



Review of Chinese species of the leafhopper genus *Amrasca* Ghauri (Hemiptera, Cicadellidae, Typhlocybinae), with description of a new species, species checklist and notes on the identity of the Indian cotton leafhopper

YE XU¹, YURU WANG¹, CHRISTOPHER H. DIETRICH², MURRAY J. FLETCHER³ & DAOZHENG QIN¹

¹Key Laboratory of Plant Protection Resources and Pest Management of Ministry of Education, Entomological Museum, Northwest A&F University, Yangling, Shaanxi Province, 712100, China

²Illinois Natural History Survey, Prairie Research Institute, University of Illinois, Champaign, Illinois, USA

³Orange Agricultural Institute, NSW Dept of Primary Industries, Forest Rd, Orange, New South Wales, 2800, Australia

Corresponding author: E-mail: chdietri@illinois.edu; murray.fletcher@dpi.nsw.gov.au; qindaozh0426@aliyun.com

Abstract

The leafhopper genus *Amrasca* Ghauri from China is reviewed. Six species are included, of which three are reported for the first time from China. A new species, *A. (Amrasca) complana* Qin, Wang & Xu, **sp. nov.** is described based on specimens from south China. A complete checklist of the genus and an identification key to species in the Chinese fauna are provided. *Jacobiasca curvata* (Ahmed & Samad) comb. nov. is removed from *Amrasca* and *A. (A.) singularis* Einyu & Ahmed is treated as a *species incertae sedis*. Habitus photos of all Chinese *Amrasca* species and illustrations of male genitalia of the new species are also given. The male holotype specimen of *Chlorita bimaculata* Matsumura is here designated as the neotype of *Empoasca biguttula* Ishida to fix the identity of this economically important species and *Sundapteryx* Dworakowska is reinstated from synonymy as a subgenus of *Amrasca*. Thus, the correct scientific name of the Indian cotton leafhopper is *Amrasca (Sundapteryx) biguttula* (Ishida).

Key words: Auchenorrhyncha, Empoascini, taxonomy, key

Introduction

The microleafhopper genus *Amrasca* belongs to the *Empoasca* complex of Empoascini within the subfamily Typhlocybinae (Hemiptera: Cicadellidae). It was established by Ghauri (1967) with *Amrasca splendens* Ghauri from India as its type species. This genus is one of a small group characterized by veins MP⁺+CuA' and MP' in the forewing arising from cell m and CuA in the hind wing not branched preapically (Ghauri, 1967) (Figs 22, 23). Two subgenera, 14 species and 1 subspecies have been reported so far, widely distributed in the Oriental and Australian Regions. Some species in this genus are serious pests of crops, for example, the cotton leafhopper, *Amrasca biguttula* (Ishida), has a broad host range including cotton, okra, brinjal and jute. Both nymph and adult stages can injure plants by sucking leaf cell contents and, possibly, by transmitting pathogens (Maketon *et al.*, 2008).

Prior to this study, two species and one subspecies of *Amrasca* have been reported in the Chinese fauna (Zhang, 1990). This paper adds a new species to this genus and three species are newly recorded from China. The identity of the Indian cotton leafhopper is also clarified through examination of type material. A species checklist of *Amrasca* and a key to all species from China are also given.

Materials and methods

The specimens examined in this study are deposited in the Entomological Museum, Northwest A&F University, Yangling, Shaanxi, China (NWAFU), Hokkaido University, Sapporo, Japan (HU) and the Moravian Museum, Brno, Czech Republic (MZM). The entire male abdomens of the specimens examined were removed and cleared in

10% NaOH and stored in glycerin. Figures of the male genitalia were made using an OLYMPUS PM-10 AD microscope. Photographs were taken by a Scientific Digital micrography system equipped with an Auto-montage imaging system attached to a QIMAGING Retiga 4000R digital camera (CCD). The length of body is measured from the apex of the vertex to the tip of the forewing when folded.

The morphological terminology follows Zhang (1990) except for the wing, which follows Dworakowska (1993), for groups of setae on the subgenital plate follow Southern (1982) and leg chaetotaxy follows Rakitov (1998).

Taxonomy

Amrasca Ghauri, 1967

Amrasca Ghauri, 1967: 159. Type species: *Amrasca splendens* Ghauri, 1967 by original designation.

Sundapteryx Dworakowska, 1970: 708. Type species: *Chlorita biguttula* Ishida, 1913 by original designation. Synonymized by Dworakowska & Viraktamath, 1975: 530.

Laokayana Dworakowska, 1972: 27. Type species: *Empoasca bombaxia* Ghauri, 1965 by original designation. Synonymized by Dworakowska & Viraktamath, 1975: 530.

Description. Body delicate. Head including eyes slightly wider than pronotum in dorsal view (Figs 1, 3, 6, 8, 10, 12, 14, 16, 18, 19, 37, 39). Crown produced medially, anterior and posterior margins not parallel, coronal suture not reaching anterior margin (Figs 1, 3, 6, 8, 10, 12, 14, 16, 18, 19, 37, 39). Profile of transition of vertex to face somewhat rounded (Figs 2, 7, 11, 15, 21, 38). Ocelli distinct, located on margin between vertex and frons near eyes (Figs 3, 4, 8, 9, 12, 13, 16, 17, 19, 20, 39, 40). Lateral frontal sutures extended to ocelli but not continuing to midline (Figs 4, 9, 13, 17, 20, 40). Face broad, anteclypeus weakly convex, not swollen (Figs 4, 9, 13, 17, 20, 40). Pronotum moderate to large (Figs 3, 8, 12, 16, 19, 39). Forewing narrow, rounded apically, apical cells occupying nearly one-third of total length; vein RP arising from r cell, MP' and MP''+CuA' dissociated at their bases, both arising from m cell; c and r cells nearly equal in width, both narrower than m and cua cells; 2nd apical cell narrowed at base, broadened apically (Fig. 22). Hind wing with CuA unbranched (Fig. 23). Front femur row AV with 1 basal seta distinctly enlarged. Front femur AM1 distinctly enlarged. Middle femur with 1 dorsoapical macroseta. Hind tibia row AV with 4 or 5 preapical macrosetae.

Male basal abdominal apodemes developed, parallel-sided or widely divergent (Figs 5, 24). Male pygofer with small rigid microsetae scattered over distal portion or restricted to apex of lobe (Figs 25–29); dorsal bridge short (Figs 25, 29). Ventral appendage present (Figs 26–28, 30). Subgenital plate extended well beyond pygofer side, A and B group setae present or unrecognizable, C group setae sharply pointed near base, reaching or not reaching to apex of the plate, D group setae long and fine (Figs 26, 27, 34). Paramere broad at base, sharply pointed apically, apophysis bearing prominent dentifer and a few slender setae in apical half (Fig. 35). Connective broad anteriorly, strongly narrowed near midlength and tapered to posterior apex, anterior margin straight or weakly concave, without median lobe or with distinct median lobe (Fig. 33). Aedeagal shaft tubular, process absent, preatrium developed, dorsoatrium absent (Figs 31, 32). Anal tube appendage well developed (Figs 27, 36).

Remarks. Among genera in the *Empoasca*-complex Eastern Hemisphere, *Amrasca* is most similar to *Jacobiasca* Dworakowska and *Jacobiella* Dworakowska in having vein RP arising from r cell, MP' and MP''+CuA' arising from cell m and hind wing vein CuA unbranched, in having the connective not fused with base of aedeagus and in having a well developed ventral pygofer appendage. *Amrasca* differs from *Jacobiasca* in having the paramere not strongly curved apically and in lacking a pair of enlarged setae on the pregenital male abdominal sternite, and from *Jacobiella* in having the subgenital plate not broadened dorsomedially and the anal tube not elongated. *Amrasca* also differs from both genera in having the male basal abdominal apodemes well developed. Based on its current species composition, *Amrasca* is somewhat heterogeneous in the form and chaetotaxy of the subgenital plate. Two subgenera have previously been recognized largely based on differences in chaetotaxy: the nominotypical subgenus and *A. (Quartasca)* Dworakowska, which differs from *Amrasca* (*Amrasca*) in having the long fine setae of the subgenital plate restricted to the basal half.

Here we recognize a third valid subgenus, *A. (Sundapteryx)* Dworakowska. The latter was originally described as a separate genus by Dworakowska (1970) based on type species *Chlorita biguttula* Ishida but was subsequently

treated as a junior synonym of *Amrasca* by Dworakowska & Viraktamath (1975). This subgenus is characterized by the presence of macrosetae only in the basal half of the subgenital plate and by the presence of apodemes and other modifications to the male pregenital tergites (Fig. 5). Species of the other two currently recognized subgenera have macrosetae extended from the base to or near the apex of the subgenital plate and lack apodemes and other modifications to pregenital abdominal tergites VI-VIII. It may be desirable to subdivide *Amrasca* further once the genus becomes better known.

Distribution. Oriental and Australian Regions.

Checklist of *Amrasca* species

Subgenus *Amrasca* (*Amrasca*) Ghauri, 1967. Type species: *Amrasca splendens* Ghauri

A. (Amrasca) apicoserrata Sohi, 1977—India, Sri Lanka

A. (Amrasca) bella Dworakowska, 1977a—Vietnam

A. (Amrasca) bombaxia (Ghauri, 1965)—China (Hainan), India, Indonesia, Sri Lanka, Vietnam, Bangladesh

A. (Amrasca) complana Qin, Wang & Xu, **sp. nov.**—China (Sichuan, Yunnan, Hainan)

A. (Amrasca) delhiensis Sohi, Mann & Shenhmar, 1987—India

A. (Amrasca) elongata Ahmed, Samad & Naheed, 1981—Pakistan

A. (Amrasca) pringlei Dworakowska, 1994—Sri Lanka

A. (Amrasca) sesuvii (Linnavuori, 1960)—Micronesia

A. (Amrasca) splendens Ghauri, 1967—China (Hainan), India, Indonesia, Sri Lanka, Thailand, Vietnam, Bangladesh

A. (Amrasca) terraereginae (Paoli, 1936)—Australia, Bangladesh

A. (Amrasca) uvka Dworakowska, 1977a—China (Hainan), Vietnam

Subgenus *Amrasca* (*Quartasca*) Dworakowska, 1972. Type species: *Laokayana* (*Q.*) *czzerwowa* Dworakowska, 1972

A. (Quartasca) czzerwowa (Dworakowska, 1972)—China (Hainan, Sichuan, Yunnan, Guangdong), Vietnam

Subgenus *Amrasca* (*Sundapteryx*) Dworakowska, 1970, new status. Type species: *Chlorita biguttula* Ishida, 1913

A. (Sundapteryx) biguttula (Ishida, 1913)—China (Northeast China, Hebei, Shaanxi, Henan, Shandong, Jiangsu, Anhui, Zhejiang, Hubei, Hunan, Jiangxi, Hainan, Taiwan), Japan, Oriental region, India, Indonesia, Pakistan, Philippines, Sri Lanka, Thailand, Vietnam, Bangladesh, Afghanistan, Micronesia

Species removed from *Amrasca*

Jacobiasca curvata Ahmed & Samad, 1972: 287, **comb. n.**

Note. The original description of *A. (Amrasca) curvata* and illustration of male genitalia (Ahmed & Samad, 1972) indicate that this species matches the diagnosis of *Jacobiasca* Dworakowska, especially the characters of the paramere with the extreme apical part curved first laterodorsad, then ventrad, and terminating in a rounded instead of a sharply spinose tip and the ventral pygofer appendage branching apically.

Species incertae sedis

A. (Amrasca) singularis Einyu & Ahmed, 1980: 18

Note. According to the original description and illustrations, this species lacks a pygofer appendage and, therefore, does not belong in *Amrasca* but its correct generic placement cannot be determined based on the information available.

Key to subgenera and species of *Amrasca* from China (males)

1. Pregenital abdominal tergum VII with pair of large lateral apodemes extended anterolaterad into segment VI, tergum VIII with pair of conspicuous arched internal ridges (Fig. 5); subgenital plate with macrosetae restricted to basal half, distal half with

- numerous conspicuous long, fine setae *A. (Sundapteryx) biguttula* (Ishida)
 Pregenital abdominal terga unmodified; subgenital plate with macrosetae extended from near base to near apex (Fig. 34), fine setae variously arranged 2
2. Male subgenital plate with group B setae absent in distal fourth of dorsal margin, paramere with apophysis strongly and evenly curved laterad throughout length. *A. (Quartasca) czerwcowa* Dworakowska
 Male subgenital plate with group B setae extended to or near apex of dorsal margin (Fig. 34), paramere with apophysis nearly straight through most of length (Fig. 35) *A. (Amrasca)*, 3
3. Ventral pygofer appendage broadened and spatulate apically, apical margin truncated, ornamented with tiny hairs (Figs 26–28, 30) *A. (Amrasca) complana* Qin, Wang & Xu, sp. nov.
 Ventral pygofer appendage not as above. 4
4. Crown almost as long as pronotum along midline (Fig. 16); preatrium less than 1.5 times as long as aedeagal shaft in lateral view *A. (Amrasca) uvka* Dworakowska
 Crown shorter than pronotum along midline; preatrium about 2.0 times as long as shaft in lateral view 5
5. Forewing with black patches in cua, m and first apical cell *A. (Amrasca) splendens* Ghauri
 Forewing with black patch apically in cua cell but without patches in other cells. *A. (Amrasca) bombaxia* Ghauri

Amrasca (Sundapteryx) biguttula (Ishida)

(Figs 1–5)

Chlorita biguttula Ishida, 1913: 1

Empoasca biguttula Shiraki, 1913: 96

Zygina punctata Melichar, 1914: 146, **syn. nov.**

Empoasca bipunctata Schumacher, 1915: 108, synonymised by Dworakowska, 1970: 712

Chlorita bimaculata Matsumura, 1916: 393, synonymised by Dworakowska, 1970: 712

Empoasca devastans Distant, 1918: 93, synonymised by Dworakowska, 1970: 712

Empoasca uniguttata Jacobi, 1941: 311, **syn. nov.**

Empoasca quadrinatissima Dlabola, 1957: 296, synonymised by Dworakowska, 1970: 712

Empoasca biguttula (Ishida), Kuoh, 1966: 96

Amrasca devastans (Distant), Ghauri, 1967: 163

Sundapteryx biguttula biguttula (Ishida), Dworakowska, 1970: 712

Sundapteryx biguttula punctata (Melichar), Dworakowska, 1970: 712

Empoasca schumacheri Metcalf, 1968: 353, **nom. nov.** for *Empoasca bipunctata* Schumacher, 1915, preoccupied by *Chloria bipunctata* Oshanin, 1871, synonymised by Linnavuori, 1975: 616

Amrasca biguttula (Ishida), Chopra, 1973: 88

Amrasca biguttula punctata (Melichar), Chopra, 1973: 88; Dworakowska, 1976: 4

Amrasca biguttula biguttula (Ishida), Dworakowska, 1977b: 285

Material examined: 10♂♂, China, Sichuan, Miyi, Binggu, 4-VII-2015, coll. Ye XU & Huanrong LUO; 3♂♂2♀♀, Shaanxi, Wugong county, 22-IX-1980, coll. Ning MA; 1♂1♀, Hunan, Chenzhou, 18-VIII-1985, coll. Yalin ZHANG & Yonghui CHAI; 1♀, 23-IV-1983; 3♂♂, 26-IV-1983; 1♂, 28-IV-1983, Hainan, Xinglong; 1♂2♀♀, 11-V-1983; 2♂♂5♀♀, 12-V-1983; 7♂♂6♀♀, 13-V-1983; 3♂♂3♀♀, 14-V-1983; 1♀, 16-V-1983; 1♂, 8-VI-1983; 1♂8♀♀, 15-V-1983; Hainan, Yacheng; 1♂5♀♀, 29-V-1983; 6♂♂4♀♀, 31-V-1983; 1♂1♀, 1-VI-1983; 2♂♂2♀♀, 15-VI-1983; Hainan botanical garden; 3♂♂1♀, Hainan, Changjiang, 22-V-1983; 1♂1♀, Hainan, Diaoluoshan, 2-V-1983; 1♀, 5-V-1983, 1♂2♀♀, 7-V-1983, Hainan, Lingshui; 1♂1♀, Hainan, Tongshi, 7-VI-1983; 6♂♂26♀♀, 25-V-1983; 1♂, 27-V-1983, Hainan, Bawangling; 2♀♀, 17-V-1983; 2♀♀, 19-V-1983, Hainan, Jianfengling, coll. Yalin ZHANG; 1♀, 4-VII-1985; 1♀, 25-XII-1999, Yunnan, Jinghong, coll. Irena Dworakowska; 1♂1♀, Guangxi, Huaping, 1-IX-2000, coll. Zhenjiang LIU, Zhongli SHA, Xiangqun YUAN.

Notes: Males of *A. biguttula* exhibit distinctive, previously unreported modifications of the pregenital abdominal tergites (VII and VIII) apparently not found in other described species of *Amrasca*. Tergum VII has a pair of large lateral apodemes that extend anterad into segment VI and tergum VIII has a pair of arched internal ridges (Fig. 5). Other Chinese species of *Amrasca* included herein have male abdominal terga VII and VIII unmodified, but similar (although not identical) modifications occur in some undescribed *Amrasca* species from Southeast Asia (Dietrich, unpublished).

The whereabouts of the type material of *C. biguttula* Ishida, 1913 are currently unknown. Shiraki's collection at Taiwan National University, Taipei, includes a single female specimen identified as "*Empoasca biguttula*" (H. T. Shih, pers. comm.). Apparently, neither Ishida (1913) nor Shiraki (1913) intended to establish a new species in their publications because both attributed the species name "*Chlorita biguttula*" to Matsumura. Unfortunately,

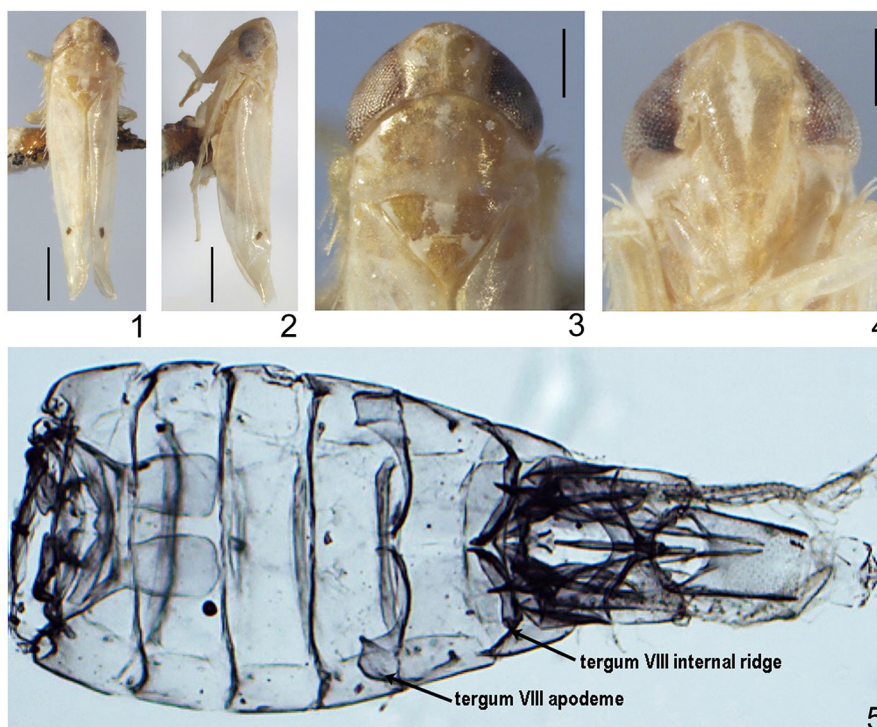
Matsumura, who identified Ishida's and Shiraki's specimens, did not publish a formal description of the species until 1916 and then gave it a different name, *Chlorita bimaculata*. Matsumura (1916) based his description on specimens from Okinawa; Taiwanese specimens identified as belonging to this species have not been found in Matsumura's collection (K. Yoshizawa, pers. comm.; see also Discussion, below).

Dworakowska (1970) based her concept of the species on Japanese specimens identified as "*bimaculata*" in the Matsumura collection, designating a lectotype male. The oldest known type specimen for the names listed above is the holotype female of *Empoasca bipunctata* Schumacher recently located in the Senckenberg Institute, Müncheberg, Germany (examined) but this is of little use in establishing the identity of the species, being a female. Distant's type material of *E. devastans* is available in the Natural History Museum, London and includes a male lectotype. Ghauri (1983) proposed that Distant's material be used as the reference material for the species and that *A. devastans* be used in preference to *A. biguttula* for this reason. However, subsequent usage has favored *A. biguttula* based on the Principle of Priority.

Our re-examination of the male lectotypes of *Chlorita bimaculata* Matsumura, *Zygina punctata* Melichar, and information provided by M. D. Webb on the lectotype of *Empoasca devastans* Distant, confirms that these three taxa are conspecific. All three specimens share the distinctive modifications of the pregenital abdominal tergites (VII and VIII) mentioned above (and shown in Fig. 5). Therefore, we believe that stability of nomenclature is best served by accepting Dworakowska's (1970) interpretation and, therefore, designate Dworakowska's lectotype male specimen of *C. bimaculata* Matsumura, deposited in the Hokkaido University (Sapporo) entomology collection, as the neotype of *C. biguttula* Ishida in order to fix the identity of the species. Thus, the correct scientific name for the Indian cotton leafhopper is *Amrasca biguttula* (Ishida) or, more completely, *Amrasca (Sundapteryx) biguttula* (Ishida).

Because we found no distinct morphological differences between the lectotypes of *Z. punctata* Melichar and *C. bimaculata* Matsumura, there seems to be no justification for treating the former as a distinct subspecies. Thus, *Zygina punctata* Melichar and its synonyms listed by Dworakowska (1970) are listed as synonyms of *A. biguttula* above.

Distribution. China (Northeast China, Hebei, Shaanxi, Henan, Shandong, Jiangsu, Anhui, Zhejiang, Hubei, Hunan, Jiangxi, Hainan, Taiwan), Japan, Oriental region, India, Indonesia (Java, Sumbawa), Pakistan, Philippines, Sri Lanka, Thailand, Vietnam, Bangladesh, Afghanistan, Micronesia.



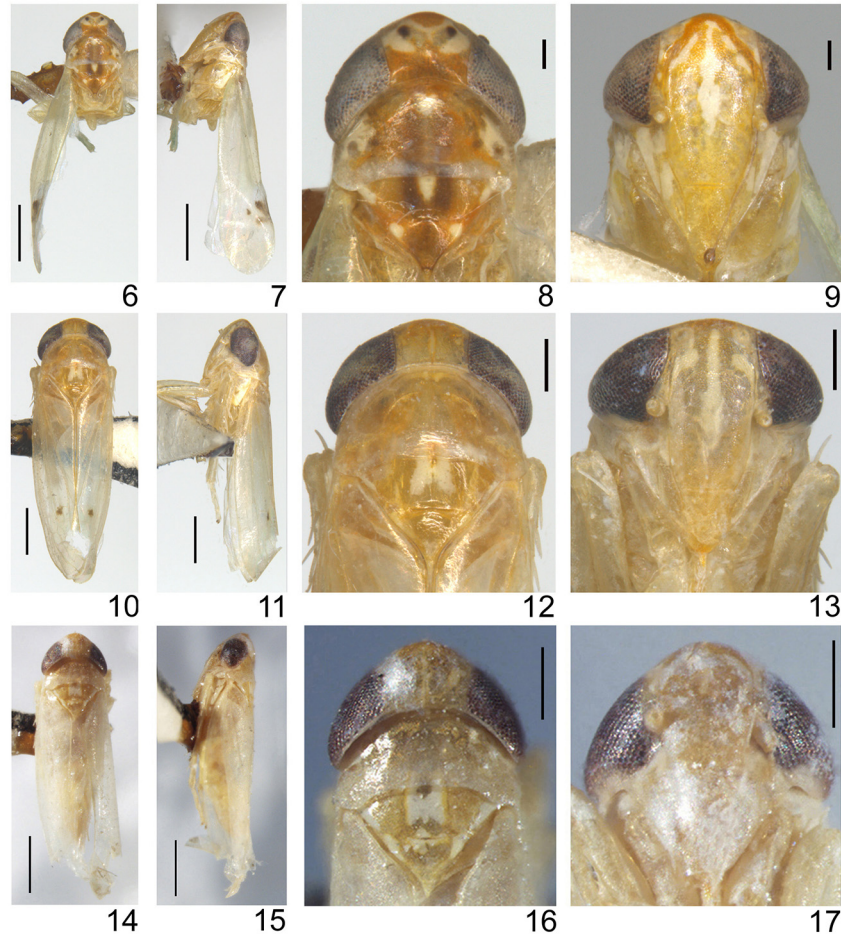
FIGURES 1–5. *Amrasca (Sundapteryx) biguttula* (Ishida). 1. adult, dorsal view; 2. adult, left lateral view; 3. head and thorax, dorsal view; 4. face; 5. male abdomen and male genitalia, dorsal view. Scale bars = 0.5 mm (Figs 1, 2), 0.2 mm (Figs 3, 4).

Amrasca (Amrasca) splendens Ghauri
(Figs 6–9)

Amrasca splendens Ghauri, 1967: 161; Dworakowska, 1994: 12; Zhang, 1990: 132

Material examined. 1♂, China, Hainan, Bawangling, 28-V-1983; 3♂♂5♀♀, Hainan, Botanical garden, 31-V-1983; 3♀♀, Hainan, Bawangling, 25-V-1983, coll. Yalin Zhang.

Distribution. China (Hainan), India, Indonesia, Sri Lanka, Thailand, Vietnam, Bangladesh.



FIGURES 6–17: 6–9. *Amrasca (Amrasca) splendens* Ghauri; 10–13. *Amrasca (Amrasca) bombaxia* (Ghauri); 14–17. *Amrasca (Amrasca) uvka* Dworakowska. 6, 10, 14. adult, dorsal view; 7, 11, 15. adult, left lateral view; 8, 12, 16. head and thorax, dorsal view; 9, 13, 17. face. Scale bars = 0.5 mm (Figs 6, 7, 10, 11, 14, 15), 0.2 mm (Figs 8, 9, 12, 13, 16, 17).

Amrasca (Amrasca) bombaxia (Ghauri), new record from China
(Figs 10–13)

Empoasca bombaxia Ghauri, 1965: 683

Amrasca bombaxia Ghauri, 1967: 163

Laokayana bombaxia (Ghauri), Dworakowska, 1972: 27

Amrasca bombaxia (Ghauri), Dworakowska & Viraktamath, 1975: 530; Dworakowska, 1994: 12

Material examined. 2♂♂4♀♀, China, Hainan, Bawangling, 24-V-1983, coll. Yalin ZHANG, by light trap.

Distribution. China (Hainan), India, Indonesia, Sri Lanka, Vietnam, Bangladesh.

Amrasca (Amrasca) uvka Dworakowska, new record from China
(Figs 14–17)

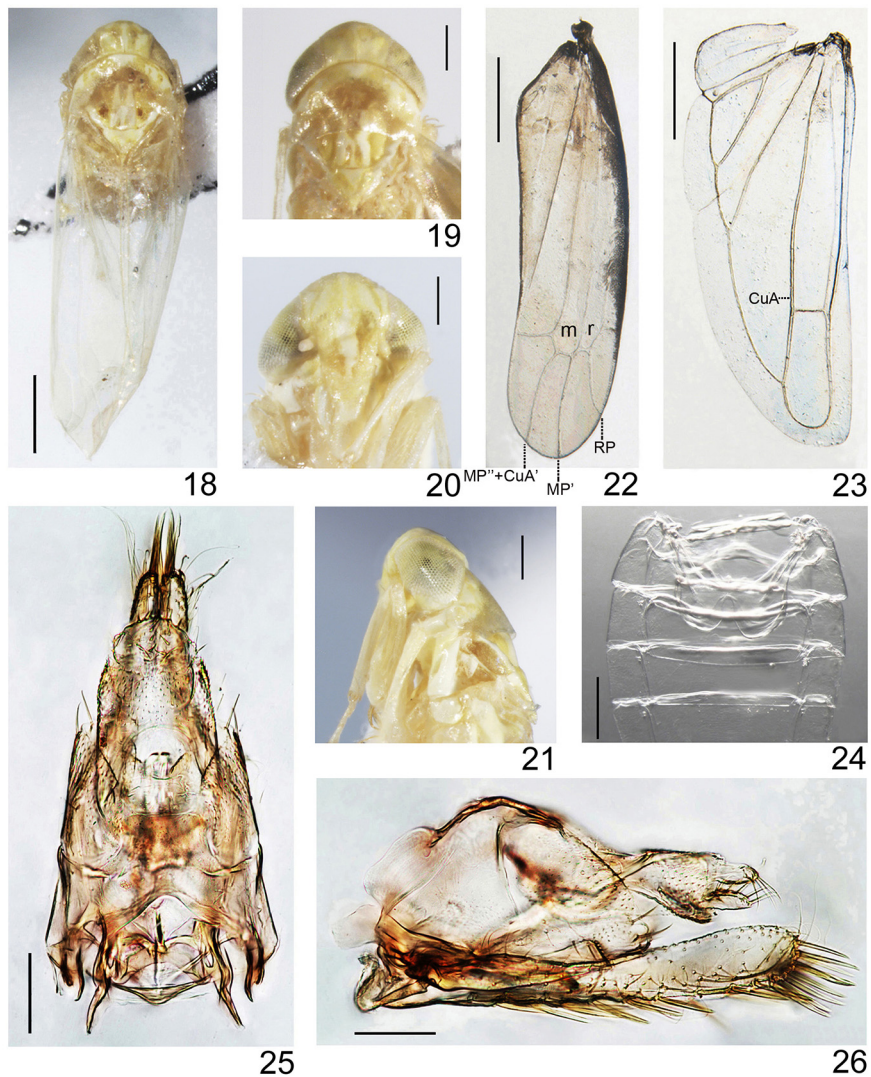
Amrasca uvka Dworakowska, 1977a: 16

Material examined. 3♂♂3♀♀, China, Hainan, Bawangling, 25-V-1983, coll. Yalin ZHANG, by light trap.

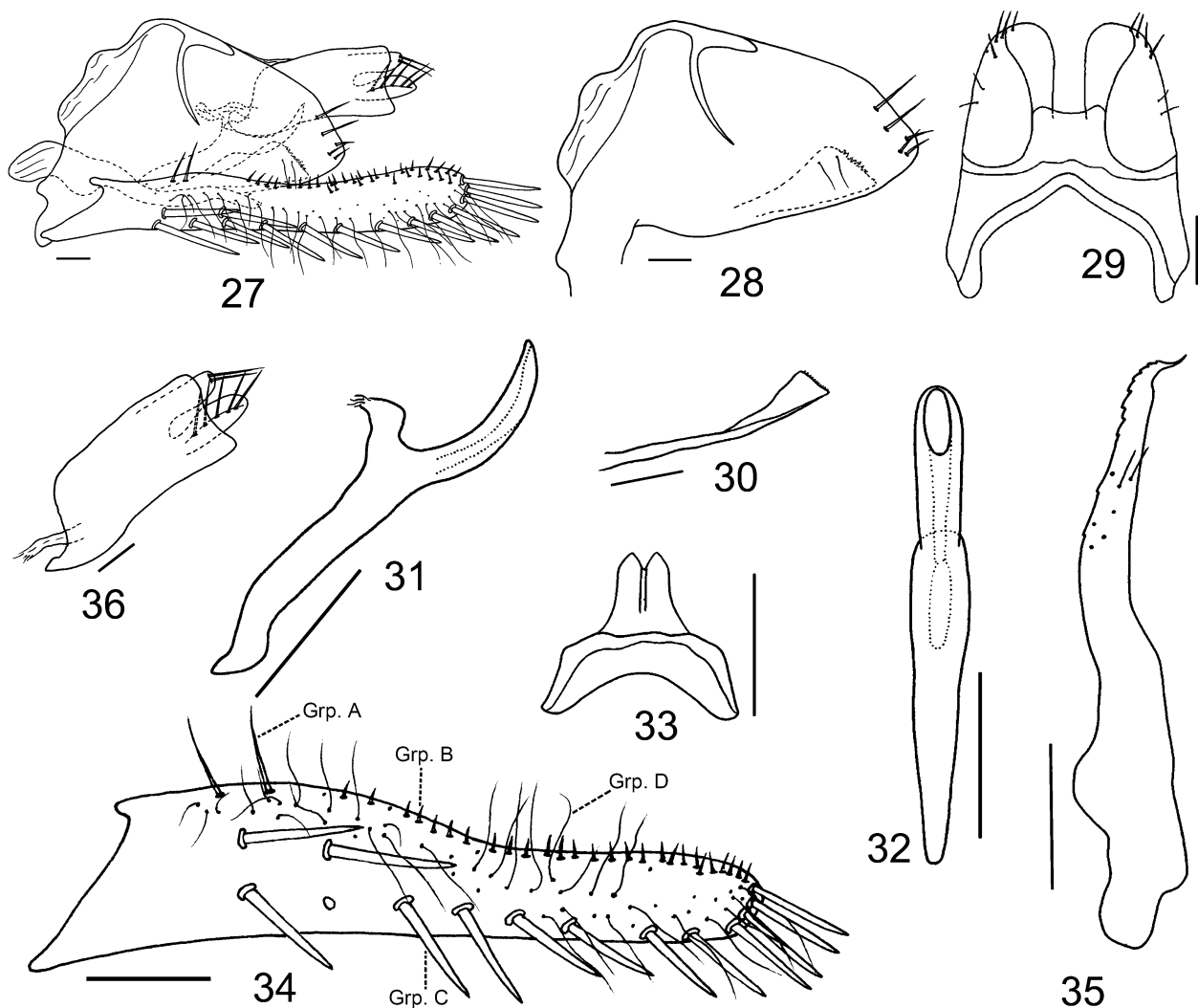
Distribution. China (Hainan), Vietnam.

Amrasca (Amrasca) complana Qin, Wang & Xu, sp. nov.
(Figs 18–36)

Type material. Holotype. ♂, China, Sichuan, Miyi, Binggu, 4-VII-2015, coll. Ye XU & Huanrong LUO (NWFU). **Paratypes.** 2♂♂, same data as holotype; 1♂, Yunnan, Mengyang, 7-VI-1991, coll. Yinglun WANG & Rungang TIAN, by light trap; 2♂♂18♀♀, Hainan, Bawangling, 25-V-1983, Yalin Zhang; 1♂6♀♀, 17-VI-1983; 1♂2♀♀, 20-VI-1983; 3♀♀, 19-VI-1983; Guangdong, Zhaoqing, Dinghushan Mountain, Yalin ZHANG, by light trap (NWFU).



FIGURES 18–26. *Amrasca (Amrasca) complana* Qin, Wang & Xu, sp. nov. 18. male adult (abdomen removed), dorsal view; 19. head and thorax, dorsal view; 20. face; 21. head and thorax, left lateral view; 22. forewing; 23. hind wing; 24. abdominal apodemes; 25. male genitalia, dorsal view; 26. male genitalia, left lateral view. Scale bars = 0.5 mm (Figs 18, 22, 23), 0.2 mm (Figs 19–21, 24); 0.1 mm (Figs 25, 26).



FIGURES 27–36. *Amrasca (Amrasca) complana* Qin, Wang & Xu, sp. nov. 27. male genitalia, left lateral view; 28. pygofer side and ventral pygofer appendage, left lateral view; 29. pygofer side, dorsal view; 30. ventral pygofer appendage; 31. aedeagus, left lateral view; 32. aedeagus, ventral view; 33. connective; 34. subgenital plate; 35. paramere; 36. anal tube, left lateral view. Scale bars = 0.1 mm (Figs 27–36).

Description. Body length: male 2.9–3.3 mm, female 3.0–3.4 mm.

Ground color light yellow. Crown, pronotum anteriorly, mesonotum and frontoclypeal area with irregular milky to creamy yellow patches (Figs 18, 19). Eyes greyish yellow (Figs 18–21). Forewing and hindwing semitransparent (Figs 18, 22, 23). Abdomen yellow. Legs pale yellow.

Basal abdominal apodemes extending to near midlength of sternite IV (Fig. 24). Male pygofer in profile rounded apically, bearing 3–5 rigid setae along posterior margin (Figs 25–29); dorsal bridge in dorsal aspect slightly less than half of total length of pygofer (Figs 25, 29). Pygofer appendage broadened and spatulate, apical margin truncated, ornamented with not numerous microtrichia (Figs 26, 28, 30). Anal tube appendage short, tapered (Fig. 27, 36). Subgenital plate far surpassing end of pygofer side, A group with 3 slender setae, B group setae very short and arranged in irregular row, C-group setae (Figs 27, 34) biseriate subbasally and thence uniseriate toward apex, D-group setae long and gracile, arising subbasally near dorsal margin of plate, scattered in 2–4 irregular rows (Figs 26, 27, 34). Paramere with 6–8 teeth on dentifer, 6–9 setae and sensory pits subapically, apex needle-like, bent dorsad in lateral view (Fig. 35). Connective inverted T shaped, basal margin incurved, caudal margin incised medially (Fig. 33). Aedagal shaft nearly half length of preatrium, curved and narrowed apically, gonopore apical on ventral side (Figs 27, 31, 32).

Etymology. The specific epithet is an adjective derived from the Latin word “*complanus*”, referring to the spatulate ventral pygofer appendage of the new species.

Remarks. This new species is similar to *A. apicoserrata* but differs from the latter in having ventral pygofer appendage short (not reaching end of pygofer lobe), apical part spatulate and bearing tiny hairs along truncated margin (ventral pygofer appendage surpassing end of pygofer lobe, razor-like and serrated at tip in *A. apicoserrata*); in having aedeagus constricted and rounded apically in ventral aspect (aedeagus truncated apically and emarginated medially in *A. apicoserrata*).

Distribution. China (Sichuan, Yunnan, Hainan, Guangdong).

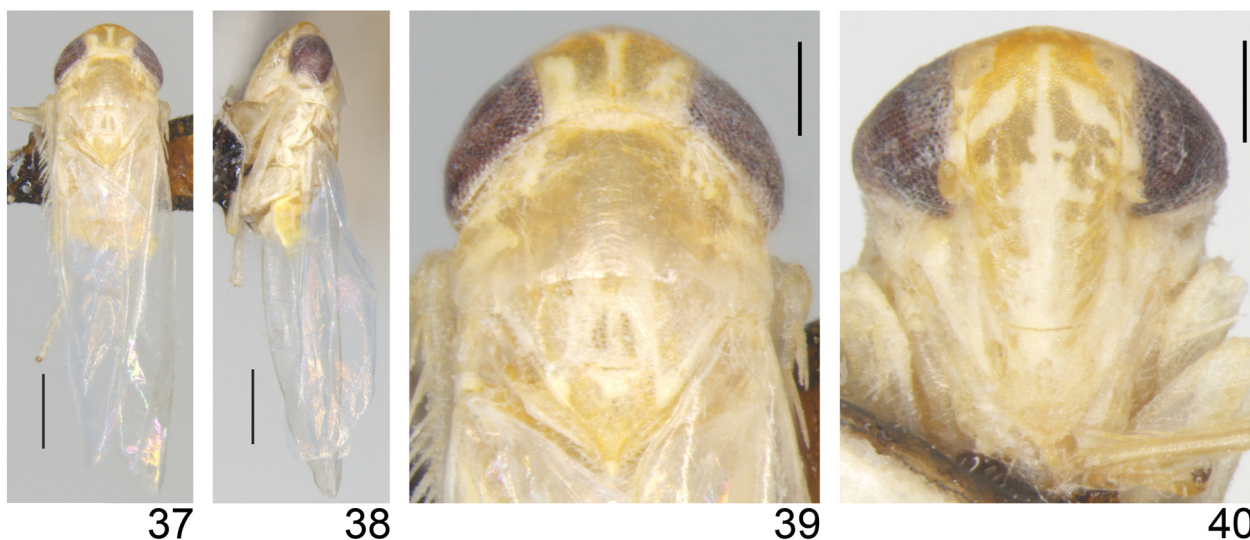
***Amrasca (Quartasca) czerwcowa* (Dworakowska), new record from China**
(Figs 37–40)

Laokayana (Quartasca) czerwcowa Dworakowska, 1972: 27

Amrasca (Quartasca) czerwcowa (Dworakowska), Dworakowska, 1977a: 16

Material examined: 1♂, China, Hainan, Bawangling, 25-V-1983, coll. Yalin ZHANG, by light trap. 1♂, China, Hunan, Hengshan Mountain, 10-VIII-1985, coll. Yalin ZHANG & Yonghui CHAI (NWFU). 1♂1♀, 11-VIII-1985, coll. Yalin ZHANG & Yonghui CHAI; 1♂, Yunnan, Menglun, 21-IV-1982, coll. Jingruo ZHOU & Sumei WANG; 1♂, Hainan, Botanical garden, 1-VI-1983, Yalin ZHANG, by light trap; 1♂, Yunnan, Mengyang, Sanchahe, 7-VI-1991, coll. Rungang TIAN, Wanzhi CAI & Yinglun WANG, by light trap (NWFU).

Distribution. China (Hainan), Vietnam.



FIGURES 37–40. *Amrasca (Quartasca) czerwcowa* (Dworakowska). 37. male adult (abdomen removed), dorsal view; 38. male adult (abdomen removed), left lateral view; 39. head and thorax, dorsal view; 40. face. Scale bars = 0.5 mm (Figs 37, 38), 0.2 mm (Figs 39, 40).

Discussion

This paper adds one species to the genus *Amrasca* but removes two others, bringing the total number of valid species to 13 with six of these recorded in China, three of which are newly recorded in China in this work. Additional species are known to exist and a comprehensive survey of Southeast Asia would reveal additional diversity in the genus. In particular, an incursion of a species of *Amrasca* in Darwin, northern Australia, in 2001 was tentatively identified as *A. biguttula* based on illustrations of *A. devastans* by Ghauri (1963). Subsequently, it was demonstrated that the species in Darwin would not feed on cotton and appeared to be specific to *Hibiscus tiliaceus* (Malvaceae) (S. Smith, pers. comm. 2002). Therefore, it is probable that the species is an undescribed species from East Timor since the Darwin incursion occurred close to docks where significant sea traffic between Australia and East Timor was occurring at the time.

The current distributions of pest species of the genus, particularly *A. biguttula*, have evidently been affected by human trade. The fact that both Ishida and Shiraki, in the same year, found a species on cotton which was unknown to them in Taiwan implies that it was a recent incursion to that island. The species was also unknown to Matsumura until he had identified it for Ishida and Shiraki (independently) and when he subsequently described it as a new species from Japan in 1916, apparently unaware that it had already been inadvertently described by both workers from Taiwan in local reports (see Ghauri 1983 for details). *Amrasca biguttula* is probably native to India. Further taxonomic study of the genus should take into account the unusual modifications of the pregenital abdominal segments of the male, reported here in *A. biguttula* for the first time, which may reliably separate species that are otherwise very similar in the morphology of the male genitalia.

Acknowledgements

The authors thank Dr Stefan Blank of the Senckenberg Institute, Müncheberg, Germany, for the loan of the holotype of *E. bipunctata* Schumacher, Dr K. Yoshizawa for lending the lectotype of *C. bimaculata* Matsumura and Dr I. Malenovsky for lending the lectotype of *Z. punctata* Melichar. Mr M. D. Webb provided important information on the lectotype of *E. devastans* Distant deposited in the Natural History Museum, London, and Dr H. T. Shih (Taiwan Agricultural Research Institute, Taichung) provided information on the specimen deposited in the Shiraki collection. This work was supported by the National Natural Science Foundation of China (31270689).

References

- Ahmed, M. & Samad, K. (1972) Some new additions to the Typhlocybinae fauna of East Pakistan. *Pakistan Journal of Scientific and Industrial Research*, 15 (4-5), 285–290.
- Ahmed, M., Samad, K. & Naheed, R. (1981) Empoascan leafhoppers infesting fruit and vegetable plants in Pakistan (Homoptera: Cicadellidae). *Entomologica Scandinavica*, 12, 1–21.
<https://doi.org/10.1163/187631281X00292>
- Chopra, N.P. (1973) Cotton Jassid: a nomenclatural correction. *Entomologists Record*, 85, 88–89
- Distant, W.L. (1918) Rhynchota, Homoptera. *The Fauna of British India, including Ceylon and Burma*, pp. 71–210.
- Dlabola, J. (1957) Die Zikaden Afghanistans (Homopt. - Auchenorrhyncha) nach den Ergebnissen der von Herrn J. Klapperich in den Jahren 1952-1953 nach Afghanistan unternommenen Expedition. *Mitteilungen der Münchner Entomologischen Gesellschaft, E. V. München*, 47 (5), 265–303.
- Dworakowska, I. (1970) On some genera of Typhlocybini and Empoascini (Auchenorrhyncha: Cicadellidae: Typhlocybinae). *Bulletin de l'Academie Polonaise des Science. Serie des Sciences Biologiques*, 18 (11), 707–716.
- Dworakowska, I. (1972) On some Oriental and Ethiopian genera of Empoascini (Auchenorrhyncha: Cicadellidae: Typhlocybinae). *Bulletin de l'Academie Polonaise des Science. Serie des Sciences Biologiques*, 20 (1), 25–34.
- Dworakowska, I. (1976) On some Oriental and Ethiopian Typhlocybinae (Homoptera: (Auchenorrhyncha, Cicadellidae). *Reichenbachia*, 16 (1), 1–51.
- Dworakowska, I. (1977a) On some Typhlocybinae from Vietnam (Homoptera: Cicadellidae). *Folia Entomologica Hungarica*, 30 (2), 9–47.
- Dworakowska, I. (1977b) On some north Indian Typhlocybinae (Homoptera, Auchenorrhyncha, Cicadellidae). *Reichenbachia*, 16 (29), 283–306.
- Dworakowska, I. (1993) Remarks on *Alebra* Fieb. and Eastern Hemisphere Alebrini (Auchenorrhyncha: Cicadellidae: Typhlocybinae). *Entomotaxonomia*, 15, 91–121.
- Dworakowska, I. (1994) Typhlocybinae (Auchenorrhyncha: Cicadellidae) known to occur in Sri Lanka. *Annotationes Zoologicae et Botanicae*, 20 (216), 3–39.
- Dworakowska, I. & Viraktamath, C.A. (1975) On some Typhlocybinae from India (Auchenorrhyncha, Cicadellidae). *Bulletin de l'Academie Polonaise des Sciences. Serie des Sciences Biologiques*, 23 (8), 521–530.
- Einyu, P. & Ahmed, M. (1980) Typhlocybinae leafhoppers of Rwenzori National Park, Uganda. Part II. Tribe Empoascini (Homoptera, Auchenorrhyncha, Cicadellidae). *Reichenbachia*, 18(2): 13–21.
- Ghauri, M.S.K. (1963) Distinctive features and geographical distribution of two closely similar pests of cotton (*Empoasca devastans* Dist. and *E. terraereginae* Paoli) (Homoptera, Cicadellidae). *Bulletin of Entomological Research*, 53 (4), 653–656.
<https://doi.org/10.1017/S0007485300048392>
- Ghauri, M.S.K. (1965) Notes on the Hemiptera from Pakistan and adjoining areas. *Annals and Magazine of Natural History. (Series 13)*, 7, 673–688.

- Ghuri, M.S.K. (1967) New mango leafhoppers from the Oriental and Austro-oriental regions (Homoptera: Cicadelloidea). *The Proceedings of the Royal Entomological Society of London*, (B). 36 (11–12), 159–166.
<https://doi.org/10.1111/j.1365-3113.1967.tb00531.x>
- Ghuri, M.S.K. (1983) Scientific name of the Indian cotton jassid. In: W.J. Knight, N.C. Pant, T.S. Robertson and M.R. Wilson (Editors), *Proceedings of the 1st International Workshop on Biotaxonomy, Classification and Biology of Leafhoppers and Planthoppers (Auchenorrhyncha) of Economic Importance, London, 4–7 October 1982*. Commonwealth Institute of Entomology, London, pp. 97–103.
- Ishida, M. (1913) Report on pests of cotton. *Taiwan Agricultural Research Institute Publication No 13*.
- Jacobi, A. (1941) Die Zikadenfauna der Kleinen Sundainseln. Nach der Expeditionsausbeute von B. Rensch. *Zoologische Jahrbücher. Abteilung für Systematik, Ökologie und Geographie der Tiere*. Jena, 74, 277–322.
- Kuoh, C.-L. (1966) *Economic Insect Fauna of China. Fasc. 10 (Homoptera Cicadellidae)*. Fauna Editorial Committee, Academia Sinica. Science Press, Beijing, China. pp. 1–170.
- Linnavuori, R. (1960) Homoptera: Cicadellidae. *Insects of Micronesia*. 6 (5), 231–344.
- Linnavuori, R. (1975) Homoptera: Cicadellidae supplement. *Insects of Micronesia*, 6 (9), 611–632.
- Maketon, M., Orosz-Coghlan, P. & Hotaga, D. (2008) Field Evaluation of Metschnikoff (*Metarhizium anisopliae*) Sorokin in Controlling Cotton Jassid (*Amrasca biguttula biguttula*) in Aubergine (*Solanum aculeatissimum*). *International journal of Agricultural & Biology*, 10 (1), 47–51.
- Matsumura, S. (1916) Applied Entomology, 1, 1–731.
- Melichar, L. (1914) Homopteren von Java, gesammelt von Herrn Edw. Jacobson. *Notes from the Leyden Museum*, 36 (9), 91–147. [pl. III.]
- Metcalf, Z.P. (1968) *General Catalogue of the Homoptera*. Fascicle VI. Cicadelloidea. Part 17. Cicadellidae. U.S. Department of Agriculture, Agriculture Research Service. 1513 pp.
- Oshanin, B. (1871) On heteropterous insects of the Zaravshan Valley. *Izvestiya Imperatorskago Obshchestva Lyubitelei Estestvoznaniya, Antropologii i Etnografii pri Imperatorskom Moskovskom Universitete*, 8, 194–213.
- Paoli, G. (1936) Descrizione di alcune nuove specie di *Empoasca* (Hemipt. Homopt.) e osservazioni su specie note. *Memorie della Società Entomologica Italiana*, 15, 5–24.
- Rakitov, R.A. (1998) On differentiation of cicadellid leg chaetotaxy (Homoptera: Auchenorrhyncha: Membracoidea). *Russian Entomological Journal*, 6 (3–4), 7–27.
- Schumacher, F. (1915) H. Sauter's Formosa-Ausbeute. *Supplementa Entomologica*, 4, 1–108.
- Shiraki, T. (1913) Investigation upon insects injurious to cotton. *Formosan Agricultural Experiment Station Special Report*, 5, 1–282.
- Sohi, A.S. (1977) New genera and species of Typhlocybinæ (Homoptera, Cicadellidae) from north-western India. *Oriental Insects*, 11 (3), 347–362.
<https://doi.org/10.1080/00305316.1977.10433815>
- Sohi, A.S., Mann, J.S. & Shenhmar, M. (1987) Eight new species of Typhlocybinæ from India (Insecta, Homoptera, Auchenorrhyncha, Cicadellidae). *Reichenbachia*, 25 (11), 37–45.
- Southern, P.S. (1982) A taxonomic study of the leafhopper genus *Empoasca* (Homoptera: Cicadellidae) in eastern Peru. *North Carolina Agricultural Research Service. Technical Bulletin*, 272, 1–194.
- Zhang, Y.L. (1990) *A taxonomic study of Chinese Cicadellidae (Homoptera)*. Tianze Eldonejo. Yangling, Shaanxi, China, 218 pp.