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Review of the cicada genus *Paharia* Distant (Hemiptera, Cicadidae), with the description of a new species and its allied species

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Abstract. The genus *Paharia* Distant, 1905 is reviewed based on the description of a new species, *Paharia oorschoti* sp. nov., and redescription of the allied *Paharia putoni* (Distant, 1892), both from Turkey. The relationships among *Paharia*, *Subpsaltria* Chen, 1943 and *Tibicina* Kolenati, 1857 of the tribe Tibicinini Distant, 1905 are discussed. The morphology of the exuviae of *Pa. oorschoti* sp. nov. and *S. yangi* Chen, 1943 is described and compared. *Tibicina insidiosa* Boulard, 1977 is transferred to *Paharia* to become *Paharia insidiosa* comb. nov. A key to all species of *Paharia* is provided.

Keywords. Cicadomorpha, Cicadoidea, *Subpsaltria*, *Tibicina*, biogeography.

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Introduction

The genus *Paharia* was erected by Distant (1905) with *Cephaloxys lacteipennis* Walker, 1850 as the type species. This genus is known from Iran, Kazakhstan, Turkmenistan, Tajikistan, Afghanistan, Turkey, Pakistan and India (Metcalf 1963; Duffels & van der Laan 1985; Sanborn 2013). Haupt (1920) transferred *Psalmocharias lacteipennis sensu* Distant 1914 and *Ps. semenovi sensu* Distant 1914 to the genus *Tibicen* Latreille, 1825, but China (1926) considered that these two species undoubtedly belong to the genus *Paharia*. Boulard (1977) categorized two subgenera into the Palearctic genus *Tibicina* Kolenati, 1857, i.e., *Tibicina Tibicina* and *Tibicina Paharia*, listing *T.* (*Pa.*) *lacteipennis* (Walker, 1850), *T.* (*Pa.*) *putoni* (Distant, 1892), *T.* (*Pa.*) *semenovi* (Oshanin, 1906) and *T.* (*Pa.*) *zevara* (Kusnezov, 1931) in the latter. Liu (1978) indicated that *Paharia* was known only from India and placed it in the tribe

Tibicinini Distant, 1905 of the subfamily Tibicininae Distant, 1905. Sanborn (2013) also put *Paharia* in Tibicinini of the subfamily Tibicininae (= Tettigadinae *auct.*) and followed Boulard (1977) by including four species in it: *Pa. lacteipennis* (Walker, 1850), *Pa. putoni* (Distant, 1892), *Pa. semenovi* (Oshanin, 1906) and *Pa. zevara* (Kusnezov, 1931).

In the present paper we review the genus *Paharia* based on the description of one new species (*Paharia oorschoti* sp. nov.) from Kurubas Geçidi, Turkey, and the redescription of the allied *Pa. putoni* from the same locality and from Iran. In addition, *Tibicina insidiosa* Boulard, 1977 is transferred to *Paharia* to become *Paharia insidiosa* comb. nov. The relationships among *Paharia*, *Subpsaltria* and *Tibicina* are discussed. The morphology of the exuviae of *Pa. oorschoti* sp. nov. and *S. yangi* Chen, 1943 is described and compared.

Material and methods

This study is based on specimens deposited in the following institutions:

NWAFU = Entomological Museum, Northwest A&F University, Yangling, China
ZMAN = Zoölogisch Museum, Amsterdam, The Netherlands

The type specimens of the new species were deposited in ZMAN (collection now held in Naturalis Biodiversity Center (NBC), Leiden, The Netherlands) and NWAFU. Various other material of *Paharia* and the related *Subpsaltria* and *Tibicina* was also borrowed from the above three institutes.

External morphology was studied using an Olympus SZX10 stereo microscope (Olympus Corporation, Tokyo, Japan), and photographed with a Nikon Coolpix P100 digital camera (Nikon Corporation, Indonesia). Male genitalia were studied and photographed using a scientific digital micrography system equipped with an auto-montage imaging system and a highly sensitive QIMAGING Retiga 4000R digital camera (CCD) (QImaging, Surrey, BC, Canada). Photographs were modified with Adobe Photoshop CS3. Terminology for morphological features and classification follows that of Moulds (2005, 2012). All measurements are in millimeters.

Results

Family Cicadidae Latreille, 1802
Subfamily Tettigadinae Distant, 1905
Tribe Tibicinini Distant, 1905

Genus ***Paharia*** Distant, 1905

Paharia Distant, 1905: 25. Type species: *Cephaloxys lacteipennis* Walker, 1850.

Tibicina (*Paharia*) – Boulard 1977: 564.

Diagnosis

Head moderately narrow, including eyes less than 0.80 times as wide as base of mesonotum; postclypeus much protruding, rostrum reaching mid coxae. Pronotum convex, much longer than head, laterally depressed; lateral pronotal collar not dentate. Abdomen about as long as forebody; timbal covers entirely absent, tympana completely exposed; abdominal sternites with lateral margins strongly recurved. Wings hyaline, with 8 and 6 apical cells on fore wing and hind wing respectively; fore wing with ulnar cell 3 more than twice as long as apical cell 5, basal cell about twice as long as broad and narrower at apex than at base. Aedeagus much elongated, curved anteriorly, with apex bifurcated.

Distribution

Iran, Kazakhstan, Turkmenistan, Tajikistan, Afghanistan, Turkey, Pakistan and India.

Paharia oorschoti sp. nov.
urn:lsid:zoobank.org:act:D40275BF-C140-474B-96BC-547796637DF7
Figs 1–2

Diagnosis

This species can be recognized by the following combination of characters: a yellow drop-shaped spot extending from median ocellus to posterior margin of head; mesonotum black with a pair of large, irregularly shaped fasciae on disc; male uncus black, with median uncal lobe pale brown and tapering to apex; aedeagal shaft elongated, curved anteriorly and then posteriorly, apex sickle-shaped; female opercula reaching posterior margin of abdominal sternite II but not overlapping each other centrally.

Etymology

The species is named after one of the collectors, H. v. Oorschot.

Material examined

Holotype

TURKEY: ♂, Van, Kurubas Geçidi, 2100 m, st. 261, 18 Jun. 1985, H. v. Oorschot and H. v.d. Brink leg. (ZMAN).

Paratypes

TURKEY: 40 ♂♂, 27 ♀♀, same collection data as for holotype (ZMAN); 3 ♂♂, 3 ♀♀, same collection data as for holotype (NWAFU); 12 ♂♂, 7 ♀♀, Van, Kurubas Geçidi, 2200 m, st. 606, 3 Jul. 1990, H. v.d. Brink, D. v.d. Poorten and W. de Prins leg. (ZMAN); 2 ♂♂, 1 ♀, same collection data as preceding (NWAFU); 1 ♂, Van, Kurubas Geçidi, 2100 m, st. 855, 25 Jul. 1992, H. v. Oorschot and H. v.d. Brink leg. (ZMAN); 1 ♂, 1 ♀, Van, Kurubas Geçidi, 2100 m, st. 1808, 29 Apr.–6 Jul. 1992, D. v.d. Poorten and W. de Prins leg. (ZMAN); 1 ♂, 1 ♀, Van, NW Kurubas Geçidi, 2200 m, st. 101, 17 Jun. 1985, Wagener leg. (ZMAN); 2 ♂♂, Van, N of Catak, 1900 m, st. 604, 2–5 Jul. 1990, H. v.d. Brink, D. v.d. Poorten and W. de Prins leg. (ZMAN).

Description

Measurements (in mm; n = 10 ♂♂, 10 ♀♀). Body length: ♂ 28.9–34.5, ♀ 24.2–29.3; fore wing length: ♂ 35.2–38.7, ♀ 31.0–38.8; width of head including eyes: ♂ 7.1–8.1, ♀ 6.8–8.0; pronotum width (including pronotal collar): ♂ 11.0–12.1, ♀ 9.6–12.2; mesonotum width: ♂ 9.5–10.4, ♀ 8.5–10.4.

Head (Fig. 1A, C). Head including eyes much narrower than base of mesonotum; head mostly black, with a yellow drop-shaped spot extending from median ocellus to posterior margin. Distance between lateral ocellus and corresponding compound eye about equal to distance between lateral ocelli. Eyes green, ocelli red. Lorum black, covered with golden hairs. Postclypeus black, covered with long golden hairs, lateral and posterior margins yellow in ventral view. Anteclypeus black. Rostrum yellow basally and black apically, reaching mid coxae.

Thorax (Fig. 1A, C). Inner area of pronotum black, distinctly longer than head, covered with dense golden hairs; narrow central longitudinal fascia yellow. Pronotal collar black with posterior margin yellow, covered with golden hairs. Mesonotum black with pair of large, irregularly shaped fasciae on disc; pair of yellow fasciae along lateral margins of mesonotum. Cruciform elevation yellow. Thoracic sternites black, covered with dense golden hairs.

Legs (Fig. 1H). Mostly yellow. Fore femur with irregular black markings; primary spine rounded apically and slightly oblique to femur; secondary spine large, erected and pointed; subapical spine undeveloped. Tibiae fuscous basally.

Wings (Fig. 1A–B). Hyaline; fore wing pale yellow, without markings; veins thick and brown; costal vein yellow. Hind wing not tinged.

Male

Abdomen (Fig. 1A–B, E). Black with no distinct markings, about as long as head and thorax together. Timbal covers yellow, undeveloped dorsally and leaving dorso-lateral timbal cavity wide open. Opercula black with yellow posterior margin, not overlapping each other centrally, not reaching posterior margin of abdominal sternite II. Abdominal sternites black and covered with golden hairs; deeply depressed,

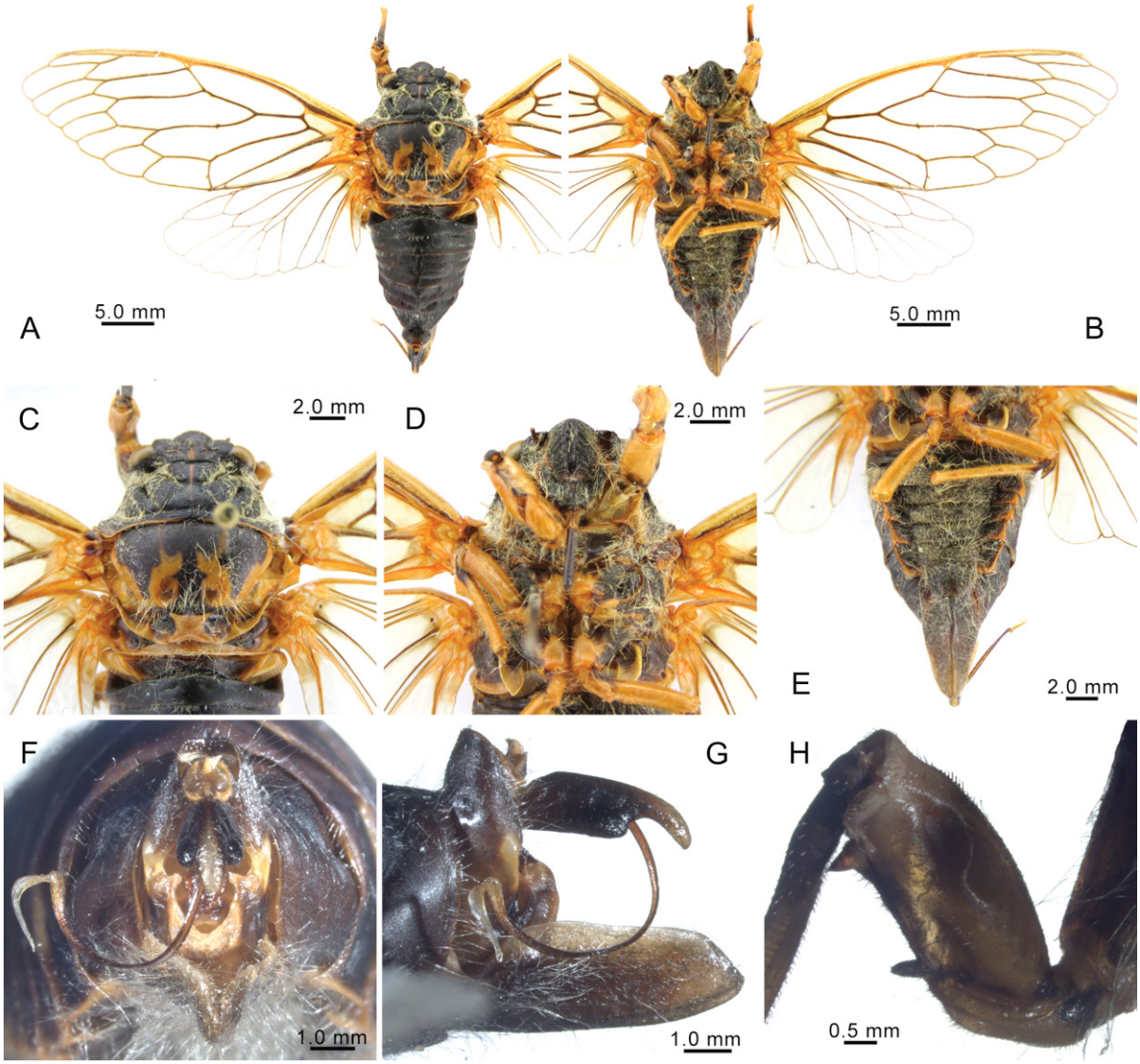

Fig. 1. *Paharia oorschoti* sp. nov. (♂, adult, holotype). **A**. Habitus, dorsal view. **B**. Habitus, ventral view. **C**. Head and thorax, dorsal view. **D**. Head and thorax, ventral view. **E**. Abdomen, ventral view. **F**. Male pygofer, ventral view. **G**. Male pygofer, lateral view. **H**. Left fore leg, showing the spines on fore femur.

with epipleurites strongly developed and very prominent; epipleurites black with lateral and posterior margins yellow; sternite VIII longer than combined length of sternites VI and VII.

Genitalia (Fig. 1F–G). Pygofer elliptical in ventral view, with long, silvery hairs. Basal lobes of pygofer curved inward distally. Anal styles yellow. Uncus black; median uncal lobe pale brown and tapering to apex; apex pointed and lower margin curved inwardly in lateral view. Aedeagal shaft elongated, curved anteriorly and then posteriorly, apex sickle-shaped.

Female

Abdomen. Dorsally black without distinct marking, abdomen about as long as head and thorax together. Opercula black-brown with yellow posterior margin, reaching posterior margin of abdominal sternite II but not overlapping. Abdominal sternites dark brown to black and covered with golden hairs; epipleurites black, strongly developed and very prominent, with lateral corners and posterior margins orange-yellow.

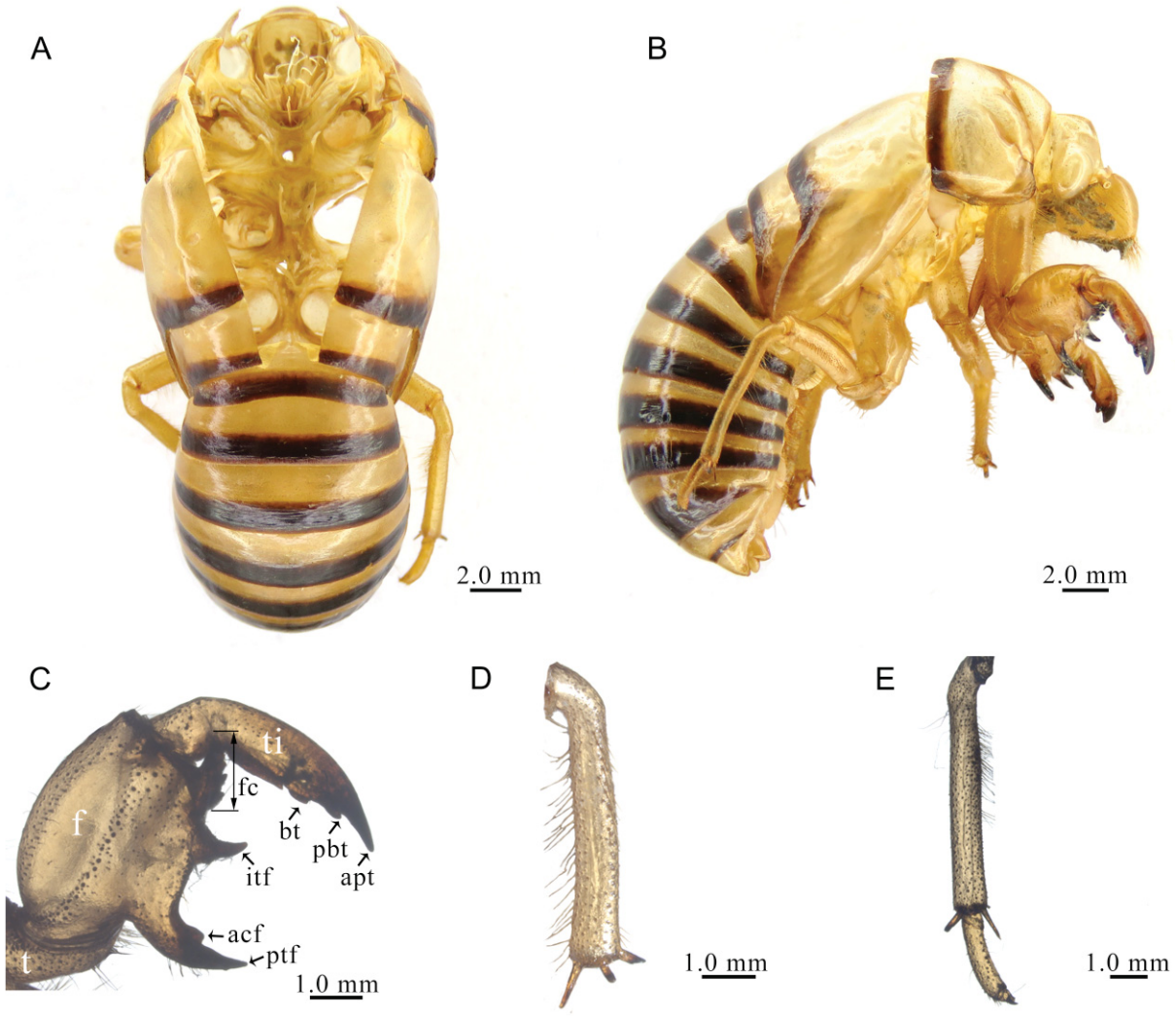

Fig. 2. *Paharia oorschoti* sp. nov. (♂, exuvia, holotype). **A**. Dorsal view of body. **B**. Lateral view of body. **C**. Right fore leg, outer view. **D**. Spines at the apex of mid tibia. **E**. Spines at the apex of hind tibia. Abbreviations: acf = accessory tooth of femur; apt = apical tooth of tibia; bt = blade of tibia; f = femur; fc = femoral comb; itf = intermediate tooth of femur; pbt = point of blade of tibia; ptf = posterior tooth of femur; t = trochanter; ti = tibia.

Sternite VIII with deep median incision, black with orange-yellow coloration along incision and on broad distal lobes. Lower part of segment IX orange-yellow to yellowish brown.

Exuviae

Body (Fig. 2A–B). Curved in lateral view, with sparse setae mainly on venter. Pronotum yellow with fuscous transverse fascia on posterior margin. Mesonotum yellow with two fuscous transverse fasciae on posterior area. Abdomen yellow with fuscous transverse fasciae on anterior margin of each tergite.

Legs (Fig. 2C–E). Generally yellow with black markings on apices of fore femur. Fore femur with posterior tooth long and sharp, accessory tooth short and robust, intermediate tooth curved upward in lateral view; femoral comb with five teeth, the first shorter than the second. Fore tibia arched, with apical tooth long and pointed. Apex of mid tibia with three spines; apex of hind tibia with two spines.

Remarks

This species is similar to *Pa. putoni*, but can be distinguished by the following characters: mesonotum with a pair of large, irregularly shaped markings (mesonotum with pair of somewhat quadrangled markings in *Pa. putoni*); male median uncal lobe pale brown, with apex pointed and lower margin curved inwardly in lateral view (male median uncal lobe black in *Pa. putoni*, with apex blunt and lower margin nearly straight in lateral view); female opercula reaching posterior margin of abdominal sternite II (female opercula not reaching posterior margin of abdominal sternite II in *Pa. putoni*).

Paharia putoni (Distant, 1892)
Fig. 3

Tibicina lacteipennis Puton, 1883: 45.
Tibicen putoni Distant, 1892a: 67 (nom. nov. pro *Tibicina lacteipennis* Puton, 1883 [*nec Tibicen lacteipennis* Walker, 1850]).

Sena lacteipennis – Distant 1906: 82.
Psalmocharias lacteipennis – Distant 1914: 10.
Paharia putoni – China 1926: 376.
Paharia putoni putoni – Sanborn 2013: 699.
Tibicina (*Paharia*) *putoni* – Boulard 1977: 564.

Material examined

TURKEY: 12 ♂♂, 11 ♀♀, Van, Kurubas Geçidi, 2100 m, st. 261, 18 Jul. 1985, H. v. Oorschot and H. v. d. Brink leg. (ZMAN); 2 ♂♂, 2 ♀♀, same collection data as precedent (NWAFU); 11 ♂♂, 3 ♀♀, Van, Kurubas Geçidi, 2200 m, st. 606, 3 Jul. 1990, H. v.d. Brink, D. v.d. Poorten and W. de Prins leg. (ZMAN); 9 ♂♂, 6 ♀♀, Mus, Seferek Geçidi, 6 km ENE of Varto, 1900–2000 m, st. 2612, 25 Jun. 2000, H. v. Oorschot, H. v. d. Brink and P. Oosterbroek leg. (ZMAN); 2 ♂♂, 2 ♀♀, same collection data as precedent (NWAFU); 2 ♂♂, Van, N of Catak, 1900 m, st. 604, 2–5 Jun. 1990, H. v.d. Brink, D. v.d. Poorten and W. de Prins leg. (ZMAN).

IRAN: 10 ♂♂, 2 ♀♀, Mãzandarãn, Khoshye'alaq, Khosh Yeilãq, 2000–2500 m, 4–6 Jul. 1972, W.L. Blom leg. (ZMAN); 2 ♂♂, 2 ♀♀, Ostan Mãzandarãn, Kūh-e-Sovar, Khosh Yeilãq, 1900–2100 m, 22–24 Jun. 1978, W.L. Blom leg. (ZMAN).

Description

Measurements (in mm; $n = 10$ ♂♂, 10 ♀♀). Body length: ♂ 24.5–27.9, ♀ 21.6–26.1; fore wing length: ♂ 29.9–36.0, ♀ 29.2–33.3; width of head including eyes: ♂ 6.2–6.9, ♀ 5.8–7.0; pronotum width (including pronotal collar): ♂ 9.2–10.0, ♀ 9.0–10.5; mesonotum width: ♂ 7.4–8.7, ♀ 7.2–8.9.

Head (Fig. 3A–B). Head including eyes much narrower than base of mesonotum; mostly black with a thin yellow spot extending from median ocellus to posterior margin of head. Distance between lateral ocellus and corresponding compound eye about equal to distance between lateral ocelli. Eyes green,

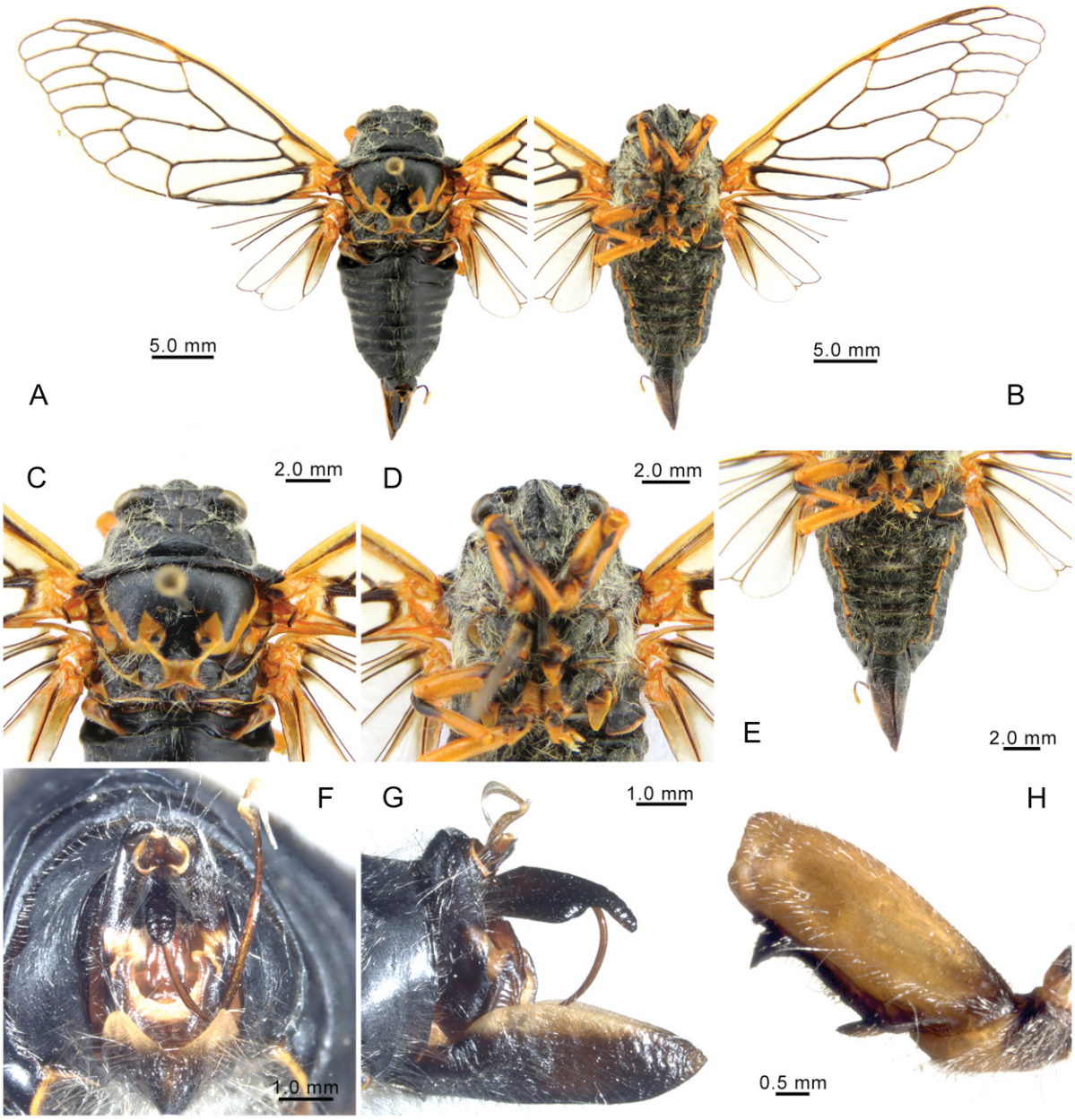

Fig. 3. *Paharia putoni* (Distant, 1892) (♂, adult), Turkey, Van, Kurubas Geçidi. **A**. Habitus, dorsal view. **B**. Habitus, ventral view. **C**. Head and thorax, dorsal view. **D**. Head and thorax, ventral view. **E**. Abdomen, ventral view. **F**. Pygofer, ventral view. **G**. Pygofer, lateral view. **H**. Left fore leg, showing the spines on fore femur.

ocelli red. Lorum black, covered with golden hairs. Postclypeus black, with yellow lateral and posterior margins in ventral view, and covered with long golden hairs. Anteclypeus black. Rostrum yellow basally and black apically, reaching mid coxae.

Thorax (Fig. 3A, C–D). Inner area of pronotum black and distinctly longer than head, covered with dense golden hairs; a faint central longitudinal fascia yellow. Pronotal collar black without markings, covered with golden hairs. Mesonotum black with somewhat quadrangled marking around corresponding scutal depression; pair of yellow fasciae along lateral margins of mesonotum. Cruciform elevation yellow. Thoracic sternites black, covered with dense golden hairs.

Legs (Fig. 3B, H). Mostly yellow. Fore femur with black marking near posterior margin in lateral view; primary spine pointed apically and slightly oblique to femur; secondary spine large, curved downward; subapical spine undeveloped. Trochanter with black marking. Tibiae fuscous to black basally.

Wings (Fig. 3A–B). Hyaline; fore wing pale yellow without markings; veins thick and brown; costal vein yellow. Hind wing not tinged.

Male

Abdomen (Fig. 3A–B, E). About as long as head and thorax together; black with white pruinosity on lateral areas and golden hairs on median areas of each tergite. Timbal covers yellow with black markings, undeveloped dorsally and leaving dorso-lateral timbal cavity wide open. Opercula black with yellow posterior margin, not overlapping each other centrally, not reaching posterior margin of abdominal sternite II. Abdominal sternites black and covered with golden hairs; deeply depressed, with epipleurites strongly developed and very prominent; epipleurites black with lateral margins yellow. Sternite VIII longer than length of two preceding sternites together.

Genitalia (Fig. 3F–G). Pygofer elliptical in ventral view, with long, silvery hairs. Basal lobes of pygofer curved inward distally. Anal styles yellow to fuscous. Uncus black; medial uncal lobe black and tapering to apex, with apex blunt and lower margin nearly straight in lateral view. Aedeagal shaft elongated, curved anteriorly and then posteriorly, apex sickle-shaped.

Female

Abdomen. About as long as head and thorax together, dorsally black with white hairs on lateral and median areas of tergites but without distinct marking. Opercula black with narrow yellow posterior margin, not overlapping and not reaching posterior margin of abdominal sternite II. Abdominal sternites black and covered with silvery hairs; epipleurites prominent, black with yellow lateral margins. Sternite VIII with deep median incision, black with distal lobes orange-yellow. Lower part of segment IX orange-yellow to yellowish brown.

Distribution

Iran, Turkmenistan, Afghanistan, Kazakhstan and Tajikistan.

Remarks

This species is morphologically very close to *Pa. oorschoti* sp. nov. (for detail, see Remarks for *Pa. oorschoti* sp. nov.).

Paharia lacteipennis (Walker, 1850)

Cephaloxys lacteipennis Walker, 1850: 237.

Mogannia lacteipennis – Atkinson 1884: 233.
Tibicen (Cephaloxys) lacteipennis – Distant 1892b: 129, pls 13–14.
Paharia lacteipennis – Distant 1905: 25.
Tibicina (*Paharia*) *lacteipennis* – Boulard 1977: 564.

Distribution

Turkey, Kazakhstan, Afghanistan, Pakistan and India.

Paharia semenovi (Oshanin, 1906)

Tibicen semenovi Oshanin, 1906: 161.

Tibicena semenovi – Oshanin 1912: 96.
Psalmocharias semenovi – Distant 1914: 10.
Paharia semenovi – China 1926: 376.
Tibicina (*Paharia*) *semenovi* – Boulard 1977: 563.

Distribution

Kazakhstan and Tajikistan.

Paharia zevara (Kusnezov, 1931)

Tibicina zevara Kusnezov, 1931: 15.

Paharia zevara – Nast 1972: 148.
Tibicina (*Paharia*) *zevara* – Boulard 1977: 564.

Distribution

Afghanistan and Tajikistan.

Paharia insidiosa (Boulard, 1977) comb. nov.

Tibicina (*Tibicina*) *insidiosa* Boulard, 1977: 557.

Distribution. Afghanistan.

Key to the species of Paharia

1. Abdominal tergite(s) with distinct marking(s) on posterior margin(s) 2
– Abdominal tergites without distinct markings 3

2. Abdomen with yellow margins on each tergite; mesonotum with pair of yellow irregularly-shaped markings extending to anterior margin of disc ..... ***Pa. lacteipennis*** (Walker, 1850)

– Abdomen with yellow margin merely on tergite VIII; mesonotum with pair of yellow irregularly-shaped markings not extending to anterior margin of disc ..... ***Pa. semenovi*** (Oshanin, 1906)

3. Pronotum with pair of large brown markings on lateral fissure of inner area ..... ***Pa. insidiosa*** (Boulard, 1977) comb. nov.
– Pronotum without distinct markings on lateral fissure 4

4. Fore wing with costal vein brown to black; pronotum without markings ..... ***Pa. zevara*** (Kusnezov, 1931)
– Fore wing with costal vein yellow; pronotum with a yellow central longitudinal fascia 5

5. Male median uncal lobes pale brown; female opercula reaching posterior margin of abdominal sternite II ..... ***Pa. oorschoti*** sp. nov.
– Male median uncal lobes black; female opercula not reaching posterior margin of abdominal sternite II ..... ***Pa. putoni*** (Distant, 1892)

Discussion

In the present paper we review the genus *Paharia* based on the description of one new species (*Pa. oorschoti* sp. nov.), the redescription of *Pa. putoni* and a comparative morphological study of this genus with the closely related *Tibicina* and *Subpsaltria*. Chen (1943) established *Subpsaltria* with the description of two species (i.e., *S. yangi* and *S. sienyangensis*) and placed it in the subfamily Tettigadinae, remarking how "this genus appears to be similar to *Paharia*, except for the presence of a pair of striated areas situated on each of the sides of the mesonotum, and a projecting scraper formed by the base of the claval area of each fore wing". However, Liu (1978) did not include *Subpsaltria* in his "Monograph of Chinese Cicadidae". Chou *et al.* (1997) synonymised *S. sienyangensis* with *S. yangi* and followed the division of Chen (1943), i.e., placing it in the subfamily Tettigadinae. Amyot (1847) established the genus *Tibicina* for *Cicada haematodes* Scopoli, 1763. Kolenati (1857) revised *Tibicina* and treated it as a subgenus of the genus *Cicada* Linnaeus, 1758. Fieber (1876) re-elevated *Tibicina* to generic rank, which was followed by later authors (cf. Metcalf 1963; Nast 1972; Duffels & van der Laan 1985). However, most denominations proposed by Amyot from 1845 to 1847 were rejected by the ICZN (Opinion 686 1963), and his denomination of *Tibicina* (Amyot, 1847) was also rejected by the ICZN later (Opinion 2165 2006). Thus, the name *Tibicina* was assigned to Kolenati (1857). Moulds (2005) put *Subpsaltria* in the tribe Tettigadini of the subfamily Tettigadinae and *Tibicina* in the tribe Tibicinini of the subfamily Tibicininae. Lee (2012) included *Paharia*, *Tibicina* and *Subpsaltria*, as well as six other genera (i.e., *Tibicinoides* Distant, 1914, *Clidophleps* Van Duzee, 1915, *Okanagodes* Davis, 1919, *Okanagana* Distant, 1905, *Ahomana* Distant, 1905 and *Subtibicina* Lee, 2012), in the tribe Tibicinini of the subfamily Tibicininae (= Tettigadinae *auct*.). Sanborn (2013) listed all these nine genera in the sole subtribe Tibicinina of the tribe Tibicinini. Sanborn (2014) later transferred *Ahomana* to the tribe Carinetini. The tribe Tibicinini is defined by the following common characters: hind wing veins RP and M not fused at base; hind wing first cubital cell width at distal end about equal to second cubital cell; male opercula not reaching posterior margins of sternite II; pygofer upper lobes absent; uncus very long (Lee 2012). However, phylogenetic relationships among the taxa of the Tibicinini remain unclarified.

Paharia is more closely related to *Subpsaltria* and *Tibicina* among the eight currently known genera of Tibicinini in having broader fore wings, a black body with yellow markings (some species have a yellow body with black markings; e.g., Fig. 4A–B), and arched pygofer uncal lobes. However, some significant characteristics of adults can be applied to distinguish these three genera. *Paharia* is distinguished from

Tibicina by its longer fore wing ulnar cell 3 (more than twice as long as apical cell 5 in *Paharia*; about 1.5–2 times as long as apical cell 5 in *Tibicina*) and the structure of the timbals (upper part of timbal well sclerotized, with longest rib less than twice the length of shortest in *Paharia*; upper part of timbal weakly sclerotized, with longest rib greater than twice the length of the shortest in *Tibicina*) (Lee 2012; Ahmed *et al.* 2015). *Paharia* can be distinguished from *Subpsaltria* by the fore wing veins, which are not or very slightly incrassated, and by the absence of the projecting scraper at the base of the fore wing.

In addition to the dissimilarity of adults, the morphology of exuviae may be informative to the taxonomy and phylogeny of Tibicinini. For example, when we compare the exuviae of *Pa. oorschoti* sp. nov. and *S. yangi*, the following distinct differentiations, in addition to the difference of fasciae on thorax and abdomen, were found to be reliable characteristics to distinguish these two genera: i) the shape of femoral teeth (posterior tooth sharp apically, accessory tooth short and robust, femoral comb with five teeth in *Pa. oorschoti* sp. nov. (Fig. 2C); posterior tooth rounded apically, accessory tooth absent, femoral comb with four teeth in *S. yangi* (Fig. 4C)); and ii) the number of spines at the apex of mid and

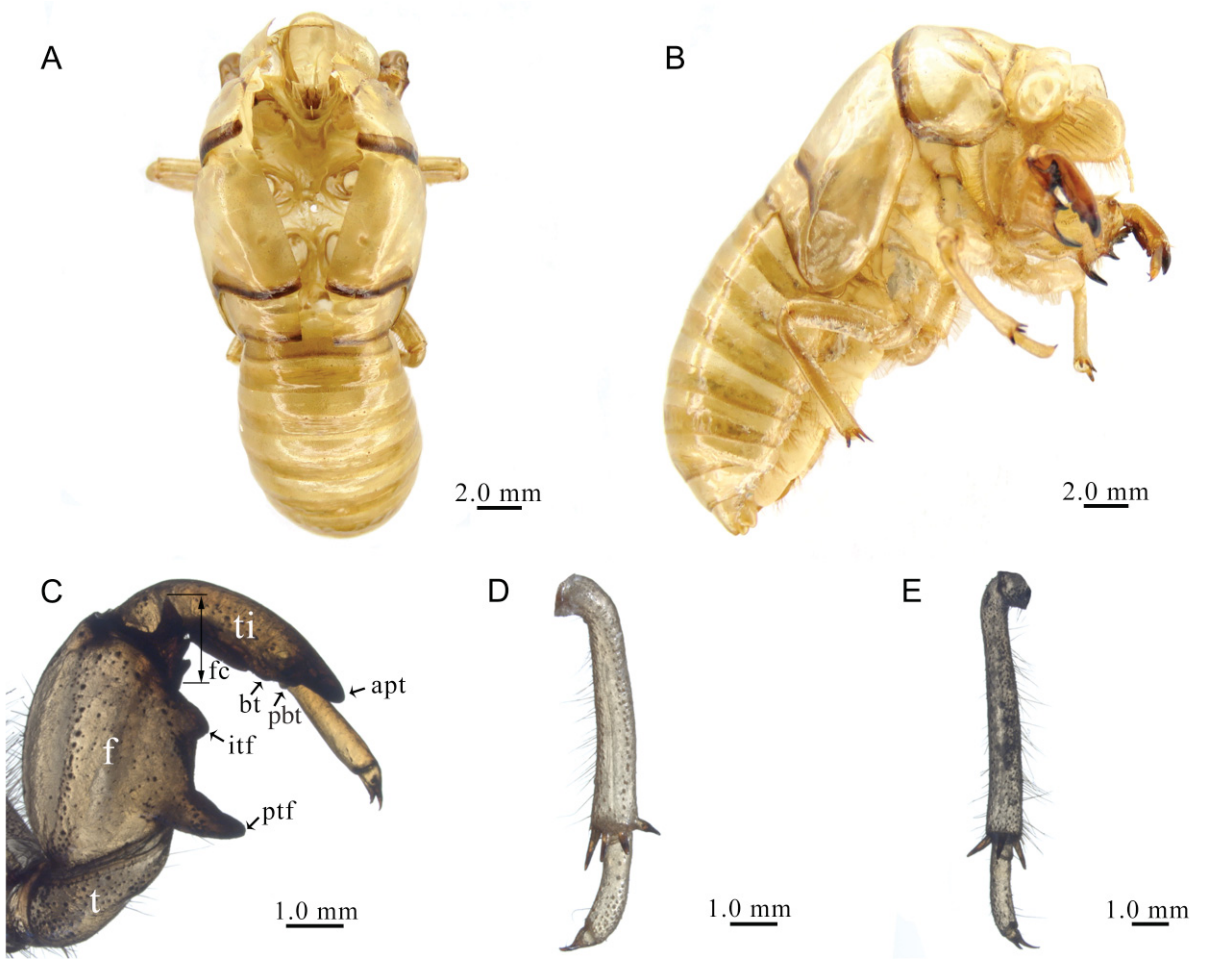

Fig. 4. *Subpsaltria yangi* Chen, 1943 (♂, exuvia). **A**. Dorsal view of body. **B**. Lateral view of body. **C.** Right fore leg, outer view. **D**. Spines at the apex of mid tibia. **E**. Spines at the apex of hind tibia. Abbreviations: apt = apical tooth of tibia; bt = blade of tibia; f = femur; fc = femoral comb; itf = intermediate tooth of femur; pbt = point of blade of tibia; ptf = posterior tooth of femur; t = trochanter; ti = tibia.

hind tibiae (three spines in mid tibiae and two spines in hind tibiae in *Pa. oorschoti* sp. nov. (Fig. 2D–E); four spines in mid tibiae and three spines in hind tibiae in *S. yangi* (Fig. 4D–E)).

Currently, all six species of *Paharia* are known from West Asia to Central and South Asia (Fig. 5). The distribution pattern of *Paharia* species indicates that this genus occurs mainly in the Palearctic Region, with *Pa. lacteipennis* expanding its distribution to Pakistan and India. *P. lacteipennis* has the widest distributional range, i.e., from Turkey to Kazakhstan and India. The remaining species of *Paharia* are all endemic to related regions. The diversity of *Paharia* is greatest in Afghanistan, where four species are distributed, i.e., *Pa. lacteipennis*, *Pa. putoni*, *Pa. zevara* and *Pa. insidiosa* comb. nov. Accordingly, we infer that *Paharia* likely originated from Palearctic Central Asia. In comparison with the distribution of *Paharia*, *Tibicina* is distributed in Europe and North Africa; *Subpsaltria* is endemic to central China; *Tibicinoides*, *Clidophleps*, *Okanagodes* and *Okanagana* are all endemic to North America; and *Subtibicina* is endemic to India. These distribution patterns of Tibicinini indicate that the evolution of this tribe has been closely related to the drift of continental plates and historical climate changes. The phylogeny and phylogeography of Tibicinini await further investigations that draw on multiple sources such as the morphology of both adults and nymphs, biogeography, acoustics, molecular data, etc.

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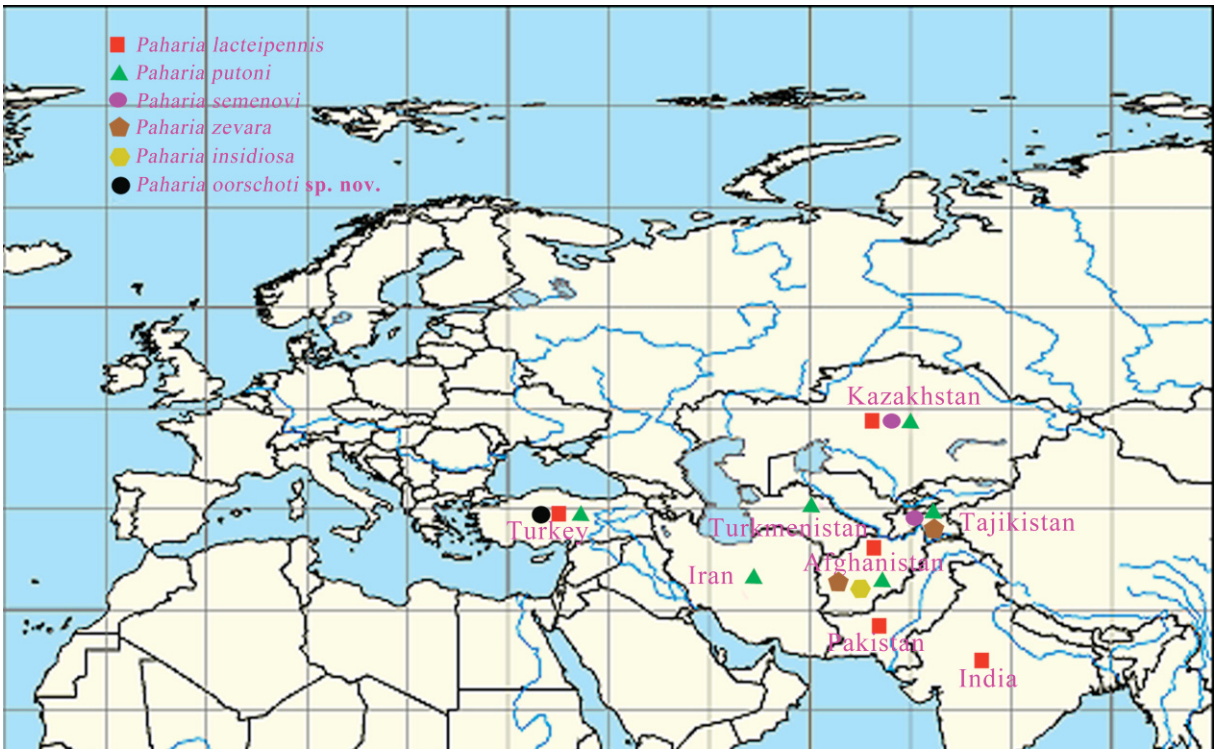

Fig. 5. Distribution of the species of *Paharia*. Red square = *Pa. lacteipennis* (Walker, 1850); green triangle = *Pa. putoni* (Distant, 1892); purple circle = *Pa. semenovi* (Oshanin, 1906); brown pentagon = *Pa. zevara* (Kusnezov, 1931); yellow hexagon = *Pa. insidiosa* (Boulard, 1977) comb. nov.; black circle = *Pa. oorschoti* sp. nov.

References

Amyot C.J.B. 1847. Entomologie Française. Rhynchotes. Ordre deuxième. Homoptères. Homoptera. Latr. *Annales de la Société entomologique de France, Deuxième Série*, 5: 143–238. Available from http://biodiversitylibrary.org/page/8259658 [accessed 9 Aug. 2017].

Ahmed Z., Sanborn A.F. & Khatri I. 2015. A key to the cicada fauna of Pakistan based on structural variation in the timbals (Hemiptera: Cicadoidea). *Pakistan Journal of Zoology* 47 (2): 589–591.

Atkinson E.T. 1884. Notes on Indian Rhynchota, No. 1. *Journal of the Asiatic Society of Bengal* 53: 210–233. Available from http://www.biodiversitylibrary.org/page/35557719#page/4/mode/1up [accessed 9 Aug. 2017].

Boulard M. 1977. Description d'une nouvelle *Tibicina* de l'ouest asiatique; révision de la liste des espèces paléarctiques appartenant à ce genre (Hemiptera, Cicadoidea). *Annales de la Société entomologique de France (N.S.)* 12: 557–566.

Chen K.-F. 1943. New genera and species of Chinese cicadas with synonymical and nomenclatorial notes. *Journal of the New York Entomological Society* 51: 19–53.

China W.E. 1926. A new species of *Cicadatra* (Homoptera, Cicadidae) from Waziristan, with notes on the allied genus *Psalmocharias* Kirk. *Annals and Magazine of Natural History* 18 (9): 374–376. https://doi.org/10.1080/00222932608633531

Chou I., Lei Z., Li L., Lu X. & Yao W. 1997. *The Cicadidae of China (Homoptera: Cicadoidea)*. Tianze Eldoneio, Hong Kong.

Distant W.L. 1892a. On some undescribed Cicadidae, with synonymical notes. *Annals and Magazine of Natural History* 10 (6): 54–67. https://doi.org/10.1080/00222939208677373

Distant W.L. 1892b. *A Monograph of Oriental Cicadidae*. Indian Museum, Calcutta. Available from http://www.biodiversitylibrary.org/page/8677365#page/11/mode/1up [accessed 9 Aug. 2017].

Distant W.L. 1905. Rhynchotal Notes. XXXIII. *Annals and Magazine of Natural History* 7 (16): 22–35. https://doi.org/10.1080/03745480509443650

Distant W.L. 1906. *A Synonymic Catalogue of Homoptera. Part 1. Cicadidae.* British Museum of Natural History, London.

Distant W.L. 1914. Homoptera, family Cicadidae, subfamily Gaeaninae. *Genera Insectorum* 158: 1–38.

Duffels J.P. & van der Laan P.A. 1985. *Series Entomologica*. Vol. 34: *Catalogue of the Cicadoidea (Homoptera, Auchenorhyncha) 1956–1980*. Dr. W. Junk Publishers, The Hague.

Fieber F.X. 1876. Les cicadines d'Europe d'après les originaux et les publications les plus récentes. 2: Description des espèces. *Revue et Magasin de Zoologie Pure et Appliquée* 4 (3): 11–268.

Haupt H. 1920. Eine neue Singcicade aus Mesopotamien. *Deutsche Entomologische Zeitschrift* 3–4: 409–412. https://doi.org/10.1002/mmnd.192019200316

Kolenati F. 1857. Homoptera Latreille. Leach. Gulaerostria Zetterstedt. *Bulletin de la Société impériale des naturalistes de Moscou, Section Biologique* 30: 399–444. Available from http://biodiversitylibrary.org/page/44192748 [accessed 9 Aug. 2017].

Kusnezov V. 1931. Übersicht der asiatischen weissgeflügelten *Tibicina*-Arten (Homoptera-Cicadidae). *Konowia* 10: 15–18.

Lee Y.J. 2012. Descriptions of two new genera and species of Cicadidae (Hemiptera) from India with some notes on tribal classification. *Deutsche Entomologische Zeitschrift* 59 (2): 225–231.

Liu K.C. 1978. Monograph of Chinese Cicadidae. *Quarterly Journal of the Taiwan Museum* 32: 1–184.

Metcalf Z.P. 1963. General catalogue of the Homoptera, Fascicle VIII. Cicadoidea. Part 1. Cicadidae. Section 1. Tibiceninae. *North Carolina State College Contribution* 1502: 1–585.

Moulds M.S. 2005. An appraisal of the higher classification of cicadas (Hemiptera: Cicadoidea) with special reference to the Australian fauna. *Records of the Australian Museum* 57: 375–446. https://doi.org/10.3853/j.0067-1975.57.2005.1447

Moulds M.S. 2012. A review of the genera of Australian cicadas (Hemiptera: Cicadoidea). *Zootaxa* 3287: 1–262.

Nast J. 1972. *Palaearctic Auchenorrhyncha (Homoptera). An Annotated Checklist.* Polish Scientific Publishers, Warsaw.

Opinion 686. 1963. Opinion 686 (Case 1478). Amyot, Méthode mononymique: placed on the official index of rejected and invalid works in zoological nomenclature. *Bulletin of Zoological Nomenclature* 20 (6): 423. Available from http://biodiversitylibrary.org/page/12221768 [accessed 9 Aug. 2017].

Opinion 2165. 2006. Opinion 2165 (Case 3327). Amyot, Methode mononymique (1845–1847): correction to Opinion 686. *Bulletin of Zoological Nomenclature* 63 (4): 284–285. Available from http://biodiversitylibrary.org/page/34353180 [accessed 9 Aug. 2017].

Oshanin V.F. 1906. Deux nouvelles espèces de cicadides de l'Asie Centrale. *Revue russe d'Entomologie* 6: 161–163. Available from http://biodiversitylibrary.org/page/11943527 [accessed 9 Aug. 2017].

Oshanin V.F. 1912. *Katalog der paläarktischen Hemipteren (Heteroptera, Homoptera - Auchenorhyncha und Psylloideae)*. Friedländer & Sohn, Berlin.

Puton A. 1883. Deux espèces nouvelles de cicadides. *Revue d'Entomologie* 2: 45–46. Available from http://biodiversitylibrary.org/page/25445565 [accessed 9 Aug. 2017].

Sanborn A.F. 2013. *Catalogue of the Cicadoidea (Hemiptera: Auchenorrhyncha)*. Academic Press/Elsevier, London.

Sanborn A.F. 2014. A new genus and new tribe of cicada from South America (Hemiptera: Cicadoidea: Cicadidae) with a note on the taxonomic position of *Ahomana* Distant, 1905. *Proceedings of the Entomological Society of Washington* 116 (3): 339–348. https://doi.org/10.4289/0013-8797.116.3.339

Walker F. 1850. *List of the Specimens of Homopterous Insects in the Collection of the British Museum*. British Museum Trustees, London.

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