

Research Article



Newly Recorded Species in the Subfamily Deltocephalinae (Homoptera: Cicadellidae) from Pakistan

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Abstract | Three species in the leafhopper subfamily Deltocephalinae, *Changwhania terauchi* Matsumura (1915) n. rec., *Linnavuoriella arcuata* Hamilton (1980) n. rec. and *Paralimnellus cingulatus* Dlabola (1960) n. rec. are reported for the first time from Pakistan. All species are described and illustrated with habitus photographs.

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Introduction

Deltocephalinae is comprised of over 38 tribes, 6,683 described species under 923 genera, making it the largest subfamily of Cicadellidae based on the number of described species, and is found in all geographical regions (Zahniser and Dietrich, 2013). Up to date, 31 genera and 57 species of Deltocephalinae have been recorded from Pakistan (Khatri and Webb, 2010). Subfamily Deltocephalinae includes small-to-large, mainly wedge-shaped leafhoppers. Ocelli on anterior margin of the head near to eyes; frontoclypeus not swollen, carinae absent; lateral frontal sutures reaching to ocelli; antennal ledges reduced or absent; gena with a fine erect seta laterad of lateral frontal suture, large, usually covering up the proepisternum. Forewing macropterous to brachypterous; if macropterous, with apices overlapping at rest; with 3 antepical cells; often with 1 or more cross veins between A1 and claval suture; inner apical cell narrowed distally, not reaching to

wing apex. Profemur AM1 setae distinct; row AV with short stout setae extending from base to 1/2 to 2/3 length of femur; intercalary row with various thin setae arranged in one row. Mesotrochanter with apical postero ventral stout seta. Metafemur macrosetal formula usually 2+2+1 with penultimate pair close-set. Metatibia usually anteroposteriorly compressed, ventrally with a median ridge. Male pygofer usually with a membranous cleft at basolateral margin. Valve produced posteriorly, lateral margins short, articulated with pygofer laterally. Sub genital plates articulated with each other and with valve; usually triangular, normally somewhat flattened; with dorsal slot or fold articulating with style. Connective Y-shaped or 'linear', rarely T-shaped; devoid of anteromedial lobe or process. Style broad at base, bilobed basally; apophysis not elongate. First valvula convex to relatively straight; dorsal sculpturing pattern reaching the dorsal margin or not; sculpturing pattern strigate, concatenate, reticulate, imbricate, maculose, or granulose. Second valvula with basal fused section as

long as distal paired blades or longer; median dorsal tooth present or not; usually with small to large, regularly or irregularly shaped dorsoapical teeth on apical 1/3 or more; teeth sometimes restricted to apical 1/4, or absent.

During ongoing studies on the leafhopper fauna of Pakistan, three additional species belonging to subfamily Deltocephalinae, *Changwhania terauchii* Matsumura (1915) n. rec., *Paralimnellus cingulatus* Dlabola (1960) n. rec. and *Linnavuoriella arcuata* Hamilton (1980) n. rec., are reported for the first time from Pakistan. The material examined is deposited in the Entomological Museum, Northwest AandF University, Yangling, Shaanxi, China (NWFU).

Genus changwhania kwon, 1980

- Type species: *Aconura terauchii* Matsumura, 1915 by original designation.
- *Changwhania* Kwon, 1980, 96, 97; Webb and Heller, 1990, 452.
- For a detailed description of this genus, see Zhang et al. (2009).

Distribution

Palearctic Region; Asia; Austro-Oriental Region

Key to species of Changwhania from Pakistan (males)

- Coronal margin of crown with pair of round black markings; aedeagus with subapical processes and truncate apex.....*C. terauchii*
- Coronal margin of crown with pair of oval black markings; aedeagus with apical processes and apically rounded.....*C. ceylonensis*

Changwhania terauchii (Matsumura, 1915) (Figure 1 A–I), *new record to Pakistan*

- *Aconura terauchii* Matsumura, 1915: 163; Matsumura, 1931; 1250; Esaki and Ito, 1954; 175.
- *Changwhania terauchii*, Kwon, 1980, 97, 99, Figure 1 (1-3), 2 (1-8); Webb and Heller, 1990: 452; Cai, Sun and Jiang, 2001: 93; Zhang et al., 2009: 21.
- Length (including tegmen). Male: 2.7 mm; female: 3.1 mm.

Materials examined: 2♂1♀, Pakistan: Azad Jammu and Kashmir: Muzaffarabad, 737 m, 12-VII-2016, coll. Naveed Hassan. 4♂11♀, Azad Jammu and Kashmir: Rawalakot, 1638 m, VII-2017, coll. Naveed Hassan.

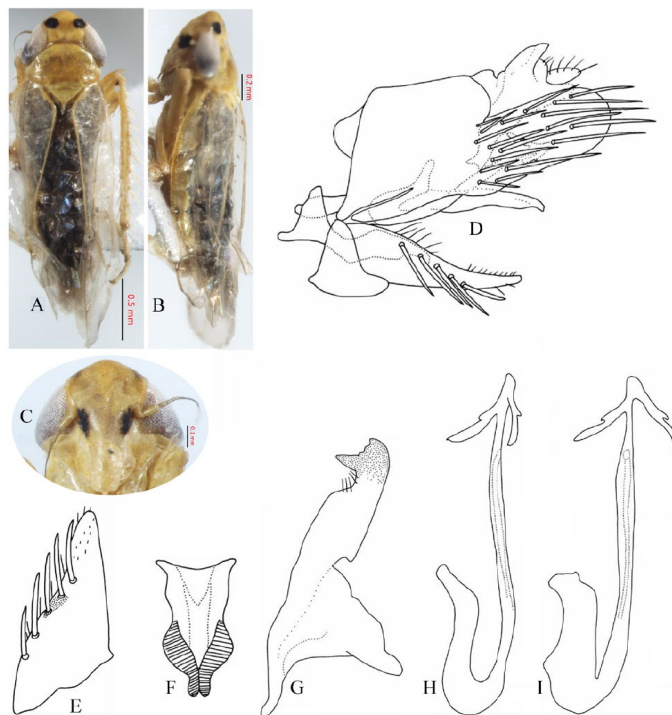


Figure 1: *Changwhania terauchii* Matsumura. **A:** Habitus, dorsal view; **B:** Habitus, lateral view; **C:** Face; **D:** Pygofer lobe, lateral view; **E:** Subgenital plate, dorsal view; **F:** Connective; **G:** Style, dorsal view; **H and I:** Aedeagus lateral and dorsal view respectively (Figure D–I by Zhang et al. 2009).

Remarks: This species can be distinguished by the head having large spots and truncate aedeagal apex with subapical processes; crown with spots more rounded than usual in *ceylonensis* and large facial spots. Both species have similar distributions and are sympatric in Nepal and possibly in other areas as well.

Distribution: Korea, Japan, China, India, Thailand, Malaysia, Java, Pakistan

Genus Linnavuoriella Evans, 1966

Linnavuoriella Evans, 1966: 134 (Type: *Platymetopius arcuata* Motschulsky, 1859)

Linnavuoriella arcuata (Motschulsky, 1859) (Figures 2 A–H), *new record to Pakistan*

Platymetopius arcuatus Motschulsky, 1859; *Tetigonia kalidasa* Kirkaldy, 1900a; *Parabolocratus centralis* Matsumura, 1912; *Parabolocratus citrinus* Evans, 1941; *Varta moshiensis* Rao, 1973; *Hecalus arcuatus* (Motschulsky, 1859), Morrison, 1973; *Linnavuoriella arcuata* Hamilton, 1980; Catanach and Dietrich, 2017.

Length: Male: 4.8–5.1mm; female: 5.8 mm.

Coloration and morphology: Crown subangularly

produced. Pronotum slightly wider than head, laterally carinate. Yellow-green. Orange lines dorsally on crown, pronotum and scutellum. Crown margin anteriorly with transverse submarginal ventral fuscous line. Forewings with dark spot at tip of clavus, two dark spots on apical margin (Figure 2 A, B and C).

Genitalia: Pygofer lobe acute apically, heavily setose in posterior half (Figure 2D). Valve broadly triangular. Connective “Y”-shaped with short stem. Subgenital plate elongate, broader at base, tapering apically with submarginal setae (Figure 2F). Style with sharp pointed apophysis (Figure 2E). Aedeagus with two pairs of petal-like terminal processes sub equal in length; gonopore subapical; dorsal apodeme finger-like (Figure 2 G, H).

Material examined: 3♂, 2♀, Pakistan: Khyber Pakhtunkhwa: Abbottabad, 1256m, 4 VIII 2016, coll. Hassan Naveed.

Distribution: Pakistan, Argentina, Australia, China, India, Malaysia, Indonesia, Laos, Japan, Thailand, Sri Lanka, Maldives, Vietnam, Philippines.

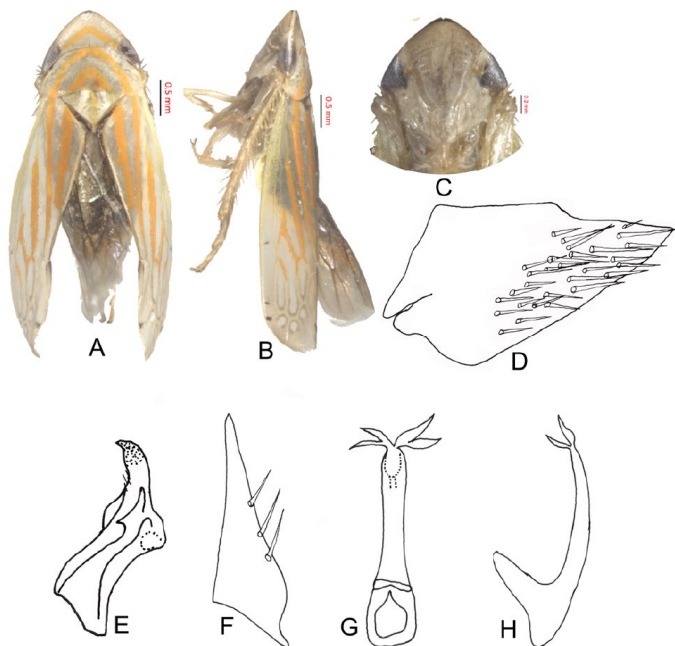


Figure 2: *Linnæuoriell aarcuratus* (Motschulsky) **A:** Habitus, dorsal view (male); **B:** Habitus, lateral view (male); **C:** Face; **D:** pygofer, lateral view; **E:** style; **F:** male subgenital plate; **G:** aedeagus, dorsal view; **H:** aedeagus, lateral view.

Genus Paralimnellus Emeljanov, 1972, new record to Pakistan

- Type species: *Paralimnus cingulatus* Dlabola, 1960. Synonymized by Xing and Li 2011.
- *Paralimnus* (*Bubulcus*) Dlabola, 1961: 320. Type

species: *Paralimnus cingulatus* Dlabola, 1960.

- *Paralimnellus* Emeljanov, 1972: 107. Type species: *Paralimnus cingulatus* Dlabola, 1960
- *Bubulcus* Dlabola, Hamilton, 1975: 487; Webb and Heller, 1990: 8. Type species: *Paralimnus cingulatus* Dlabola, 1960
- *Dlabolasia* Nemesio, 2007: 143; *nomen novum* for *Bubulcus* Dlabola, 1961, preoccupied by *Bubulcus* Bonaparte, 1854.

This genus closely resembles *Calamotettix* Emeljanov, in the aedeagal shaft dorsoventrally flattened, style shape and pygofer lobe with processes extending from the inner wall, but can be differentiated by the subgenital plates with apex narrow, anteclypeus narrowed apically and lacking the first ante-apical cell on the elytra (Emeljanov, 1972). This genus is represented by only one species and is recorded for the first time from Pakistan.

Distribution: Palearctic Region, Oriental Region.

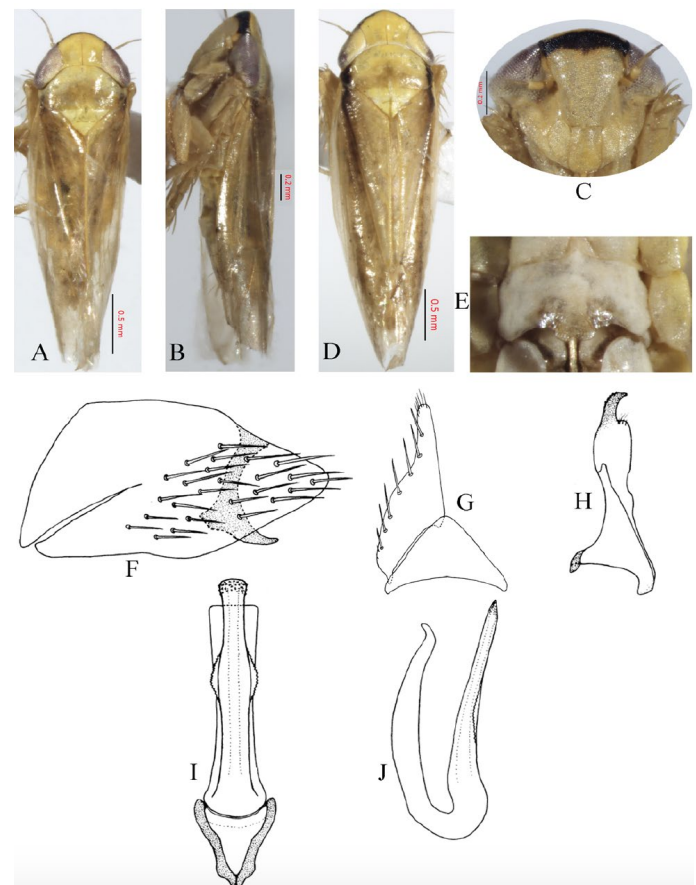


Figure 3: *Paralimnellus cingulatus* (Dlabola) **A:** Habitus, dorsal view (male); **B:** Habitus, lateral view (male); **C:** Face; **D:** Habitus, dorsal view (female); **E:** Female seventh sternite, ventral view; **F:** Pygofer, lateral view; **G:** Subgenital plate and valve, ventral view; **H:** Style, dorsal view; **I:** Aedeagus and connective, ventral view; **J:** Aedeagus, lateral view (Figure F–J by Xing and Li, 2011).

Paralimnellus cingulatus (Dlabola, 1960) (Figure 3 A–J), new record to Pakistan

- *Paralimnus cingulatus* Dlabola, 1960: 2
- *Paralimnus* (*Bubulcus*) *cingulatus* Dlabola, 1961: 320
- *Paralimnellus cingulatus* (Dlabola), Emeljanov 1972: 107
- *Bubulcus cingulatus* Dlabola; Hamilton 1975: 487; Webb and Heller 1990: 8
- *Paralimnus* (*Dlabolasia*) *cingulatus* Dlabola; Nemesio 2007: 143
- *Paralimnellus cingulatus* Xing and Li, 2011: 54–56, new taxonomic status
- Length (including tegmen). Male: 2.7–2.9 mm; Female: 3.5 mm.

Material examined: 4♂, 3♀, Pakistan: Azad Jammu and Kashmir: Rawalakot, 1638 m, VII-2017, coll. Hassan Naveed.

Distribution: USSR, Iran, Nepal, India, Korea, China, Pakistan.

Note: Emeljanov (1972) provided illustrations for the male pygofer side and aedeagus. Hamilton (1975) and Webb and Heller (1990) did not provide figures of the male genitalia.

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Author's Contribution

HN describes the species; HNKS wrote the paper; ZY provides technical support and revise the manuscript. All authors read and approved the final manuscript. The authors declare no conflict of interests.

References

- Bonaparte, C.L. 1854. Conspectus systematis ornithologiae. Ann. Sci. Nat. Paris, Zool. (4)1: 105-152.
- Catanach, T.A and C.H. Dietrich. 2017. Molecular phylogeny of the grassland leafhopper

Tribe Hecalini (Hemiptera: Cicadellidae: Deltocephalinae). Ann. Entomol. Soc. Am. 111 (2): 68-72. <https://doi.org/10.1093/aesa/sax076>

- Distant, W.L. 1908. Rhynchota-Homoptera. In: Bingham, C.T. (Ed.), The fauna of British India, including Ceylon and Burma. 4: pp. 501.
- Dlabola, J. 1960. Einigeneue zikadenaus dagestan und zentralasien (Homoptera). Stuttgarter beitraege zur naturkunde aus dem staatliche mus. Naturkunde in Stuttgart. 40: 1-5.
- Dlabola, J. 1961. Die Zikaden von Zentralasien, Dagestan und Transkaukasien (Homopt. Auchenorrhyncha). Acta Entomol. Musei Nationalis Pragae. 34: 241-358.
- Cai, P., J.H. Sun and J.F. Jiang. 2001. A list of Chinese Cicadellidae (Homoptera) on Kudzu, with description of new species and new records. Sci. Silvae Sinicae. 37(3): 92-100.
- Emeljanov, A.F. 1972. New Palaearctic leafhoppers of the subfamily Deltocephalinae (Homoptera, Cicadellidae). Entomologicheskoe Obozrenie. 51(1): 102-111.
- Esaki, T. and S. Ito. 1954. A tentative catalogue of Jassoidea of Japan and her Adjacent Territories. Japan Soc. Prom.Sci. Ueno Park, Tokyo. pp. 315.
- Evans, J.W. 1941. New Australian leafhoppers. Trans. Royal Soc. South Aust. 65: 36-41.
- Evans, J.W. 1966. The leafhoppers and froghoppers of Australia and New Zealand (Homoptera: Cicadelloidea and Cercopoidea). Aust. Mus. Memoir. 12: 1-347. <https://doi.org/10.3853/j.0067-1967.12.1966.425>
- Hamilton, K.G.A. 1975. Review of the tribal classification of the leafhopper subfamily Aphrodinae (Deltocephalinae of authors) of the Holarctic region (Rhynchota: Homoptera: Cicadellidae). Can. Entomol. 107: 477-498. <https://doi.org/10.4039/Ent107477-5>
- Hamilton, K.G.A. 1980. Contribution to the study of the World Macropsini (Rhynchota: Homoptera: Cicadellidae). Can. Entomol. 112: 875-932. <https://doi.org/10.4039/Ent112875-9>
- Kirkaldy, G.W. 1900. Bibliographical and nomenclatorial notes on the Rhynchota. No. 1. Entomol. 33: 238-243. <https://doi.org/10.5962/bhl.part.3888>
- Khatri, I. and M.D. Webb. 2010. The Deltocephalinae leafhoppers of Pakistan (Hemiptera, Cicadellidae). Zootaxa, 2365:

- 1-47.
- Kwon, Y.J. 1980. *Changwhania* gen. n., new Palaearctic genus of leafhoppers from the subtribe Deltocephalina (Homoptera: Cicadellidae). Commemoration papers for professor C.W. Kim's 60th Birthday Anniversary. 95-102.
- Matsumura, S. 1912. Die acocephalinen und bythoscopinen Japans. Sapporo Coll. Agric. J.4: 279-325.
- Matsumura, S. 1915. Neue Cicadinen Koreas. Trans. Nat. Hist. Soc. Sapporo. 5: 154-184.
- Matsumura, S. 1931. 6000 Illustrated Insects of the Japan Empire. Tokyo: Tokohshoin. pp. 1496. 10 pls.
- Morrison W.P. 1973. A revision of the Hecalinae (Homoptera) of the Oriental Region. Pacific Ins. 15 (3and4): 379-438.
- Motschulsky, V.I. 1859. Homopteres. In "Insectes des Indes orientales, et de contrées analogues". Etudes Entomologiques, rédigées par Victor de Motschulsky. 8: 25-118.
- Nemesio, A. 2007. *Dlabolasia* (Homoptera: Cicadellidae), a new subgeneric name for *Bubulcus* Dlabola, 1961. Acta Zool. Cracoviensia. 50B (2): 143. <https://doi.org/10.3409/000000007783995165>
- Rao, K.R. 1973. Studies on a small collection of Jassids from Poona (Homoptera: Cicadellidae). Zool. Anz. Leipzig. 191: 93-98.
- Webb, M.D. and F.R. Heller. 1990. The leafhopper genus *Pseupalus* in the old world tropics, with a check-list of the afrotropical and oriental paralimnini (Homoptera: Cicadellidae: Deltocephalinae). stuttgarter beiträge zur naturkunde, Serie A (Biologie). 452: 1-10.
- Xing, J.C. and Z.Z. Li. 2011. New taxonomic status of *Paralimnellus* Emeljanov, 1972 and *Dlabolasia* Nemesio, 2007 (Hemiptera: Cicadellidae: Deltocephalinae: Paralimnini). Zootaxa. 2831: 54-56. <https://doi.org/10.11646/zootaxa.2831.1.4>
- Zahniser, J.N. and C.H. Dietrich. 2013. A review of the tribes of Deltocephalinae (Hemiptera: Auchenorrhyncha: Cicadellidae). Eur. J. Taxonomy. 45: 1-211. <https://doi.org/10.5852/ejt.2013.45>
- Zhang, Y.L., Y. Duan and M.D. Webb. 2009. A taxonomic review of the Old World leafhopper genus *Changwhania* Kwon (Hemiptera: Cicadellidae: Deltocephalinae: Paralimnini). Zootaxa. 2089: 19-32.