Two new species of the leafhopper subgenus *Empoasca* (*Empoasca*) Walsh (Hemiptera, Cicadellidae, Typhlocybinae, Empoascini) from China

Xiaofei Yu¹,², Maofa Yang¹,²

¹ Institute of Entomology, Guizhou University, Guiyang Guizhou, 550025, P. R. China ² Guizhou Provincial Key Laboratory for Agricultural Pest Management of the Mountainous Region, Guiyang Guizhou, 550025, P. R. China.

Corresponding author: Maofa Yang (yangmaofa@sohu.com)

Academic editor: Mick Webb | Received 21 March 2014 | Accepted 10 July 2014 | Published 28 August 2014

http://zoobank.org/B955D322-5234-43D5-85C8-50121FCF680B

Citation: Yu XF, Yang MF (2014) Two new species of the leafhopper subgenus *Empoasca* (*Empoasca*) Walsh (Hemiptera, Cicadellidae, Typhlocybinae, Empoascini) from China. ZooKeys 437: 25–32. doi: 10.3897/zookeys.437.7563

Abstract
Two new species of the leafhopper subgenus *Empoasca* (*Empoasca*) namely, *E.* (*E.*) *dorsodenticulata* Yu & Yang, sp. n. and *E.* (*E.*) *spiculata* Yu & Yang, sp. n. from China are described and illustrated and a key provided for Chinese subgenera of *Empoasca*.

Keywords
Subgenera, Key

Introduction
The leafhopper genus *Empoasca* Walsh, 1862 includes 11 subgenera (Oman et al. 1990) of which five occur in China: *Empoasca* (*Empoasca*) Walsh, 1862, *Empoasca* (*Distantasca*) Dworakowska, 1972, *Empoasca* (*Matsumurasca*) Anufriev, 1973, *Empoasca* (*Livasca*) Dworakowska & Viraktamath, 1978 and *Empoasca* (*Okubasca*) Dworakowska, 1982. The subgenus *Empoasca* (*Empoasca*) is very species rich with over
400 known species worldwide of which 53 species are known from China treated by Dworakowska (1972, 1982), Kuoh (1966), Chou and Ma (1981), Cai and Shen (1999), Matsumura (1931), Zhang and Xiao (2000), Zhang, Liu and Qin (2008), Liu, Qin, Fletcher and Zhang (2011a, 2011b) and Yu, Yang and Meng (2012). In the current paper we describe two new species in the subgenus from China and provide a key to the subgenera of *Empoasca* from China.

**Material and methods**

The methods and terminology follow Zhang (1990) except for the nomenclature of wing, for which we follow Dworakowska (1993). Male specimens were dissected under a MOTIC B1 SMS-168 SERIES microscope. Figures were made using an OLYMPUS CX41 and enhanced using Adobe Illustrator CS4. Pictures were taken with VHX-1000C and dealt with by Adobe Illustrator CS4. The body length is measured from the apex of the head to the apex of the forewing, the specimens examined are deposited in Institute of Entomology, Guizhou University, Guizhou Guiyang, China (GUGC) and The Natural History Museum, England.

**Results**

*Empoasca* (Empoasca) Walsh, 1862

*Empoasca* (Empoasca) Walsh, 1862: 149

**Type species.** *Empoasca viridescens* Walsh (a junior synonym of *Tettigonia fabae* Harris, 1841).

**Diagnosis.** Body color green to yellowish, with variable symmetrical patches on head and thorax; coronal suture not reaching midlength of crown (Figs 18a, 20a, 24a, 26a); forewing with RP and MP’ stalked (Fig. 22) or separated (Fig. 28); hindwing with CuA unbranched (Fig. 23, 29); male pygofer, with fine sparse setae distally, macrosetae absent, ventral pygofer appendage present (in some species processes crossed in dorsal view), free from pygofer lobe, at least for halflength of pygofer (Figs 1, 9); subgenital plate broad basally, basal series of setae on outer margin and an oblique series of macrosetae from base to apex bi-seriate basally (Figs 5, 13); paramere elongate, curved, with apical teeth (Figs 6, 14); aedeagus with preatrium present, shaft without processes or occasionally with pair of processes, gonopore apical on ventral surface, dorsal apodeme poorly developed or absent (Figs 7, 8, 15, 16); anal tube processes distinct.

**Distribution.** Worldwide.
Two new species of the leafhopper subgenus Empoasca (Empoasca) Walsh...

Empoasca (Empoasca) dorsodenticulata Yu & Yang, sp. n.
http://zoobank.org/D485282D-C23B-4CC4-B628-22179ACC251A
Figs 1–8, 18–23

**Type material.** Holotype: male, Kuankuoshui, Guizhou Province, 14 August 2010, coll. Xiaofei Yu. Paratypes: 1 male, Shiwandashan, Guangxi Province, 4 May 2011, coll. Rong Huang; 1 male, Liupanshui, Guizhou Province, 2 June 2012, coll. Maofa Yang, Zhijiang Bai and Xiaofei Yu.

Length. Male: 4.0–4.1mm.

Green to yellowish (Fig. 18a). Crown with a green patch each side of coronal suture (Figs 18a, 20a). Face in some species with an off-white longitudinal stripe on anteclypeus (Figs 19b, 21b). Scutellum with a whitish stripe medially (Figs 18a, 20a). Forewing with RP and MP’ stalked at base (Fig. 22).

Male ventral abdominal apodemes reaching segment 4 (Fig. 2). Male pygofer lobe with dorsal margin oblique and apical margin straight in lateral view, with fine setae adjacent apical margin; ventral pygofer appendage shorter than pygofer, tapering caudad, subapically denticulate; dorsal bridge about 1/3 length of pygofer (Figs 1, 3, 4). Subgenital plates elongate, with 20 macrosetae arranged obliquely in two basal rows centrally and a

---

**Figures 1–8.** *E. (E.) dorsodenticulata* Yu & Yang, sp. n. 1 male genital capsule, lateral view 2 male abdominal apodemes 3 male pygofer, dorsal view 4 ventral pygofer appendage, dorsal view 5 subgenital plate, ventral view 6 paramere and connective 7 aedeagus, dorsal view 8 aedeagus, lateral view.
single distal row on lateral margin, ca. 25 elongate fine setae and medial margin with 6 basal group macrosetae followed by ca. 16 spine-like setae (Figs 1, 5). Paramere as in Fig. 6. Aedeagus with elongate preatrium; shaft slightly expanded near apex in lateral view, tapered from base to apex in ventral view, apical 1/3 with numerous irregular denticles dorsally (Figs 1, 7, 8). Anal tube process slightly sinuate (Fig. 1). Connective lamellate (Fig. 6).

**Etymology.** The new species name alludes to the dorsal denticles on the aedeagal shaft.

**Remarks.** The new species is similar to *Empoasca (Empoasca) borowikae* Dworakowska, 1976 but differs in having the male ventral abdominal apodemes reaching segment 4, ventral pygofer appendage denticulate near apex and apical 1/3 of aedeagus with dorsal denticles. The new species is also similar to *Empoasca (Empoasca) gutianensis* Liu, 2011 but differs in the aedeagus without denticles ventrally and anal tube process sinuate.

*Empoasca (Empoasca) spiculata* Yu & Yang, sp. n.

http://zoobank.org/4CDD261B-E282-4D5F-9F8F-26BA4CA306B2
Figs 9–17, 24–29

**Type material.** Holotype. male, Luya mountain, Shanxi Province, 19 August 2011, coll. Hu Li; Paratypes: 5 males, Lvliang mountain, Shanxi Province, 22 August 2011, coll. Hu Li, Zhizhua Fan and Xiaofei Yu (1 male, BMNH).

Length. Male 3.9–4.1 mm.

Yellowish (Fig. 24a). A yellow stripe along coronal suture (Figs 24a, 26a). Scutellum with a central whitish streak (Figs 24a, 26a). Forewing with RP and MP’ stalked at base or separated (Fig 28).

Male ventral abdominal apodemes reaching segment 4 (Fig. 10). Male pygofer lobe tapered to rounded apex with ca. 15 setae, ventral pygofer appendage extended far beyond pygofer, prococeses crossed in dorsal view, apex expanded and forked, lower branch serrate; dorsal bridge about 1/4 length of pygofer (Figs 9, 11, 12). Subgenital plates relatively broad with 20 macrosetae arranged obliquely in two basal rows centrally and a single distal row on lateral margin, and ca. 37 elongate fine setae from base to apex and medial margin with 5 basal group macrosetae followed by ca. 22 spine-like setae (Figs 9, 13). Paramere as Fig. 14. Aedeagus club-shaped in lateral view; shaft dorsally laterally compressed and less sclerotized, ventrally spiculate, with apex broadly rounded in ventral view; (Figs 9, 15, 16). Anal tube process falcate, apex spine-like (Figs 9, 17). Connective lamellate (Fig. 15).

**Etymology.** The new species name alludes to the ventral spicules on the aedeagal shaft.

**Remarks.** The new species differs from other members of the subgenus in having the ventral pygofer appendage forked, aedeagal shaft laterally compressed dorsally and ventrally spiculate.
Two new species of the leafhopper subgenus Empoasca (Empoasca) Walsh...

Figures 9–17. *E. (E.) spiculata* Yu & Yang, sp. n. 9 male genital capsule, lateral view 10 male abdominal apodemes 11 male pygofer, dorsal view 12 ventral pygofer appendage, dorsal view 13 subgenital plate, ventral view 14 paramere 15 aedeagus and connective, dorsal view 16 aedeagus, lateral view 17 anal tube process.

Key of the subgenera of *Empoasca* known from China (males only)

1. Subgenital plates with very long fine setae distally (Fig. 30) ... *E. (Distantasca)*
   - Subgenital plates with macrosetae distally (Figs. 31, 32, 33, 34) .................. 2
2. Pygofer lobe with rigid microsetae at ventral margin and ventral pygofer appendage short; subgenital plates elongate and tapered to narrow apex, with all outer marginal setae short (Fig. 31) ........................................ *E. (Okubasca)*
   - Pygofer lobe without rigid microsetae at ventral margin and ventral pygofer appendage long (Fig. 1); subgenital plates moderately long and tapered to broadly rounded apex, with outer basal group of long macrosetae and more distal short setae (Figs. 32, 33, 34) .................................................. 3
3. Subgenital plates very short and broad (Fig. 32) .................... *E. (Livasca)*
   - Subgenital plates elongate ........................................................................ 4
4. Subgenital plates distinctly broader basally than distally (Fig. 33) ...........
   .......................................................... *E. (Matsumurasca)*
   - Subgenital plates slightly broader basally than distally (Fig. 34) ... *E. (Empoasca)*
Acknowledgement

We sincerely thank Mr M. D. Webb (Department of Entomology of The Natural History Museum, England) for reviewing the MS and giving his kind help. We are also grateful to Miss Rong Huang, Mr Hu Li, Miss Zhihua Fan and Zhijiang Bai (Institute of Entomology, Guizhou University, Guiyang Guizhou, 550025, P. R. China) for collecting material. We also thank Dr. Meng Jiao, Mr Chang Han and Bin Yan (Institute of Entomology, Guizhou University, Guiyang Guizhou, 550025, P. R. China) for giving help during the manuscript writing.
Two new species of the leafhopper subgenus Empoasca (Empoasca) Walsh...

Figures 30–34. Empoasca subgenera from China, subgenital plates (type species except 33). 30 Empoasca (Distantasca) terminalis (following Distant 1918) 31 Empoasca (Okubasca) okubella (following Matsumura 1931) 32 Empoasca (Livasca) malliki (from Dworakowska and Viraktamath 1978) 33 Empoasca (Matsumurasca) clypealata (from Qin and Zhang 2008) 34 Empoasca fabae (from Harris 1841).

References

Anufriev GA (1973) The genus Empoasca Walsh, 1864 (Homoptera: Cicadellidae: Typhlocybinae) in the Soviet Maritime Territory. Annales Zoologici 30: 537–558.
Cai P, Shen XC (1999) The fauna and taxonomy of insects in Henan Mt Jigong, Vol.3: Insects of the Jigong Mountain Region. China Agricultural Sci-tech Press, Beijing.
Chou I, Ma N (1981) On some new species and new records of Typhlocybinae from China (Homoptera: Cicadellidae). Entomotaxonomia 3: 191–210.
Distant WL (1918) Homoptera: Appendix, Heteroptera: Addenda. In: Shipley AE, Marshall G (Eds) The fauna of British India, including Ceylon and Burma, Rhynchota. Vol. VII, Secretary of State for India in Council, 210 pp.
Dworakowska I (1972) On some East Asiatic species of the genus Empoasca Walsh (Auchenorrhyncha: Cicadellidae: Typhlocybinae). Bulletin de l’ Academie Polonaise des Sciences Cl II Serie des Sciences biologiques 20(1): 17–24.
Dworakowska I (1976) On some oriental and Ethiopian Typhlocybinae (Homoptera: Auchenorrhyncha: Cicadellidae). Reichenbachia 16(1): 1–51.
Dworakowska I (1982) Empoascini of Japan, Korea and north-east part of China (Homoptera: Auchenorrhyncha: Cicadellidae: Typhlocybinae). Reichenbachia 20(1): 33–57.
Dworakowska I (1993) Remarks on Alebra Fiab. and Eastern Hemisphere Alebrini (Auchenorrhyncha: Cicadellidae: Typhlocybinae). Entomotaxonomia 15(2): 91–121.
Dworakowska I, Virktamath CA (1978) On some India Typhlocybinae (Auchenorrhyncha: Cicadellidae). Bulletin de l’ Academie Polonaise des Sciences Cl II Serie des Sciences biologiques 26(8): 529–548.

Harris TW (1841) A report on the insects of Massachusetts injurious to vegetation. Folsom Wells.

Kuoh CL (1966) Economic insect fauna of China Fasc 10, Cicadellidae (Homoptera). China Science Press, Beijing, 170 pp.

Liu Y, Qin DZ, Fletcher MJ, Zhang YL (2011a) Review of Chinese Empoasca Walsh (Hemiptera: Cicadellidae), with description of seven new species and some new Chinese records. Zootaxa 3055: 1–21.

Liu Y, Qin DZ, Fletcher MJ, Zhang YL (2011b) Four new species of Empoasca (Hemiptera: Cicadellidae: Typhlocybinae: Empoascini) and one new record from China. Zootaxa 3070: 29–39.

Matsumura S (1931) A revision of the Palaearctic and Oriental Typhlocybid-genera with description of new species and new genera. Insect Matsumurana 6(2): 55–91.

Oman PW, Knight WJ, Nielson MW (1990) Leafhoppers (Cicadellidae): A Bibliography, generic checklist and index to the world literature 1956–1985. CAB International Institute of Entomology, 368 pp.

Qin DZ, Zhang YL (2008) The leafhopper subgenus Empoasca (Matsumurasca) from China (Hemiptera: Cicadellidae: Typhlocybinae: Empoascini), with descriptions of three new species. Zootaxa 1817: 18–26.

Walsh BD (1862) Fire blight. Two new foes of the apple and pear. Prairie Farmer (NS) 10: 147–149.

Yu XF, Yang MF, Meng ZH (2012) A new species of leafhopper (Hemiptera: Cicadellidae: Typhlocybinae) injurious to Fructus evodiae. Journal of Mountain Agriculture and Biology 31(2): 95–98.

Zhang YL, Liu Y, Qin DZ (2008) Empoasca (Emposca) paraparvipenis n. sp. and some new records of the subgenus from China (Hemiptera: Cicadellidae: Typhlocybinae: Empoascini). Zootaxa 1949: 63–68.

Zhang YL (1990) A taxonomic study of Chinese Cicadellidae (Homoptera). Tianze Edonejo, Yangling, Shaanxi, 218 pp.

Zhang YL, Xiao NN (2000) Typhlocybinae (Auchenorrhyncha: Cicadellidae) collected by a light trap in Yuxi, China. Entomotaxonomia 22(2): 107–115.