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Taxonomic problems with *Gynaikothrips* and related genera (Thysanoptera, Phlaeothripinae): the *ficorum*/*uzeli* complex and taxa endemic to Australia

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Abstract

Ten species from Australia in or related to the genus *Gynaikothrips* are discussed. Variation among specimens of the pest species on *Ficus* trees, the *ficorum*/*uzeli* complex, is examined with the conclusion that recognition of these two species remains questionable. Two species related to this complex are newly recorded from Australia, *insulsus* Priesner and *luzonensis* Priesner, and *edentatus* Priesner is placed as a **syn.n**. of *ficorum*. Two new *Gynaikothrips* are described, *jasmini* **sp.n**. and *platypodae* **sp.n**., and *additamentus* Karny is transferred from *Gynaikothrips* to *Eilapinothrips* **gen. n**. A new species of *Agynaikothrips* is described as the third known member of this genus, *lorieni* **sp.n**., and *Liothrips umbratus* Hood **comb.rev.** is returned to this original genus from *Gynaikothrips*. Two species described in *Gynaikothrips* from the Philippines, *capitulatus* Reyes and *pedanus* Reyes, are transferred to the genus *Teuchothrips*. The monobasic genus, *Aiganothrips* Bhatti, is considered a **syn.n.** of *Gynaikothrips*, and the monobasic genus, *Jennythrips* Bhatti, is considered a **syn.n.** of *Liothrips*.

Key words: *Ficus* galls, generic relationships, new genera, new species, new synonyms

Introduction

Species of the Palaeotropical genus *Gynaikothrips* are generally considered to be associated with the induction of leaf-distortions or galls on various species of plants (Mound 1994). In the horticultural industry these thrips can cause considerable problems due to their feeding activities on the young leaves of decorative *Ficus* species, particularly of *G. ficorum* on *Ficus microcarpa* (= *retusa*), and of *G. uzeli* on *Ficus benjamina*. Indeed, sometimes the thrips become so numerous that they may become a minor health hazard to people relaxing in the shade of the trees. However, there are considerable problems in distinguishing these two species of *Gynaikothrips*, particularly as both of them have become spread around the world by the trade in their host plants far from their area of origin in southeastern Asia (Mound *et al*. 1996). The two common *Ficus* species are planted in northern and northeastern Australia as decorative amenity trees in coastal holiday areas. The leaves of these trees are galled by what is interpreted here as a complex of species that is discussed as the *ficorum*/*uzeli* complex. One objective of the studies presented here (**Section A**) was to try to find a more satisfactory distinction between *ficorum* and *uzeli*. As a result, we record from Australia for the first time two further related species, *G. luzonensis* that was described from the Philippines, and *G. insulsus* that was described from Taiwan. However, despite distinguishing these four named entities, their identity as independent species remains questionable because of the structural variation within and between samples, as discussed below. Moreover, as indicated below, molecular data from 400 specimens of the *ficorum*/*uzeli* complex that we and our colleagues collected worldwide provided little support for reciprocal monophyly of *G. ficorum* and *G. uzeli*. The second objective here (**Section B**) was to distinguish the three Australian endemic species of *Gynaikothrips* (including two new species) that induce leaf galls on plants that are native to Australia. Moreover, **(Section C)** a new species is described in the related genus, *Agynaikothrips*, and two further endemic Australian species are transferred from *Gynaikothrips* to other genera, including one new genus.

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Acknowledgements and abbreviations
We are grateful to Andrea Hastenpflug-Vesmanis at the Forschungsinstitut Senckenberg, Frankfurt [SMF], for arranging loans of species described by Priesner. Also, to Mark Schutze for organising several loans of slides to the Australian National Insect Collection, Canberra [ANIC] from the Queensland Primary Industries Insect Collection, Brisbane [QDPC]. The Queensland Herbarium, Brisbane, kindly provided identifications of several plants. In particular we are grateful to Professor Lyn Cook at the University of Queensland for her observations and helpful advice concerning relationships amongst these thrips based on her unpublished molecular data.

The following abbreviations are used: CPS—campaniform sensilla; po—postocular setae; pronotal setae am—anteromarginal, aa—anteroangular, ml—midlateral, epim—epimeral, pa—posteroangular

Host associations of *Gynaikothrips* species

There are 42 species listed in the genus *Gynaikothrips* (ThripsWiki 2021). Of these species, 16 are recorded from *Ficus* [Moraceae], six (including one new species described below) are each recorded from the leaves of plants in six different families [Altingiaceae, Araliaceae, Euphorbiaceae, Myrtaceae, Oleaceae, Rubiaceae], and 21 are not recorded from any named plant. The leaf-galls induced by *Gynaikothrips* species often have little precise form, and this contrasts with the galls induced by *Kladothrips* species on *Acacia* in Australia (Crespi *et al*. 2004). Feeding by *Gynaikothrips australis* on the lower surface of a leaf of *Ficus macrophylla* induces (Fig. 3) only a slight in-rolling of the leaf margin (Tree & Walter 2009), often with some reddish mottling on the upper surface. Similar, but rather more extreme, leaf distortion is induced on *Ficus platypoda* by a new species described below (Figs 4, 5). In contrast, feeding by *G. ficorum* on the upper surface of a young leaf of *F. microcarpa* can induce that leaf to distort in various ways. The parenchymatous tissues of the leaf hypertrophy irregularly, resulting in the leaf folding upwards, over and partially enclosing the thrips (Rivnay 1947). These galls are commonly initiated by single females (Tree & Walter 2009), and typically such a fold occurs along the mid-line, producing a neatly folded pod-like structure with the surface mottled with red (Fig. 1). But if the thrips feeds nearer the leaf margin then only that margin folds over, and this can lead to irregularly distorted, rather twisted leaves. The galls induced by *G. uzeli* on *F. benjamina* are similar in form (Fig. 2) to those induced by *G. ficorum*.

Some species of *Gynaikothrips* appear to exhibit a fairly high level of specificity in their host plant relationships. Thus *G. ficorum* is particularly common galling leaves on *Ficus microcarpa* although it was found to induce galls to some extent on *F. benjamina* under experimental conditions (Tree *et al* 2015). In contrast, Australian populations of the closely related species *G. uzeli* have been found to induce galls only on *F. benjamina*, both in nature and also under experimental conditions (Tree *et al*. 2015). In Taiwan, a few *G. ficorum* were noted to invade the galls of *G. uzeli* on *F. benjamina* as these matured. In Australia, *G. australis* is largely specific to *F. macrophylla*, the Moreton Bay Fig, although it has been found on *F. rubiginosa* and *F. obliqua*, tree species that co-exists with *F. macrophylla* along much of the coastal region of eastern Australia (Tree & Walter 2009). Moreover, a new species is described below that is common and widespread across northern Australia on the Rock Fig, *F. platypoda*, but has been found twice in central Australia galling leaves on *F. brachypoda*.

Gynaikothrips relationships

This genus is a member of the *Liothrips*-lineage of leaf-feeding Phlaeothripinae, a group involving at least 40 genera mainly from the Old World tropics. An identification key to help distinguish many of these genera in southeast Asia was provided by Dang *et al*. (2014), but the systematic relationships amongst these genera remain poorly defined. Generally, species of the *Liothrips*-lineage share the presence of one sense cone on antennal segment III and three sense cones on segment IV, also the absence of prosternal basantra. Moreover, species in most of the genera have the metathoracic sternopleural sutures well-developed, and the mesopresternum sclerite reduced to two lateral triangles, or at least very slender medially (Fig. 7). In contrast, species that are most closely related to *G. uzeli*, the type-species of *Gynaikothrips*, have no metathoracic sternopleural sutures, and the mesopresternum is broadly transverse and complete medially (Figs 8, 9).

Among the genera from Asia that were treated as members of the *Liothrips*-lineage by Dang *et al*. (2014), the

following four share the absence of metathoracic sternopleural sutures and the presence of a broad mesopresternum. *Agynaikothrips* was erected for two species from southern Japan and Taiwan, and according to its description (Okajima 2006) it is particularly close to *Gynaikothrips* but with maxillary stylets elongate and closer together medially in the head; a new species of this genus is described below from Australia. The genus *Praeciputhrips* was erected for a single species from the Philippines (Reyes 1994), and the holotype (in ANIC) has been re-examined; it has long maxillary stylets, but both compound eyes have one posterolateral facet greatly expanded, and the setae on tergite IX are elongate rather than short. *Gemmathrips* is similarly known by a single species from the Philippines (Reyes 1994), and the holotype (in ANIC) shares with *Praeciputhrips* the condition of the compound eyes but is distinguished by the shorter maxillary stylets and long, slender antennal segment VIII. In contrast, *Rosingothrips* from the Philippines (Reyes 1994) shares most conditions with *Gemmathrips* but has the metathoracic sternopleural sutures present and very long. A further genus related to *Gynaikothrips* is *Litotetothrips*, but all the species in that genus have antennal segment VIII unusually long.

Two genera closely related to *Gynaikothrips* are *Gigantothrips* and *Leeuwenia* (Mound & Tree 2021). All species of these three genera are gall-inducing, or are associated with galls, and all share the absence of metathoracic sternopleural sutures and the presence of a broad mesopresternum. *Gynaikothrips* and *Gigantothrips* are not only similar in structure but many of their species live on the leaves of species in the genus *Ficus*. Currently, *Gigantothrips* is distinguished because the type species, *elegans*, has several additional pairs of strongly sigmoid setae on tergites II–IV (or V) (Fig. 10). However, other species in this genus have these extra setae either less strongly sigmoid or long and straight, e.g. *xynos* & *caudatus* (Figs 11, 12). However, in that these extra setae point mesad on each tergite they clearly serve the function of additional wing-retaining setae. These species are particularly similar to *Gynaikothrips australis* discussed below (Fig. 13). Without further study of more of the included species it is not possible at present to decide if only a single genus should be recognised. The closely related genus *Leeuwenia* remains distinguished by the greater length of the last abdominal segment, although a few species placed in that genus are particularly similar to some *Gynaikothrips* species (Mound 2004).

From Australia, five species are currently listed in *Gynaikothrips* (ABRS 2021), but two of these species have the mesopresternum weak or absent medially, and the metathoracic sternopleural sutures long and well-developed. The first of these two, *additamentus* Karny, is referred below to a new genus, *Eilapinothrips*, whereas the second, *umbratus* Hood, is discussed below as a member of the genus *Liothrips*. Two new species of *Gynaikothrips* are described that are presumably Australian endemics, the genus *Agynaikothrips* is recorded from Australia with one new species, and two furher species are recorded from this continent in the *ficorum*/*uzeli* complex.

Gynaikothrips Zimmermann

Gynaikothrips Zimmermann, 1900: 13. Type species *Gynaikothrips uzeli* Zimmermann, 1900, by monotypy.
Aiganothrips Bhatti, 1991: 66. Type species *Gynaikothrips hystrix* Bagnall. **syn.n**.

There is no modern taxonomic study of the 42 species currently listed in this genus (ThripsWiki 2021), apart from a key to two species known from Japan (Okajima 2006), and the redescription of one species from India (Shyam *et al*. 2019). The only available keys to species in the genus are by Priesner (1939) to 12 species, and by Ananthakrishnan and Sen (1980) to nine species from India. However, these two keys employ various weakly-defined and variable character states and are of limited practical value. Moreover, some of the included species are possibly not congeneric with *uzeli*. The two keys provided here are based solely on Australian specimens together with type specimens of some species described by Priesner (1939). Hopefully, the character states used will prove to be useful in future studies on non-Australian species. Each of the seven species recognised here has the following character states: antennae 8-segmented, III with 1 sense cone, IV with 3^{+1} sense cones; pronotum strongly sculptured with all five pairs of major setae represented although with some often reduced; notopleural sutures complete or weakly incomplete; prosternal basantra absent, fernal sclerites large; mesopresternum transverse and complete; metathoracic sternopleural sutures absent (Figs 8, 9).

Aiganothrips Bhatti is here considered a synonym of *Gynaikothrips*. It was erected for a single species from the Pacific island of Tonga that has unusually long setae on the head and pronotum. However, that species is a member of a species-group that has been collected from the leaves of *Ficus* trees on several Pacific islands, including Tonga, Suva and Fiji. Species limits among the members of this Pacific radiation remain unclear, but some populations

have been studied (in ANIC) that exhibit remarkable variation in the length of several pairs of major setae on the head and thorax, and this variation appears to be related to body size, at least in part. Type specimens of two species from the Philippines described in the genus *Gynaikothrips* by Reyes (1994 & 1996) have been studied (in ANIC) and found to have well-developed metathoracic sternopleural sutures and short, broad heads. Structurally, these two species are typical members of the *Teuchothrips* complex that is widespread in Australia and New Caledonia, and the following new combinations are therefore proposed: *Teuchothrips capitulatus* (Reyes) **comb.n**. and *Teuchothrips pedanus* (Reyes) **comb.n**.

Gynaikothrips species in Australia

1. Metascutum with no discal setae anterior to major pair of metanotal median setae (Fig. 17) [*ficorum*/*uzeli* complex] 2
-. Metascutum with several small setae anterior to median major setal pair (Figs 14–16) [Australian endemic species] 5
2. Males with pore plate on sternite VIII sub-circular, not extending to sternite margins (Figs 18–20) 3
-. Males with pore plate on sternite VIII occupying most of sternite and extending onto lateral thirds of tergite (Fig. 21) 4
3. Pronotal posteroangular setae at least 60% as long as epimeral setae (Fig. 25); postocular setae *usually* extend beyond posterior margin of compound eye (Fig. 29) . . . . . *uzeli*
-. Pronotal posteroangular setae less than 20% as long as epimeral setae (Fig. 24); postocular setae rarely extend to posterior margin of compound eye (cf. Fig. 27) . . . . . *ficorum*
4. Head with postocular setae short, not reaching posterior margin of eye, sometimes no longer than minor setae on head (Fig. 27); pronotal posteroangular setae varying from no larger than discal setae to almost 0.5 as long as epimeral setae . . . . . *insulsus*
-. Head with postocular seta about as long as eye (Fig. 28); pronotal posteroangular setae two-thirds as long as epimeral setae . . . . . *luzonensis*
5. Antennal segments IV–VI pale with apex dark brown (Fig. 33); tarsi and apices of mid and hind tibiae brown to light brown; pelta usually with about 4 CPS (Fig. 34) . . . . . *australis*
-. Antennal segments IV–VI clear yellow (Figs 37, 42); apices clear yellow of mid and hind tibiae and their tarsi; pelta with no more than 2 CPS (Figs 39, 44) 6
6. Pronotum with weakly defined sculptured reticles that have no internal markings (Fig. 36); reticles of mesonotum and pelta also lack internal markings (Fig. 39); metanotum with a few small setae anteromesad of median major setae (Fig. 16); fore wing with less than 14 duplicated cilia; male sternite VIII pore plate not extending to sternite margins (Fig. 38) . . . . . *jasmini* **sp.n**.
-. Pronotal sculptured reticles with many internal markings (Figs 40, 41), similar markings usually present on mesonotum and pelta; metanotum with several small setae anterolateral to median major setae (Fig. 15); fore wing with 18–24 duplicated cilia; male sternite VIII fully occupied by pore plate (Fig. 43) . . . . . *platypodae* **sp.n.**

SECTION A: *Gynaikothrips ficorum*/*uzeli* complex

Four named species (*ficorum, insularis, luzonensis* and *uzeli*) are distinguished here among Australian specimens of the *ficorum*/*uzeli* complex. These species are usually distinguished from each other based on the length of the pronotal posteroangular setae (Fig. 26), and also the length of the po setae. However, having examined specimens from approximately 300 field samples from 30 different countries around the world, in addition to many Australian specimens, we consider that these setae can be remarkably unstable in their development, both within and between populations. Bilateral asymmetry in both setal pairs is common (Fig. 26), even amongst individuals from the same field sample, and as a result recognition of the two common pest species, *ficorum* and *uzeli*, remains questionable. We have considered the alternative conclusion, that a single highly variable species is involved, but experimental host-acceptance studies (Tree *et al*. 2015) indicate that some sort of biological difference can exist between the different forms. Among the available specimens of these species, we here recognise that the pore plate on sternite VIII of males occurs in two different forms. This pore plate is either subcircular medially on the sternite (Figs 18–20), or else it extends to the lateral margins of the sternite (Fig. 21) and dorsally onto the lateral thirds of the tergite (Figs 22, 23). Amongst most of the available specimens there is a sharp distinction between these two conditions, although the median sub-circular plate can vary in size between populations from a small median area to occupying 50% of the sternite area, and the pore plate areas on the tergite also vary in size. In practice, a population of these gall-thrips on an individual tree is possibly largely isolated from other populations, leading to inbreeding and possibly to structural differences between populations. However, there has been no critical study on variation amongst individuals within and between galls, and between trees, and between sites (Mound & Kranz 1997). Moreover, sometimes an individual of one species has been collected in a gall with a population of another

species, suggesting the possibility of occasional outbreeding between species. Certainly, the pattern of structural variation in the *ficorum*/*uzeli* group is complex. To distinguish species, we here rely on the form of the male pore plate to distinguish species; we consider that females within this complex often cannot be placed to species.

In an attempt to solve this problem, molecular data were obtained by Prof. Lyn Cook at The University of Queensland from about 400 specimens of our worldwide samples mentioned above. However, little support was found for reciprocal monophyly of *G. ficorum* and *G. uzeli*, and additional data, preferably from the nuclear genome, are required to further explore relationships between the forms distinguished here.

Gynaikothrips ficorum (Marchal)

(Figs 1 & 24)

Phloeothrips ficorum Marchal, 1908: 252.
Gynaikothrips edentatus Priesner, 1939: 482. **syn.n.**

Five further species are listed in synonymy with *ficorum* (ThripsWiki 2021) but the original material of these species has not been re-examined. However, the male holotype of *edentatus* has been studied on loan from Frankfurt and cannot be distinguished from small males of the widespread species *ficorum*. In contrast to *uzeli*, both sexes of *ficorum* usually have short pronotal posteroangular setae, also postocular setae that do not extend to the posterior margin of the compound eyes. These setal lengths show little variation within most populations, but in some populations, individuals occur with one or more of the four setae involved being unusually long.

Males identifiable as *ficorum*, mostly taken from rolled leaves of *Ficus microcarpa*, have been studied from **Australia** (Queensland: Brisbane to Cape Tribulation; NSW: Yamba & Bogabilla; Western Australia: Perth & Carnarvon; Northern Territory: Darwin); New Zealand, Cook Islands, South Africa, China (Yunnan), Taiwan, Thailand, Vietnam, Hong Kong, Indonesia (Sumatra, Medan, *edentatus* holotype male from *Ficus* leaf-gall, vi.1925, Fulmek, in SMF), Monaco. Israel, Morocco, Tunisia, USA.

Also, female *ficorum* have been confirmed by molecular analyses from Australia, (South Australia), and Morocco (type locality), but no males were collected together with these females.

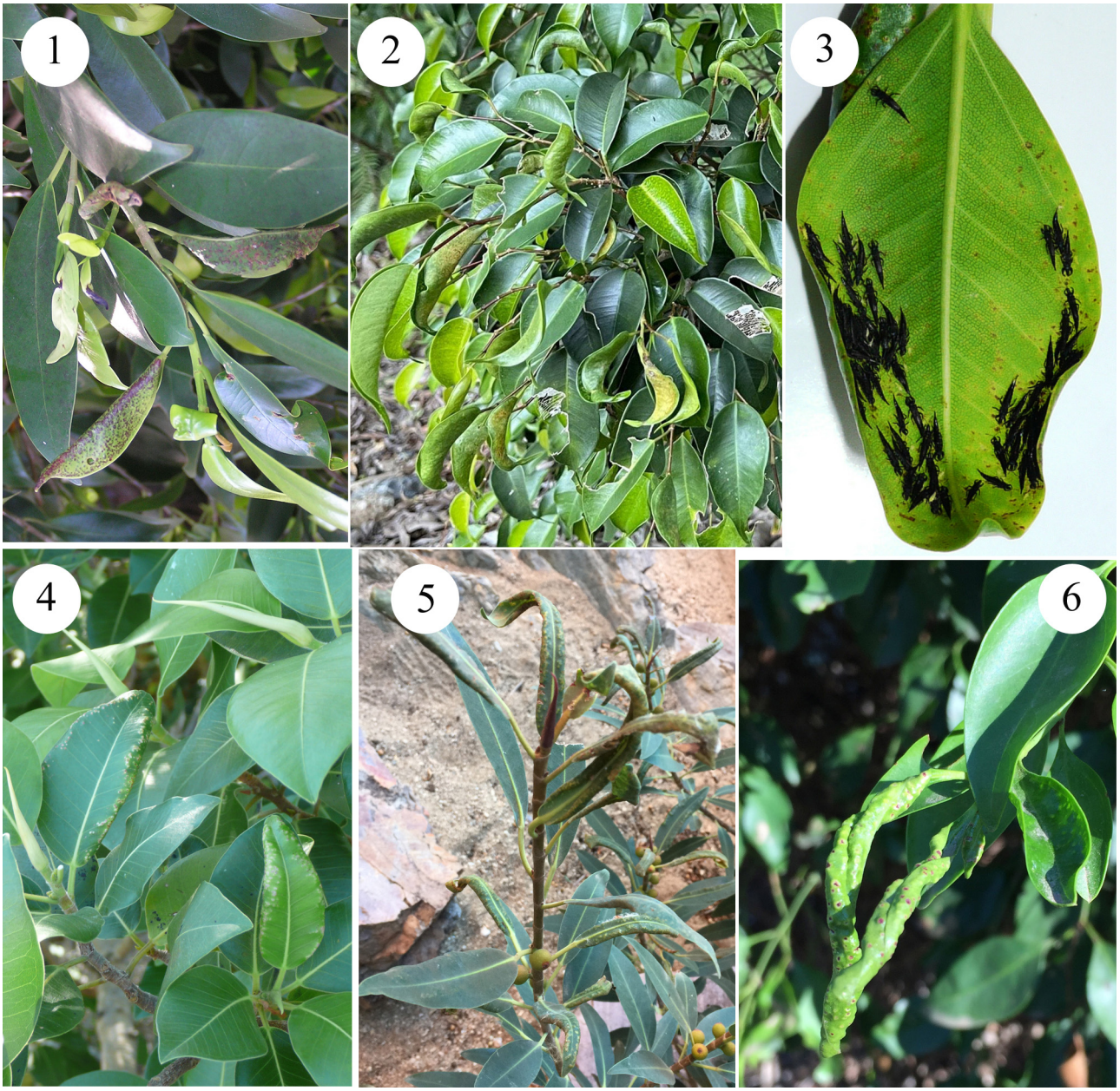
Gynaikothrips insulsus Priesner

(Figs 21, 22, 27)

Gynaikothrips insulsus Priesner, 1939: 481

The holotype female of this species, together with a male, was collected in Taiwan, Kotosho, but the identity of specimens from Celebes mentioned by Priesner (1939: 482) cannot be confirmed. Specimens in the Senckenberg Museum bearing the name *insulsus* from the Solomon Islands are here considered to be some different species, because the pore plate does not extend onto the tergite. Here recorded from Australia for the first time, *insulsus* has been taken commonly along the Queensland east coast between Brisbane and Cairns, particularly in association with *Ficus benjamina*. The pronotal sculpture is sometimes less robust than that of both *ficorum* and *uzeli* (Fig. 27), and the tibiae of the middle pair of legs are often more extensively yellow. Some specimens taken on the Esplanade at Cairns had the pronotal sculpture robust as in *uzeli* but the male pore plates typical of *insulsus*. In chaetotaxy and sculpture, this species is similar to the Indian species, *microchaetus* Ananthakrishnan and Jagadish, but that has the fore wing sub-basal setae acute and less than 50 microns long, and the pore plate of males occupies most of tergite VIII as well as all of the sternite (Shyam *et al*. 2019).

Males that are here identified as *insulsus* have been studied from: **Taiwan**, paratype male, Kotosho, ix.1938 (R. Takahashi), in SMF; Taichung, viii.2013 (Alice Wells), in ANIC; Pintung, iii.2014 (Lin Y.), in QDPC. **Australia**, **Queensland** mostly in QDPC: Noosa (20-22.ix.2009; 4.viii.2012), Innisfail (15.ix.1996), Nambour (13.vi.1989), Bowen (19.xii.1985), Townsville 28.iv.1942), Mareeba (24.xi.1986), Cairns, 12.xi.2007; 29.x.2008; 5.xi.2008); **Northern Territory**, Darwin, 28.ix.2009; x.2011.



FIGURES 1–6. Leaf distortions induced by *Gynaikothrips* species. **(1)** *G. ficorum* gall on *Ficus microcarpa*; **(2)** *G. uzeli* gall on *F. benjamina*; **(3)** *G. australis* on *F. macrophylla*; **(4–5)** *G. platypodae* on *F. platypoda*; **(6)** *G. jasmini* on *Jasminum simplicifolium*.

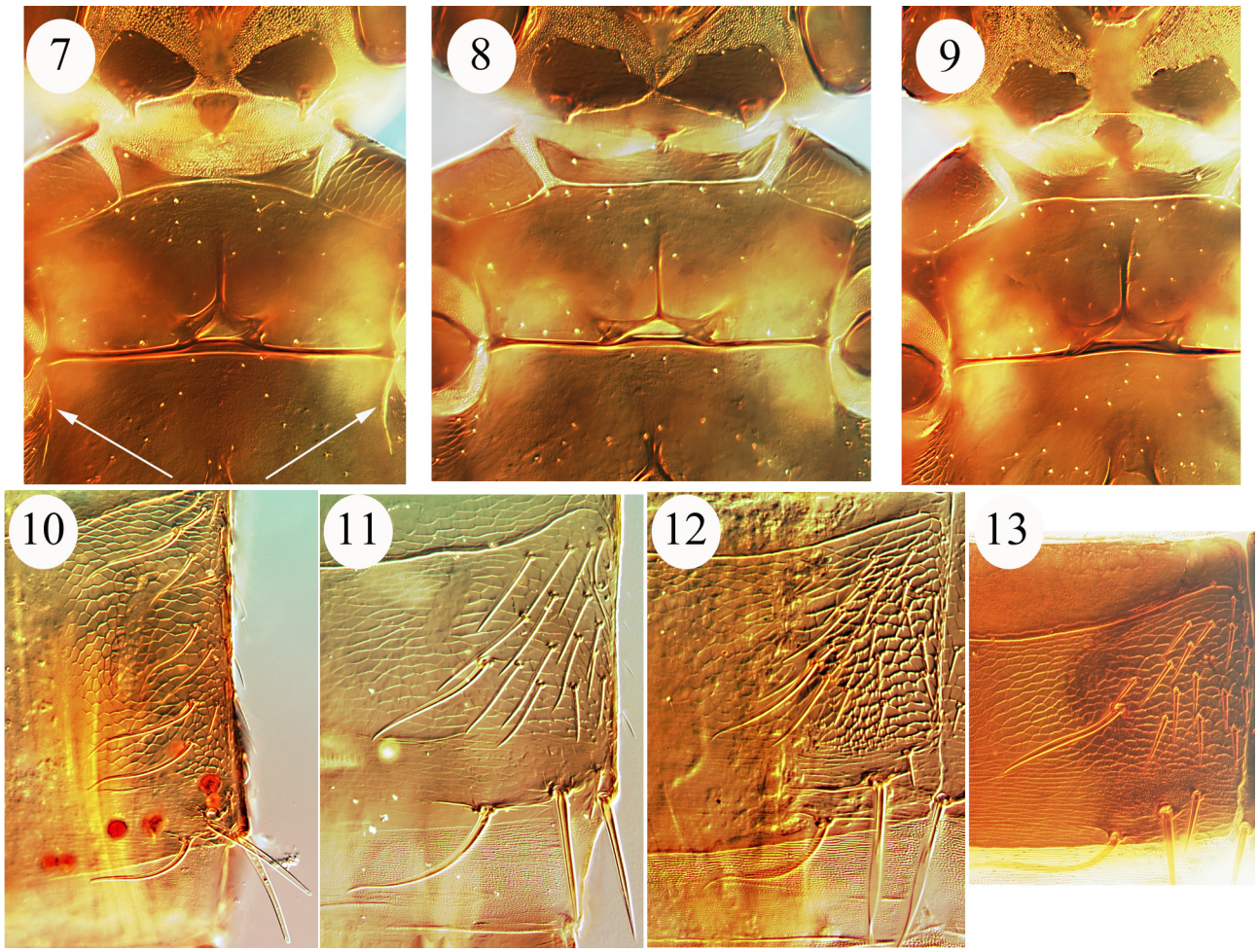
***Gynaikothrips luzonensis* Priesner**
(Figs 23 & 28)

Gynaikothrips luzonensis Priesner, 1939: 480

Described originally from Luzon in the Philippines, this species has also been recorded from Mindanao (Reyes 1994). Priesner (1939) also listed specimens from Taiwan, but those have not been re-examined. The species is here recorded from northern Australia for the first time. The cephalic setae vary in length. The post-oculars are sometimes longer than the dorsal length of the eyes, but usually do not extend much beyond the mid-point of the eyes. The mid-dorsal pair of setae are often short but are sometimes half as long as the postoculars (Fig. 28). The pronotal anteroangular setae are usually little larger than the discal setae, but one or more is often considerably longer. The

pronotal midlateral setae are usually small, but in a few specimens are developed as major setae. No correlation has been detected between these variations. However, at Noosaville (Queensland) on 4.viii.2012 two males of typical *luzonensis*, with long-head and long postocular setae, were collected from the same group of *Ficus benjamina* trees as one male of typical *insulsus*, with the head short, short postocular setae, and less robust pronotal sculpture.

Males that are here identified as *luzonensis* have been studied from: **Philippines**, holotype female and paratype male, Luzon, Los Banos, from *Ficus* sp., without date. **Australia** (mostly in QDPC and from *F. benjamina*): **Queensland**: Brisbane (14.ii.2012; 10.iv.2012; 16.iv.2015), Noosa (2–4.viii.2012; 10.i.2013); **Northern Territory**: Darwin (29.ix.2009; x.2011; 6.iii.2013; 3.v.2014; 3.vii.2014; 6.viii.2014), Virginia (7-11.iii.2013), Bathurst Island (x.2011), Groote Island (11.x.2011).



FIGURES 7–13. *Eilapinothrips*, *Gynaikothrips* and *Gigantothrips*. Thoracic sternites 7–9: **(7)** *E. additamentus*; **(8)** *G. jasmini*; **(9)** *G. platypodae*. Tergite III 10–13: **(10)** *Gig. elegans*; **(11)** *Gig. caudatus*; **(12)** *Gig. xynos*; **(13)** *Gyn. australis*.

Gynaikothrips uzeli (Zimmermann)

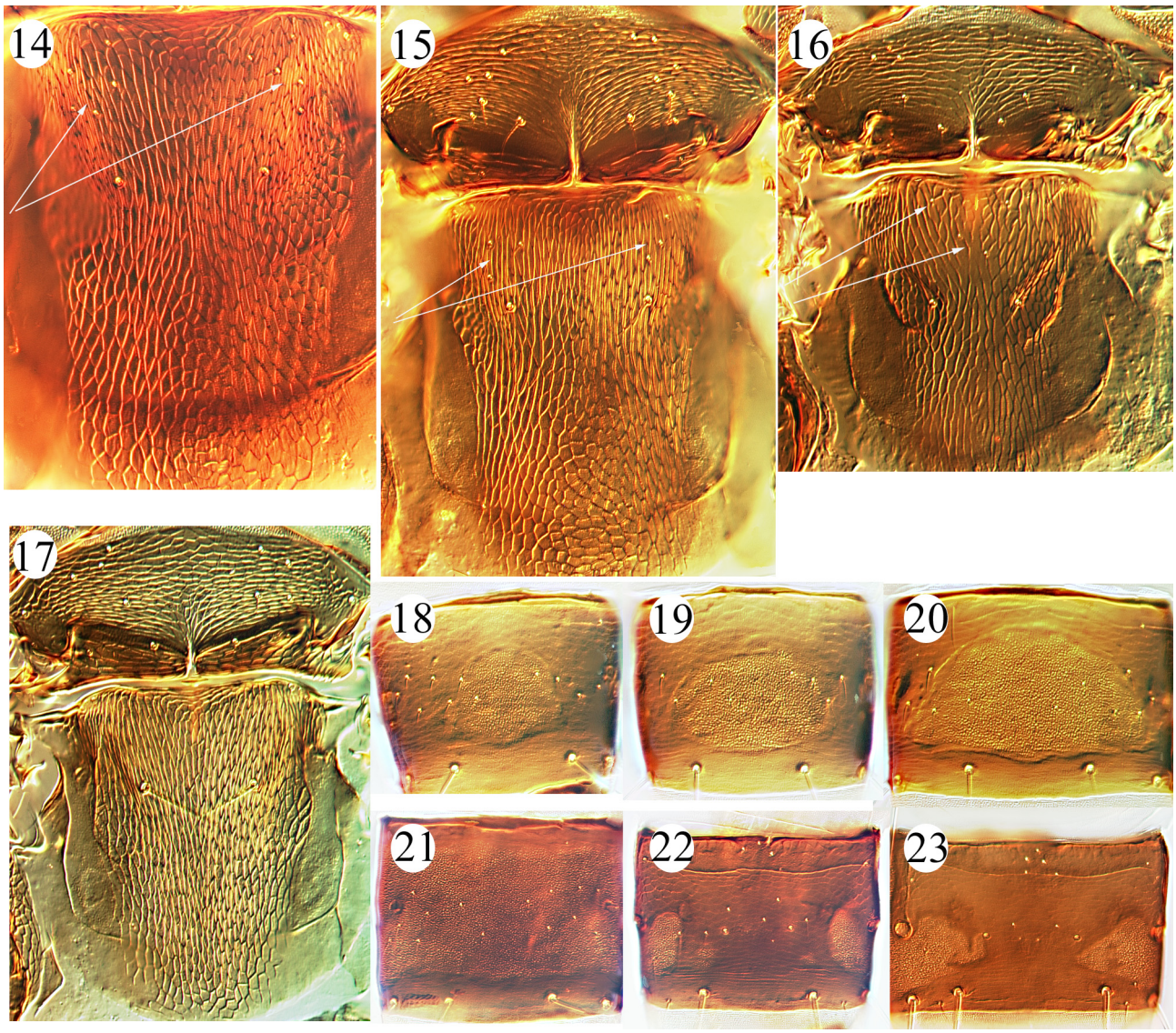
(Figs 2, 17–20, 25, 26, 29, 30)

Mesothrips uzeli Zimmermann, 1900: 12.

Described originally from Java, this species is reported widely in the Indonesia/Malaysia region (Reyes 1994), and two synonyms are included (ThripsWiki 2021). It has presumably been distributed by the horticultural trade in decorative *Ficus* cultivars and became common in parts of the Americas from early in the 2000s (Held *et al*. 2005). It was first recorded in Australia in 2012 (Tree 2012). Although considered a pest, the galled leaves that may turn slightly pinkish and are sometimes considered a decorative advantage on bonsai specimens. Males from populations at the localities listed below have on sternite VIII a median sub-circular pore plate, although this varies greatly in size within and between populations (Figs 18–20). Setal lengths are particularly variable in this species.

The postocular setae sometimes do not extend to the posterior margin of the eyes (Fig. 29), but more often they are considerably longer (Fig. 30) with a second pair of long mid-dorsal setae present that vary slightly in position. The pronotal anteroangular setae are commonly elongate to a greater or lesser extent, and more rarely one or both of the midlateral setae may be elongate, and one or both of the epimeral setae may be duplicated. These variations have all been found within single populations.

Males identifiable as *uzeli*, mostly taken from rolled leaves of *Ficus benjamina*, have been studied from: **Australia** (Queensland, Cairns to Hann River), New Caledonia, Timor Leste, Philippines, Singapore, Taiwan, Vietnam, Laos, Cambodia, Thailand, Malaysia, Indonesia, Maldive Islands, Spain, Syria, Israel, Costa Rica, Columbia, Peru, Brazil, Galapagos Islands, USA (Florida, South Carolina).



FIGURES 14–23. *Gynaikothrips* species. Metanotal chaetotaxy 14–17: **(14)** *australis*; **(15)** *platypodae*; **(16)** *jasmini*; **(17)** *uzeli*. Male sternite VIII 18–21: **(18)** *uzeli* [East Timor]; **(19)** *uzeli* [Maldives]; **(20)** *uzeli* [Cairns]; **(21)** *insulsus*. Male tergite VIII 22–23: **(22)** *insulsus*; **(23)** *luzonensis*.

SECTION B: *Gynaikothrips* species endemic to Australia

The following three *Gynaikothrips* species are all associated with the leaves of native Australian plants. The two that live on *Ficus* species show structural similarities to some *Gigantothrips* species, but the body size of the third species is much smaller.

***Gynaikothrips australis* Bagnall**
(Figs 3, 13, 14, 31–35)

Gynaikothrips australis Bagnall, 1929: 187

Originally described from syntypes of both sexes taken at Gosford, New South Wales from curling leaves of *Ficus macrophylla*, 13.vi.1922 (?1902), this species is widespread along the east coast of Australia. It is largely host specific on the Moreton Bay Fig but has been taken twice on the similar species *Ficus rubiginosa and Ficus obliqua*. The record below from South Australia is presumably due to a garden introduction of this tree to an area outside its natural range. Feeding by adult *australis* induces slight curling of one leaf margin on one of the large leaves of *F. macrophylla*, but without forming a closed tube. Substantial colonies of the thrips may then develop in this open but protected habitat (Fig. 3). This species pupates under loose bark of the trees, not in the gall, and adults commonly disperse around the leaf during the day (Tree & Walter 2009). This species is similar in structure to *G. platypodae* **sp.n.** described below, but has longer, bicoloured antennal segments (Fig. 33), and a more extensive tuberculate area at the base of the fore wing (Fig. 35).

Female macroptera. Body and legs dark brown with tarsi slightly paler; antennal segment III largely yellow with apical third weakly shaded (Fig. 33), IV–VI dark brown at apex and variably yellow on basal half; fore wing shaded with dark longitudinal marking on basal half and strong tuberculate sculpture particularly around sub-basal setae. Head with weak and narrow transverse striations; po setae slightly shorter than dorsal eye length with apices very weakly expanded, mid-dorsal setae usually as long as po setae (Fig. 31); maxillary stylets wide apart, retracted about half-way to po setae. Pronotal reticulations with no internal linear markings (Fig. 32). Mesonotal lateral setae small. Metanotum anterior half with longitudinally elongate reticulation with weak longitudinal lines within some reticles, posterior half with equiangular reticulation; with 6 to 8 pairs of small setae anterolateral to median major pair. Fore tarsus with inner apex slightly directed forwards as an obscure tooth. Fore wing with robust sculpture around sub-basal setae (Fig. 35). Pelta acute at apex, reticulate and sometimes with linear markings in a few reticles; with 2 (or more) pairs of CPS, one or more CPS developed as a small seta (Fig. 34); tergites II–IV with 8–12 discal setae laterally of which one or more sometimes is directed mesad; tergites V–VII posteroangular setae shorter than median length of tergite; tube slender, about 4.0 as long as basal width.

Measurements (one female from Sydney in microns). Body length 5000. Head, length 450; width 280; po setae 140; mid-dorsal setae 150. Pronotum, length 300; width 500; major setae, am 110, aa 135, ml 175, epim 260, pa 300. Fore wing length 2000; number of duplicated cilia 35. Tergite IX setae S1 480. Tube length 550. Antennal segment III–VIII lengths, 160, 155, 150, 135, 95, 60.

Male macroptera. Structurally similar to females, but large male with fore tarsal tooth larger, and fore femora and pronotum enlarged. Tergite IX setae S2 short and stout, 0.1 to 0.2 as long as setae S1.

Specimens studied (from *Ficus macrophylla* leaves except where stated). **South Australia**, Bridgewater, 4 females, 4 males with larvae from *Ficus rubiginosa* leaves, 15.ii.2001. **New South Wales**: Bawley Point, 1 female in trap, 1.xii.2001. Jervis Bay, 1 female, 7 males, 25.xi.2000. Sydney, Royal National Park, 1 female from *Ficus rubiginosa*, 2.ix.2001. Sydney Domain: 1 female, 26.iii.1996; 16 females, 14 males 23.xi.2000; 1 female, x.2003; 1 female, 1 male, 13.ii.2005. Gosford, 4 females, 1918, 1 female, 1 male, 11.vi.1902 (Syntypes?). Taree, Landsdowne, 5 females, 4 males, 27.xii.2000. Lismore, 1 female, 29.xi.1922. **Queensland**, St Lucia, University Campus, 3 females, 1 male, from *Ficus macrophylla* leaves, 10.iii.2006.

***Gynaikothrips jasmini* sp.n.**
(Figs 6, 8, 16, 36–39)

Female macroptera. Body and legs brown, all tarsi yellow, also apex of mid and hind tibiae and distal half of fore tibiae; antennal segment I brown, II paler at apex, III–VIII almost uniformly yellow but distal segments lightly shaded at apex (Fig. 37); fore wing pale distally but shaded at base with darker longitudinal marking on basal half, no sculpture around sub-basal setae. Head with weak transversely striate reticulation (Fig. 36); po setae arise far behind eyes and rather laterally, shorter than dorsal eye length with apices very weakly expanded; mid-dorsal setae as long as or longer than po setae, nearer to inner margin of eyes but variable in position and sometimes asymmetric;

maxillary stylets wide apart, retracted about half-way to po setae. Pronotum with weak irregular sculpture and no internal markings (Fig. 36); am setae slender and pointed, aa setae with apices blunt, three pairs of long major setae with weakly capitate apices. Mesonotal lateral setae small. Metanotum with longitudinally elongate reticulation but reticles with no internal markings; with 1 or 2 pairs of small setae placed asymmetrically anteromesad of small median major pair (Fig. 16). Mesopresternum transverse, metathoracic sternopleural sutures present (Fig. 8). Fore tarsus with minute, forwardly directed tooth on inner apex. Fore wing with 11–13 duplicated cilia, no sculpture around sub-basal setae. Pelta bell-shaped (Fig. 39), no reticles with internal markings, one pair of CPS present; tergites II–IV with about 4 discal setae laterally; tergites V–VII posteroangular setae capitate, slightly shorter than median length of tergite; tube about 2.7 times as long as basal width.

Measurements (holotype female in microns). Body length 2650. Head, length 260; width 200; po setae 40; mid-dorsal setae 60. Pronotum, length 160; width 300; major setae, am 35, aa 30, ml 55, epim 95, pa 60. Fore wing length 1050; number of duplicated cilia 13. Tergite IX setae S1 250. Tube length 250. Antennal segment III–VIII lengths, 75, 70, 75, 70, 65, 35.

Male macroptera. Colour and sculpture similar to female; large male with prothorax, fore femora and fore tarsal tooth larger; pronotal sculpture lines more robust, median longitudinal apodeme present; tergite IX setae S2 about 0.3 as long as setae S1; sternite VIII almost entirely occupied by pore plate except near posterior margin (Fig. 38).

Specimens studied. Holotype female, **Queensland**, Carnarvon Station Reserve, Carnarvon Gorge [2502'S 14811'E], from leaf rolls on *Jasminum simplicifolium*, iv.2007 (Alice Wells), in ANIC.

Paratypes all from same host plant: 1 female, 2 males collected with holotype; Carnarvon Station Reserve, Blue Water Springs, 3 males, 8.x.2014; 2 females, 14.x.2014; Carnarvon Gorge, 1 female, 1 male, 11.v.2017 (all D.J.Tree and mostly in QDPC).

Comments. The specimens listed were all taken from rolled leaf galls on various plants of *Jasminum simplicifolium* var. *australiense* (Fig. 6). This new species contrasts with the other *Gynaikothrips* considered here, all of which are from *Ficus*, in that it lacks complex robust sculpture on the pronotum. Some of the differences noted such as setal lengths are possibly related to the smaller body size, but the sculpture on the pronotum, mesonotum and metanotum are distinctive. Only two other species have been described in the *Liothrips*-lineage from the leaves of *Jasminum*. *Dolerothrips jasmini* Karny (1913) was described from Java and recognised subsequently by Priesner (1929) as a member of the Haplothripini genus *Mesothrips*. A second species from Java, *Liothrips jasmini* Priesner (1968), was placed by Bhatti (1993) as the sole member of a new genus *Jennythrips* on the basis that the prosternal basantra were present. Recent examination of the holotype female has recognised that the basantra are not present, therefore the genus *Jennythrips* is here considered a **new synonym** of *Liothrips*, and the species considered as *Liothrips jasmini* Priesner **comb. rev**. This species has the typical *Liothrips* character states of a divided mesopresternum and presence of metathoracic sternopleural sutures.

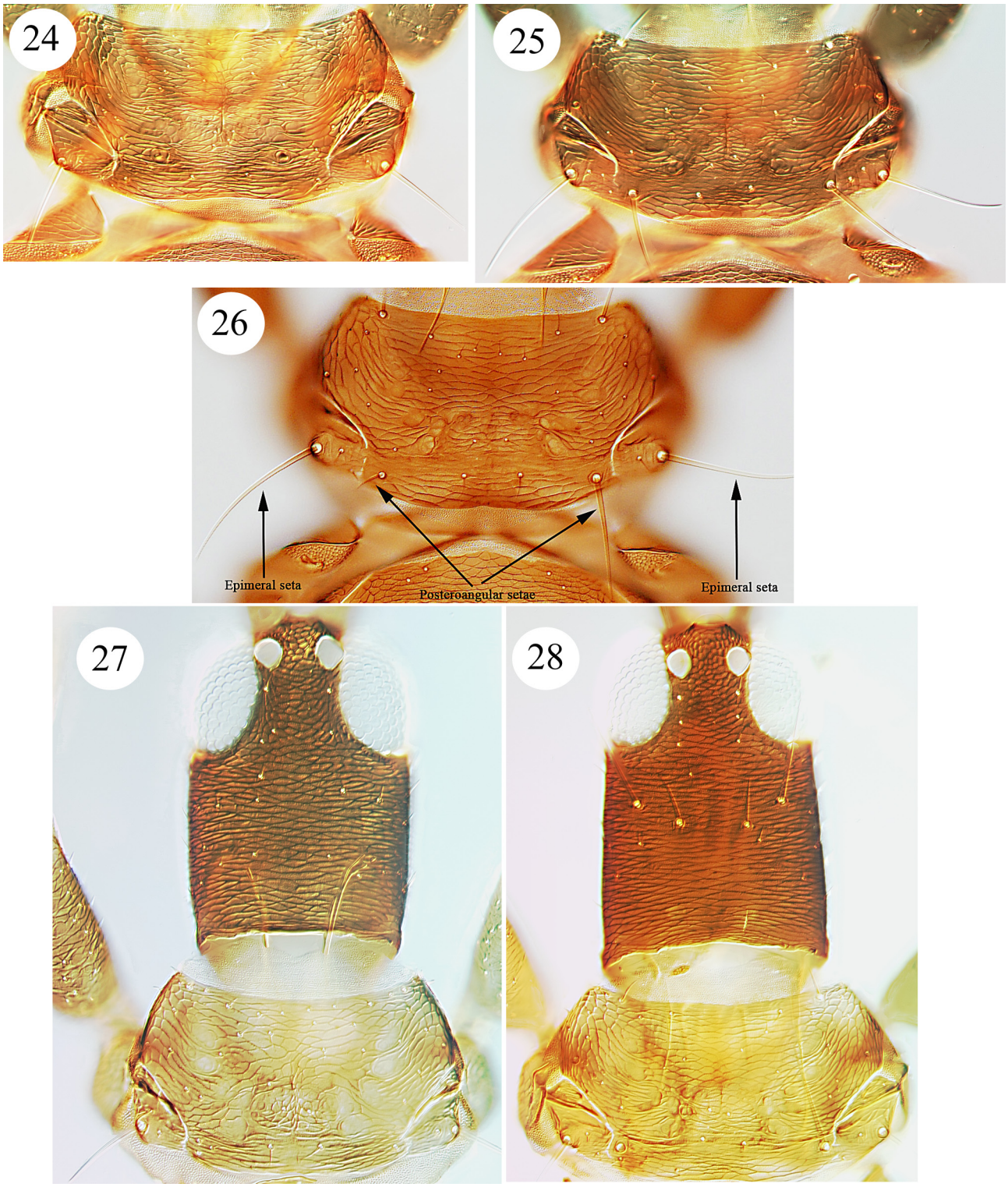
Gynaikothrips platypodae **sp.n.**

(Figs 4, 5, 9, 15, 40–44)

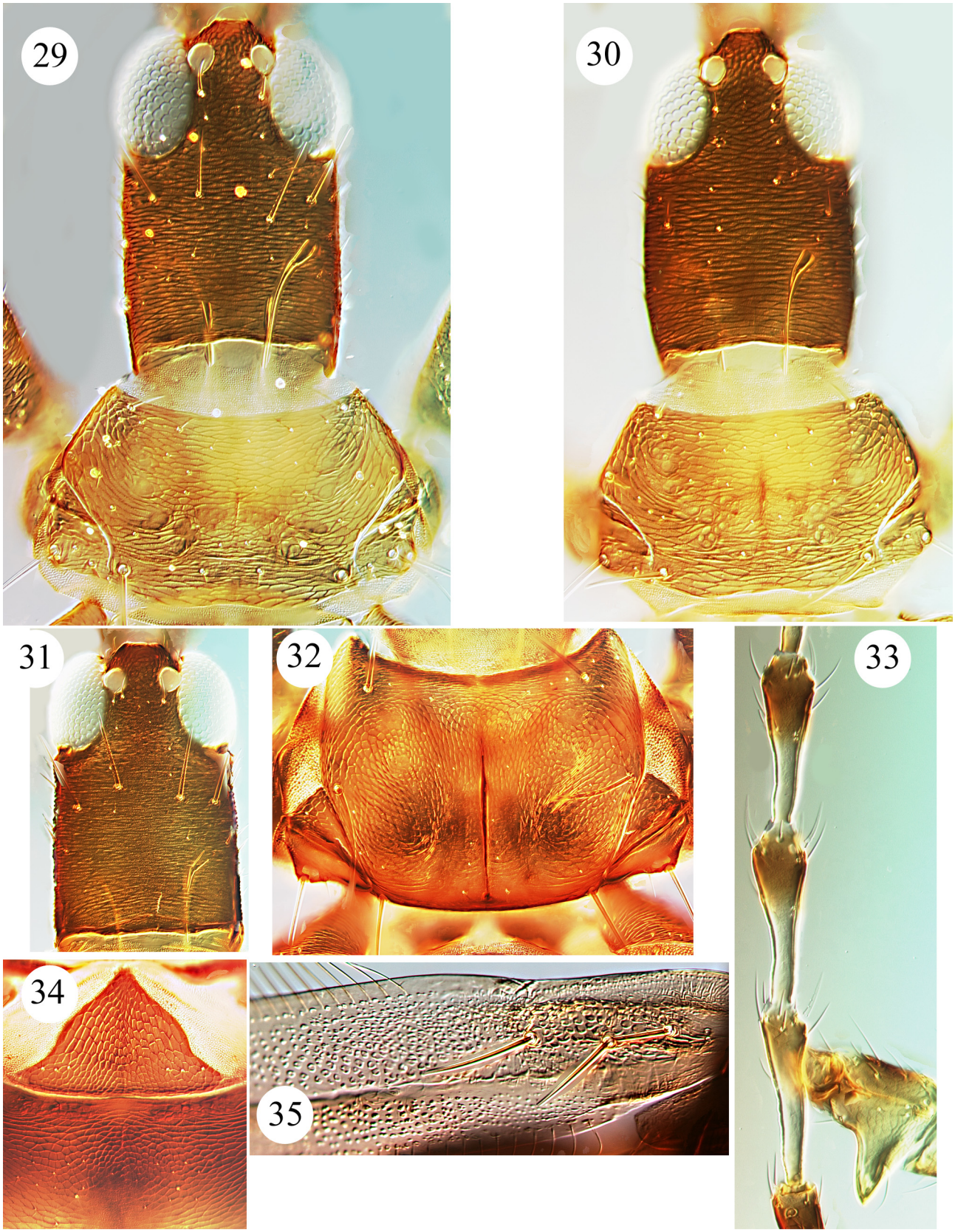
Female macroptera. Body and legs dark brown, except all tarsi yellow, also most of fore tibiae and extreme apices of mid and hind tibiae. Antennal segments I–II dark brown, III–VIII almost clear yellow (Fig. 42); fore wings shaded, with dark brown longitudinal mark and small area of tuberculate sculpture around sub-basal setae. Head longer than wide (Fig. 40), vertex transversely striate but reticulate around ocelli; po and mid-dorsal setae much shorter than dorsal eye length, with apices blunt to very weakly expanded; maxillary stylets wide apart, retracted about half-way to po setae. Pronotum with complex reticulation (Fig 41), most reticles with internal longitudinal striae; major setae pale with apices blunt to weakly expanded; am setae sometimes no larger than discal setae. Mesonotal lateral setae small; antero-median reticles with internal striae. Metanotum with 3 or 4 pairs of small setae anterolateral to median major setae; anterior reticles linear, posterior reticles equiangular, all without internal striae (Fig. 15). Mesopresternum transverse, metathoracic sternopleural sutures present (Fig. 9). Fore tarsus with small, forwardly directed tooth on inner apex. Fore wing with 18–24 duplicated cilia. Pelta triangular (Fig. 44), some reticles with internal markings, one pair of CPS usually present but sometimes replaced by minute seta; tergites II–IV with 8–12 discal setae laterally of which one or more sometimes is directed mesad; tergites V–VII posteroangular setae bluntly capitate, shorter than median length of tergite; tube about 3.5 times as long as basal width.

Measurements (holotype female in microns). Body length 3350. Head, length 330; width 240; po setae 50; mid-dorsal setae 60. Pronotum, length 215; width 350; major setae, am 50, aa 50, ml 50, epim 125, pa 100. Fore wing length 1300; number of duplicated cilia 18. Tergite IX setae S1 400. Tube length 350. Antennal segment III–VIII lengths, 100, 100, 110, 85, 75, 45.

Male macroptera. Similar to female in colour and reticulation; fore tarsal tooth no larger than that of female and often scarcely visible; sternite VIII almost occupied by large pore plate (Fig. 43); tergite IX setae S2 short and stout, 0.1 to 0.2 as long as setae S1.



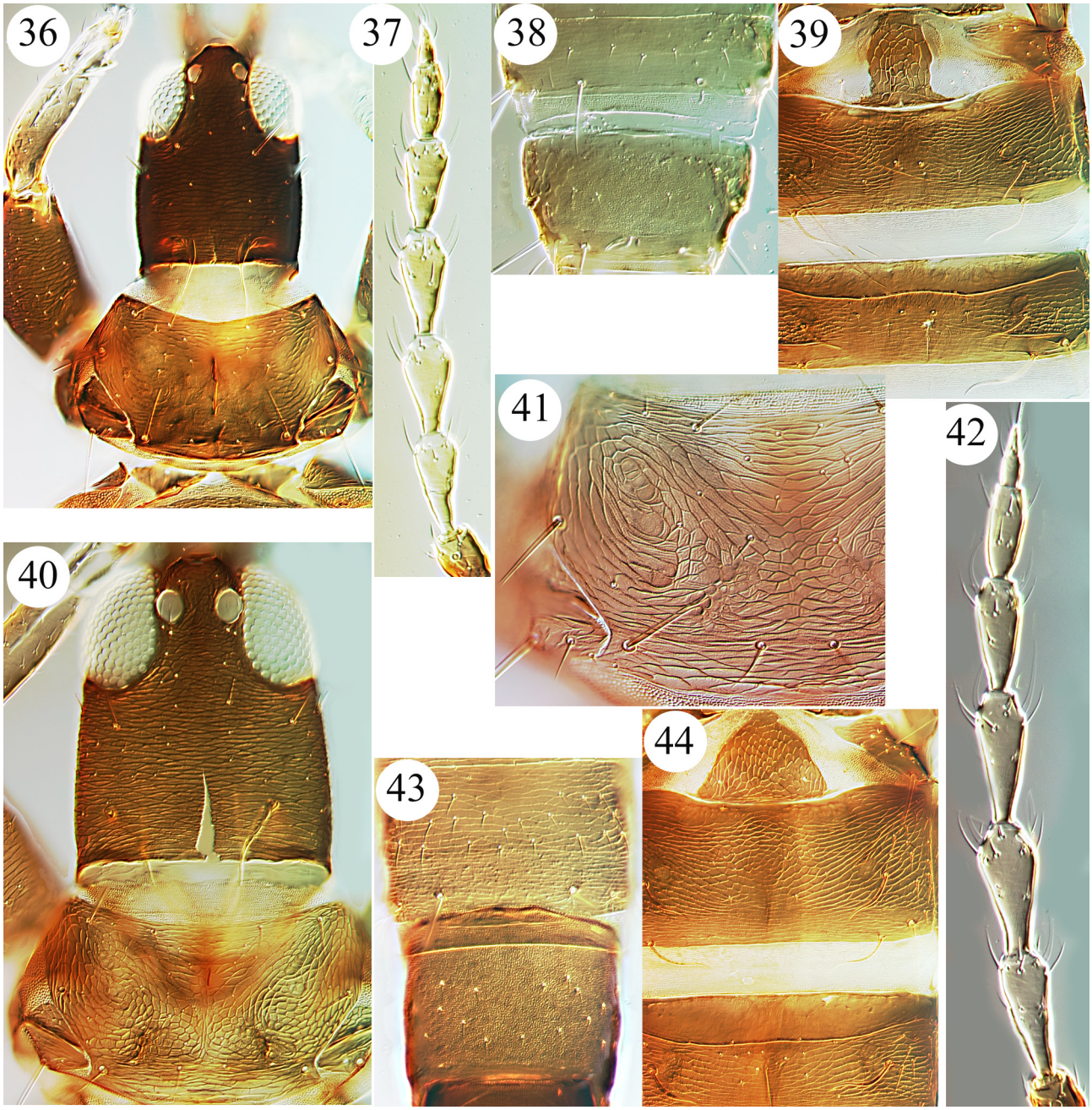
FIGURES 24–28. *Gynaikothrips* species. Pronotum 24–26: **(24)** *ficorum*; **(25–26)** *uzeli*. Head & pronotum: **(27)** *insulsus*; **(28)** *luzonensis*.



FIGURES 29–35. *Gynaikothrips* species. Head & pronotum *uzeli* 29–30: **(29)** from Ecuador; **(30)** from East Timor. *G. australis* 31–35: **(31)** Head; **(32)** Pronotum; **(33)** antennal segments III–V; **(34)** pelta; **(35)** Fore wing base.

Specimens studied. Holotype female, **Australia**, **Northern Territory**, Litchfield, 80km south of Darwin, from galled leaves on *Ficus platypoda*, 31.xii.1995 (LAM 2937), in ANIC.

Paratypes: 10 females, 9 males collected with holotype; same locality, 4 females 2 males 26.xii.1996. **Northern Territory** mostly in QDPC: Darwin Esplanade, 5 females, 1 male from *F. platypoda* leaf gall, 6.v.2015; Caranbinini Conservation Park, 8 females from *F. platypoda*, 25.iv.2009; Cutta Cutta, Katherine, 1 female from *F. platypoda*, 28.iv.2009; Umbrawarra Gorge, 60km southeast of Adelaide River, 5 females, 1 male from *F. platypoda*, 29.iv.2009; Kings Canyon, 2 males from *Ficus brachypoda* leaf gall, 3.ix.2017; Ormiston Gorge, 2 females, 4 males from *F. brachypoda* leaf galls, 30.viii.2017. **Western Australia**: Millstream, 8 females, 6 males from rolled leaf of *F. platypoda*, 23.ix.1995; Kimberley, Wieno Gorge, 5 females from *F. platypoda*, iv.1997; Hamersley, 7 females, 6 males from *Ficus* leaves, iv.1997; Bungle Bungle Range, Cathedral Gorge, 8 females from *Ficus*, 9.v.2000; Kununurra, 1 female, 4 males from *Ficus* leaf roll, 20.ix.2009; Black Hill Bore, 200km southwest of Dampier, 5 females 2 males from *F. platypoda* leaf galls, 30.vi.2011; Barrow Island, 1 female, 4 males beaten from foliage, v.2007.



FIGURES 36–44. *Gynaikothrips* species. *G. jasmini* **sp.n.** 36–39: **(36)** Head & pronotum; **(37)** Antenna; **(38)** Male sternites VII–VIII; **(39)** Pelta & tergites. *G. platypodae* **sp.n.** 40–44: **(40)** Head & pronotum; **(41)** Pronotal sculpture; **(42)** Antenna; **(43)**

Male sternites VII–VIII; **(44)** Pelta & tergites.

Comments. The tuberculate area at the base of the fore wing of *platypoda* is similar to that of *australis* but is less extensive and less robust. As is common in gall thrips species, there is considerable variation in details within and between samples, with the pronotal am and aa setae often small and slender, and the epim and pa setae varying in length.

Section C. Australian taxa closely related to *Gynaikothrips*

Field studies in recent years have produced material of further species that need to be considered in relation to the genus *Gynaikothrips*. As a result, one new species is described below in a newly recorded genus, one species is transferred to a new genus, and a third species is returned to the genus *Liothrips*.

Agynaikothrips Okajima

Type species *Agynaikothrips okinawaensis* Okajima, 2006

The type species of this genus that was taken on the leaves of ?*Scurrula yadoriki* [Loranthaceae], on the Ryukyu Islands, Japan. The only other included species, *venapennis* Moulton, remains known from a single female without antennae collected in Taiwan in 1927. These two species have the maxillary stylets longer and closer together medially than in species of *Gynaikothrips*. Moreover, these species differ from *Liothrips* in having the mesopresternum complete and the metathoracic sternopleural sutures absent. A full diagnosis of the genus, complete with line drawings, was provided by Okajima (2006). The new species described below is unusual in lacking sigmoid wing-retaining setae on tergite VII, and the maxillary stylets are less deeply retracted into the head than in the other two species.

Agynaikothrips lorieni sp.n.
(Figs 45–49)

Female macroptera. Body brown and femora, tarsi yellow also tibiae except near base; antennal segments III–VI yellow, VII yellow at base, VIII brown; major setae all pale, with apices weakly capitate; fore wing pale but faintly shaded around margins. Head twice as long as wide, eyes protruding (Fig. 45); vertex with weak transverse sculpture; postocular setae placed midway between posterior margin of eyes and posterior margin of head; maxillary stylets retracted to postocular setae, less than one fifth of head with apart; mouth cone pointed, extending across prosternum. Antennae long and slender (Fig. 47), segment VIII narrowed to base; III with one sense cone, IV with 3^{+1} sense cones. Pronotum with weak sculpture (Fig. 46); notopleural sutures complete or slightly incomplete. Metanotum with closely spaced linear sculpture lines (Fig. 49), posterior third with longitudinal reticles having internal markings. Fore wing broad, with about 18 duplicated cilia; sub-basal setae long and arranged in a line. Prosternal basantra absent; ferna and spinasternum well-developed; mesopresternum complete and boat-shaped; metathoracic sternopleural sutures absent (faintly indicated in paratype). Pelta elongate triangular, slightly recessed into anterior margin of tergite II, with weak sculpture; tergites II–VI each with 2 pairs of sigmoid wing-retaining setae (Fig. 48), VII lacks these setae; major setae on II–VIII all long and weakly capitate, on IX long and finely acute.

Measurements (holotype female, and paratype, in microns). Body length length 3500 (3900). Head, length 380 (420); width 190 (200); po setae 100 (115). Pronotum, length 160 (190); width 310 (400); major setae, am 75, aa 55, ml 100, epim 150, pa 150. Fore wing length 1300. Tergite III longest seta 160; tergite IX setae S1 250. Tube length 260. Antennal segment III-VIII lengths, 145, 130, 110, 90, 75, 45.

Specimens studied. Holotype female, **Australia**, New South Wales, Lorien, 3km north of Lansdowne, July 2001, from *Archontophoenix cunninghamiana* foliage (G. Williams), in ANIC.

Paratype, one female, same site, from *Waterhousea floribunda* foliage, 22.x.2001.

Comments. At first sight, the long head and long pronotal setae suggest that this species is a member of the

genus *Liothrips*, but the pronotal setae are all pale and translucent, and the thoracic sternal characters suggest otherwise. The species differs from both described species of *Agynaikothrips* in having the head longer than the tube, the maxillary stylets retracted only to the postocular setae and about one fifth of the head width apart, the pronotum with five pairs of long major, pale setae, and females lacking a fore tarsal tooth. In these character states this species is intermediate between species of *Agynaikothrips*, *Gynaikothrips* and *Gigantothrips*, and they further emphasise the problems of distinguishing genera in the *Liothrips*-lineage.

Eilapinothrips gen. n.

Type species *Cryptothrips additamentus* Karny

The type species of this new monobasic genus differs most significantly from *Gynaikothrips* species in having two sense cones on the third antennal segment, the mesopresternum is divided into a pair of lateral triangles, the metathoracic sternopleural sutures are long and well-defined, both sexes have a prominent tooth on the basal third of the fore tarsus, and the fore wing lacks prominent sculpture around the sub-basal setae. These character states suggest that *additamentus* is only distantly related to *australis*, and the two have converged in structure and sculpture in their shared habitat. The type species might be considered a rather elongate species of *Teuchothrips*, a genus to which it seems likely to be related. It is possible that *additamentus* is derived from within the *Liothrips*/*Teuchothrips* complex, and that antennal segment III of this species has secondarily developed a second sense cone on the third antennal segment. However, given the present classification system of Phlaeothripinae, there seems little alternative to placing the species in a separate genus.

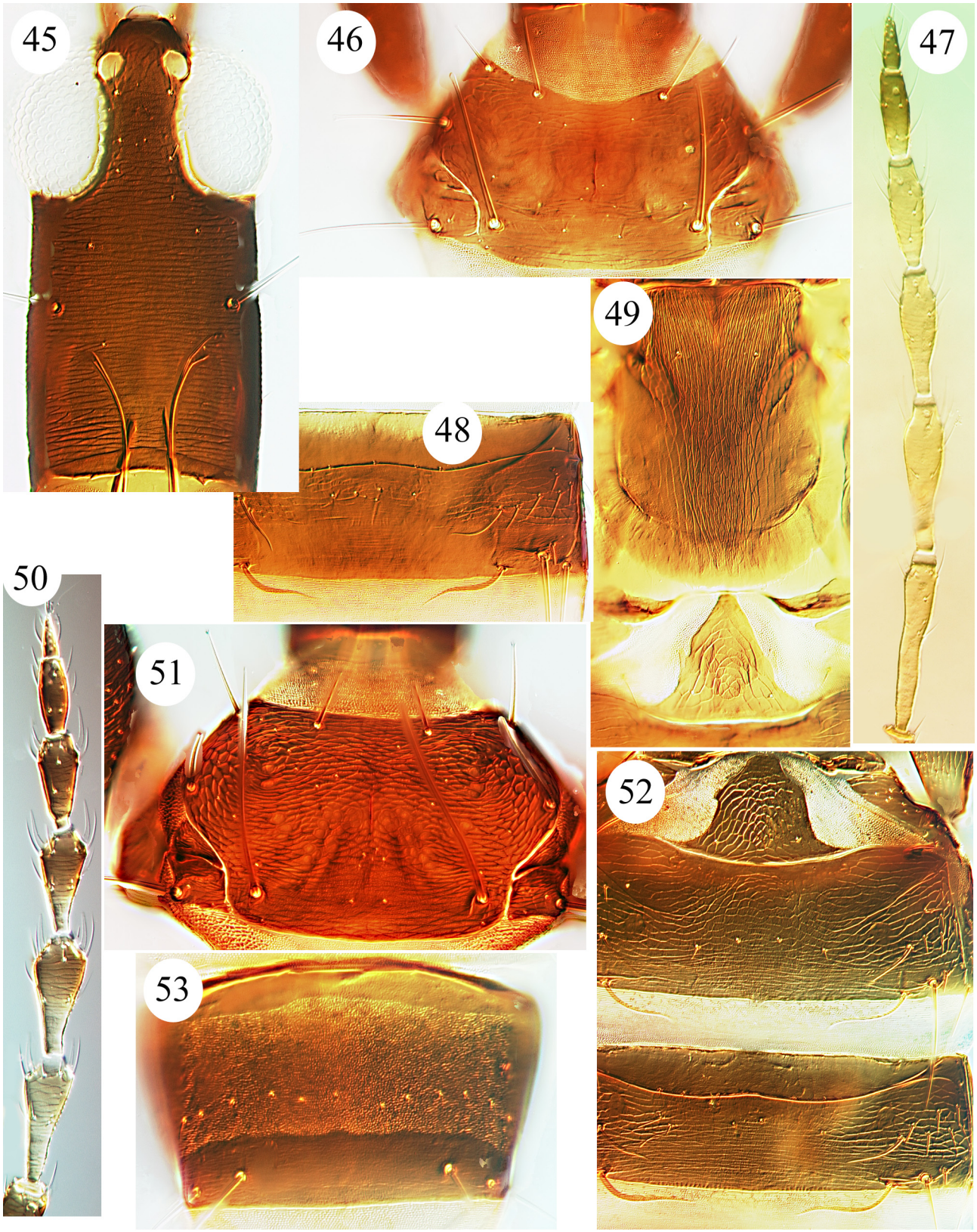
Diagnosis. General appearance *Liothrips*-like; antennae 8-segmented, III with 2 sense cones, IV with 3^{+1} sense cones, VIII with base slightly narrower than apex of VII (Fig. 50). Head longer than wide; postocular setae long, weakly capitate, arising near lateral margin of head, mid-dorsal head setae sometimes well-developed; genae with several small setae; maxillary stylets retracted half-way to postocular setae, one-fifth of head width apart; mouth cone pointed but not extending beyond fore coxae. Pronotum strongly reticulate, with 5 pairs of long capitate setae (Fig. 51); notopleural sutures complete. Prosternal basantra absent; mesopresternum reduced to two large lateral triangles that are weakly connected medially; metathoracic sternopleural sutures long. Metanotum sculptured with many small reticles, median setae not long. Fore tarsi in both sexes with prominent tooth arising close to base. Fore wing parallel sided, with about 20 duplicated cilia; sub-basal setae long and capitate. Pelta bell-shaped with wide base (Fig. 52); tergites II–VII each with 2 pairs of sigmoid wing-retaining setae; tergite IX setae slightly longer than tube, male with setae S2 short and capitate; male sternite VIII largely occupied by pore plate (Fig. 53).

Eilapinothrips additamentus (Karny)
(Figs 50–53)

Cryptothrips additamentus Karny, 1924: 31
Teuchothrips additamentus (Karny) Mound & Houston, 1987: 17
Gynaikothrips additamentus (Karny) Mound, 2008: 56

Collected originally at Mt Tambourine, southeastern Queensland, 1910–1913, this species was based on one female and one male, however, the damaged male is possibly not conspecific with the Lectotype female (Mound 2008). This thrips lives as a kleptoparasite within the leaf roll galls induced by *Gynaikothrips australis* on the tree known as Moreton Bay Fig, *Ficus macrophylla*, as well as together with *Gynaikothrips platypodae* within galls on *Ficus platypoda*. It has been taken in considerable numbers both around Brisbane and in the Domain at Sydney.
Female macroptera. With the character states in the generic diagnosis above: Body and legs dark brown with tarsi a little paler; antennal segment III yellow with apex weakly shaded (Fig. 50), IV–VI brown at apex with basal area variably yellow; fore wing shaded, with no sculpture around sub-basal setae; head with po setae longer than dorsal eye length, weakly capitate; vertex with narrow transverse reticulation; tergites II–V with 8–12 strong discal setae laterally, some of which are directed mesad, posteroangular setae on V–VII longer than tergal length; tube less than 3.5 times as long as its basal width. Male with setae S2 on tergite IX about 0.4 as long as setae S1.

Measurements (one female from Sydney in microns). Body length 3700. Head, length 370; width 250; po setae 160. Pronotum, length 200; width 400; major setae, am 75, aa 100, ml 120, epim 170, pa 200. Fore wing length 1400; number of duplicated cilia 15. Tergite IX setae S1 300. Tube length 330. Antennal segment III–VIII lengths, 115, 115, 100, 90, 75, 40.



FIGURES 45–53. *Eilapinothrips & Agynaikothrips* species. *A. lorieni* 45–49: **(45)** Head; **(46)** Pronotum; **(47)** Antenna; **(48)** Tergite III; **(49)** Metanotum & pelta. *E. additamentus* 50–53: **(50)** Antenna; **(51)** Pronotum; **(52)** Pelta & tergites; **(53)** Male sternite VIII.

Specimens studied. **Australia**, from *Ficus macrophylla* leaves: **New South Wales**, Sydney Domain, 1 female, 26.iii.1996; 15 females, 8 males, 23.xi.2000; 2 females, 25.x.2003; 4 females, 3 males, 13.ii.2005; Lismore, 1 female, 29.ix.1922 (W.W.Froggatt); **Queensland**, Brisbane, The Gap, both sexes, 5.x.2006, viii. 2007, x.2007, viii.2012 (in QDPC). **Northern Territory**, Umbrawarra Gorge, 5 females, 3 males from *Ficus platypoda* leaves, 29.vi.2009 (in QDPC).

Liothrips umbratus Hood comb. rev.

Liothrips umbratus Hood, 1918: 132
Gynaikothrips umbratus (Hood) Karny, 1928: 39

In contrast to the species of *Gynaikothrips*, this species shares with the species of *Liothrips* and the Australian species placed in *Teuchothrips* the following character states: mesopresternum weak or absent medially and sternopleural sutures long. However, in contrast to the current interpretation of *Teuchothrips* that is based on the type species *simplicipennis*, the poorly known species *umbratus* has antennal segment VIII more constricted at the base, all five pairs of pronotal major setae well-developed, and the fore wings with duplicated cilia. It is a dark brown species with antennal segments III–IV yellow and V–VI largely yellow, and the fore wing is particularly dark. The mid-dorsal setae on the head are well-developed, the metanotum has several minute setae anteromedially, and tergite IX setae S1 are longer than the tube. The specimens listed below were compared with the type specimens in the USNM Collection, Washington DC., that bear the following data "sweeping in jungle at Nelson (=Pentland), near Charters Towers, Queensland, 25.v.1913 (A.A. Girault).

Specimens studied. **Australia**, Queensland, Redlynch, Freshwater Creek, 4 females from "large-leafed mesophyte in rainforest, 11.viii.1968 (J.A.L. Watson), in ANIC.

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