Six New Record Species of Whiteflies (Hemiptera: Aleyrodidae) Infesting Morus alba in China

Authors: Ji-Rui Wang, Zao-Qin Song, and Yu-Zhou Du
Source: Journal of Insect Science, 14(136) : 1-5
Published By: Entomological Society of America
URL: https://doi.org/10.1093/jisesa/ieu136
Six New Record Species of Whiteflies (Hemiptera: Aleyrodidae) Infesting Morus alba in China

Ji-Rui Wang,1 Zao-Qin Song,1,2 and Yu-Zhou Du1,3

1School of Horticulture Plant Protection & Institute of Applied Entomology, Yangzhou University, Yangzhou 225009, China
2Crop Cultivation and Technology Promotion Stations of Yizheng, Yizheng 211400, China
3Corresponding author, e-mail: yzdu@yzu.edu.cn


ABSTRACT. To determine the species of whiteflies occurring on mulberry, Morus alba L. (Rosales: Moraceae) in China, we collected samples in more than 87 sites in 16 provinces of China from 2008 to 2011. In total, 10 species, representing seven genera of the subfamily Aleyrodinae, were identified. Of these, six species are newly recorded on mulberry in China, namely, Aleuroclava ficicola Takahashi, Aleuroclava gordoniae (Takahashi), Aleurotuberculatus ficicola (Kuwana), Bemisia afer (Priesner & Hosny), Bemisia tabaci Gennadius, and Pealius machili Takahashi. Information on the taxonomy, distribution, and host plants of the whitefly species found on mulberry in China, along with a brief description and illustrations of each species are provided.

Key Words: mulberry pest, ESEM, description, puparium, taxonomy

Mulberry trees, Morus alba L. (Rosales: Moraceae), are widely cultivated in south China and other Asian countries, and their leaves are used to feed silkworms, Bombyx mori L. As in most commercial plantations and field crops, mulberry is prone to the attack of a diverse complex of pest species belonging to a large number of insect orders (Bandyopadhyay et al. 1999). Whiteflies are an economically important group of insects infesting a wide range of host plant (Mound and Halsey 1978). Nymphs and adults are found primarily on the underside of mulberry leaves. They feed by sucking the plant phloem, which cause yellowish speckles on the leaves, gradually causing them to curl, wither, and fall off. The decreased quality of the leaves results in poor growth and development of the B. mori, and subsequent loss of silk production. Whiteflies are not only injurious to their host plants through feeding but also capable of transmitting numerous of plant viruses. In addition, whitefly nymphs secrete the honeydew on the leaves in the lower parts of the tree canopy, which induce sooty mold disease, affecting the quality of mulberry leaves (Song et al. 2011). Sericulture is very important in Asia, so the quality of mulberry is directly related to the development of sericulture.

Mulberry is a favor host plant for whiteflies. There are a total 17 species (Table 1) of whiteflies recorded from mulberry worldwide including 8 species from India (Bandyopadhyay et al. 1999, David and Ragupathy 2004). The majority of these species are widely distributed and considered to be economically important. Since 1991, Pealius mori (Takahashi) has become a major pest in mulberry, and outbreaks of the pest often occur in southwestern and eastern China (Xiong et al. 2011). To determine the identity and incidence of whitefly species on mulberry in China, a survey was conducted from 2008 to 2011 in locations in 16 provinces of China.

Materials and Methods

Specimens were collected in mulberry groves in 16 provinces of China (Heilongjiang, Liaoning, Jilin, Beijing, Shandong, Shanxi, Anhui, Zhejiang, Jiangxi, Hubei, Guangdong, Guangxi, Guizhou, Yunnan, Sichuan, and Chongqing) by Z.-Q. Song and J.-R. Wang. Specimens were mounted by using the method suggested by Martin (1987) and examined with an MZ APO Leica microscope (Wetzlar, Germany). Some specimens were prepared and observed with the environmental scanning electron microscope (ESEM), and digital images were taken. Mulberry leaves infested with whitefly puparia were cut into small squares, which were then attached with a black carbon conductive adhesive and placed on the sample stage. They were then examined using a Philips XL30-ESEM (Amsterdam, Nederland) at 20 kV per EHT and 66.7–120 Pa between 150× to 1,600× to observe them and take digital images.

As for the identification, J.-R. Wang identified the whitefly specimens preliminary to genus, through referring to the literature of all the species of this genus and made sure what species the specimen was. They were sent to A. K. Dubey (Forest Entomology Division, Forest Research Institute, New Forest, Dehradun, India) and B. V. David (International Consultant [GLP], 76/2A Sree Ramulu st., Madanandapuram) for confirmation of identification.

Taxonomic Accounts. In total, 10 species representing 7 genera of the subfamily Aleyrodinae were identified, including 6 new record species of whiteflies in mulberry, namely, Aleuroclava ficicola Takahashi, Aleuroclava gordoniae (Takahashi), Aleurotuberculatus ficicola (Kuwana), Bemisia afer (Priesner & Hosny), Bemisia tabaci Gennadius, Pealius machili Takahashi, and other 4 recorded species in mulberry, namely, Aleuroclava psidi (Singh), Aleurolobus marlatti (Quaintance), Pealius mori (Takahashi), and Parabemisia myricae (Kuwana). The pest status, illustrations, brief descriptions and information on the taxonomy, distribution worldwide, and hosts found in China of each of these six newly recorded species is provided. The result provides a detailed key for field identification of the whiteflies in mulberry from China. The illustrations also act as an additional tool for the identification of whitefly species.

Distribution. China (Zhejiang, Taiwan).


ALEUROCLAVA GORDONIAE (Takahashi) (Figs. 3–5).


*Aleuroclava gordoniae* (Takahashi); Martin, 1999: 31.

Diagnosis. Puparium black, without wax secretion. Oval, markedly narrowed on both anterior and posterior margin. Longitudinal and transverse molting sutures reaching the margin; abdominal segments distinct on the median area. Dorsal disk with many small granules except on the median area of abdomen and the margin area, some minute circular pores, and many lineal markings on the marginal area. Submarginal with many transverse ridges which are rounded. Thoracic tracheal folds faintly discernible, the clefts small, not forming a pore; caudal furrow distinct. Vasiform orifice small, wider than long. Operculum nearly filling the orifice. Lingula not exposed.


Distribution. China (Jiangsu, Hong Kong, Taiwan).

Host plants. *Schefflera octophylla* (Lour.) Harms, *Cinnamomum camphora* (L.) Presl, *Cinnamomum japonicum* Siebold, *Ficus retusa*

---

Table 1. The whitefly recorded from mulberry in the world

<table>
<thead>
<tr>
<th>Species</th>
<th>Distribution</th>
<th>Citation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 <em>Acaculeyronodes rachipora</em> (Singh)</td>
<td>India, Iran, and Israel</td>
<td>Evans (2008)</td>
</tr>
<tr>
<td>2 <em>Aleurocanthus lobulus</em> Jesudasan &amp; David</td>
<td>India</td>
<td>David and Ragupathy (2004)</td>
</tr>
<tr>
<td>3 <em>Aleuroclava aucubae</em> (Kuwana)</td>
<td>China and Japan</td>
<td>Martin (1999)</td>
</tr>
<tr>
<td>4 <em>Aleuroclava davidii</em> (Qureshi)</td>
<td>Pakistan</td>
<td>Martin (1999)</td>
</tr>
<tr>
<td>5 <em>Aleuroclava pentatuberculato</em> Sundararaj &amp; David</td>
<td>India</td>
<td>David and Ragupathy (2004)</td>
</tr>
<tr>
<td>6 <em>Aleuroclava psidi</em> (Singh)</td>
<td>India</td>
<td>David and Ragupathy (2004)</td>
</tr>
<tr>
<td>7 <em>Aleurodicus dispersus</em> Russell</td>
<td>India</td>
<td>David and Ragupathy (2004)</td>
</tr>
<tr>
<td>8 <em>Aleurolobus marlatti</em> (Quaintance)</td>
<td>India</td>
<td>David and Ragupathy (2004)</td>
</tr>
<tr>
<td>9 <em>Aleuroplatus altocili</em> (Peal)</td>
<td>India</td>
<td>David and Ragupathy (2004)</td>
</tr>
<tr>
<td>10 <em>Aleuroplatus pectiinerus</em> Quaintance &amp; Baker</td>
<td>India, Pakistan, and Sri Lanka</td>
<td>Martin and Mound (2007)</td>
</tr>
<tr>
<td>12 <em>Asterobemisia dentata</em> Danzig</td>
<td>Tadzhikistan</td>
<td>Kuwana (1922)</td>
</tr>
<tr>
<td>13 <em>Bemisia shinanoensis</em> Kuwana</td>
<td>Japan</td>
<td>Bandyopadhyay et al. (1999)</td>
</tr>
<tr>
<td>14 <em>Dialeuropora decempuncta</em> (Quaintance &amp; Baker)</td>
<td>India</td>
<td>Evans (2008)</td>
</tr>
<tr>
<td>15 <em>Parabemisia myricae</em> (Kuwana)</td>
<td>Japan</td>
<td>Takahashi (1932) and David and Ragupathy (2004)</td>
</tr>
<tr>
<td>16 <em>Pealius mori</em> (Takahashi)</td>
<td>China and India</td>
<td>Quaintance and Baker (1914)</td>
</tr>
<tr>
<td>17 <em>Tetraleurodes mori</em> (Quaintance)</td>
<td>The United States</td>
<td>Quaintance and Baker (1914)</td>
</tr>
</tbody>
</table>

**Aleurotrachelus camelliae (Kuwana)** (Figs. 6 and 7).

Aleyrodes camelliae Kuwana, 1911: 625.


**Distribution.** Brazil, Egypt, France, Iran, Israel, Italy, Sicily, and Spain; Cameroon, Chad, Congo, Guinea, Ivory Coast, Kenya, Madagascar, Malawi, Niger, Nigeria, Sierra Leone, South Africa, Sudan, Uganda, Zaire, China (Beijing, Shaanxi), Korea, India, Pakistan, Australia, and New Guinea (Evans 2008).

**Host plants.** Lonicer a sp., M. alba L., Robinia pseudacacia L., Rosa chinensis Jacq., and Rosa multiflora Thunb. in China. In addition, 20 plant families are reported as hosts in Europe and Mediterranean countries (Mound and Halsey 1978; Evans 2008).

**Bemisia tabaci Gennadius (Figs. 10 and 11).**

**Diagnosis.** Puparium oval, margin finely crenate, marginal setae present, and tracheal pore areas not differentiated from margin. Submargin not separate from the dorsal disc. Vasiform orifice triangular, with some posterior tubercles. Operculum semicircular, filling about one half of vasiform orifice, lingual elongate with tip exposed. Caudal ridges and furrow present. Vasiform orifice longer than length of caudal furrow; caudal setae always stout at least as long as length of vasiform orifice whose sides are almost straight (Suh and Hodges 2008).

**Material examined.** Six puparia, China, Shangrao (28.27° N, 117.58° E), Jiangxi Province, from M. alba, 15/2010, Coll. J.-R. Wang, deposited in Yangzhou University.

**Distribution.** Worldwide.

**Host plants.** Hundreds of plant species including many kinds of vegetables.

**Pealius machili Takahashi (Figs. 12–14).**

**Pealius machili Takahashi, 1935: 62.**
Diagnosis. Puparium white, elliptic, with a very narrow secretion along the margin. Sixteen pairs of setae along the margin, all subequal in length, each arising from a small tubercle. Midthoracic and transverse molting sutures reaching the margin, many very small rounded papillae joining the lateral part of transverse molting suture. Meso- and metanota, base of abdominal segments I–VI each with a pair of markings in the median area. Vasiform orifice nearly rectangular, operculum semicircle, filling two thirds of vasiform orifice. Lingula exposed and extends to the bottom of the vasiform orifice. Caudal furrow distinct, longer than the vasiform orifice, granulated.


Distribution. China (Jiangxi, Taiwan).


1. Puparium black...............................................................2
   - Puparium white or yellowish.........................................4
2. Eye spots crescent shaped distinct; margin rim marked by a large number of light transparent sutures extending beyond the margin; vasiform orifice triangular...........................Aleurot. marlatti
   - Eye spots indistinct; margin rim without the light transparent sutures extending beyond the margin; vasiform orifice subcordate .........................3

3. Puparium outline almost octagonal and covered by a thin transparent wax .................................................................Aleurot. camelliae
   - Puparium oval and not covered by a thin transparent wax .................A. gordoniae

4. With many pairs of short setae in a row along the whole margin......
   - With many pairs of short setae in a row along the whole margin .........5

5. With transparent secretions extending from case margin all around; dorsum without any small circular pores .........................Pa. myricae
   - Without transparent secretions extending from case margin all around; dorsum without some small circular pores ..........................6

6. Sixteen pairs of setae along the margin, transverse suture with many very small rounded papillae in a row on the lateral part... P. machili
   - Fourteen pairs of setae along the margin, transverse suture without any very small rounded papillae in a row on the lateral part............P. mori
7. Puparium with T-shaped tubercle on cephalothorax, dorsum with numerous very small papillae and granules......................... A. psidii
- Puparium without T-shaped tubercle on cephalothorax, dorsum without numerous very small papillae and granules......................... B. tabaci.
- Cephalothorax with five pairs of short blunt tubercles, median abdominal tubercles present on segments one to seven, vasiform orifice rounded ................................................................. A. ficicola.
- Cephalothorax without short blunt tubercles, median abdominal tubercles absent on segments one to seven, vasiform orifice triangular ................................................................. B. tabaci.
- Vasiform orifice longer than length of caudal furrow; caudal setae always stout at least as long as length of vasiform orifice whose sides are almost straight ................................................................. 8
- Vasiform orifice as long as, or shorter than length of caudal furrow; caudal setae usually stout shorter than length of vasiform orifice whose sides are usually distinctly concave ................................................................. B. afer.

Acknowledgments

We express our deep gratitude to the Testing Center of Yangzhou University for using the Philips XL30-Environmental Scanning Electron Microscope. This research was supported by Special Fund for Agro-Scientific Research in the Public Interest of China (201303019 and 200803005).

References Cited


Received 15 November 2013; accepted 17 March 2014.