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## A new species of *Cicadatra* Kolenati, 1857 from China, with primary phylogenetic analyses of the tribe Cicadatrini (Hemiptera: Cicadidae)

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### Abstract

A new species of the genus *Cicadatra* Kolenati, 1857, *C. hei* sp. nov., from Sichuan Province, China is described. A key to the species of *Cicadatra* from China is provided. Morphological characters for 9 taxa of the tribe Cicadatrini and for 3 outgroup taxa are examined to present the first phylogenetic reconstruction within the Cicadatrini. The monophyly of Cicadatrini is supported, and Cicadatrini is more allied to the outgroup *Cicadetta* of the subfamily Cicadettinae (= Tibiciniinae auct.) from TNT and WinClada analyses. The systematic status of the tribe Cicadatrini is discussed. The genus *Cicadalna* Boulard, 2006 is recognized to be a junior synonym of *Emathia* Stål, 1866, and *Cicadalna takensis* Boulard, 2006 is transferred from *Cicadalna* to *Emathia* to become *Emathia takensis* (Boulard, 2006) **comb. nov.**

**Key words:** Cicadomorpha, Cicadoidea, Cicadini, *Cicadalna*, phylogeny

### Introduction

Amyot (1847) established the genus *Cicadatra* with *Cicada atra* Olivier, 1790 as the type species. Kolenati (1857) treated *Cicadatra* as a subgenus of *Cicada* Linnaeus, 1758. Stål (1861) treated *Cicadatra* as a subgenus of *Tettigia* Kolenati, 1857. However, the denomination of *Cicadatra* (Amyot 1847) was rejected by the ICZN (Opinion 686, 1963). Thus, the term *Cicadatra* was assigned to Kolenati (1857). The original characters were outlined for *Cicadatra* by Amyot (1847) and Kolenati (1857) and expanded upon by Distant (1914). Distributional analyses for species of *Cicadatra* in the Middle East area have been made previously by some workers from Europe, Iran, and Pakistan (China 1926; Dlabola 1960, 1970, 1979, 1981; Nast 1972; Linnavouri 1962; Melichar 1896). In more recent years, some new species of *Cicadatra* have been described from nearby Iran, the Mediterranean region and Pakistan (Ahmed & Sanborn 2010; Ahmed *et al.* 2010; Ahmed *et al.* 2012; Mozaffarian & Sanborn 2010; Mozaffarian *et al.* 2010; Simões *et al.* 2013; Mozaffarian & Sanborn 2015).

Identification of species of *Cicadatra* is challenging due to the variation of species and the similar general appearance of many species within this genus (Ahmed *et al.* 2013). The *Cicadatra* exhibits a wide geographical distribution across the Palaearctic Region extending westward from Pakistan across the Middle East to Europe, North Africa and the Mediterranean region, northward to Russia and Georgia, and eastward to India and China (Nast 1972, Ahmed & Sanborn 2010; Mozaffarian & Sanborn 2010, Ahmed *et al.* 2013, Ahmed *et al.* 2015). This genus is currently represented by 41 species worldwide, among which only 2 species are known from China (Sanborn 2013).

In our study, we described one new species (*Cicadatra hei* sp. nov.) of the tribe Cicadatrini from China, and examined morphological characters to present the first phylogenetic reconstruction within Cicadatrini derived from a cladistic analysis. We scored 30 morphological characters for 9 taxa of Cicadatrini and for 3 outgroup taxa. Analyses were based on maximum parsimony using both programs TNT 1.1 and WinClada 1.0. The systematic status of the tribe Cicadatrini is discussed. In addition, according to morphological characters, the genus *Cicadalna* Boulard, 2006 is recognized to be a junior synonym of *Emathia* Stål, 1866, and *Cicadalna takensis* Boulard, 2006 is transferred from *Cicadalna* to *Emathia* to become *Emathia takensis* (Boulard, 2006) **comb. nov.**

## Materials and methods

### Specimens examined and morphological analyses

Types are deposited in the following collections:

NWAFU Entomological Museum, Northwest A&F University, Yangling, China

CLHC Collection of Li He, Chengdu, China

This study is based mainly on specimens deposited in the Entomological Museum, Northwest A&F University, Yangling, China (abbreviated as NWAFU in the text). Related materials of the tribe Cicadatrini deposited in CLHC and The Natural History Museum, London, UK (BMNH) were also checked. External morphology was observed using an Olympus SZX10 stereomicroscope (Olympus Corporation, Tokyo, Japan), and photographed with a Nikon Coolpix P100 digital camera (Nikon Corporation, Indonesia). Male genitalia was observed and photographed using a Scientific Digital micrography system equipped with an Auto-montage imaging system and a high sensitive QIMAGING Retiga 4000R digital camera (CCD) (QImaging, Surrey, BC, Canada). The extracted pygofer, if necessary, was dissected and placed in 10% KOH boiled for 2–5 minutes, washed, and transferred to glycerin for observation, and the aedeagus were photographed using CCD similarly. Photographs were modified with Adobe Photoshop CS3. All measurements are in millimeter. The type materials of the new species are deposited in NWAFU and CLHC. Terminology for morphological features follows that of Moulds (2005, 2012).

In the present study, all the 9 genera of the tribe Cicadatrini were included in the phylogenetic analysis (see detailed taxa list in Table 1). The character polarity was determined using the outgroup taxa, i.e., *Paharia* Distant, 1905 (subfamily Tettigadinae), *Meimuna* Distant, 1905 (subfamily Cicadinae), and *Cicadetta* Kolenati, 1857 (subfamily Cicadettinae (= Tibicininae *auct.*)). We examined the specimens of most taxa included in the analysis. Character states of the species without available specimens were obtained using literature for guidance. Thirty morphological characters were obtained from male adults (see below). All characters were treated as unordered and with equal weight.

0. Head width including eyes: (0) wider than base of mesonotum; (1) about as wide as base of mesonotum; (2) narrower than base of mesonotum.
1. Length of rostrum: (0) just reaching anterior margin of mid coxae; (1) reaching posterior margin of mid coxae; (2) reaching mid trochanter; (3) reaching hind coxae.
2. Lateral margins of pronotum (excluding lateral angles of pronotal collar): (0) oblique; (1) nearly rectangular.
3. Pronotal collar lateral development: (0) amplified; (1) not amplified.
4. Pronotal collar lateral tooth: (0) absent; (1) present.
5. Metanotum: (0) entirely concealed at dorsal midline; (1) partly visible at dorsal midline.
6. Length of male abdomen: (0) as long as forebody; (1) longer than forebody; (2) shorter than forebody.
7. Length of male opercula: (0) short, not or slightly extending beyond posterior margin of abdominal sternite II; (1) long, extending beyond posterior margin of abdominal sternite III.
8. Shape of male opercula: (0) transverse; (1) longitudinal, inner margins curved outward apically; (2) longitudinal, inner margins curved inward apically.
9. Male opercula: (0) enlarged at subapical portion towards body centre; (1) not enlarged at subapical portion towards body centre.
10. Timbal covers: (0) concealing timbals mostly; (1) exposing timbals almost entirely; (2) absent.
11. Shape of timbal covers: (0) rectangular shaped; (1) crescent-like shaped; (2) oval shaped; (3) semicircular; (4) absent.
12. Number of timbal ribs: (0) fewer than ten long ribs; (1) ten or more than ten long ribs.
13. Male tergites: (0) tergites 2–8 tapering apically; (1) tergite 3 wider than tergite 2 and then tapering apically; (2) tergites 2–6 nearly straight and tergites 7–8 tapering apically.
14. Fore wing apical cells: (0) 8 cells; (1) 7 cells.
15. Hind wing apical cells: (0) 6 or 5 cells; (1) 4 cells.
16. Infuscations on base of apical cells of hind wing: (0) absent; (1) present.

17. Fore wing apical cell 1: (0) as long as or longer than apical cell 2; (1) shorter than apical cell 2.
18. Hind wing apical cell 1 with its distal end: (0) clearly shorter than end of apical cell 2; (1) as long as end of apical cell 2.
19. Fore wing M and CuA: (0) unfused and widely separated at basal cell; (1) unfused but very much closer to each other; (2) meeting at basal cell.
20. Fore wing vein CuA: (0) bowed; (1) angled.
21. Hind wing veins M and RP: (0) separated at their bases; (1) fused at their bases.
22. Hind wing 1st cubital cell width at distal end: (0) much greater than 2nd cubital cell (twice or more); (1) slightly greater or about equal to 2nd cubital cell; (2) narrower than 2nd cubital cell.
23. Hind wing anal lobe: (0) broad with vein 3A usually strongly curved at distal end, long and separated from wing margin; (1) narrow with vein 3A tending straight, short and usually adjacent to wing margin.
24. Shape of dorsal beak of pygofer: (0) apex pointed and thin apex in lateral view; (1) apex somewhat rounded and thick in lateral view; (2) absent.
25. Upper lobes of pygofer: (0) undeveloped; (1) long and pointed; (2) short and truncate; (3) short and blunt rounded.
26. Distal shoulder of pygofer: (0) not developed; (1) rounded, often the most distal part of pygofer.
27. Aedeagus: (0) long, protruding from slit of medial uncal lobes; (1) short, concealing under uncal lobes.
28. Aedeagus: (0) with several processes apically and subapically; (1) without processes.
29. Apical part of aedeagus: (0) not bifurcate; (1) bifurcate.

**Phylogenetic analysis.** The phylogenetic analysis was performed in TNT 1.1 (Tree Analysis using New Technology; Goloboff *et al.* 2003, 2008), and the size of the dataset allowed exact searches to be made under the traditional search with 1000 replications. The branch support values were calculated with the function implemented in TNT (tree bisection and reconnection, TBR, from existing trees). Bootstrap replicates (Felsenstein 1985) were completed to assess node support with 1000 replicates and 50% was used as the cut off value. Character distributions were examined using WinClada 1.0 (Nixon 2002). The illustrated cladograms were edited using Adobe illustrator CS6.0.

## **Taxonomy**

### **Family Cicadidae Latreille, 1802**

#### **Subfamily Cicadinae Latreille, 1802**

#### **Tribe Cicadatrini Distant, 1905**

#### **Genus *Cicadatra* Kolenati, 1857**

*Cicadatra* Amyot, 1847: 153 (Non binom.). Type species: *Cicada atra* Olivier, 1790  
*Cicada Cicadatra* Kolenati, 1857: 407. Type species: *Cicatra burriana* Horváth, 1912  
*Tettigia (Cicadatra)* Stål, 1861: 617. Type species: *Cicatra burriana* Horváth, 1912

Head including eyes narrower than base of mesonotum; less than width between eyes. Postclypeus not protruded. Pronotum wider than long with lateral margins more or less obliquely straight. Male abdomen short, about as long as forebody; timbal covers incomplete. Male opercula short and transverse, not extending beyond posterior margin of abdominal sternite II. Wings hyaline, with 8 and 6 apical cells on fore wing and hind wing, respectively; fore wing usually with infuscation at bases of apical cells and more than twice but less than three times as long as broad. Pygofer elliptical in ventral view; dorsal beak and upper lobes present. Aedeagus curved ventrally from slit of medial uncal lobes, with several processes apically and subapically.

## Key to species of *Cicadatra* from China

1. Male opercula black; fore wing with a marginal series of fuscous spots near apices of longitudinal veins to apical cells . . . . .  
..... *C. shaluensis* China, 1925
- Male opercula ochereous; fore wing without spots near apices of longitudinal veins to apical cells . . . . . 2
2. Fore wing with broad, continuous infuscation at bases of apical cells 1–7; abdominal tergites V and VI with white pollinosity transverse fasciae. . . . . *C. hei* sp. nov.
- Fore wing with thin, continuous infuscation at bases of apical cells 1–5; abdominal tergites V and VI with pair of small white pollinosity spots laterally . . . . . *C. gregoryi* China, 1925

### *Cicadatra hei* sp. nov.

Figs 1–2

**Type material.** Holotype: ♂ (NWFU), China: Mt. Daheishan (26°36'14.82"N, 101°39'24.81"E), Geliping Town, Panzhihua City, Sichuan Prov., 1410 m, 24.X.2016, coll. Li He. Paratypes: 2♂♂, 1♀ (NWFU), China: Mt. Daheishan (26°36'51.74"N, 101°40'39.33"E), Geliping Town, Panzhihua City, Sichuan Prov., 1582 m, 25.IX.2014, coll. Li He; 1♂ (CLHC), China: Mt. Daheishan (26°36'51.74"N, 101°40'39.33"E), Geliping Town, Panzhihua City, Sichuan Prov., 1582 m, 25.IX.2014, coll. Li He; 1♂ (CLHC), China: Mt. Daheishan (26°36'14.82"N, 101°39'24.81"E), Geliping Town, Panzhihua City, Sichuan Prov., 1410 m, 24.X.2016, coll. Li He; 2♂♂ (CLHC), China: Mt. Daheishan (26°36'14.82"N, 101°39'24.81"E), Geliping Town, Panzhihua City, Sichuan Prov., 1410 m, 7.XII.2016, coll. Benfu Miao.

**Measurements of types** (3♂♂, 1♀; in mm). Body length: ♂21.1–25.4, ♀23.6; fore wing length: ♂27.7–29.6, ♀29.9; fore wing width: ♂10.1–11.3, ♀10.9; ♂width of head including eyes: ♂6.7–7.5, ♀7.3; pronotum width (including pronotal collar): ♂8.8–9.4, ♀9.3; mesonotum width: ♂6.7–7.0, ♀7.3; expanse of forewings: ♂61.1–66.7; ♀63.7.

**Etymology.** The species name is named after the collector. The gender is feminine.

**Description of male.** Head (Fig. 1A–C) about as wide as pronotum. Generally black without distinct markings. Eyes brown, ocelli dark brown. Supra-antennal plates orange-yellow. Postclypeus orange-yellow, with longitudinal central fasciae black; series of 7–8 transverse fasciae black. Anteclypeus black. Rostrum with black apex extending to mid trochanter. Genae black, with dense, long silvery hairs. Distance between lateral ocellus and corresponding eye slightly wider than distance between lateral ocelli.

Thorax (Fig. 1A–C). Pronotum almost black, with anterior margin yellow; a central yellow fasciae, extending from anterior margin of pronotum, broadened at posterior end; pair of faint yellow spots near anterior margin of pronotum; pronotal collar yellow with posterior margin rippled. Mesonotum black, without distinct markings. Cruciform elevation yellow, with anterior and posterior angles black. Thoracic sternites black, with dense, long silvery hairs.

Legs (Fig. 1E). Black with orange-yellow patches. Fore femur with only two spines, secondary spine erect and subapical spine curved.

Wings (Fig. 1A, B). Hyaline, veins ochraceous. Fore wing with distinct, continuous infuscations at bases of apical cells 1–7 and proximal portion of apical cell 1. Hind wing with distinct, continuous infuscation at bases of apical cells 1–5; proximal portions of cubital cell 2 and anal cell 1 tinged with light brown.

Abdomen (Fig. 1A, B, D). Black, with white pollinosity fasciae between tergites VI and VII. Timbal covers black, short and rounded, incomplete but concealing timbals mostly; timbals with ten long ribs. Opercula ochereous, covered with silvery hairs; with rounded apex not extending beyond posterior margin of sternite II. Abdominal sternites mostly black, covered with dense silvery hairs.

Genitalia (Fig. 1F–H). Pygofer rounded in ventral view, with dense, long silvery hairs. Dorsal beak long. Upper lobes of pygofer well developed, very long and pointed. Basal lobes of pygofer widened basally, and slightly pointed apically. Uncus short, pair of median clasper processes separated basally. Aedeagus with basal part broadened; apex with three sclerotized processes and two folded saccate hooks.

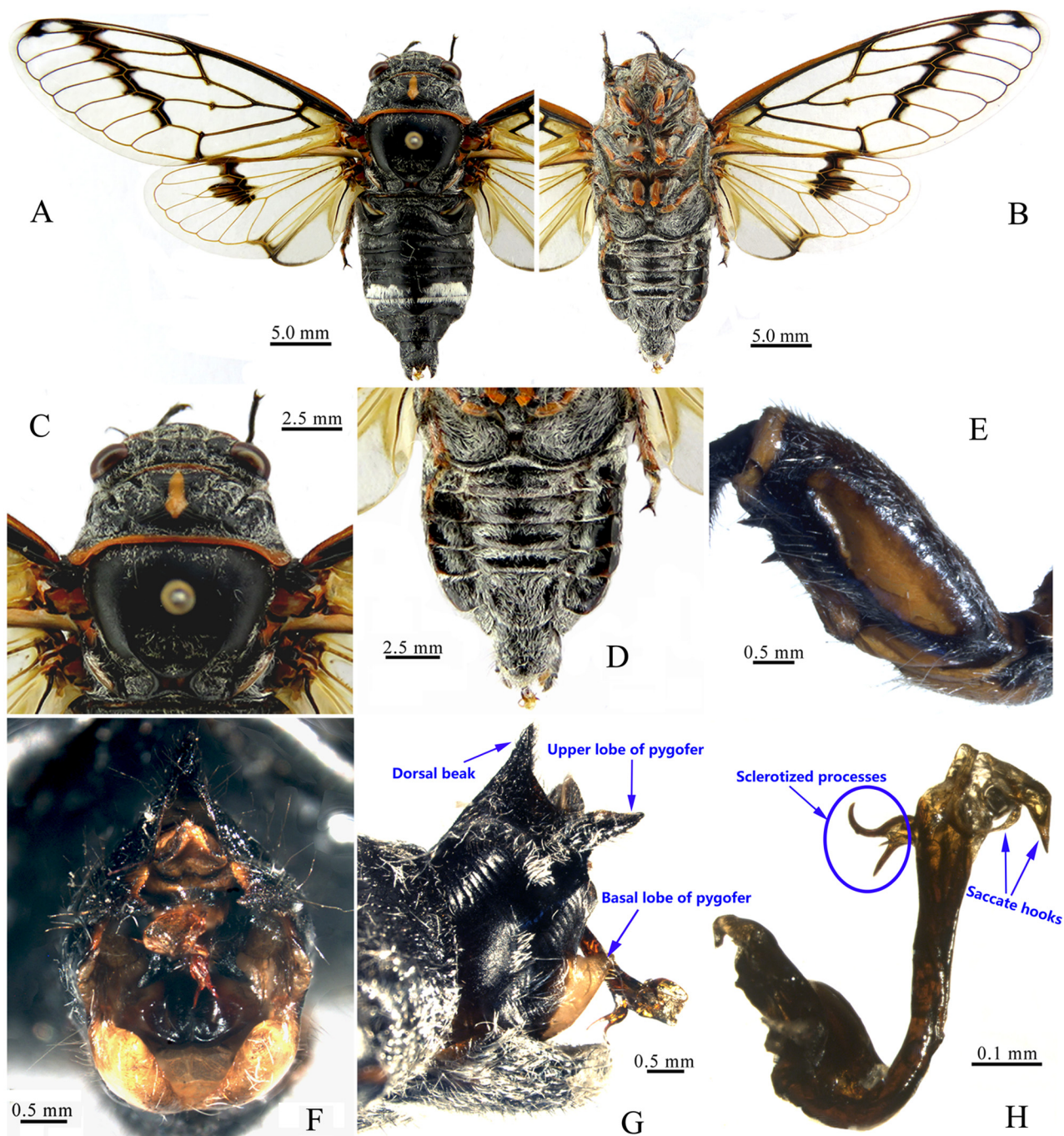
**Description of female** (Fig. 2). Opercula scarcely developed. Abdominal segment 7 with posterior margin incised at middle. Abdominal segment 9 black, with yellow median marking in ventral view. Ovipositor sheath black, extending beyond abdominal segment 9. Other characteristics similar to male.

**Habitat.** The adult emergence of this new species gets started from late September and lasts to December,

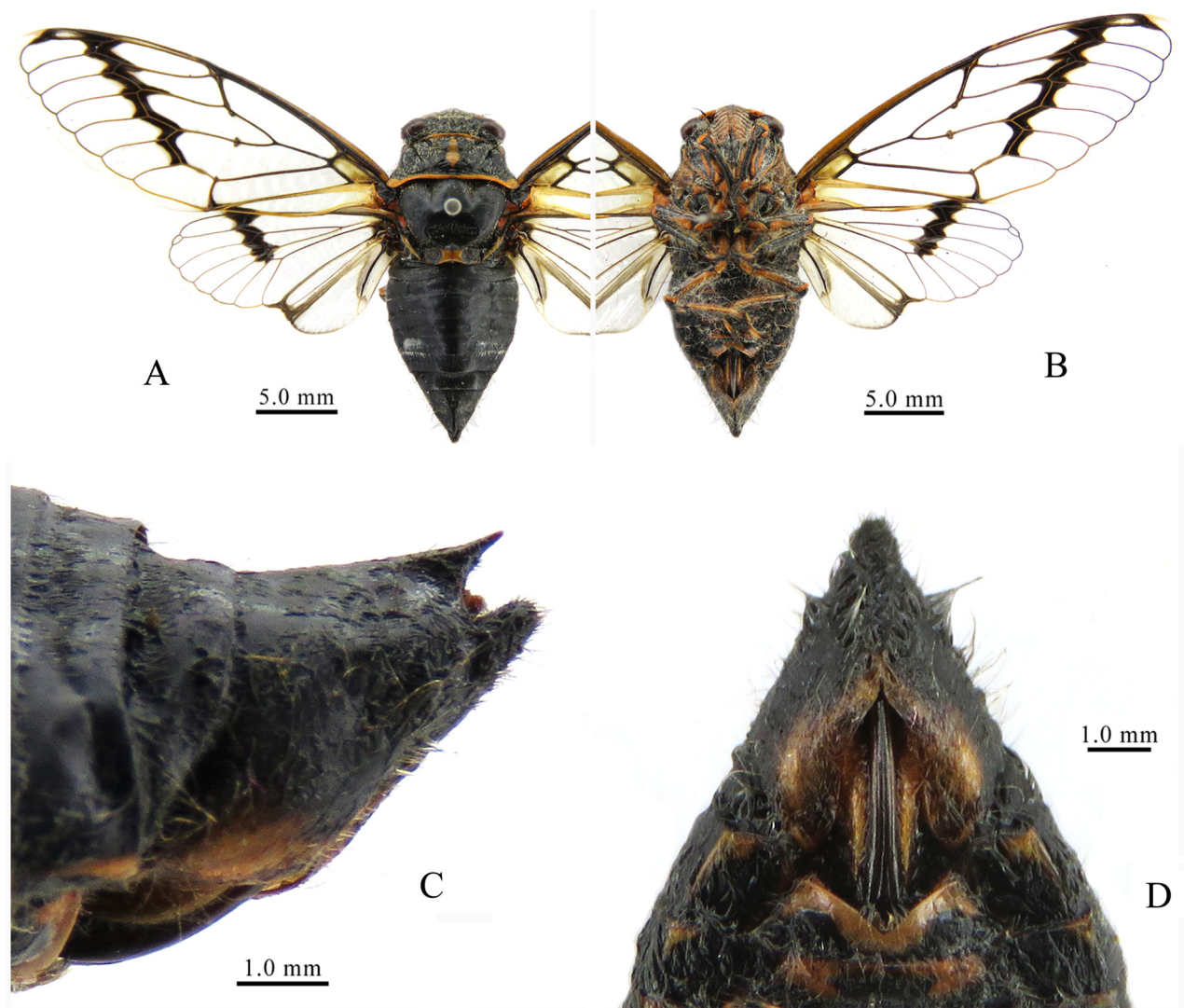
which is much later than that of most other cicadas occurring in Sichuan Province. Most individuals were observed sitting and singing on Zill Mango trees (*Mangifera indica* L.), but also on some other plants such as *Dodonaea viscosa* (L.) Jacq. and *Sorghum bicolor* (L.) Moench (Fig. 3).

**Distribution.** China (Sichuan).

**Remarks.** This new species is similar to *C. gregoryi*, but can be distinguished by the following characters: white pollinosity fasciae between tergites VI and VII of abdomen, continuous infuscation at bases of apical cells 1–7 of fore wing, the broad infuscation on apical cells 1–5 of hind wing, the two spines of fore femur, and the developed basal lobes of pygofer.



**FIGURE 1.** *Cicadatra hei* sp. nov. (male). A. habitus, dorsal view; B. habitus, ventral view; C. head and thorax, dorsal view; D. abdomen, ventral view; E. left foreleg, showing the spines on fore femur; F. male pygofer, ventral view G. male pygofer, lateral view; H. aedeagus, lateral view.



**FIGURE 2.** *Cicadatra hei* sp. nov. (female). A. habitus, dorsal view; B. habitus, ventral view; C. female terminalia, lateral view; D. female terminalia, ventral view.

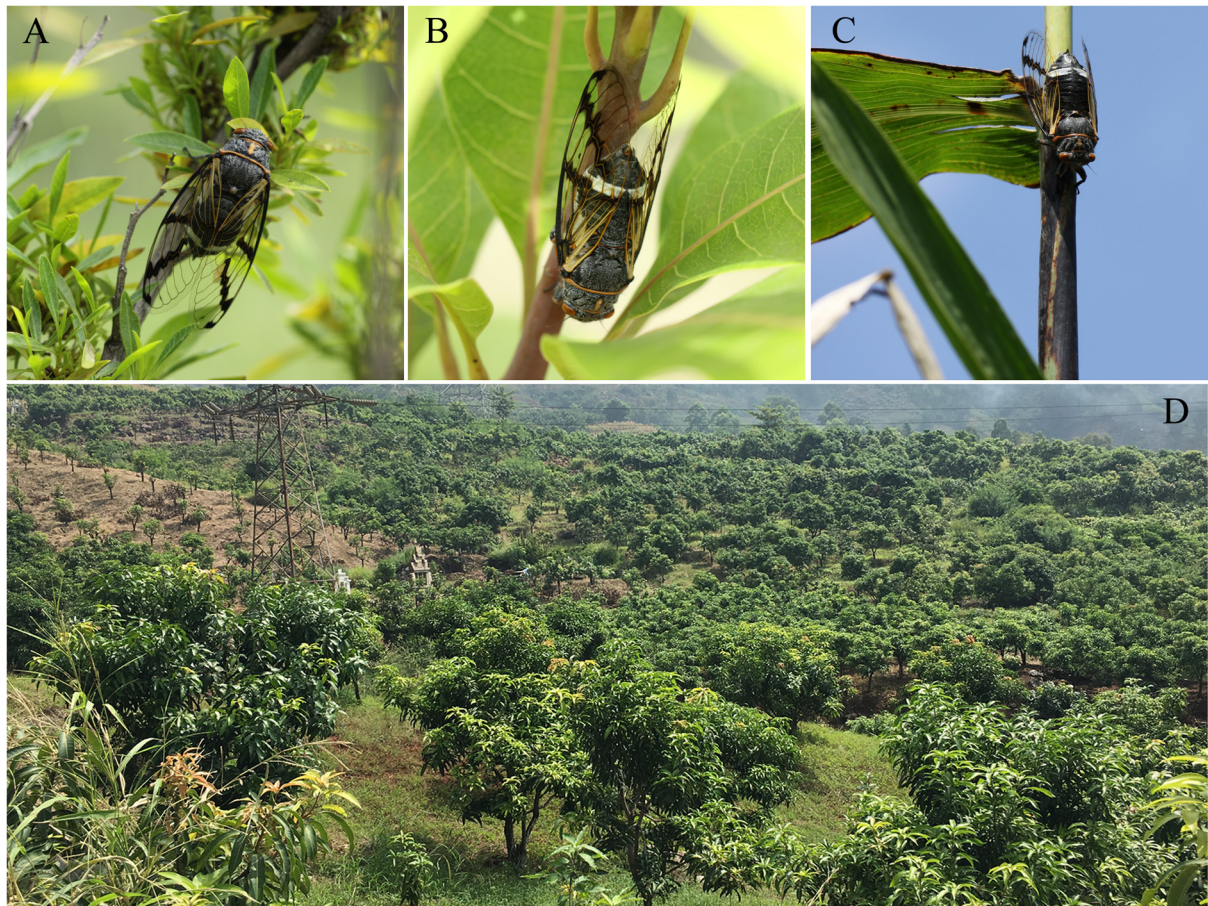
### Genus *Emathia* Stål, 1866

*Emathia* Stål, 1866: 8. Type species: *Emathia aegrota* Stål, 1866.

*Cicadalna* Boulard, 2006: 529. **syn. n.** Type species: *Cicadalna takensis* Boulard, 2006.

**Diagnosis.** Head about as long as pronotum, including eyes about as wide as base of mesonotum. Rostrum almost reaching the posterior coxae. Pronotum a little shorter than mesonotum, with barely developed lateral margin, not amplified. Abdomen short, about as long as forebody. Timbal covers incomplete, narrow and exposed inwardly; male opercula small, not extending beyond posterior margin of abdominal sternite II. Wings hyaline, with 8 and 6 apical cells on fore wing and hind wing, respectively.

**Remarks.** The genus *Cicadalna* was erected by Boulard (2006) for the type species, *Cicadalna takensis*. Later, the same author reviewed *Cicadalna* and placed it in the tribe Cicadini of the subfamily Cicadinae (Boulard 2013). However, the incomplete timbal covers, small opercula, shape of male genitalia and wing venation are inseparable between *Cicadalna* from *Emathia*, and no other sound morphological characters are available to separate these two genera. Accordingly, *Cicadalna* is treated here as a junior synonym of *Emathia*.



**FIGURE 3.** Habitat and host plants of *Cicadatra hei* sp. nov. A. host plants (*Dodonaea viscosa* (L.) Jacq.); B. host plants (*Mangifera indica* L.); C. host plants (*Sorghum bicolor* (L.) Moench); D. habitat.

***Emathia takensis* (Boulard, 2006) comb. nov.**

*Cicadalna takensis* Boulard, 2006: 592.

**Phylogenetic analyses**

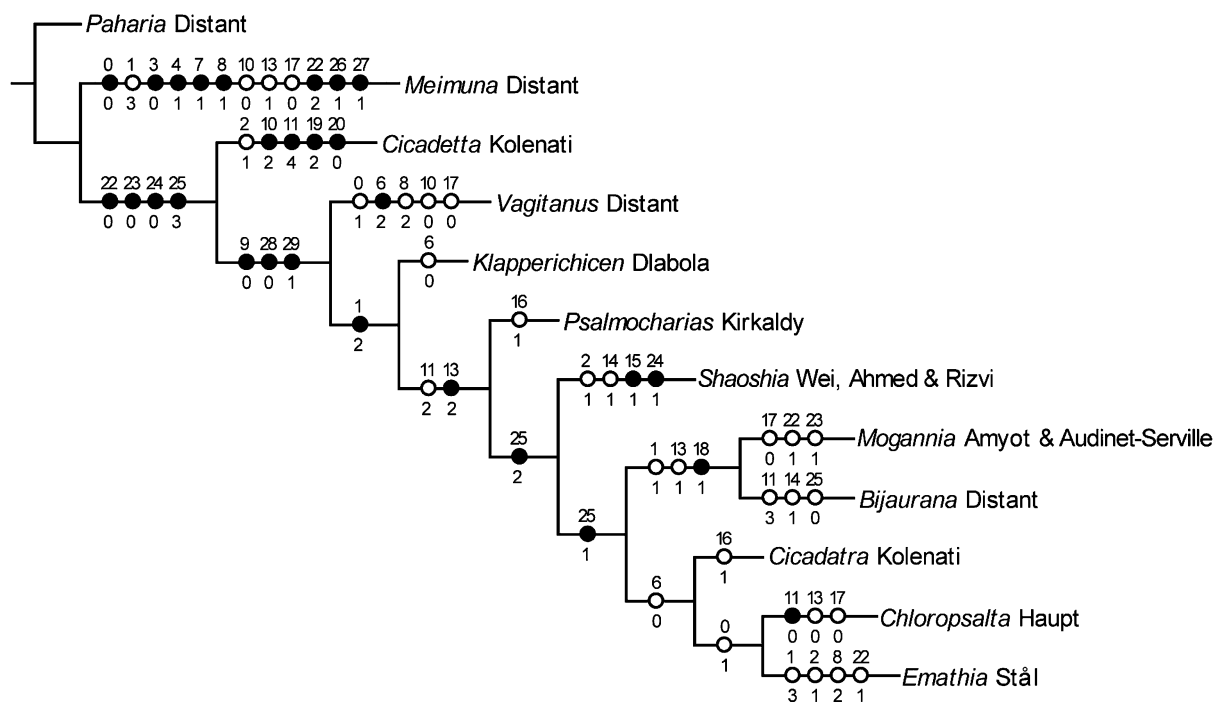
**TNT analysis.** This study represents the first attempt to use a cladistics analysis to elucidate the relationships within the tribe Cicadatrini. The matrix includes 30 morphological characters coded for 9 genera of Cicadatrini and 3 outgroup taxa (Table 1). An exact search using the traditional search algorithm of TNT yielded a parsimonious tree. The monophyly of Cicadatrini is supported, and Cicadatrini is more allied to the outgroup *Cicadetta* of the subfamily Cicadettinae (= Tibicininae auct.).

**WinClada analysis.** The analysis resulted in 10 equally most parsimonious cladograms with a length of 82, a consistency index of 0.53 and a retention index of 0.42. For discussion, we reproduced one of these 10 trees representing the most topological similarity to the TNT tree. In this selected tree (Fig. 4), the monophyly of Cicadatrini is also supported by a number of undisputed characters, and Cicadatrini is more allied to the genus *Cicadetta* of the subfamily Cicadettinae (= Tibicininae auct.). *Vagitanus* is the first divergence which is separated from other taxa of Cicadatrini due to the head width including eyes about as wide as base of mesonotum (char. 0: 1), male abdomen shorter than forebody (char. 6: 2), male opercula longitudinal with inner margins curved inward apically (char. 8: 2), timbal covers concealing timbals mostly (char. 10: 0), and fore wing apical cell 1 longer than apical cell 2 (char. 17: 0). *Klapperichicen* is the sister to the remaining taxa, which is characterised by male abdomen as long as forebody (char. 6: 0). The remaining taxa have the following apomorphies: timbal covers oval

shaped (char. 11: 2), and tergites 2–6 nearly straight and tergites 7–8 tapering apically (char. 13: 2). *Shaoshia* is the sister to the remaining taxa due to the following characteristics: lateral margins of pronotum nearly rectangular (char. 2: 1), fore wing with 7 apical cells (char. 14: 1), hind wing with 4 apical cells (char. 15: 1), and apex of dorsal beak of pygofer somewhat rounded and thick in lateral view (char. 24: 1). The remaining taxa, with one synapomorphy (upper lobes of pygofer long and pointed (char. 25: 1)), split into two clades. The clade “*Mogannia* + *Bijaurana*” is separated from the clade “*Cicadatra* + (*Chloropsalta* + *Emathia*)” due to the following characteristics: rostrum reaching posterior margin of mid coxae (char. 1: 1), male tergite 3 wider than tergite 2 and then tapering apically (char. 13: 1), and hind wing apical cell 1 with its distal end as long as end of apical cell 2 (char. 18: 1).

## Discussion

Metcalf (1963) and Duffels & van der Laan (1985) put 13 genera in the tribe Cicadini, i.e., *Cicada* L., *Cicadatra*, *Emathia*, *Illyria* Moulds, 1985, *Leptosemia* Matsumura, 1917, *Neocicada* Kato, 1932, *Nipponosemia*, *Onomacritus* Distant, 1912, *Psalmocharias*, *Tamasa* Distant, 1905, *Taungia* Ollenbach, 1929, *Triglena* Fieber, 1875 and *Vagitanus*. However, Lee & Hayashi (2003) treated Cicadini as a subtribe of the tribe Dundubiini and also included the species of the former Terpnosiina and Leptosaltriina in their subtribe Cicadina. Later, Lee (2008) changed the tribe name from Dundubiini to Cicadini, with four subtribes included, i.e., Cicadina, Cosmopsaltriina, Dundubiina and Tosenina. Lee & Hill (2010) added the subtribe Psithyristriina Distant, 1905 to Cicadini. Lee (2011) also added the subtribe Oncotympanina Ishihara, 1961 to Cicadini to increase the number of its subtribes to seven. However, Lee & Emery (2013) elevated the subtribe Leptosaltriina Moulton, 1923 to the tribe Leptosaltriini Moulton, 1923, placing the following six subtribes in this tribe: Puranina Lee, 2013, Leptosaltriina, Mosaicina Lee, 2013, Gudabina Lee, 2013, Euterpnosiina Lee, 2013, and Leptosemiina Lee, 2013. Sanborn (2013) put five subtribes in Cicadini, i.e., Cicadina, Oncotympanina, Psithyristriina, Minipomponia Boulard, 2008, and Leptosaltriina. More recently, Lee & Emery (2014) elevated Dundubiina Atkinson, 1886 to the tribe Dundubiini, and included four subtribes in it (Dundubiina, Megapomponiina Lee, 2014, Orientopsaltriina Lee, 2014, Aolina Boulard, 2012). The definition of the name “Cicadini” has been changed repeatedly, which causes many difficulties and chaos.



**FIGURE 4.** One of 10 most parsimonious cladograms of the tribe Cicadatrini phylogenetic relationships in the program WinClada, with a length of 82, a consistency index of 0.53 and a retention index of 0.42, found under equal weighting. Nonhomoplastic synapomorphies are indicated by closed circles, homoplasies by open circles.





In addition, the systematic status of the tribe Cicadatrini, currently put in the subfamily Cicadinae, also remains questionable. Lee & Hill (2010) recognized Moganniini as a junior synonym of Cicadatrini and redefined the latter by including *Cicadatra*, *Psalmocharias*, *Mogannia*, *Nipponosemia* and *Emathia*. Chen *et al.* (2012) suggested that *Mogannia* may be more allied to some members of the subfamily Cicadettinae (= Tibicininae *auct.*) due to the following common characteristics: 1) width of first cubital cell of hind wing at distal end much broader than second cubital cell (twice or more); 2) upper lobes of pygofer present; 3) large claspers dominating the whole 10<sup>th</sup> abdominal segment; 4) uncus duck-bill shaped, small and flat, not dominant; 5) aedeagus restrained by claspers; 6) fore wing vein CuA1 divided by a cross vein so that proximal portion is the shortest; and 7) male opercula more or less reaching margin of tympanal cavity, directed towards distomedial margin of tympanal cavity, apically broadly rounded, not meeting. Lee (2014) synonymized *Nipponosemia* with *Vagitanus* and tentatively kept Cicadatrini in Cicadinae by including the nine genera, i.e., *Psalmocharias*, *Cicadatra*, *Emathia*, *Chloropsalta*, *Klapperichicen*, *Shaoshia*, *Mogannia*, *Vagitanus* and *Bijaurana*. According to the morphological cladistic results of our present study, the Cicadatrini genera are closer to the outgroup *Cicadetta*, which also indicates that the Cicadatrini is more allied to related groups of Cicadettinae (= Tibicininae *auct.*) than to members of Cicadinae. However, we only chose male adult morphological characters in the present phylogenetic analyses. The systematic position of Cicadatrini and its phylogenetic relationship with related taxa need to be further researched based on more morphological and molecular data, *etc.*

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## References

- Ahmed, Z. & Sanborn, A.F. (2010) The cicada fauna of Pakistan including the description of four new species (Hemiptera: Cicadoidea: Cicadidae). *Zootaxa*, 2516, 27–48.
- Ahmed, Z., Sanborn, A.F. & Hill, K.B.R. (2010) A new species of the cicada genus *Cicadatra* from Pakistan (Hemiptera: Cicadoidea: Cicadidae). *Zoology in the Middle East*, 51, 75–81.  
<https://doi.org/10.1080/09397140.2010.10638443>
- Ahmed, Z., Sanborn, A.F. & Akhter, M.A. (2012) A new species of the cicada genus *Cicadatra* Kolenati, 1857 (Hemiptera, Cicadidae) from Pakistan with a key to the known species of Pakistani *Cicadatra*. *ZooKeys*, 174, 41–48.  
<https://doi.org/10.3897/zookeys.174.2299>
- Ahmed, Z., Sanborn, A.F. & Akhter, M.A. (2013) Two new species of the genus *Cicadatra* Kolenati (Hemiptera: Cicadidae) from Pakistan. *Zootaxa*, 3750 (2), 176–184.  
<https://doi.org/10.11646/zootaxa.3750.2.5>
- Ahmed, Z., Sanborn, A.F. & Khatri, I. (2015) A Key to the Cicada Fauna of Pakistan Based on Structural Variation in the Tibials (Hemiptera: Cicadoidea). *Pakistan Journal of Zoology*, 47 (2), 589–591.
- Amyot, C.J.B. (1847) Entomologie Française. Rhynchotes. Ordre deuxième. Homoptères. Homoptera. Latr. *Annales de la Société entomologique de France*, 1847, 143–238.
- Boulard, M. (2006) *Cicadalna takensis*, nouvelle espèce d'un genre nouveau découverte en Thaïlande du Nord (Rhynchota, Cicadidae). *Bulletin de la Société entomologique de France*, 111 (4), 529–534.
- Boulard, M. (2013) *The Cicadas of Thailand. Vol. 2. Taxonomy and Sonic Ethology*. Siri Scientific Press, Manchester, 436 pp.
- Chen, X., Yang, M. & Wei, C. (2012) Review of the cicada genus *Mogannia* Amyot & Serville from China, with descriptions of three new species (Hemiptera: Cicadidae). *Zootaxa*, 3568, 1–35.
- 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>
- Distant, W.L. (1914) Homoptera, family Cicadidae, subfamily Gaeaninae. *Genera Insectorum*, 158, 1–38.
- Dlabola, J. (1960) Iranische zikaden (Homoptera, Auchenorrhyncha). *Stuttgarter Beiträge zur Naturkunde aus dem Staatlichen*

- Museum für Naturkunde in Stuttgart*, 41, 1–24.
- Dlabola, J. (1970) Beiträge zur Taxonomie und Chorologie einiger palaearktischer Zikadenarten (Homoptera, Auchenorrhyncha). *Mitteilungen der Münchner Entomologischen Gesellschaft*, 59, 90–107.
- Dlabola, J. (1979) Neue Zikaden aus Anatolien, Iran und aus südeuropäischen Ländern (Homoptera: Auchenorrhyncha). *Acta Zoologica Academiae Scientiarum Hungaricae*, 25, 235–257.
- Dlabola, J. (1981) Ergebnisse der Tschechoslowakisch-Iranischen Entomologischen Expedition nach dem Iran. (1970–1973). *Acta Entomologica Musei Nationalis Pragae*, 40, 127–308.
- Duffels, J.P. & van der Laan, P.A. (1985) Catalogue of the Cicadoidea (Homoptera, Auchenorrhyncha) 1956–1980. *Series Entomologica*, 34, 1–414.
- Felsenstein, J. (1985) Confidence limits on phylogenies: an approach using the bootstrap. *Evolution*, 39, 783–791.  
<https://doi.org/10.2307/2408678>
- Goloboff, P.A., Farris, J.S. & Nixon, K.C. (2003) TNT. Tree Analysis Using New Technology. *Program and documentation*. Available from: <http://www.zmuc.dk/public/phylogeny.tnt> (accessed 7 February 2017)
- Goloboff, P.A., Farris, J.S. & Nixon, K.C. (2008) TNT, a free program for phylogenetic analysis. *Cladistics*, 24, 774–786.  
<https://doi.org/10.1111/j.1096-0031.2008.00217.x>
- Kolenati, F.A. (1857) "Homoptera Latreille. Leach. Gulaerostria Zetterstedt." in Meletemata Entomologica. *Bulletin de la Société Impériale des Naturalistes de Moscou*, 30, 399–429.
- Lee, Y.J. (2008) A checklist of Cicadidae (Insecta: Hemiptera) from Vietnam, with some taxonomic remarks. *Zootaxa*, 1787, 1–27.
- Lee, Y.J. (2011) New genus and two new species of Oncotympanina stat. nov. (Hemiptera: Cicadidae: Cicadini) and the erection of Sonatini new tribe. *Journal of Asia-Pacific Entomology*, 14 (2), 167–171.  
<https://doi.org/10.1016/j.aspen.2010.12.001>
- Lee, Y.J. (2014) Cicadas (Hemiptera: Cicadidae) of Laos, with the description of four new genera and two new species. *Annales de la Société entomologique de France (N.S.) International Journal of Entomology*, 50 (1), 59–81.
- Lee, Y.J. & Emery, D. (2013) New genera and species of Leptopsaltriini (Hemiptera: Cicadidae: Cicadinae) from India and Tibet, with the descriptions of five new subtribes. *Zoosystema*, 35 (4), 525–535.  
<https://doi.org/10.5252/z2013n4a6>
- Lee, Y.J. & Emery, D. (2014) Description of a new genus and species of the tribe Dundubiini (Hemiptera: Cicadidae: Cicadinae) from India, with taxonomic notes on Dundubiini including the description of two new subtribes. *Zoosystema*, 36 (1), 73–80.  
<https://doi.org/10.5252/z2014n1a5>
- Lee, Y.J. & Hayashi, M. (2003) Taxonomic review of Cicadidae (Hemiptera, Auchenorrhyncha) from Taiwan, part I. Platyleurini, Tibicenini, Polyneurini, and Dundubiini (Dundubiina). *Insecta Koreana*, 20, 149–185.
- Lee, Y.J. & Hill, K.B.R. (2010) Systematic revision of the genus *Psithyristria* Stål (Hemiptera: Cicadidae) with seven new species and a molecular phylogeny of the genus and higher taxa. *Systematic Entomology*, 35, 277–305.  
<https://doi.org/10.1111/j.1365-3113.2009.00509.x>
- Linnavuori, R. (1962) Hemiptera of Israel. III. *Annales Zoologici Societatis Zoologicae-Botanicae Fennicae 'Vanamo'*, 24, 1–108.
- Melichar, L. (1896) *Cicadinen (Hemiptera-Homoptera) von Mittel-Europa*. Verlag von Felix L. Dames, Berlin, 364 pp.  
<https://doi.org/10.5962/bhl.title.8568>
- Metcalf, Z.P. (1963) *General catalogue of the Homoptera. Fascicle VIII. Cicadoidea, part 1. Cicadidae. section II. Gaeninae and Cicadinae*. North Carolina State College, Raleigh, 333. [pp. 587–919]
- 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.
- Mozaffarian, F. & Sanborn, A.F. (2010) The cicadas of Iran with the description of two new species (Hemiptera: Cicadoidea: Cicadidae). *Mitteilungen aus dem Museum für Naturkunde in Berlin – Deutsche Entomologische Zeitschrift*, 57, 69–84.
- Mozaffarian, F. & Sanborn, A.F. (2015) *Cicadatra pazukii*, a new cicada species, with an identification key to the species of *Cicadatra* in Iran (Hemiptera: Cicadidae). *Acta Entomologica Musei Nationalis Pragae*, 55 (1), 19–27.
- Nast, J. (1972) Palaeartic Auchenorrhyncha (Homoptera). In: *An Annotated check list*. Polish Scientific Publishers, Warszawa, pp. 136–156.
- Nixon, K.C. (2002) WinClada ver. 1.00.08. Published by the author, Ithaca, NY.
- 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.
- Sanborn, A.F. (2013) *Catalogue of the Cicadoidea (Hemiptera: Auchenorrhyncha)*. Academic Press, San Diego, 1002 pp.
- Simões, P.C., Sanborn, A. & Quartau, J.A. (2013) Two new species of *Cicadatra* (Hemiptera: Cicadoidea) from Greece. *Entomological Science*, 16 (1), 83–90.  
<https://doi.org/10.1111/j.1479-8298.2012.00540.x>
- Stål, C. (1861) Genera nonnulla nova Cicadinorum. *Annales de la Société Entomologique de France*, 1 (4), 613–622.