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Description of a grass feeding whitefly of the genus *Tetraleurodes* (Hemiptera: Aleyrodidae) from the Indo-Myanmar border

Anil Kumar Dubey[1] *and V. V. Ramamurthy*[2,*]

ABSTRACT

A new species of whitefly, *Tetraleurodes champaiensis* Dubey **sp. nov.** (Hemiptera: Aleyrodidae) found infesting *Sporobolus heterolepis* (Poaceae) in Mizoram (India) is described along with measurements, line drawings and scanning electron microscope images. The species differs from *Tetraleurodes thenmozhiae* Jesudasan & David in being black in color and have bluntly pointed dorsal setae. The puparia of *T. thenmozhiae* are white and have capitate dorsal setae. The puparia of the new species were found feeding at the basal parts of central grass blades and almost near the ground level. An identification key to grass feeding *Tetraleurodes* species is provided. There was no ant attendance.

Key Words: *champaiensis*, Poaceae, *Sporobolus heterolepis*, Mizoram, whitefly

RESUMEN

Se describe con medidas, dibujos de línea e imágenes obtenidas con el microscopio electrónico de barrido, una nueva especie de mosca blanca, *Tetraleurodes champaiensis* Dubey **sp. nov.** (Hemiptera: Aleyrodidae) que se encontró infestando *Sporobolus heterolepis* (Poaceae) en Mizoram (India). La especie se diferencia de *Tetraleurodes thenmozhiae* Jesudasan & David por tener la cutícula del color negro, la presencia de setas mesotoracicas y setas puntiagudas en el dorso. Las puparias de *T. thenmozhiae* son blancas y tienen setas dorsales capitadas. Las puparias de la nueva especie fueron encontradas alimentándose en la parte basal de las hojas centrales del pasto y casi cerca del nivel de tierra.

Palabras Clave: Poaceae, *Sporobolus heterolepis*, Mizoram, mosca blanca

The genus *Tetraleurodes* Cockerell (Hemiptera: Aleyrodidae) is relatively well defined among whitefly genera, that is present in all the geographical regions of the world, although it has yet to be found in the Hawaiian Islands. The genus currently includes nearly 70 species worldwide. Puparia of the genus *Tetraleurodes* are recognizable from similar genera such as, *Aleurolobus* Quaintance & Baker and *Crescentaleyrodes* David & Jesudasan mainly by the absence of the first abdominal setae and posteriorly elevated vasiform orifice. However, Martin (1999) accepted the placement of species in the genus which have a pair of "pseudosetae" located near the midline of the first abdominal segment. We consider the first abdominal setae to be absent in the species of the genus and those on or near the metathoracic legs are widely separated, not close to the midline. *Tetraleurodes* species commonly feed on monocot as well as dicot plants. Some legume (Fabaceae) feeding species have series of glandular tubercles with a central pore along the submargin of the puparium and form the *Tetraleurodes acaciae* group within *Tetraleurodes*. A search made by Gregory A. Evans in USNM whitefly collection revealed that the paratype of *T. thenmozhiae* has white puparia and the eighth abdominal setae are capitate (personal communication). The new species is close to *Tetraleurodes thenmozhiae* Jesudasan & David (1991) in its shape but differs in having a black cuticle and by the presence of pointed eighth abdominal setae. *Tetraleurodes thenmozhiae* was described from *Cinnamomum* sp. (Laurales: Lauraceae) whereas puparia of *T. champaiensis* Dubey **sp. nov.** were found infesting the basal region of grass (Poales: Poaceae) blades, almost near ground level and mostly on the central blades. Recently, Sundararaj & Pushpa (2009) provided a puparial key to the 8 *Tetraleurodes* species known to be present in India. A revision of Indian species of *Tetraleurodes* is under way by the first author and the findings will be published separately with a new key. There was no ant attendance on puparia at the time of collection.

The genus *Tetraleurodes* comprises nine grass-feeding (Poaceae) species from all over the world, of which, *T. bambusae* Jesudasan & David, *T. champaiensis* **sp. nov.**, *T. dendrocalamae* Dubey & Sundararaj, *T. pusana* Takahashi and *T. rugosus* Corbett have been described from the Oriental Region, *T. graminis* Takahashi and *T. oplismeni* Takahashi from the Palaearctic Region, and one species each *T. marshalli* Bondar and *T. andropogoni* (Dozier) from the Neotropical and Afro-tropical region, respectively. *Tetraleurodes* species feed both on monocot and dicot host plants. So far, all the above-mentioned *Tetraleurodes* species are exclusively recorded from Poaceous hosts, except *T. andropogoni*. Among these, *T. bambusae* and *T. dendrocalamae* were described from a species of bamboo and *Dendrocalamus strictus*, respectively whereas all others are from grasses (*Andropogon cicornis*, *Andropogon* sp., ?*Imperata* sp., *Oplismenus* sp. and unidentified grass). Among

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Poaceae-feeding *Tetraleurodes*, only *T. andropogoni* is found infesting ten host plants belonging to nine families, of which seven host plants are dicots belonging to seven families (Annonaceae, Euphorbiaceae, Fabaceae, Flacourtiaceae, Linaceae, Loranthaceae and Rutaceae), and three monocots belonging to two families (Arecaceae and Poaceae). The feeding behavior of *Tetraleurodes* species is less understood, *T. bambusae* is found in aggregation on the undersurface of leaves mainly near the bases of the leaves, and *T. pusana* feed along midrib of grasses (personal observation). The puparia of *T. bambusae*, *T. graminis*, *T. marshalli* and *T. oplismeni* have been reported with wax around the margin, *T. champaiensis* **sp. nov.** and *T. dendrocalamae* without wax, and no records are available on wax secretion in *T. andropogoni*, *T. pusana* and *T. rugosus*. Among these *Tetraleurodes*, *T. marshalli* is a single representative of grass-feeding species from the New World. The new species can be identified from other grass feeding *Tetraleurodes* species by using the key provided ahead.

Material and Methods

The puparia of *T. champaiensis* **sp. nov.** were collected by A. K. Dubey from *Sporobolus heterolepis* A. Gray (Poales: Poaceae) growing on hillocks along Tiau River, which forms the border of India and Myanmar. Puparia were mounted following the method given in Dubey & David (2012) and deposited in the Division of Entomology, Indian Agricultural Research Institute (IARI), New Delhi, India. These mounted slides were taken on loan and studied at the Forest Research Institute, Dehradun, India. The terminology for morphological structures follows Bink-Moenen (1983), Martin (1985) and Gill (1990). The holotype is deposited in the Division of Entomology, IARI, New Delhi. One paratype will be deposited in each of the Natural History Museum (NHM), London, UK; Aleyrodidae collection of United States Natural History Museum (USNM), United States Department of Agriculture (USDA), Beltsville, Maryland, USA and Forest Research Institute, Dehradun, India. One paratype slide bearing 14 puparia is available in the personal collection of A. K. Dubey. The remaining paratypes are deposited in the Entomology Division of IARI, New Delhi. The compound microscope DM 500 fitted with a drawing tube and digital camera Leica DFC 290 was used for drawings and microphotographs. Measurements were taken by Leica Leitz Labor Lux-S compound microscope from the Forest Research Institute, Dehradun, India. Scanning Electron Microscope study follows the method given in Dubey & Ramamurthy (2013).

Results

Tetraleurodes champaiensis Dubey **sp. nov.** (Figs. 1–12)

PUPARIUM

Cuticle dark black; without wax secretion; elongate; 846-1070 µm long, 395-618 µm wide, broadest at the metathoracic/first abdominal segment region. Puparia were found 1-6 per leaf, mostly at the basal region, almost near ground level (white part of grass blades) and on central blades of the grass, but occasionally a single puparium is observed somewhat above the basal region (green part of the grass blades).

MARGIN

Crenulate, 14-21 crenulations in 0.1 mm, each crenulation with a wax secreting gland at base. Anterior marginal setae 16-25 µm long and posterior marginal setae 32-32 µm long. Caudal and thoracic tracheal pore areas not modified in a comb or pores.

DORSUM

Submargin separated from the dorsal disc by a submarginal raised fold except the anterior and posterior submedian area. Submargin with small striations. Longitudinal moulting suture reaching margin and transverse moulting suture slightly turned anteriorly and reaching submarginal furrow. Abdominal segments rhachis-form and elevated on median area. Median length of abdominal segment VII (34 µm long) nearly 65% of the segment VI (52 µm long) but in scanning electron microscope image the abdominal segment VII appears almost equal to that of VI. The distance between posterior margin of vasiform orifice and the puparial caudal margin measured 55-73 µm long. Caudal and thoracic tracheal furrows absent. The distance between pores and porettes equal to 1-4 times of the diameter of the large pore. Submedian pockets present. Submedian depressions occupying nearly half the length of respective abdominal segment. Geminate pores present, mostly scattered on submargin and subdorsum, but present in a longitudinal row on submedian area.

CHAETOTAXY

Cephalic setae 18-20 µm, metathoracic setae 11-23 µm, eighth abdominal setae, anterolateral of vasiform orifice 9-17 µm and caudal setae 20-48 µm long. First abdominal setae absent.

VASIFORM ORIFICE

Elevated posteriorly; subcircular, slightly longer than wide, 46-71 µm long, 41-53 µm wide; operculum subcordate, 32-41 µm long, 27-35 µm wide, almost covering the orifice, but in some puparia covering half the length of orifice (Fig. 9). Lingula tip visible in some slide mounted specimens, sometimes reaching beyond posterior margin of the vasiform orifice (Fig. 9), apex bilobed, and each lobe with a pair of small subapical setae.

VENTER

A pair of ventral abdominal setae present, length varies 6.9-18 µm long, 34-38 µm apart. Antennae reaching the base of prolegs, 57-73 µm long (keel 3-9 µm long). Microsetae present at base of meso- and metathoracic legs, each approximately 2.5 µm long. Adhesive sacs and spiracles visible. Stipples absent in thoracic tracheal folds but present in caudal tracheal fold.

HOST PLANT

Sporobolus heterolepis A. Gray (Poales: Poaceae).

MATERIAL EXAMINED

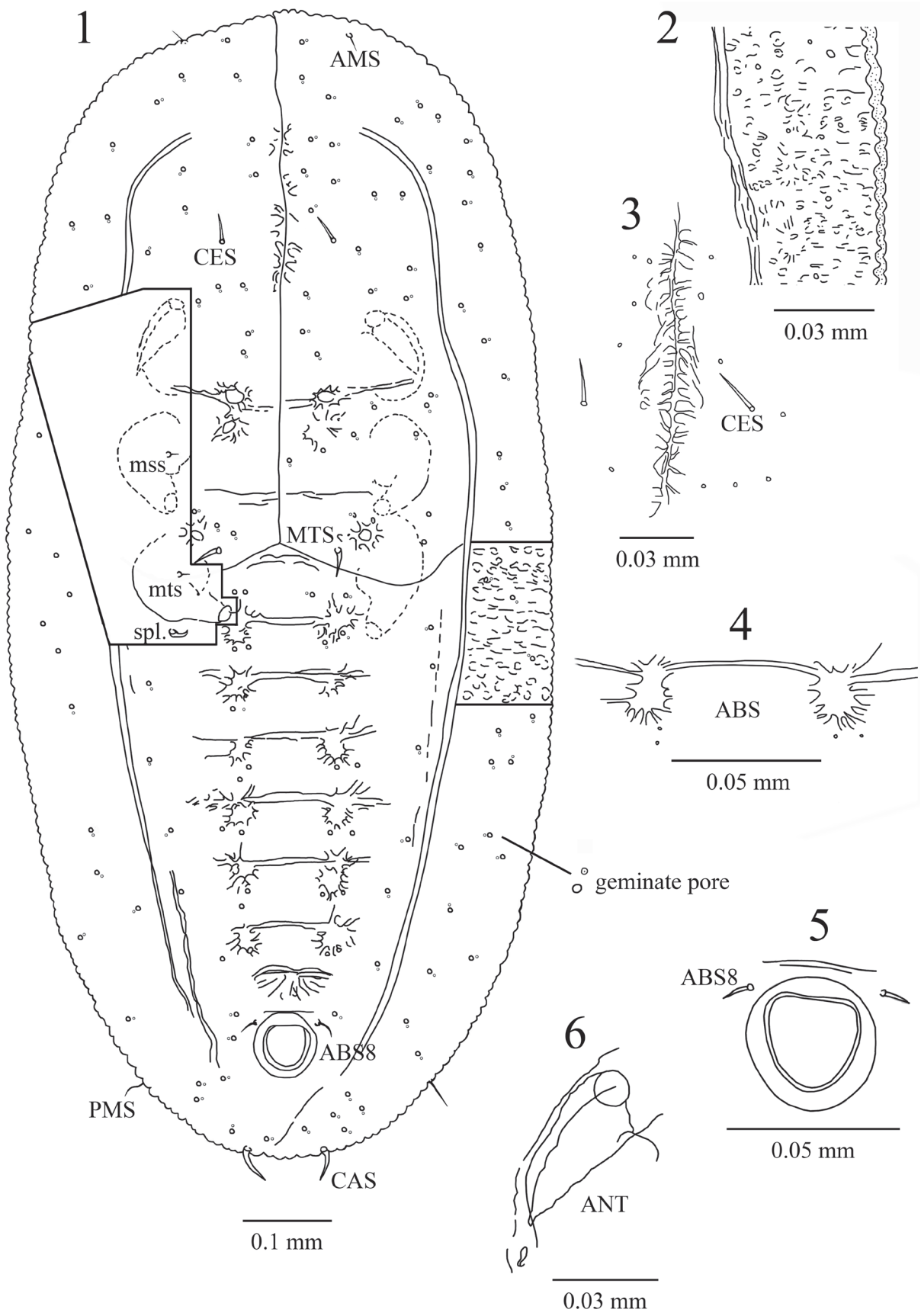
Holotype: India: Mizoram, Champai near border of India and Myanmar, one puparium on slide, on *Sporobolus heterolepis*, 24.VII.2011, A. K. Dubey (IARI).

Paratypes: Sixty five paratypes on 13 slides, data same as the Holotype (AKD, FRI, IARI, NHM, USNM).

ETYMOLOGY

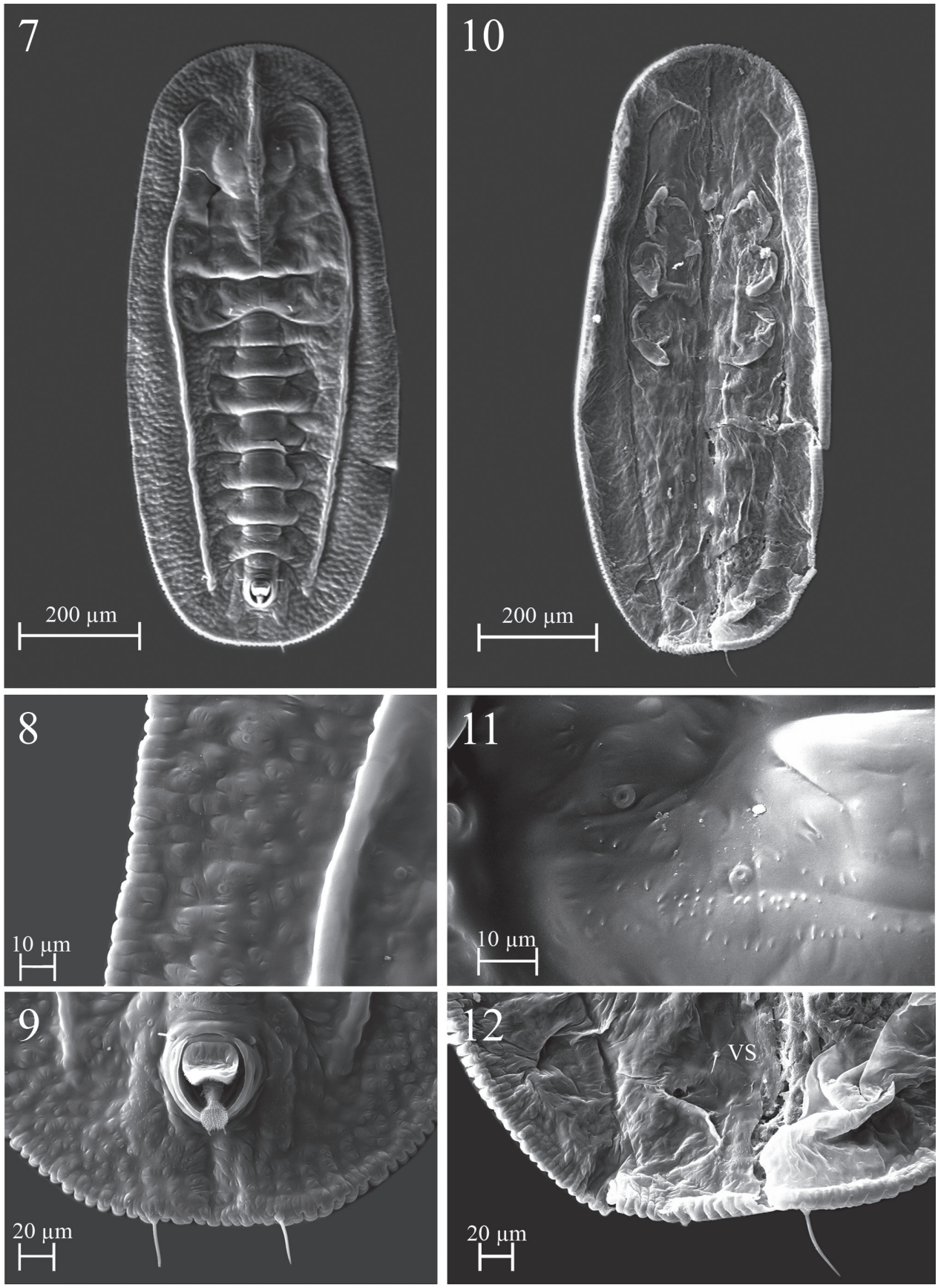
The species is named for the Champai district of Mizoram (India), which is type locality of the new species.

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Figs. 1-6. *Tetraleurodes champaiensis* **sp. nov.:** 1, puparium, dorsal and ventral views. 2, margin. 3, longitudinal molting suture and cephalic setae. 4, abdominal submedian pockets and depression. 5, vasiform orifice. 6, prothoracic leg and antenna.

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Figs. 7-12. *Tetraleurodes champaiensis* **sp. nov.:** SEM microphotographs. 7, puparium, dorsal view. 8, margin, thoracic tracheal pore area. 9, posterior abdominal area, vasiform orifice and lingula. 10, puparium, ventral view. 11, geminate pores. 12, caudal tracheal fold, ventral setae.

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Key to the Puparia of the Grass-Feeding (Poaceae) *Tetraleurodes* Species

(*Puparial characters referred from Bondar (1928), a single grass-feeding *Tetraleurodes* species known from the New World.)

1. Puparium yellowish-brown or pale yellow 2

—. Puparium orangey or dark colored or dark black 4

2. Cephalic setae (184 µm) and metathoracic setae (230 µm) long, reaching beyond the margin of the puparium . . . . . *T. pusana*; India.

—. Cephalic setae (8-38 µm) and metathoracic setae (10-43 µm) long, not reaching beyond the margin of the pupaium 3

3. Dorsal disc with numerous minute tubercles; submargin without papillae-like markings . . . . . *T. bambusae*; India.

—. Dorsal disc free from minute tubercles; submargin with bilobed papillae-like markings . . . . . *T. oplismeni*; Taiwan.

4. Puparium subcircular, slightly pointed anteriorly and broadly round at posterior end; metathoracic setae absent . . . . . *T. andropogoni*; Africa: Congo, Ivory Coast, Nigeria, Uganda, Zaire.

—. Puparium elongate, elliptical, sub-elliptical or octahedral in shape; posteriorly narrow or as broad as anterior end; metathoracic setae present 5

5. Puparium orangey or dark colored; margin modified in to fine teeth in the caudal and thoracic tracheal pore opening areas; submarginal setae (about 12 pairs) slightly reaching beyond the margin . . . . . *T. marshalli*; Brazil*

—. Puparium dark black; margin not modified in to fine teeth in the caudal and thoracic tracheal pore opening areas; submarginal setae not reaching beyond the puparial margin, if present (ex. *T. rugosa*) 6

6. Mesothoracic setae absent 7

—. Mesothoracic setae present 8

7. Subdorsum without dense granules; submargin with small corrugations; wax secreting glands absent at base of marginal teeth; vasiform orifice subcircular; tip of lingula bilobed . . . . . *T. champaiensis* **sp. nov.**; India.

—. Subdorsum with dense granules; submargin with lines; submargin with wax secreting glands present at base of marginal teeth; vasiform orifice subcordate; tip of lingula tongue-like . . . . . *T. graminis*; Taiwan.

8. Puparium elliptical; transverse moulting suture turned anteriorly; bands of microtubercles absent on submargin; eye spots present . . . . . *T. rugosus*; Sri Lanka.

—. Puparium octahedral; transverse moulting suture not turned anteriorly; bands of microtubercles present on submargin; eye spots absent . . . . . *T. dendrocalamae*; India.

Remarks

The puparium of *T. champaiensis* **sp. nov.** resembles that of *T. thenmozhiae* but differs from it in having a dark black cuticle, and the presence of acute cephalic, metathoracic and eighth abdominal setae; from *Tetraleurodes graminis* Takahashi by the absence of wax glands at the base of the marginal teeth, dense granules on the subdorsum, the pattern of submarginal corrugations, shape of vasiform orifice and bilobed lingula, and by the presence of rhachis-form abdominal segments. It differs in shape from other grass feeding *Tetraleurodes* species, *T. marshalli* Bondar, *T. pusana* Takahashi, *T. rugosus* Corbett. Also, it differs from *T. pusana* by the presence of short cephalic setae (18-20 µm long) and metathoracic setae (11-23 µm long), not reaching beyond the puparial margin (the puparia of *T. pusana* have long cephalic setae (184 µm long) and metathoracic setae (230 µm long), both reaching beyond the puparial margin); and from *T. rugosus* and *T. marshalli* by the absence of thoracic tracheal combs and submarginal setae, respectively.

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