



Two new synonyms among Panchaetothripinae (Thysanoptera: Thripidae) with three species newly recorded from China

ZHAOHONG WANG^{1,2}, LAURENCE MOUND³, RUNQIAN MAO^{1*} & XIAOLI TONG^{2*}

¹Guangdong Key Laboratory of Animal Conservation and Resource Utilization, Guangdong Public Laboratory of Wild Animal Conservation and Utilization, Institute of Zoology, Guangdong Academy of Sciences, Guangzhou 510260, China

✉ wangzh@giz.gd.cn; <https://orcid.org/0000-0002-3915-0749>

✉ maorun@giz.gd.cn; <https://orcid.org/0000-0003-0282-7119>

²Department of Entomology, College of Plant Protection, South China Agricultural University, Guangzhou 510642, China

✉ xtong@scau.edu.cn; <https://orcid.org/0000-0003-1731-229X>

³CSIRO Australian National Insect Collection, Canberra 2601, Australia

✉ laurence.mound@csiro.au; <https://orcid.org/0000-0002-6019-4762>

*Corresponding author. ✉ maorun@giz.gd.cn; ✉ xtong@scau.edu.cn

Abstract

Helionothrips mube and *Panchaetothrips bifurcus* are here recognized as new synonyms of *Helionothrips aino* and *Panchaetothrips timonii* based on large numbers of specimens and continuous morphological differences. Three species, *Caliothrips insularis*, *Hercinothrips femoralis* and *Phibalothrips rugosus* are newly recorded from China and the previous record of *Caliothrips indicus* from China is here considered incorrect. Illustrations of males and larvae of *Hercinothrips femoralis* are also provided.

Key words: new species records, synonymies, *Helionothrips*, *Panchaetothrips*

Introduction

With 42 genera and 146 species worldwide, Panchaetothripinae is one of the four subfamilies of Thripidae (ThripsWiki 2022). It is generally recognized by the presence on the body surface of strong reticulation, and fore wing first vein more or less fused to the costa (Wilson 1975). According to Zhang *et al.* (2019), members of Panchaetothripinae also share such synapomorphies as the presence of a second long sense cone on antennal segment IV, the lack of a discal seta on the fore wing clavus, the presence of a posteromarginal craspedum on tergites and sternites, and two extra pairs of setae near the posterior margin of female sternite VII.

Most Panchaetothripinae are known from the Old World tropics, with only six of the 42 recognised genera being from the Neotropics. The species breed on older leaves of herbaceous or woody plants including ferns and Poaceae. Despite this, a few species of *Caliothrips* are sometimes associated with young plant tissues, such as *C. impurus* (Priesner) on seedling cotton in Sudan, and *C. indicus* (Bagnall) on young soybean plants in India (Wilson 1975). Host plant specificity at species level seems to be unusual, with many species recorded from a diverse range of plants. They are not usually considered as major pests, but Mound *et al.* (2022) list 25 species of Panchaetothripinae as impacting human crop productivity, most of these being considered local or minor pests.

In China, species of Panchaetothripinae are common in tropical and subtropical areas, with only a few grass-living species found in the fields of north China, including *C. tongi* Mound, Zhang & Bei and *Phibalothrips peringueyi* (Faure). Mirab-balou *et al.* (2017) reviewed 32 species in 13 genera of Panchaetothripinae from China. Since then, a further four monotypic genera have been recorded from South China (Li *et al.* 2018; Xie *et al.* 2019). Therefore, with the genus *Hercinothrips* here newly recorded, there are now 18 genera of Panchaetothripinae known from China. The purpose of this contribution is to establish two new species-level synonyms, and to newly record a further three species from China.

Genus *Caliothrips* Daniel

Currently 23 species are recognized in this genus (ThripsWiki 2022), and various members are found widely in the warmer parts of the world. In China, the Western American species, *C. fasciatus* (Pergande), was recorded from Fujian Province in 1930 based on a single female; that slide is now considered to have been mislabeled when it was prepared in California (Mound *et al.* 2011). *Caliothrips indicus* was recorded by Han and Cui (1992), and then repeated by Han (1997) who provided detailed descriptions and measurements; those details are interpreted below as a misidentification of *C. quadrifasciatus* (Girault). In 2011, *C. insularis* (Hood) was recorded from China at Beijing and Hebei (Huang *et al.* 2011). However, the illustrations in that paper clearly indicate that the specimens were members of a different species, and that can now be identified as *C. tongi*. Despite this, *C. insularis*, a species that is widely distributed among the Caribbean islands, is here definitively recorded from China for the first time. As a result, the following three species of *Caliothrips* are now recognized from China.

Key to *Caliothrips* species from China

1. Abdominal tergites with transverse sub-parallel lines at lateral thirds and no reticles medially (Fig. 5); pronotum with clearly longitudinal reticles (Fig. 2); fore wing with four dark areas and three pale areas (Fig. 8) *quadrifasciatus*
- Abdominal tergites with equiangular or longitudinal elongate reticles at lateral thirds and anterior medially (Fig. 4); pronotum with almost equiangular reticles (Figs 1, 3); fore wing with two clear pale areas 2
2. Head with transverse ridge across the vertex (Fig. 3); fore wing pale sub-basally and sub-apically, medially with a long dark area (Fig. 9); abdominal tergites II–VIII medially with equiangular reticles and internal wrinkles (Fig. 6) *tongi*
- Head without transverse ridge across the vertex (Fig. 1); fore wing pale basally, dark from fork of veins and gradually paler to sub-apex, dark at apex (Fig. 7); abdominal tergites II–VIII medially with fewer reticles, internal wrinkles only present in anterior reticles, absent in posterior reticles (Fig. 4) *insularis*

Caliothrips insularis (Hood)

(Figs 1, 4, 7, 32)

Hercothrips insularis Hood, 1928: 234.

This species was described originally from the Caribbean islands of St Croix and Cuba but has subsequently been recorded as widespread between Venezuela and Florida, as well as from Mauritius in the Indian Ocean (Nakahara 1991). The available records indicate that it has been taken from several species of Poaceae, as well as *Cyperus* and *Lilium*, and in recent years large populations have been found on grass in Guangzhou. From most species in the genus, it is distinguished by the color pattern on the fore wing (Fig. 7), with dark areas at sub-base and at apex with the median area pale brown and even paler at base and sub-apex. The identification here is based on the key by Nakahara (1991) also one female from Panama (in ANIC, Canberra). The species has probably been introduced to China through the horticultural trade in live plants.

Specimens studied. CHINA, **Guangdong**, South China Agriculture University (SCAU) (23°09'N, 113°21'E), 39 females from turf grass, 12.xi.2016 (Zhaohong Wang). PANAMA, Panama City, from lawn grass, 21.vi.1983 (LAM).

Caliothrips quadrifasciatus (Girault)

(Figs 2, 5, 8, 10, 33–34)

Sericothrips quadrifasciatus Girault, 1927: 1.

Hercothrips graminicola Bagnall & Cameron, 1932: 417.

Described from Australia, this species is recognized as the senior synonym of *C. graminicola*, a species known from Africa and India (Mound & Houston 1987). The record of *indicus* from China was repeated by Mirab-balou *et al.* (2017) and the specimens studied by Han (1997) have not been re-examined. Han states that the males he studied

had sternal pore plates about 40–50 microns wide, whereas *indicus* has these structures 80–90 microns wide (Wilson 1975). This suggests that the identification of *indicus* by Han was a misidentification of *quadrifasciatus*, in which the pore plates of males are also very wide but never much wider than 60 microns (Fig. 10). In addition, the tergal sculpture of *quadrifasciatus* is distinctive in forming sub-parallel oblique reticles (Fig. 5). This is another member of the genus that is typically found on various grasses.

Specimens studied. CHINA, **Guangxi**, Hezhou (24°57'N, 111°55'E), 3 females and 3 males from wormwood, 16.ix.2015 (Chao Zhao). **Guangdong**, Gaozhou, Yuntan (23°53'N, 111°10'E), 11 females and 3 males from grass, 8.ix.2014 (Zhaohong Wang).

Genus *Helionothrips* Bagnall

There are 29 species listed in this Old World tropical genus (ThripsWiki 2022), and Mirab-balou *et al.* (2017) provided a key to 13 species recorded from China. However, one of these species is here placed into synonymy based on studying large amount of material, although without studying the type specimens. Members of *Helionothrips* have a distinctive arched antecostal ridge on the abdominal tergites, and the vertex of the head has a strong transverse ridge.

Helionothrips aino (Ishida)

(Figs 23–25, 36–37)

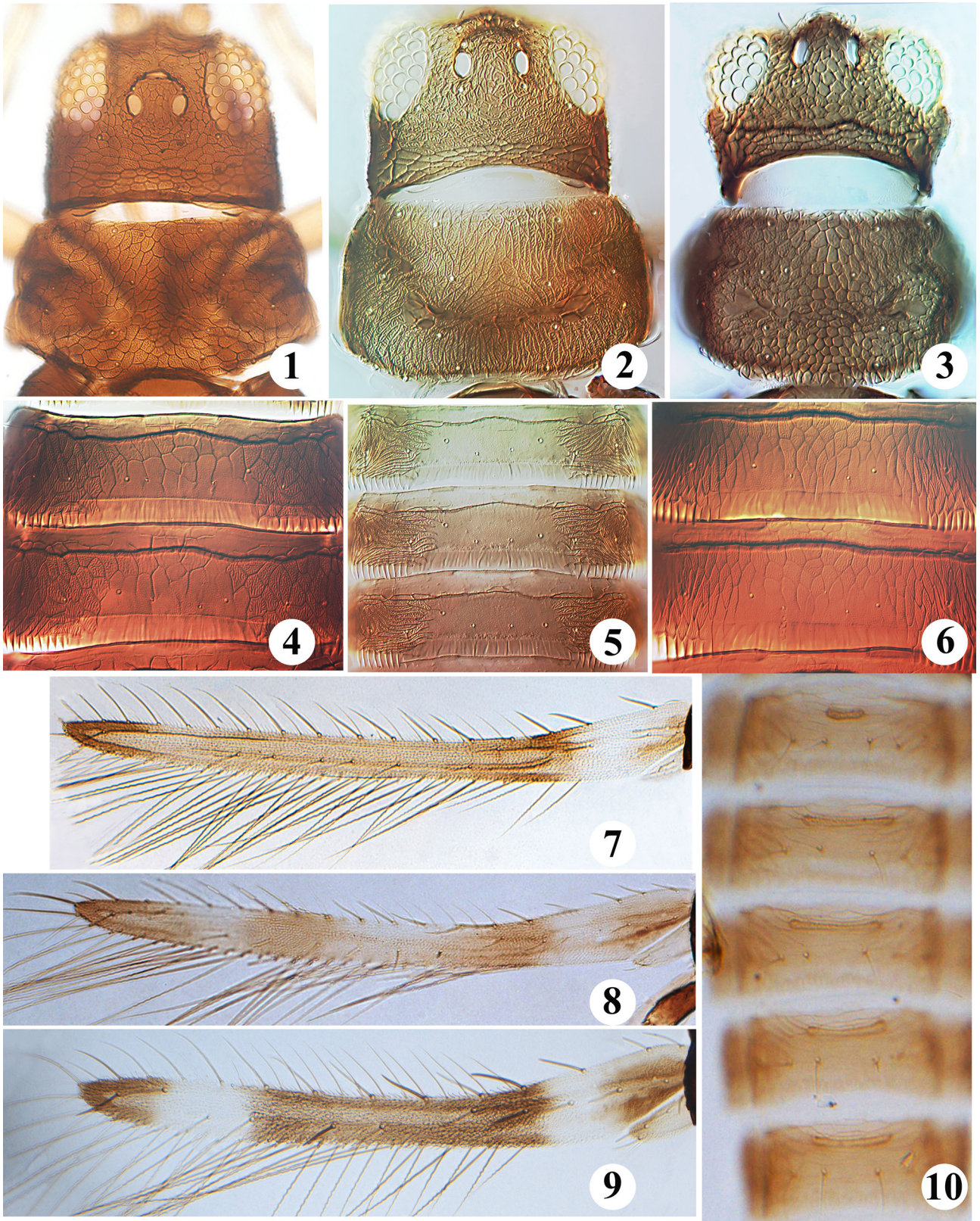
Heliothrips aino Ishida, 1931: 34.

Helionothrips mube Kudô, 1992: 275. **Syn.n.**

Kudô (1992) described *mube* from 33 females taken in Kyushu, southern Japan, also nine females and five males from the island of Okinawa. All of these specimens were collected from *Stauntonia hexaphylla* [Lardizabalaceae], and the species was distinguished from *aino* by the slightly paler apex of the tibiae, longer antennal sense cone on segments III, IV and VI, male with pore plates on sternites VI–VIII although smaller on VI, and male stout setae on tergite IX with bases widely separated. However, the color differences are indistinct and variable between populations, the distance between the bases of the stout setae on tergite IX could be influenced by slide making, and *aino* has also been collected from plants of Lardizabalaceae. In this study, some males from Guizhou, Guangdong and Guangxi also have a small pore plate on sternite V. Kudô (1992) also indicated some males with a vestigial pore plate on sternite VI, therefore pore plates in this species can be present on sternites V–VIII, VI–VIII or VII–VIII (Figs 23–25). The first author of the current paper (ZHW) has also observed similar variation in the male pore plates of *Helionothrips cephalicus* collected in China. As a result, we here consider *mube* to be the same polyphagous species as *aino*.

This species can be recognised by the head, pronotum and meso-metanotum reticulate without internal wrinkles; abdominal tergites III–VII with antecostal ridge distinctively arched, VIII with comb of long microtrichia interrupted medially; antennal segments I–V yellow, at least paler than segment VI.

Specimens studied: CHINA, **Beijing**, Botanical Garden (25°14'N, 107°54'E), 2 females from *Actinidia arguta* [Actinidiaceae], 15.v.2018 (Xiaoli Tong); **Sichuan**, Chongzhou, Anzhihe National Nature Reserve (30°48'N, 103°48'E), 1 female, 27.vii.2016 (Baoqiang Pan); **Yunnan**, Xishuangbanna, Mengla (21°28'N, 101°34'E), 2 females from weeds, 17.iv.1987 (Weiqiu Zhang); **Guizhou**, Guiyang City, Wudang District, (26°38'N, 106°44'E), 5 males, 2 females from unknown host plant, 20.viii.2008 (Chenming Yuan); Guizhou, Libo County, Weng'ang Town (25°14'N, 107°54'E), 1 female, 22.vii.2015 (Zhaohong Wang); **Hunan**, Yanling, Shuikou Town (26°34'N, 113°48'E), 5 females, 3 males from taro (*Colocasia esculenta*), 23.viii.2015 (Zhaohong Wang); **Jiangxi**, Chongyi, Yangling National Forest Park (25°38'N, 114°18'E), 4 females, 1 male from shrub, 23.viii.2015 (Zhaohong Wang); **Guangdong**, Guangzhou City, Longdong, (23°14'N, 113°23'E), 1 female, 1 male from grasses, 9.v.2012 (M. Mirab-balou); **Guangxi**, Jinxiu County, Dayaoshan National Nature Reserve (24°07'N, 110°12'E), 1 female from Asteraceae, 15.xi.2011 (Shulan Yang); Guangxi, Jiuwanshan National Nature Reserve, Yangmei'ao (25°11'N, 108°38'E), 5 females, 16 males from *Colocasia esculenta* [Araceae], 21.vii.2015 (Zhaohong Wang).



FIGURES 1–10. *Caliothrips* species. 1–3, head and pronotum of females: (1) *C. insularis*; (2) *C. quadrifasciatus*; (3) *C. tongi*. 4–6, tergites IV–VI of females : (4) *C. insularis*; (5) *C. quadrifasciatus*; (6) *C. tongi*. 7–9, fore wing of females: (7). *C. insularis*; (8) *C. quadrifasciatus*; (9) *C. tongi*. (10) male pore plates of *C. quadrifasciatus* on sternites III–VII.

Genus *Hercinothrips* Bagnall

There are nine species listed in this genus (ThripsWiki 2022), all originally from Africa. The genus is here recorded from China for the first time, and the species involved is known from various tropical countries as well as in greenhouses in the temperate parts of the world. In the key to genera from China (Mirab-balou *et al.* 2017) *Hercinothrips* will be distinguished by the presence of two complete rows of setae on the fore wing, the presence of 2-segmented tarsi, and the absence of groups of microtrichia laterally on the second abdominal segment. These character states, together with the reticulate head, will also distinguish the genus from amongst the Thripidae genera recorded from China in the identification system by Zhang *et al.* (2020).

Hercinothrips femoralis (Reuter)

(Figs 11–22, 38–39)

Heliothrips femoralis Reuter, 1891: 166.

This species is widespread around the world in tropical and subtropical areas (Roditakis *et al.* 2006). Feeding by larvae and adults can cause leaf damage to many kinds of plants, including calla lily (*Zantedeschia aethiopica*), chrysanthemums, figs (*Ficus* spp.), banana, cotton, cowpea, cucumber, groundnut, maize, sugar beet, sugar cane and tomato (Moritz *et al.* 2013). A large population has been found in China in greenhouse damaging the leaves of cabbage (Fig. 20) and sweet potato.

In addition to the generic character states indicated above, this species can be identified by: body brown to dark brown, head with yellow longitudinal areas between eyes and ocelli; fore wing mainly brown but pale at apex, sub-basally, and submedian areas, posteromarginal cilia wavy (Fig. 16); antennae 8-segmented, segments III & IV each with a small forked sense cone (Fig. 13); head, pronotum, meso-metanotum reticulate with internal wrinkles (Fig. 11); metanotum median setae arise medially with one pair of campaniform sensilla (Fig. 12); abdominal tergites weakly reticulate medially, median pair of setae small, posterior margins with complete craspedum; tergite VIII with comb of a few microtrichia laterally but none medially; tergite X with longitudinal split almost complete. Male with sternal marginal setae minute, sternites III–VII with slender transverse pore plate (Fig. 14), tergite IX with 3 pairs of thorn-like setae and a few wartlike tubercles (Fig. 15).

The eggs were inserted into the leaves, slightly protruding from the surrounding leaf surface, and a pair of eyespots could be seen before hatching (Figs 17, 18). The first and second instar larvae are yellow, and always bear a drop of dark excretion on the abdomen apex (Fig. 19), and this is left as black spots on the leaf surface. The second instar larvae have 7-segmented antennae (Fig. 21), with the major body setae short and pointed (Fig. 22).

Material studied. CHINA, **Guangdong**, Guangzhou, Institute of Zoology, Guangdong Academy of Sciences (23°10'N, 113°30'E), 25 females, 6 males from sweet potato, 12.iv.2022 (Zhaohong Wang); same location 6 females, 4 males from cabbage, 30.vi.2022.

Genus *Panchaetothrips* Bagnall

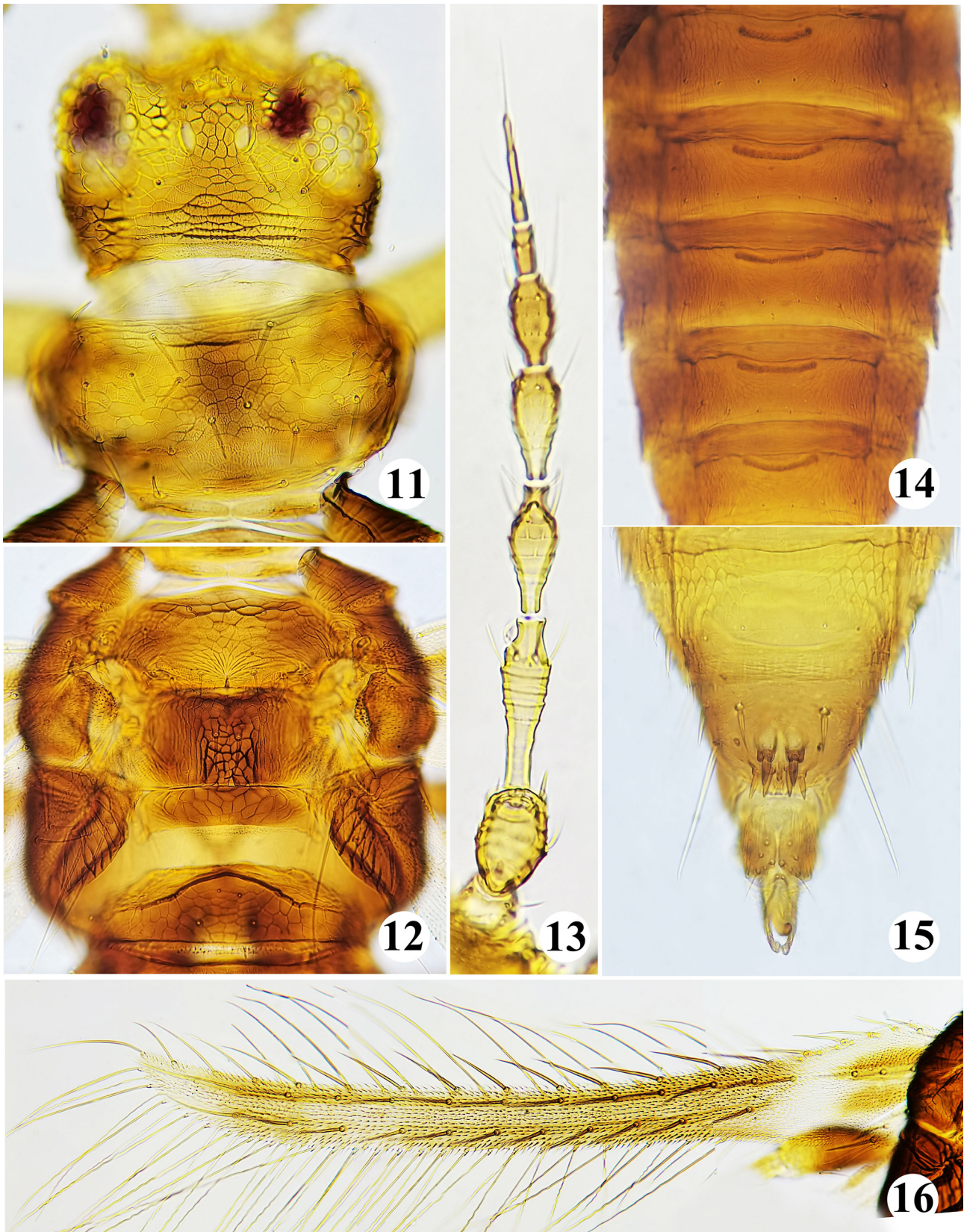
There are seven species listed in this genus from the Old World tropics (ThripsWiki 2022), but one of these is here placed into synonymy based on the study of type material. Members of the genus are distinguished from other Panchaetothripinae by the presence of sculptured ridges anterolaterally on the second abdominal tergite, and the elongate, parallel-sided tenth abdominal segment.

Panchaetothrips timonii Mound & Postle

(Figs 26–27, 40–41)

Panchaetothrips timonii Mound & Postle, 2004: 136.

Panchaetothrips bifurcus Mirab-balou & Tong, 2017: 151. **Syn. n.**

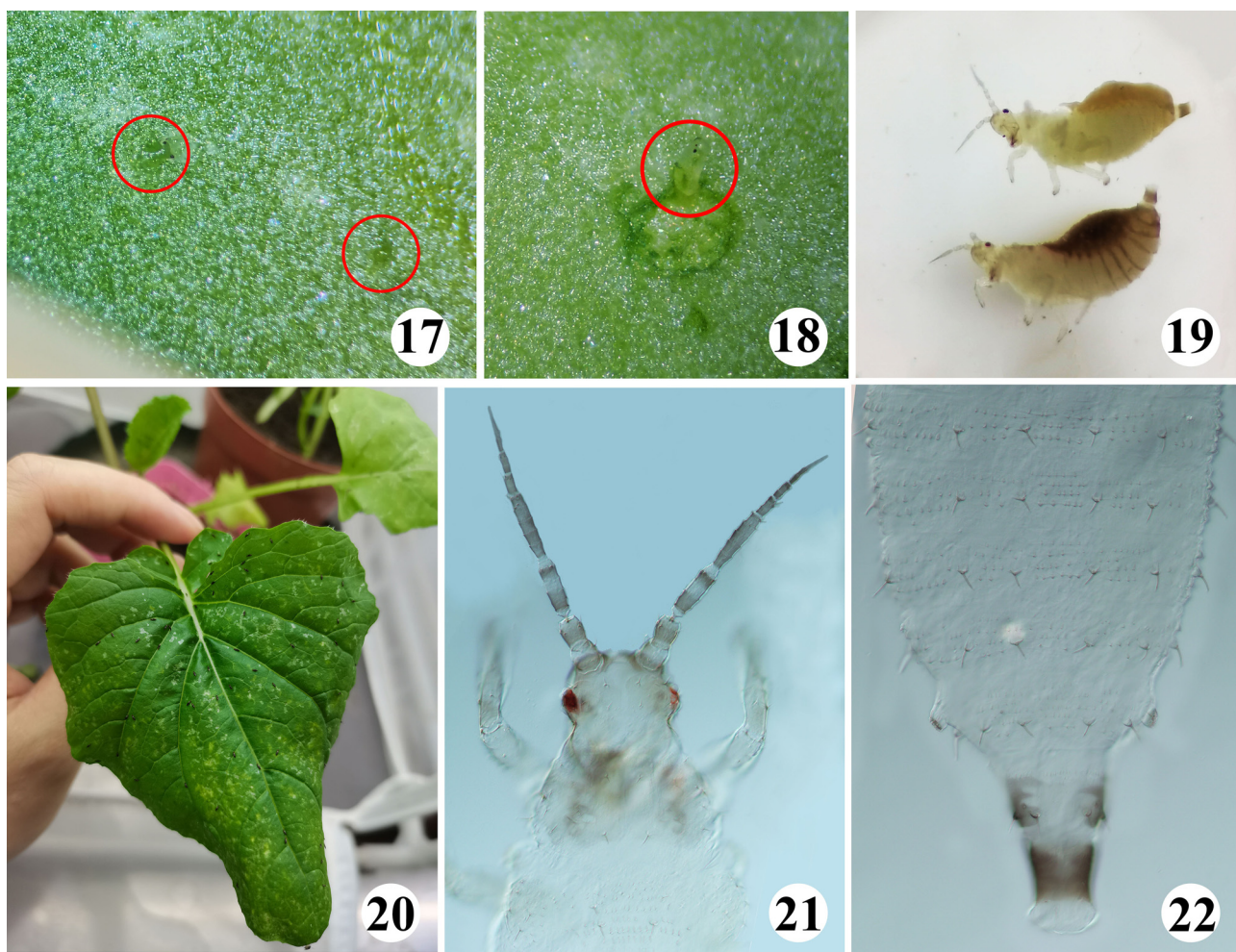


FIGURES 11–16. *Hercinothrips femoralis*. 11–13, female: (11) head and pronotum; (12) meso–metanotum; (13) antenna. 14–16, males: (14) sternites III–VII; (15) tergite IX; (16) fore wing.

Described originally from Broome, in northwestern Australia, from *Timonius timon* [Rubiaceae], the species here considered to be a synonym was described from South China. It was distinguished from *P. timonii* by body color

slightly darker, reticulation posterior to hind ocelli with no internal markings, and tergite II with the median pair of posteromarginal setae shorter than the submedian pair. However, in re-studying the types and paratypes of both species, we found no significant differences between them. The color differences could be influenced by slide making and age of specimens. The internal markings in reticulations on the head are so weak that sometimes are invisible, even in specimens from Australia. On tergite II the posteromarginal median setae are fine and slightly shorter than this pair of setae in both the Australian and subsequently collected Chinese specimens. The thrips fauna of southern China and northern Australia are known previously to share several species (Zhang *et al.* 2018).

Specimens studied. CHINA, **Guangdong**, Zhaoqing, Dinghushan Natural Nature Reserve (23°10'N, 112°32'E), types of *bifurcus*: 1 female, 5 males from Poaceae, 9.i.1978 (Weiqiu Zhang); **Hainan**, Jingfengling National Nature Reserve (18°44'N, 108°51'E), 2 females, 1 male from grass, 5.iv.1980 (Weiqiu Zhang). **Jiangxi**, Chongyi, Yangling National Forest Park (25°39'N, 114°18'E), 1 female, host unknown, 22.viii.2015 (Zhaohong Wang). **Western Australia**, Broome, Willie Creek, types of *timonii*: 3 females, 25.vii.2003, 14 females 2 males, 12.viii.2003, 2 females, 1 male, from curled leaf of *Timonius timon* (Rubiaceae), 28.vi.1999 (A.C.Postle).



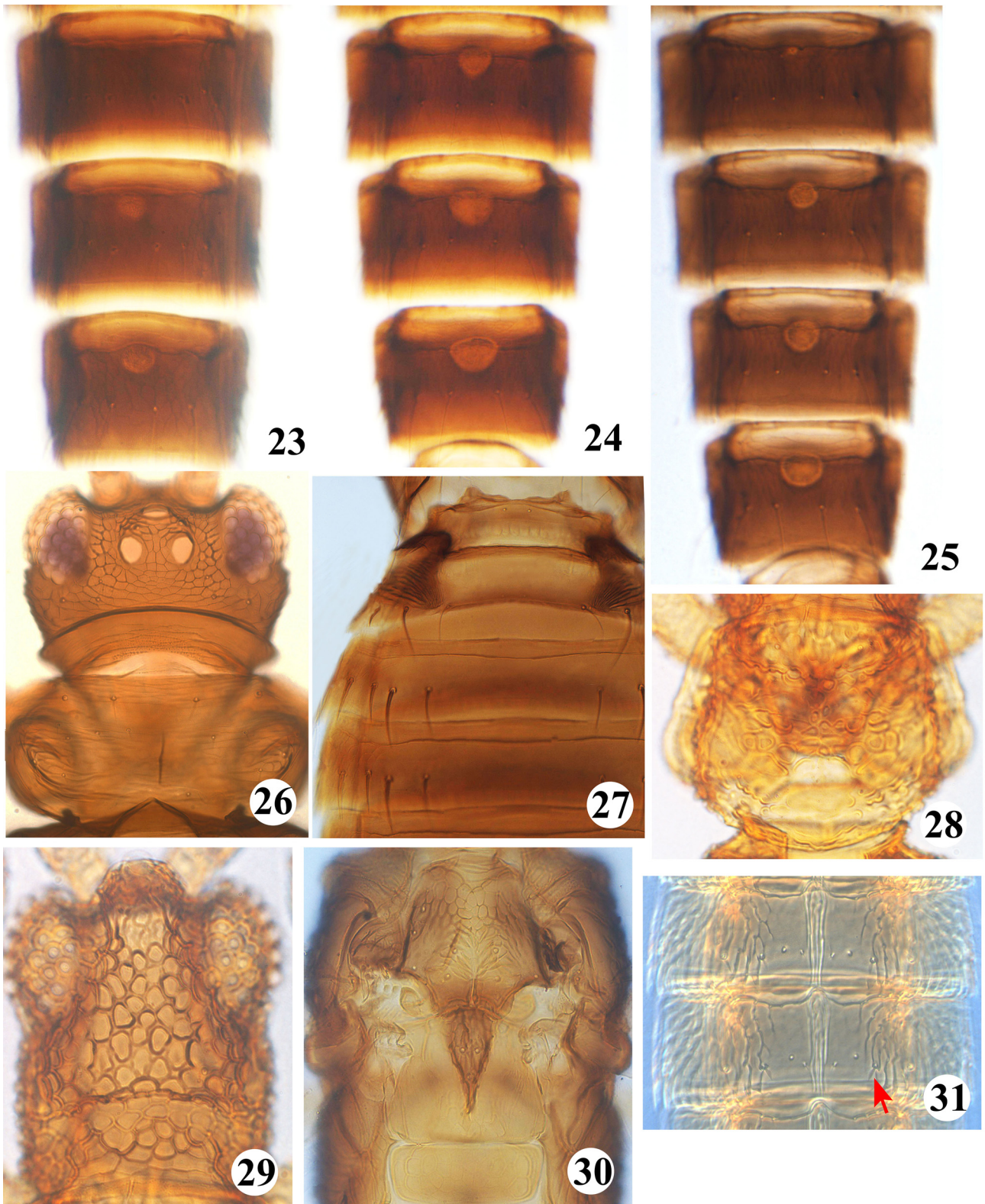
FIGURES 17–22. *Hercinothrips femoralis*: (17) eggs inside cabbage leaves; (18) eggs dig out from cabbage leaves; (19) second instar larvae with excrement on the back; (20) adults feeding on cabbage leaves. 21–22, second instar larvae: (21) head and thorax; (22) abdominal tergites IV–X.

Genus *Phibalothrips* Hood

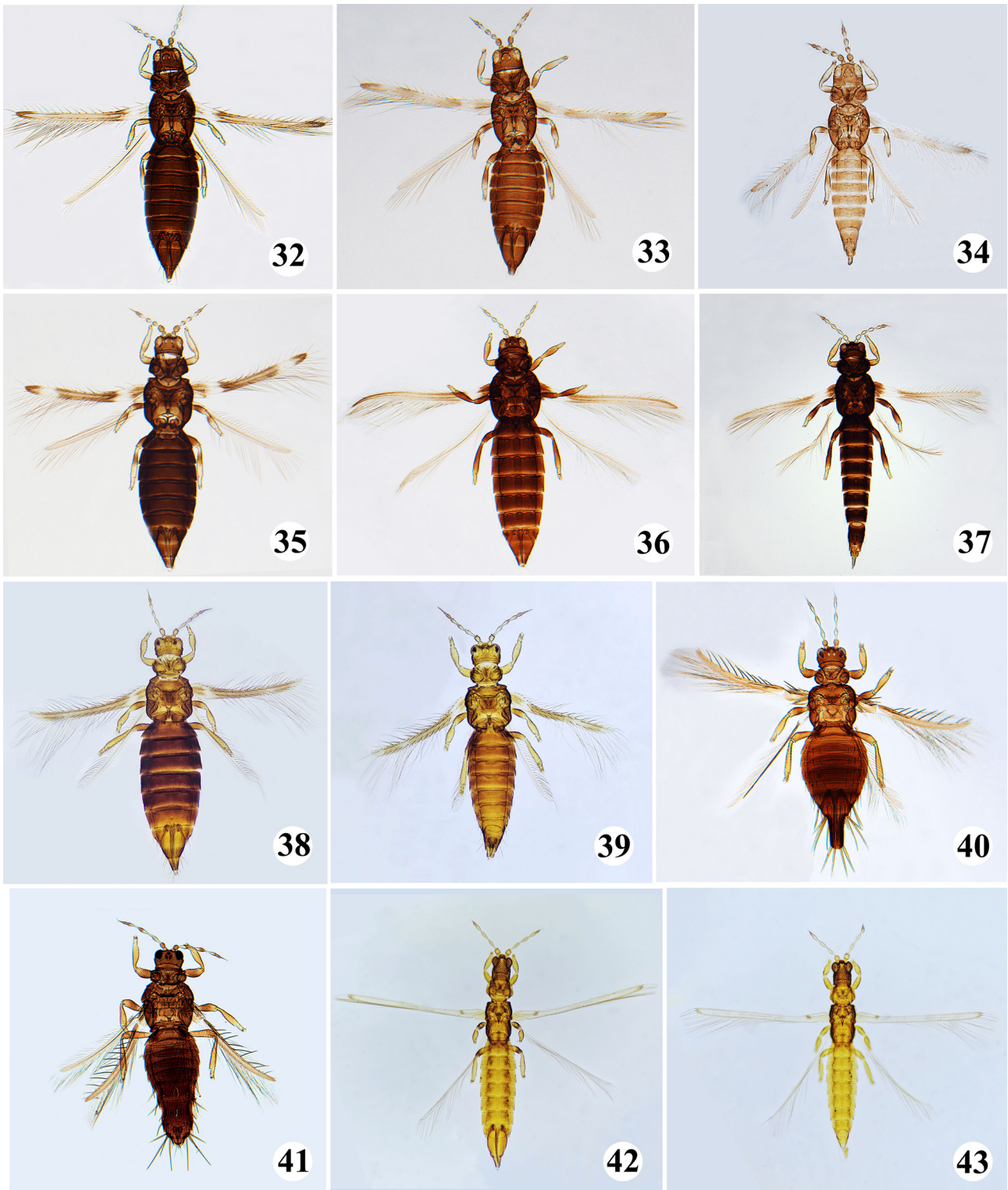
Four species are listed in this genus, all grass-living and all from the Old World (ThripsWiki 2022). Members of the genus are distinguished amongst Panchaetothripinae by their 7-segmented antennae with simple sense cones on segments III and IV, and the lack of cilia on the anterior margin of the fore wings.

Phibalothrips rugosus Kudô
(Figs 28–31, 42–43)

Phibalothrips rugosus Kudô, 1979: 351.



FIGURES 23–31. Panchaetothripine species. 23–25, *Helionothrips aino* male pore plates: (23) sternites VI–VIII; (24) sternites VI–VIII; (25) sternites V–VIII. 26–27. *Panchaetothrips timonii* female: (26) head and pronotum; (27) tergites I–IV. 28–31, *Phibalothrips rugosus* female: (28) pronotum; (29) head; (30) meso–metanotum; (31) tergites IV–V.



FIGURES 32–43. Panchaetothripine species from China. (32) *C. insularis* female; (33) *C. quadrifasciatus* female; (34) *C. quadrifasciatus* male; (35) *C. tongi* female; (36) *Helionothrips aino* female; (37) *Helionothrips aino* male; (38) *Hercinothrips femoralis* female; (39) *Hercinothrips femoralis* male; (40) *Panchaetothrips timonii* female; (41) *Panchaetothrips timonii* male; (42) *Phibalothrips rugosus* female; (43) *Phibalothrips rugosus* male.

Described originally from a single female taken in Malaysia at Kuala Lumpur, this species was subsequently recorded from the island of Okinawa, Japan (Minoura & Masumoto 2016). In recent years, it has been found quite commonly in South China from the leaves of bamboo, sometimes in large numbers.

Specimens studied. CHINA, Guangdong, Shenzhen, Mt. Wutongshan (22°24'N, 113°17'E), 6 females from bamboo, 19.xii.2015 (Zhaohong Wang); Guangdong, Shaoguan, Mt. Danxianshan (24°53'N, 113°40'E), 68 females, 28 males from bamboo, 12.xii.2020 (Zhaohong Wang).

Acknowledgment

This research was funded by the Guangdong Academy of Sciences (GDAS) Special Project of Science and Technology Development (2022GDASZH-2022010106) and Science and Technology Planning Project of Guangzhou (202206010043).

References

- Bagnall, R.S. & Cameron, W.P.L. (1932) Descriptions of two species of *Hercotothrips* injurious to cotton in the British Sudan, and of an allied species on grass. *Annals and Magazine of Natural History*, Series 10, 10, 412–419.
<https://doi.org/10.1080/00222933208673590>
- Girault, A.A. (1927) *Thysanoptera Nova Australiensis. Vol. II*. Published privately, Brisbane, pp. 1–2.
- Han, Y.F. (1997) *Economic insect fauna of China. Fasc. 55 (Thysanoptera)*. Science Press, Beijing. [in Chinese, unknown pagination]
- Han, Y.F. & Cui, Y.Z. (1992) *Insects in Hengduan mountain (1), Thysanoptera*. Science Press, Beijing. [in Chinese, unknown pagination]
- Hood, J.D. (1928) New neotropical Thysanoptera collected by C.B. Williams II. *Psyche*, 34, 230–246.
<https://doi.org/10.1155/1927/87329>
- Huang, L.N., Qiao, G.X. & Lian, Z.M. (2011) Chinese *Caliothrips* Daniel (Thysanoptera, Thripidae). *Acta Zootaxonomica Sinica*, 36 (1), 165–169.
- Ishida, M. (1931) Fauna of the Thysanoptera of Japan. *Insecta matsumurana*, 7 (1), 32–42.
- Kudô, I. (1979) Some Panchaetothripine Thysanoptera from Southeast Asia. *Oriental Insects*, 13 (3–4), 345–355.
<https://doi.org/10.1080/00305316.1979.10433628>
- Kudô, I. (1992) Panchaetothripinae in Japan (Thysanoptera, Thripidae) I. Panchaetothripini, the Genera Other than *Helionothrips*. *Japanese Journal of Entomology*, 60 (1), 109–125.
- Li, Y.J., Li, Z.Y. & Zhang, H.R. (2018) A new Panchaetothripinae genus and species, also a newly recorded genus, from Southwestern China (Thysanoptera: Thripidae). *Zootaxa*, 4394 (2), 235–242.
<https://doi.org/10.11646/zootaxa.4394.2.6>
- Minoura, K. & Masumoto, M. (2016) New records of Panchaetothripinae from Japan (Thysanoptera, Thripidae). *Zootaxa*, 4171 (1), 196–200.
<https://doi.org/10.11646/zootaxa.4171.1.13>
- Mirab-balou, M., Wang, Z. & Tong, X. (2017) Review of the Panchaetothripinae (Thysanoptera: Thripidae) of China, with two new species descriptions. *Canadian Entomologist*, 149 (2), 141–158.
<https://doi.org/10.4039/tce.2016.53>
- Moritz, G., Brandt, S., Triapitsyn, S. & Subramanian, S. (2013) Identification and information tools for pest thrips in East Africa. CBIT Publishing, Queensland. Available from: <https://thripsnet.zoologie.uni-halle.de/key-server-neu/data/03030c05-030b-4107-880b-0a0a0702060d/media/Html/index.html> (accessed 30 June 2022)
- Mound, L.A. & Houston, K.J. (1987) An annotated check-list of Thysanoptera from Australia. *Occasional Papers on Systematic Entomology*, 4, 1–28.
- Mound, L.A. & Postle, A. (2004) *Panchaetothrips timonii* sp.n. (Thysanoptera, Thripidae); first Australian record of this Old World tropical genus. *Australian Journal of Entomology*, 43, 133–137.
<https://doi.org/10.1111/j.1440-6055.2004.00401.x>
- Mound, L.A., Wang, Z., Lima, É.F.B., Marullo, R. (2022) Problems with the Concept of “Pest” among the Diversity of Pestiferous Thrips. *Insects*, 13, 61.
<https://doi.org/10.3390/insects13010061>
- Mound, L.A., Zhang, H.R. & Bei, Y.W. (2011) *Caliothrips tongi* sp.n. (Thysanoptera, Thripidae) from China, and a dubious record of North American Bean Thrips. *Zootaxa*, 2736 (1), 57–62.
<https://doi.org/10.11646/zootaxa.2736.1.5>
- Nakahara, S. (1991) Two new species of *Caliothrips* (Thysanoptera: Thripidae) and a key to the Nearctic species. *Journal of the New York Entomological Society*, 99, 97–103.
- Reuter, O.M. (1891) Thysanoptera, funna i finska orangerier. *Meddeleser af Societas pro Fauna et Flora Fennica*, 17, 160–167.
- Roditakis, E., Mound, L.A. & Roditakis, N.E. (2006) First record in Crete of *Hercinothrips femoralis* in greenhouse banana

- plantations. *Phytoparasitica*, 34, 488–490.
<https://doi.org/10.1007/BF02981204>
- ThripsWiki (2022) *Thrips Wiki—providing information on the World's thrips*. Available from: <http://thrips.info/wiki/> (accessed 30 June 2022)
- Wilson, T.H. (1975) A monograph of the subfamily Panchaethripinae (Thysanoptera: Thripidae). *Memoirs of the American Entomological Institute*, 23, 1–354.
- Xie, Y.L., Li, Y.J., Li, Z.Y. & Zhang, H.R. (2019) Two genera of Panchaethripinae newly recorded from China, with first description of males of *Opimothrips tubulatus* (Thysanoptera, Thripidae). *Zootaxa*, 4567 (3), 583–586.
<https://doi.org/10.11646/zootaxa.4567.3.10>
- Zhang, S.M., Mound, L.A. & Feng, J.N. (2019) Morphological phylogeny of Thripidae (Thysanoptera: Terebrantia). *Invertebrate Systematics*, 33 (4), 671–696.
<https://doi.org/10.1071/IS19001>
- Zhang, S.M., Mound, L.A. & Hastings, A. (2020) *Thysanoptera-Thripidae Chinensis Thripidae Genera from China*. Lucidcentral.org, Identic Pty Ltd, Queensland. Available from: https://keys.lucidcentral.org/keys/v3/thysanoptera_chinensis/ (accessed 12 September 2022)
- Zhang, S.M., Wang, Z.H., Li, Y.J. & Mound, L.A. (2018) One new species, two generic synonyms and eight new records of Thripidae from China (Thysanoptera). *Zootaxa*, 4418 (4), 370–378.
<https://doi.org/10.11646/zootaxa.4418.4.3>