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A Taxonomic study of *Amrasca biguttula* (Ishida, 1913) (*Cicadellidae, Typhlocybinae*) in Egypt

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Abstract
The species *Amrasca biguttula* (Ishida, 1913) is primarily found in Asia, including countries such as Afghanistan, Bangladesh, China, Japan, India, Indonesia, Pakistan, the Philippines, Sri Lanka, Thailand, Vietnam, and Australia. This study reports the presence of *A. biguttula* in Egypt for the first time. The species is described and illustrated based on comprehensive collections, utilizing both morphological and genital characteristics.

Keywords: Cotton leafhopper, Empoascini, kafr elsheikh

Introduction
Leafhoppers (*Hemiptera*: *Auchenorrhyncha*: *Cicadellidae*) are widely recognized as sap-sucking pests that inflict damage on both wild and cultivated plants globally. With over 22,000 species, *Cicadellidae* is one of the largest and most diverse insect families. Most species exhibit a strong association with their host plants, which they rely on for nutrition (Forero, 2008; Hamilton, 2014; Pinedo-Escatel & Moya-Raygoza, 2018) [20, 26, 46]. These insects are phytophagous, feeding primarily on plant sap, particularly from the xylem, using their specialized piercing-sucking mouthparts. Their feeding and oviposition activities can cause direct harm to plants, while they also serve as vectors for harmful plant pathogens, including bacteria and viruses (Carter, 1973; Harris, 1979; Feeley *et al.*, 2001; Larivière *et al.*, 2010; Paradell *et al.*, 2014; Albre & Gibernau, 2019) [3, 27, 19, 33, 44, 1]. *Typhlocybinae* is the second-largest subfamily within *Cicadellidae*, following Deltocephalinae, in terms of described species. Many of these species are economically significant pests, primarily due to the direct damage caused by their feeding. Some species are also known to transmit plant pathogens (DeLong, 1971; Weintraub & Beanland, 2006) [5, 50]. Empoascini, the second-largest tribe within *Typhlocybinae*, comprises approximately 1,373 valid species across 83 genera (Southern & Dietrich, 2010; Xu *et al.*, 2017a, 2017b; Dmitriev & Dietrich, 2019) [49, 51, 52, 10]. This tribe is distinguished by the absence of an appendix in the forewing and the presence of a submarginal vein at the apex of the hindwing, with veins RP and MP' converging distally (Dietrich, 2005) [6]. *Amrasca biguttula* (Ishida) belongs to this tribe and is recognized as a significant agricultural pest, causing hopper burn, a condition characterized by leaf browning and curling due to feeding damage and plant immune responses. This results in substantial crop losses and control costs annually (Backus *et al.*, 2005) [2]. In recent years, Africa has witnessed the invasion of several new crop pests, including *Tuta absoluta* on tomatoes and other solanaceous plants in 2011, *Spodoptera frugiperda* on maize and other cereals in 2017, and, most recently, *A. biguttula* on cotton and other malvaceous plants during 2022-2023 (Zinsou *et al.*, 2024) [56]. Similar invasions have been reported in Egypt, where *A. biguttula* was identified in 2024 on cotton, okra, and Roselle in the Kafr ElSheikh governorate. Although earlier studies by Parker *et al.* (2021) [45] and Kamel *et al.* (2024) [30] mentioned the presence of *A. biguttula* in Egypt, they did not provide sufficient evidence, such as living specimens, to confirm its establishment in the Egyptian fauna. Therefore, this study was conducted to verify the taxonomic identity of *A. biguttula* in Egypt based on collected specimens from Kafr ElSheikh governorate.

Material and Methods: The study was conducted in agricultural fields located in Kafr ElSheikh governorate, where *Amrasca biguttula* Leafhoppers are known to be a prevalent pest species.

The fields included a variety of crops such as cotton (*Gossypium hirsutum*), Roselle (*Hibiscus sabdariffa),* okra (*Abelmoschus esculentus*) which are commonly affected by these pests. The sampling was performed over 2024, during the peak infestation period to ensure effective collection by using collection net (e.g., mesh size 1.5 mm). The net was 50 cm in diameter with a long handle (approx. 1.5 meters) for reaching plants at various heights. A manual aspirator was used for capturing Leafhoppers directly from the leaves and stems. The aspirator was fitted with a collection chamber to store the insects without harm both methods used sterile, labeled collection vials (10 mL capacity) to store the specimens. The vials were kept in a cool place to prevent damage to the insects. All collected specimens were identified under a dissecting microscope (10x magnification) based on morphological features, including body size, color, and wing patterns, as described by Dietrich (2005) [6]. The collected specimens were sorted into different developmental stages (adult, nymph, egg) for further analysis. The specimens were categorized into different developmental stages (adult, nymph, egg) for further analysis. All samples were transported to the Insect Taxonomy Department laboratory at the Plant Protection Research Institute in Dokki, Giza, for detailed identification and counting. Relevant literature, including works by Habib *et al.* (1975a, 1975b, 1976) [23, 24, 25], Knight (1983) [31], Oman *et al.* (1990) [42], and Zahniser & Dietrich (2010) [53], was used for species classification. Voucher specimens were deposited in the Reference Egyptian Museum of Insects at the Taxonomy Department, Plant Protection Research Institute, Dokki, and Giza. Photographs were taken using an Olympus Stereomicroscope equipped with an Olympus EP 50 camera (5 MP).

Results and Discussion

Tribe: Empoascini Distant, 1908

Genus: *Amrasca* Ghauri, 1967 [22]

Amrasca Ghauri, 1967 [22]: 159. Type species: *Amrasca splendens* Ghauri, 1967 [22] by original designation.

Sundapteryx Dworakowska, 1970 [12]: 708. Type species: *Chlorita biguttula* Ishida, 1913 [28] by original designation. Synonymized by Dworakowska & Viraktamath, 1975 [11]: 530.

Subgenus: *Amrasca* (*Sundapteryx*) Dworakowska, 1970 [12], Type species: *Chlorita biguttula* Ishida, 1913 [28].

Remark: The genus *Amrasca* exhibits heterogeneity in the form and chaetotaxy of the subgenital plate. Two subgenera were previously recognized based on chaetotaxy: *Amrasca* (*Amrasca*), characterized by long, fine setae restricted to the basal half of the subgenital plate, and *A. (Quartasca)* Dworakowska, which differs in chaetotaxy. YE XU *et al.* (2017) [51] recognized *A. (Sundapteryx)* Dworakowska as a third valid subgenus, based on the type species *Chlorita biguttula* Ishida.

***Amrasca (Sundapteryx) biguttula* (Ishida) (Figs 1-6)**

Chlorita biguttula Ishida [28], 1913: 1

Empoasca biguttula Shiraki, 1913 [48]: 96

Zygina punctata Melichar, 1914 [38]: 146, YE XU *et al.* 2017 [51]: 363

Empoasca bipunctata Schumacher, 1915 [47]: 108, Dworakowska, 1970 [12]: 712

Chlorita bimaculata Matsumura, 1916 [37]: 393 Dworakowska, 1970 [12]: 712

Empoasca devastans Distant, 1918 [7]: 93, Dworakowska, 1970 [12]: 712

Empoasca uniguttata Jacobi, 1941 [29]: 311, syn. nov.

Empoasca quadrinotatissima Dlabola, 1957 [9]: 296, synonymised Dworakowska, 1970 [12]: 712

Empoasca biguttula (Ishida), Kuoh, 1966 [32]: 96

Amrasca devastans (Distant), Ghauri, 1967 [22]: 163

Sundapteryx biguttula biguttula (Ishida), Dworakowska, 1970 [12]: 712

Sundapteryx biguttula punctata (Melichar), Dworakowska, 1970 [12]: 712

Empoasca schumacheri Metcalf, 1968 [40]: 353, nom. nov. (by YE XU *et al.* 2017 [51]: 363) for *Empoasca bipunctata* Schumacher, 1915 [47], *Chloria bipunctata* Oshanin, 1871 [41], Linnavuori, 1975 [35]: 616,

Amrasca biguttula (Ishida), Chopra, 1973 [4]: 88

Amrasca biguttula punctata (Melichar), Chopra, 1973 [4]: 88; Dworakowska, 1976 [15]: 4

Amrasca biguttula biguttula (Ishida), Dworakowska, 1977b [16]: 285

Local distribution: Kafr ElSheikh

World distribution: Australian Region; **Oriental region**: India, Indonesia, Pakistan, Philippines, Sri Lanka, Thailand, Vietnam, Bangladesh, Afghanistan, Micronesia; Palaearctic region: China, Egypt, Japan.

Specimens examined.

53♀, 23♂, Egypt: Kafr ElSheikh: 8. V. 2024, 12. VI. 2024, 15. VII. 2024, 30. VII. 2024.

Description

Insect with delicate body. In dorsal view, including compound eyes, the head is clearly wider than the pronotum (Figs. 1&2). Anterior and posterior margins of crown not parallel and the coronal suture not extending to crown midlength. From vertex to the face in transition profile is slightly rounded. Ocelli are distinct and positioned near the eyes at the margin between the vertex and frons. The lateral frontal sutures reach the ocelli without reaching to the midline. Face distinctly broad, with weakly convex and not bulged anteclypeus. pronotum somewhat large. Rostrum significantly covering the hind coxae base (Fig. 3).

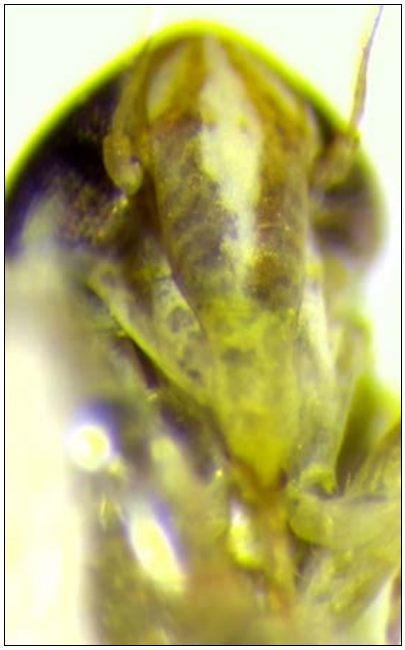
Forewing (Fig. 4) exhibits narrow structure and rounded apex, and its total length constituted by apical cells nearly one-third. The RP vein arises from the r cell, but the MP and MP+CuA veins originate from the m cell and split apart at the bases.. The c and r cells are approximately equal in width, both being narrower than the m and CuA cells. The second apical cell is characterized by a narrowed base and a broadened apex. In contrast, the hind wing displays an unbranched CuA. The front femur presents a row of AV with one distinctly enlarged basal seta. Additionally, the AM1 seta of the front femur is notably enlarged. The middle femur features one dorsoapical macroseta, while the hind tibia AV row contains four or five preapical macrosetae.

Male genitalia: (Figs. 5&6) basal abdominal apodemes developed, parallel-sided. Small, stiff microsetae are dispersed throughout the distal part of the male pygofer dorsal bridge short. Ventral appendage present. Subgenital

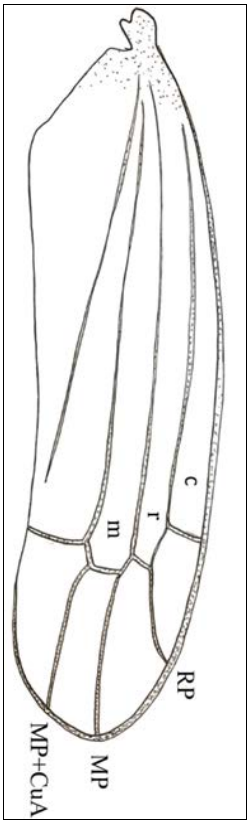
plate extended well beyond pygofer side, subgenital plate with macrosetae restricted to basal half, distal half with numerous conspicuous long, fine setae. Apophysis large dentifer and few thin setae in the apical half, paramere broad at the base and sharply pointed at the apex. Anterior connective large, tapered to posterior apex, and significantly narrowed around midlength. Aedeagal shaft tubular, preatrium formed, dorsoatrium absent, and process lacking. Anal tube appendage well developed.

1

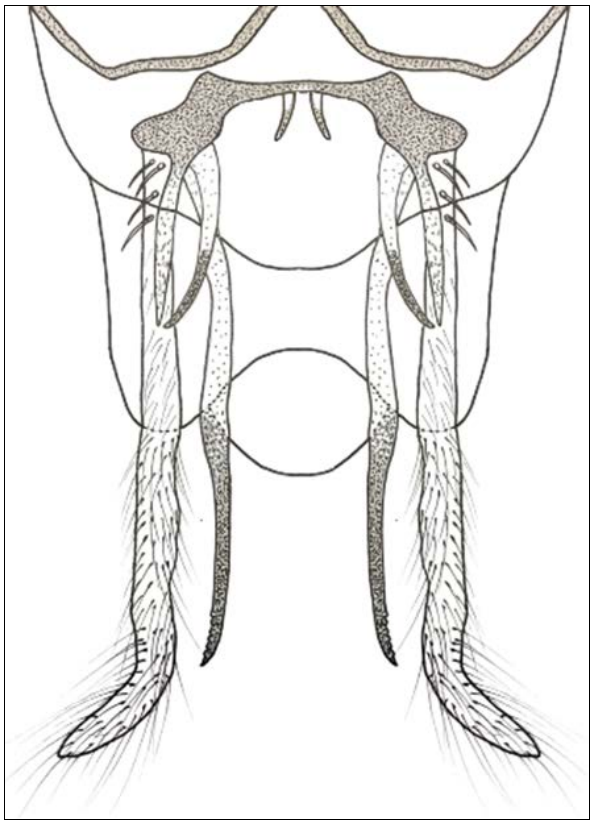
2



3



4



5

6

Amrasca biguttula (Ishida) Fig. 1. Habitus, Fig. 2. Dorsal view of head and pronotum, Fig. 3. Face and ventral view, Fig. 4. Forewing, Fig. 5. Male genital, Fig. 6. subgenital plate.

Conclusion: According to the present study, geographic distribution of the species *Amrasca biguttula* (Ishida) has expanded to include Egypt as a representative of North Africa in Palaearctic region.

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