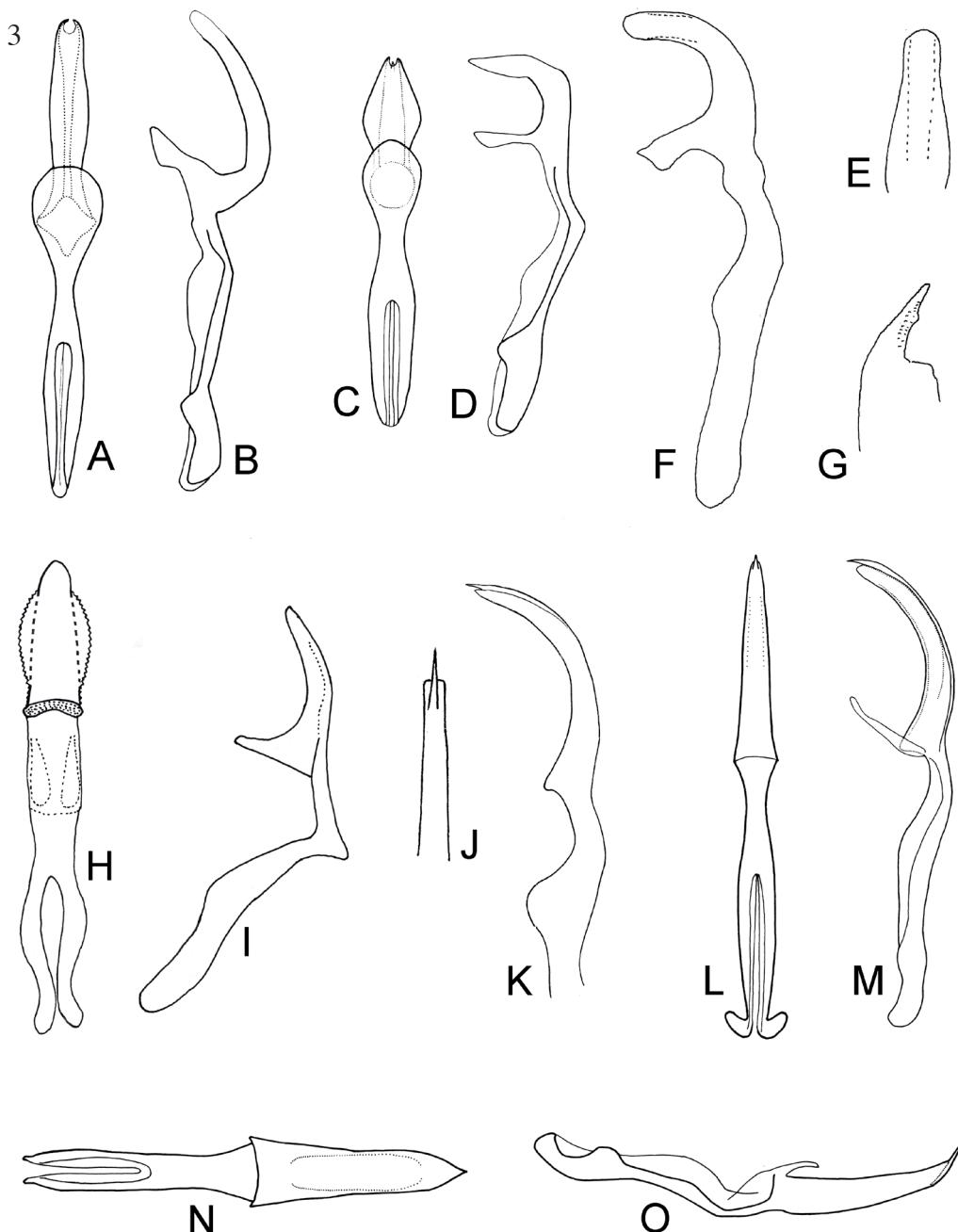


Figure 3. *Deltcephalus vulgaris* Dash & Viraktamath, 1998. A-D, A. Aedeagus and connective, dorsal view; B. Aedeagus and connective, lateral view; C. Aedeagus and connective, dorsal view; D. Aedeagus and connective, lateral view; *Deltcephalus infirmus* (Melichar, 1903) E-G, E. Apex of aedeagus; F. Aedeagus and connective, lateral view; G. Style apophysis; *Maiestas albomaculata* Dash & Viraktamath, 1998 H-I, H. Aedeagus and connective, dorsal view; I. Aedeagus and connective, lateral view; *Maiestas pruthii* (Metcalf, 1967), (Figure by Khatri & Webb 2010) J-k, J. Aedeagus, dorsal apex; K. Aedeagus, lateral view; *Maiestas samuelsoni* (Knight, 1976) (Figure by Zhang & Duan 2011) L-M, L. Aedeagus, dorsal apex; M. Aedeagus, lateral view; *Maiestas tarenii* (Dash & Viraktamath 1998), (Figure by Zhang & Duan 2011) N-O, N. Aedeagus, dorsal apex; O. Aedeagus, lateral view.

Acknowledgements

We are grateful to John Richard Schrock (Emporia State University, USA) and Prof. Viraktamath (University of Agricultural Sciences, Bangalore, India) for revising the manuscript. Special thanks to an anonymous referee for reading the manuscript and making some suggestions. The National Natural Science Foundation of China (31420103911) and The Ministry of Science and Technology of the People's Republic of China (2005DKA21402, 2015FY210300 supported this study).

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