

**Taxonomic Revision of the Oriental Planthopper Genus *Putala*,
with Description of a New Species and Resurrection of the Genus
Avephora (Hemiptera: Fulgoroidea: Dictyopharidae)**

Author(s): Zhi-Shun Song and Ai-Ping Liang

Source: Annals of the Entomological Society of America, 104(2):154-170. 2011.

Published By: Entomological Society of America

DOI: 10.1603/AN10069

URL: <http://www.bioone.org/doi/full/10.1603/AN10069>

BioOne (www.bioone.org) is an electronic aggregator of bioscience research content, and the online home to over 160 journals and books published by not-for-profit societies, associations, museums, institutions, and presses.

Your use of this PDF, the BioOne Web site, and all posted and associated content indicates your acceptance of BioOne's Terms of Use, available at www.bioone.org/page/terms_of_use.

Usage of BioOne content is strictly limited to personal, educational, and non-commercial use. Commercial inquiries or rights and permissions requests should be directed to the individual publisher as copyright holder.

Taxonomic Revision of the Oriental Planthopper Genus *Putala*, With Description of a New Species and Resurrection of the Genus *Avephora* (Hemiptera: Fulgoroidea: Dictyopharidae)

ZHI-SHUN SONG AND AI-PING LIANG¹

Key Laboratory of Zoological Systematics and Evolution, Institute of Zoology, Chinese Academy of Sciences, No. 1 Beichen West Road, Chao-yang District, Beijing 100101, People's Republic of China

Ann. Entomol. Soc. Am. 104(2): 154–170 (2011); DOI: 10.1603/ANI10069

ABSTRACT There has been confusion regarding the taxonomy and distribution of species in the dictyopharid planthopper genus *Putala* Melichar, 1903. Based on critical review and examination of parts of type material, *Putala* is revised and restricted in southern Asia of the Oriental region. Three *Putala* species are recognized in the genus, including a new species: *Putala maculata* Distant, 1906; *Putala rostrata* Melichar, 1903; and *Putala spinula* sp. nov. The genus *Avephora* Bierman stat. rev. is resurrected from synonymy with *Dictyophara* Germar, 1833 and reestablished here as a valid genus. Four recognized *Avephora* species are *Avephora eugeniae* (Stål, 1859) comb. nov.; *Avephora brachycephala* (Distant, 1906) comb. nov.; *Avephora rugosa* (Shakila-Mushtaq, 1991) comb. nov.; and *Avephora hazarensis* (Shakila-Mushtaq, 1991) comb. nov.; the latter three species are from *Putala*. One new generic and two new specific synonyms are suggested: *Avephora* Bierman, 1910 = *Electryone* Kirkaldy, 1913 syn. nov.; *Avephora eugeniae* (Stål, 1859) comb. nov. = *Electryone macaonica* Kirkaldy, 1913 syn. nov.; and *Philotheria apicemaculata* (Stål, 1855) = *Putala figurata* (Gerstaecker, 1895 nec. Singh-Pruthi, 1925) syn. nov. Photographs of all species of *Putala* and parts of *Avephora* are presented. Descriptions of the two genera and their included species are provided together with structural illustrations of male genitalia. Distribution map and keys to the species of the both genera are provided. First description and illustration of male genitalia as well as photograph of *Philotheria apicata* (Melichar) also are provided to distinguish it easily from *Putala* species.

KEY WORDS *Putala*, *Avephora*, revision, Dictyopharidae, Oriental region

The planthopper family Dictyopharidae is one of the larger families of the 28 Fulgoroidea families currently recognized, including nearly 760 described species in 159 genera (Bourgoin 2010), not 400 genera as stated by Song and Liang (2006). These species are widely distributed in most parts of the world, especially in the tropical regions such as the South America, the Oriental region, and the East Indies (Metcalf 1946). Many species are confined to arid and semiarid regions where they seem to be very local in their distribution and often confined to a single host plant (Metcalf 1946).

Traditionally, it is recognized by most dictyopharid workers that the family is separated into two subfamilies Dictyopharinae and Orgeriinae. The subfamily Orgeriinae, a distinct lineage within Dictyopharidae, composed of four tribes (Colobocini, Almanini, Orgeriini, and Ranissini), is all restricted in the arid regions of the Holarctic (Emeljanov et al. 2005). The phylogenetic relationships and evolution of Orgeriinae tribes was proposed by Emeljanov (1980, 2005). The second subfamily Dictyopharinae, distributed

worldwide, comprises nine extant tribes (Aluntiini, Cladodipterini, Cleotychini, Dictyopharini, Hastini, Nersiini, Phylloscelini, Orthopagini, and Scoloptini) and two fossil tribes (Netutelini and Worskaitini) (Emeljanov 1983, 1997, 2008; Szvedo 2008). Currently, the phylogenetic analyses among the higher taxa in Dictyopharinae are still lacking.

The dictyopharid genus *Putala* was established by Melichar in 1903 based on a single species, *Putala rostrata* Melichar, 1903, from Ceylon (Sri Lanka). Since Melichar (1904) added the second species *P. apicata* from eastern Africa, the genus has become a confused taxon for its diversiform morphological characters and disjunct geographic distribution. In 1906, Distant (1906a,b,c) successively described four *Putala* species from the Old World, i.e., *P. maculata* (southern India), *P. brachycephala* (Singapore, southern India), *P. lewisi* (Japan), and *P. transvaaliensis* (South Africa). Bergroth (1907) described the seventh species *P. sima* from Bombay, India.

Five of the above-mentioned *Putala* species, excluding *P. apicata* and *P. sima*, were described by Melichar (1912) in his dictyopharid monograph, whereas *P. apicata* was omitted without explanation and *P. sima*

¹ Corresponding author, e-mail: liangap@ioz.ac.cn.

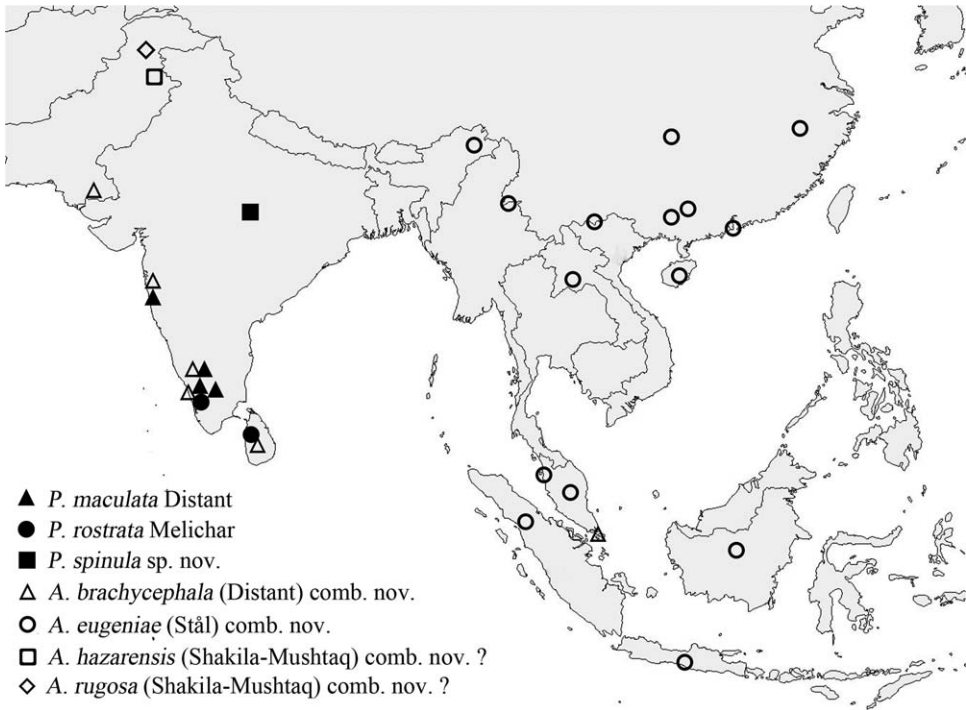


Fig. 1. Geographic worldwide distribution of *Putala* and *Aevephora* species.

was moved questionably into *Miasa* Distant, 1906. Subsequently, *P. lewisi* was designated as the type species of the new genus *Neoputala* by Distant in 1914, and *P. sima* was placed in the synonymy of *P. maculata* by the same worker in 1916. In 1957, Fennah (1957) moved *P. apicata* from *Putala* into Afrotropical genus *Philotheria* Melichar. Several years later, *P. transvaaliensis* also was moved into *Philotheria* by Synave (1965). In 1991, Shakila-Mushtaq (1991) described two new Pakistani species *Putala rugosa* Shakila-Mushtaq and *Putala hazarensis* Shakila-Mushtaq whose heads are short and broad, similar to *P. brachycephala*. Emeljanov (2008) designated the lectotype of *P. rostrata* (type species of *Putala*) and transferred *Putala* from Orthopagini to Dictyopharini. Emeljanov (2008) also proposed that *Putala* should be treated as a monotypical genus, and the other species described in it apparently did not belong to it.

Based on examination of parts of type material and our critical review of the literature, *Putala* is revised and restricted in southern Asia of Oriental region (Fig. 1). Three *Putala* species are recognized in it including a new species: *Putala maculata* Distant (southern India), *Putala rostrata* Melichar (type species, Sri Lanka and southern India), and *Putala spinula* sp. nov. (central India). The other *Putala* species are proposed to transfer into the genus *Aevephora* Bierman, 1910 stat. rev. that is resurrected from synonymy with *Dictyophara* Germar, 1833 and reestablished here as a valid genus. *Aevephora* comprises four species: *Aevephora eugeniae* (Stål) comb. nov.; *Aevephora brachycephala* (Distant) comb. nov.; *Aevephora hazarensis* (Shakila-Mushtaq) comb. nov.; and *Aevephora*

rugosa (Shakila-Mushtaq) comb. nov.; the latter three species are from *Putala*.

Materials and Methods

The specimens studied in the course of this work are deposited in the following institutions whose names are abbreviated in the text as follows: AMNH, American Museum of Natural History, New York, USA; BMNH, The Natural History Museum (formerly British Museum [Natural History]), London, United Kingdom; BPBM, Bernice Pauahi Bishop Museum, Honolulu, HI, USA; CAS, California Academy of Sciences, San Francisco, CA, USA; IZCAS Zoological Museum, Institute of Zoology, Chinese Academy of Sciences, Beijing, People's Republic of China; NCB, Naturalis Netherlands Centre for Biodiversity Naturalis, Leiden, Netherlands; NCSU, Department of Entomology Insect Collection, North Carolina State University, Raleigh, NC, USA; SMNH, Swedish Museum of Natural History, Stockholm, Sweden; and USNM National Museum of Natural History, Washington, DC, USA.

Morphological characters were observed with a Stemi SV II optical stereomicroscope (Carl Zeiss, Jena, Germany) and were illustrated with the aid of a drawing tube attached to the microscope; measurements were made with the aid of an eyepiece micrometer. The dorsal habitus of dictyopharid species is shown in Fig. 2.

The following abbreviations are used in the text: BL, body length (from apex of cephalic process to



Fig. 2. Dorsal habitus of dictyopharids species. (A and B) *Putala maculata* Distant, male. (C) *Putala rostrata* Melichar, male. (D) Same, female. (E) *Putala spinula* sp. nov., male. (F) Same, female. (G) *Avephora brachycephala* (Ditant) comb. nov., male. (H) Same, female. (I) *Avephora eugeniae* (Stål) comb. nov., male. (J) Same, female. (K) *Orthopagus splendens* (Germar), male. (L) *Philotheria apicata* (Melichar), male. (Online figure in color.)

tip of forewings); HL, head length (from apex of cephalic process to base of eyes); HW, head width (including eyes); and FWL, forewing length. The

morphological terminology and measurements used in this study follow Kramer (1950) and Song and Liang (2008).

Systematics

Family Dictyopharidae Spinola, 1839

Subfamily Dictyopharinae Spinola, 1839

Tribe Dictyopharini Melichar, 1912

Genus *Putala* Melichar, 1903

Putala Melichar, 1903: 26. Type species: *P. rostrata* Melichar, 1903; by original designation and monotypy.

Putala Melichar: Distant, 1906: 237; Bierman, 1910: 9; Melichar, 1912: 216; Kirkaldy, 1913: 12; Distant, 1914: 412; Metcalf, 1946: 79.

Diagnosis. Head elongate, distinctly slender and upturned; vertex with lateral carinate margins elevated, broad at base and distinctly narrowed in front of eyes, with median carina relatively distinct on a bulge between eyes; pronotum with only median carina sharp and high; mesonotum faintly tricarinate or not carinate; forewings with stigma broad and distinct; legs moderately elongate, fore femora not flattened and dilated, hind tibiae with seven apical spines; anal tube with apical ventral margin truncated, protruded an angle on each side in dorsal view; aedeagus with a pair of short and slender phallical processes extended dorsally from phallobasal cavity; phallobase basally sclerotized and pigmented, with inflated membranous apical lobes covered with long sclerotized spines.

Male. General color brownish ochraceous to ochraceous, alternated with yellowish white or fuscous colors.

Head produced in an elongate, distinctly slender cephalic process that it broadest between eyes and distinctly narrowed in front of eyes in dorsal view (Figs. 3A, 4A, and 5A) and upturned in lateral view (Figs. 3B, 4B, and 5B). Vertex (Figs. 3A, 4A, and 5A) very narrow, base nearly half to two thirds as wide as transverse diameter of eyes in dorsal view (Figs. 3A, 4A, and 5A); lateral carinate margins strongly elevated, subparallel and broadly sulcate at base, slightly sinuate in front of eyes, and then distinctly narrowed and nearly parallel to apex; posterior margin arcuately concave; median carina only relatively distinct on a bulge between eyes, with a lateral oblique depression on each side. Frons (Figs. 3C, 4C, and 5C) widest below antennae, lateral carinate margins slightly converging toward apex and abruptly narrowed in front of eyes; posterior margin somewhat concave; median carina distinct and complete, lateral carinae not sharp, subparallel, nearly approaching frontoclypeal suture. Postclypeus and anteclypeus convex medially, with distinct median carina. Rostrum long, reaching beyond abdominal segment VI. Eyes oval and large. Ocelli relatively large, reddish. Antennae with scape very small; pedicel large and subglobose, with >50 distinct sensory plaque organs distributed over entire surface; flagellum long, setuliform.

Pronotum (Figs. 3A, 4A, and 5A) broad, distinctly shorter than mesonotum medially; anterior margin slightly centrally convex, lateral marginal areas straight and sloping with two long longitudinal carinae on each side between eyes and tegulae, posterior margin broadly concave; median carina sharp and high, with a big lateral pit at side of carina, respectively. Mesonotum (Figs. 3A, 4A, and 5A) faintly tricarinate or not carinate. Forewings (Figs. 3D and 4D) with Sc+R, M and Cu all branched apically; stigma broad and distinct, with three to five cross veins. Legs moderately long; fore femora not flattened and dilated, hind tibiae with five to six lateral and seven apical black-tipped spines.

Male genitalia with pygofer slightly narrow and high, ventrally distinctly broader than dorsally in lateral aspect (Figs. 3F, 4F, and 5E), posterior margin excavated apically to accommodate anal tube. Anal tube large and stout, apical ventral margin truncated, protruded an angle on each side, apical dorsal margin deeply excavated to accommodate anal style in dorsal view (Figs. 3E, 4E, and 5D). Anal style usually short and small. Parameres moderately large, with numerous spiniform setae on inner surfaces in basal half in ventral aspect (Figs. 4G and 5F); apex strongly expanded, upper margin with dorsally directed, black-tipped process at apex, outer upper edge with a ventrally directed, hooklike process near middle in lateral aspect (Figs. 3F, 4F, and 5E). Aedeagus (Figs. 3H-J, 4H-J, and 5G-I) moderate and symmetrical, with a pair of short and slender phallical processes extended dorsally from phallobasal cavity; phallobase basally sclerotized and pigmented, with inflated membranous apical lobes, covered with long sclerotized spines.

Female. General color similar to that of the male.

Female genitalia (Fig. 6A) with anal tube large, broad rounded in dorsal view (Fig. 6B). First valvula strongly sclerotized with five different-sized teeth in lateral view (Fig. 6C); second valvulae triangular, symmetrical in ventral view (Fig. 6D), connected at base and separated from one-fourth base, with an elongate, arced keel on subapex, respectively; third valvula with two sclerotized lobes, lateral lobe with one to two long spines at apex in lateral view (Fig. 6E).

Distribution. Sri Lanka, India.

Biology. In common with most planthopper groups, no biological data are currently available for species of *Putala*.

Discussion. *Putala* are externally similar to *Philotheria* Melichar but can be separated from the latter by the vertex with lateral carinate margins subparallel between eyes (broadest basally and gradually converging before eyes in *Philotheria*); the frons with median and lateral carinae well developed, but smoothed (lateral and median carinae sharp and complete in *Philotheria*); the fore femora normal (the fore femora with a small spine near apex in *Philotheria*); and the male genitalia structure, especially the aedeagus with a pair of short and slender phallical processes (with a pair of broad and elongate phallical processes, apex acute in *Philotheria*).

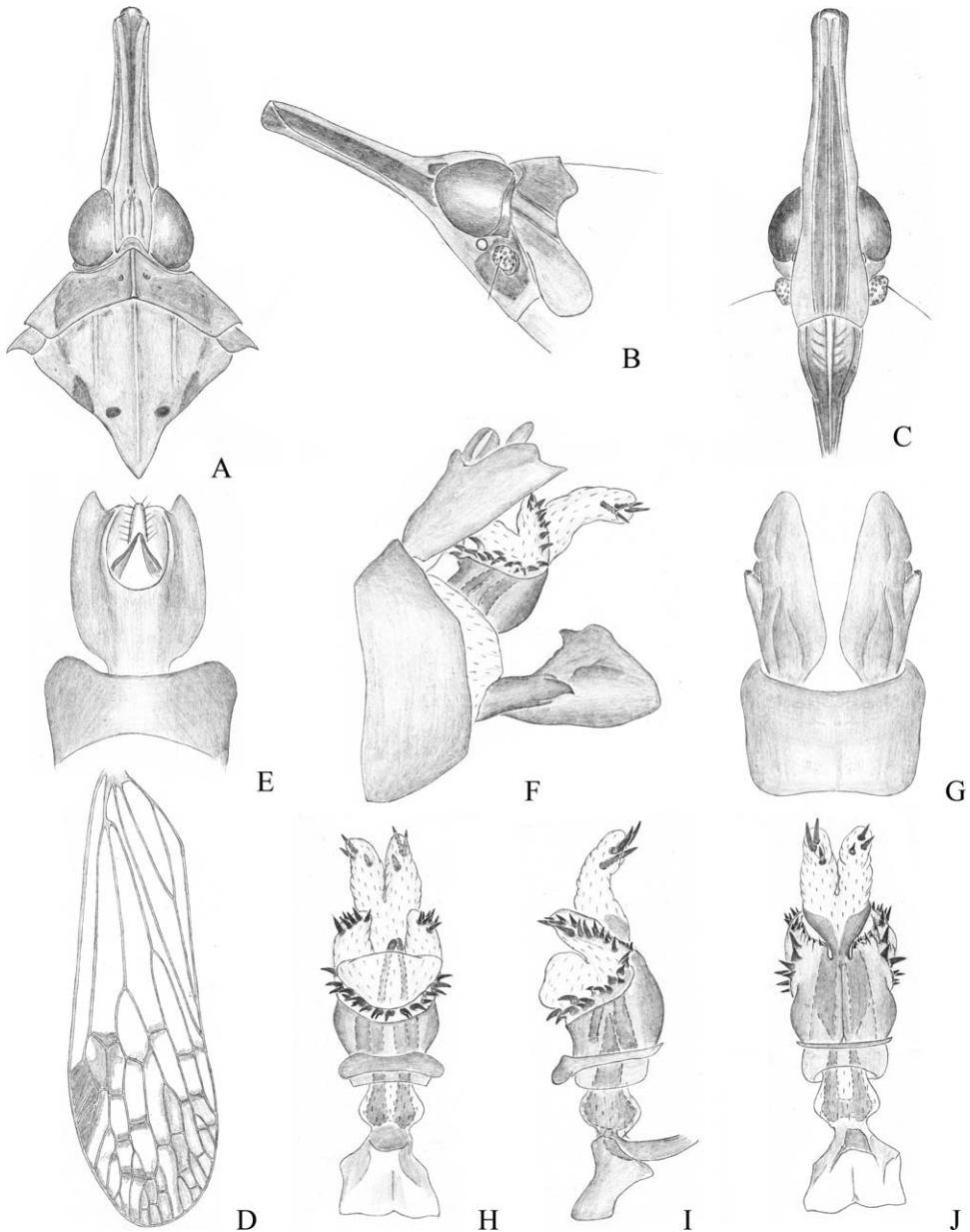


Fig. 3. *Putala maculata* Distant. (A) Head, pronotum, and mesonotum, dorsal view. (B) Head and pronotum, lateral view. (C) Head, ventral view. (D) Left forewing. (E) Pygofer and anal tube of male, dorsal view. (F) Genitalia of male, lateral view. (G) Pygofer and parameres of male, ventral view. (H) Aedeagus, dorsal view. (I) Aedeagus, lateral view. (J) Aedeagus, ventral view.

Key to Species of Genus *Putala* Melichar

1. Forewings (Fig. 3D) with piceous scattered apical maculate markings; pygofer with posterior margin slightly protruded in lateral view (Fig. 3F) *P. maculata* Distant
- Forewings (Fig. 4D) without apical maculate markings; pygofer with posterior margin produced a large angular process, directed posteriorly in lateral view (Figs. 4F and 5E). 2

2. Cephalic process long, nearly as long as pronotum and mesonotum combined ($\approx 0.9:1$); phallobase stout, with a pair of ventral apical lobes possessing three to four long spines at apex, respectively (Fig. 4J) *P. rostrata* Melichar
- Cephalic process relatively short, distinctly shorter than pronotum and mesonotum combined ($\approx 0.7:1$); phallobase slender, with a

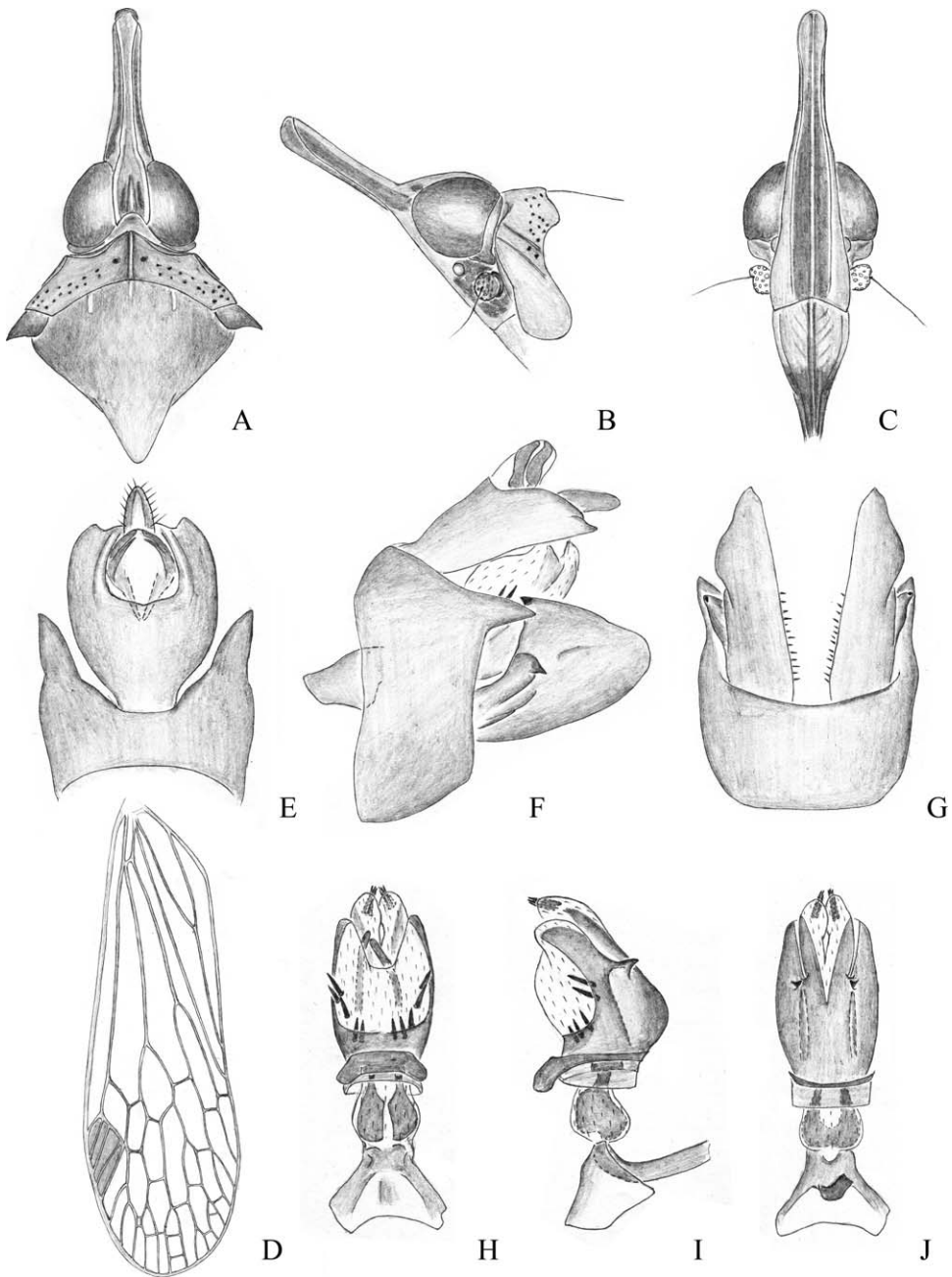


Fig. 4. *Putala rostrata* Melichar. (A) Head, pronotum, and mesonotum, dorsal view. (B) Head and pronotum, lateral view. (C) Head, ventral view. (D) Left forewing. (E) Pygofer and anal tube of male, dorsal view. (F) Genitalia of male, lateral view. (G) Pygofer and parameres of male, ventral view. (H) Aedeagus, dorsal view. (I) Aedeagus, lateral view. (J) Aedeagus, ventral view.

pair of ventral apical lobes possessing a single long spine at apex, respectively (Fig. 5I) *P. spinula* sp. nov.

***Putala maculata* Distant, 1906**
(Figs. 2A and B and 3A–J)

Putala maculata Distant, 1906: 247, fig. 107. Holotype ♂, INDIA (BMNH) [examined].

Putala sima Bergroth, 1907: 290. Synonymized by Distant, 1916: 26.

Putala maculata Distant: Melichar, 1912: 101; Distant, 1916: 26; Metcalf, 1946: 80.

Male. Body large, somewhat slender. BL, 11.5–11.7 mm; HL, 2.5–2.8 mm; HW, 1.3–1.4 mm; FWL, 8.2–8.3 mm.

General color (Fig. 2A and B) brownish ochraceous, marked with fuscous and piceous. Vertex and

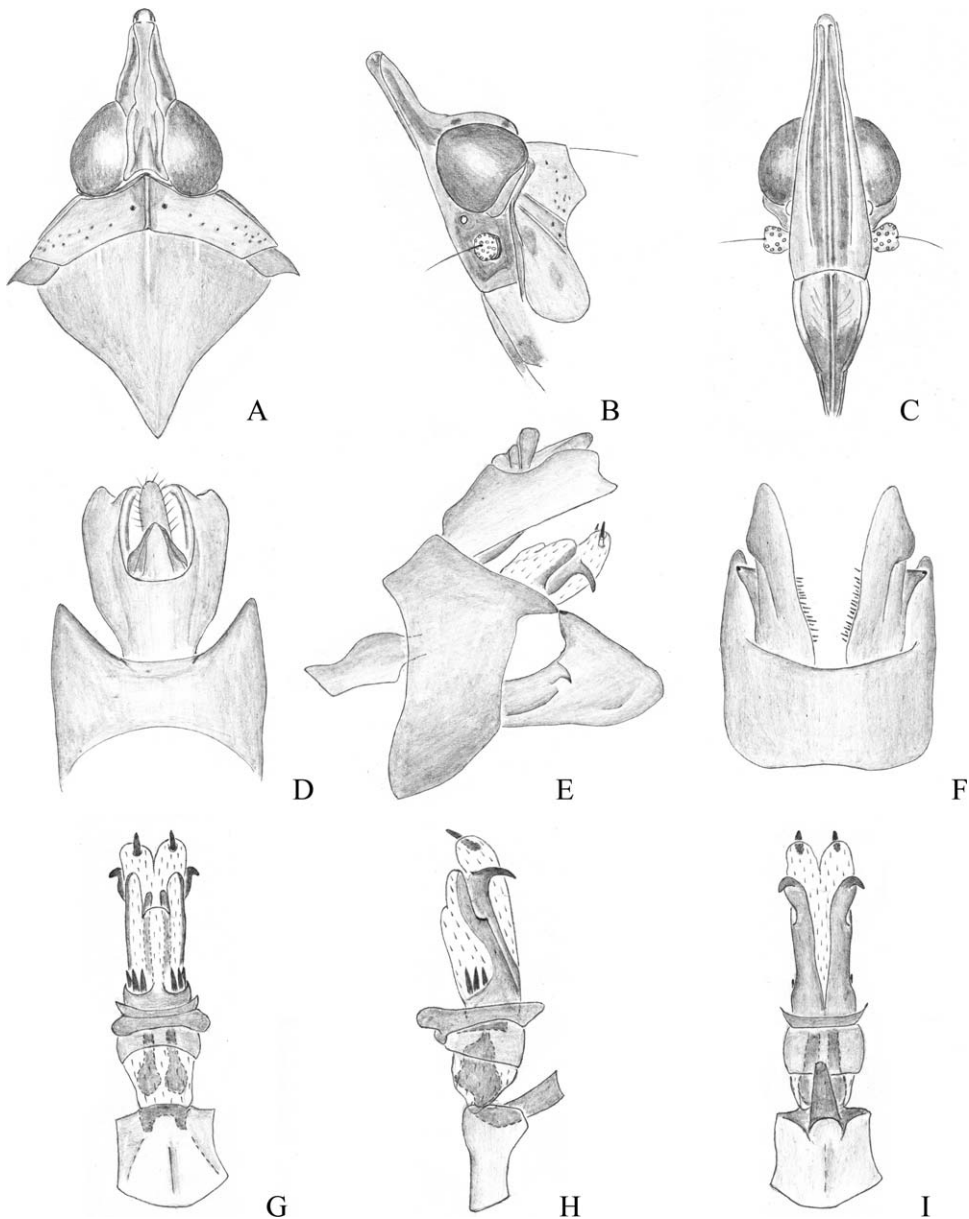


Fig. 5. *Putala spinula* sp. nov. (A) Head, pronotum, and mesonotum, dorsal view. (B) Head and pronotum, lateral view. (C) Head, ventral view. (D) Pygofer and anal tube of male, dorsal view. (E) Genitalia of male, lateral view. (F) Pygofer and parameres of male, ventral view. (G) Aedeagus, dorsal view. (H) Aedeagus, lateral view. (I) Aedeagus, ventral view.

parts of genae pale ochraceous, a longitudinal line before eyes on vertex, a longitudinal stripe and a small spot before eyes on genae, and the area surrounding ocelli and antennae beneath eyes fuscous. Frons, base of postclypeus yellowish, apical part of frons, apex of postclypeus, anteclypeus fuscous, two fasciae between lateral carinae and median carina orange-red and lateral carinae and median carina stramineous green. Labrum and rostrum yellowish brown, apical segment brown with extreme apex black. Pronotum and mesonotum brownish ochraceous, marked with

fuscous and piceous, tens of indistinct dots on each side of pronotum, and a pair of triangular spots and a pair of small round spots on posterior part of mesonotum dark brown. Thorax ventrally pale ochraceous, mesopleurae and mesosterna fuscous. Forewings (Fig. 3D) hyaline, venation fuscous, stigma and scattered apical maculate markings piceous. Legs pale ochraceous, with longitudinal piceous lines; fore coxae dark brown; tarsi and claws brown; tips of apical spines on hind tibiae and tarsi black. Abdomen dorsally dark castaneous brown, the posterior segmental margins

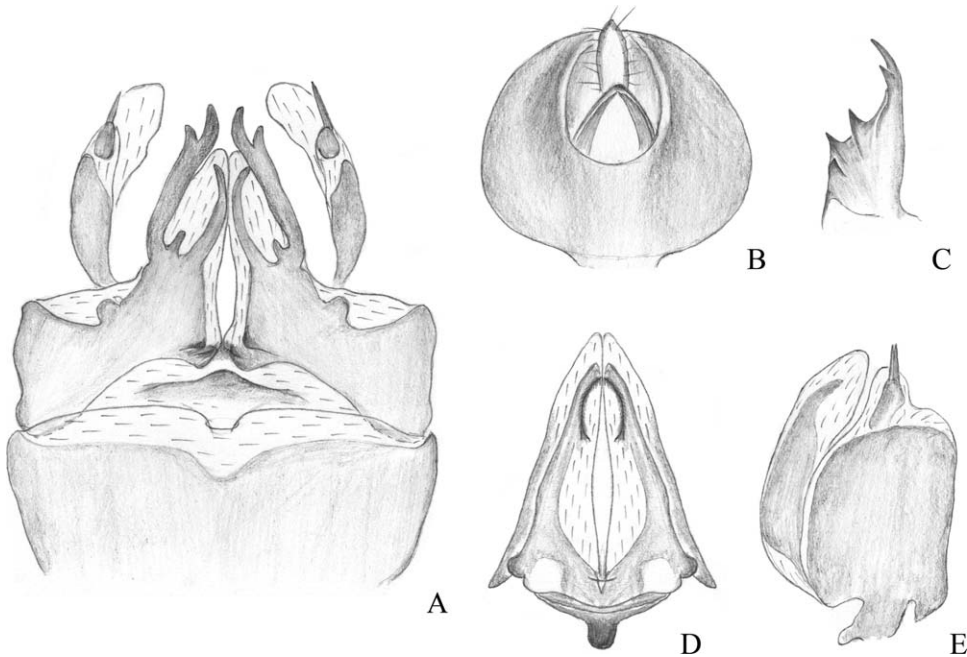


Fig. 6. *Putala spinula* sp. nov. (A) Genitalia of female, ventral view. (B) Anal tube, dorsal view. (C) First valvula, lateral view. (D) Second valvulae, ventral view. (E) Third valvula, lateral view.

and lateral linear spots fuscous; sterna piceous, with numerous yellowish spots.

Head slightly longer than pronotum and mesonotum combined ($\approx 1.1:1$). Lower lateral carinae between eyes and tegulae on pronotum invisible in dorsal view (Fig. 3A). Mesonotum (Fig. 3A) more or less arched, faintly tricarinate, lateral carinae straight, nearly parallel. Forewings as in Fig. 3D. Hind tarsomeres I and II with 15–16 and 13–14 apical spines, respectively.

Male genitalia with pygofer with posterior margin more or less convex without process in lateral view (Fig. 3F); dorsal-lateral margins slightly protruded posteriorly in dorsal view (Fig. 3E). Parameres narrow basally, expanded toward apex in lateral view (Fig. 3F), posterior margin nearly straight on lower part and hunched at apex, upper process small and protruded at subapex. Aedeagus moderately large and stout; bases of dorsal and lateral parts and most portion of ventral part on phallobase sclerotized and pigmented, the remainder membranous; dorsal part with a large rounded lobe, surrounded with ≈ 20 large stout spines at base in dorsal view (Fig. 3H); lateral apical parts produced in a pair of large lobes with ≈ 15 spines from base to apex in lateral view (Fig. 3I); ventral part with a pair of elongate apical lobes that possess three to four long spines in ventral view (Fig. 3J).

Type Material Examined. Holotype δ , INDIA: Nilgiri, Hampson; [Distant's handwriting] *Putala maculate* Dist. Type; Distant Coll. B.M. 1911-383 (BMNH). Paratypes: INDIA: 1 δ , Nilgiri, Hampson; Distant Coll. B.M. 1911-383; 1 η , Utakamand (both in BMNH).

Other Material Examined. INDIA. Southern India: S. Coorg; 1 δ , Ammatti, 3,000 feet, V-1951, P. S. Nathan (NCSU); southern India: Madras state: Nilgiri Hills: 1 δ , Naduvattam, 1,828 m, V-1958, P. S. Nathan (CAS); Travancore: 1 δ , Primed, 3,400 feet, 4–6-V-1937, no collector (BMNH).

Distribution. Southern India.

Discussion. The species has some notable differences from *P. rostrata* and *P. spinula* sp. nov. as follows: the larger body, the mesonotum (Fig. 3A) being faintly tricarinate, the forewings with piceous scattered apical maculate markings, posterior margin of the pygofer without process in lateral view (Fig. 3F) and the aedeagus with more stout spines.

***Putala rostrata* Melichar, 1903**

(Figs. 2C and D, 4A–J)

Putala rostrata Melichar, 1903: 26, pl. I, fig. 8a and b. *Putala rostrata* Melichar: Distant, 1906: 246; Melichar, 1912: 101, pl. III, figs. 17–19; Metcalf, 1946: 80.

Male. Body moderately large, more or less slender. BL, 9.7–10.0 mm; HL, 1.9–2.0 mm; HW, 1.1–1.2 mm; FWL, 6.9–7.1 mm.

General color (Fig. 2C and D) brownish ochraceous to ochraceous, alternated with yellowish white colors. Vertex and parts of genae yellowish white, base of vertex, a longitudinal gena stripe running from eye to apex of cephalic process and the area surrounding ocellus and antenna beneath eye fuscous. Frons pale ochraceous, several spots on anterior part between lateral carina and lateral carinate margin fuscous, and

two fasciae between lateral carinae and median carina orange-red. Postclypeus yellowish or yellowish brown, anteclypeus and labrum fuscous. Rostrum yellowish brown, apical segment brown with extreme apex black. Pronotum yellowish white, with two lines of ≈ 16 dark brown dots on each side. Mesonotum ochraceous to fuscous, darker anterolaterally and paler on posterior part, with three pale longitudinal stripes on front margin which are abbreviated posteriorly. Thorax ventrally pale ochraceous, mesopleurae and mesosterna dark brown. Legs pale ochraceous, with longitudinal piceous lines; fore coxae dark brown; tarsi and claws brown; tips of apical spines on hind tibiae and tarsi black. Abdomen dorsally ochraceous, the posterior segmental margins and lateral linear spots fuscous; sterna piceous, with numerous yellowish spots.

Head with cephalic process elongate and slender (males maybe longer than females), slightly shorter than pronotum and mesonotum combined ($\approx 0.9:1$). Lower lateral carinae between eyes and tegulae on pronotum distinctly visible in dorsal view (Fig. 4A). Mesonotum (Fig. 4A) distinctly arched, carinae absent or very faint (median carina seems more obvious), three very short longitudinal stripes on front margin. Forewings as in Fig. 4D, without scattered apical maculate markings. Hind tarsomeres I and II with 15–18 and 12–14 apical spines, respectively.

Male genitalia with pygofer with posterior margin with a large, angular, directed posteriorly process near upper middle in lateral view (Fig. 4F); dorsal margin deeply excavated to accommodate anal tube, dorsal-lateral margins angularly produced posteriorly in dorsal view (Fig. 4E). Parameres distinctly broadening toward apex in lateral view (Fig. 4F), posterior margin nearly straight, upper process obviously stout at subapex and relatively small at tip. Aedeagus moderate and stout; base of dorsal part and most portion of lateral and ventral parts on phallobase sclerotized and pigmented, the remainder membranous; dorsal membranous part with five long spines from base to middle on each side in dorsal view (Fig. 4H); lateral part produced in a lamellar process which its edge membranous in lateral view (Fig. 4I); ventral part strongly hunched on base, with a pair of short angular processes directed ventrally on middle, and a pair of apical lobes that possess three to four long spines at apex in ventral view (Fig. 4J).

Female. BL, 10.5 mm; HL, 2.1 mm; HW, 1.3 mm; FWL, 7.3 mm.

Material Examined. SRI LANKA (CEYLON): Uva Province: Egodapitiya: 1♂, Nilgala, 1–13-VII-1968, P. B. Karunaratne, T. F. Halstead (CAS); Mate. Dist.: 1♀, Siquiriya, 800 feet, black light, 13–14-XI-1976, G. P. Hevel, R. E. Dietz, S. Karunaratne, D. W. Balasooriya (USNM). INDIA: Southern India: S. Coorg: 2♂♂, Ammatti, 3,000 ft, V-1951, P. S. Nathan (NCSU).

Distribution. Sri Lanka, southern India (new record).

Discussion. There are some apomorphic characters in *P. rostrata* and *P. spinula* sp. nov., which are apparently more closely related. The characters include

cephalic process slender and strongly upturned; pronotum yellowish white; mesonotum distinctly arched, not carinate or faintly tricarinate, with three very short longitudinal stripes on front margin; forewings hyaline, without apical maculate markings; and pygofer with posterior margin produced a large angular process, directed posteriorly.

Putala spinula sp. nov.
(Figs. 2E and F, 5A–I, 6A–E)

Male. Body moderate, somewhat slender. BL, 9.3 mm; HL, 1.6 mm; HW, 1.2 mm; FWL, 7.1 mm.

General color (Fig. 2E and F) ochraceous, alternated with yellowish white colors. Vertex and parts of genae yellowish white, base of vertex, a longitudinal gena stripe running from eye to apex of cephalic process and the area surrounding ocellus and antenna beneath eye fuscous. Frons pale ochraceous, anterior part between lateral carina and lateral carinate margin fuscous, and two fasciae between lateral carinae and median carina orange. Postclypeus yellowish, anteclypeus and labrum fuscous. Rostrum yellowish brown, apical segment brown with extreme apex black. Pronotum yellowish white, with two lines of ≈ 16 dark brown dots on each side. Mesonotum fuscous, darker anterolaterally and paler on posterior part, with three pale ochraceous longitudinal stripes that maybe sometimes discontinuous. Thorax ventrally pale ochraceous, mesopleurae and mesosterna dark brown. Legs pale ochraceous, apical spots and longitudinal lines piceous; coxae dark brown. Abdomen dorsally ochraceous, the posterior segmental margins and lateral linear spots fuscous; sterna piceous, with numerous yellowish spots.

Head relatively short, distinctly shorter than pronotum and mesonotum combined ($\approx 0.7:1$). Lower lateral carinae between eyes and tegulae on pronotum distinctly visible in dorsal view (Fig. 5A). Mesonotum (Fig. 5A) distinctly arched, carinae absent or very faint (median carina seems more obvious), three very short longitudinal stripes on front margin. Forewings without scattered apical maculate markings. Hind tarsomeres I and II with 20–22 and 17–19 apical spines, respectively.

Male genitalia: pygofer with posterior margin with a large, angular, directed posteriorly process near upper middle in lateral view (Fig. 5E). Parameres distinctly broadening toward apex in lateral view (Fig. 4E), posterior margin nearly straight, upper process obviously large and stout at apex. Aedeagus moderate and slender; base of dorsal part and most portion of lateral and ventral parts on phallobase sclerotized and pigmented, the remainder membranous; dorsal membranous part with three long spines at base on each side in dorsal view (Fig. 5G); lateral part produced in a lamellar process which its edge membranous in lateral view (Fig. 5H); sclerotized portion of ventral part long -shaped, with a pair of long, incurved angular processes directed ventrally at subapex, and a pair of apical lobes that possess a single long, sclerotized spines at apex in ventral view (Fig. 5I).

Female. BL, 10.1 mm; HL, 1.7 mm; HW, 1.3 mm; FWL, 7.6 mm. Female genitalia (Fig. 6A–E) as generic description.

Material Examined. HOLOTYPE: 1♂, INDIA.

Central India: Madhya Pradesh state: IX-1957, Jabalpur, 488 m, P. S. Nathan (Brunson P. Bliven Collection 1981 Accession Calif. Acad. of SCI.) (CAS). PARATYPE: 1♀, same data as holotype.

Distribution. Central India.

Etymology. This species is named for the presence of long spines on the phallobase of the aedeagus.

Discussion. This new species is externally similar to *P. rostrata*, but can be distinguished from the latter by its shorter cephalic process and the slender phallobase with a pair of ventral lobes possessing a single long spine at apex (the stout phallobase with a pair of ventral lobes possessing three to four long spines at apex in *P. rostrata*).

Avephora Bierman, 1910 stat. rev

Avephora Bierman, 1910: 12. Type species: *A. pasteuriana* Bierman, 1910, now regarded as a synonym of *A. eugeniae* (Stål, 1859) comb. nov.; by original designation and monotypy.

Electryone Kirkaldy, 1913: 12. Type species: *E. macanica* Kirkaldy, 1913; by original designation and monotypy. New synonymy.

Diagnosis. Head short and slightly slender; vertex moderately broad, with lateral carinate margins highly ridged, with median carina relatively distinct between eyes; pronotum with only median carina sharp and high; mesonotum obviously tricarinate; legs moderately elongate, fore femora not flattened and dilated, hind tibiae with seven apical spines; anal tube with apical ventral margin more or less round apically, without angle on each side in dorsal view; aedeagus moderate and symmetrical, with a pair of short and slender phallical processes extended dorsally from phallobasal cavity; phallobase basally sclerotized and pigmented, with inflated membranous apical lobes, covered with long sclerotized spines.

Male. General color brownish ochraceous to ochraceous.

Head (Figs. 7A and 8A) produced in a short and slightly slender cephalic process. Vertex (Figs. 7A and 8A) moderately broad, base nearly as wide as transverse diameter of eyes in dorsal view (Figs. 7A and 8A); lateral carinate margins highly ridged, subparallel at base, regularly narrowed toward apex; anterior margin more or less rounded apically, posterior margin slightly concave; median carina only relatively distinct on a bulge at base. Frons (Figs. 7C and 8C) widest below antennae, lateral carinate margins slightly converging toward apex; posterior margin somewhat concave; median carina distinct and complete, lateral carinae nearly parallel, nearly approaching frontoclypeal suture. Postclypeus and anteclypeus convex medially, with distinct median carina. Rostrum long, reaching beyond abdominal segment VI. Eyes oval and large. Ocelli relatively large, reddish. Antennae with scape

very small; pedicel large and subglobose, with >50 distinct sensory plaque organs distributed over entire surface; flagellum long, setuliform.

Pronotum (Figs. 7A and 8A) broad, distinctly shorter than mesonotum medially; anterior margin centrally arched, lateral marginal areas straight and sloping with two long longitudinal carinae on each side between eyes and tegulae, posterior margin broadly concave; median carina sharp and high, with a big lateral pit on each side. Mesonotum (Figs. 7A and 8A) more or less flat and tricarinate, median carina distinct and complete; lateral carinae somewhat faint, nearly straight, converging anteriorly but not reaching posterior margin of pronotum. Forewings (Figs. 7D and 8D) with Sc+R, M, and Cu all branched apically; stigma broad and distinct, with three to five cross veins. Legs moderately long; fore femora not flattened and dilated, hind tibiae with five to six lateral and seven apical black-tipped spines; hind tarsomeres I with 18–21 and tarsomeres II with 16–20 black-tipped apical spines, respectively.

Male genitalia with pygofer slightly narrow and high in lateral aspect (Figs. 7F and 8F), ventrally distinctly broader than dorsally, posterior margin excavated apically to accommodate anal tube. Anal tube large and stout, apical ventral margin more or less round apically, without angle on each side, dorsal posterior margin deeply excavated to accommodate anal style in dorsal view (Figs. 7E and 8E); anal style usually short and small. Parameres moderately large, with numerous spiniform setae on inner surfaces in basal half; upper margin with dorsally directed, black-tipped process at apex, outer upper edge with a ventrally directed, hooklike process near middle in lateral aspect (Figs. 7F and 8F). Aedeagus (Figs. 7H–J and 8H–J) moderate and symmetrical, with a pair of short and slender phallical processes extended dorsally; phallobase basally sclerotized and pigmented, with inflated membranous apical lobes, covered with long sclerotized spines.

Female. Female genitalia similar to *putala* species.

Distribution. India, Sri Lanka, Pakistan, Laos, southern China, Singapore, Malaysia, and Indonesia.

Biology. Collecting data show that adults of *A. brachycephala* can be collected from *Guizotia abyssinica* (Asterales: Asteraceae), an erect, stout, branched annual herb grown for its edible oil and seed.

Discussion. *Avephora* was described by Bierman based on a single species *Avephora pasteuriana* Bierman, 1910 from western Sumatra, Indonesia. Subsequently, *A. pasteuriana* was synonymized with *Dictyophora* [sic] *eugeniae* (Stål, 1855) by Melichar in 1912, so *Avephora* became a junior synonym of *Dictyophara*. However, *Dictyophara* was confirmed to be a highly confused taxon containing many nonnatural taxa, and its strict distribution should be restricted in the Palearctic region (Emeljanov 2004, Song and Liang 2008). It is undoubted that *D. eugeniae* (= *A. pasteuriana*) does not belong to *Dictyophara* and *Avephora* Bierman should be a good genus.

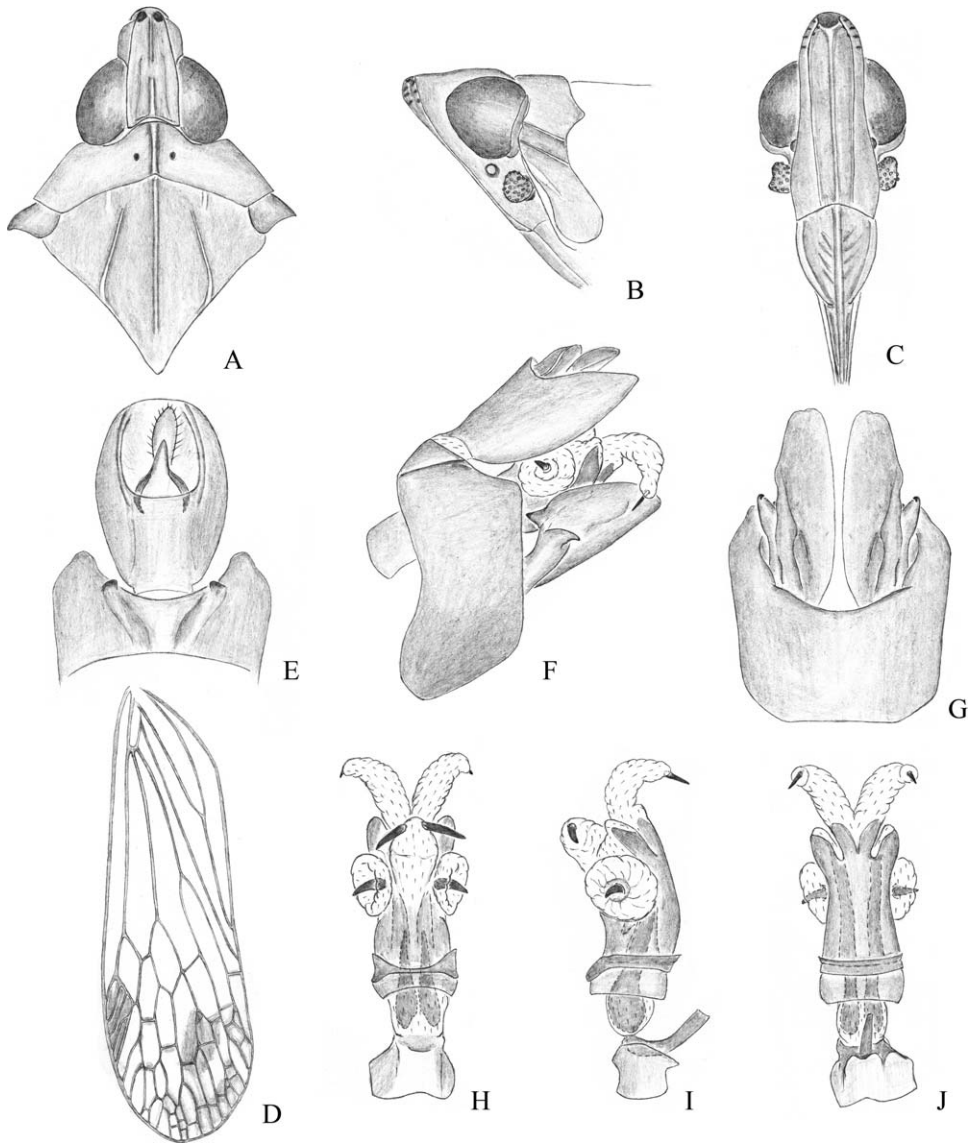


Fig. 7. *Avephora brachycephala* (Ditant) comb. nov. (A) Head, pronotum, and mesonotum, dorsal view. (B) Head and pronotum, lateral view. (C) Head, ventral view. (D) Left forewing. (E) Pygofer and anal tube of male, dorsal view. (F) Genitalia of male, lateral view. (G) Pygofer and parameres of male, ventral view. (H) Aedeagus, dorsal view. (I) Aedeagus, lateral view. (J) Aedeagus, ventral view.

Based on our critical review of the literature and examination of type material of *Pseudophana eugeniae* Stål (= *D. eugeniae*), *Avephora pasteuriana* Bierman, and *Electryone macaonica* Kirkaldy, we propose that *Avephora* Bierman is resurrected from synonymy with *Dictyophara* and reestablished here as a valid genus. Simultaneously, *Electryone macaonica* Kirkaldy is a new junior synonym of *A. eugeniae* (Stål) and *Electryone* Kirkaldy is a new junior synonym of *Avephora* Bierman.

Avephora can be distinguished from *Putala* by the combination of the following diagnostic characters: cephalic process shorter (elongate, distinctly slender

and upturned in *Putala*), vertex broader, base nearly as wide as transverse diameter of eyes (very narrow, base nearly half to two thirds as wide as transverse diameter of eyes in *Putala*), mesonotum obviously tricarinate and anal tube with apical ventral margin more or less round apically, without angle on each side in dorsal view (apical ventral margin truncated, protruded an angle on each side in *Putala*).

It is also externally similar to *Orthopagus* Uhler, 1896 (Fig. 1K), but can be separated from the latter by the vertex with median carina only distinct between eyes (median carina distinct and complete in *Orthopagus*); the fore femora normal (fore femora flattened and

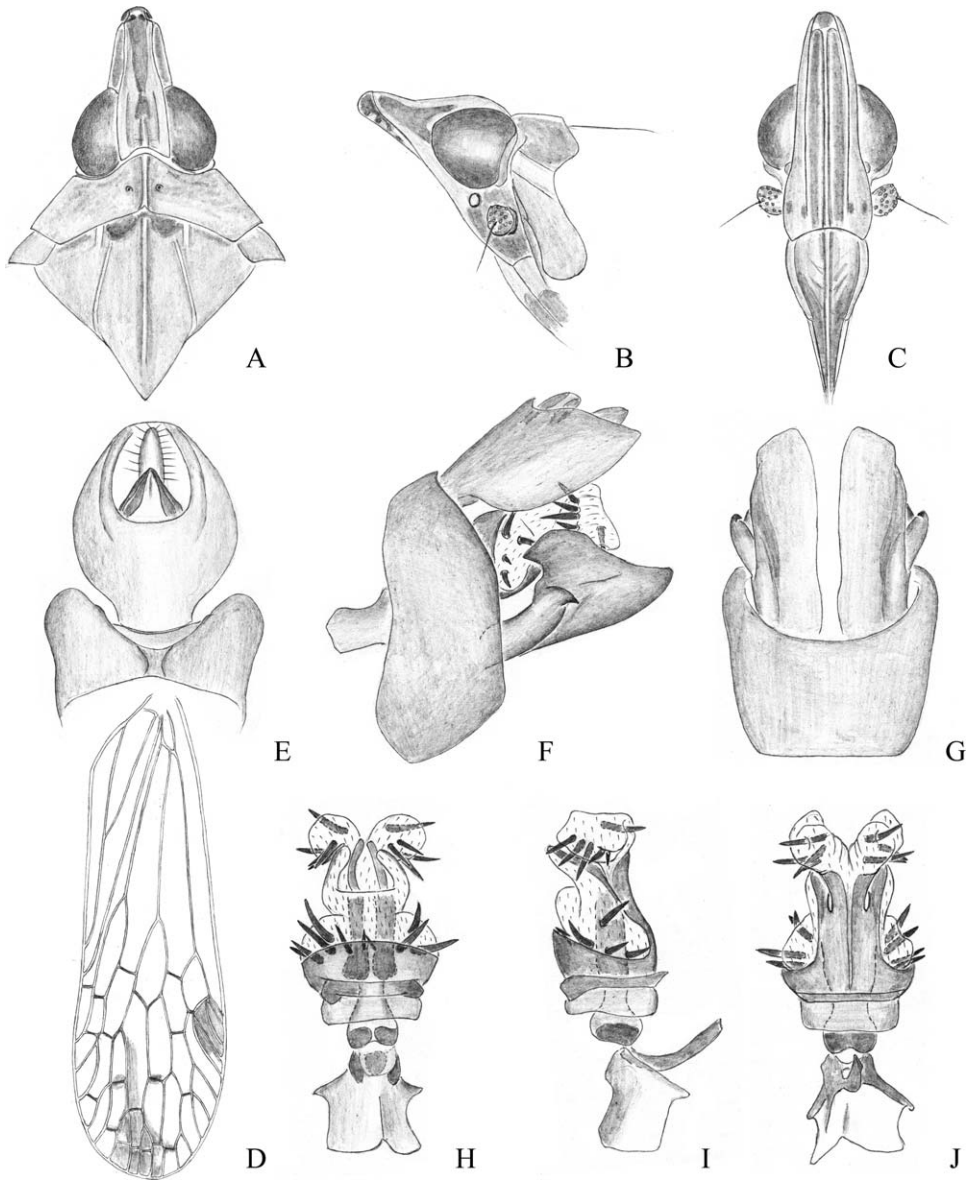


Fig. 8. *Avephora eugeniae* (Stål) comb. nov. (A) Head, pronotum, and mesonotum, dorsal view. (B) Head and pronotum, lateral view. (C) Head, ventral view. (D) Left forewing. (E) Pygofer and anal tube of male, dorsal view. (F) Genitalia of male, lateral view. (G) Pygofer and parameres of male, ventral view. (H) Aedeagus, dorsal view. (I) Aedeagus, lateral view. (J) Aedeagus, ventral view.

dilated with a distinct blunt spine near apex in *Orthopagus*); and the male genitalia structure, especially the aedeagus with long sclerotized spines.

Key to Species of Genus *Avephora* Bierman

- 1. Pronotum with lateral and median carinae, all distinctly and completely developed
 *A. rugosa* (Shakila-Mushtaq) comb. nov.
 Pronotum with only median carina sharp and high 2

- 2. Cephalic process nearly conical; vertex with lateral carinate margins gradually narrowing to arrowhead at apex
 *A. hazarensis* (Shakila-Mushtaq) comb. nov.
 Cephalic process nearly cylindrical; vertex with lateral carinate margins subparallel at base, regularly narrowed toward apex, rounded apically 3
- 3. Cephalic process short; parameres with upper process small and directed dorsally at middle; phallobase with a pair of ventral lobes

possessing a single long spine at apex, respectively

- *A. brachycephala* (Distant) comb. nov.
Cephalic process relatively long; parameres with upper process obviously expanded and directed anteriorly at subapex; phallobase with a pair of ventral lobes possessing five to six long spines at apex, respectively
. *A. eugeniae* (Stål) comb. nov.

Avephora brachycephala (Distant 1906) comb. nov
(Figs. 2G and H, 7A–J)

Putala brachycephala Distant, 1906: 354. Holotype ♂, SINGAPORE (BMNH) [examined].

Putala brachycephala Distant: Melichar, 1912: 103; Distant, 1916: 26, fig. 13; Shakila-Mushtaq, 1991: 44, fig. 3A–I; Shakila-Mushtaq, 1994: 29.

Male. Body relatively large. BL, 8.3–9.0 mm; HL, 1.1 mm; HW, 1.2 mm; FWL, 6.7–7.2 mm.

General color (Fig. 2G and H) brownish ochraceous. Vertex and parts of genae pale ochraceous, a longitudinal line before eyes on vertex, and the area surrounding ocelli and antennae beneath eyes fuscate. Frons, base of postclypeus yellowish, apical part of frons, apex of postclypeus, anteclypeus fuscous, two fasciae between lateral carinae and median carina orange-red. Labrum and rostrum yellowish brown, apical segment brown with extreme apex black. Pronotum and mesonotum brownish ochraceous, marked with fuscous and piceous. Thorax ventrally pale ochraceous, mesopleurae and mesosterna fuscous. Forewings (Fig. 7D) hyaline, venation fuscous, stigma piceous, apical maculate markings brown or paler to invisible. Legs pale ochraceous, with longitudinal piceous lines; fore coxae dark brown; tarsi and claws brown; tips of apical spines on hind tibiae and tarsi black. Abdomen dorsally dark castaneous brown, the posterior segmental margins and lateral linear spots fuscous; sterna piceous, with numerous yellowish spots.

Head short, nearly half as long as pronotum and mesonotum combined. Vertex (Fig. 7A) relatively broad, with ratio of length to width between eyes $\approx 2.3:1$. Forewings as in Fig. 7D. Hind tarsomeres I and II with 19–21 and 18–19 apical spines, respectively.

Male genitalia with pygofer with posterior margin more or less protruded angularly near upper middle in lateral view (Fig. 7F); dorsal margin moderately excavated to accommodate anal tube, dorsal-lateral margins angularly produced posteriorly in dorsal view (Fig. 7E). Anal tube large and long-oval in dorsal view (Fig. 7E), with ratio of length to width on middle $\approx 1.5:1$. Parameres narrow basally, broadest medially and reduced toward apex in lateral view (Fig. 7F), upper process small and directed dorsally at middle. Aedeagus moderately large and slender, with a pair of much shorter and slenderer phallical processes which is not extended from phallobasal cavity; bases of dorsal and lateral parts and most portion of ventral part of phallobase sclerotized and pigmented, the remainder membranous; dorsal part with a large apical lob pos-

sessing a pair of long spines in dorsal view (Fig. 7H); lateral middle parts with a pair of rounded lobes possessing one to two long spines in center in lateral view (Fig. 7I); ventral part with a pair of V-shaped elongate apical lobes, directed ventrally, that possess a single long spines in ventral view (Fig. 7J).

Female. BL, 10.6–11.8 mm; HL, 1.3–1.4 mm; HW, 1.4–1.5 mm; FWL, 8.0–8.7 mm.

Type Material Examined. Holotype ♂, SINGAPORE: H. N. Ridley, 1901-77; [Distant's handwriting] *Putala brachycephala* Dist. Type (BMNH). Paratype: INDIA: 1 ♀, Bombay, Dixon, Distant Coll. B.M. 1911-383 (BMNH).

Other Material Examined. INDIA: 1 ♂, central India: Orissa state: X-1958, Jeypore, 541 m, P. S. Nathan, B. P. Bliven (Brunson P. Bliven Collection 1981 Accession Calif. Acad. of SCI) (CAS); 1 ♀, Mysore: Bangalore: 11-IX-1977, Karnataka, 916 m, K. D. Ghorpade, ex: *Guizotia abyssinica* (AMNH); southern India: S. Malabar: 1 ♂, Walayar Forests, 1,000 feet, IX-1952, P. S. Nathan; S. India: 1 ♂, Coimbatore, no collecting time, P. S. Nathan; southern India: 1 ♂, Coimbatore, I-1953, P. S. Nathan (all in NCSU); southern India: Madras state: 1 ♂, Coimbatore, 426 m, X-1962, P. S. Nathan, B. P. Bliven) (Brunson P. Bliven Collection 1981 Accession Calif. Acad. of SCI) (CAS). SRI LANKA (CEYLON): Rat. Dist.: 1 ♀, Uggalka Itota, 350 feet. Irrigation Bungalow, 31-I-8-II-1970, D. Rowe (USNM).

Distribution. India, Sri Lanka (new record), Pakistan, Singapore, and Malaysia.

Discussion. The species is externally similar to *A. eugeniae* but can be distinguished from the latter by its shorter cephalic process; the parameres (Fig. 6F) with upper process small and directed dorsally at middle; and the phallobase with a pair of ventral lobes possessing a single long spine at apex, respectively.

Avephora eugeniae (Stål, 1859) comb. nov
(Figs. 2I and J, 8A–J)

Pseudophana eugeniae Stål, 1859: 271. Holotype ♂, INDONESIA (Java) (SMNH) [examined].

Avephara pasteuriana Bierman, 1910: 12, pl. 1, fig. 5a–c. Synonymized by Melichar, 1912: 131. Holotype ♂, INDONESIA (Sumatra) (NCB Naturalis) [examined].

Dictyophora [sic] *eugeniae* (Stål): Melichar, 1912: 131. *Electryone macaonica* Kirkaldy, 1913: 13. Paralectotype ♂, CHINA (Macao) (BPBM) [examined]. New synonymy.

Male. Body relatively large, somewhat slender. BL, 8.1–9.6 mm; HL, 1.3–1.4 mm; HW, 1.1–1.2 mm; FWL, 6.3–7.6 mm.

General color (Fig. 1I and J) brownish ochraceous, female darker than male. Vertex and parts of genae pale ochraceous, a longitudinal line before eyes on vertex, a longitudinal stripe and a small spot before eyes on genae, and the area surrounding ocelli and antennae beneath eyes fuscous. Frons, base of postclypeus yellowish, apical part of frons, apex of postclypeus, anteclypeus fuscous, two fasciae between lat-

eral carinae and median carina orange-red. Labrum and rostrum yellowish brown, apical segment brown with extreme apex black. Pronotum and mesonotum brownish ochraceous, marked with fuscous and piceous. Thorax ventrally pale ochraceous, mesopleurae and mesosterna fuscous. Forewings (Fig. 8D) hyaline, venation fuscous, stigma and apical maculate markings piceous. Legs pale ochraceous, with longitudinal piceous lines; fore coxae dark brown; tarsi and claws brown; tips of apical spines on hind tibiae and tarsi black. Abdomen dorsally dark castaneous brown, the posterior segmental margins and lateral linear spots fuscous; sterna piceous, with numerous yellowish spots.

Head produced in a relatively elongate cephalic process, slightly upwardly directed, shorter than pronotum and mesonotum combined ($\approx 0.7:1$). Vertex (Fig. 8A) with ratio of length to width between eyes $\approx 2.8:1$. Forewings as in Fig. 8D. Hind tarsomeres I and II with 18–20 and 16–18 apical spines, respectively.

Male genitalia with pygofer with posterior margin nearly straight without process in lateral view (Fig. 8F); dorsal-lateral margins slightly protruded posteriorly in dorsal view (Fig. 8E). Anal tube large and oval in dorsal view (Fig. 8E), with ratio of length to width on middle $\approx 1.3:1$. Parameres base narrow, expanded toward apex, broadest subapically in lateral view (Fig. 8F), apex angularly protruded, upper process obviously expanded and directed anteriorly at subapex. Aedeagus moderate and stout, with a pair of short and slender phallical processes extended dorsally from phallobasal cavity; bases of dorsal and lateral parts and most portion of ventral parts of phallobase sclerotized and pigmented, the remainder membranous; dorsal and lateral membranous parts distinctly knobbed, with four to six long spines from base to middle on each side in dorsal view (Fig. 8H); lateral apical part produced in a narrow lamellar process that its edge membranous in lateral view (Fig. 8I); ventral part with a pair of quadrate apical lobes that possess four to six long spines in ventral view (Fig. 8J).

Female. BL, 9.6–10.2 mm; HL, 1.3–1.4 mm; HW, 1.2–1.3 mm; FWL, 7.7–8.2 mm.

Type Material Examined. Holotype ♂ of *Pseudophana eugeniae* Stål, 1859 (NHRS-GULI000000024). INDONESIA: Java, no collected time, Kinb., [red label] Typus (SMNH).

Holotype ♂ of *Avephara pasteuriana* Bierman, 1910. INDONESIA: Pad. Sidemp., West Sumatra, no collected time, J. D. Pasteur, ♂, [red label] Type, *Avephara pasteuriana* Bierman det. (NCB Naturalis).

Paralectotype ♂ *Electryone macaonica* Kirkaldy, 1913, here designated. CHINA: Macao, no collected time, J. C. K., [yellow label] Paralectotype ♂ *Electryone macaonica* Kirkaldy desig. Z. S. Song & A. P. Liang (BPBM).

Other Material Examined. INDIA: 1♂, Mohanbari, 18-IX-1943, D. E. Hardy; Assam: 1♂, Hellgate, 35 miles SE of Ledo, 22-IX-1943, D. E. Hardy (both in USNM). LAOS: 1♂, Nongtevada, 27-VII-1965, native collector; Vientiane Prov.: 1♂, Tha Ngone, 1-IX-1965, native collector (both in BPBM). MALAYSIA: 1♂ (9338),

Island of Penang, no collected time, Baker (USNM); 1♂, Malay Penin., 4-II-1927[?], Maib W. Cool, Ex F. M. S. Museum. B. M. 1955–354 (BMNH). CHINA: Chongqing: 2♀♀, Hechuan, 12-V-1939, no collector; Yunnan: 1♂, Hekou, Xiaonanxi, 200 m, 11-VI-1956, K. R. Huang; 1♂, Ruili, 800 m, 6-VI-1956, T. R. Huang; Guangxi: 2♂♂, 6♀♀, Guilin, Mt. Yanshan, 25-VIII, 11–15-IX, 11-X, 27-XI-1952, 7-VI-1963, no collector; 1♂, 2♀♀, 8–12-VII-1963, C. G. Wang, S. Y. Wang; 1♂, Liangfeng, 7-VI-1963, no collector; 2♀♀, Fangcheng, Banbaxiang, 250–550 m, 3–4-VI-2000, J. Yao, W. Z. Li; 1♀, Longzhou, Longgang, 330 m, 15-VI-1960, W. Z. Li; 1♀, Shanglin, 17-IX-1964, S. L. Liu; Jiangxi: 1♂, Mt. Lushan, 10-V-1930, no collector; 1♀, Nifeng [Yifeng], 30-IX-1936, S. K. Teng; Hainan: 1♀, 23-V-1936, G. Ros (all in IZCAS).

Distribution. India (Assam), Laos, southern China (Chongqing, Guangxi, Hainan, Yunan, Jiangxi, Macao), Malaysia (Penang, Borneo), and Indonesia (Java, Sumatra).

Discussion. *E. macaonica* was described by Kirkaldy (1913) from Macao, China. We examined a specimen collected by John Crampton W. Kershaw (J.C.K.) in Macao at BPBM. It is undoubtedly one of type material Kirkaldy examined in his monograph (Kirkaldy 1913). In 1996, the author Liang examined other type material of *E. macaonica* Kirkaldy deposited at BPBM. Our study shows *E. macaonica* is a junior synonym of *A. eugeniae* (Stål) comb. nov.

Avephara hazarensis (Shakila-Mushtaq, 1991)
comb. nov. ?

Avephara hazarensis Shakila-Mushtaq, 1991: 43, fig. 2A–I.

Avephara hazarensis Shakila-Mushtaq: Shakila-Mushtaq, 1994: 29.

Distribution. Pakistan.

Avephara rugosa (Shakila-Mushtaq, 1991)
comb. nov. ?

Avephara rugosa Shakila-Mushtaq, 1991: 42, fig. 1A–I.

Avephara rugosa Shakila-Mushtaq: Shakila-Mushtaq, 1994: 29.

Distribution. Pakistan.

Discussion. Shakila-Mushtaq (1991) described two *Putala* species (*P. rugosa* and *P. hazarensis*) according to *P. brachycephala* Distant from Pakistan, those who have short and broad cephalic process. It is clear that those species do not belong to *Putala*.

Descriptions and illustrations of the both Pakistani species in Shakila-Mushtaq (1991) show that they have much difference from *Avephara* species, such as the pronotum with lateral and median carinae in *rugosa*, the cephalic process nearly conical in *hazarensis*. We do not have access to examination of the Shakila-Mushtaq's specimens in Pakistan. The two Pakistani species are temporarily placed in the genus *Avephara*, and their taxonomic status need to be revised in future.

Philotheria Melichar, 1912

Philotheria Melichar, 1912: 92. Type species: *Dyctiophora* [sic] *senegalensis* Spinola, 1839; by original designation and monotypy.

Distribution. Afrotropical region.

Discussion. The African dictyopharid genus *Philotheria* was established by Melichar in 1912 based on a single species, *Dyctiophora* [sic] *senegalensis* Spinola, 1839 from Senegal. As an Afrotropical taxon, nowadays it contains 31 species, most of which were transferred into *Philotheria* from other genera. A standard taxonomic revision on the known species of *Philotheria* is badly needed.

Philotheria apicata (Melichar 1904)

(Figs. 2L, 9A–J)

Putala apicata Melichar, 1904: 29.

Putala apicata Melichar: Distant, 1906: 417; Metcalf, 1946: 80.

Philotheria apicata (Melichar): Fennah, 1957: 56.

Male. Body large, somewhat slender. BL, 8.3–9.1 mm; HL, 1.8–1.9 mm; HW, 1.1 mm; FWL, 5.9–6.4 mm.

General color (Fig. 2L) brownish ochraceous, marked with fuscous and piceous. Vertex and parts of genae pale ochraceous, a broad longitudinal genal stripe piceous. Frons, base of postclypeus yellowish, apical part of frons, apex of postclypeus, anteclypeus fuscous. Labrum and rostrum yellowish brown, apical segment brown with extreme apex black. Pronotum and mesonotum brownish ochraceous, marked with fuscous and piceous, tens of indistinct dots on each side of pronotum dark brown. Thorax ventrally pale ochraceous, mesopleurae and mesosterna fuscous. Forewings (Fig. 9D) hyaline, venation fuscous, stigma and apical maculate markings piceous. Legs pale ochraceous, with longitudinal piceous lines; fore coxae dark brown; tarsi and claws brown; tips of apical spines on hind tibiae and tarsi black. Abdomen dorsally dark castaneous brown, the posterior segmental margins and lateral linear spots fuscous; sterna piceous, with numerous yellowish spots.

Head with cephalic process elongate and distinctly slender, obviously upturned before eyes in lateral view (Fig. 9B), nearly as long as pronotum and mesonotum combined. Vertex (Fig. 9A) slender and elongate, base nearly as wide as transverse diameter of eyes in dorsal view (Fig. 9A); lateral carinate margins highly ridged and sulcate, gradually converging before eyes, and then distinctly narrowed and nearly parallel to apex; posterior margin arcuately concave; median carina only distinct at basal one-fifths. Frons (Fig. 9C) widest below antennae, lateral carinate margins slightly converging toward apex; lateral and median carinae sharp and complete. Postclypeus and anteclypeus convex medially, with distinct median carina.

Pronotum (Fig. 9A) with anterior margin centrally convex, lateral marginal areas straight and sloping with two long longitudinal carinae on each side between eyes and tegulae, posterior margin broadly concave;

lateral and median carinae distinct, median carina sharp and high, with a big lateral pit at side of carina, respectively. Mesonotum (Fig. 9A) more or less arched and tricarinate, lateral carinae slightly convergent. Forewings as in Fig. 8D. Legs moderately long; fore femora not flattened and dilated, with a short acute spine near apex; hind tibiae with five lateral and seven apical spines; hind tarsomeres I and II with 18–19 with 15–16 apical spines, respectively.

Male genitalia with pygofer very narrow and high, ventrally slightly broader than dorsally, posterior margin slightly protruded posteriorly near middle in lateral view (Fig. 9F), excavated apically to accommodate anal tube, distinctly protruded in dorsal view (Fig. 9E). Anal tube large and broad apically, apical ventral margin truncated, protruded an angle on each side, apical dorsal margin deeply excavated to accommodate anal style, with ratio of length to width at apex $\approx 1.1:1$ in dorsal view (Fig. 9E); anal style usually short and small, with extreme apex not extended beyond posterior margin of anal tube in dorsal view (Fig. 9E). Parameres moderately large, with numerous spiniform setae on inner surfaces in basal half; base narrow, expanded toward apex, distinctly humped near apex in ventral view (Fig. 9G); posterior margin nearly straight, upper margin with an elongate, dorsally directed, black-tipped process at apex, outer upper edge with a ventrally directed, hooklike process near middle. Aedeagus large and stout, with a pair of elongate phallical processes extended dorsolaterally from phallobasal cavity, apex acute; lateral parts of phallobase sclerotized and pigmented, the remainder membranous; dorsal part with a pair of large rounded membranous lobes spineless in dorsal view (Fig. 9H); ventral part inflated, with a pair of large, quadrate apical lobes possessing 22–26 long spines on lower ventrolateral area (Fig. 9I and J).

Material Examined. SUDAN: Blue Nile: 1♂, Singa-Damazin, 15–17-XI-1962, Linnavuori (AMNH); Upper Nile: 1♂, Malakal, 5–20-I-1963, Linnavuori (AMNH).

Distribution. Northeast Africa, eastern Africa, Sudan.

Discussion. The species is externally similar to *Putala* species but can be distinguished from the latter by its frons with lateral and median carinae sharp and complete; the fore femora with a small spine near apex; the male genitalia structure, especially the aedeagus with a pair of broad and elongate phallical processes, apex acute.

Philotheria apicamaculata (Stål, 1855)

Pseudophana apicamaculata Stål, 1855: 91.

Dictyophora [sic] *apicamaculata* (Stål): Walker, 1958: 318.

Dictyophara figurata Gerstaecker, 1895: 14. Synonymized by Melichar, 1912: 217.

Putala figurata (Gerstaecker, 1895 nec. Singh-Pruthi, 1925): Singh-Pruthi, 1925: 219; Metcalf, 1946: 80. New synonymy.

Philotheria apicamaculata (Stål): Synave, 1965: 5.

Distribution. Southern Africa, western Africa.

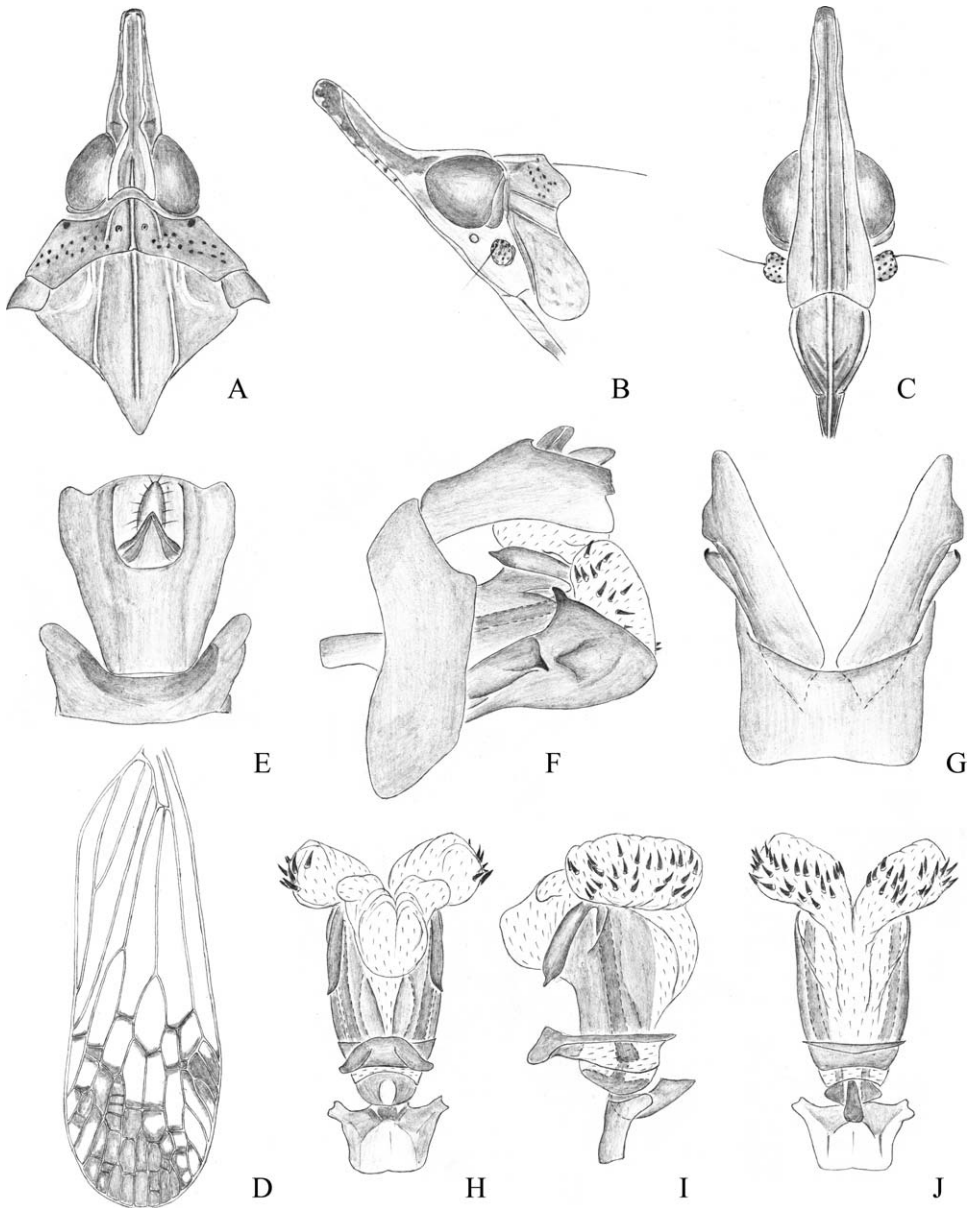


Fig. 9. *Philotheria apicalata* (Melichar). A. head, pronotum and mesonotum, dorsal view; B. head and pronotum, lateral view; C. head, ventral view; D. left forewing; E. pygofer and anal tube of male, dorsal view; F. genitalia of male, lateral view; G. pygofer and parameres of male, ventral view; H. aedeagus, dorsal view; I. aedeagus, lateral view; J. aedeagus, ventral view.

Discussion. Singh-Pruthi (1925) described and illustrated the male genitalia of *Putala figurata* (Gerstaecker, 1895) (= *Dictyophara figurata* Gerstaecker, from South Africa and West Africa) in his monograph about morphology of the male genitalia in Rhynchota. Metcalf (1946) (catalog of world Dictyopharidae) erroneously placed it into a new *Putala* species erected by Singh-Pruthi. Actually, *D. figurata* Gerstaecker had been synonymized with *D. apicemaculata* (Stål, 1855) by Melichar in 1912 and was transferred into *Philotheria* by Synave (1965), so *Putala figurata* (Gerstaecker, 1895 nec. Singh-

Pruthi, 1925) is a synonym of *Philotheria apicemaculata* (Stål, 1855).

Acknowledgments

We are grateful to the following individuals and institutions for loans of specimens or access to collections: Randall T. Schuh (AMNH), Mick Webb (BMNH), Davis J. Preston and Scott E. Miller (BPBM), Norman D. Penny (CAS), Robert L. Blinn and Lewis L. Deitz (NCSU), Drs. Richard C. Froeschner and Thomas J. Henry (USNM), Gunvi Lind-

berg (SMNH), and Yvonne D. van Nierop (NCB Naturalis). Three anonymous reviewers are greatly appreciated for their efforts in improving this article. The work on which this article is based was supported by the following sources: Scientific Survey on the Middle- and Lower-reaches of Lancang (Mekong) River and Grand Shangri-La Area (2008FY110300), National Science Fund for Fostering Talents in Basic Research (special subjects in animal taxonomy, NSFC-J0630964/J0109), and a grant (O529YX5105) from the Key Laboratory of the Zoological Systematics and Evolution of the Chinese Academy of Sciences.

References Cited

- Bierman, C.J.H. 1910. Homopteren aus Niederländisch Ost-Indien. II herausgegeben von D. MacGillavry und K.W. Dammerman. *Notes Leyden Mus.* 33: 1–68.
- Bourgoin, T. 2010. Fulgoromorpha lists on the web. (<http://flow.snv.jussieu.fr/cgi-bin/flowsite.pl?db=flow&page=explorer&lang=en&card=board#base>).
- Distant, W. L. 1906a. Rhynchotal Notes. *Ann. Mag. Nat. Hist.* 7: 349–356.
- Distant, W. L. 1906b. Some undescribed genera and species of South African Rhynchota. *Trans. S. Afr. Philos. Soc.* 16: 413–418.
- Distant, W. L. 1906c. The fauna of British India, including Ceylon and Burma. Rhynchota vol. 3 (Heteroptera-Homoptera). Taylor & Francis, London, United Kingdom.
- Distant, W. L. 1914. Some additions to the genera and species in the homopterous family Fulgoridae. *Ann. Mag. Nat. Hist.* 8: 409–413.
- Distant, W. L. 1916. The fauna of British India, including Ceylon and Burma. Rhynchota vol. 6 (Heteroptera-Homoptera). Taylor & Francis, London, United Kingdom.
- Emeljanov, A. F. 1980. Phylogeny and evolution of subfamily Orgeriinae (Homoptera, Dictyopharidae). *Tshtenija pamjati Cholodkovskovo* 32: 3–96.
- Emeljanov, A. F. 1983. Dictyopharidae from the Cretaceous deposits on the Taymyr Peninsula (Insecta, Homoptera). *Paleont. Zh.* 3: 79–85.
- Emeljanov, A. F. 1997. A new genus and species of the Dictyopharidae from Australia belonging to a new tribe (Homoptera, Cicadina). *Zoo. Rossica* 6: 77–82.
- Emeljanov, A. F. 2004. The subgeneric division of the genus *Dictyophara* Germar, 1833 (Homoptera: Dictyopharidae). *Russ. Entomol. J.* 12: 357–358.
- Emeljanov, A. F. 2008. New genera and species of the family Dictyopharidae (Homoptera) with notes on the systematics of the subfamily Dictyopharinae. *Entomol. Rev.* 87: 360–396.
- Emeljanov, A. F., V. G. Kuznetsova, C. Nokkala, and S. Nokkala. 2005. Phylogeny and evolution of the subfamily Orgeriinae (Homoptera, Dictyopharidae), pp. 15–16. *In* Symposium: Auchenorrhynchan Feeding Processes. 12th International Auchenorrhyncha Congress and the 5th International Workshop on Leafhoppers and Planthoppers of Economic Importance, 8–12 August 2005, University of California, Berkeley, CA.
- Fennah, R. G. 1957. Fulgoroidea from the Belgian Congo (Hemiptera Homoptera). *Ann. Mus. R. Congo Belge*, 8, *Sci. Zool.* 59: 1–206.
- Kirkaldy, G. W. 1913. On some new species of leaf-hoppers. Part 1. *Bull. Hawaiian Sugar Plant. Assoc. Div. Entomol.* 12: 7–27.
- Kramer, S. 1950. The morphology and phylogeny of auchenorrhynchos Homoptera (Insecta). *Ill. Biol. Monogr.* 20: 1–109.
- Melichar, L. 1903. Homopteren Fauna von Ceylon. Verlag von Felix L. Dames, Berlin, Germany.
- Melichar, L. 1904. Neue Homopteren aus Süd-Schoa, Galla und den Somal-Ländern. *Verh. Zool. Bot. Ges. Wien* 54: 25–48.
- Melichar, L. 1912. Monographie der Dictyophorinen (Homoptera). *Abh. Zool. Bot. Ges. Wien.* 7: 1–221.
- Metcalf, Z. P. 1946. General catalogue of the Hemiptera, Fasci. IV. Fulgoroidea, Part 8 Dictyopharidae. *Smith College, Northampton, MA.*
- Shakila-Mushtaq. 1991. Genus *Putala* from Pakistan. *Pak. Entomol.* 13: 41–45.
- Shakila-Mushtaq. 1994. Family Dictyopharidae (Fulgoroidea: Homoptera) from Pakistan. *Pak. Entomol.* 16: 1–32.
- Singh-Pruthi, H. 1925. The morphology of the male genitalia in Rhynchota. *Trans. R. Entomol. Soc. Lond.* 73: 127–267.
- Song, Z. S., and A. P. Liang. 2006. First record of the genus *Dictyopharina* Melichar (Hemiptera: Fulgoroidea: Dictyopharidae) from China, with descriptions of two new species. *Zootaxa* 1166: 21–33.
- Song, Z. S., and A. P. Liang. 2008. The Palaearctic planthopper genus *Dictyophara* Germar, 1833 (Hemiptera: Fulgoroidea: Dictyopharidae) in China. *Ann. Zool.* 58: 537–549.
- Synave, H. 1965. Dictyopharidae (Homoptera Fulgoroidea). *Explor. Parc Nat. Garamba Miss. Saeger* 1949–1952. 47: 1–63.

Received 21 April 2010; accepted 4 January 2011.