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Source: Florida Entomologist, 96(2) : 610-618

Published By: Florida Entomological Society

URL: https://doi.org/10.1653/024.096.0228

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A NEW LEAF-FEEDING SPECIES OF *CTENOTHRIPS* (THYSANOPTERA: THRIPIDAE) FROM CHINA

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ABSTRACT

Ctenothrips yangi **sp. nov.** is described from Southwestern China, where it causes severe damage to the leaves of *Bryophyllum pinnatum* (Saxifragales: Crassulaceae). This new species exhibits considerable variation in the position of the metanotal setae and campaniform sensilla. A detailed description of the larval stages is provided.

Key Words: Thripidae, *Ctenothrips*, new species, larval, China

RESUMEN

Se describe *Ctenothrips yangi* **sp. nov.** del suroeste de China, donde ocasiona un daño severo a hojas de *Bryophyllum pinnatum* (Saxifragales: Crassulaceae). Esta nueva especie exhibe una variación considerable en la posición de las setas metanotales y sensilas campodeiformes. Se presenta una descripción detallada de los estadios larvales.

Palabras Clave: Thripidae, *Ctenothrips*, especie nueva, larval, China

Ctenothrips Franklin (Thysanoptera: Thripidae) is a relatively small genus of Thripidae that comprises only 13 species, including one new species described here, and these are recorded from North America, Europe and Asia (Mound 2013). The genus is characterized by the combination of 8-segmented antennae, segments III & IV with sensorium forked, 3-segmented maxillary palps, 2-segmented tarsi, pronotum with 2 pairs of long posteroangular setae, polygonally reticulated surface of metanotum and abdomen, posteromarginal comb on tergite VIII complete, sternites of abdominal without discal setae, and male with pore plate on sternites.

The new species described here, was collected from the leaves of *Bryophyllum pinnatum* (Lam.) Oken (Saxifragales: Crassulaceae) at the Arboretum, Kunming City, Yunnan Province. This perennial herb is used in folkloric medicine in China. Possibly this herb originated in Madagascar, but is now grown widely in Australia, tropical Africa, India and tropical America. The type specimens of *Ctenothrips yangi* **sp. nov.** are preserved in Yunnan Agricultural University (YNAU), Kunming, Yunnan, China.

MATERIALS AND METHODS

Preserved slide specimens were used in this study. Collecting methods for thrips, and methods for slide preparation follow Zhang et al. (2006). All measurements described in this paper are in micrometers (μm). Specimens were observed with the help of a Carl Zeiss-Axiostar plus microscope. Figures were made using a Q-Imaging CCD with an Image-Pro Plus software.

RESULTS

Biogeography of Genus *Ctenothrips* in China

In China the Palaearctic and Oriental regions overlap, resulting in an abundant insect fauna. Biogeographically, 7 regions can be recognized in China, the North-East, Northern China, Mongolia-Xinjiang, Tibetan, South-West, Central China and South China (Zhang 2011). Members of the genus *Ctenothrips* are not uniformly distributed across this country. Most of them are found in the South-West, an area considered part of the Oriental region. Two species, *C. taibaishanensis* Feng,

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Zhang & Wang, 2003 and the European species *C. distinctus* Uzel, 1895, have been taken only in Northern China, which is considered part of the Palaearctic region (Han 1997; Feng et al. 2003). One species, *C. smilax* Bhatti, 1976 has been taken in both South-West and Northern China (Hu & Feng 2011).

Although the alpine fauna in China of the major insect orders has been well studied, the Thysanoptera is little known up to this time, and this new species is regarded as an alpine thrips. We found this new macropterous species at an elevation of about 2,006 m asl. *Ctenothrips nonnae* Haga & Okajima is micropterous and occurred at an elevation of about 2,500 m asl (Haga & Okajima 1989), and the macropterous species, *C. niger* and *C. kwanzanensis*, also occurred at high elevations (1,800-2,500 m) (Takahashi 1937; Kudô 1977). *Ctenothrips guizhouensis* Xie, Zhang and Li, 2011, which occurred at the low elevations, is also macropterous (Xie et al. 2011). Both macropterous and micropterous species have been found at elevations of about 900 m in China, and the relationship between altitude and wing length is still unclear.

Ctenothrips yangi **sp. nov.** (Figs. 1-25)

Description. Female macroptera. Body dark brown; apex of tibiae paler, tarsi yellow (Figs. 1 and 16). Antennal segments I & II dark brown, III-IV and basal half of V yellow, the other segments brown (Fig. 7). Forewings brown with apex slightly paler, base yellow (Fig. 12). Antennae 8-segmented, segments III & IV with sensorium forked (Fig. 7). Head longer than wide, with sculpturing of distinctly elongate reticulations behind eyes; eyes with strong hairs between the facets; ocellar setae I absent, setae III well developed in between posterior ocelli; all postocular setae arising in a camber row; between eye and cheek strongly concave (Fig. 3). Pronotum wider than long, surface smooth except for a few faint transverse lines round, less than ten small scattered discal setae, 2 pairs of long posteroangular setae, posterior margin with 2 pairs of short setae (Fig. 4). Prosternum basantra absent; ferna entire, undivided (Fig. 5). Mesonotum with polygonally reticulate sculpturing, anteromedian campaniform sensilla (CPS) present, but no striations close to these (Fig. 6); mesopresternum rectangular (Fig. 5). Metanotum with polygonally reticulate sculpturing but striate laterally; median setae situated well behind anterior margin, arising closer to each other than to lateral pair; one pair of CPS situated posterior to median setae (Fig. 6). Meso- and metasternum furca without spinula (Fig. 11). Fore wings very narrow and slender for length; first and second veins each with setae row complete, first vein with 17 setae, second vein with 13-15 setae (Fig. 12); clavus with 5 marginal setae and more or less equally long (Fig. 13). Abdominal tergites I-VII and anterior margin of VIII polygonally reticulate sculpturing (Figs. 9 and 10), CPS close to posterior margin; posteromarginal comb on tergite VIII complete with long, fine microtrichia; tergite IX with 2 pairs of CPS, but without reticulation, median setae extending beyond apex of X; tergite X tube-like, sculptured with elongate reticulation, median longitudinal split complete (Fig. 10). Both pleurotergites and sternites of abdominal without discal setae, but with 2-3 pairs of posteromarginal setae, sternite VII with 3 pairs of posteromarginal setae, but S1 & S2 are situated in front of posterior margin (Fig. 8).

Measurements

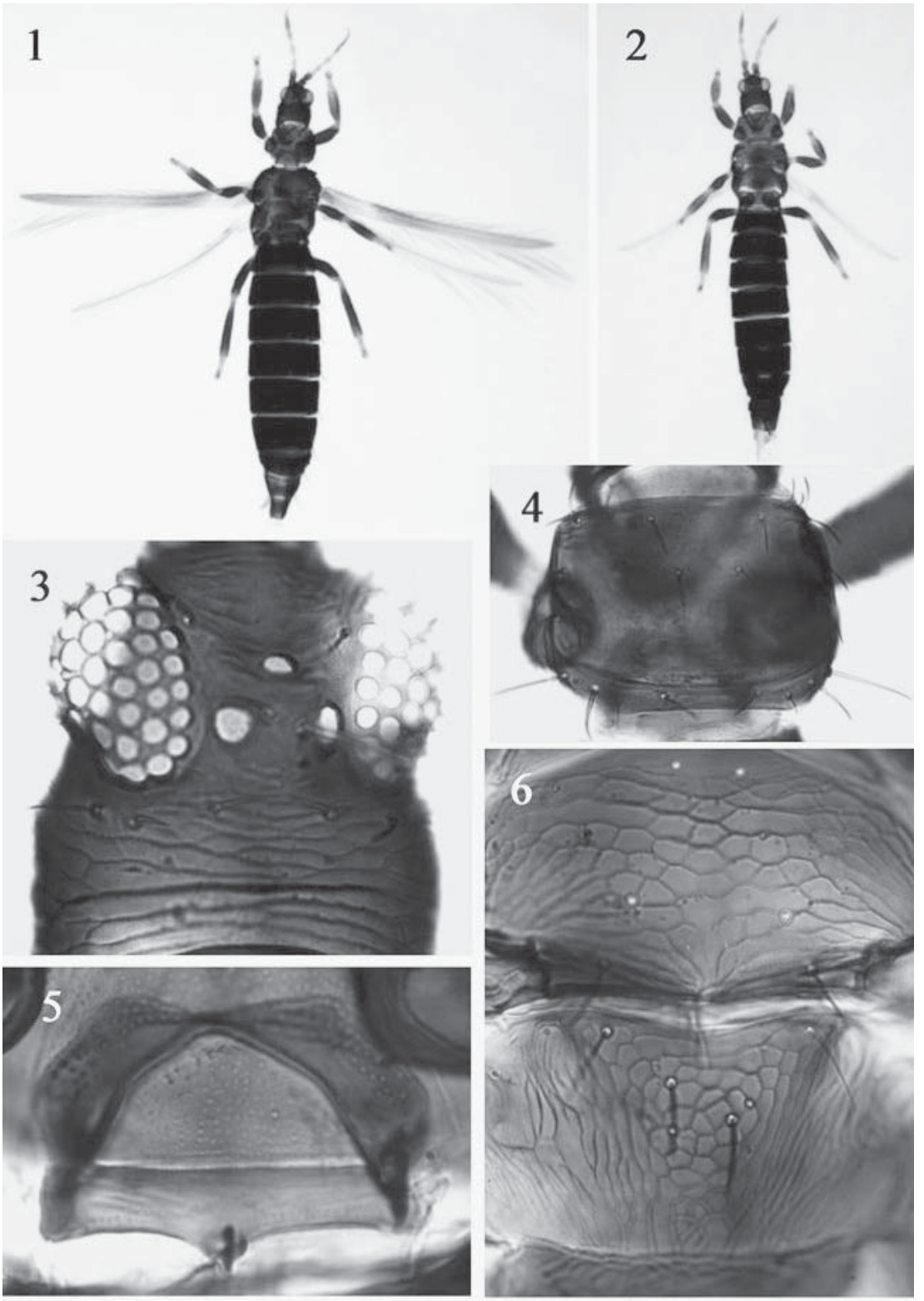
HOLOTYPE female. Body length 2020. Head, length 175; width across eyes 176. Ocellar setae II length 24; ocellar setae III length 41; postocular setae I length 25. Pronotum, length 159; width 215; posteroangular setae length 45-65; posteromarginal setae length 21-30. Metanotum median setae length 28. Fore wing length 1176. Antennal length 349; segments III-VIII length 63, 60, 52, 75, 11, 15.

Male Macroptera. Body color similar to female but smaller. Abdominal sternites III-VIII each with transverse pore plate (Fig. 2).

First Instar Larvae. Body pale yellow to lucency, including antennal segment I, the other segments yellow to pale brown. Red pigment present only in eyes (Figs. 15, 18 and 22); pretarsi and apex of mouth cone dark. Body length 806. Antennal length 212.

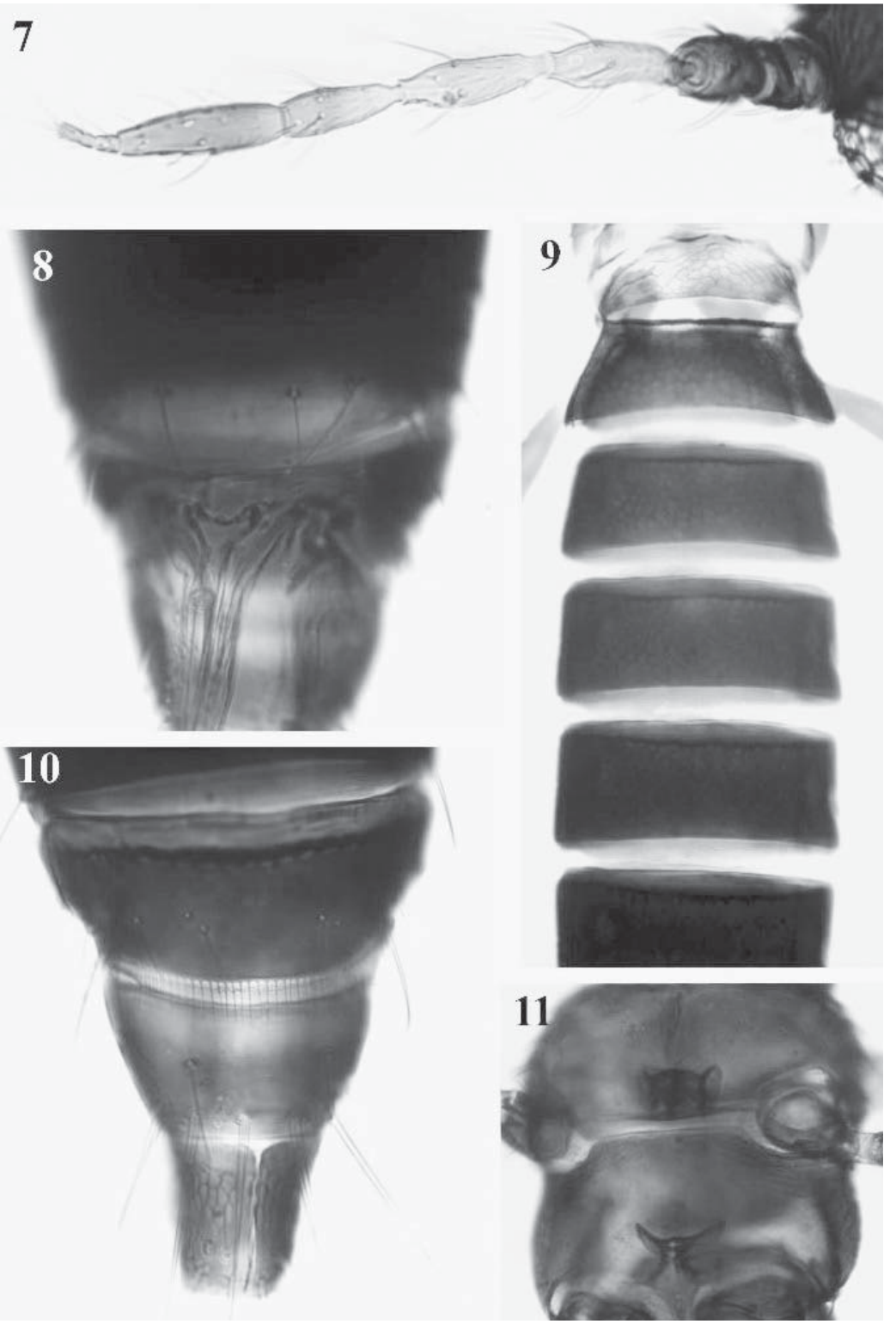
Second Instar Larvae. Body similar to first instar larvae but larger (Fig. 19). Antennal segments yellow to pale brown (Fig. 23). Tarsi, tibiae and apex of mouth cone dark. Red pigment present only in eyes (Fig. 19). Head smooth, without distinct local sclerotization; tergite with 4 pairs of long knobbed setae (lateral pair pointed and shorter than the others) (Fig. 25). Antennal segments II & III with 3-4 rows of weak microtrichia, segment IV with 5-6 rows of distinct microtrichia. Pronotum with 5 pairs of long knobbed setae round, surface smooth except for peripheral area with plaques, plaque diameter less than basal diameter of knobbed seta, plaques without microtrichia; meso- and metanotum with plaques, plaque diameters less than basal diameters of knobbed setae. Abdominal tergites with transverse rows of oval plaques, also with knobbed setae; elongate plaques on tergite III without microtrichia; tergite IX with many fine teeth microtrichia on posterior margin, but posteromarginal setae are situated in front of posterior margin (Fig. 24), elongate plaques on tergite IX with distinct microtrichia and plaque diameter longer than basal diameter of knobbed seta; tergites IX

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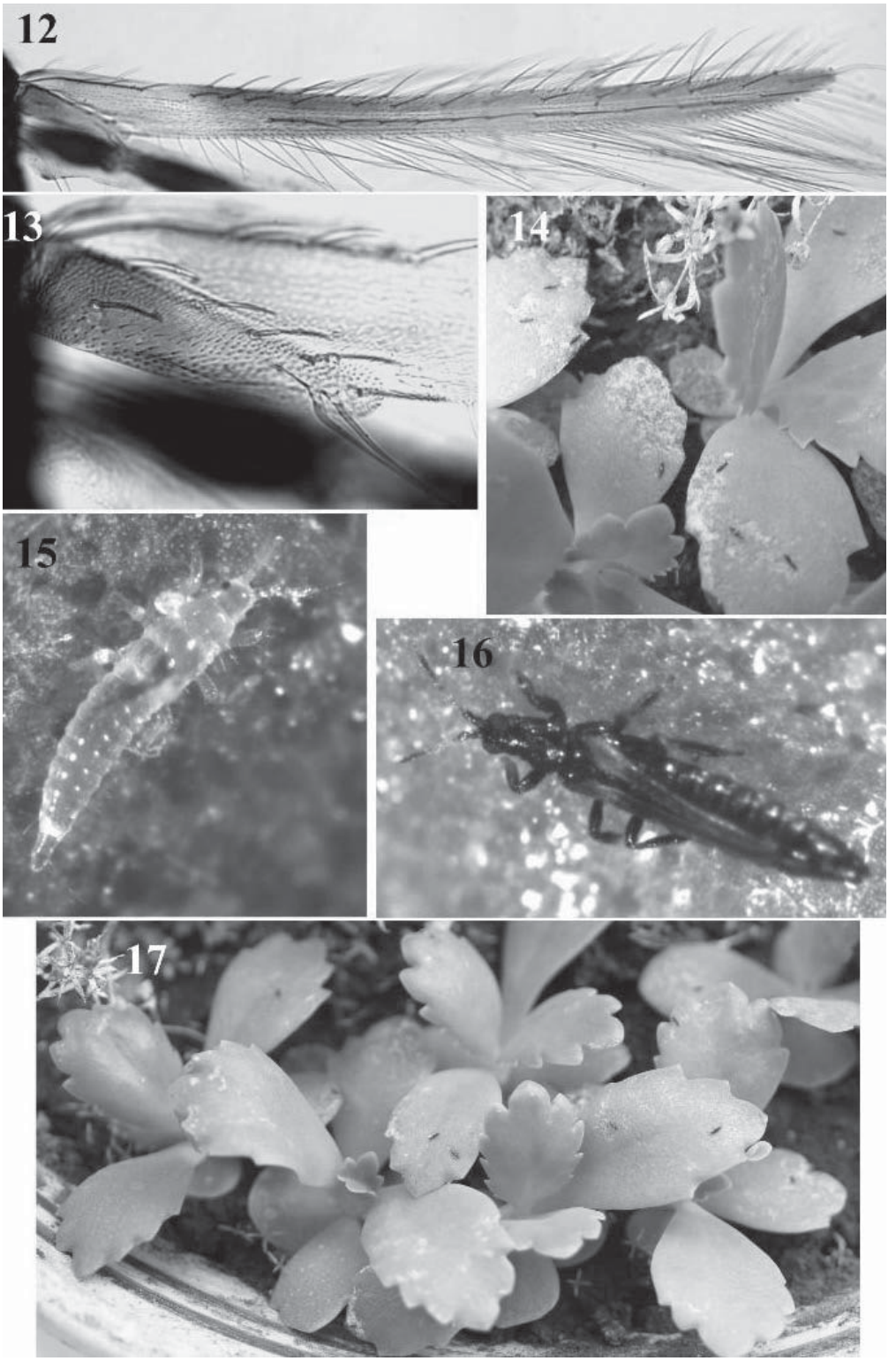
Figs. 1-6. Adults of *Ctenothrips yangi*. (1) Dorsal view of female. (2) Dorsal view of male. (3) Dorsal view of head. (4) Pronotum. (5) Prosternum. (6) Mesonotum and metanotum.

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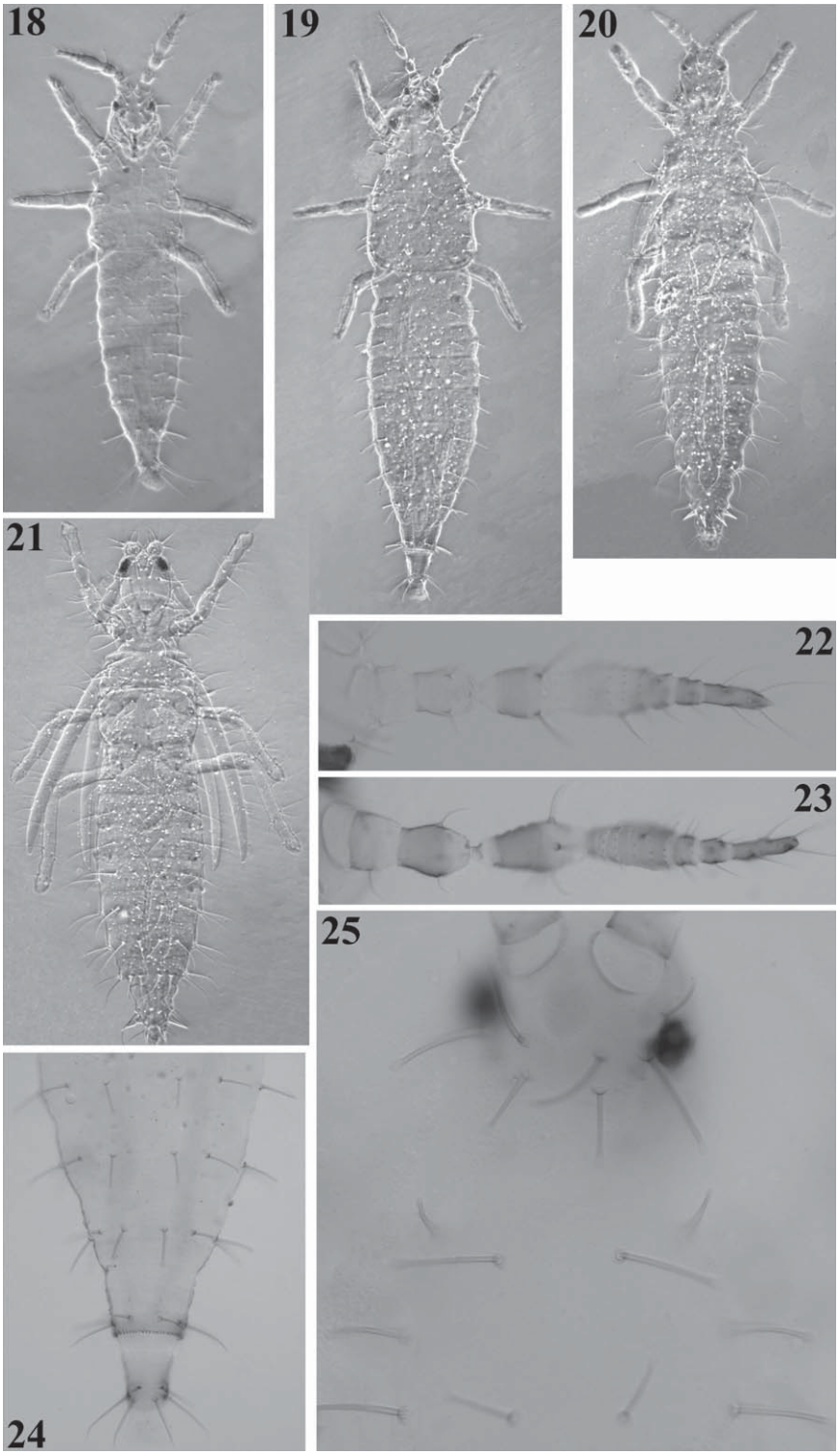
Figs. 7-11. Adults of *Ctenothrips yangi*. (7) Left antenna. (8) Abdominal sternite VII and posteromarginal setae. (9) Abdominal tergites I-VI. (10) Abdominal tergites VIII-X and posteromarginal comb. (11) Meso- and metasternum furca.

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Figs. 12-17. Adults of *Ctenothrips yangi*. (12) Right forewing. (13) Right forewing clavus. (14) Bright yellow spots and living adult. (15) Dorsal view of living larvae. (16) Dorsal view of living adult. (17) silver spots and living adult.

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Figs. 18-25. Larvae of *Ctenothrips yangi*. (18) First instar larvae. (19) Second instar larvae. (20) Prepupa. (21) Pupa. (22) Right antenna of first instar larvae. (23) Left antenna of second instar larvae. (24) Abdominal tergites VII-X of second instar larvae. (25) Head and pronotum of second instar larvae. In order to obtain clear photos of larvae, Figs. 18-21 were photographed by phase contrast.

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& X without sclerotized bands; tergite X without rows of microtrichia between seta I (Fig. 24). Mesonotum with spiracle laterally, spiracle with 12-16 smaller round facets laterally to spiracular opening and a larger oblong facet under spiracular opening; tergite II with spiracle laterally, spiracle with 4-6 smaller round facets, spiracle on tergite VIII similar in shape and size to that on tergite II. Body length 1814. Antennal length 278.

Prepupa. Body paler than second instar larvae. Body smaller than second instar larvae, but body setae more and longer. Apex of pretarsi dark. Red pigment present only in eyes (Fig. 20). Both fore wing and under wing present, but short. Abdominal tergite IX with 2 pairs of stout posteromarginal setae. Body length 1650. Antennal length 219. Fore wing length 401.

Pupa. Body colour similar to prepupa but setae more and longer. Red pigment present only in eyes (Fig. 21). Antenna extend dorsad. Both fore wing and under wing longer than prepupa. Abdominal tergite IX also with 2 pairs of stout posteromarginal setae. Body length 1716. Antennal length 375. Fore wing length 503.

Material Examined

HOLOTYPE female, CHINA, Yunnan Province, Kunming City, Arboretum, (N 25° 08' E 102° 43', 2,006 m asl), from young leaves of *B. pinnatum*, 17-VI-2011, Yang Chun-Xing. Paratypes: 18 females, 10 males, collected with holotype, with same data. All the type specimens are deposited in Yunnan Agricultural University, Kunming.

Larvae were collected on the young leaves of *Pilea peperomioides* Diels (Rosales: Urticaceae) directly indoors, and the isolated leaves with second instar larvae were put in a petri dish sealed with parafilm; and several days later, the prepupae and pupae were collected from the petri dish.

Etymology

The new species is named after the collector of the type species, Mr. Yang, the husband of the corresponding author.

Biology. Both adults and larvae of *C. yangi* **sp. nov.** prefer feeding on the outer surface to inner surface of leaves of *B. pinnatum* (Figs. 14-17), also named life plant, love plant, Canterbury bells, air plant, etc. *C. yangi* **sp. nov.** can cause severe damage to the leaves including silver spots on the leaves (Fig. 17). Affected areas of leaves later turned bright yellow (Fig. 14) and finally withered.

Several plants including grasses were planted together with the damaged *B. pinnatum* at the corner of the corresponding author's house. Obvious damage symptom could be observed on the leaves g of *Oxalis corniculata* L. (Oxidales: Oxalidaceae) (Fig. 26), *Glycine max* (L.) Merr. (Fabales: Fabaceae) (Fig. 27), *P. peperomioides* (Fig. 28) and *Mentha haplocalyx* Briq. (Lamiales: Lamiaceae) (Fig. 29). The larvae were found on the leaves of these plants, which showed that *C. yangi* **sp. nov.** can complete its development on the above plants.

Host Plants

Bryophyllum pinnatum (Crassulaceae), *Oxalis corniculata* (Oxalidaceae), *Glycine max* (Leguminosae), *Pilea peperomioides* (Urticaceae), *Mentha haplocalyx* (Lamiaceae).

Distribution

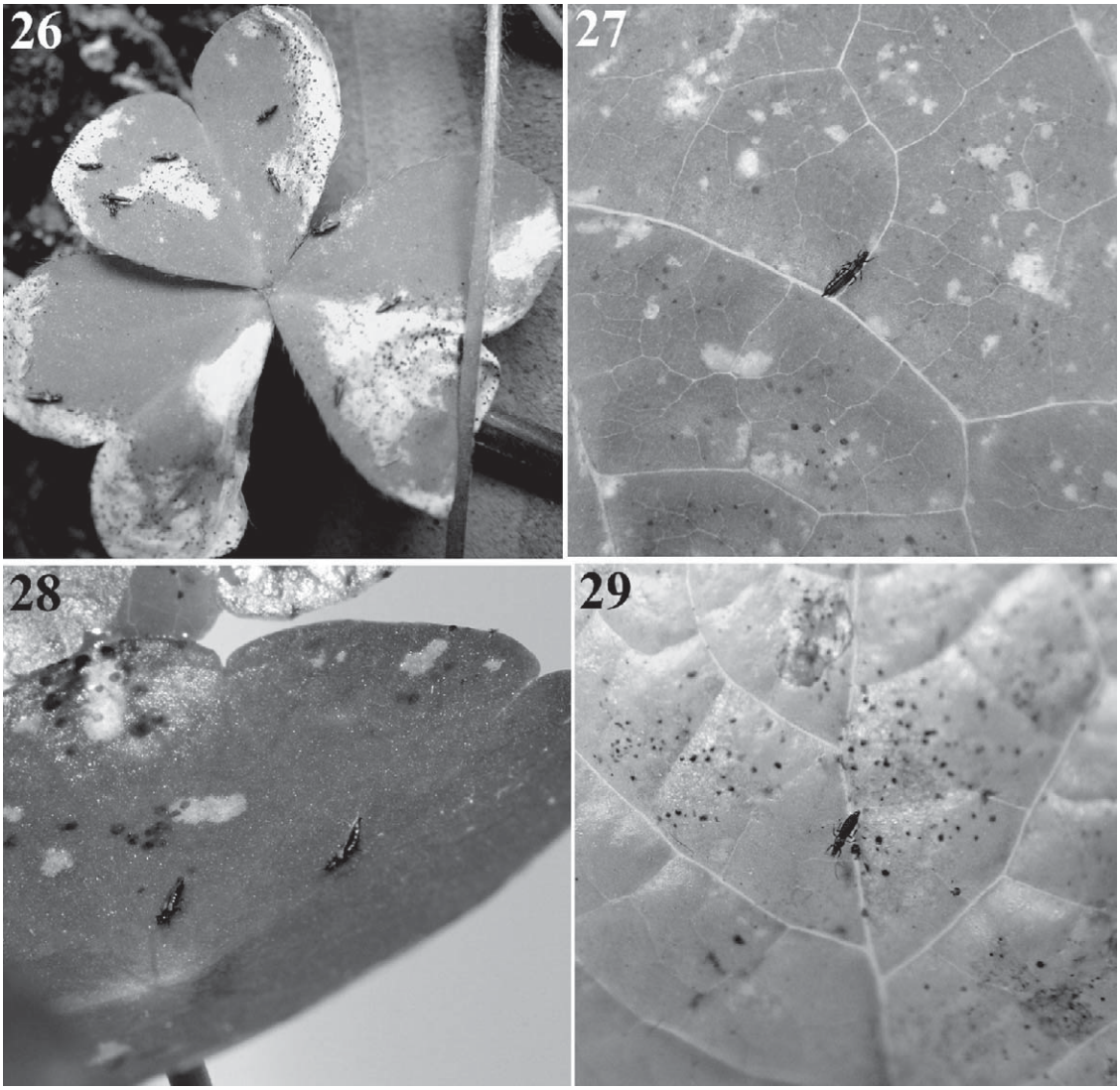
China (Yunnan).

Comments

This new species exhibits much intraspecific variation on the metanotum, with the positions of the median setae and CPS varying (Fig. 6). Most of the specimens are similar to the holotype, but some of the specimens have one pair of CPS anterior to the median setae.

Just like its congeners, this new species is very dark in color tending to be almost black, but treatment with NaOH enables a study of its anatomy. Using the key to world species of *Ctenothrips* published in Xie et al. (2011), this new species runs to No. 7, but it can be distinguished easily from remaining species by having a longer tube-like abdominal segment X, and the area between the eye and the cheek is strongly concave. This new species may be closely allied to the East Asia species *C. nonnae* (Haga & Okajima 1989), but it can be separated from the latter by the following features: pronotum surface smooth except for a few faint transverse lines round (Fig. 4); forewings longer, more than twice as long as antennae (Fig. 1); ocellar setae III well developed in between posterior ocelli, not placed in anterior margin of posterior ocelli (Fig. 3). Although similar to *C. kwanzanensis*, it is distinguished from that species by the presence of 2 pairs of pronotal postero-marginal setae (Fig. 4), and antennal segment III is yellow (Fig. 7). This new species can be distinguished readily from the 2 South Asia species, *C. smilax* (Bhatti 1976) and *C. niger* Kudo, 1977 (Kudô 1977), since both of these have ocellar setae pair I present on the head. It is also distinguished easily from *C. transeolineae* (Chen 1979), since the latter has almost equal head setae and one pair of posteromarginal setae on pronotum. It shares many morphological character states with the Europe species *C. distinctus* (Franklin 1907). However, it can be distinguished easily from the latter by the absence of a spinula on the mesosternal furca (Fig. 11).

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Figs. 26-29. Areas of leaves affected by *Ctenothrips yangi*. (26) *Oxalis corniculata*. (27) *Glycine max*. (28) *Pilea peperomioides*. (29) *Mentha haplocalyx*.

Acknowledgments

Thanks are due to Laurence Mound, CSIRO, Canberra, Australia, for providing us with many valuable comments and specimens of *Ctenothrips bridwelli*. We also thank to Tong Xiao-li of South China Agricultural University, Guangzhou, for loaning specimens of *C. leionotus* and critically reviewing the manuscript, and to Qiao Ge-xia of Chinese Academy of Sciences, Beijing, for loaning specimen of *C. cornipennis* described by Han Yun-fa. This study was supported by the Special Fund for Agro-Scientific Research in the Public Interest (No. 201103026 and 200803025), Scientific Research Funds of Department of Education of Yunnan Province (No. 2012J078 and 2012Z028), Yunnan Agricultural University on Sustainable Management of Agricultural Alien Invasive Species (No. 2011HC005) and Natural Science Funds of Yunnan Province (No. 2007C054M).

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