

On the systematic positions of the Bladinini Kirkaldy, Tonginae Kirkaldy, and Trienopinae Fennah (Homoptera, Fulgoroidea)

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The structure of the male and female genitalia is discussed as the criterion for identification of taxonomic positions of Bladinini Kirkaldy, Tonginae Kirkaldy, and Trienopinae Fennah within fulgoroid families. Tongini Kirkaldy, stat. n. is transferred to the family Nogodinidae Melichar. *Bowesdorpia* Synave and provisionally *Bilbilis* Stål are transferred to the tribe Mithymnini Fennah, *Mangola* Melichar and *Rileyopsis* Bergevin to the tribe Epacriini Fennah (Nogodinidae). Gaetuliini Fennah, stat. n. and Trienopini Fennah, stat. n. are transferred to the family Tropiduchidae Stål. *Distichoptera* Brèthes, 1913 is placed in synonymy under *Nubithia* Stål, 1859 (Gaetuliini) and *Ivinga* Distant, 1911 under *Trienopa* Signoret, 1860 (Trienopini). *Fritzruehlia* Schmidt is transferred to the Trienopini.

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Introduction

Despite great interest to study of phylogenetic relationships within planthoppers (Emeljanov, 1990, 1999; Bourgoïn et al., 1997; Yeh et al., 1998, 2005; Urban & Cryan, 2006), the taxonomy of higher Fulgoroidea is still not stable. The present paper is an attempt to identify correctly the taxonomic positions of the Bladinini Kirkaldy, Tonginae Kirkaldy, and Trienopinae Fennah based on the study of the male and female genitalia.

The morphological terminology follows Gnezdilov (2003). The genital segments of examined specimens were macerated in 10% KOH and drawn in glycerin jelly using light microscope.

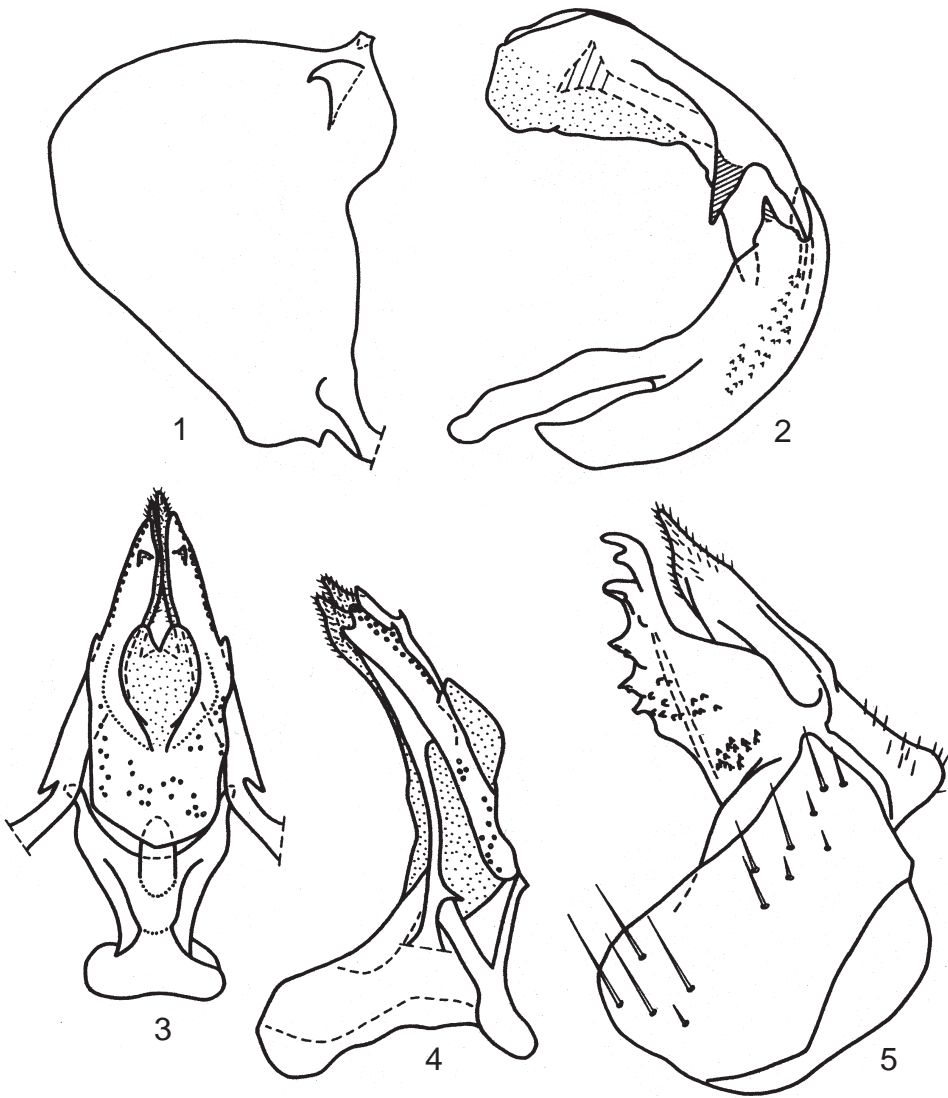
The material examined is deposited in the following collections: ZIN – Zoological Institute of the Russian Academy of Sciences, St.Petersburg, Russia; CASC – California Academy of Sciences, San Francisco, USA; ARCP – Agricultural Research Council, Pretoria, South Africa; MNHN – Museum National d'Histoire Naturelle, Paris, France.

Taxonomy

The Bladinini (Nogodinidae) *sensu* Fennah (1978, 1984) and the Acanaloniidae *sensu* Emeljanov (1999) should be considered polyphyletic groups. This view is supported by morphological (see below) and molecular data (Urban & Cryan, 2006).

The structure of the male genitalia can be used for correct identification of the Nogodinidae s. str. The Nogodinidae Melichar (and first of all, *Nogodina* Stål, the type genus of the family) are characterized by the massive phallobase with variform processes and distinctive style with long and narrow capitulum devoid of teeth. Within the Nogodinidae, there are two patterns of the female genitalia. Most of the genera are characterized by the elongate gonoplasts and narrow connective laminae of gonapophyses VIII and IX (Gnezdilov, 2003, figs 20-22). Another pattern, in the genus *Bladina* Stål, with rounded gonoplasts, wide posterior connective lamina of gonapophyses IX and anterior connective lamina of gonapophyses VIII, is similar to that in the Fulgoridae and Caliscelidae (Gnezdilov, 2003, figs 37, 38). According to Shcherbakov (2006), *Bladina*-like nogodinids with rounded ovipositor could be treated as the earliest higher Fulgoroidea.

The Tonginae Kirkaldy, 1907, recently transferred to the family Acanaloniidae from the Issidae (Emeljanov, 1999), according to the structure of the penis and style (massive phallobase with processes and style with long, narrow capitulum without teeth) (see Fennah, 1954, figs 9, 11; Chan & Yang, 1994, figs 31-33) are closer to the members of the family Nogodinidae Melichar than to Acanaloniidae Amyot & Serville. The Acanaloniidae s. str. are characterized by the phallobase bearing a pair of long apical processes directed to its base and style with a large plate, which has an elongate caudo-dorsal part, but a short capitulum

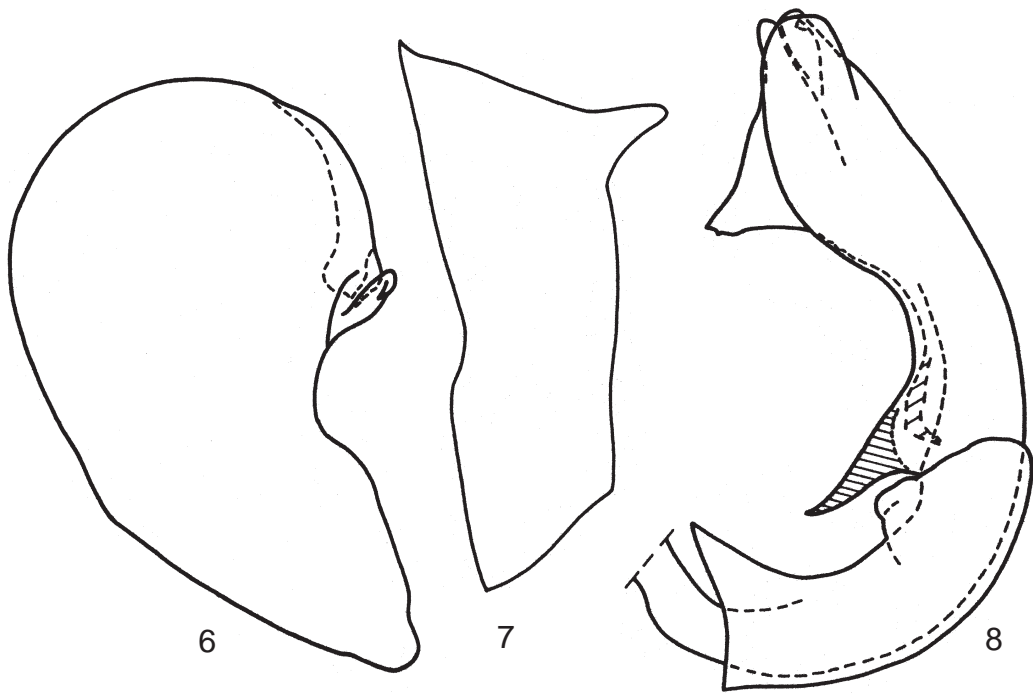


Figs 1-5. *Gaetulia vulgaris* Caldwell, male (1, 2) and female (3-5) genitalia. 1, style, lateral view; 2, penis, lateral view; 3, posterior connective lamina of gonapophyses IX, dorsal view; 4, same, lateral view; 5, anterior connective lamina of gonapophyse VIII and gonocoxa VIII, lateral view.

(see Fennah, 1967, figs 12-30; Freund & Wilson, 1995, figs 3-21). I propose to transfer Tonginae to the family Nogodinidae and treat it as a distinct tribe, Tongini Kirkaldy, stat. n.

The Bladinini Kirkaldy, 1907 were treated by Fennah (1978) as including 3 subtribes: Bladiniina Kirkaldy, 1907, Elicina Melichar, 1915, and Gaetuliina Fennah, 1978. The monotypic subtribe Bladiniina, according to the structure of the male genitalia in *Bladina* (massive phallobase with processes and style with long, narrow capitulum without teeth) belongs to the Nogodinidae. Con-

rarily, the Gaetuliina are characterized by the male genitalia (Figs 1-2; see also Doering, 1936, pls 38-41; 1938, pls 63-66; 1939, pls 14-19; Synave, 1956, figs 1-8) very close to those of the members of the family Tropiduchidae, particularly Trypetimorphini (see Bourgoïn & Huang, 1990, fig. 1): aedeagus in the shape of a narrow curved tube with hook-shaped processes, phallobase short, style with distinctive finger-shaped lateral tooth. The mentioned pattern of the male genitalia was observed in the following genera: *Gaetulia* Stål, *Nubithia* Stål, *Dyctidea* Uhler,



Figs 6-8. *Trienopa flavida* Signoret, male genitalia. **6**, style, lateral view; **7**, pygofer, lateral view; **8**, penis, lateral view.

Dictyonia Uhler, *Osbornia* Ball, *Dictyobia* Uhler, *Dictyonissus* Uhler, *Dictyssa* Melichar, *Danepteryx* Uhler, *Neaethus* Stål, *Gamergus* Stål, *Gamergomorphus* Melichar, *Paragamergomorphus* Synave, *Johannesburgia* Distant, *Alleloplasis* Waterhouse, *Salona* Stål.

The examined structure of the ovipositor of *Gaetulia vulgaris* Caldwell (Figs 3-5) strongly differs from that of *Bladina*: posterior connective lamina flattened dorso-ventrally, gonospiculum bridge with 3 distinct long rods jointed with posterior connective lamina, anterior connective lamina with wide comb bearing small denticles on its plate, and gonoplacs with denticles. Gonospiculum bridge with long rods and anterior connective lamina with small denticles on its plate show the affinity of *Gaetulia* to the Tropiduchidae (*Trypetimorpha* Costa) (Gnezdilov, 2003, figs 35, 36).

I propose to transfer the subtribe Gaetuliina Fennah (excluding *Bilbilis* Stål) to the family Tropiduchidae and treat it as a distinct tribe, Gaetuliini Fennah, 1978, stat. n. This point of view is supported by recently provided data of nucleotide sequences from four nuclear genes (Urban & Cryan, 2006). According to these data, the two studied gaetuliini genera (*Dictyssa* and *Danepteryx*) represent a sister group of Tropiduchidae.

The molecular data also support the position of the *Bladina* separate of gaetuliini genera and other Nogodinidae.

The genus *Bilbilis* Stål, according to the structure of the penis and style (see Fennah, 1984, figs 1-9) belongs to Nogodinidae and close to the members of the tribe Mithymnini Fennah. The genus *Bowesdorpia* Synave described in the family Issidae (Synave, 1956), according to the structure of the penis with long aedeagal hooks branching from its apex and the structure of the style, is close to the mithymnini genera *Telmossias* Fennah and *Stilpnochlaena* Fennah. I propose to transfer *Bowesdorpia* and provisionally *Bilbilis* to the tribe Mithymnini.

The genus *Mangola* Melichar, according to the structure of the male genitalia (see Synave, 1957, figs 26, 27; Diabola, 1985, figs 96, 97, 101), is close to the members of the nogodinid tribe Epacriini Fennah.

The members of the subfamily Trienopinae Fennah, erected in the family Issidae (Fennah, 1954) and recently transferred to the family Acanaloniidae (Emeljanov, 1999), are characterized by the styles fused ventrally in basal half and bearing a finger-shaped lateral tooth, short phallobase and massive aedeagus with triangular processes (Figs 6, 8). The structure of the male

genitalia of Trienopinae is close to that of the tropiduchid tribe Eporini Fennah, 1982 known from India, Sri Lanka, SE Asia, Madagascar, Mascarene and Seychelles Islands (Williams, 1981; Fennah, 1982). The female genitalia of the Trienopinae are characterized by the narrow and elongate connective laminae of gonapophyses VIII and IX (Gnezdilov, 2003, figs 23, 24) and gonopods with marginal teeth. I propose to transfer the Trienopinae Fennah to the family Tropiduchidae and treat it as a distinct tribe, Trienopini Fennah, 1954, stat. n.

List of proposed combinations and examined material

Family **NOGODINIDAE** Melichar

Tribe **Tongini** Kirkaldy, stat. n.

Included genera: according to Fennah (1954).

Tribe **Mithymnini** Fennah

Included genera: according to Fennah (1984) and additionally *Bowesdorpia* Synave, 1956.

Provisionally included genus: *Bilbilis* Stål.

Bowesdorpia tricornis Synave, 1956

Examined material (ARCP and ZIN). **South Africa**, *Wiedouw Province*: 2 M, 2 F, Western Cape, Farm foot Gifberg Pass, SE of Vanrhynsdorp, 120 m, swept off *Wiborgia mucronata*, *Salvia lanceolata*, and *Chrysanthemoides incana*, 3-10.X.2002, M. Stiller leg.

Tribe **Epacriini** Fennah

Included genera: according to Fennah (1978, 1984) and additionally *Mangola* Melichar, 1906 and *Rileyopsis* Bergevin, 1917.

Rileyopsis peyerimhoffi Bergevin, 1917

Examined type material (MNHN). M, type (not dissected), Djelfa, collection E. de Bergevin.

Family **TROPIDUCHIDAE** Stål

Tribe **Gaetuliini** Fennah, stat. n.

Included genera (after Fennah, 1978, 1984): *Gaetulia* Stål, *Nubithia* Stål, *Dyctidea* Uhler, *Dictyonia* Uhler, *Osbornia* Ball, *Dictyobia* Uhler, *Dictyonissus* Uhler, *Dictyssa* Melichar, *Danepteryx* Uhler, *Neaethus* Stål, *Dictyssonina* Ball, *Misodema* Melichar, *Acrisius* Stål, *Gamerus* Stål, *Gameromorpha* Melichar, *Paragamergomorpha* Synave, *Johannesburgia* Distant, *Salona* Stål, *Alleloplasis* Waterhouse, *Paralasonia* Muir, *Nurunderia* Distant, *Indogaetulia*

Schmidt, *Pucina* Stål, *Laberia* Stål, *Riancia* Signoret, *Exphora* Signoret, *Siopaphora* Metcalf.

Gaetulia vulgaris Caldwell, 1947
(Figs 1-5)

Examined material (ZIN). **Mexico**, *Tamaulipas*, Gomez Farias: 1 F, 11.IV.1998; 1 M, 4.VIII.2000, all leg. D.R. Kasparyan.

Genus **Nubithia** Stål

Nubithia Stål, 1859: 323. Type species: *Nubithia griseocens* Stål, 1859.

Distichoptera Brèthes 1913: 151, **syn. n.** Type species: *Distichoptera porteri* Brèthes, 1913.

Nubithia porteri (Brèthes, 1913), comb. n.

Distichoptera porteri Brèthes, 1913: 151.

Note. The original description was examined.

Tribe **Trienopini** Fennah, stat. n.

Included genera: according to Fennah (1954) and additionally *Fritzruehelia* Schmidt, 1924.

Note. The genus *Fritzruehelia* is placed in the Trienopini according to the very long clavus of forewing and the structure of the male genitalia (after Synave, 1957, figs 28, 29).

Genus **Trienopa** Signoret

Trienopa Signoret, 1860: 188. Type species: *Trienopa flavida* Signoret, 1860.

Ivinga Distant, 1911: 42, **syn. n.** Type species: *Ivinga typica* Distant, 1911.

Note. Comparison of the descriptions and figures by Signoret (1860, figs 4, 4a, 4b) and Distant (1911, figs 2, 2a) shows that *Ivinga* Distant is a junior synonym of *Trienopa* Signoret. Fennah (1954) has treated *Ivinga* as a subgenus of *Trienopa* based on the presence of an apical carina on coryphe in *Ivinga* and absence of such a carina in *Trienopa*; actually, according to Signoret's description, *Trienopa flavida* also has such a carina.

Trienopa flavida Signoret, 1860
(Figs 6-8)

Examined material (CASC and ZIN). **Madagascar**: *Diego-Suarez* (= *Antsiranana*) *Prov.*: 2 F, Parc National Montagne d'Ambre, 960 m, 23.I.2001, M.E. Irwin leg.; 1 M, same locality, 960 m, 19.III.-5.IV.2001, malaise trap, R. Harin'Hala leg.; 1 F, same locality, 960 m, 21-26.IV.2001, malaise trap, M.E. Irwin, E.I. Schlinger & R. Harin'Hala leg.; 1 F, same locality, 1125 m, 29.I.-11.II.2001, malaise trap, R. Harin'Hala leg.; 1 F, Sakalava Beach, dwarf littoral forest, 10 m, 7-22.IV.2001, malaise trap across sandy trail, R. Harin'Hala leg.; 1 M, same locality, dwarf littoral forest, 25.VI.-6.VII.2001, R. Harin'Hala leg.; 1 M, dry forest 7 km N of Joffreville, 330 m, 7-27.IV.2001, malaise trap, R. Harin'Hala leg.;

Toamasina Prov.: 1 M, botanic garden near entrance to Andasibe National Park, 7-16.XI.2001, 1025 m, tropical forest, malaise trap, R. Harin'Hala leg.; 1 F, same locality, 24.X.-1.XI.2001, R. Harin'Hala leg.; *Antananarive Prov.*: 1 F, 7 km SE of Andasibe National Park headquarters, 9-23.IV.2001, 1050 m, malaise trap, R. Harin'Hala leg.; *Mahajanga Prov.*: 1 M, 1 F, Réserve d'Ankoririka, 10.6 km NE of Tsaramandroso, 210 m, 9-14.IV.2001, tropical dry forest, low vegetation, Fisher, Griswold et al. leg.

Trienopa typica (Distant, 1911), comb. n.

Ivinga typica Distant, 1911: 42.

Note. The original description was examined.

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References

- Bourgoïn, T. & Huang, J.** 1990. Morphologie comparée des genitalia mâles des Trypetimorphini et remarques phylogénétiques (Hemiptera: Fulgoromorpha: Tropiduchidae). *Ann. Soc. entomol. Fr.* (N.S.), **26**(4) : 555-564.
- Bourgoïn, T., Steffen-Campbell, J.D. & Campbell, B.C.** 1997. Molecular phylogeny of Fulgoromorpha (Insecta, Hemiptera, Archaeorrhyncha). The enigmatic Tettigometridae: evolutionary affiliations and historical biogeography. *Cladistics*, **13**: 207-224.
- Brèthes, J.** 1913. Description d'un nouveau genre et d'une nouvelle espèce d'Hémiptère Homoptère Sud-américaine. *Rev. Chil. Hist. Nat.*, **17**: 151-151.
- Chan, M.L. & Yang, Ch.T.** 1994. *Issidae of Taiwan* (Homoptera: Fulgoroidea). Taichung: ROC. 188 p.
- Distant, W.L.** 1911. "Sealark" Rhynchota. IV. In: The Percy Sladen Trust expedition to the Indian Ocean in 1905. Vol. 2. *Trans. Linn. Soc. Lond., Ser. 2, Zoology*, **13**: 29-48, 1 plate.
- Dlabola, J.** 1985. Neue mediterrane, eremische und ostafrikanische Issiden-Taxone (Hom., Auchenorrhyncha). *Acta Mus. nat. Pragae*, **40B**(3-4): 217-243.
- Doering, K.C.** 1936. A contribution to the taxonomy of the subfamily Issinae in America north of Mexico (Fulgoridae, Homoptera). Part I. *Univ. Kans. Sci. Bull.*, **24**(17): 421-467.
- Doering, K.C.** 1938. A contribution to the taxonomy of the subfamily Issinae in America north of Mexico (Fulgoridae, Homoptera). Part II. *Univ. Kans. Sci. Bull.*, **25**(20): 447-575.
- Doering, K.C.** 1939. A contribution to the taxonomy of the subfamily Issinae in America north of Mexico (Fulgoridae, Homoptera). Part III. *Univ. Kans. Sci. Bull.*, **26**(2): 83-167.
- Emeljanov, A.F.** 1990. An attempt of construction of a phylogenetic tree of the planthoppers (Homoptera, Cicadina). *Entomol. Obozr.*, **69**(2): 353-356. (In Russian).
- Emeljanov, A.F.** 1999. Notes on delimitation of families of the Issidae group with description of a new species of Caliscelidae belonging to a new genus and tribe (Homoptera, Fulgoroidea). *Zoosyst. Ross.*, **8**(1): 61-72.
- Fennah, R.G.** 1954. The higher classification of the family Issidae (Homoptera: Fulgoroidea) with descriptions of new species. *Trans. Roy. entomol. Soc. Lond.*, **105**(19): 455-474.
- Fennah, R.G.** 1967. Fulgoroidea from the Galapagos Archipelago. *Proc. Calif. Acad. Sci.*, Ser. 4, **35**(4): 53-102.
- Fennah, R.G.** 1978. The higher classification of the Nogodinidae (Homoptera, Fulgoroidea) with the description of a new genus and species. *Entomol. mon. Mag.*, **113**, 1977: 113-119.
- Fennah, R.G.** 1982. A tribal classification of the Tropiduchidae (Homoptera: Fulgoroidea), with the description of a new species on tea in Malaysia. *Bull. entomol. Res.*, **72**: 631-643.
- Fennah, R.G.** 1984. Revisionary notes on the classification of the Nogodinidae (Homoptera, Fulgoroidea), with description of a new genus and a new species. *Entomol. mon. Mag.*, **120**: 81-86.
- Freund, R. & Wilson, S.W.** 1995. The planthopper genus *Acanalonia* in the United States (Homoptera: Issidae): male and female genitalic morphology. *Insecta Mundi*, **9**(3-4): 195-215.
- Gnezdilov, V.M.** 2003. Review of the family Issidae (Homoptera, Cicadina) of the European fauna, with notes on the structure of the ovipositor in planthoppers. *Chteniya pamyati N.A. Kholodkovskogo* [Meetings in Memory of N.A. Cholodkovsky], **56**(1): 1-145. (In Russian with English summary).
- Signoret, V.** 1860. Faune des Hémiptères de Madagascar. Pt. 1. Homoptères. *Ann. Soc. entomol. Fr.* (Ser. 3), **8**: 177-206, 2 plates.
- Synave, H.** 1956. Contribution à l'étude des Issidae africains (Homoptera-Fulgoroidea). *Bull. Inst. Sci. natur. Belg.*, **32**(57): 1-22.
- Synave, H.** 1957. Issidae (Homoptera - Fulgoroidea). *Explor. Parc nat. Upemba, Miss. G.F. De Witte*, **43**: 1-78.
- Shcherbakov, D.E.** 2006. The earliest find of Tropiduchidae (Homoptera: Auchenorrhyncha), representing a new tribe, from the Eocene of Green River, USA, with notes on the fossil record of higher Fulgoroidea. *Russ. entomol. J.*, **15**(3): 315-322.
- Stål, C.** 1859. Novae quaedam Fulgorinorum formae speciosae insigniores. *Berlin. entomol. Z.*, **3**: 313-328.
- Urban, J.M. & Cryan, J.R.** 2006. Evolution of the planthoppers (Insecta: Hemiptera: Fulgoroidea). *Molec. Phylogen. Evol.*, **42**: 556-572.
- Williams, J.R.** 1981. Tropiduchidae (Fulgoroidea: Homoptera) from the Mascarenes. *J. entomol. Soc. South Afr.*, **44**(1): 109-130.
- Yeh, W.-B., Yang, C.-T. & Hui, C.-F.** 1998. Phylogenetic relationships of the Tropiduchidae-group (Homoptera: Fulgoroidea) of planthoppers inferred through nucleotide sequences. *Zool. Stud.*, **37**(1): 45-55.
- Yeh, W.-B., Yang, C.-T. & Hui, C.-F.** 2005. A molecular phylogeny of planthoppers (Hemiptera: Fulgoroidea) inferred from mitochondrial 16S rDNA sequences. *Zool. Stud.*, **44**(4): 519-535.