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Leaf-feeding species of the genus *Liothrips* from China (Thysanoptera, Phlaeothripinae)

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Abstract

The 250 species of the second largest genus of Thysanoptera, *Liothrips*, are known as feeding mainly on green leaves, with many inducing galls or associated with galls. In China, 33 species are recognized including *L. brevis* **sp. n.**, *L. elongatus* **sp. n.**, *L. longistylus* **sp. n.**, *L. motuoensis* **sp. n.**, *L. piceae* **sp. n.**, *L. populi* **sp. n.** and *L. tibetanus* **sp. n.**, also seven species are recorded from this country for the first time. Four Han's *Liothrips* species are considered as new synonymies of *L. vaneeckei* that might be widespread in the Holarctic region. Three species are newly combined as *Liothrips aporosae* **comb.n.**, *Teuchothrips fuscus* **comb.n.** and *T. turkestanicus* **comb.n.** The illustrated identification key to Chinese *Liothrips* species excludes *L. hsuae* but includes *L. mirabilis* due to its potential as a pest of *Piper* plants are growing throughout Southern China. Biology, structural variation, and generic relationships are also discussed.

Key words: Identification key, new species, new combinations, new records

Introduction

The largest subfamily in Thysanoptera, Phlaeothripinae is considered to include three major segregates or lineages. One of these is the well-defined tribe Haplothripini that comprises mainly flower-living species, as well as some predatory species (Mound & Marullo 1996; Mound & Minaei 2007). Another is the *Phlaeothrips*-lineage of fungus-feeding species, in contrast to the third one, the *Liothrips*-lineage, with species feeding mainly on green leaves, and many inducing galls or associated with galls (Mound & Marullo 1996; Okajima 2006; Dang *et al*. 2014; Mound *et al*. 2023). In this group, the genus *Liothrips* is one of the four most species-rich genera in Thysanoptera, with 276 species listed (ThripsWiki 2023). In contrast, *Haplothrips* includes 240 species, *Frankliniella* comprises 239 species, and the genus *Thrips* has 303 species (ThripsWiki 2023). However, there is no satisfactory identification system to *Liothrips* species known from China, although Han (1997b) provided a key to 11 species, Feng *et al*. (2021) to 22 species, and Wang and Lin (2020) a key to 12 species from Taiwan, China. A modern key to 24 *Liothrips* species from Japan (Okajima 2006) is helpful to recognize some species from China, but no identification systems are available to the rich faunas of most tropical countries. An identification key to genus level in Phlaeothripinae from China and Southeast Asia is available that included 34 genera in the *Liothrips*-lineage (Dang *et al*. 2014). The objective of this study is to review the many species of *Liothrips* available from China. This identification system deals with 33 species, of which seven are new species, four species described by Han are synonymised, and seven species are recorded from China for the first time. Additionally, three species are newly combined as *Liothrips aporosae* **comb.n.**, *Teuchothrips fuscus* **comb.n.** and *T. turkestanicus* **comb.n.**

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Biology—host plants and distributions

Taxonomy was often considered as involving little more than the description of dead specimens by comparing with species described previously. The biology of a species is often ignored, although this can be an equally important reflection of its genetic composition as its external appearance. Although almost all *Liothrips* are associated with the leaves of plants, many species in this genus were described without any information about the plant species from which each was collected. Moreover, when a plant name is recorded, there is often little evidence that this is anything more than a 'finding place', rather than a plant used for feeding and breeding (Dang *et al*. 2014). A practical definition of host plants for a thrips species is a plant on which the insect can maintain a population (Mound 2013). The approach to the taxonomy of thrips is in sharp contrast to the approach to studies on aphids, in which many species are specific to a particular host plant (Blackman & Eastop 1994). The biology of most *Liothrips* species remains unknown, although radiation within this genus is likely to be related in some way to the diversity of available plants with suitable leaves.

Some *Liothrips* species seem to feed on many different plants, even in different plant families. For example, *L. piperinus* was reported invading leaf galls on *Piper kadzura* [Piperaceae], *Castanopsis cuspidata* and *C. sieboldii* [Fagaceae], and feeding on leaves of *Elaeocarpus sylvestris* [Elaeocarpaceae] (Okajima 2006; Mound 2020), and in this study, many specimens of *L. piperinus* from Yunnan were found in leaf galls of *Smilax glaucochina* [Smilacaceae]. However, many *Liothrips* species seem to feed on a specific or congeneric plant (Stannard 1968; Han 1997b; Okajima 2006; Mound 2020; Wang & Lin 2020). In China, there are six species confirmed as feeding on a specific plant, including *L. bournierorum* on leaves of *Tsuga chinensis*, *L. brevitubus* on *Mallotus* sp., *L. heptapleuricola* in leaf galls of *Heptapleurinum arboricolum*, *L. longistylus* **sp. n.** on leaves of *Adinandra millettii*, *L. piceae* **sp. n.** on leaves of *Picea* sp., and *L. populi* **sp. n.** on leaves of *Populus euphratica* (Table S1). Structural and colour variations between populations can also create confusion. Thus Priesner (1968) reported 16 species of *Liothrips* from leaf-galls on *Piper* spp., but Mound (2020) working with more extensive collections recognized only nine species from *Piper* vines and with other names as synonyms.

The genus *Liothrips* is reported all over the world, but particularly in the tropics. Similarly, in China most *Liothrips* species are from the southern sub-tropical areas (Table S1). However, two new species are described here from the North: *L. piceae* **sp. n.** from Xinjiang and *L. populi* **sp. n.** from Inner Mongolia. In addition, two species are recorded from the middle of China, *L. threobrevis* from Henan and *L. wasabiae* from Shaanxi. There is no evidence of some particular difference in appearance between northern and southern species, but leaf galls are not known in any *Liothrips* species from the North. In the first author's collecting experience, thrips are barely collected from plant galls in the northern China. Again, this association of *Liothrips* with areas that have the most diverse flora emphasises the importance of observing and collecting biological information for any thrips species. We therefore strongly recommend that students record as much detail as possible during field work to record thrips behavior, rather than just sweeping plants to collect and study adults.

Technical problems

For taxonomic study, each thrips specimen must be mounted in Canada balsam onto a microscope slide that is then labelled with the associated data. Various accounts of this process are available (Mound & Marullo 1996; Okajima 2006), and the objective is to produce cleared and undistorted specimens on which details are readily visible (see the 3500 photomicrographs in Okajima & Masumoto 2022). Unfortunately, many slides from previous generations of workers do not meet these standards of clarity. Karny, for example, did not clear specimens of *Liothrips*, and almost all specimens were mounted ventral side up on the slides. Some of the photomicrographs given here are based on older type-specimens. These specimens are often distorted and crushed, with dorsal and ventral surfaces pressed into the same focal plane. Han (1997b) indicated that specimens were cleared in trichlorophenol solution, and it seems that this has emerged from many specimens when these were subsequently mounted in Canada balsam. Images of these specimens produced here are clearly unsatisfactory, and the character states on which such distorted specimens are distinguished in the key below may prove to be unreliable. A further problem is that the descriptions of many new species, also new localities and host records, are based solely on published literature without any direct comparisons to the original specimens of previously described species. Although sometimes essential, this habit when practised by a series of authors, can lead to a cascade of misidentifications.

Relationships of the genus *Liothrips* in China

Species of the *Liothrips*-lineage usually have one and three sense cones on antennal segments III–IV respectively, and they also lack prosternal basantra. These character states generally differentiate members of this lineage from the other two groups in Phlaeothripinae. Among the 34 genera listed in the *Liothrips*-lineage from China and Southeast Asia, 15 genera were recorded from China (Dang *et al*. 2014), including *Eurhynchothrips*, *Gigantothrips*, *Gynaikothrips*, *Horistothrips*, *Leeuwenia*, *Liophloeothrips*, *Liothrips*, *Litotetothrips*, *Manothrips*, *Medogothrips*, *Phaenothrips*, *Psephenothrips*, *Agynaikothrips*, *Crotonothrips* and *Eugynothrips*, of which the last three were known only from Taiwan. Of these 15 genera, the following five are closely related to *Liothrips*.

Phaenothrips was erected as a subgenus of *Liothrips* by Priesner (1968), and eight species are included in this genus with the following characters combination: elongate sense cones on antennal segments which are more than 2/3 length of their segments, and short postocular setae (Priesner 1968; Bhatti 1995). One more character to be considered is that all species of *Phaenothrips* have all tibiae yellow. Although the genus can be distinguished from *Liothrips* by the characters combination, some of the character states also appear in species such as *L. piperinus* (with long sense cones and short postocular setae) (Fig. 28) and *L. pallipes* (with long sense cones and all tibiae yellow) (Fig. 27). Moreover, the postocular setae vary in length among *Liothrips* species. Despite these problems, *Phaenothrips* is considered an 'independent' genus, and some specimens from Hainan and Tibet are identified as *P. callosae* and *P. eugeniae*.

Gynaikothrips, a genus with species often associated with leaf-galls of *Ficus* trees, includes 37 species worldwide. A recent taxonomic study of the ten species from Australia indicates the important characters (Mound & Tree 2021) that are useful for distinguishing *Gynaikothrips* from *Liothrips*, as also mentioned by Dang *et al*. (2014): pronotum strongly sculptured; absence of metathoracic sternopleural sutures; presence of a broad mesopresternum. One new species described here, *L. tibetanus* **sp. n.**, has irregular reticulate sculpture on the pronotum (Fig. 50) as is typical of *Gynaikothrips*, but it is identified as a *Liothrips* species due to the presence of the metathoracic sternopleural sutures, and the medially eroded mesopresternum (Fig. 68).

Psephenothrips, another poorly-defined genus of *Liothrips*-lineage from Asia, is apparently distinguished from *Liothrips* because of long maxillary stylets that are close together in the middle of the head (Okajima 2006; Dang *et al*. 2021). Further distinguishing characters include antennal segment VIII elongate and contracted at base, mesopresternum transverse and protruding medially, and metanotum with polygonal reticulation. In contrast, *Liothrips* species have antennal segment VIII rather short and broadly joined to VII, or slightly contracted at base (Figs 31–40), the mesopresternum usually eroded medially or reduced to two lateral triangles (Figs 53–58, 62–66), and the metanotum with longitudinal striae or reticulation (Figs 69–87). One species recently described, *Psephenothrips aporosae*, is here placed as a new combination in *Liothrips* due to the shape of antennal segment VIII and the mesopresternum eroded medially (Fig. 53) (Tong *et al*. 2021). It cannot be identified to species using keys to *Psephenothrips* species provided by Wang and Lin (2020) and Dang *et al*. (2021).

Eurhynchothrips, a small genus of five species worldwide, also has long stylets and elongate antennal segment VIII as *Psephenothrips*. But it can be poorly distinguished by sternopleural suture present and a stout maxillary bridge on the shortest distance between stylets. An elongate antennal segment VIII is a typical character in *Litotetothrips* as well, which is usually as long as or longer than VII in comparison to *Liothrips*. Members of *Eurhynchothrips* share three more characters to distinguish them within the *Liothrips*-lineage: head short and constricted at base, maxillary stylets short and V-shaped, and pronotal aa and am setae reduced.

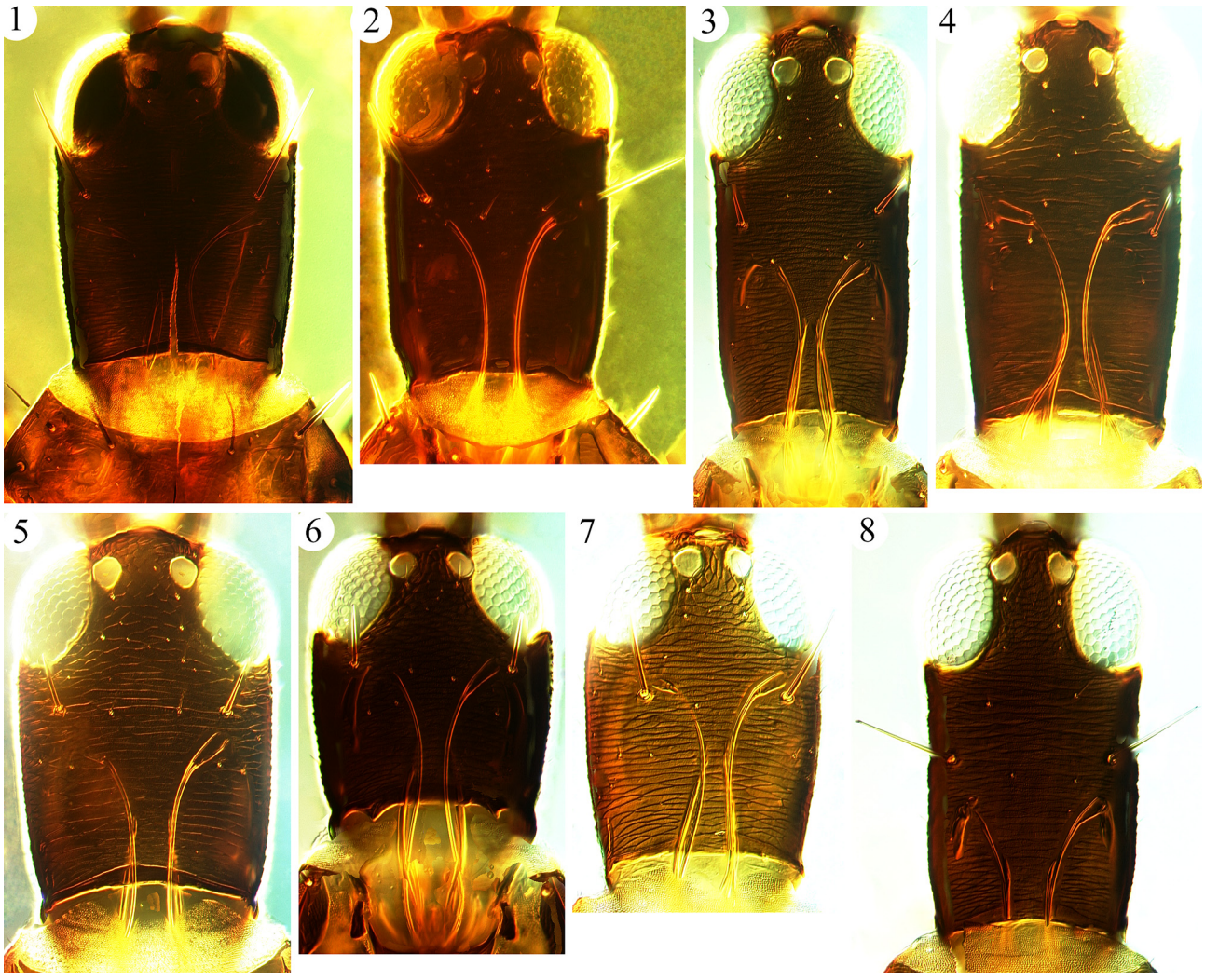
In addition to these five genera recorded from China, the genus *Teuchothrips* represents a radiation in the *Liothrips* group that is largely endemic to Australia (Mound 2008; Mound *et al*. 2023). A fore tarsal tooth is present in both sexes of *Teuchothrips* species, whereas both sexes of *Liothrips* species lack fore tarsal teeth (Okajima 2006; Mound *et al*. 2023). As a consequence, *Rhynchothrips fuscus* Moulton and *R. turkestanicus* John, from China, both of which bear such fore tarsal teeth (Fig. 14), are considered here as **new combinations** in *Teuchothrips* (John 1928; Steinweden & Moulton 1930; Han 1997b).

Structural variation in Chinese *Liothrips*

Most species of *Liothrips* are uniformly brown to dark brown in colour, in contrast to many fungus-feeding species that have a bicoloured body. Generally, they have one and three sense cones on antennal segments III & IV respectively, and the basantra are absent. However, segment IV has only two sense cones in some exceptional

species in the closely related genus *Teuchothrips* (Mound & Goldarazena 2022; Mound *et al*. 2023). Additionally, these sense cones are usually short, not as long as the apical width of this segment. In *L. piperinus*, however, they are rather elongate, somewhat longer than half the length of this segment (Fig. 28). All species of *Liothrips* from China studied here show the above mentioned uniform character states.

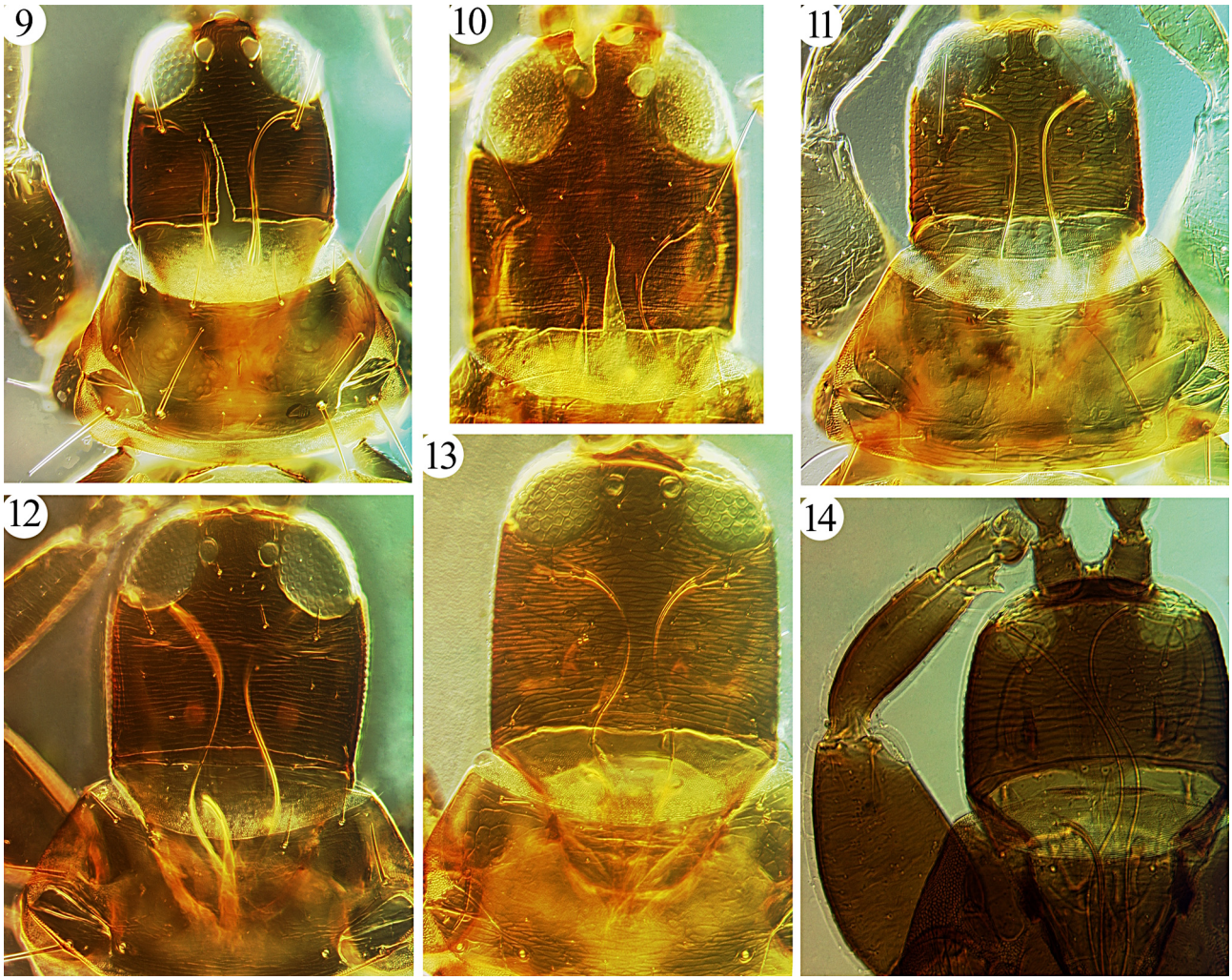
Coloration of appendages. In contrast to the uniform brown body, appendages of *Liothrips* have various colours. The middle antennal segments have gradual colour from pale to brown compared with the uniform brown I–II and VII–VIII (Figs 31, 34, 40). Similarly, all tibiae are uniformly yellow in three species, *L. motuoensis* **sp. n.**, *L. pallipes* and *L. mirabilis*, but others have tibiae coloured gradually from brown at basal third to brown entirely and some have brown tarsi as well. Fore tibiae colour was used to separate species very early in the key to *Liothrips* from Japan by Okajima (2006), which is also used in couplet 13 of this key. It seems to work well when fore tibiae are clear yellow or somewhat shaded, but "slightly shaded" is sometimes difficult to judge if fore tibiae colour is natural or caused by maceration in hydroxide solution. In contrast, it is easier to distinguish opacity of the fore wings, as well as when the tarsi and tibiae are concolorous, as in *L. piceae* **sp. n.** and *L. floridensis*.



FIGURES 1–8. Heads of *Liothrips* species. (**1**) *adusticornis*; (**2**) *bomiensis*; (**3**) *elongatus* **sp. n.**; (**4**) *motuoensis* **sp. n.**; (**5**) *hagai*; (**6**) *heptapleuricola*; (**7**) *miyazakii*; (**8**) *mohanrami*.

Head shape. Members of *Liothrips* usually have the head longer than wide, sometimes even twice as long as broad, as in *L. elongatus* **sp. n.** (Fig. 3). However, the following four species from China have an unusually short head, as is also found in the Japanese species, *L. fungi*. The first one, *L. populi* **sp. n.,** is similar to *L. fungi* in having S1–S2 setae on tergite IX only about half as long as the tube, but it can be distinguished by the very short postocular setae and slender segments III–VII (Figs 12, 29). *L. brevis* **sp. n.** has the metanotum sculpture dense and closely striate (Fig. 71), but the other species in this group have longitudinal reticulation. *L. longistylus* **sp. n.** has

an elongate mouth-cone which is longer than the head, as in *L. fungi* from Japan, but they can be distinguished by length of postocular setae (Fig. 11). *L. fungi* is also very similar to *L. aporosae* in having short postocular setae, long stylets and the shape of the mesopresternum (Fig. 53). *L. fungi* was considered a fungus-feeder, as it was collected from dead branches. However, *L. aporosae* was originally described in the galls of *Aporosa octandra*. Similarly, another short headed species from India on leaf galls of *Jasminum*, *L. nanus,* could not be distinguished from *L. aporosae*. One type female was checked here, and the only difference between them is setae S1–S2 on tergite IX as long as tube and absent metathoracic sternopleural sutures in *L. nanus* but these setae are shorter than tube and the sutures are present in *L. aporosae*.



FIGURES 9–14. Heads and pronotum. *Liothrips* species (**9–13**): (**9**) *brevis* **sp. n.**; (**10**) *mirabilis*; (**11**) *longistylus* **sp. n.**; (**12**) *populi* **sp. n.**; (**13**) *piceae* **sp. n.** (**14**) *Teuchothrips turkestanicus*.

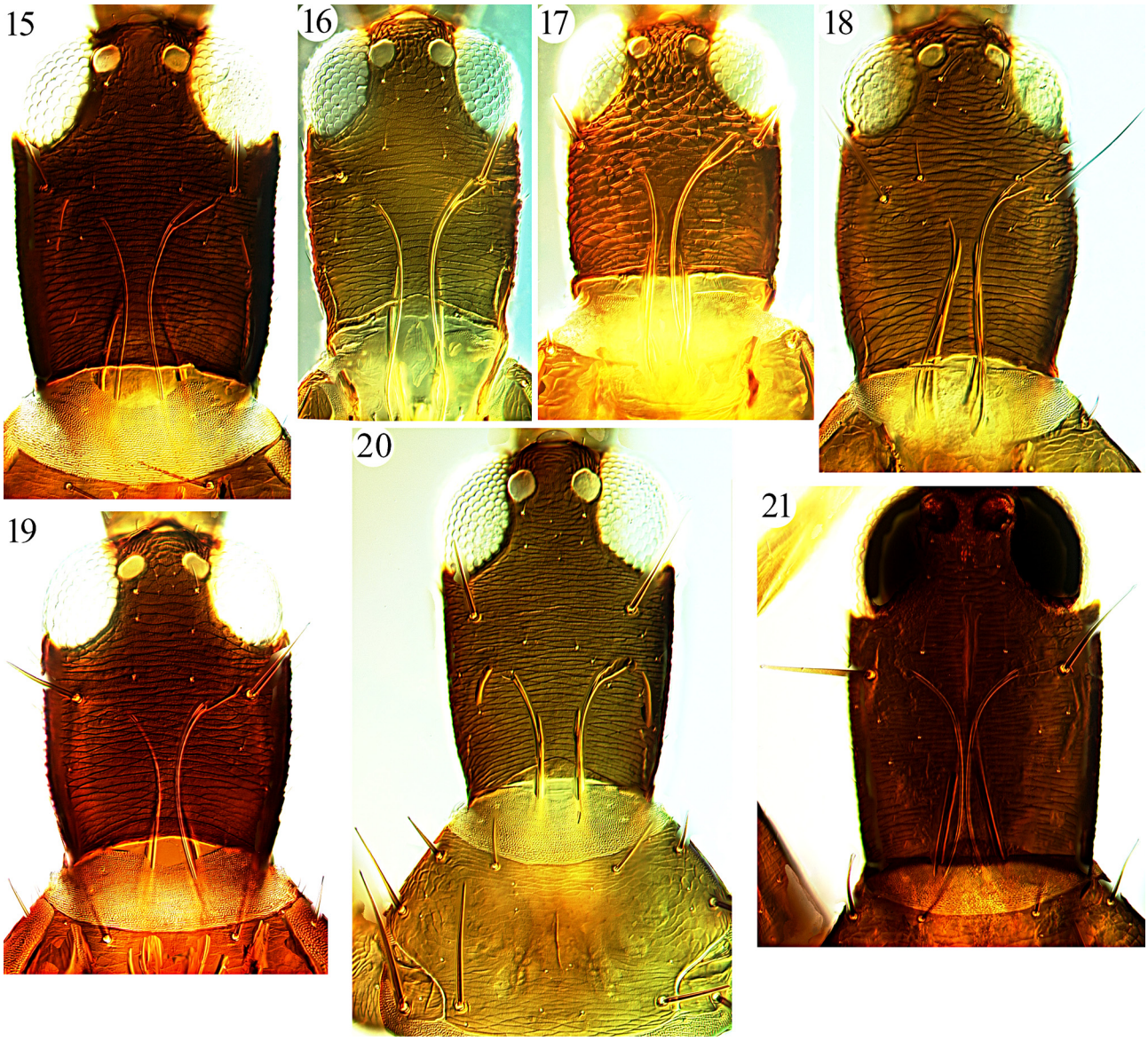
Postocular setae. Although the Chinese *Liothrips* species have one pair of dominant setae behind eyes, their length and position are various. These setae vary from small and not reaching posterior margin of eyes, as in *L. motuoensis* **sp. n.** (Fig. 4), to much longer than eyes as in *L. longistylus* **sp. n.** (Fig. 11). In addition, this pair of setae are far away from eyes and located in the middle of dorsal head in *L. mohanrami* (Fig. 8) and *L. threobrevis*, whereas in many species they are close to eyes (Figs 1–2, 5–7, 9–16).

Maxillary stylets. Most *Liothrips* species from China have maxillary stylets reaching to postocular setae (Figs 4, 6, 7, 9, 11–13, 17–19, 21). In many species they are close together medially (Figs 4, 6, 7, 11–13, 15–19, 21), but in *L. pallipes* they are wide apart. In all species with a short head the stylets are elongate and reach to the compound eyes (Figs 9, 11–13), but among the other species of the genus the separation between the stylets is various. Some species have stylets low down in the basal third of head (Figs 3, 8, 20).

Antennal segments length. In *Liothrips* species, antennal segment VIII broadly connects to VII and is short, never longer than VII. This is an important character state to distinguish *Liothrips* from the closely related genera,

Eurhynchothrips, *Psephenothrips* and *Litotetothrips*. In contrast to *Teuchothrips* species that have antennal segments III and IV never elongate, these segments in *Liothrips* vary in length between species, from twice as long as apically wide in *L. vaneekei* (Fig. 40) to 5 times as long in *L. elongatus* **sp. n.** (Fig. 31).

Pronotal setae. Five pairs of major pronotal setae are usually present in *Liothrips,* even though setae am and aa are smaller (Figs 42–47, 49–52). In *L. bournierorum* and *L. motuoensis* **sp. n.** the pa setae are also minute (Fig. 48), and the proscutum is eroded laterally with the ml setae arising on the area of chitinous islets in the former species. Moreover, these major setae are usually blunt or expanded at apex, but acute in *L. mirabilis* as well as all major setae (Fig. 43).



FIGURES 15–21. Heads of *Liothrips* species. (**15**) *setinodis*; (**16**) *rohdeae*; (**17**) *tibetanus* **sp. n.**; (**18**) *vaneeckei*. (**19**) *wasabiae*; (**20**) *takahashii*; (**21**) *piperinus*.

Mesopresternum. Okajima (2006: 462) indicated the various shapes of this structure in *Liothrips* that is eroded medially or divided into two triangular plates in most Chinese species (Figs 53–58, 62–66). There are two exceptions, in *L. floridensis* and *L. populi* **sp. n.** the mesopresternum is transverse and boat-shaped (Figs 67, 61).

Metanotal sculpture. All Chinese *Liothrips* species have the metanotum with dense longitudinal striae or longitudinally reticulate sculpture (Figs 69–74, 76–83, 84–87). But *L. tibetanus* **sp. n.** is an exception having bold reticulation not only on the metanotum but also on the pronotum and pelta (Figs 50, 84). This pronotal irregular reticulation is similar to species of *Gynaikothrips*. Its body shape and surface sculpture appear similar to some *Teuchothrips* from Australia. Therefore, *L. tibetanus* **sp. n.** is possibly a transitional in form among these three groups.

Metathoracic sternopleural suture. The presence of this suture has been considered a consistent character state of *Liothrips* species (Okajima 2006; Dang *et al*. 2014). Okajima (2006: 20) considered it a plesiomorphic trait. However, exceptions are found in *L. rohdeae* and *L. motuoensis* **sp. n**., which do not possess these sutures. Typically, they are short in *Liothrips* species, but are somewhat longer in *L. tibetanus* **sp. n.** (Fig. 68).

***Tergite II accessory setae*.** The number of lateral accessory setae on tergite II is useful to distinguish *L. takahashii* (Fig. 90) (Wang & Lin 2020; Mound *et al*. 2023), because in other *Liothrips* species there are usually no more than 7 these setae (Fig. 89). A second species with numerous accessory setae on tergite II is the new species described from Yunnan, *L. elongatus* **sp. n.**, which can be distinguished from *L. takahashii* by elongate head and antennae (Figs 3, 31).

***Tergite IX setae*.** The posteromarginal setae on the ninth tergite are usually long and pointed at apex, about as long as the tube or only a little shorter, although in *L. populi* **sp. n.** these setae are shorter, about half as long as the tube (Fig. 102). Moreover, in *L. motuoensis* **sp. n.** the S1 setae are similarly short with their apices weakly blunt, whereas setae S2–S3 are equal in length to the tube and acute at apex (Fig. 99).

***Male abdominal segment VIII pore plate*.** Males of *Liothrips* commonly have an entire pore plate on sternite VIII (Figs 91, 94–96), but in *L. bomiensis* and *L. heptapleuricola* no pore plate is developed. In a few species the pore plate is extended onto tergite VIII, forming a lateral pair in *L. takahashii* (Fig. 92) and *L. mohanrami* (Fig. 93). But in *L. takahashii* these paired pore plates are small and can be seen on posterior lateral part (Fig. 92) while in *L. mohanrami* they are larger and occupy around half of this tergite (Fig. 93). Paired tergal pore plates also exist in the Japanese species, *L. tsutsumii* (Okajima 2006).

Material and methods

The descriptions, photomicrograph images and drawings were produced from slide-mounted specimens with a Nikon Eclipse 80i microscope. Images were prepared with a Leica DM2500 using DIC illumination, and processed with Automontage and Photoshop 7.0. The abbreviations used for the pronotal setae are as follows: **am—**anteromarginal, **aa—**anteroangular, **ml—**midlateral, **epim—**epimeral, **pa—**posteroangular. **CPS** refers to campaniform sensilla. The unit of measurement in this study is the micrometre. Most specimens studied here are available in the School of Bioscience and Engineering, Shaanxi University of Technology (**SNUT**), Hanzhong, China, the National Zoological Museum of China (**NZMC**), Institute of Zoology, Chinese Academy of Sciences, Beijing, China, and the Australian National Insect Collection (**ANIC**), Canberra, Australia. Additionally, many type slides were on loan from the Naturmuseum Senckenberg (**SMF**), Frankfurt, Germany, and the Tokyo University of Agriculture (**TUA**), Tokyo, Japan. Holotypes of the new species are deposited in the place indicated for each one.

Liothrips Uzel

Liothrips Uzel, 1895: 261. Type species *Phloeothrips setinodis* Reuter, by subsequent designation of Hood, 1918: 131.

The earliest species of *Liothrips* recorded from China (Taiwan) were *malloti*, *malloti var. flavicornis* and *terminaliae* by Moulton (1928a), of which the first two are now treated as synonyms of *L. brevitubus*, and the third has been transferred to *Liophloeothrips* (Priesner 1968) (Wang & Lin 2020). Additionally, Moulton (1928a; 1928b) described several species in *Gynaikothrips* from Taiwan, of which three are now placed in *Liothrips*, *L. kuwayamai*, *L. takahashii* and *L. kuwanai*, of which the latter was synonymised with *L. pallipes* by Mound (2020). Zhang studied thrips specimens collected from southern China, among which five valid species of *Liothrips* were recorded (Zhang 1984; Zhang *et al*. 1999). Finally, Han focused on southwest part of China, and described seven valid species (Han 1988, 1993, 1997a, 1997b). After that, no one tried to review this large genus across China, until 2020, when 12 species were recorded from Taiwan including two new species (Wang & Lin 2020). Based on the above studies, we here try to clarify the diversity of this genus in China including 33 species in total, of which five are known only from Taiwan (Table S1).

Generic diagnosis: Medium sized, usually dark and macropterous. Antennae 8-segmented, VIII much shorter than VII (Figs 31–40), and broad at base, III–IV with one and three major sense cones respectively (Figs 22–30, 41), IV rarely with two. Head length various, ranged from broader than long to about twice as long as wide (Figs 1–13,

15–21); usually transversely striate or weakly reticulate; usually with one pair of long postocular setae (rarely 2 or 0); eyes well-developed; maxillary stylets retracted halfway to postocular setae or eyes, close together or wide apart. Pronotum usually with 5 pairs of major setae (Figs 42–46, 49–52), sometimes am or aa or pa reduced (Figs 47, 48), rarely only epim developed, notopleural sutures complete; basantra absent, ferna large, mesopresternum transverse or divided into two triangles (Figs 53–58, 61–68); metathoracic sternopleural sutures usually well developed (Figs 66–68), rarely absent. Fore tarsal tooth absent in both sexes; fore wings not constricted medially, usually with many duplicated cilia. Pelta triangular (Figs 69–87), tergites II–VII each with 2 pairs of sigmoid wing-retaining setae; IX with setae S1 and S2 usually long and pointed (Figs 97–102); tube usually shorter than head, anal setae usually as long as tube or shorter. Male sternite VIII usually with large pore plate (Figs 91, 94–96), rarely small or absent, sometimes tergite VIII with a pair of pore plate as well (Figs 92, 93).

Key to *Liothrips* species of China

(* indicates species not seen; *L. hsuae* is excluded; *L. mirabilis* is included due to its pest potential of *Piper* plants grown throughout southern China.)

1. All legs brown (Fig. 60), sometimes paler at fore tibiae apices and tarsi 2
-. At least all tarsi yellow (Fig. 59) 3
2. Postocular setae short, just reaching posterior margin of eyes (Fig. 3); metanotum with longitudinal reticulation (Fig. 76); antennal segments VII and VIII broadly joined (Fig. 35); major setae blunt at apices (on leaves of *Picea* sp.) . . . . *piceae* **sp. n.**
-. Postocular setae about as long as or longer than eyes; metanotum with polygonal reticulation (Fig. 75); antennal segment VIII constricted at base; major setae with expanded apices (on leaves of *Litsea glutinosa*) . . . . . *floridensis*
3. All tibiae uniformly yellow 4
-. Mid and hind tibia at least more or less shaded 7
4. Postocular setae minute, not longer than other discal head setae (on *Styrax* sp.) . . . . . *styracinus**
-. Postocular setae much longer than other discal head setae 5
5. Pronotal pa setae minute (Fig. 48); metanotum finely reticulate (Fig. 73); tergite IX setae S1 short and blunt, about half length of S2 (Fig. 99). . . . . *motuoensis* **sp. n.**
-. Pronotal pa well developed, about as long as epim setae; metanotum closely striate; S1 on tergite IX acute, about as long as S2 6
6. All major setae expanded or blunt at apex; postocular setae much shorter than eyes; tergite IX S1 setae shorter than tube; antennal segment III slender, about 4.0 times as long as wide (Fig. 27) (in leaf gall of *Piper* spp.) . . . . . *pallipes*
-. All major setae acute at apex (Fig. 43); postocular setae slightly shorter than eyes (Fig. 10); tergite IX S1 setae longer than tube; antennal segment III slender, about 2.3 times as long as wide (Fig. 41) (on *Pavetha hispida* and in rolled leaf margins of pepper plant). . . . . *mirabilis*
7. Head short, as long as wide or shorter 8
-. Head longer than wide 11
8. Postocular setae small, much shorter than eyes, just reaching posterior margin of eyes (Fig. 12) [fore wings hyaline] (on leaves of *Populus euphratica*) . . . . . *populi* **sp. n.**
-. Postocular setae well developed, a little shorter than eyes or longer 9
9. Metanotum closely striate (Fig. 71); antennal segments III–VI uniformly yellow (Fig. 23). . . . . *brevis* **sp. n.**
-. Metanotum longitudinally reticulate; antennal segments IV–VI more or less shaded brown 10
10. Fore wing hyaline; postocular setae much longer than eyes (Fig. 11) (on leaves of *Adinandra millettii*). . . . . *longistylus* **sp. n.**
-. Fore wing shaded brown; postocular setae a little shorter than eyes (on leaves of *Symplocos laurina*) . . . . . *aporosae*
11. Proscutum eroded laterally, midlateral setae arising on the area of chitinous islets, pa minute [metanotum closely striate (Fig. 70)] (on leaves of *Tsuga chinensis*) . . . . . *bournierorum*
-. Proscutum fully transverse bearing midlateral setae laterally, pa setae elongate. 12
12. Front part of pronotum (Fig. 50), metanotum (Fig. 84) and lateral parts of tergites II–VII distinctly reticulate [Antennal segments III–VI uniformly yellow, VII–VIII brown (Fig. 39); mid and hind tibiae uniformly brown; S1 on tergite IX blunt, shorter than S2 (Fig. 101)] . . . . . *tibetanus* **sp. n.**
-. No reticulation on lateral parts at least of tergites II–VII. 13
13. Fore tibiae more or less shaded, at least basally or exteriorly 14
-. Fore tibiae clear yellow 24
14. Tergite II close to lateral margin with irregular row of 9–12 discal setae 15
-. Tergite II close to lateral margin with irregular row of 4–7 discal setae 16
15. Head twice as long as wide (Fig. 3); antennal segment III about 5 times as long as wide (Fig. 31); postocular setae scarcely reaching posterior margin of eyes (Fig. 3); pronotal setae am and aa small (Fig. 45), sometimes well-developed in male (on leaves of *Ficus tikoua*) . . . . . *elongatus* **sp. n.**
-. Head 1.4 times as long as wide (Fig. 20); antennal segment III about 3 times as long as wide; postocular setae extending well-beyond posterior margin of eyes (Fig. 20); pronotum with strong and dark major setae, am and aa usually developed . . . . . *takahashii*

16. Postocular setae far from eyes, located dorsally in middle of head (Fig. 8); pronotal setae am minute, much shorter than ml (Fig. 46) . . . 17
-. Postocular setae close to eyes; pronotal am and aa well developed, sometimes reduced . . . 18
17. Mid and hind tibiae brown in basal half, yellow in apical half; pronotal aa setae as minute as am (Fig. 46) (on *Globba racemosa*) . . . *mohanrami*
-. Mid and hind tibiae uniformly brown; pronotal aa setae much longer than am (on *Liquidambar* sp.) . . . *threobrevis*[*]
18. Fore wings hyaline . . . 19
-. Fore wing shaded brown or grey, at least with a dark stripe . . . 20
19. Mesopresternum reduced to two lateral triangles; antennal segment III yellow, IV–VI yellow with shaded apices (Fig. 22) (on *Gnetum* spp.) . . . *adusticornis*
-. Mesopresternum boat-shaped with median protrusion; antennal segments III–VI uniformly yellow, sometimes VI shaded at apices (on *Viburnum* sp.) . . . *kuwayamai*[*]
20. Antennal segments III–VII yellow except VII brownish at apex, VIII brown; mid and hind tibiae uniformly dark brown . . . 21
-. Antennal segments VII–VIII brown; apical 1/6–1/3 of mid and hind tibiae yellow . . . 22
21. Postocular setae shorter than eyes; antennal segments III–IV slender and elongate, III longer than IV (Fig. 24) (in leaf galls of *Fagraea obovata*) . . . *fagraeae*
-. Postocular setae longer than eyes; antennal segments III–VII short, III slightly shorter than IV (on *Mallotus* sp.) . . . *brevitubus*
22. Metanotum sculptured with hexagonal reticles medially . . . *dayulingensis*[*]
-. Metanotum sculptured with narrow reticulation or longitudinal stripes medially . . . 23
23. Postocular setae blunt or expanded at apex (Fig. 7); antennal segments slender, III about 3.0 times as long as wide, IV about 2.2 times as long as wide, sense cones on III–IV as long as or a little longer than width of their segments (Fig. 37); metanotum with narrow reticulate sculpture (Fig. 83); anal setae shorter than tube (on *Gentiana scabra*) . . . *miyazakii*
-. Postocular setae acute at apex (Fig. 18); antennal segments short and broad, III about 2.0 times as long as wide or a little longer, IV about 1.5 times as long as wide (Fig. 40), sense cones on III–IV no longer than width of their segments; metanotum sculptured with complete and dense longitudinal stripes medially but at anterior angles scarcely narrowly reticulate (Fig. 85); anal setae about as long as tube (on lily bulbs) . . . *vaneeckei*
24. Pelta with no CPS, with or without small setae posterolaterally . . . 25
-. Pelta with a pair of CPS, sometimes with a minute seta close to the CPS . . . 26
25. Pelta with 3–4 small setae posterolaterally (Fig. 72); antennal segments IV–VI uniformly yellow, VII–VIII brown (Fig. 36) (on leaves of *Schefflera heptaphylla*) . . . *heptapleuricola*
-. Pelta without any small setae; antennal segments IV–VIII yellow, sometimes VIII slightly shaded (on *Vitex* sp.) . . . *vitivorus*[*]
26. Head short, no more than 1.3 times as long as wide; antennal segment III no more than 3 times as long as wide . . . 27
-. Head elongate, more than 1.5 times as long as wide; antennal segment III more than 3 times as long as wide . . . 28
27. Antennal segments III–VIII uniformly yellow except VIII slightly shaded (Fig. 26); postocular setae shorter than eyes; fore wings hyaline (in leaf gall of *Jasminum grandiflorum*) . . . *minys*
-. Antenna segments IV–V shaded at apex, VI brown with pale at base, VII–VIII uniformly brown (Fig. 34); postocular setae as long as eyes (Fig. 19); fore wings more or less shaded brown, with a longitudinal brown stripe (on leaves of *Periploca sepium*) . . . *wasabiae*
28. Sense cones on antennal segments III–IV short, shorter than width of this segment; metanotum longitudinally reticulate . . . 29
-. Sense cones on antennal segments III–IV elongate, longer than width of this segment; metanotum closely striate . . . 30
29. Mid and hind tibiae yellow at apical and basal 1/5 . . . *bomiensis*
-. Mid and hind tibiae uniformly dark brown (on leaves of *Heptapleurum* sp.) . . . *heptapleurinus*[*]
30. Sense cones on antennal segments III–IV elongate, longer than half the length of this segment (Fig. 28) (in leaf galls of *Smilax glaucochina*) . . . *piperinus*
-. Sense cones on antennal segments III–IV shorter than half the length of this segment . . . 31
31. Pronotal am and aa minute, sometimes aa a little longer but much smaller than ml (Fig. 47) (on leaves of *Viburnum sieboldii*) . . . *hagai*
-. Pronotal am and aa setae well developed (Fig. 49) . . . 32
32. Metathoracic sternopleural sutures absent; sense cones on antennal segments III–IV moderately long, about 1/2 times as long as this segment (Fig. 33) (on leaves of *Rohdea japonica*) . . . *rohdeae*
-. Metathoracic sternopleural sutures present; sense cones on antennal segments III–IV short, about 1/3 times as long as this segment (Fig. 30) . . . *setinodis*

***Liothrips adusticornis* (Karny)**

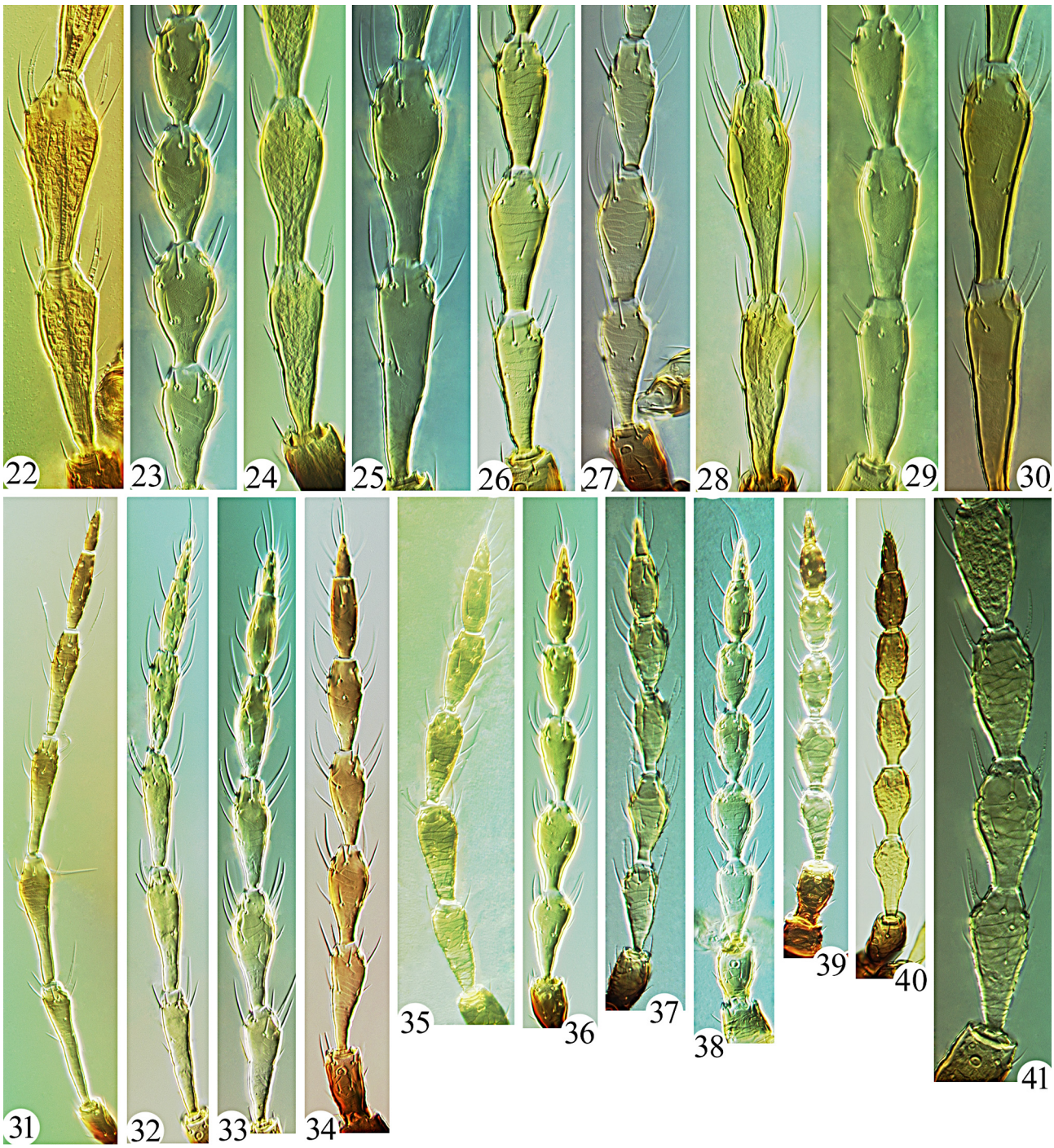
(Figs 1, 22, 42)

Gynaikothrips adusticornis Karny, 1916: 21.

This species was described from Java, and subsequently recorded from Fujian and Hainan, China (Zhang *et al*. 1999) but with no description. These records were later repeated by Mirab-balou (2011), but with no additional information. No slides have been studied here from the collections of South China Agricultural University (Zhang

et al. 1999), but one female and one male from Hong Kong are here identified as this species, taken on *Gnetum luofuense*—the same plant genus as for the syntype listed below. In contrast to the syntype female, the Hong Kong specimens have the sense cones on the antennal segments elongate, about 2/3 as long as their segments, and the postocular setae shorter than the eyes, whereas the syntype has the sense cones less than half the length of their segments (Fig. 22), and the postocular setae as long as the eyes (Fig. 1).

Specimens studied. CHINA, Hong Kong, one female and one male on *Gnetum luofuense*, 30.xi.2005, Martin J.H. (ANIC). INDONESIA, Java, Syntype female on *Gnetum latifolium*, 26.ix.1918, Docters van Leeuwen T. (SMF).



FIGURES 22–41. Antennae of *Liothrips* species. (**22**) *adusticornis*; (**23**) *brevis* **sp. n.**; (**24**) *fagraeae*; (**25**) *hagai*; (**26**) *minys*; (**27**) *pallipes*; (**28**) *piperinus*; (**29**) *populi* **sp. n.**; (**30**) *setinodis*; (**31**) *elongatus* **sp. n.**; (**32**) *mohanrami*; (**33**) *rohdeae*; (**34**) *wasabiae*; (**35**) *piceae* **sp. n.**; (**36**) *heptapleuricola*; (**37**) *miyazakii*; (**38**) *longistylus* **sp. n.**; (**39**) *tibetanus* **sp. n.**; (**40**) *vaneeckei*; (**41**) *mirabilis*.

Liothrips aporosae (Tong *et al*.) comb.n

(Figs 53, 96)

Psephenothrips aporosae Tong, Lau & Zhao, 2021: 292.

This species was described from Hainan and Hong Kong, China, taken from galls on *Aporosa octandra*. Due to its long maxillary stylets, that are close together in the head, and the presence of five pairs of rather small pronotal major setae with knobbed apices, this species was associated initially with *Psephenothrips.* Members of that genus, however, are characterized by the following features: (1) antennal segment VIII elongate and constricted at base, (2) mesopresternum transverse and protruding medially, (3) metanotum sculptured with polygonal reticulation and (4) sternite VIII in males without a pore plate. In contrast, this species has the following character states: (1) antennal segment VIII short and broadly joined to VII, (2) mesopresternum eroded medially and (3) metanotum sculptured with longitudinal reticulation (Fig. 53). Moreover, (4) the males from Guangdong listed below have a large pore plate as in males of *Liothrips* (Fig. 96). Furthermore, three of the new species described in this study have a very short head similar to *L. aporosae* and they all have typical characters states of *Liothrips* (*L. populi* **sp. n.,** *L. brevis* **sp. n.** and *L. longistylus* **sp. n.**). Therefore, *aporosae* is placed here as a new combination in *Liothrips*.

Specimens studied. CHINA, Hainan, 1 female, 7.iv.1958, Xiangling Meng (NZMC); Guangdong, Guangzhou, 2 males on *Symplocos laurina*, 14.v.1958, Xiangling Meng (NZMC).

Liothrips bomiensis Han

(Figs 2, 52, 69)

Liothrips bomiensis Han, 1988: 187.

This species was described from Tibet, China from a holotype male and 13 paratypes including two females and 11 males taken from leaves of an unknown tree. In the original description there was no mention of a pore plate on sternite VIII of males, but all of the type specimens were checked here and the males do not have a pore plate. This species has one pair of postocular setae (Fig. 2) like other *Liothrips*, whereas the original drawing indicated the presence of two pairs (Han 1988, fig. 4). With the mid and hind tibiae dark brown but yellow at base and apices, this species is easily differentiated from other Chinese *Liothrips* species.

Specimens studied. CHINA, Tibet, Bomi County, holotype male, from leaves of an unknown tree, 6.ix.1973, F.S. Huang (NZMC); paratypes: two females and 11 males with same data as holotype (NZMC).

Liothrips bournierorum Han

(Figs 70, 97)

Liothrips bournierorum Han, 1993: 201.

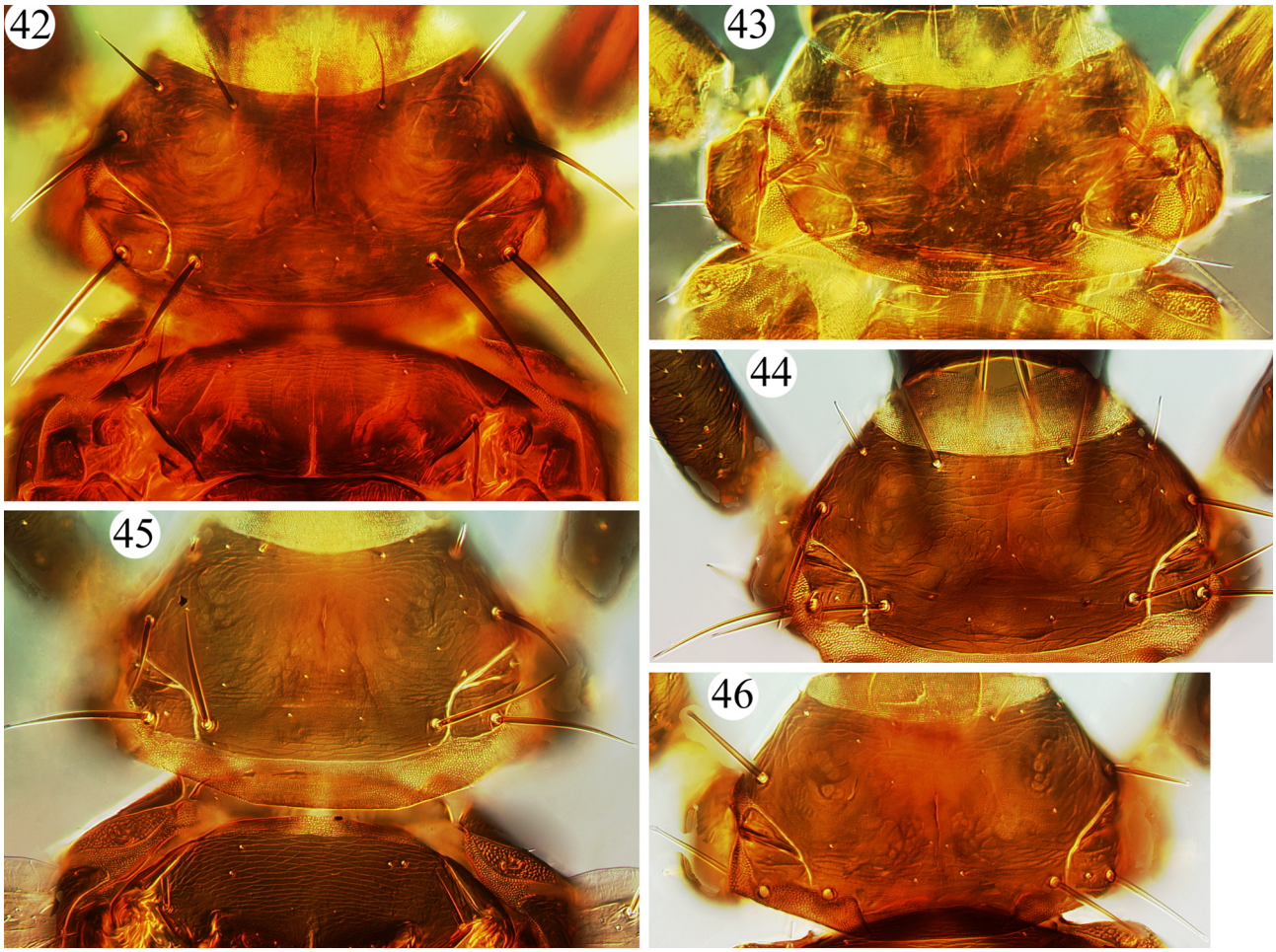
Described from Sichuan, Southern China, this species is unusual in having only the epimeral setae well developed on the pronotum, the other setae especially the pa being minute. The sculpture on the metanotum is not typical of *Liothrips*, with thick longitudinal striae medially and polygonal reticulation laterally (Fig. 70). This was not mentioned in the original description. A pore plate cannot be observed on sternite VIII of the only available male because the specimen is squashed and contaminated. The antennae, head and fore wings are similar to the females and there is no fore tarsal tooth.

Specimens studied. CHINA, Sichuan, Moxi, Luding County, holotype female on *Tsuga chinensis*, 9.vi.1983, Yunqi Cui (NZMC); paratypes 8 females and 1 male with the same data as holotype (NZMC).

***Liothrips brevis* sp. n.**
(Figs 9, 23, 56, 71, 98)

Female macroptera. Body brown; all femora brown, fore tibiae clear yellow, mid and hind tibiae brown with extreme apices yellow, all tarsi yellow; antennal segments I brown, II brown at base and lateral margins, apical half yellow, III–VI uniform yellow, VII–VIII lightly brown; major setae dark; fore wing shaded with light brown.

Head as long as wide, genae convex (Fig. 9); postocular setae blunt, slightly shorter than eyes; eyes equal dorsally and ventrally; maxillary stylets about 0.25 of head width apart, retracted to level of postocular setae (Fig. 9); mouth cone bluntly pointed, reaching to level of posterior margin of ferna. Antennal segment III about twice as long as apical width (Fig. 23); IV with 3 major sense cones, VIII small but distinct from VII. Pronotum transverse, with 5 pairs of long blunt setae, am slightly longer than aa; surface almost smooth, with weak sculpture near margins. Fore femora not enlarged. Fore wing with 3 blunt sub-basal setae arising in straight line, almost equal in length, with about 10 duplicated cilia. Mesonotum transversely reticulate, lateral setae well-developed, blunt. Metanotum sculptured with longitudinal stripes, major setae slender and acute. Mesopresternum paired lateral triangles weakly connected medially (Fig. 56), metathoracic sternopleural sutures short. Pelta broadly triangular, weakly reticulate, with a pair of CPS (Fig. 71); tergite II with 3 pairs of lateral setae; tergite VIII posterolateral setae well-developed, slightly shorter than posteroangulars; tergite IX setae S1–S3 about as long as tube, acute at apex (Fig. 98); tube shorter than head, anal setae about as long as tube.



FIGURES 42–46. Pronotum of *Liothrips* species. (**42**) *adusticornis*; (**43**) *mirabilis*; (**44**) *wasabiae*; (**45**) *elongatus* **sp. n.**; (**46**) *mohanrami*.

Measurements (holotype female in microns). Body length 2310. Head length (maximum width) 200 (210); postocular setae length 80; antennal segments I–VIII length (width): 40 (40), 45 (35), 65 (35), 60 (40), 60 (35), 60 (35), 55 (30), 30 (15); sense cone on III length 25. Pronotum length (width) 150 (285); am 60, aa 50, ml 75, epim

95, pa 105. Fore wing length 840; sub-basal setae S1 70, S2 70, S3 80. Tergite VIII posterolateral setae 80; tergite IX setae S1 180, S2 180, S3 160; tube length 180, basal width 95, apical width 45; anal setae length 160.

Male macroptera. Similar to female in colour and sculpture; abdominal tergite IX setae S2 short and acute; sternite VIII largely occupied by pore plate.

Measurements (paratype male in microns). Body length 2240. Head length (maximum width) 200 (225); postocular setae length 75. Pronotum length (width) 125 (275); am 45, aa 30, ml 60, epim 100, pa 95. Tergite IX setae S1 180, S2 35, S3 190; tube length 175, basal width 100, apical width 55; anal setae length 165.

Specimens studied. Holotype female, CHINA, Guangxi, Chongzuo, Daxin, taken on leaves of unknown tree, 25.vii. 2021, Xia Wang (SNUT).

Paratypes: 1 female with same data as holotype (SNUT); Yunnan, 2 males on leaves of unknown tree, 6.v.1980, Tiesen Zhong (NZMC).

Etymology. This species name refers to the short head.

Comments. *Liothrips brevis* **sp. n.** is one of four species among the Chinese *Liothrips* that have the head short. It is similar to *L. longistylus* **sp. n.** and *L. aporosae* in having an elongate mouth cone and the postocular setae well-developed. But they can be distinguished by the sculpture of the metanotum and the antennal coloration as in the above key.

Liothrips brevitubus Karny

Liothrips brevitubus Karny, 1912a: 156.
Liothrips malloti Moulton, 1928a: 308.
Liothrips malloti var. *flavicornis* Moulton, 1928a: 310.

Described from Java, Indonesia, with two subsequent synonyms from Taiwan taken on *Mallotus* sp., this species was redescribed by Wang and Lin (2020) based on many specimens from Taiwan.

Specimens studied. CHINA, Taiwan, Taihoku, 3 females, 5.ii.1928, R. Takahashi (SMF). [note: probably collected with the *malloti* holotype]

Liothrips dayulingensis Wang & Lin

Liothrips dayulingensis Wang & Lin, 2020: 356.

Described from Taiwan on grasses, this species was distinguished by Wang and Lin (2020) from typical *Liothrips* species by having hexagonal reticles medially on the metanotum. No specimen was checked here.

Liothrips elongatus sp. n.
(Figs 3, 31, 45, 54, 59, 77, 95)

Female macroptera. Body brown; all femora brown, fore tibiae light brown medially with base and apex yellow, mid and hind tibiae brown with apices yellow, all tarsi yellow; antennal segments I–II brown, but II pale at apex, III–IV largely yellow with apices shaded, V–VI yellow at basal half, shaded at apical half, VII–VIII lightly brown (Fig. 31); major setae dark; fore wing pale, shaded at base, with a median dark stripe.

Head twice as long as wide (Fig. 3); postocular setae blunt, scarcely reaching to posterior margin of eyes; eyes equal dorsally and ventrally; maxillary stylets retracted to lower part of head, not reaching postocular setae (Fig. 3); mouth cone short and round. Antennal segments elongate, III about 4 times as long as apical width (Fig. 31); IV with 3 major sense cones, VIII distinct from VII. Pronotum transverse, with 4 pairs of long blunt setae, am scarcely larger than discal setae (Fig. 45); surface weakly sculptured. All legs slender. Fore wing with 3 blunt sub-basal setae arising in straight line, almost equal length, with 14 duplicated cilia. Mesonotum transversely reticulate, lateral setae well-developed, blunt. Metanotum weakly sculptured with longitudinal reticles, major setae slender and acute (Fig. 77). Mesopresternum with paired lateral triangles (Fig. 54), metathoracic sternopleural sutures short. Pelta broadly

triangular, weakly reticulate, with pair of CPS (Fig. 77); tergite II with 9–12 pairs of lateral setae; tergite VIII posterolateral setae well-developed, shorter than posteroangles; tergite IX setae S1–S3 slightly shorter than tube, acute at apex; tube shorter than head, anal setae slightly shorter than tube.

Measurements (holotype female in microns). Body length 3900. Head length (maximum width) 450 (215); postocular setae length 65; antennal segments I–VIII length (width): 50 (45), 70 (35), 155 (35), 150 (45), 140 (30), 125 (30), 75 (25), 40 (15); sense cone on III length 65. Pronotum length (width) 200 (350); am 5, aa 40, ml 40, epim 150, pa 120. Fore wing length 1500; sub-basal setae S1 90, S2 130, S3 130. Tergite VIII posterolateral setae 115; tergite IX setae S1 330, S2 300, S3 225; tube length 370, basal width 95, apical width 55; anal setae length 310.

Male macroptera. Similar to female in colour and sculpture; pronotal am slightly short than aa, but much shorter than other major setae; abdominal tergite II with 8–9 pairs of lateral setae; tergite IX setae S2 short, slightly blunt at apex; sternite VIII largely occupied by pore plate (Fig. 95).

Measurements (paratype male in microns). Body length 3350. Head length (maximum width) 390 (200); postocular setae length 65. Pronotum length (width) 180 (325); am 15, aa 25, ml 75, epim 130, pa 105. Tergite IX setae S1 310, S2 100, S3 360; tube length 335, basal width 95, apical width 50; anal setae length 310.

Specimens studied. Holotype female, China, Yunnan, Kunming garden, 29.ix.2010, Laurence Mound (SNUT).

Paratypes: 2 males with the same data as holotype (SNUT & ANIC); Yunnan, Chenggong, 1 male, 8.viii.2010, Hongrui Zhang (ANIC).

Etymology. The species epithet refers to the elongate head and antennae.

Comments. This is the second known species with tergite II bearing numerous discal setae laterally, and as in *L. takahashii* it has short stylets. However, it has an elongate head and antennae (Figs 3, 31), short postocular setae (Fig. 3) and small pronotal aa and am setae (Fig. 45) and is easily distinguished from *L. takahashii*.

Liothrips fagraeae **Priesner**

(Fig. 24)

Liothrips (*Liothrips*) *fagraeae* Priesner, 1968: 184.

This species, described from Java in leaf galls of *Fagraea obovata*, was recorded from Sichuan, China taken on *Litsea pungens* by Han (1997b). It is similar to *L. adusticornis* in body shape and leg coloration, but they can be distinguished by the color of wings and antennae, the length of sense cones on antennae (Fig. 24), and the postocular setae as shown in the key above. Unfortunately, no slides of this species from China are available in Han's collection, and this record needs further confirmation.

Specimens studied. INDONESIA, Java, Tjibodas, one paratype female and male on *Fagraea obovata*, 15.vi.1925, M. Bruggeman (SMF).

Liothrips floridensis **(Watson)**

(Figs 67, 75)

Cryptothrips floridensis Watson, 1913: 145.

This species was described from Satsuma, Florida, USA, from *Cinnamomum camphora* [Lauraceae], but is wide spread in Japan, Taiwan and Sri Lanka (Okajima 2006). In China, the first record was from Hainan on Lauraceae (Zhang 1984); Zhang *et al*. (1999) reported it from the following places Fujian, Hainan, Guangdong and Taiwan. Two males from Guangdong have been studied here, which came from leaves of *Litsea glutinosa* (Lauraceae). *L. floridensis* is easy distinguished by the mesopresternum boat-shaped and extending anteriorly at middle (Fig. 67), with all legs brown but fore tibiae pale at apices and fore tarsi pale, and metanotum sculptured with polygonal reticulation (Fig. 75). The two males from Guangdong have the postocular setae slightly longer than the eyes.

Specimens studied. CHINA, Guangdong, Foshan City, two males on *Litsea glutinosa*, 6.v.1958, Y.F. Han (NZMC). U.S.A., California, three females on *Cinnamomum camphora*, 9.ix.2011, N. Nisson (ANIC).

Liothrips hagai Okajima
(Figs 5, 25, 47, 74, 89)

Liothrips hagai Okajima, 2006: 428.

Described from Nagano, Honshu, Japan on *Viburnum sieboldii* leaves, this species is recorded from China for the first time with one female and one male from Yunnan. They are very similar in body shape and colouration of antennae, but the metanotal sculpture is a little different in the Yunnan specimens from the type specimens in Japan. The sculpture in Yunnan specimens is of longitudinal striae, but in Japanese specimens it comprises longitudinal reticulation (Fig. 74).

Specimens studied. CHINA, Yunnan, Gongshan County, one female and one male, 14.viii.2009, Lixin Su (SNUT). JAPAN, Nagano, Sugadaira, paratype female and male on *Viburnum sieboldi*, 27.vii.1983, Haga K. (TUA).

Liothrips heptapleuricola (Takahashi)
(Figs 6, 36, 72)

Smerinthothrips heptapleuricola Takahashi, 1937: 341.

Living in Taiwan in leaf galls of *Heptapleurum arboricola* (possible spelling error in plant name, Wang & Lin 2020: 361), this species has an unusual pelta with no CPS but bearing 3–4 tiny setae posterolaterally (Fig. 72). From Yunnan, 17 females and 6 males on leaves or leaf galls of plants labelled as *Schefflera heptaphylla* and *S. octophylla* are here recognized from China. The host plant name *Schefflera heptaphylla* is more validly *Heptapleurum heptaphyllum* as the genus *Heptapleurum* was distinguished from *Schefflera* in 2020 and accepted by Plants of the World Online (Lowry *et al*. 2020; POWO 2023). Moreover, *Schefflera octophylla* is a synonym of *H. heptaphyllum* (IPNI 2023).

Specimens studied. CHINA, Yunnan, Kunming, 15 females and 3 males on leaves of *Schefflera heptaphylla*, 3.viii.2007, H. Zhang (ANIC); Yunnan, Kunming, 2 females and 3 males in leaf galls of *Schefflera octophylla*, 17.vi.2005, L.M. Tie (ANIC).

Liothrips heptapleurinus Priesner

Liothrips heptapleurinus Priesner, 1935: 360.

Described from Taiwan on *Heptapleurum* sp., and also recorded from Ryukyu islands, Japan on leaves of *H. heptaphyllum* (*Schefflera octophylla* in Okajima 2006). This thrips species could not be distinguished satisfactorily from *L. heptapleuricola*, that also is recorded in Taiwan from leaf galls on the same plant genus (Takahashi 1937). However, according to the redescription of *L. heptapleurinus* by Okajima (2006), it is different in having the pelta with a pair of CPS but no tiny setae, and the postocular setae longer than eyes. No slide of this species has been seen, but it is placed in the above key based on Okajima's clear redescription.

Liothrips hsuae Wang & Lin

Liothrips hsuae Wang & Lin, 2020: 362.

Described from Taiwan on *Ficus* sp., this species was stated to be similar to *L. piperinus*, but it seems to be more similar to *L. kuwayamai* in body shape and coloration. Both of them have a complete mesopresternum with median protrusion, although in *Liothrips* species this sclerite is usually eroded medially or divided into two lateral triangles. Wang and Lin (2020) indicated that these two species might be distinguished by length of pronotal am, which was minute in *L. kuwayamai* but well-developed in *L. hsuae*. However, the redescription of *L. kuwayamai* from Okajima (2006) based on 131 females including the holotype showed that both am and aa setae on the pronotum were

well-developed, and no other features were found to differentiate these species. Therefore, *L. hsuae* is possibly a synonym of *L. kuwayamai* and is excluded from the key given above.

Liothrips kuwayamai (Moulton)

Gynaikothrips kuwayamai Moulton, 1928a: 302.

This species was described from Taiwan based on a single female, and later recorded from Yunnan by Han (1997b). However, Han did not list any specimens as having been studied, and no slides have been available for the studies reported here. The species is therefore included in the key given above based on the redescription by Okajima (2006).

Liothrips longistylus sp. n.
(Figs 11, 38, 57)

Female macroptera. Body brown; fore femora largely yellow, with light brown in basal third and on outer margin, mid and hind femora light brown, with apical third pale, fore tibiae clear yellow, mid and hind tibiae light brown with apices and base pale, all tarsi yellow; antennal segments I–II light brown, paler than head, III clear yellow, IV largely yellow with slightly shaded at apex, V–VI light brown, with base pale, VII–VIII lightly brown (Fig. 38); major setae dark; fore wings hyaline.

Head wider than long (Fig. 11); postocular setae much longer than eyes, softly pointed (Fig. 11); eyes dorsally and ventrally equal in length; maxillary stylets about 0.13 of head width apart, retracted to compound eyes; mouth cone bluntly pointed, reaching to level of posterior margin of ferna. Antennal segment III about twice as long as apical width (Fig. 38); IV with 3 major sense cones; VIII constricted at base. Pronotum transverse, with 5 pairs of long slightly blunt setae, am shorter than aa; surface almost smooth, with weak sculpture near margins. All legs normal, fore femora slightly enlarged. Fore wing with 3 blunt sub-basal setae arising in straight line, S1 shorter than S2 and S3, with about 20 duplicated cilia. Mesonotum transversely reticulate, lateral setae well-developed, pointed at apex. Metanotum sculptured longitudinal reticulate, major setae slender and acute. Mesopresternum eroded medially, but weakly connected (Fig. 57), metathoracic sternopleural sutures short. Pelta broadly triangular, weakly reticulate, without pair of CPS (but present in one paratype female); tergite II with 2 pairs of lateral setae; tergite VIII posterolateral setae well-developed, but much shorter than posteroangulars; tergite IX setae S1–S3 shorter than tube, softly acute at apex; tube slightly longer than head, anal setae shorter than tube.

Measurements (holotype female in microns). Body length 2550. Head length (maximum width) 195 (235); postocular setae length 100; eye dorsal length 70; antennal segments I–VIII length (width): 45 (40), 50 (35), 75 (35), 70 (40), 65 (40), 65 (35), 60 (30), 40 (15); sense cone on III length 30. Pronotum length (width) 165 (365); am 45, aa 70, ml 75, epim 130, pa 125. Fore wing sub-basal setae S1 50, S2 80, S3 95. Tergite VIII posterolateral setae 80; tergite IX setae S1 170, S2 170, S3 210; tube length 225, basal width 100, apical width 50; anal setae length 185.

Male. Unknown.

Specimens studied. Holotype female, CHINA, Guangxi, Damingshan National Nature Reserve, taken on the leaves of *Adinandra millettii*, 21.v.2011, Lihong Dang (NZMC).

Paratypes: 1 female with same data as holotype (SNUT); same location, 1 female, 29.v.2011, Lihong Dang (NZMC).

Etymology. The species epithet refers to the elongate maxillary stylets.

Comments. This new species is similar to *L. fungi* in the short, slightly broader head (Okajima 2006), but it differs with the postocular setae longer than eyes, slightly blunt at apex (Fig. 11); antennal segments short, IV–VII almost spherical with base constricted, III about 1.8 times as long as wide; mouth-cone longer than head capsule and reaching posterior of ferna; tergum IX S1 and S2 subequal in length, a bit shorter than tube; head as long as tube. In *L. fungi* the postocular setae are much shorter than eyes, expanded at apex; antennal segments normal, III about 2.5 times as long as wide; mouth-cone much longer than head capsule, the tip reaching mesopresternum; tergum IX S1 and S2 subequal in length, much shorter than tube; head a little longer than tube.

Liothrips minys Ananthakrishnan
(Figs 26, 82)

Liothrips minys Ananthakrishnan 1972a: 12.

Described from Courtallam, India from *Jasminum* galls, the species name was replaced twice, from *L. tenuis* and *L. exiguus* (Ananthakrishnan & Jagadish, 1969: 206; Ananthakrishnan, 1972b: 114). Five females and five males from China are here identified as *L. minys*, based on the description of *L. exiguus* (Ananthakrishnan, 1972b: 114). Of these, two females and two males were taken on leaf galls of *Jasminum grandiflorum* in Yunnan, one female and one male in galls of *Fagraea ceilanica* in Guangdong, one female on *Tabernaemontana divaricata* in Fujian, and one female and two males from Shaanxi. This species is somewhat similar to *L. wasabiae* in body shape, but is easily distinguished by the hyaline wings and largely yellow antennae (Fig. 26).

Specimens studied. CHINA, Yunnan, Lushui, 2 females and 2 males in leaf rolls of *Jasminium grandiflorum*, 27.v.2010, Yonghui Xie (ANIC); Shaanxi, Hanzhong, 1 female and 2 males, 23.vii.2017, Yang Hu (SNUT); Guangdong, 1 female and 1 male in galls of *Fagraea ceilanica*, 18.vi.2015, Xiaoli Tong (ANIC); Fujian, 1 female on *Tabernaemontana divaricata*, 28.vi.2009, Jiaqian Gao (ANIC).

Liothrips mirabilis (Schmutz)
(Figs 10, 41, 43)

Gynaikothrips mirabilis Schmutz, 1913: 1041.

This species was described from Peradenya, Sri Lanka on *Pavetha hispida* and also from rolled leaf margins of a pepper plant. No specimens have been studied from China, but the species is included here as a potential pest of *Piper* plants growing throughout Southern China. It was recorded living in marginal leaf galls of *Piper nigrum* in Sri Lanka, and *L. karnyi* is listed as a synonym. It is similar to *L. pallipes* with all tibiae yellow and antennal segments III–VIII uniformly yellow (Fig. 41), but they can be distinguished by above key.

Specimens studied. SRI LANKA, Peradeniya, syntype male on *Pavetha hispida*, 11.ii–5.v.1902, H. Karny (SMF).

Liothrips miyazakii Okajima
(Figs 7, 37, 51, 83)

Liothrips miyazakii Okajima, 2006: 444.

Described from Nikko, Honshu, Japan on *Gentiana scabra*, this species seems similar to *L. wasabiae* in its body shape. One paratype female was studied here with the following character states: fore tibiae slightly shaded at basal third, antennal segments III–VI broad with basal stem (Fig. 37), postocular setae finely pointed at apex (Fig. 7), antennal segments largely yellow, with apical half of VI also VII–VIII light brown (Fig. 37), and maxillary stylets not reaching to eyes (Fig. 7). The three females listed below from Sichuan province possibly represent *L. miyazakii*, but their major setae are expanded at the apex and antennal segment III is more slender.

Specimens studied. CHINA, Sichuan, Guangyuan, 3 females on unknown grasses, 09.viii.2018, D.L. Xie (SNUT). JAPAN, Tochigi, Nikko, paratype female on *Gentiana scabra*, 15.vi.1990, M. Miyazaki (TUA).

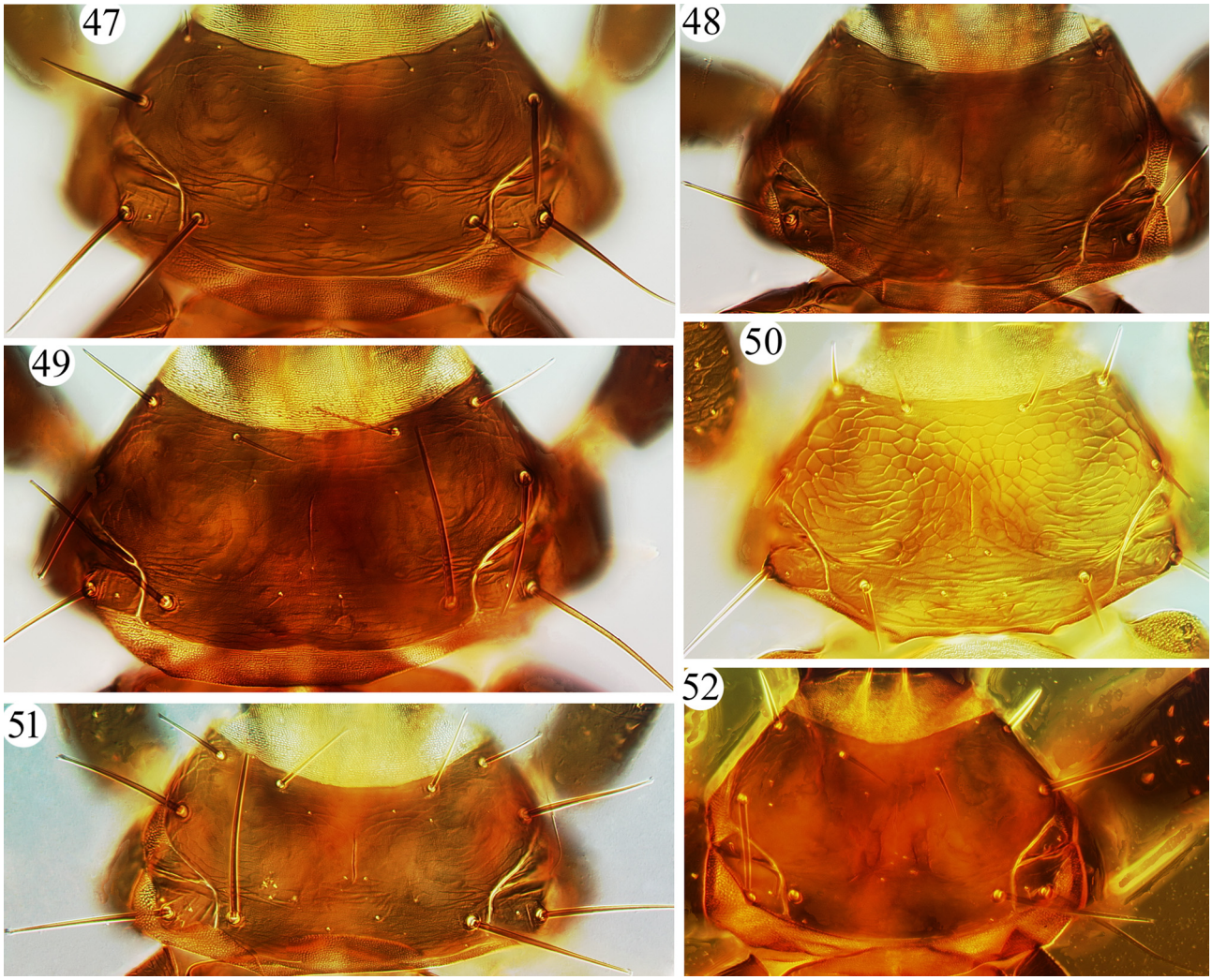
Liothrips mohanrami Bhatti
(Figs 8, 32, 46, 55, 79, 93)

Liothrips mohanrami Bhatti, Varatharajan & Singh, 2006: 377.

Described from Nagaland, India in galls on *Mastersia* sp., this species is unusual in having males with the pore plate entire on sternite VIII and extending dorsally onto tergite VIII as a lateral pair of pore plates that may be slightly

connected at posterior (Fig. 93) (Bhatti *et al*. 2006: figs 14–16). The species has further remarkable characters: antennal segments III–VII largely yellow and elongate (Fig. 32), and postocular setae located in the middle of head between posterior margins of eyes (Fig. 8). These characters are also observed in the Japanese species, *L. tsutsumii*. The latter, however, has hind tibiae brown with extreme apex pale and metanotum reticulate medially, whereas in *L. mohanrami* the mid and hind tibiae are yellow with basal third brown and metanotum with dense longitudinal stripes (Fig. 79). Two males from Tibet, China are identified here as *L. mohanrami* by comparing with the original description and drawings; these have the pore plate on tergite VIII as figured for one male from India (Fig. 93). They show exactly the same characters in body coloration and structures, but were taken on leaves of *Globba racemosa*.

Specimens studied. CHINA, Tibet, Motuo, 2 males on the leaves of *Globba racemosa*, 20.vii.2022, Yanqiao Li (SNUT).



FIGURES 47–52. Pronotum of *Liothrips* species. (**47**) *hagai*; (**48**) *motuoensis* **sp. n.**; (**49**) *setinodis*; (**50**) *tibetanus* **sp. n.**; (**51**) *miyazakii*; (**52**) *bomiensis*.

Liothrips motuoensis **sp. n.**

(Figs 4, 48, 65, 73, 99)

Female macroptera. Body brown; all femora brown, all tibiae and tarsi clear yellow; antennal segments I–II brown, II pale at apex, III–VII uniform yellow, VIII lightly brown; major setae pale; fore wing shaded light brown.

Head about twice as long as wide (Fig. 4); postocular setae blunt, much shorter than eyes, not reaching posterior margin of eyes (Fig. 4); eyes dorsally and ventrally equal in length; maxillary stylets close together medially, retracted to level of postocular setae; mouth cone short and round. Antennal segment III about 2 times as long as apical width; IV with 3 major sense cones, VIII constricted at base. Pronotum transverse, with 2 pairs of long blunt

setae, am, aa and pa minute (Fig. 48), slightly longer than discal setae, epim longest; surface almost smooth, with weak sculpture near margins. All legs slender. Fore wing with 3 blunt sub-basal setae arising in straight line, almost equal length, with 11 duplicated cilia. Mesonotum transversely reticulate, lateral setae well-developed, slightly blunt. Metanotum longitudinally reticulate, major setae slender and acute (Fig. 73). Mesopresternum with paired lateral triangles (Fig. 65), metathoracic sternopleural sutures absent. Pelta broadly triangular, weakly reticulate, with pair of CPS (Fig. 73); tergite II with 4 pairs of lateral setae; tergite VIII posterolateral setae well-developed, slightly shorter than posteroangulars; tergite IX setae S1 about half as long as tube, blunt at apex (Fig. 99), S2–S3 about as long as tube, acute at apex; tube shorter than head, anal setae shorter than tube.

Measurements (holotype female in microns). Body length 3000. Head length (maximum width) 350 (225); postocular setae length 45; antennal segments I–VIII length (width): 40 (40), 55 (35), 115 (40), 125 (50), 110 (45), 80 (40), 70 (35), 45 (15); sense cone on III length 55. Pronotum length (width) 175 (310); am 5, aa 5, ml 50, epim 105, pa 10. Fore wing length 1450; sub-basal setae S1 85, S2 85, S3 90. Tergite VIII posterolateral setae 110; tergite IX setae S1 160, S2 290, S3 305; tube length 310, basal width 90, apical width 50; anal setae length 250.

Male macroptera. Similar to female in colour and sculpture; pronotal am and pa minute, aa developed, about as long as ml, blunt at apex; abdominal tergite IX setae S2 short and softly pointed; sternite VIII largely occupied by pore plate.

Measurements (paratype male in microns). Body length 2940. Head length (maximum width) 350 (205); postocular setae length 35. Pronotum length (width) 170 (310); am 5, aa 35, ml 35, epim 95, pa 10. Tergite IX setae S1 130, S2 70, S3 370; tube length 350, basal width 90, apical width 50; anal setae length 260.

Specimens studied. Holotype female, CHINA, Tibet, Motuo, taken on leaves of tree, 16.vii. 2022, Yanqiao Li (SNUT).

Paratypes: 2 females and 1 male with same data as holotype (SNUT & NZMC).

Etymology. The species epiphet refers to the collection site.

Comments. This new species has all tibiae yellow as in two other *Liothrips* species from China, *L. styracinus* and *L. pallipes*, as well as *L. mirabilis* that is a potential pest of *Piper* plant grown throughout Southern China. This new species can be easily recognized by having only two pairs of setae well-developed on the pronotum (Fig. 48), and S1 on tergite IX short and blunt, about half the length of S2 (Fig. 99).

Liothrips pallipes **(Karny)**

(Fig. 27)

Gynaikothrips pallipes Karny, 1913: 110.

Described as *Gynaikothrips pallipes* from Taiwan, and reported by Han (1997a) under the name *L. kuwanai* (Moulton 1928a), the latter was synonymised and extensively discussed by Mound (2020). This species is easily recognized with all tibiae yellow. From Australia 10 females and 6 males identified as *L. pallipes* (Karny) have antennal segments III–VI uniformly yellow (Fig. 27), VII–VIII brown and postocular setae longer than eyes. These specimens are indistinguishable from the female from Guangxi.

Specimens studied. CHINA, Guangxi, Fangchenggang City, Shangsi County, one female, 6.viii.2015, Chunfeng Li (SNUT). AUSTRALIA, Queensland, 10 females and 6 males in leaf rolls of *Piper canina*, 5.xi.2008, L. Mound (ANIC).

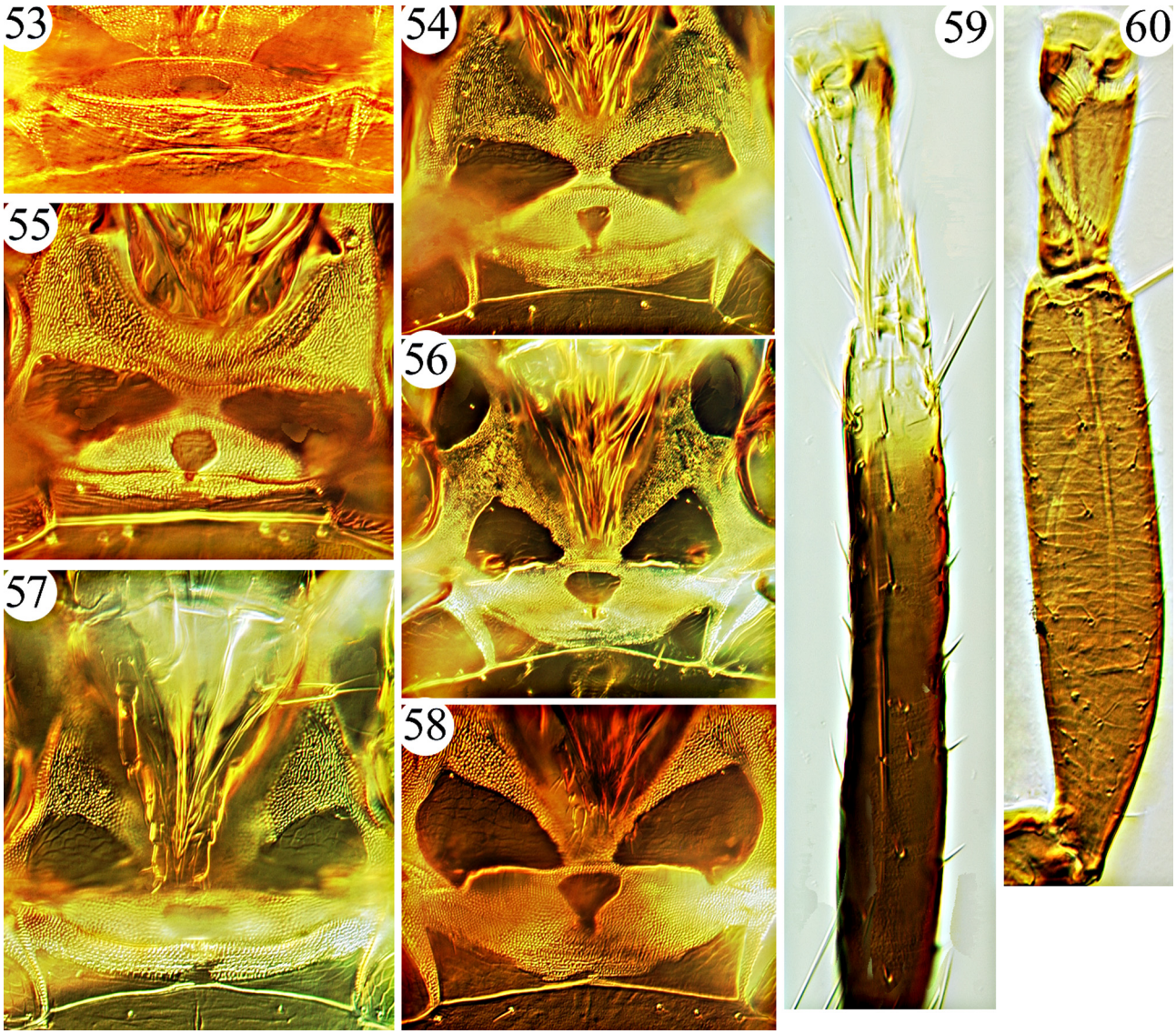
Liothrips piceae **sp. n.**

(Figs 13, 35, 60, 66, 76)

Female macroptera. Body brown; all legs brown (Fig. 60), just fore tarsi and apices of fore tibiae lightly brown; antennal segments I–II brown, III yellow at basal half and light brown at apical half, IV–VI largely brown with base pale, VII–VIII brown (Fig. 35); major setae pale; fore wing hyaline.

Head slightly wider than long (Fig. 13); postocular setae acute, scarcely reaching to posterior margin of eyes (Fig. 13); eyes dorsally and ventrally equal in length; maxillary stylets close together medially, retracted to eyes;

mouth cone blunt and short. Antennal segment III more than twice as long as apical width (Fig. 35); IV with 3 major sense cones; VIII small, distinct from VII (Fig. 35). Pronotum transverse, with 4 pairs of long softly pointed setae, am minute; surface almost smooth, weakly sculptured near margins. Fore femora not enlarged. Fore wing with 3 slightly blunt sub-basal setae arising in straight line, with 10 duplicated cilia. Mesonotum transversely reticulate, lateral setae developed, slightly blunt. Metanotum longitudinally reticulate, major setae fine and acute (Fig. 76). Mesopresternum eroded medially, metathoracic sternopleural sutures short (Fig. 66). Pelta broadly triangular, weakly reticulate, with a pair of CPS (Fig. 76); tergite II with 3 pairs of lateral setae; tergite VIII posterolateral setae well-developed, slightly shorter than posteroangulars; tergite IX setae S1–S3 shorter than tube, acute; tube slightly shorter than head, anal setae longer than tube.



FIGURES 53–60. *Liothrips* species. Mesopresternum (**53–58**): (**53**) *aporosae*; (**54**) *elongatus* **sp. n.**; (**55**) *mohanrami*; (**56**) *brevis* **sp. n.**; (**57**) *longistylus* **sp. n.**; (**58**) *setinodis*. Hind tibiae and tarsi (**59–60**): (**59**) *elongatus* **sp. n.**; (**60**) *piceae* **sp. n.**

Measurements (holotype female in microns). Body length 3160. Head length (maximum width) 270 (295); postocular setae length 40; antennal segments I–VIII length (width): 50 (45), 55 (40), 90 (35), 100 (45), 90 (40), 80 (35), 65 (25), 30 (20); sense cone on III length 30. Pronotum length (width) 170 (355); am 5, aa 35, ml 45, epim 130, pa 100. Fore wing length 1210; sub-basal setae S1 ?, S2 90, S3 100. Tergite VIII posterolateral setae 70; tergite IX setae S1 195, S2 200, S3 195; tube length 225, basal width 110, apical width 75; anal setae length 245.

Male. Unknown.

Specimens studied. Holotype female, CHINA, Xinjiang, on leaves of *Picea*, 9.vi. 1981 (NZMC).

Paratype: 1 female with same data as holotype (SNUT).

Etymology. The species epithet "*piceae*" refers to the plant genus *Picea* on which the type specimens were found.

Comments. This new species has all legs brown including all tarsi (Fig. 60). This colouring does not occur in other Chinese *Liothrips* except for *L. floridensis*. From the latter *L. piceae* **sp. n.** can be distinguished by the relatively short head and short postocular setae which do not reach the posterior margin of the eyes (Fig. 13).

Liothrips piperinus Priesner

(Figs 21, 28, 100)

Liothrips (*Liothrips*) *piperinus* Priesner, 1935: 361.

Described by Priesner based on "females" from Taiwan, China, this species has also been recorded from Japan and Chinese mainland (Fujian, Guangdong and Hainan provinces) (Zhang 1984; Zhang *et al*. 1999; Okajima 2006). It is known to have unusually elongate sense cones on antennal segments III and IV that are about two thirds as long as their segments (Fig. 28), and the maxillary stylets are long and close together medially (Fig. 21). According to these characters, the specimens listed below from Kunming are identified as *L. piperinus*, but they have a few differences from the holotype female: setae S1 on tergite IX about 0.6 times as long as tube, also mid and hind tibiae yellow on apical 1/4–1/3 (in holotype, S1 on tergite IX about 0.8 time as long as tube (Fig. 100), and mid and hind tibiae yellow on apical one seventh). However, they are very similar to two specimens from Japan, showing various lengths of postocular setae. *L. piperinus* was described originally from a species of *Piper* but recorded on *Elaeocarpus* and *Castanopsis* by Okajima (2006), and as living in *Ficus* leaf-galls by Zhang (1984). In Yunnan, many specimens were found in leaf galls on *Smilax glaucochina*. This thrips is very possibly an invader of leaf galls induced by some *Liothrips*-lineage species on a range of different plants (Mound 2020).

Specimens studied. CHINA, Taiwan, Habon, Holotype female on *Piper*, 10.viii.1934, R. Takahashi (SMF); Kunming, 7 females and 6 males in leaf gall on *Smilax glaucochina*, 24.ix.2019, L.A. Mound (ANIC). JAPAN, Honshu, Shizuoka, one female and one male on *Piper*, 9.xi.1975, I. Kudo (SMF).

Liothrips populi sp. n.

(Figs 12, 29, 61, 78, 94, 102)

Female macroptera. Body brown; all femora and tibiae brown, fore tibiae brown, pale at apical half, all tarsi yellow; antennal segments I–II lightly brown, paler than head, III–VIII yellow, VII–VIII light brown (Fig. 29); major setae dark; fore wing hyaline.

Head as long as wide (Fig. 12); postocular setae blunt, shorter than eyes, just reaching to posterior margin of eyes (Fig. 12); eyes dorsally and ventrally equal in length; maxillary stylets about 0.14 of head width apart, retracted to level of eyes; mouth cone bluntly pointed, reaching to level of anterior margin of ferna. Antennal segment III about 3 times as long as apical width (Fig. 29); IV with 3 major sense cones, VIII small, distinct from VII. Pronotum transverse, with 5 pairs of long blunt setae, am and aa subequal in length; surface almost smooth, with weak sculpture near margins. Fore wings with 3 blunt sub-basal setae arising in straight line, almost equal in length, with 11 duplicated cilia. Mesonotum transversely reticulate, lateral setae well-developed, blunt, a pair of setae posteromedially slightly shorter than lateral pair, acute. Metanotum longitudinally reticulate, major setae well-developed, slightly blunt (Fig. 78). Mesopresternum boat-shaped, transverse medially (Fig. 61), metathoracic sternopleural sutures short. Pelta broadly triangular, weakly reticulate, with a pair of CPS; tergite II with a pair of lateral setae; tergite VIII with posterolateral setae well-developed, shorter than posteroangulars; tergite IX setae S1–S3 much shorter than tube, softly pointed; tube shorter than head, anal setae about as long as tube.

Measurements (holotype female in microns). Body length 2510. Head length (maximum width) 265 (265); postocular setae length 30; antennal segments I–VIII length (width): 40 (45), 60 (30), 85 (25), 80 (35), 70 (30), 60 (30), 60 (25), 35 (15); sense cone on III length 25. Pronotum length (width) 155 (335); am 40, aa 40, ml 65, epim 100, pa ?. Fore wing length 1000; sub-basal setae S1 65, S2 80, S3 100. Tergite VIII posterolateral setae 80; tergite IX setae S1 110, S2 120, S3 135; tube length 200, basal width 80, apical width 45; anal setae length 195.

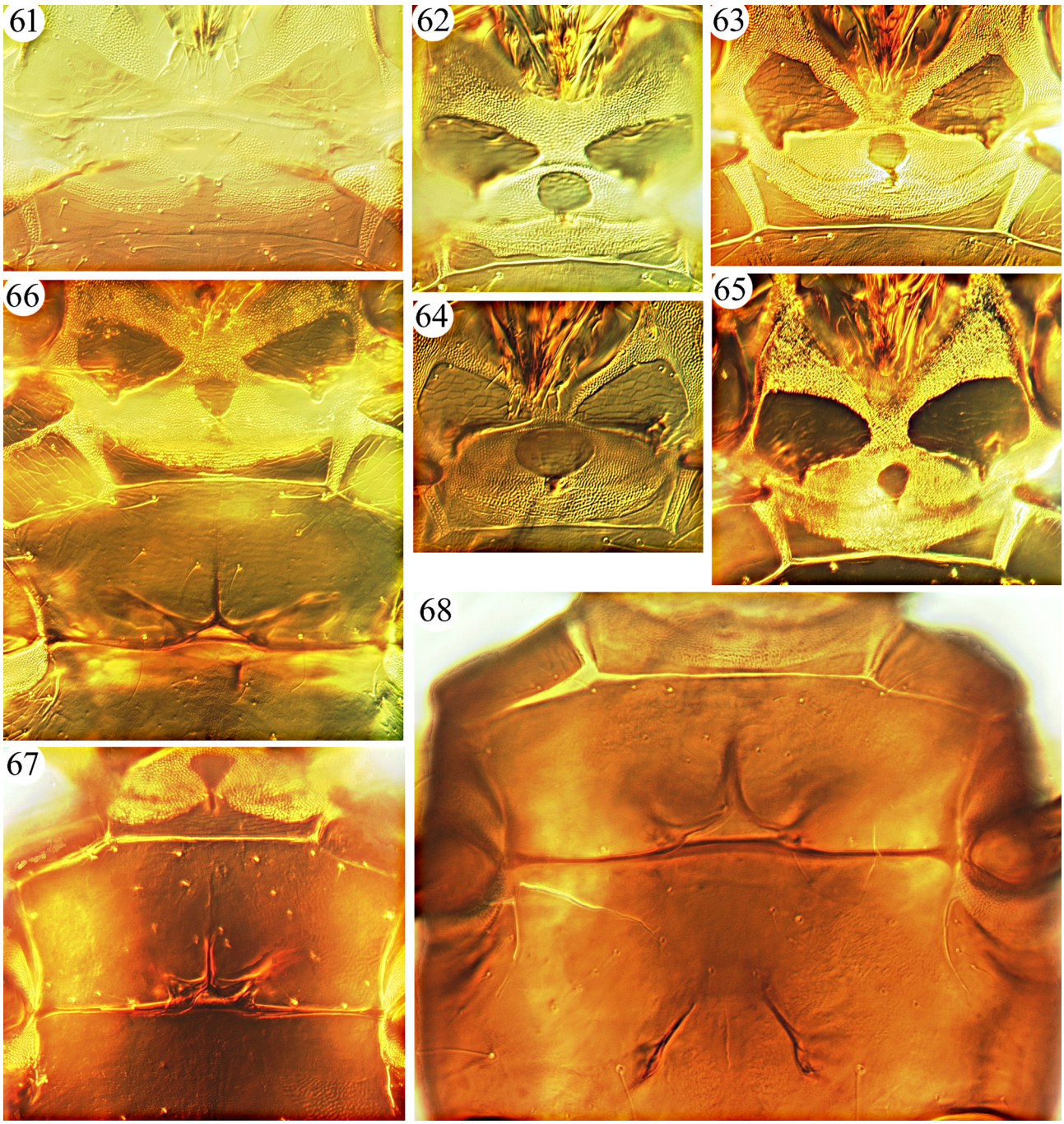
Male macroptera. Similar to female in colour and sculpture; mesopresternum eroded medially; abdominal tergite IX setae S2 short and softly acute (Fig. 102); sternite VIII largely occupied by pore plate (Fig. 94).

Measurements (paratype male in microns). Body length 1850. Head length (maximum width) 215 (220); postocular setae length 25. Pronotum length (width) 110 (315); am 25, aa 30, ml 50, epim 75, pa 65. Tergite IX setae S1 100, S2 55, S3 155; tube length 165, basal width 65, apical width 35; anal setae length 145.

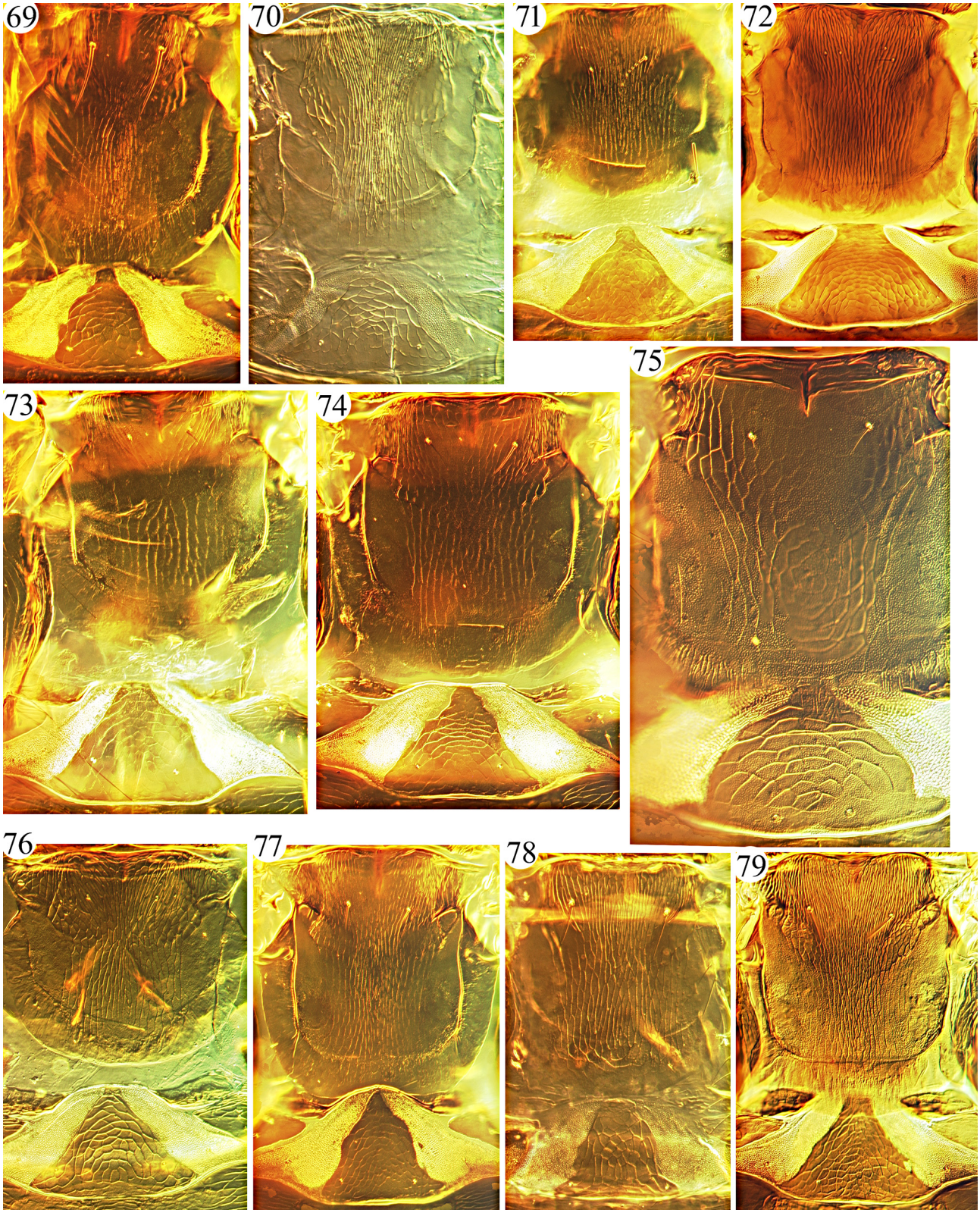
Specimens studied. Holotype female, CHINA, Inner Mongolia, on leaves of *Populus euphratica*, 25.vii. 1991 (NZMC).

Paratypes: 1 female and 3 males with same data as holotype (NZMC & SNUT).

Etymology. This species name is composed of one Latin word based on the plant name from which the type specimens were collected.



FIGURES 61–68. *Liothrips* species. Mesopresternum (**61–65**): (**61**) *populi* **sp. n.**; (**62**) *rohdeae*; (**63**) *wasabiae*; (**64**) *vaneeckei*; (**65**) *motuoensis* **sp. n.** Mesopresternum and metathoracic sternopleural sutures (**66–68**): (**66**) *piceae* **sp. n.**; (**67**) *floridensis*; (**68**) *tibetanus* **sp. n.**



FIGURES 69–79. Metanotum and pelta of *Liothrips* species. (**69**) *bomiensis*; (**70**) *bournierorum*; (**71**) *brevis* **sp. n.**; (**72**) *heptapleuricola*; (**73**) *motuoensis* **sp. n.**; (**74**) *hagai*; (**75**) *floridensis*; (**76**) *piceae* **sp. n.**; (**77**) *elongatus* **sp. n.**; (**78**) *populi* **sp. n.**; (**79**) *mohanrami*.

Comments. This new species is similar to some others with a short head. It seems closely related to *L. rohdeae* (Okajima 2006), but differs as follows: mid and hind tibiae uniformly brown; fore wings pale without brown stripe; postocular setae not exceeding posterior margin of eyes (Fig. 12); sense cones on antennal segments III–IV rather short, shorter than width of this segment (Fig. 29); maxillary stylets rather long, reaching eyes (Fig. 12); pelta hat-shape with small lateral lobes (Fig. 78); tergite IX setae S1 much shorter than tube, about half length of tube (Fig. 102); taken on the leaves of *Populus euphratica*. In contrast, *L. rohdeae* has mid and hind tibiae dark brown with apical third to fourth yellowish; fore wings with a median longitudinal pale brown stripe; postocular setae exceeding posterior margin of eyes (Fig. 16); sense cones on antennal segments III–IV about half length of this segment (Fig. 33); maxillary stylets reaching postocular setae (Fig. 16); pelta triangular (Fig. 87); tergite IX setae S1 about 1.4 times as long as tube; taken on young leaves of *Rohdea japonica*.

Liothrips rohdeae Okajima

(Figs 16, 33, 62, 87)

Liothrips rohdeae Okajima, 2006: 448.

Described from Japan, Chiba, Honshu, this species is difficult to distinguish from both *L. hagai* Okajima from Japan and *L. setinodis* (Reuter) from Europe. By comparing the paratypes with paratypes of *L. hagai*, also three slides of *L. setinodis* collected from England, this species has the mesopresternum eroded with a narrow connection medially rather than divided into two lateral triangular plates. However, one female of *L. setinodis* has the mesopresternum narrowly connected medially (Fig. 62), and this is probably intraspecific variation. However, *L. rohdeae* is considered to be a valid species having been collected only on the specific plant, *Rohdea japonica*. More studies, including molecular data, are needed to verify these three species. According to morphological aspects, two males from Sichuan are extremely similar to the paratypes of *L. rohdeae*, and this species is newly recorded from China.

Specimens studied. CHINA, Sichuan, Guangyuan, two males on unknown tree leaves, 8.viii.2018, L.H. Dang, Y. Hu and D.L. Xie (SNUT). JAPAN, Honshu, Chba-ken, paratype one female and one male on *Rohdea japonica*, 10–18.vi.1997, M. Sawada (TUA).

Liothrips setinodis (Reuter)

(Figs 15, 30, 49, 58, 81)

Phloeothrips setinodis Reuter, 1880: 310.

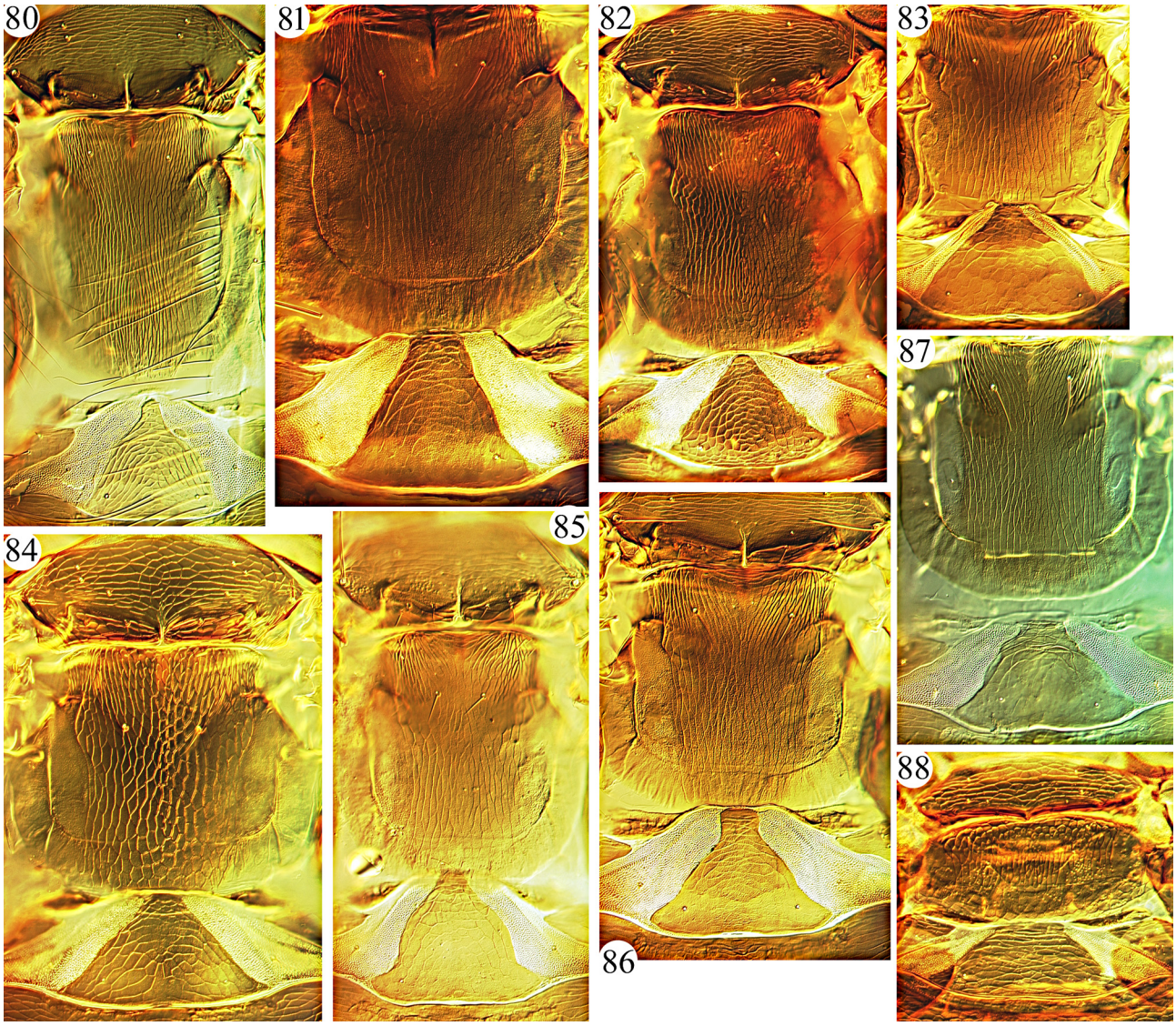
Described from Aberdeen, Scotland, this species is widespread across Europe with three subsequent synonyms (Uzel 1895; Karny 1912b; Priesner 1914; ThripsWiki 2023). Okajima (2006: 429) described *L. hagai* from Japan as related to this species but comparing two type specimens of *L. hagai* with three females of *L. setinodis* from England, they can just be distinguished by the length of pronotal am and aa setae and the colouration of their antennae (see above key) (Figs 49, 30). Han (1997b), using the synonymic name *L. hradecensis*, described and illustrated the species from Sichuan, China, but with no collection details. No specimens from China have been seen that can be identified confidently as the European species *L. setinodis* (Mound *et al*. 2018). However, a female from Guangxi has been studied that is remarkably similar in structure, but differs in having the metanotum more closely striate medially (Fig. 81).

Specimens studied. CHINA, Guangxi, Maoershan, one female on grasses, 3.vi.2011, L.H. Dang (NZMC). ENGLAND, Kent, Shoreham, two females on *Fagus*, 25.vi.1978, W.R. Dolling (ANIC); Oxfordshire, Lambridge Wood, one female, 27.vi.2014, A. Polaszek (ANIC).

Liothrips styracinus Priesner

Liothrips (*Liothrips*) *styracinus* Priesner, 1968: 202.

Described originally from Taiwan based on one female and one male from *Styrax* sp. this species was recorded from Fujian (Zhang *et al*. 1999). No specimens have been seen for the present study, but it was added in the key according to the original description.



FIGURES 80–88. Metanotum and pelta. *Liothrips* species (**80–87**): (**80**) *takahashii*; (**81**) *setinodis*; (**82**) *minys*; (**83**) *miyazakii*; (**84**) *tibetanus* **sp. n.**; (**85**) *vaneeckei*; (**86**) *wasabiae*; (**87**) *rohdeae*. (**88**) *Teuchothrips turkestanicus*.

***Liothrips takahashii* (Moulton)**

(Figs 20, 80, 90, 91, 92)

Gynaikothrips takahashii Moulton, 1928a: 313.

Described from Taiwan on *Ficus retusa*, this species was subsequently recorded from Singapore, Malaysia, Indonesia, Java, Japan and Australia in leaf rolls or galls on *Dissochaeta* sp. and *Ficus* sp. (Priesner 1930; Priesner 1968; Okajima 2006; Mound *et al*. 2023). In this study, seven females and three males from Yunnan are identified as this species with the unique character of more than seven discal setae on each lateral margin of tergite II (Fig. 90), as mentioned by Mound *et al*. (2023).

Specimens studied. CHINA, Yunnan, Puer City, 3 females, 1.vii.2017, Yanqiao Li (SNUT); Yunnan, Baoshan City, 2 females, 17.vi.2021, Xia Wang & Chengwen Li (SNUT); Yunnan, Kunming, 4 females and 3 males in leaf rolls, 19.ix.2019, L. Mound (ANIC).

Liothrips threobrevis Wang & Lin

Liothrips threobrevis Wang & Lin, 2020: 367. [replacement name for *citricornis* Moulton, homonym of *citricornis* Hood]

Described by Moulton as *L. citricornis* from Taiwan, based on four females and one male on *Liquidambar formosana* [Altingiaceae], this name was subsequently included in a key and recorded by Zhang (1984) from the Province of Henan. Han (1997b) also recorded it from Hainan with a redescription and illustrations, but no slides are available. Wang and Lin proposed a new name, *Liothrips threobrevis*, to replace *Liothrips citricornis* Moulton as this is a homonym of *Liothrips citricornis* Hood. This species is placed in the key above based on the redescription by Wang and Lin (2020).

Liothrips tibetanus sp. n.

(Figs 17, 39, 50, 68, 84, 101)

Female macroptera. Body brown; all femora brown, fore tibiae yellow with shaded medially, mid and hind tibiae brown, all tarsi yellow; antennal segments I–II brown III–VI uniformly yellow, VII–VIII lightly brown, VII pale at base (Fig. 39); major setae pale; fore wing shaded light brown.

Head longer than wide, transversely reticulate (Fig. 17); postocular setae blunt, shorter than eyes (Fig. 17); eyes dorsally and ventrally equal in length; maxillary stylets about 0.1 of head width apart, retracted to level of postocular setae (Fig. 17); mouth cone bluntly pointed, reaching to level of anterior margin of ferna. Antennal segment III about 3 times as long as apical width (Fig. 39); IV with 3 major sense cones, VIII small but distinct from VII. Pronotum sculptured reticulate at anterior half, irregular lines at posterior half, with 5 pairs of long blunt setae, epim setae longest (Fig. 50). All legs normal. Fore wings with 3 blunt sub-basal setae arising in straight line, almost equal in length, with 8–9 duplicated cilia. Mesonotum transversely reticulate, lateral setae well-developed, blunt. Metanotum longitudinally reticulate, major setae slender and acute (Fig. 84). Mesopresternum eroded medially but weakly connected, metathoracic sternopleural sutures long (Fig. 68). Pelta broadly triangular, weakly reticulate, with pair of CPS (Fig. 84); tergite II with 4–5 pairs of lateral setae; tergite VIII posterolateral setae well-developed, shorter than posteroangulares; tergite IX setae S1 about half the length of tube, blunt at apex (Fig. 101), S2–S3 shorter than tube, apex acute; tube longer than head, anal setae shorter than tube.

Measurements (holotype female in microns). Body length 2730. Head length (maximum width) 230 (200); postocular setae length 55; antennal segments I–VIII length (width): 40 (40), 50 (35), 70 (25), 70 (40), 65 (30), 60 (30), 50 (25), 30 (10); sense cone on III length 30. Pronotum length (width) 190 (325); am 25, aa 35, ml 40, epim 110, pa 50. Fore wing length 1050; sub-basal setae S1 45, S2 55, S3 55. Tergite VIII posterolateral setae 70; tergite IX setae S1 150, S2 230, S3 230; tube length 320, basal width 85, apical width 45; anal setae length 215.

Male macroptera. Similar to female in colour and sculpture; abdominal tergite IX setae S2 short and acute; sternite VIII largely occupied by pore plate.

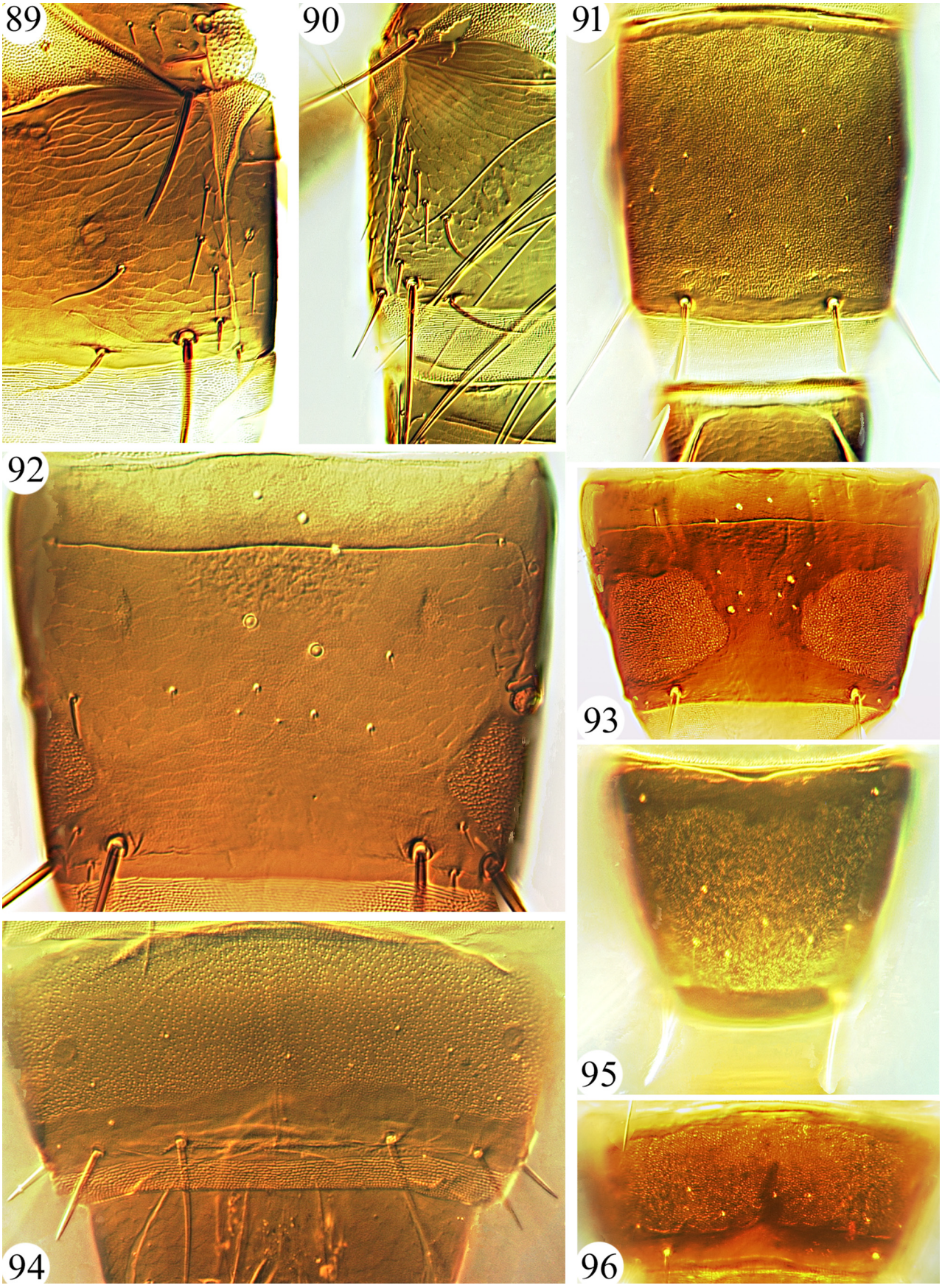
Measurements (paratype male in microns). Body length 1980. Head length (maximum width) 210 (180); postocular setae length 45. Pronotum length (width) 150 (270); am 20, aa 25, ml 20, epim 85, pa 55. Tergite IX setae S1 130, S2 35, S3 230; tube length 275, basal width 80, apical width 40; anal setae length 185.

Specimens studied. Holotype female, CHINA, Tibet, Motuo, on unknown plant, 20.vii. 2022, Yanqiao Li (SNUT).

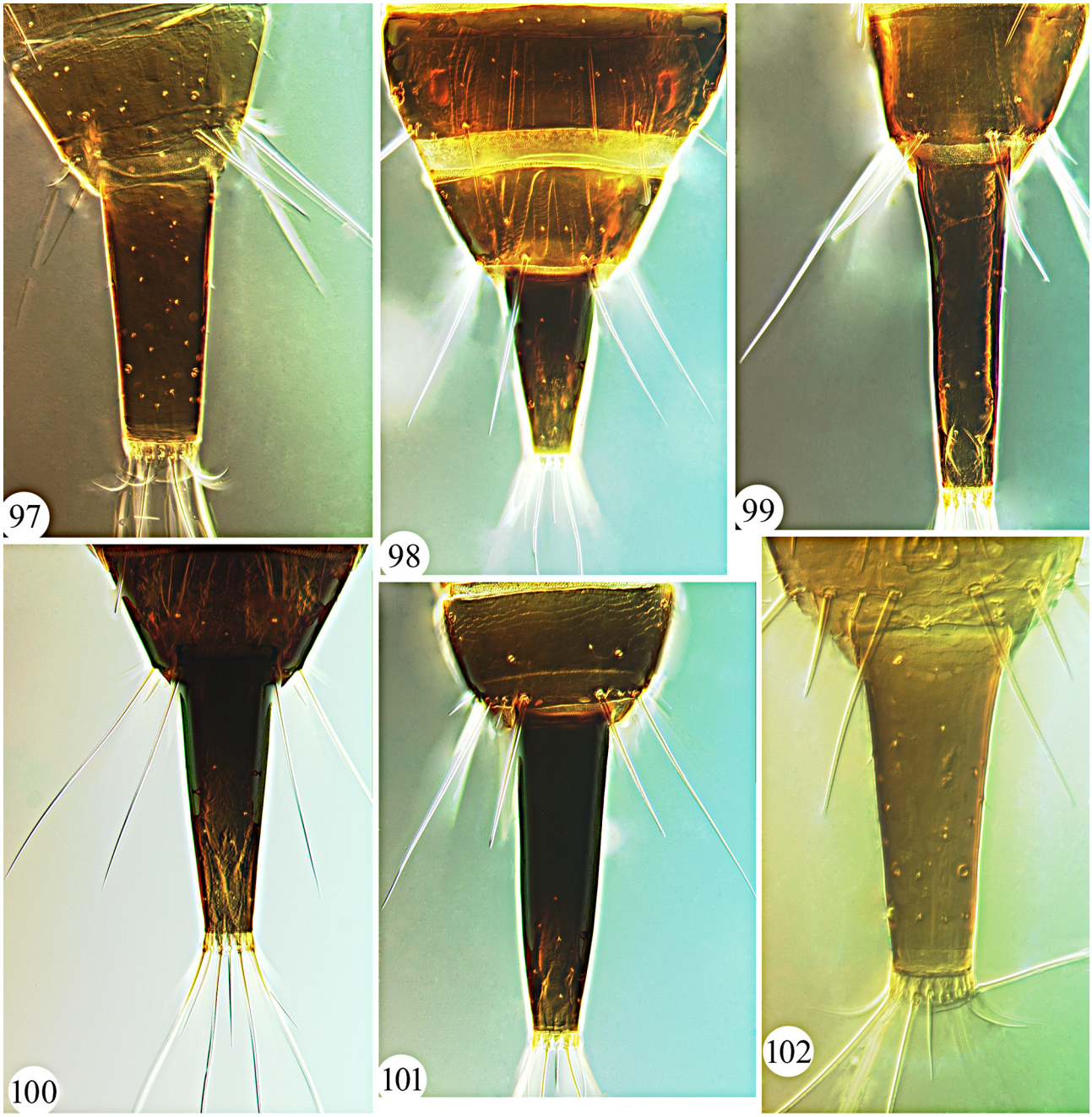
Paratypes: 1 female and 1 male with same data as holotype (SNUT & NZMC).

Etymology. This species name is composed of one Latin word based on the region where the type specimens were collected.

Comments. The pronotum of this new species is irregularly reticulate, with sculpture rather like that which is characteristic for species of *Gynaikothrips*. Nevertheless, it is clearly associated with *Liothrips* due to the presence of metathoracic sternopleural sutures and the medially eroded mesopresternum (Fig. 68). It seems worth noting that the body shape and sculpture of *L. tibetanus* **sp. n.** is somewhat similar to species of *Teuchothrips*, but it has no fore tarsal tooth in either sex.



FIGURES 89–96. *Liothrips* species. (**89**) *hagai*, tergite II; (**90**) *takahashii*, tergite II; (**91**) *takahashii*, pore plate on sternite VIII; (**92**) *takahashii*, pore plates on tergite VIII; (**93**) *mohanrami*, pore plates on tergite VIII; (**94**) *populi* **sp. n.**, pore plate on sternite VIII; (**95**) *elongatus* **sp. n.**, pore plate on sternite VIII; (**96**) *aporosae*, pore plate on sternite VIII.



FIGURES 97–102. Tergites IX–X of *Liothrips* species. (**97**) *bournierorum*; (**98**) *brevis* **sp. n.**; (**99**) *motuoensis* **sp. n.**; (**100**) *piperinus*; (**101**) *tibetanus* **sp. n.**; (**102**) *populi* **sp. n.**

Liothrips vaneeckei **Priesner**
(Figs 18, 40, 64, 85)

Liothrips vaneeckei Priesner, 1920: 211.
Liothrips chinensis Han, 1997a: 559, 569. **Syn.n.**
Liothrips diwasabiae Han, 1997a: 562, 570. **Syn.n.**
Liothrips sanxiaensis Han, 1997a: 563, 570. **Syn.n.**
Liothrips sinarundinariae Han, 1997a: 564, 570. **Syn.n.**

A syntype slide listed below has 32 adults with 28 females and 4 males and three pupae, many of which are damaged and dark. However, some distinguishing characters can be seen as follows: antennal segments short,

III no more than 2.5 times as long as wide, III clear yellow, IV–V light brown with yellow at base, VI largely brown with extreme base yellow, VII–VIII brown (Fig. 40); postocular setae as long as or a little longer than eyes, slightly blunt at apex (Fig. 18), rarely shorter than eyes; maxillary stylets retracted to postocular setae, close together medially in head, their separation 0.05–0.1 of head width (Fig. 18); metanotum with sculpture of complete and dense longitudinal stripes medially, and narrowly reticulate at anterior angles (Fig. 85); all tarsi yellow, fore tibiae yellow but shaded sub-basally, mid and hind tibiae yellow on distal fifth or more; fore wings shaded brown with dark median longitudinal line; anal setae as long as tube. Specimens on a slide from USA and some slides from Australia in ANIC labelled as *L. vaneeckei* show variation in sculpture on the metanotum and also with regard to the length of the anal setae. This species is usually found under the scales of cultivated lily bulbs. It was originally described from the Netherlands, but is recorded from Japan, New Zealand, Australia, and China and might be widespread in the Holarctic (Okajima 2006; Mound *et al*. 2023; Han 1997a). The type specimens of the following species have been checked, *L. sinarundinariae* Han, *L. chinensis* Han, *L. sanxiaensis* Han and *L. diwasabiae* Han. No significant differences could be seen between these and the available specimens of *L. vaneeckei*, and all four are here considered as new synonyms of that species.

Specimens studied. CHINA, Sichuan, Wushan and Wan Counties, 2 paratype females of *chinensis,* 19 and 28.v.1994, J. Yao (NZMC); Sichuan, Wushan County, 2 paratype males of *sanxiaensis*, 19.v.1994, J. Yao (NZMC); Sichuan, Wushan County, 2 paratype females of *sinarundinariae*, 19.v.1994, J. Yao (NZMC); Sichuan, Wushan County, holotype female of *diwasabiae*, 21.ix.1994, S.M. Song (NZMC). NETHERLANDS, Alphen aan den Rijn, Syntypes 28 females and 4 males on *Lilium pardalinum*, 12.vii.1915 (SMF); Winkel, 7 females and 2 males in Lilie, iv.1932 (SMF); Gelderland, Wageningen, 1 female and 1 male on *Lilium*, 25.xi.1960, v.d. Giese (SMF). U.S.A., California, Los Angeles County, 1 female on Lily bulbs, 14.iv.1924 (SMF).

Liothrips vitivorus (Priesner)

Smerinthothrips vitivorus Priesner, 1935: 364. Replacement name for *claripennis* Moulton, 1928a not *claripennis* Karny, 1916

Described from Taiwan on *Vitex* sp., this is the second *Liothrips* species from China that has no CPS on abdominal tergite I. The first one, *L. heptapleuricola*, has several pairs of small setae posterolaterally on the pelta (Fig. 72).

Liothrips wasabiae Haga & Okajima
(Figs 19, 34, 44, 63, 86)

Liothrips wasabiae Haga & Okajima, 1983: 333.

Described from Honshu, Japan on *Wasabia japonica*, this species was found living on all parts of *Wasabia japonica*, including leaves, stem and underground tubers. Many specimens from northern China have been studied and are here identified as *L. wasabiae*, after comparison with a paratype female and male. However, a few males from China show variation; base of mid and hind tibiae paler; postocellar setae elongate, about twice as long as diameter of an ocellus, median setae between postocular setae the same length; mid and hind tibiae yellow on apical half; setae S1–S3 on tergite IX sometimes shorter than tube.

Specimens studied. CHINA, Shaanxi, Yanan City, Ziwuling natural reserve, 2 females and 3 males on *Periplora*, 19–20.vii.2020, X. Wang and Y.Q. Li (SNUT); Shaanxi, Yanan City, Ziwuling natural reserve, 3 females and 1 male, 5–19.vii.2019, R. Dang (SNUT); Shaanxi, Yanan City, Ziwuling natural reserve, 2 females, 15.vii.2019, J. Shen (SNUT). JAPAN, Shimane, Masuda-shi, one female and one male paratype on *Wasabia japonica*, vii.1981, T. Murai (TUA).

Species from China removed from *Liothrips*

Teuchothrips fuscus (Steinweden & Moulton) comb.n.

Rhynchothrips fuscus Steinweden & Moulton, 1930: 29.

This species was described in the genus *Rhynchothrips* on two females, collected from Kashing, Zhejiang province of China under elm bark. It was transferred to *Liothrips* by Mound and Marullo (1996) but is here transferred to *Teuchothrips* because the original description indicates the presence of a tarsal tooth in females.

***Teuchothrips turkestanicus* (John) comb.n.**

(Figs 14, 88)

Rhynchothrips turkestanicus John, 1928: 139.

Described originally from Turkestan (Kazakhstan) near the northwestern border of China, and one syntype female has been studied. The species was subsequently recorded by Han (1997b) from China, Ningxia and Inner Mongolia. Han also redescribed it based on females with various wing lengths and also wingless males. The wingless female and male from Ningxia listed below have been compared to the syntype listed, and all known specimens of the species have a well-developed slender fore tarsal tooth (Fig. 14). The species is therefore here transferred to the genus *Teuchothrips*.

Specimens studied. CHINA, Ningxia, Yinchuan, one female and one male on leaves of elm tree, 17.viii.1987, H. Tan (SMF). TURKESTAN, co-type female, 10.v.1927, H. Priesner (SMF).

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