

Contribution to the knowledge of Chinese species of *Acanthaleyrodes* Takahashi (Hemiptera: Aleyrodidae)

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Abstract: Two species in the genus *Acanthaleyrodes* Takahashi (Hemiptera: Aleyrodidae) from China, *A. callicarpae* Takahashi and *A. styraci* Takahashi are reported in this paper. The diagnosis, distribution, host plant and morphological illustrations of these two species are provided. An identification key to the puparia of Chinese *Acanthaleyrodes* species is given.

Key words: whiteflies; taxonomy; new record; key; China

中国针粉虱属 *Acanthaleyrodes* Takahashi 种类研究 (半翅目: 粉虱科)

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摘要: 对粉虱科针粉虱属 *Acanthaleyrodes* 2 个种——杜虹针粉虱 *A. callicarpae* Takahashi 和安息香针粉虱 *A. styraci* Takahashi 进行了分类研究, 提供了这 2 种粉虱的鉴别特征、分布、寄主植物及形态图。以伪蛹特征编制了中国针粉虱属分种检索表。

关键词: 粉虱; 分类; 新记录; 检索表; 中国

Introduction

The genus *Acanthaleyrodes* was originally established by Takahashi (1931), with *A. callicarpae* as its type species by monotypy. Only three known species hitherto have been placed in this genus. Takahashi (1931) described *A. callicarpae* from *Callicarpa formosana* and *Mallotus* sp. from Taiwan. Young (1944) recorded this same species from *Rubus* sp. in Sichuan, China, but Dubey considered the puparia Young determined as *A. callicarpae* as possibly representing an undescribed species which different from *A. callicarpae*. Martin & Lau (2011) also commented that Young's description account did not match other *A. callicarpae* specimen. We tried to examine Young's materials in Shanghai Entomological Museum, but these materials have been lost. But through checking the description and picture, Young's species differs from *A. callicarpae* by the presence of median abdominal depressions,

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the absence of the median abdominal tubercles, and the number of tuberculate setae. We do not attempt to discuss this species further here because of the absence of additional study material. Corbett (1933) described *A. spinifera* on *Diospyros* sp. from Malaya, while Martin and Mound (2007) transferred it to *Tuberaleyrodes* after studying Corbett's materials. Takahashi (1942) described *A. styraci* from *Styrax* sp. in Thailand. Martin & Lau (2011) recorded *A. styraci* on *Rubus reflexus* from Hong Kong. Dubey *et al.* (2014) described *A. elevates* from *Bridelia retusa* in Kerala, India, as a new record of *Acanthaleyrodes* from India. In addition, Dubey *et al.* (2014) compared the morphology of *A. callicarpae* with *A. styraci* and redescribed them in detail with illustrations of puparia and immatures; the generic characteristics of *Acanthaleyrodes* were also redefined and distinguished from those of *Tuberaleyrodes*.

Here we collected *A. callicarpae* and *A. styraci* from China, both being newly recorded from mainland China. As descriptions of these two species were provided by Takahashi (1931, 1942) and Dubey *et al.* (2014), we do not redescribe them here. The diagnostic characters and the host plants (Table 1) of *Acanthaleyrodes* species are provided.

Table 1. Host plants of *Acanthaleyrodes* species

Whitefly species	Host plant family	Host plant species	Citation
	Verbenaceae	<i>Callicarpa formosana</i>	Takahashi (1931)
	Euphorbiaceae	<i>Mallotus</i> sp.	Takahashi (1931)
	Euphorbiaceae	<i>Mallotus japonicus</i>	new record
<i>Acanthaleyrodes callicarpae</i> Takahashi	Rosaceae	<i>Rubus</i> sp.	Takahashi (1933)
	Rosaceae	<i>Rubus lambertianus</i>	new record
	Rosaceae	<i>Sanguisorba officinalis</i>	new record
	Vitaceae	<i>Vitis vinifera</i>	Mound & Halsey (1978)
<i>Acanthaleyrodes styraci</i> Takahashi	Styraceae	<i>Styrax</i> sp.	Takahashi (1942)
	Rosaceae	<i>Rubus reflexus</i>	Martin & Lau (2011)
	Rosaceae	<i>Rubus pacificus</i>	new record
<i>Acanthaleyrodes elevatus</i> Dubey	Euphorbiaceae	<i>Bridelia retusa</i>	Dubey <i>et al.</i> (2014)

Material and methods

Puparia of *A. callicarpae* were collected from Dayao Mountain, Guangxi; Shuangxikou, Qingliangfeng Nature Reserve, Zhejiang and from Hualian, Taiwan. *A. styraci* were collected from Gutian Mountain and Tonglu, Zhejiang. Specimens were mounted following the method given by Dubey & David (2012). The terminology for morphological structures follows Bink-Moenen (1983), Martin (1985) and Gill (1990). The measurements and camera lucida drawings were made using an OLYMPUS microscope BX63. The Scanning Electron Microscope images were taken by a Philips XL30-Environmental Scanning Electron Microscope at 20 kV/EHT and 80 Pa between 160× to 1271× magnification. The specimens are deposited in the Insect Collection of Zhejiang Agriculture & Forestry University.

Taxonomy

Acanthaleyrodes Takahashi, 1931

Acanthaleyrodes Takahashi, 1931: 220. Type species: *Acanthaleyrodes callicarpae* Takahashi, by monotypy.

Diagnosis. Puparia white or yellowish, elliptical, dorsal disk without wax secretion, submarginal area not separated from dorsal disc, subdorsal area with wavy corrugations. Margin crenulate, some species with some deep irregular indentations on the margin. With some pairs of long tuberculate setae on the dorsal disk; longitudinal moulting suture reaching margin and transverse moulting suture reaching submedian area. Vasiform orifice subcordate or cordate, operculum almost covering all the orifice. Caudal furrow distinct (Dubey *et al.* 2014; Takahashi, 1931).

1. *Acanthaleyrodes callicarpae* Takahashi (Figs. 1–3)

Acanthaleyrodes callicarpae: Takahashi, 1931. Journal of the Society of Tropical Agriculture, Taiwan, 221.

Distribution. China (Zhejiang, Guangxi, Taiwan).

Specimens examined. 13 puparia on 11 slides, on *Sanguisorba officinalis*, China, Zhejiang, Shuangxikou, 18-VII-2018, Coll. Jirui WANG; 5 puparia on 5 slides, on *Rubus lambertianus*, Zhejiang, Qingliangfeng Nature Reserve, 04-VIII-2016, Coll. Jirui WANG; 8 puparia on 6 slides, on *Mallotus japonicas*, Guangxi, Dayao Mt., 24-VII-2011, Coll. Jirui WANG. 6 puparia on 4 slides, on *Rubus lambertianus*, Zhejiang, Qingliangfeng Nature Reserve, 04-VIII-2016, Coll. Jirui WANG. 7 puparia on 3 slides, on *Callicarpa formosana*, Taiwan, Hualian, 24-XII-2018, Coll. Zhirong LIAO. 2 puparia on 1 slides, on *Callicarpa formosana*, Taiwan, Fushan, the collection date unknow, Coll. Juncheng KO. All specimens are deposited in Insect Collection of Zhejiang Agriculture & Forestry University.



Figure 1. Live image of *Acanthaleyrodes callicarpae* Takahashi from *Rubus lambertianus*: A. Puparium; B. Empty pupal case.

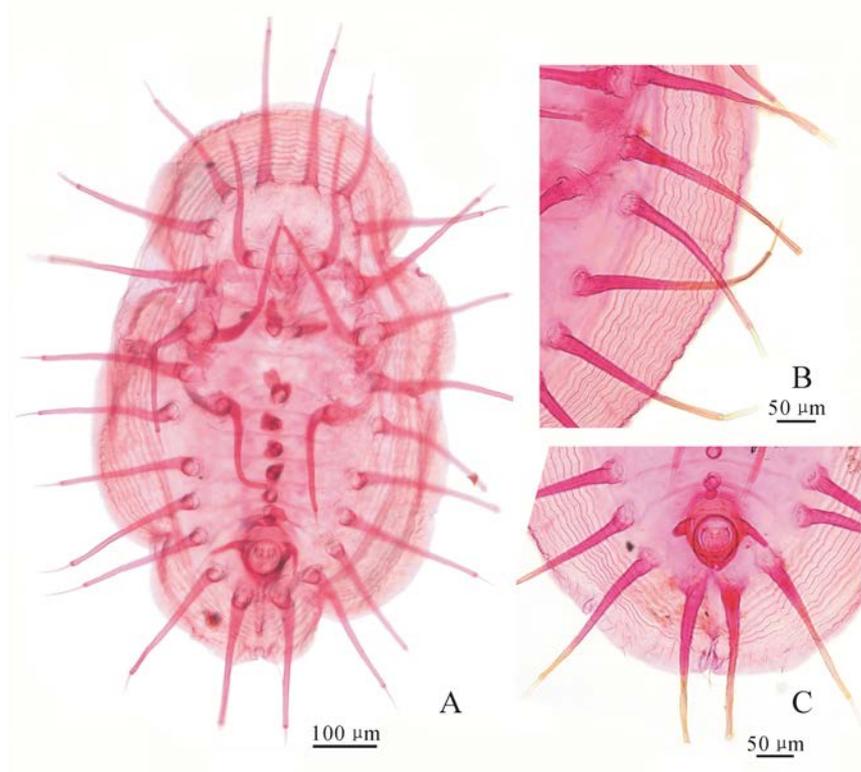


Figure 2. *Acanthaleyrodes callicarpae* Takahashi, slide mounted specimen: A. Puparium; B. Margin and submarginal setae; C. Vasiform orifice and caudal furrow.

Diagnosis. Puparia yellow or white, elliptical, about 0.756 mm in length, 0.421 mm in width, without waxy secretion, with some deep irregular indentations on the margin. Margin slightly crenulate, anterior and posterior marginal setae about 56.2 µm and 75.7 µm long respectively. Subdorsal with 9–11 rows of wavy corrugations. 16 pairs of tuberculate setae present on the dorsum, of the 8 pairs each on cephalothorax and abdomen, about ranges in value 131–236 µm. Thoracic and abdominal segment sutures well-defined, median tubercles present on metathorax and abdominal segments I–VII. Vasiform orifice slightly elevated, cordate, without teeth, a little longer than wide, about 72.6 µm long, 60.6 µm wide. Operculum squarish, 40.8 µm long, 36.2 µm wide, almost covering all the orifice. Caudal furrow distinct, narrow, about 82.7 µm long.

Remarks. Yan & Bai (2017) recorded *A. callicarpae* as referred Young (1944), as we commented on Young's species determination in the introduction, we also find that Yan & Bai also misidentified this species. Hence *A. callicarpae* is a newly recorded species to the Chinese mainland. Through the study of its recorded host plants, we find that *A. callicarpae* normally in habits hairy leaves, such as *Mallotus japonicas*, *Rubus lambertianus*, and *Sanguisorba officinalis*. When we collected this species, there were about 8–12 puparia per leaf, while the adults were very rare. So there is still a need to collect some adults to further study the adult morphological characters.

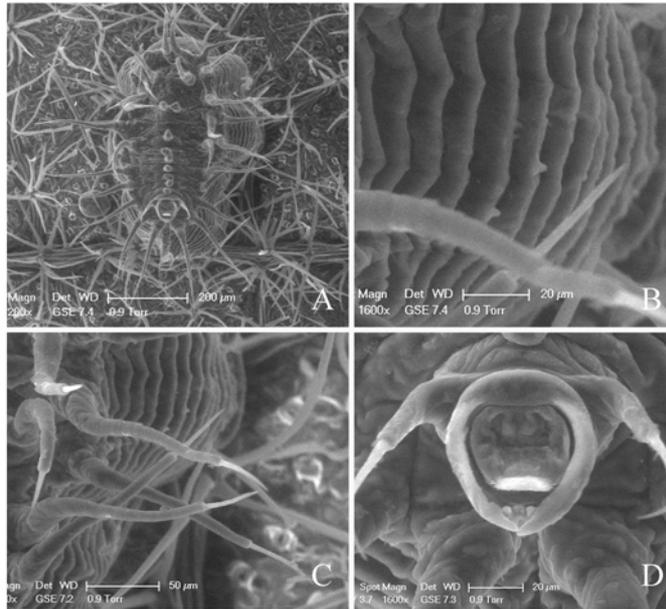


Figure 3. SEM of *Acanthaleyrodes callicarpae* Takahashi. A. Puparium; B. Margin and submargin; C. Submarginal setae; D. Vasiform orifice and caudal furrow.

2. *Acanthaleyrodes styraci* Takahashi (Figs. 4, 5)

Acanthaleyrodes styraci: Takahashi, 1942: 173.

Distribution. China (Zhejiang, Hong Kong); Thailand.

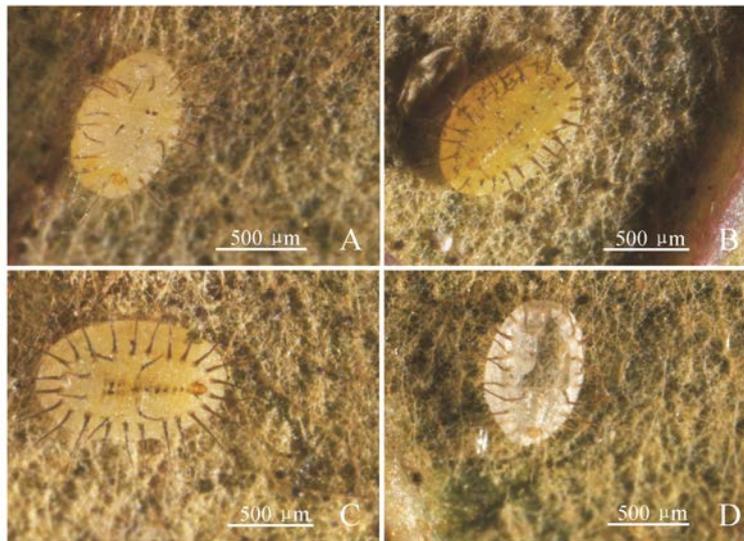


Figure 4. Live image of *Acanthaleyrodes styraci* Takahashi from *Rubus pacificus*. A. Third instar nymph; B, C. Puparium; D. Empty pupal case.

Specimens examined. China, 7 puparia on 5 slides, on *Rubus pacificus*, Zhejiang, Gutian Mt., 19-VII-2017, Coll. Jirui WANG; 4 puparia on 4 slides, on *Rubus pacificus*, Zhejiang, Tonglu, 13-V-2018, Coll. Jirui WANG. All specimens are deposited in the Insect Collection of Zhejiang Agriculture & Forestry University.

Diagnosis. Puparia yellowish in life, becoming transparent after emergence of adults, elliptical, about 1.11 mm in length, 0.737 mm in width, without waxy secretion. Margin irregularly crenulate, anterior and posterior marginal setae about 68.5 μm and 82.3 μm long respectively. Submargin with small lines reaching subdorsal wavy lines. Many small papillae present on the sub-dorsum, especially on the thoracic and abdominal segments. 16 pairs of tuberculate setae present on the dorsum, brown, of the 8 pairs each on cephalothorax and abdomen, ranging in value 1581–2870 μm . Median tubercles present on metathorax and abdominal segments I–VII. Vasiform orifice cordate, about 85.7 μm long, 73.4 μm wide. Operculum subcordate, 45.5 μm long, 42.4 μm wide, almost covering all of the orifice. Caudal furrow distinct, narrow, about 95.6 μm long.

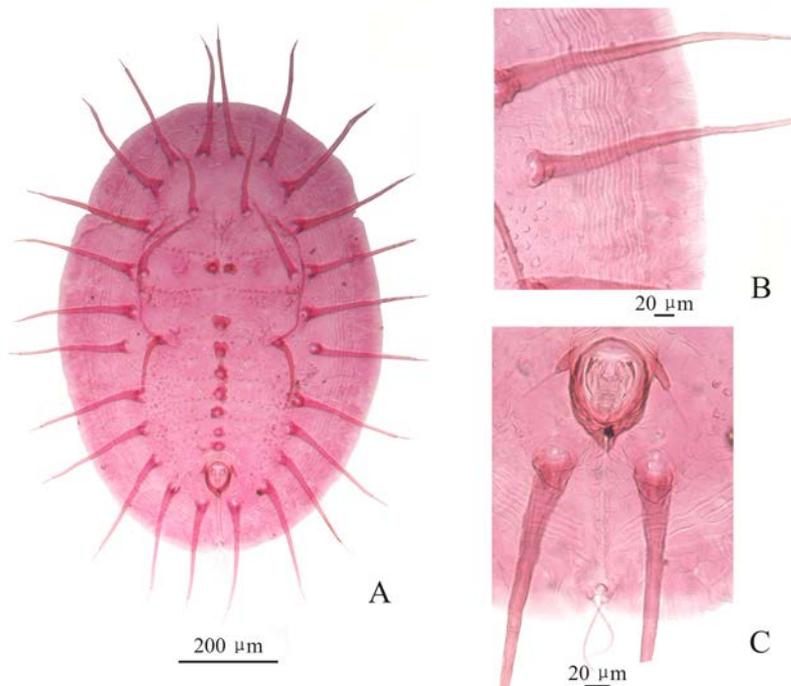


Figure 5. *Acanthaleyrodes styraci* Takahashi, slide mounted specimen. A. Puparium; B. Margin and submarginal setae; C. Vasiform orifice and caudal furrow.

Remarks. *A. styraci* is also a newly recorded species to the Chinese mainland. And we found *A. styraci* infesting *Rubus pacificus* in Zhejiang. Dubey *et al.* (2014) provided brief descriptions of the puparium, third instar and second instar of *A. styraci*. The puparia of *A. styraci* is very similar to *A. callicarpae* by having 16 pairs of long tuberculate setae on dorsum; submarginal area with many parallel wavy lines encircling the case; the median tubercles are presents on the metathorax and abdominal segments I–VII, but differs by the presence of many small papillae present on the sub-dorsum, especially on the thoracic and abdominal segments.

Key to the puparia of *Acanthaleyrodes* species from China

1. Puparia yellow or white, elliptical, about 0.756 mm in length, 0.421 mm in width; with some deep irregular indentations on the margin; subdorsal tuberculate setae white; operculum squarish.....
..... *Acanthaleyrodes callicarpae*
- Puparia yellowish in life, becoming transparent after emergence of adults, about 1.11 mm in length, 0.737 mm in width; margin without irregular indentation; subdorsal tuberculate setae brown.....
..... *Acanthaleyrodes styraci*

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