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DESCRIPTION OF A NEW SPECIES OF *TUBERALEYRODES* (HEMIPTERA: ALEYRODIDAE) FROM CHINA

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ABSTRACT

Tuberaleyrodes lauri Dubey and Wang new species (Hemiptera: Aleyrodidae) is described from China on *Cinnamomum subavenium* (Laurales: Lauraceae). The puparium of the new species differs from that of all other *Tuberaleyrodes* species by the presence of 6 to 8 pairs of subdorsal setae placed on long elevated tubercles, 8 pairs of small submarginal setae, an operculum that completely covers the orifice and reduced median length of abdominal segment VII. An identification key to puparia of the *Tuberaleyrodes* species is provided.

Key Words: *Cinnamomum subavenium*, key, tuberculate setae, whitefly

RESUMEN

Se describe *Tuberaleyrodes lauri* Dubey y Wang (Hemiptera: Aleyrodidae), una nueva especie recolectada sobre *Cinnamomum subavenium* (Laurales: Lauraceae) de China. El pupario de la nueva especie difiere de todas las otras especies del género *Tuberaleyrodes* por la presencia de 6 a 8 pares de setas subdorsales colocadas en tubérculos largos y elevados, 8 pares de setas submarginales cortas, el opérculo que cubre completamente el orificio y la longitud mediana de segmento abdominal VII reducida. Se provee una clave de identificación para los puparios de las especies del género *Tuberaleyrodes*.

Palabras Clave: *Cinnamomum subavenium*, clave, setas tuberculadas, mosca blanca

The genus *Tuberaleyrodes* (Hemiptera: Aleyrodidae) comprises 5 species worldwide (Martin & Mound 2007). Puparia of *Tuberaleyrodes* species have dorsal setae on elongated tubercles, and the pattern of tuberculation is useful for species identification (Dubey et al. 2008). However, the length of the dorsal tubercles is found to vary with the nature of leaf surface. *Tuberaleyrodes* species are usually found feeding on Lauraceous hosts and are likely to be confused due to intraspecific variations. For instance, according to the literature, *T. machili* var. *actinidaphnis* Takahashi is a variety of *T. machili* Takahashi found on different genera of Lauraceae. Currently, *T. machili actinodaphnis* remains as a synonym of *T. machili*, however, further examinations of type specimens are needed to confirm their synonymy.

MATERIALS AND METHODS

Puparia of the new species were collected by J. R. Wang from Daming Mountain in South-Central Guangxi Province of China. Puparia were mounted following techniques in Martin (1987). The terminology for morphological structures follows Bink-Moenen (1983), Martin (1985) and Gill (1990). The holotype is deposited in the Institute of Applied Entomology, College of Horticulture and Plant Protection, Yangzhou University, China. One paratype each will be deposited in the Australian National Insects Collection, Canberra, Australia; Natural History Museum (NHM), London, UK; United States Department of Agriculture (USDA), Beltsville, Maryland, USA and Zoological Survey of India (ZSI), Kolkata, India, and the remaining paratypes are deposited at the Yangzhou University and in A. K. Dubey's (AKD) personal collection in New Delhi, India. The measurements and camera lucida drawings were made using a MZ APO Leica microscope. Scanning Electron Microscope images were taken with a Philips XL30-Environmental Scanning Electron Microscope at 20 kV/EHT and 66.7 Pa.

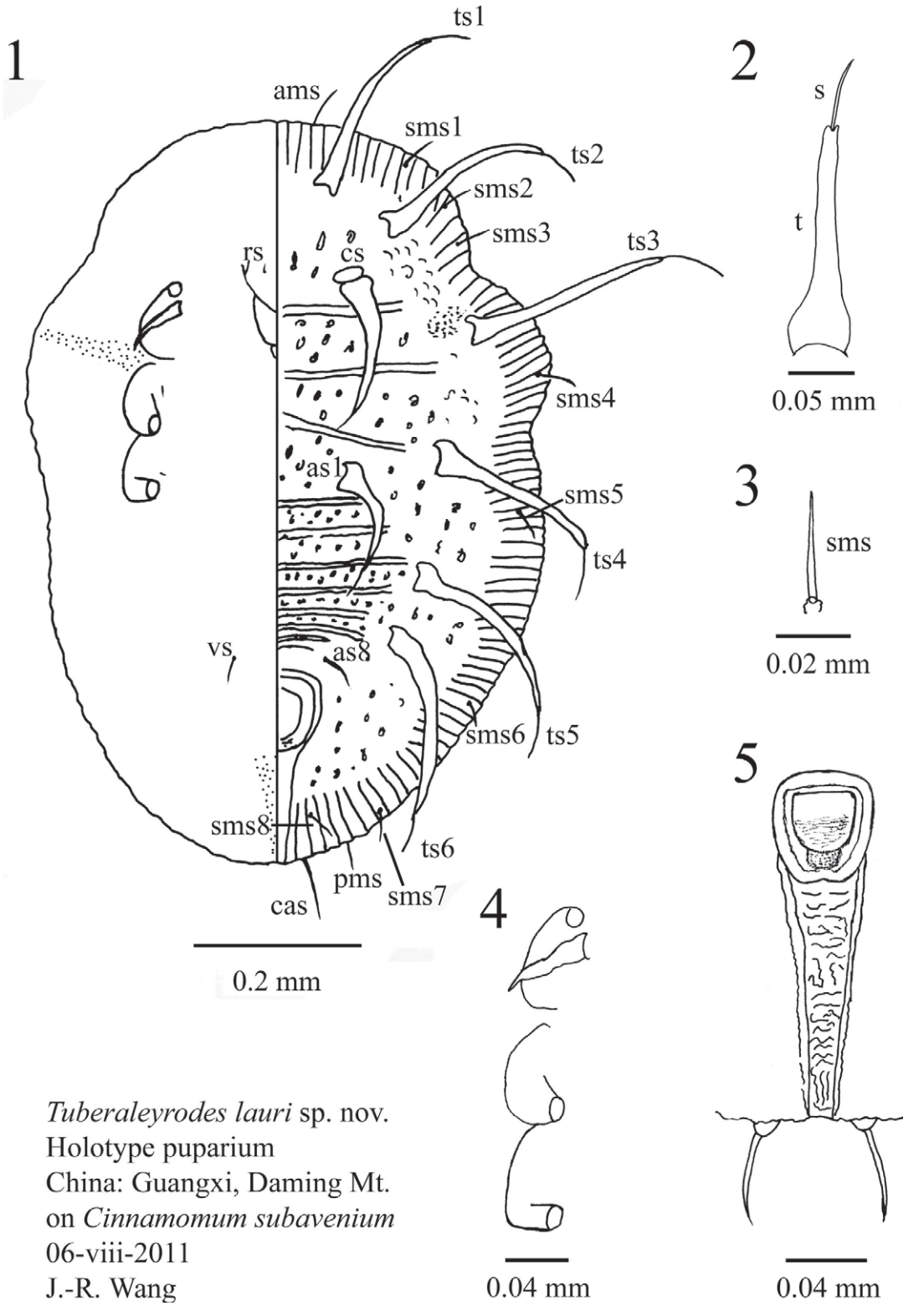
TAXONOMY

Tuberaleyrodes lauri **sp. nov.** Dubey & Wang (Figs. 1-10)

Puparium

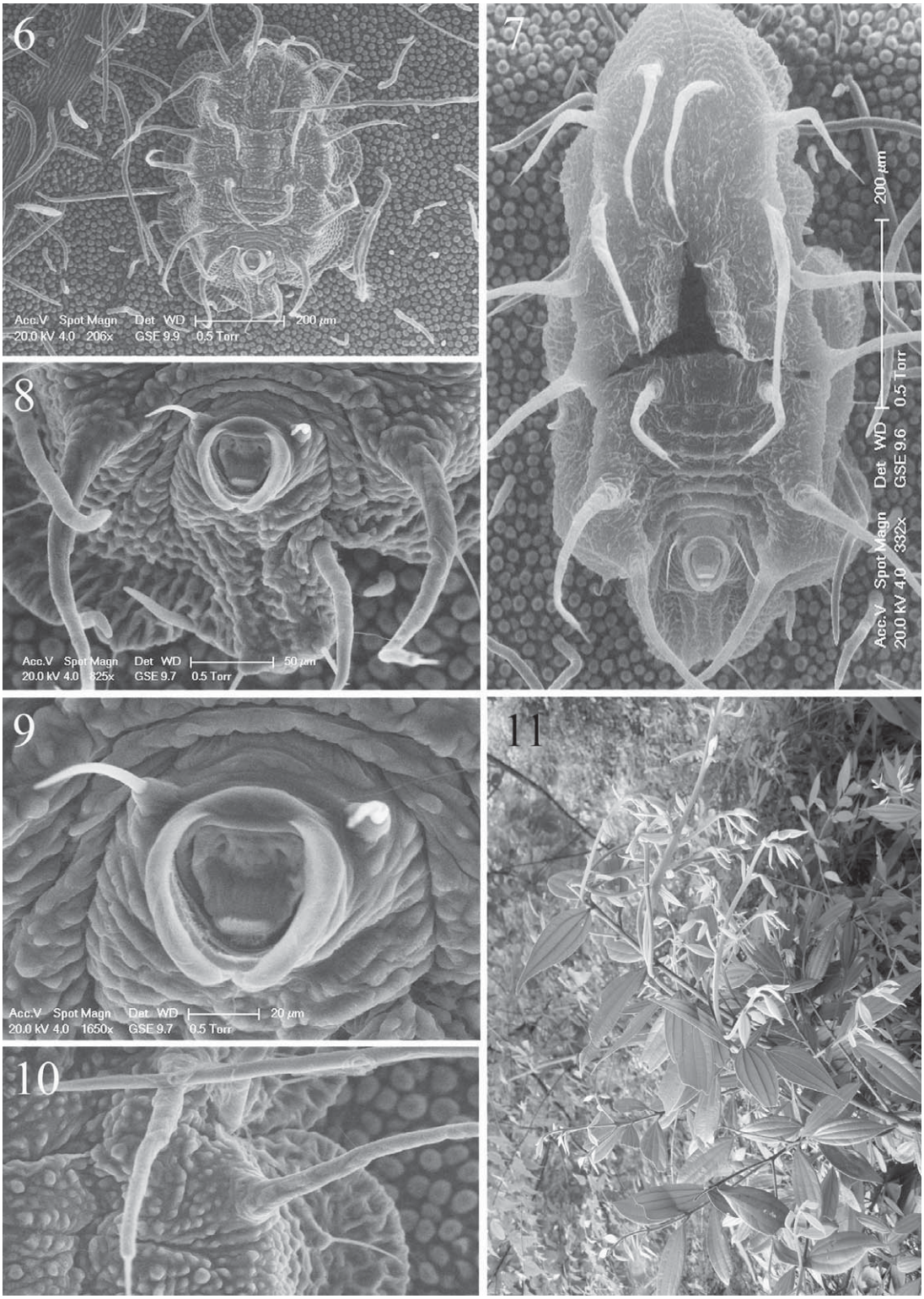
Light yellow, suboval, found on the lower surface of leaves, 860-920 µm long, 610-660 µm wide.

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Figs. 1-5. *Tuberaleyrodes lauri* **sp. nov.** 1, puparium, dorsal and ventral views. 2, tuberculate seta. 3, submarginal seta, 4, legs and antenna, 5, vasiform orifice and caudal furrow.

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Figs. 6-11. SEM of *Tuberaleyrodes lauri* **sp. nov.** and host plant, 6. puparium, habitus, 7, empty pupal case, 8, caudal furrow, 9, vasiform orifice, 10, tuberculate seta, 11, host plant *Cinnamomum subavenium* (Laurales: Lauraceae).

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Margin

Irregularly and smoothly crenulate, 15-16 crenulations in 0.1 mm. Margin not modified at thoracic tracheal pore openings, but slightly emarginated at caudal tracheal pore opening.

Dorsum

Elongate tubercles (t) tapering and variably curved (= falcate), 195-327 µm long, apically with a seta (s), 32-40 µm long (Figs. 1 and 2; ts). Tuberculate setae are formed from dorsal elevation of puparial cuticle, ts slightly swollen on puparial surface and without articulating circle or groove, surface puffy, with ridges or grooves or minute tubercles, not smooth, gradually narrowing towards apex and forming a socket in which apical seta is fixed. Submargin not separated from the dorsal disc. Six pairs of subdorsal tubercle-setae —2 cephalic pairs, 1 prothoracic pair, 3 pairs on abdominal segment I and IV & VII, position varies on cadual area. Length of subdorsal tubercles were subequal to cephalic tubercles 195-327 µm long, but actual length of apical seta on elongate tubercle measured 32-40 µm long.

Eight pairs of submarginal setae (sms): 4 pairs each on cephalothorax and abdomen. 3 pairs sms on cephalothorax, 1 pair sms laterad of metathorax; 1 pair sms laterad of abdominal segment II, and 3 pairs sms laterad of segment VII to caudal end; sms length variable, 7-47 µm long, length varied within a puparium from 4 to 42 µm long, sms on posterior abdomen usually smaller than others.

Cephalic setae (cs) and first abdominal setae (as1) on elevated tubercles, eighth abdominal (as8) and caudal setae (cs) not on elevated tubercles.

Submedian pockets (smp) were visible on cephalothoracic and abdominal segment sutures. Dorsal pores (dp) located on minute tubercles, a row each in submargin and submedian area, dorsal pores irregularly located on subdorsum. Median length of abdominal segment VII 20 µm long almost half the length of segment VI. Thoracic tracheal furrows absent but caudal furrow indicated, filled with irregular ridges resembling those of dorsal crenulations, 100-105 µm long, 15 µm wide.

Vasiform Orifice

Subcordate, as long as wide or slightly longer than wide, 53-67 µm long, 52-67 wide; posterior edge elevated; operculum subcordate, almost covering the orifice, 30-37 µm long, 36-37 µm wide; lingula tip exposed, simple lobe, not extending beyond the posterior margin of the vasiform orifice. No paired apical setae observed on lingula.

Venter

Paired ventral abdominal setae, 27-50 µm long, 22 µm apart; paired meso-, and metathoracic setae, 3 µm long; paired rostral setae, 2 µm long. Antennae reaching near the base of prolegs, 70-80 µm long, keel 5 µm long. Thoracic and caudal tracheal folds indicated with stipples. Spiracles visible.

Chaetotaxy

Anterior marginal setae 20-22 µm long, posterior marginal setae 27-42 µm long. Cephalic setae 287-335 µm long of which the actual length of setae located on tip of elevated cuticle measured 30-40 µm long. Similarly, the first abdominal setae measured 152-296 µm long, the length of first abdominal setae was slightly shorter than cephalic setae, sometimes the cephalic setae was observed along the subdorsal setae. The number of subdorsal setae found one pair more or less in each half of the puparium. Eighth abdominal setae 77-100 µm long and caudal setae 78-100 µm long.

Host Plant

Cinnamomum subavenium Miq. (Laurales: Lauraceae). (Fig. 11)

Material Examined

HOLOTYPE, China: Guangxi, Daming Mt., 1 puparium on slide, on *Cinnamomum subavenium*, 06.viii.2011, J.-R. Wang (YU).

PARATYPES: 17 puparia on 16 slides, data same as of holotype (AKD-5, ANIC-1, NHM-1, USDA-1, ZSI-1 & remaining in Yangzhou University, China). (see details of acronyms in Material and Methods)

Etymology

The species name *'lauri'* is derived from the family of the host plant, Lauraceae.

Key to the Puparia of *Tuberaleyrodes* Species

1. Eight pairs of simple submarginal setae present along the bases of tuberculate setae . . . . . *lauri* **sp. nov.** Dubey & Wang

—. Eight pairs of simple submarginal setae absent along the bases of tuberculate setae 2

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2. Tuberculate setae not reaching beyond the puparial margin; meso- and metathoracic setae absent . . . . . *spiniferosa*

—. Tuberculate setae setae reaching beyond the puparial margin and at least mesothoracic setae present; submarginal setae placed on small tubercles not reaching beyond puparial margin 3

3. Puparia elliptical; all or at least most of the submarginal setae reaching beyond the puparial margin 4

—. Puparia oval; none of the submarginal setae reaching beyond the puparial margin 5

4. Caudal setae fixed in basal sockets or placed on elevated tubercles; metathoracic setae absent; abdominal submedian/subdorsal area without setae. . . . . .*rambutana*

—. Caudal setae not fixed in basal sockets/elevated tuberclesabdominal submedian/subdorsal area with setae 5

5. Thoracic tracheal area with clear cleft; meso- and metathoracic setae absent; submedian area of cephalothorax and abdomen with a longitudinal row of tubercles . . . . . *bobuae*

—. Thoracic tracheal area with slight indentation, cleft absent; meso- and metathoracic setae present; submedian area of cephalothorax and abdomen without longitudinal row of tubercles 6

6. Puparium pale; ventral submarginal area without a fold along puparial margin; submedian area of metathorax with a pair of tubercles cluster, usually pigmented; median tubercles absent on abdominal segments, but tubercles along the segment sutures present . . . . . *machili*

—. Puparia grayish black; ventral submarginal area with a fold along puparial margin; submedian area of metathorax without a pair of tubercles cluster, not pigmented; median tubercles present on abdominal segments . . . . . *neolitseae*

Remarks

The new species differs from all the known *Tuberaleyrodes* species by the presence of subdorsal setae placed on elongate tubercles that reach well beyond the lateral margin, 8 pairs of minute submarginal setae placed approximate to the row of subdorsal setae, tuberculate dorsum and the median length of abdominal segment VII nearly half of VI. It resembles *T. rambutana* Takahashi by the presence of longer dorsal setae, but differs from it in shape and by the absence of mesothoracic setae. It also resembles *Acanthaleyrodes callicarpae* Takahashi, but differs from it by the absence of wavy markings on submarginal/subdorsal area. *Tuberaleyrodes* and *Acanthaleyrodes* share some common characteristics such as dorsally elevated tuberculate setae but the latter differs by the presence of posteriorly an elevated vasiform orifice.

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