



Studies on the genus *Lefroyothrips*, with new records from Malaysia, New Caledonia and a new species from Australia (Thysanoptera, Thripidae)

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Abstract

Six species are recognised in the genus *Lefroyothrips*, including one new species from Australia. The metascutal chaetotaxy of two of these species is unique amongst Thripidae. New distribution records given here indicate that four of the species are widely distributed: *L. pictus* across tropical Africa, *L. lefroyi* from northern India to Taiwan, *L. fasciatus* from Malaysia to northern Australia and New Guinea, and *L. varatharajani* from southern India to New Caledonia and northern Australia. An illustrated key is provided to the six known species in this genus.

Key words: Geographic distributions, canopy insects, identification key, generic diagnosis

Introduction

Species of the genus *Lefroyothrips* Priesner are reported here to be found widely in the Old World tropics, from Africa to the Australasian region. However, judging from the few specimens in museum collections the species have been collected infrequently. The available collecting records suggest that these thrips are all associated with flowers rather than leaves. The type-species, *L. lefroyi*, was described from northern India by Bagnall (1913) as “the tea flower thrips”, and subsequent collections indicate an association with the flowers of *Camellia sinensis*. A second species, *L. fasciatus* (Moulton), is recorded here from flowers of *Dipterocarpus sublamellatus*, high in the canopy of this rainforest tree in Malaysia. Records provided here indicate that both of these thrips species occur widely across southeast Asia, and an extensive distribution is also recorded here for *L. varatharajani* Rachana & Manjunath, a species described recently from southern India. This combination of wide distributions but infrequent collection may suggest that the species usually live in the canopy of particular tree species, well beyond the reach of traditional thrips collecting methods.

The six species of *Lefroyothrips* recognized here exhibit remarkable inter-specific structural variation. This includes the cephalic chaetotaxy (Figs 8, 9), the form of the antennal segments (Figs 1–6), the presence or absence of male sternal pore plates, and a metascutal chaetotaxy in two species that is probably unique amongst Thripidae. The members of this family usually have two pairs of major setae on the metascutum: a submedian pair arising at the anterior margin, and a median pair of commonly larger setae arising either at or behind the margin, depending on the species. However, the metascutum of *L. fasciatus* and also the new species of this genus described below has one, two or even three extra setae medially (Figs 11–13), a condition that is not previously reported for any species of Thripidae.

Currently there are five species listed in this genus (ThripsWiki 2021), with a sixth species described below. New distribution records are given here for three species, together with an identification key to the six known species. Nomenclatural details are available in ThripsWiki (2021), and the following abbreviations and depositories are used: CPS—campaniform sensilla; setae S1—any setal pair closest to the midline, with S2 the closest seta lateral to S1. CISUKM—Centre for Insect Systematics, Universiti Kebangsaan Malaysia, Bangi; ANIC—Australian National Insect Collection, Canberra; CAS—California Academy of Sciences, San Francisco; BMNH—The Natural History Museum, London; SMF—Senckenberg Museum, Frankfurt.

Lefroyothrips Priesner

Taeniothrips (*Lefroyothrips*) Priesner, 1938: 499. Type species *Physothrips lefroyi* Bagnall.
Lefroyothrips Priesner; Bhatti, 1978: 188.

In erecting this genus, Priesner described two new species from Java and Sumatra, although both are now considered synonyms of *lefroyi*. This type species differs from the other known species in the genus in having ocellar setae pair III very small (Fig. 8), in having the postocular setae arranged in an irregular pair of rows not in a single row, and in having the metascutum strongly reticulate (Fig. 14). All of the known males in the genus have a set of six thorn-like setae on tergite IX (Figs 20–21, 25), but the male sternites bear pore plates in three species although not in two species (male not known for *tribulationi* **sp.n.**). Further remarkable differences among the included species are in the fore wing banding pattern, as indicated in the key below, in the presence of additional setae medially on the metascutum of two species, *L. fasciatus* and *L. tribulationi* (Figs 11–12, 15), in the form of antennal segments III–IV (Figs 1–6), and in the length of ocellar setae pair III from 15 to 80 microns.

Generic diagnosis: Head wider than long, vertex with median transverse ridge; ocellar setae pair I arranged irregularly one in front of the other, setae pair III long or short; 5 or 6 pairs of postocular setae; compound eyes without pigmented facets. Antennae 8-segmented; segment I without paired dorso-apical setae; III and IV with sense cones forked; segment II with microtrichia on dorsal surface, III–VI with microtrichia on both surfaces. Pronotum with two pairs of long posteroangular setae, posterior margin with 3 or 4 pairs of setae. Mesonotum transversely reticulate, median setae in front of posterior margin; anterior CPS present. Metascutum variably reticulate, setal pairs usually at anterior margin, paired CPS on posterior third of sclerite. Prosternal ferna complete medially; basantra membranous, without setae; prospinasternum broad and transverse. Mesosternum with sternopleural sutures complete; endofurca with spinula. Metasternal endofurca without spinula. Fore wing first vein with row of setae on basal half, 2 or 3 setae on distal half; second vein setal row complete; clavus with one discal and 5 veinal setae, subapical seta longest. Tarsi 2-segmented. Tergites without ctenidia or craspeda, tergal setae S1 small and wide apart, arising between campaniform sensilla; VIII with group of microtrichia anterior to spiracle, posterior margin with regular comb of long microtrichia (Figs 17–20); IX with 2 pairs of CPS; X with median split almost complete. Pleurotergites without discal setae. Sternites III–VII without discal setae, 3 pairs of marginal setae, sternite VII posteromarginal setae long, S1 arising in front of posterior margin, S2 either at or in front of margin (Fig. 22). Male similar to female; tergite IX with three pairs of stout, dark, thorn-like setae (Figs 20–21, 25); sternites without discal setae, with or without pore plates (Figs 26–27).

Key to species of *Lefroyothrips*

[* from description]

1. Fore wing dark at apex, with one shaded band medially and the second at apex (Fig. 23); sternite VII of female with setae S2 arising at margin; male without sternal pore plates 2
- Fore wing pale at apex, with shaded bands near veinal fork and on distal third sub-apically; some species with sternite VII setae S2 of female arising in front of margin; sternal pore plates present on males (where known) 3
2. Abdominal tergites II and VII dark brown, much darker than I and III–VI; segments VIII–X variably brownish yellow to medium brown. *fasciatus*
- Abdominal tergites mainly brown, but I and V yellow, VIII sharply yellow on posterior half, IX with a narrow yellow band at anterior margin (Fig. 18) *pictus*
3. Ocellar setae pair III 80 microns long; body uniformly brown, tergites darker on anterior halves **obscurus*
- Ocellar setae pair III less than 50 microns; body extensively pale 4
4. Ocellar setae pair III very small (Fig. 8), shorter than length of a posterior ocellus, and no longer than postocular setae pair I; postocular setae in an irregular pair of rows [sternite VII posteromarginal setae S2 usually sub-marginal in origin (Fig. 22)] *lefroyi*
- Ocellar setae III longer, at least twice as long as postocular setae I (Figs 9, 24); postocular setae arranged in a single transverse row 5
5. All antennal segments dark, III with base and apex sharply pale (Fig. 5); metanotal median setae arise well behind anterior margin (Fig. 15); sternite VII setae S2 arise well in front of posterior margin *tribulationi* **sp.n.**
- At least antennal segment III pale (Fig. 6); metanotal median setae arise at anterior margin (Fig. 16); sternite VII setae S2 arise at posterior margin *varatharajani*

***Lefroythrips fasciatus* (Moulton)**

(Figs 1–2, 11–12, 21, 23)

Taeniothrips (Lefroythrips) fasciatus Moulton, 1940: 250.

This species was described from two females and three males taken without host data at Koitaki, a locality in Papua New Guinea near Port Moresby. Subsequently, two females were reported from the Philippines (Reyes 1994), one male was recorded from Australia in northern Queensland (Mound & Tree 2020), and the species is here reported for the first time from Peninsular Malaysia. Most Thripidae have two pairs of setae on the metascutum, a strong and usually long median pair that may arise on the anterior margin or further back on this sclerite, and a second smaller pair laterally. In contrast, *fasciatus* has one, two or even three extra setae on the metascutum mesad of the major pair. However, these extra setae are not stable either in their presence or in their position (Figs 11–13). In the sample from the tree canopy listed below, one female has 3 extra setae medially, 7 females and 3 males have two medially, one female and 3 males have a single seta medially, and one male has two extra setae medially but has one of the major setae not developed. Moreover, the three females from which the new species *L. tribulationi* is described also have these extra metascutal setae (Fig. 15).

The specimens of *L. fasciatus* collected in Malaysia were taken from flowers in the canopy of a large rainforest tree, a species of *Dipterocarpus*, and the samples also included the Thripidae species *Tenoithrips keruing* (Ng *et al.* 2019). This host association might suggest why *L. fasciatus* is rarely collected despite being reported so widely. Thrips that live high in the tree canopy, on flowers, or on leaves or on dead branches, are difficult to sample effectively (Mound 2020). However, Yamazaki *et al.* (2020) have demonstrated that the number of Thysanoptera individuals taken from tree canopies in Brazil can be greater than the number of any other group of insects apart from Diptera and Hymenoptera.

Female macroptera. Body pale, abdominal segments II and VII with dark marking, IX–X varying from darker yellow to brown; all tibiae and tarsi yellow; antennal segments I–II slightly shaded, III–IV pale, V–VI shaded, VII–VIII pale; fore wings with two shaded cross bands, at middle and at apex (Fig. 23). With the structural character states in the generic diagnosis: Head with areas in front of first ocellus and ocellar area smooth, vertex with fine strong transverse striations; ocellar setae III long, arising within ocellar triangle in line with anterior margins of posterior ocelli; five pairs of short postocular setae in single row, the first pair arising just behind posterior ocelli. Pronotum with few sculpture lines and more than 20 small, scattered discal setae. Metascutum with longitudinally elongate reticulation; with 1 or 2 (rarely 3) setae medially between the major median setal pair (Figs 11–13); campaniform sensilla wide apart and close to posterior margin. Fore wing first vein with 7 setae on basal half, 3 setae on distal half. Abdominal tergite I with transverse lines anteriorly; tergites II–VII smooth on median area mesad of setae pair II; tergite IX with two pairs of CPS. Sternite VII posteromarginal setae long, setae S2 arising at margin.

Male macroptera. Colour and structure of body similar to female; tergite IX with 3 pairs of stout setae (Fig. 21); sternites III–VII without pore plates.

Specimens studied. **Papua New Guinea**, Koitaki, holotype female paratype male without host data, 15.ix.1928 (CAS). **Malaysia**, Pasoh Forest Reserve, Negeri Sembilan, 10 females, 7 males on *Dipterocarpus sublamellatus* flowers (Dipterocarpaceae) in tree canopy at a height of 30m, 8–10.iv.2019 (Ng, Y.F. & Ain, N.) (in CISUKM); UKM, Bangi, Selangor, 1 male on *Plumeria rubra*, 15.i.2009 (Ng, Y.F. & Eow, L.X.) (in CISUKM). **Australia**, Queensland, Cape Tribulation, 1 male from *Pouteria sapota* fls, 8.vii.1995 (LAM) (in ANIC).

***Lefroythrips lefroyi* (Bagnall)**

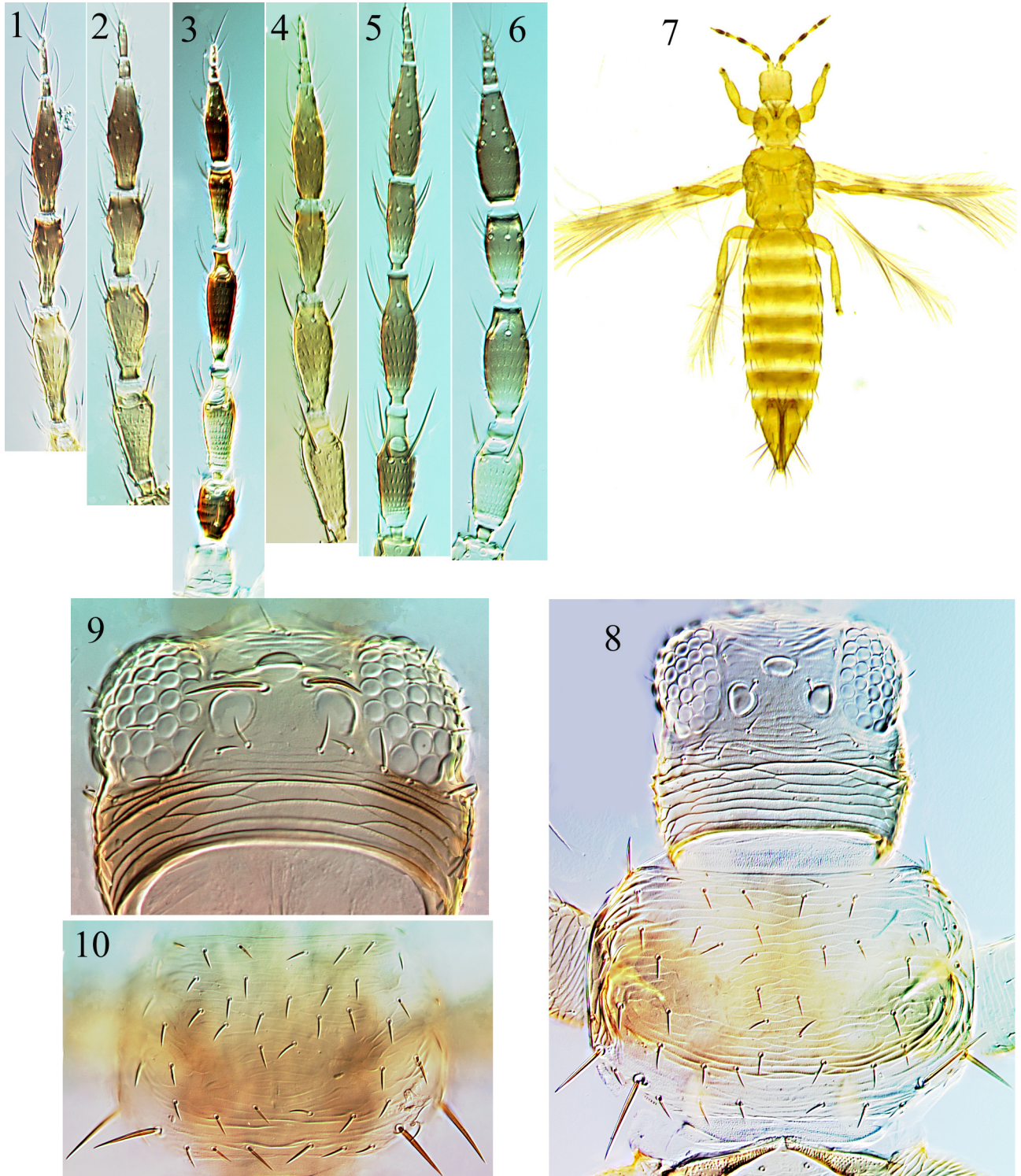
(Figs 3, 7–8, 14, 17, 22, 27)

Physothrips lefroyi Bagnall, 1913: 292.

Described as the “Tea-flower thrips” from Darjeeling in northern India, this species has been found in the flowers of various plant species, but particularly the flowers of *Camellia sinensis*. It is widely distributed across the Asian tropics, and is known from northern India, Malaysia, Java, Philippines, southern China and Taiwan (Rachana & Manjunath 2020).

Female macroptera. Body variable in colour from largely yellow (Fig. 7) to posterior tergites with pale brown

markings; all tibiae and tarsi yellow; antennal segments I, III and V pale, II, IV and VI–VIII shaded or brown; fore wings pale, with 3 weak transverse shadings at veinal fork, medially and subapically. Head with ocellar area smooth, vertex with transverse striations (Fig. 8); ocellar setae III scarcely 15 microns long, on margins of ocellar triangle; postocular setae arranged irregularly, pair S2 posterior to S1. Antennal segments III–V slender (Fig. 3). Pronotum with irregular transverse striations (Fig. 8). Metascutum with strong equiangular reticulate sculpture (Fig. 14); median setae at anterior margin, CPS on posterior third. Abdominal tergites II–VII faintly reticulate anteromedially but without sculpture posteromedially. Sternite VII posteromarginal setae S2 arising close to but in front of posterior margin.



FIGURES 1–10. *Lefroyothrips* species. Antennal segments, 1–6: (1) *fasciatus* holotype; (2) *fasciatus* male; (3) *lefroyi*; (4) *pictus* paratype; (5) *tribulationi*; (6) *varatharajani*. 7–8 *lefroyi*: (7) female; (8) head & pronotum. *L. tribulationi*, 9–10: (9) head; (10) pronotum.

Male macroptera. Body colour and structure similar to female; sternites III–VII with oval-shaped pore plates (Fig. 27), located near anterior margin.

Specimens studied. **Malaysia**, Cameron Highlands MARDI Research Station, Pahang, 1 female, 1 male on Nashi pear flowers, 18.xii.2013 (Alfera & Nurul) (in CISUKM). **Hong Kong**, 1 female from tea, 3.i.1966; **China**, Yunnan, 4 females, 1 male from *Camellia sinensis* fls, ix.2019 (LAM) (in ANIC).

***Lefroythrips obscurus* (Ananthakrishnan & Jagadish)**

Taeniothrips obscurus Ananthakrishnan & Jagadish, 1966: 253.

Described from one female and two males taken on coffee plants, 27.ix.1965, at Valparai in southern India, this species remains known only from the original description. Unfortunately, that description mainly comprises a series of measurements with few comments on structural details. Although Bhatti (1978) transferred the species to *Lefroythrips*, the statement by the original authors that the fore wing is banded with two patches is equivocal. For the purposes of the key above it is assumed here that the distal band was sub-apical leaving the apex pale. The position of the setae on sternite VII was also not mentioned.

***Lefroythrips pictus* (Hood)**

(Figs 4, 18, 20)

Physothrips pictus Hood, 1916: 116.

This species was described from four females and two males taken from the flowers of *Melia azedarach*, 14.i.1915, at Ibadan, Nigeria, but it has subsequently been identified from Sierre Leone, Cameroon, Uganda, Rwanda and Angola. It shares with *L. fasciatus* the dark band at the apex of the fore wing, but the tergites of females have a distinctive colour pattern, with tergites VI–X brown, but the posterior half of VIII and the anterior third of IX sharply pale (Fig. 18). Antennal segments III–V (Fig. 4) are slightly less slender than in *L. lefroyi* and without the small sub-basal swelling found in *L. fasciatus*.

Specimens studied. **Nigeria**, Ibadan, 1 female paratype in *Melia azedarach* fls, 14.i.1915, 1 male in *Citrus* fls, 11.iii.1964; Ile-Ife, 1 female in light trap, i.1970 (in BMNH). **Angola**, 1 male on *Citrus* fruits, 24.v.1971 (in BMNH). **Rwanda**, Rusumu, 1 female on *Carapa grandiflora*, x.1993 (in SMF).

***Lefroythrips tribulationi* sp.n.**

(Figs 5, 9–10, 15, 19)

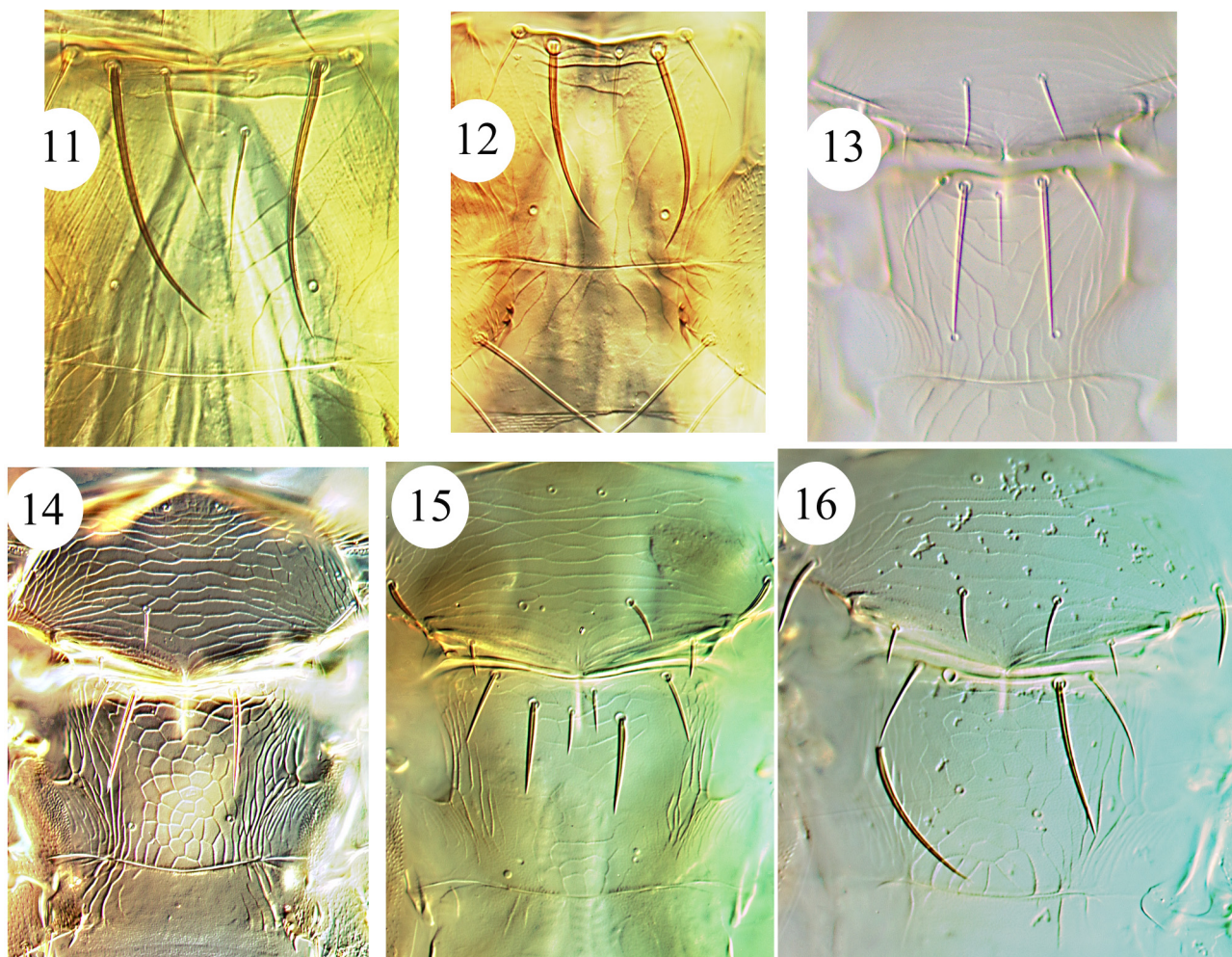
Female macroptera. Colour mainly yellow with light brown areas as follows: behind each compound eye, on pronotum longitudinally and sublaterally, on metascutum laterally, on tergites III–VII medially and with paired lateral areas; major setae dark brown; legs yellow; fore wings very weakly shaded, with slightly darker area at veinal fork; antennal segments brown to dark brown, III with constricted apex sharply paler and base also paler (Fig. 5). With the character states of the generic diagnosis. Head without sculpture in ocellar region, transversely irregularly striate on posterior area, postocular ridge weakly developed (Fig. 9); ocellar setae III arise within ocellar triangle, length about equal to distance between posterior ocelli, ocellar setae pair I irregularly placed. Antennal segments III and IV with constricted elongate apex. Pronotum with weak irregular transverse striae, inner pair of posteroangular setae slightly shorter than outer pair (Fig. 10). Metanotum weakly reticulate, median major setae arise well behind anterior margin, medially with 1 or 2 extra setae (Fig. 15); CPS near posterior of sclerite. Fore wing first vein with 2 setae distally. Tergites without sculpture lines medially. Sternite VII setal pair S2 arise well in front of margin.

Measurements (holotype in microns). Body length 1750. Head, length 110; width 169; ocellar setae III 25. Pronotum, length 140; width 210; posteroangular setae—inner 45, outer 50. Metascutum major setae 40. Fore wing length 850. Antennal segments III–VIII length 75, 75, 50, 60, 12, 15.

Specimens studied. Holotype female, **Australia, Queensland**, Cape Tribulation, from *Syzygium* fls, ix.2001 (S. Boulter) (in ANIC).

Paratypes: Queensland, Redlynch, Stoney Creek, 6.xi.2008 (LAM)—1 female from *Syzygium tierneyanum*, 1 female from *Myristica insipida* (LAM) (in ANIC).

Comments. The antennae of this species are unusual among species of this genus, both for their dark colour and for the constricted elongate apex to segments III and IV. The distribution of the dark areas on the yellow body is probably distinctive, as are the almost uniformly coloured fore wings. The metascutum of the holotype has two extra setae medially, whereas both paratypes have only one such median seta.



FIGURES 11–16. *Lefroyothrips* species—metascutum. (11) *fasciatus* holotype; (12) *fasciatus* paratype male; (13) *fasciatus* male; (14) *lefroyi*; (15) *tribulationi*; (16) *varatharajani*.

***Lefroyothrips varatharajani* Rachana & Manjunath**

(Figs 6, 16, 24–26)

Lefroyothrips varatharajani Rachana & Manjunath, 2020: 592

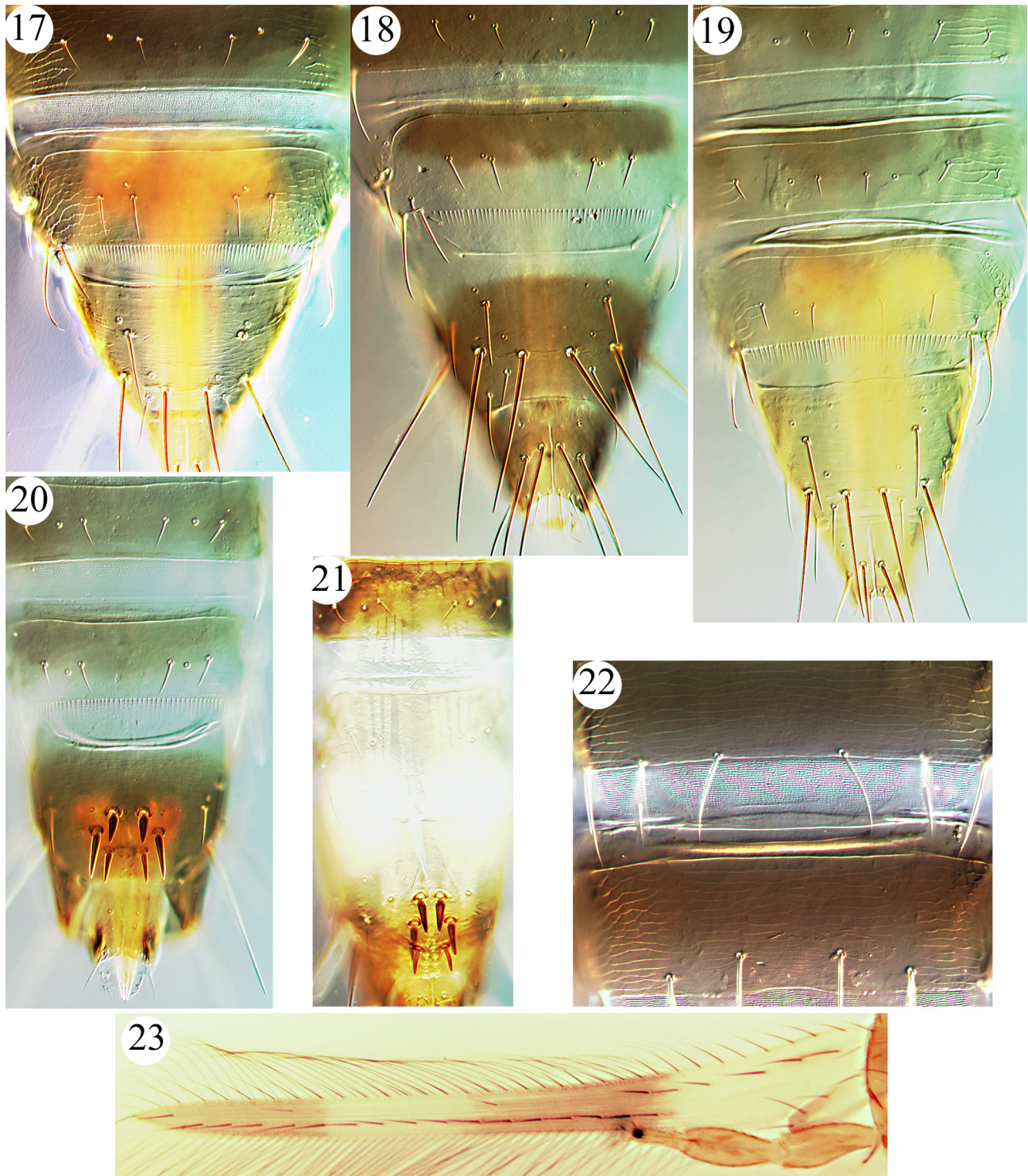
Based on 16 females and 8 males from *Mimusops elengi* taken 11.iii.2020 in India, Bengaluru, this species is here recorded from Western Australia and New Caledonia. This distribution seems remarkable but is not greatly different from that indicated above for *L. fasciatus*. The specimens studied listed below agree fully with the recent detailed description of this species. It is probably closely related to *L. lefroyi* but has the metascutum only weakly reticulate (cf Figs 14, 16).

Female macroptera. Body and legs yellow, posterior tergites brownish-yellow; antennal segments IV–VI brown or with brown marking (Fig. 6); fore wings pale with two short shaded areas, at veinal fork and subapically. With

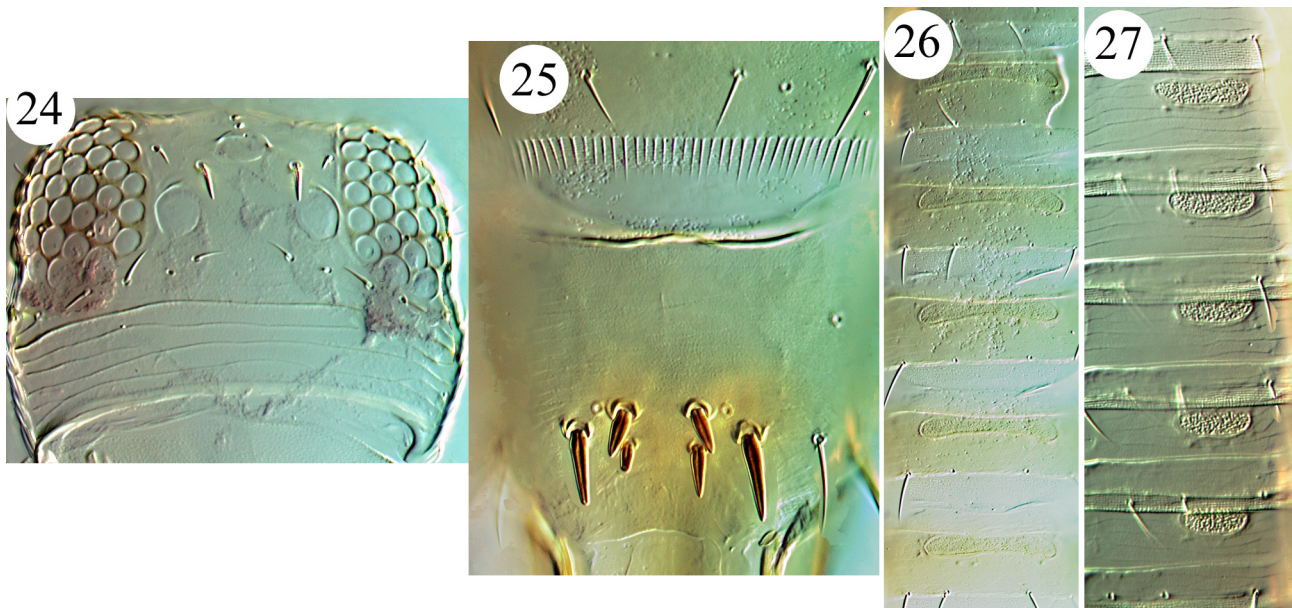
the character states of the generic diagnosis. Ocellar setae pair III slightly shorter than distance between posterior ocelli (Fig. 24); postocular setae in single row with S2 sometimes slightly displaced posteriorly. Metascutum weakly reticulate (Fig. 16), CPS on posterior third of sclerite and slightly variable in position. Fore wing first vein distally with 1 or 2 setae. Sternite VII setae S2 arise at posterior margin.

Male macroptera. Similar to female; tergite VIII with long comb, IX with 3 pairs of stout setae (Fig. 25); sternites III–VII with transverse pore plate close to anterior margin (Fig. 26).

Specimens studied. **Western Australia**, Kununnura, Frank Wise Institute, 2 females from grasses, 24.ii.2005 (LAM). **New Caledonia**, La Foa, 2 females, 4 males from *Pouteria sapota* fls, 9.iv.2012 (LAM) (in ANIC).



FIGURES 17–23. *Lefroyothrips* species. Female tergites VII–X, 17–19: (17) *lefroyi*; (18) *pictus*; (19) *tribulationi*. male tergite IX, 20–21: (20) *pictus*; (21) *fasciatus*. (22) *lefroyi* female sternites VI–VII. (23) *fasciatus* fore wing.



FIGURES 24–27. *Lefroyothrips* species. *L. varatharajani* 24–26: (24) head; (25) male tergites VIII–IX; (26) male sternites. (27) *L. lefroyi* male sternites.

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