



Identification and host associations of some Thysanoptera Phlaeothripinae described from Australia pre-1930

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Abstract

Among Australian fungus-feeding Thysanoptera, five new synonyms are recognised in *Horistothrips* Morgan, and among leaf-feeding species, three new synonyms are recognised in *Teuchothrips* Hood and one in *Neocecidothrips* Moulton. *Horistothrips curviseta* Girault is transferred to *Neocecidothrips* as the second species in that genus and its host-plant is identified. *Cryptothrips additamentus* Karny is transferred to *Gynaikothrips* Zimmermann and identified as a common kleptoparasite in the leaf roll galls of *Gynaikothrips australis* Bagnall. A key is provided to 13 Australian species remaining in *Teuchothrips*; host-plants are recognised for six of these, but seven remain known only from their original fragmented specimens.

Keywords: *Horistothrips*, *Teuchothrips*, *Neocecidothrips*, *Gynaikothrips*, synonyms, host-plants

Introduction

The historical legacy provided to modern thrips biologists by poor descriptive taxonomy from the first half of the 20th century remains a significant obstacle to investigating the real biological diversity of these insects. Prior to 1905, only three species-group names had been proposed for any Australian thrips, but between 1905 and 1935 there was a surge by northern hemisphere workers in descriptive activity on thrips from this continent (Mound, 2004), with the erection of 320 species-group names during these 30 years. Unfortunately, most of these species were described on single individuals with no biological information, and the descriptions were superficial and sometimes no more than two to four lines. Moreover, many of the specimens were severely damaged and so imperfectly slide-mounted that suitable characters cannot be seen (Fig. 1). Progressively, these original specimens have been re-examined and compared with material derived from recent field studies, these studies being aimed at establishing host-plant relationships and developing an understanding of structural variation within and between populations of these polymorphic insects (Crespi et al., 2004). As a result, 40% of the 320 species-group names proposed prior to 1935 for Australian Thysanoptera are now considered synonyms (Mound, 1996), and this paper establishes a further nine new synonyms.

This paper is focussed on two genera whose type species were described from Australia. *Horistothrips australis* Morgan does not appear to have been re-studied since its original description in 1913, although ten species have been described in, or allocated to, the genus without any generic definition being produced. Similarly, *Teuchothrips simplicipennis* Hood has remained unstudied since the original description in 1919, although more than 40 species have been associated with this generic name. The limited objective of this paper is to establish species-level synonymies, to facilitate identification of the taxa involved, and to record host plants where these have been recognised during recent field studies. Elucidation of the systematic relationships among these thrips, particularly those associated with the name *Teuchothrips*, will require consider-

ably more field work as there are so many undescribed species, many of which induce gall-like leaf distortions (Fig. 2). Moreover, molecular data will be required, because there is often little variation in structure between species among these phytophagous phlaeothripines, despite many of them exhibiting polymorphisms associated with sex and wing development.

Type specimens of the species discussed in this paper are deposited in the following institutions: R.S. Bagnall (The Natural History Museum, London); A.A. Girault (The Queensland Museum, Brisbane); H.H. Karny (Naturhistoriska Riksmuseet, Stockholm); J.D. Hood, also A.C. Morgan (U.S. National Museum of Natural History, Washington); D. Moulton (California Academy of Sciences, San Francisco).



FIGURE 1. Type slides of three species described by Karny, and three species described by Girault.



FIGURE 2. Leaf-roll gall on *Pittosporum undulatum* induced by *Teuchothrips ater*.

***Horistothrips* Morgan**

Horistothrips Morgan, 1913: 35. Type-species *H. australiae* Morgan, by monotypy.

Aspidothrips Karny, 1920: 38. Type-species *A. platygaster* Karny. Synonymised by Mound & Houston, 1987: 15.

The Australian species of *Horistothrips* are apparently fungal-hyphae feeders, living under the bark of dead trees. They are thus the ecological equivalent of species in the worldwide genera *Hoplandrothrips* Hood and *Hoplothrips* Amyot & Serville although, curiously, no substantial colonies of either *Hoplothrips* nor *Horistothrips* species have been found in Australia, despite much searching of apparently suitable habitats. Moreover,

only one undescribed species of *Horistothrips* has been collected. Presumably, the aridity of the climate, together with predation by Australia's ubiquitous ant and arachnid species, inhibits the development on this continent of the large sub-cortical populations of hyphal-feeding phlaeothripines that can be so common in Europe (Mound et al., 1976).

Described as a monobasic genus, *Horistothrips* has come to include 10 nominal species. Seven of these are from Australia, of which five are here placed into synonymy. The systematic relationships of the genus are not clear, but in contrast to members of such genera as *Hoplothrips* and *Hoplandrothrips* in the *Phlaeothrips*-lineage of fungus feeders (Mound & Marullo, 1996), the third antennal segment does not bear three sensoria. Instead, this segment has only a single sensorium, as in members of the leaf-feeding lineage of phlaeothripines related to *Liothrips*. The three non-Australian species listed in the genus have not been studied but, judging from their original descriptions, they seem unlikely to be closely related to the Australian species: *Horistothrips claruspilus* Moulton (Fiji); *Horistothrips magnafemora* Moulton (Fiji); *Horistothrips palidispinosus* Steinweden & Moulton (China).

Generic definition

Phlaeothripinae, usually micropterous. Antennae 8-segmented, III with one sensorium, IV with 3⁺ or 2⁺; VIII not constricted at base. Head longer than wide, at least posterior half reticulate, postocular setae strongly capitate; maxillary stylets retracted to eyes, close together medially (Fig. 3); mouth cone pointed and extending between fore coxae (Fig. 5). Pronotum almost as long as wide, with five pairs of capitate major setae; epimeral sutures complete. Fore femora swollen, fore tibia often with a minute apical tubercle on inner margin, fore tarsal tooth long. Prosternum without basantra, but chitinous islets large and robust (Fig. 5); ferna relatively small; mesopraesternum reduced to two lateral triangles. Metathoracic sternopleural sutures long and narrow (Fig. 5). Metanotum boldly reticulate (Fig. 4), median setae pointed. Pelta and tergite II reticulate; tergites II–VII each with two pairs of weak wing-retaining setae, lateral marginal setae long and strongly capitate; tergite IX setae S1 and S2 long and capitate; tube about as long as head width, anal setae long. Male with tergite IX setae S2 capitate but shorter than S1, sternite VIII with wide glandular area.

Key to *Horistothrips* species

1. Pelta occupying no more than 60% of anterior margin of abdominal tergite II (Fig. 4); postocular setae about 1.5 times as long as width of antennal segment II; male glandular area transverse across sternite VIII *australiae*
- . Pelta occupying more than 80% of anterior margin of abdominal tergite II (Fig. 8); postocular setae scarcely 1.2 times as long as width of antennal segment II; male glandular area on sternite VIII transversely oval *platygaster*

Horistothrips australiae Morgan

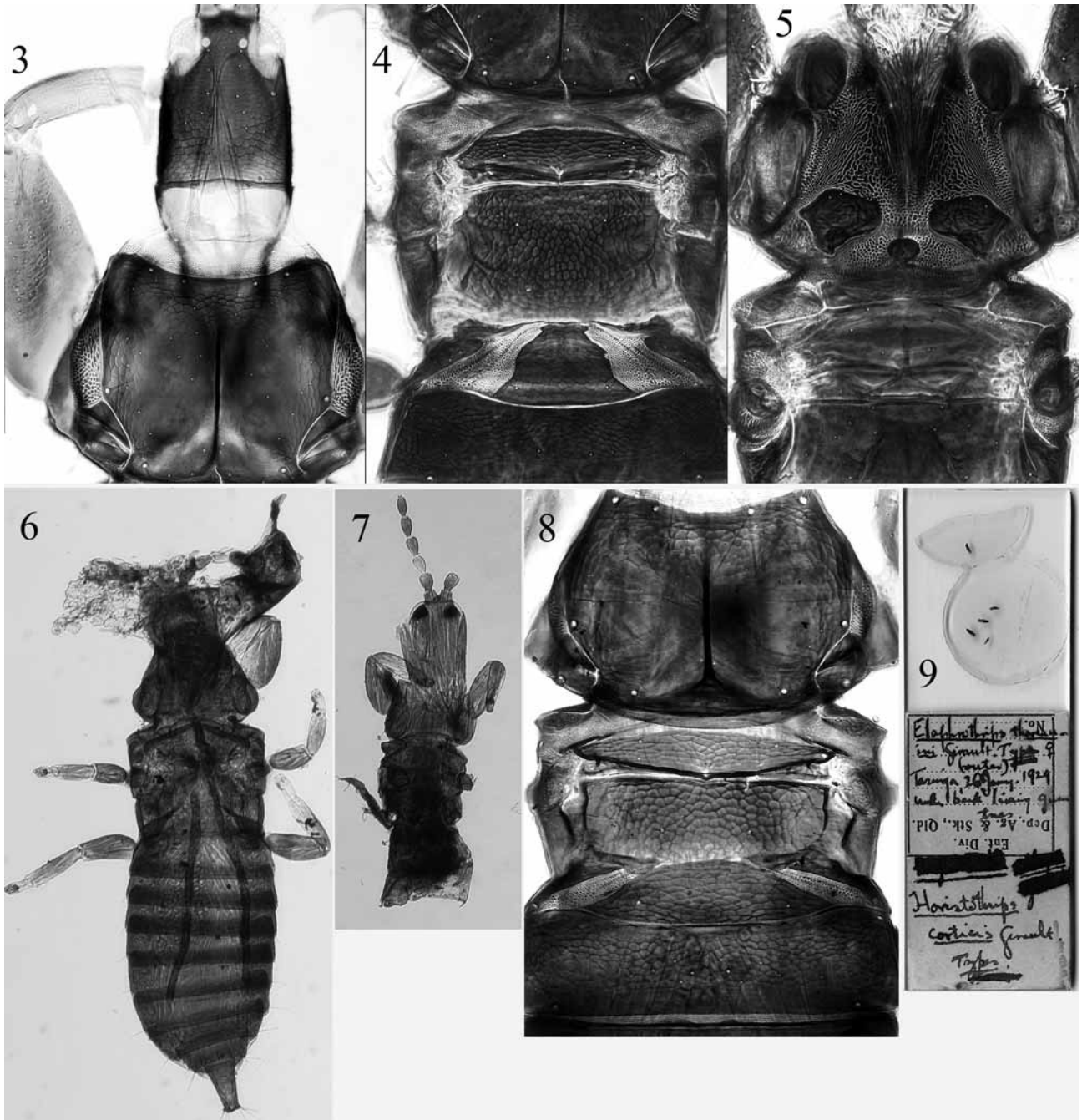
Horistothrips australiae Morgan, 1913: 36

Horistothrips corticis Girault, 1929b: 2. **syn.n.**

Elaphrothrips thoreauini Girault, 1929b: 3. **syn.n.**

Morgan's description of this species included the statement "Type slide contains two females, one wingless and one winged, and three pupae and one larva." The mention of a "type slide" is confusing, because the

generic description refers to “three females, one winged and two wingless”. A slide that corresponds with Morgan’s statement is available in the US National Museum. However, there is a second slide, re-labelled by J.D. Hood but with Morgan’s original labels on the reverse. One original label indicates “2♀s Type slide”, but the word Type has been changed subsequently to “Paratype”. This slide bears three pupae (one concealed under the margin) and one larva, together with one male and one female, both micropterae. These are clearly part of the original series, although they are not mentioned with the description, particularly the presence of the male.



FIGURES 3–9. *Horistothrips* species. *H. australis* 3–5: (3) Head & pronotum; (4) Mesonota & pelta; (5) Thoracic sternites. *H. ischnosoma* 6–7: (6) **Lectotype** female; (7) Paralectotype. (8) *H. calvus* syntype male, pronotum to tergite II. (9) Type slide of *thoreauini* and *corticis*.

The original data was: Australia, Swan River, under dead scales of *Eriococcus* on *Eucalyptus*, collected by George Compere, and received at USDA, Washington on 1 March 1902. The Swan River runs through Perth, Western Australia, and a further micropterous female of *H. australiae* has now been studied from *Eucalyptus* about 120km South East of Perth.

The two species described by Girault that are here placed into synonymy with *australiae* were collected together “under bark of living gum, Mt Cootha, 26th January, 1929”. The original specimens, all micropterae, are mounted onto one microscope slide (Fig. 9). The specimen indicated by the label as *thoreauini* is a large female under one cover glass; the *corticis* specimens include two large and one small female, with one small male.

In addition to these specimens, from opposite sides of the Australian continent, a few specimens have also been studied from South Australia; one micropterous female from *Eucalyptus* bark at Willunga, South East of Adelaide, and several specimens of both sexes from under the bark of *Eucalyptus camaldulensis* at Orroroo (all in ANIC, Canberra). The species is variable in body size and the lengths of some major setae, including the postoculars, both within and between sexes. The specimens from Orroroo are pale, possibly through long storage in alcohol, and the sub-basal area of the third antennal segment is more swollen than in the other available specimens.

***Horistothrips platygaster* (Karny)**

Aspidothrips platygaster Karny, 1920: 39

Horistothrips platygaster (Karny); Mound & Houston, 1987: 15

Horistothrips calvus Karny, 1920: 39 **syn.n.**

Horistothrips impennis Karny, 1920: 39 **syn.n.**

Horistothrips ischnosoma Karny, 1920: 39 **syn.n.**

Karny described *A. platygaster* from a single micropterous female, collected in “N. W. Australien”. This specimen has now been compared with the original (Fig 8) two specimens of *H. calvus* (male and female micropterae), also the original two specimens of *H. impennis* (male and female micropterae), these four specimens having been collected in the Kimberley region of north western Australia. All five specimens are here considered to represent the same species, the differences noted by Karny being due, primarily, to different degrees of contraction of the body prior to slide mounting. *H. ischnosoma* was based on two severely damaged specimens collected in the Kimberley Region of Australia. The female with the whole thorax and abdomen (Fig. 6) is here designated **Lectotype** and is considered to be a small *platygaster*, but the second specimen with the abdomen missing (Fig. 7) is possibly a different species.

***Teuchothrips* Hood**

Teuchothrips Hood, 1919: 86. Type species *Teuchothrips simplicipennis* Hood, by original designation from six species.

Rather more than 40 species-group names have been associated with the generic name *Teuchothrips*, mostly from Australia. Five species from New Caledonia, and seven from India or Indonesia are currently listed under this genus (Mound, 2008), but no attempt is made here to consider these non-Australian species. These thrips are members of the leaf-feeding *Liothrips*-lineage (Mound & Marullo, 1996) of Phlaeothripinae, a group that is particularly species-rich in South East Asia and Australia. In the Australian National Insect Collection there are many similar-looking undescribed species that are often associated with various types of leaf deformations or galls (Mound & Morris, 2007). Many of these species are likely to prove to be host specific,

but without substantial and replicated samples it is not possible to interpret the patterns of variation in colour and structure that seem to exist within and between populations, including the presence of winged and wingless morphs.

The genus *Teuchothrips* is not distinguished satisfactorily from the worldwide genus *Liothrips* Uzel that includes over 250 species. Species in both genera have a single sensorium on the third antennal segment, and three (usually 3⁺ but more rarely 2) sensoria on the fourth segment. The prosternum lacks basantra, there are no prominent setae laterally on the head, and on the ninth abdominal tergite of males the S2 pair of setae are shorter than the S1 pair. The only differences are that *Teuchothrips* species tend to have the eighth antennal segment short and broadly based, and at least one of the five pairs of pronotal major setae is not elongate, whereas *Liothrips* species have the eighth antennal segment longer and constricted basally, and all five pairs of pronotal major setae are elongate. Despite this, several of the Australian species currently in *Teuchothrips* have all five pairs of pronotal setae well developed, with the epimeral setae considerably longer than in other species listed in the genus. No attempt is made here to develop a revised generic classification, because that will require studies on many similar but undescribed Australian species. At present it seems possible that *Teuchothrips* might be restricted to a few species that resemble the type species in lacking duplicated cilia on the forewings.

Key to Australian species listed in *Teuchothrips*

1. Head with two pairs of major postocular setae (Fig. 16); maxillary stylets separated by about 50% of head width, retracted into head less than one third of distance to posterior margin of eyes; fore tibia of both sexes with small apical tubercle *burroughsi*
- Head with no more than one pair of major postocular setae; maxillary stylets no more than 25% of head width apart, retracted at least half way to eyes (Figs 10, 14); fore tibia rarely with small apical tubercle .2
2. Head with postocular setae not distinguished from minor setae (Fig. 20) *melaleucae*
- Head with postocular setae distinct but variable in size.3
3. Metanotal reticulation closely spaced, forming almost linear striations (Fig. 12) *acripilus*
- Metanotal reticulation variable, but more equiangular (Figs 14, 17)4
4. Postocular setae longer than dorsal length of eye but never broadly capitate5
- Postocular setae either much shorter than dorsal length of eye or with apices broadly capitate8
5. Postocular setae finely acute; forewing without duplicated cilia*froggatti*
- Postocular setae with apices softly to broadly rounded; duplicated cilia present on forewing 6
6. Forewing sub-basal setae with bases arranged in a triangle, S2 sometimes almost posterior to S3 (Fig. 15) *ater*
- Forewing sub-basal setae with bases arranged in a straight line7
7. Tergite IX S1 setae with apices expanded; forewing with 4 duplicated cilia; antennal segment III slender, more than 2.0 times as long as apical width *clavipilus*
- Tergite IX S1 setae with apices finely acute; forewing with 8 duplicated cilia; antennal segment III about 1.7 times as long as apical width *longisetae*
8. Pronotal anteromarginal setae (Fig. 22) at least 1.4 times as long as width of second antennal segment; on *Eremophila deserti*..... *connatus*
- Pronotal anteromarginal setae less than 1.2 times as long as width of second antennal segment9
9. Forewings short or absent.....10
- Forewings fully developed12
10. Antennal segments III–VI almost completely yellow; tergite IX setae S1 less than 0.5 as long as tube; on *Callistemon saligna* *minor*

- . Antennal segments IV–VI almost completely brown; tergite IX setae S1 at least 0.6 as long as tube 11
- 11. Head of micropterae weakly reticulate; antennal segments IV–VII tapering to sub-parallel-sided pedicel (Fig. 25); on *Leptospermum myrsinoides* *simplicipennis*
- . Head of micropterae strongly reticulate; antennal segments IV–VII sharply constricted to parallel-sided pedicel (Fig. 13); on *Bursaria spinosa* *badiipennis*
- 12. Forewings without duplicated cilia..... 13
- . Forewings with duplicated cilia present 14
- 13. Antennal segments III–VI almost completely yellow; tergite IX setae S1 less than 0.5 as long as tube; on *Callistemon saligna* *minor*
- . Antennal segments IV–VI almost completely brown; tergite IX setae S1 at least 0.7 as long as tube; on *Leptospermum myrsinoides* *simplicipennis*
- 14. Antennal segment IV with 2 major sense cones *sodalis*
- . Antennal segment IV with 3 major sense cones..... 15
- 15. Maxillary stylets at least 0.25 of head width apart medially in head, retracted no more than half way to postocular setae; on *Callistemon citrinum*..... *disjunctus*
- . Maxillary stylets close together medially in head, retracted to postocular setae; on *Bursaria spinosa* *badiipennis*

***Teuchothrips acripilus* (Karny)**

Horistothrips acripilus Karny, 1920: 39

Teuchothrips acripilus (Karny); Mound & Houston, 1987: 17

Described in a key, this species is known only from a single female without antennae. It was collected at Malanda, northern Queensland, between 1910 and 1913. The maxillary stylets are scarcely 0.1 of the head width apart, and the mouth cone is long and pointed, extending between the fore coxae to the mesopraesternum that is very slender medially. The fore tarsi apparently lack a tooth, and the metanotum is more closely striate than in any other similar-looking species (Fig. 12). The forewing is shaded throughout its length with the sub-basal setae arising in a straight line, and there about seven duplicated cilia. The major setae on the head and pronotum are long and light brown (Figs 10–11), the epimeral and posteroangular setae being more than 0.6 as long as the pronotum.

***Teuchothrips ater* (Girault)**

Liothrips ater Girault, 1927a: 2

Androthrips niger Girault, 1927a: 2

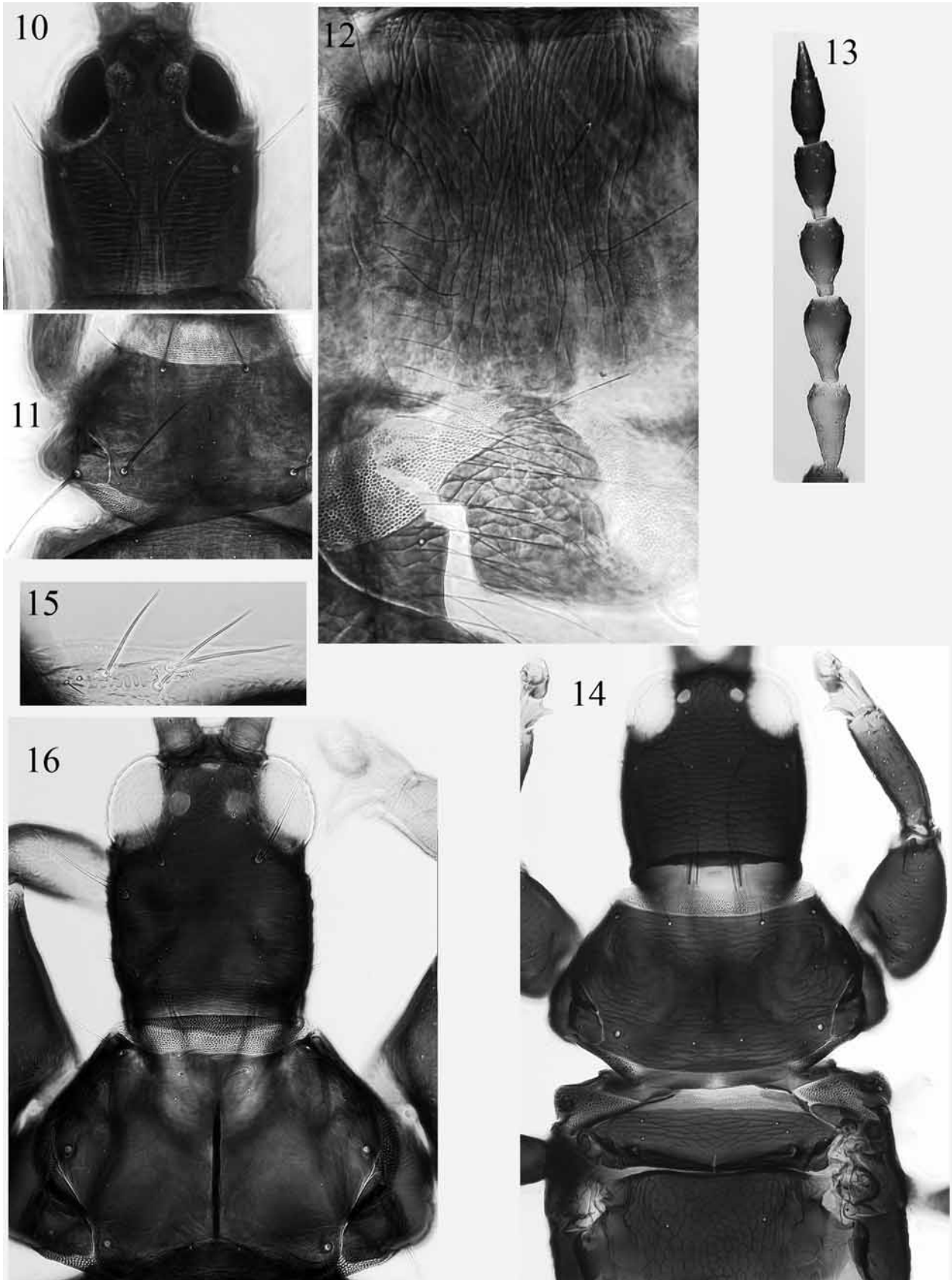
Teuchothrips bursariicola Priesner, 1928: 647

Teuchothrips pittosporiicola Bagnall, 1929: 191. **syn.n.**

Smerinthothrips fuscipennis Moulton, 1968: 93-4

Teuchothrips ater (Girault); Mound & Houston, 1987: 17

This is interpreted as a structurally variable, polyphagous species. It is a minor pest in eastern Australia, inducing deformation of, and producing substantial colonies on, the apical leaves of *Pittosporum undulatum* (Fig. 2), both in gardens and in forests. In South Australia it has been found inducing leaf rolls on *Pittosporum phylliraeoides*, and cultivated varieties of this plant have also been damaged by this thrips near Perth in Western Australia. It is recorded below forming substantial colonies on the external surfaces of galls that were induced by *Neocecidothrips curviseta* on *Aurantiarpa rhombifolia* (Pittosporaceae). Although recorded in



FIGURES 10–16. *Teuchothrips* species. *T. acripilus* holotype 10–12: (10) Head; (11) Pronotum; (12) Metanotum & pelta. *T. badiipennis* 13–14: (13) Antenna; (14) Female head & thorax. (15) *T. ater* forewing sub-basal setae. (16) *T. burroughsi* head & pronotum.

association with the common shrub, *Bursaria spinosa*, another member of the Pittosporaceae, and taken in leaf galls on several other plants, including *Geijera* (Rutaceae), on these plants it is possibly a kleptoparasite within galls that have been induced by other thrips. Adults vary in size within populations, and sometimes vary between populations in the form of the apices of the setae on the ninth tergite.

The single specimen from which Girault described *ater* is a female, collected from *Eucalyptus* at Melbourne, the single specimen from which he described *niger* came from southern Queensland on brigalow (*Acacia harpophylla*), and Moulton's description of *fuscipennis* was based on three females from Port Lincoln, South Australia, with no host association. In contrast, Bagnall described the species from both sexes taken on *Pittosporum* leaves at Sydney, and Priesner described *bursariicola* from both sexes taken on *Bursaria spinosa* at Healesville in Victoria. The synonymy of *nigronympha* Girault indicated by Mound & Houston (1987) is now recognised as incorrect (see *connatus* below).

Mound (1968) indicated that in *pittosporiicola* the S1 and S2 setae on tergite IX have acute apices, but that these setae in the type specimens of *bursariicola* have their apices "softly pointed or weakly expanded". Moreover, South Australian specimens from *Pittosporum phylliraeoides* were identified as *bursariicola* on this character. Specimens collected recently from *P. phylliraeoides* in Western Australia also have these setae distinctly expanded, thus a possibility remains that the form on *P. phylliraeoides* represents a different species from the one with finely acute setae on *P. undulatum*. However, the name *niger* would have priority over *bursariicola*, because the male type of *niger* has tergite IX setae S1 and S2 with expanded apices. Because, within some populations, the form of the setal apices is variable from softly pointed to weakly capitate, the *niger* form is here considered to be the same species as the *ater* form in which the setae are finely acute. Despite extensive searching, this species has not been taken by the present author from *Bursaria*. One sample of both sexes with tergite IX setae finely acute has been studied that bears the data "*Geijera salicifolia*, Mullaley, NSW", but that host plant record is almost certainly incorrect as *G. salicifolia* does not occur so far west of the Great Dividing Range as Mullaley.

***Teuchothrips badiipennis* Hood**

Teuchothrips badiipennis Hood, 1919: 87

Described on three females from Brooklyn, NSW with no host data, this species is now recognised as one of two species associated with small galls on the buds of the common shrub, *Bursaria spinosa*. This conclusion is based on a comparison of the holotype with a long series of specimens (Figs 13–14) from Black Mountain in Canberra, ACT. Both sexes can be long or short-winged, and major males have a small tubercle at the apex of the fore tibia and a large glandular area occupying the anterior half of the eighth sternite.

***Teuchothrips burroughsi* (Girault)**

Dichaetothrips burroughsi Girault, 1929a: 29

Teuchothrips burroughsi (Girault); Mound & Houston, 1987: 17

Described from an unspecified number of specimens taken in "leaf galls" at Boonah in South East Queensland, this species has not been collected since. Judging from the syntypes, the species is distinctive with two pairs of long postocular setae and the head constricted behind the eyes (Fig. 16). The maxillary stylets are unusually low in the head and wide apart, the fore tibia bears a small apical tubercle in both sexes, and tergite IX setae S1 are finely pointed and 0.7 as long as the tube. The forewing sub-basal setae arise in a straight line, and there are more than 20 duplicated cilia. Antennal segment III bears one sensorium, and IV bears three sen-

soria. The head shape, stylets and postocular setae distinguish this species from other species currently treated in *Teuchothrips*, and the metanotum is unusual (Fig. 17) in bearing a group of small setae anterior to the median major setae.

***Teuchothrips clavipilus* (Karny)**

Horistothrips clavipilus Karny, 1920: 39

Teuchothrips clavipilus (Karny); Mound & Houston, 1987: 17

Described in a key, this species is known only from a single male, collected at Cedar Creek in northern Queensland between 1910 and 1913. A second specimen, taken at Colosseum, is a female not a male (see Karny, 1924: 22), and is here considered to be a different species because it has much shorter major setae and more extensive yellow on the hind tibiae. The holotype has long pale major setae; the postocular setae are longer than those of the *acripilus* holotype but the pronotal posteroangular and epimeral setae are shorter. The maxillary stylets are long and particularly close together medially (Fig. 19), but although the mouth cone is long and pointed it does not reach to the mesopraesternum, possibly because the pronotum of this male is so massive. The fore femora are enlarged, and the fore tarsal tooth is also large. The metanotal reticulation is arranged concentrically (Fig. 18), the three sub-basal setae on the forewing are arranged in a straight line, but only four duplicated cilia are visible. Antennal segments IV and V are yellow with only weak brown shading at the apex. There is a large glandular area occupying the eighth sternite except for the posterior margin. Several specimens closely similar to this holotype were beaten from *Geijera parviflora* at Dalby, South East Queensland. However, these have the antennal segments, including segment III, more extensively brown, the pronotal anteromarginal setae scarcely longer than the width of the second antennal segment, the apices of the major setae only weakly expanded, and the forewing sub-basal setal bases arranged in a triangle, as in *T. ater*.

***Teuchothrips connatus* (Hood)**

Liothrips connatus Hood, 1918: 135

Cryptothrips nigronympha Girault, 1928b: 3. **syn.n.**

Described from a single female collected at Pentland in northern Queensland, this holotype has now been compared with the original specimens of *nigronympha*, together with three females collected by Alice Wells on *Eremophila deserti* near Taroom in southern Queensland during April, 2007. These three females were collected together with a good series of *Klambothrips walsinghami* (see below), and this plant is likely to prove to be the host of both species.

Girault's description of *nigronympha* was: "From *Horistothrips Australiae*: P.L.'s equal, wing coloured centrally only, antennal 3 dusky at apex, 8 not twice longer than wide. Females, brigalow, Wallumbilla, 17th October, 1923." The slide labelled type (Fig. 1) bears three females under one coverslip. One has the third antennal segment yellow, not "dusky at apex" as given in the original description. Moreover, this female has a pair of small cheek setae near the base, the postocular setae and the pronotal anteromarginal and midlateral setae are no larger than discal setae, and there is no fore tarsal tooth. This specimen is now recognised as *Klambothrips walsinghami* (see below).

The other two females on the Girault type slide are apparently conspecific, but both are crushed. The stylets of one specimen are long and close together; the postocular setae are long (125 microns), much longer than the distance between the eyes, but capitate; antennal segment III bears one sensorium, IV bears three sensoria; the pronotum has five pairs of equally long setae (Fig. 22); the metanotum and pelta are strongly reticu-

late; tergite IX setae have softly rounded apices, setae S1 are not quite as long as the tube; the forewing sub-basal setae arise in a straight line, and only five duplicated cilia are visible on the forewing which is broad and slightly shaded at the margins. Contrary to Mound & Houston (1987) *nigronympha* cannot be a synonym of *ater*, because of the arrangement of the sub-basal wing setae.

***Teuchothrips disjunctus* (Hood)**

Liothrips disjunctus Hood, 1918: 134

Described from a single female taken on Thursday Island, Torres Strait, Queensland, this species is now recognised as the pest thrips that induces leaves to curl and turn red on *Callistemon citrinum*, a common garden shrub in Australia and New Zealand. A full redescription based on New Zealand specimens was given by Mound & Walker (1986). The species has the maxillary stylets retracted into the head rather less deeply than in many similar species (Fig. 21).

***Teuchothrips froggatti* (Bagnall)**

Mesothrips froggatti Bagnall, 1924: 637

This species remains known only from the original specimens, collected by W.W. Froggatt near Sydney in 1893 from the terminal buds of a *Callistemon* species. All of the specimens lack antennae, but the maxillary stylets are exceptionally long and close together (Fig. 23), and the mouth cone is broadly rounded. However, the difference in shape of the mouth cone between the available specimens of *acripilus*, *clavipilus* and *froggatti* could be related to differences in slide preparation methods. In *froggatti* the postocular and four pairs of pronotal setae are unusually long and pale, but in both sexes the pronotal anteromarginal setae are scarcely longer than the discal setae. The fore tarsal tooth is well developed and acute in both sexes, and one available female has the fore femora swollen, much larger than one available male. In the female, abdominal tergite IX setae S1 have finely acute apices, and setae S2 of the male are short and acute. The male apparently lacks a glandular area on the eighth sternite.

***Teuchothrips longiseta* (Girault)**

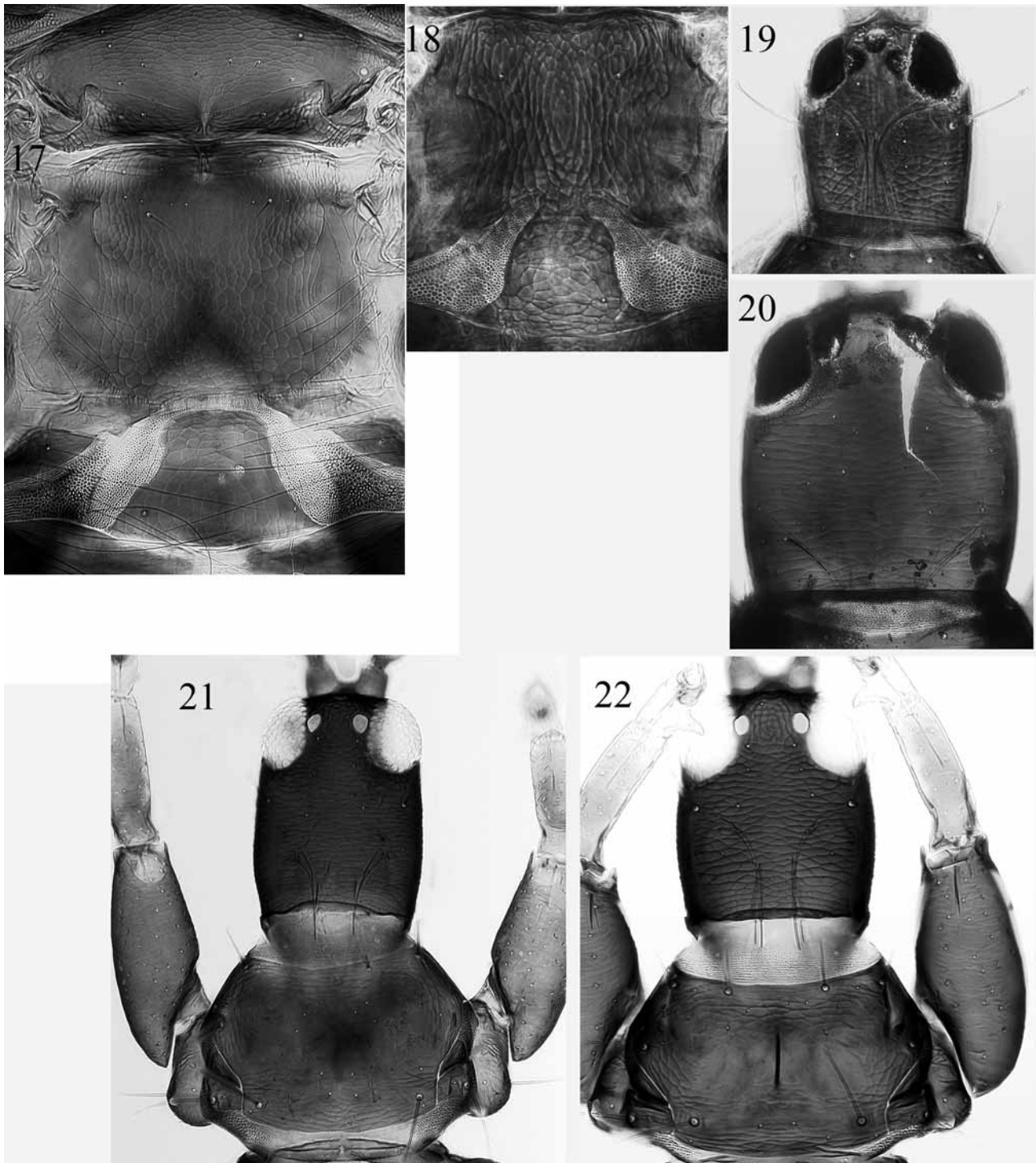
Horistothrips longiseta Girault, 1926: 1

Teuchothrips longiseta (Girault); Mound & Houston, 1987: 18

The original description was: "As *aerispilus* [sic] but distal bristles abdomen pale, postoculars closer to margin, 2 small setae between posterior bristles prothorax. Males ex twig galls *Acacia linifolia*, Brisbane, Tryon." Girault left two slides of this species, bearing a total of about 24 individuals. These syntypes have been compared with a series of both sexes collected in 1962 from galls on a *Melaleuca* species at Brisbane.

The chaetotaxy and body sculpture are remarkably similar to that of *froggatti*, but the number of forewing duplicated cilia ranges from 8 to 11. In contrast, the single known macroptera of *froggatti* has no duplicated cilia on the forewings, and this suggests that these are not the same species. The head is short and reticulate in *longiseta*, with the stylets retracted to the compound eyes and touching medially. Antennal segment III bears one sensorium, and segment IV bears 2⁺¹ sensoria. In both sexes the fore tarsal tooth is long and slender, and the fore tibia does not bear a tubercle. Tergite IX setae S1 are finely acute and as long as the tube, but the S2

setae in males are shorter and capitate. The tube is longer than the head. As in *froggatti*, the male apparently has no glandular area on the eighth sternite.



FIGURES 17–22. *Teuchothrips* species. (17) *T. burroughsi* metanotum & pelta. *T. clavipilus* holotype 18–19: (18) Metanotum & pelta; (19) Head. (20) *T. melaleucae* head of syntype. (21) *T. disjunctus* head & pronotum. (22) *T. connatus* head & pronotum.

***Teuchothrips melaleucae* (Girault)**

Liothrips melaleucae Girault, 1926: 1

Teuchothrips melaleucae (Girault); Mound & Houston, 1987: 18

The original description was: "From *priesneri*: Spur present; thoracic bristles unequal, mainly an unequal pair caudal corner. 7 accessory fringes each margin. Male, female ex galled leaves *Melaleuca leucodendron*, Brisbane, Tryon." The original slide in the Girault collection is labelled "types" but without further data (Fig. 1), and bears about 16 specimens. Seven of these have wings, but nine are wingless; all are severely damaged, and one of the three cover-glasses is crushed. Because the original description refers to "7 accessory fringes", the winged individuals must be considered the representatives of this species.

The six female and one male macropterae share the following character states: head with postocular setae not developed (Fig. 20); pronotal anteromarginal setae as long as anteroangular setae; fore tarsal tooth small and slender; tergite IX setae S1 and S2 obscured or broken, but S3 finely acute and as long as tube; hind tarsi yellow, but apex of hind tibiae brown. The antennal segments are similar in colour to those of *minor*, with segments III–V or VI largely pale yellow; antennal segment III bears 1 sensorium, and IV bears 2 sensoria, but these sensoria are considerably longer than those of *minor*. The head has no obvious cheek setae, and the forewings of these macropterae have about seven duplicated cilia.

The species has not been collected since it was described, but one female with the type data of *sodalis* (in BMNH) is possibly *melaleuca*, although the pronotal anteromarginal setae are no larger than discal setae, there are eight duplicated wing cilia, and tergite IX setae S1 are capitate and shorter than the basal width of the tube.

The nine wingless specimens on the *melaleuca* type slide cannot be distinguished from micropterae of *T. minor* Bagnall, and they share with that species the following character states: head shorter and more reticulate than macropterae of *melaleuca*, postocular setae present, no pronotal anteromarginal setae; fore tarsal tooth stout; tergite IX setae S1 & S2 setae capitate but less than 0.5 of tube length; tarsi and extreme apices of hind tibiae sharply yellow.

***Teuchothrips minor* Bagnall**

Teuchothrips minor Bagnall, 1929: 193

Collected by W.W. Froggatt at Port Macquarie on 3.ii.1900, the original host data was given as "in spirally curled leaf of *Melaleuca*". However, this is probably a misidentification, because recent field work has found this thrips at several widely separated sites in curled leaves of the small tree, *Callistemon saligna*. This tree has the typical "paper-bark" associated with *Melaleuca* species, and moreover has small pale inflorescences. Some of the recent collections are from cultivated specimens of *C. saligna* around Canberra, but it has also been taken in curled leaves on the same tree species in native forest on the north coast of New South Wales near Lismore, and also in Brisbane Forest Park, in southern Queensland. The thrips is a distinctive species, with short and capitate postocular and pronotal setae, and pale antennal segments III–VI with only two sensoria on segment IV. In both sexes a small tubercle is present at the inner apex of the fore tibiae, and tergite IX setae S1 and S2 are capitate and about 1.2 times as long as the basal width of the tube. The male has a glandular area on sternite VIII anterior to the discal setae. Many specimens are micropterous, but the macropterae lack duplicated cilia on the forewings.

***Teuchothrips simplicipennis* Hood**

Teuchothrips simplicipennis Hood, 1919: 86

Mesothrips insolens Bagnall, 1924: 638. **syn.n.**

Hood described this species from "two females taken by sweeping in forest, at Brooklyn, New South Wales, November 1 and 9, 1914", whereas Bagnall described *insolens* from an unspecified number of both sexes col-

lected by R. Kelly in January 1917 from *Leptospermum myrsinoides* at Healesville, Victoria. This is the type species of *Teuchothrips*, but further specimens have proved difficult to find. The only recent specimens that are unequivocally conspecific were taken at sites near Adelaide in South Australia on *L. myrsinoides*. This host plant association is interesting, because although *L. myrsinoides* is common from Adelaide and Kangaroo Island in South Australia to Lakes Entrance in eastern Victoria, there are few records of this plant in coastal New South Wales, and only one in the region of Sydney where the type specimens of *T. simplicipennis* were presumably collected.

In this species, the postocular setae of females are short (Fig. 24), not extending to the posterior margin of the eyes, but in males these setae are considerably longer. In general appearance the species resembles *minor*, the only other member of this group known to lack forewing duplicated cilia. However, in *T. simplicipennis* antennal segment IV bears 3⁺ sensoria, and tergite IX setae S1 are capitate and 0.6 as long as the tube in females and even longer in males. Sternite VIII of males has a transverse glandular area anterior to the discal setae.

***Teuchothrips sodalis* Bagnall**

Teuchothrips sodalis Bagnall, 1929: 190

Bagnall described this species from a single fragmented male (Mound, 1967). The slide bears the data, New South Wales, Port Macquarie, in spirally curled leaf of *Melaleuca*, 3.ii.1900 (W.W.Froggatt). Apparently collected with the type series of *minor*, the validity of the host plant record is discussed under that species. There is one damaged female in ANIC with similar data, except for the date, 1901. No other specimens of the species have been found. The postocular setae are capitate, and about 0.5 as long as the distance between the compound eyes. Antennal segment III apparently bears one sensorium, and IV apparently bears two sensoria. The pronotal epimeral setae are capitate, almost as long as the distance between the compound eyes, and the fore tarsal tooth is long and slender. The forewing has seven duplicated cilia, and the sub-basal setae are in a straight row. Tergite IX setae S1 are capitate, and about 0.8 as long as the tube, but S2 of the male is about half as long.

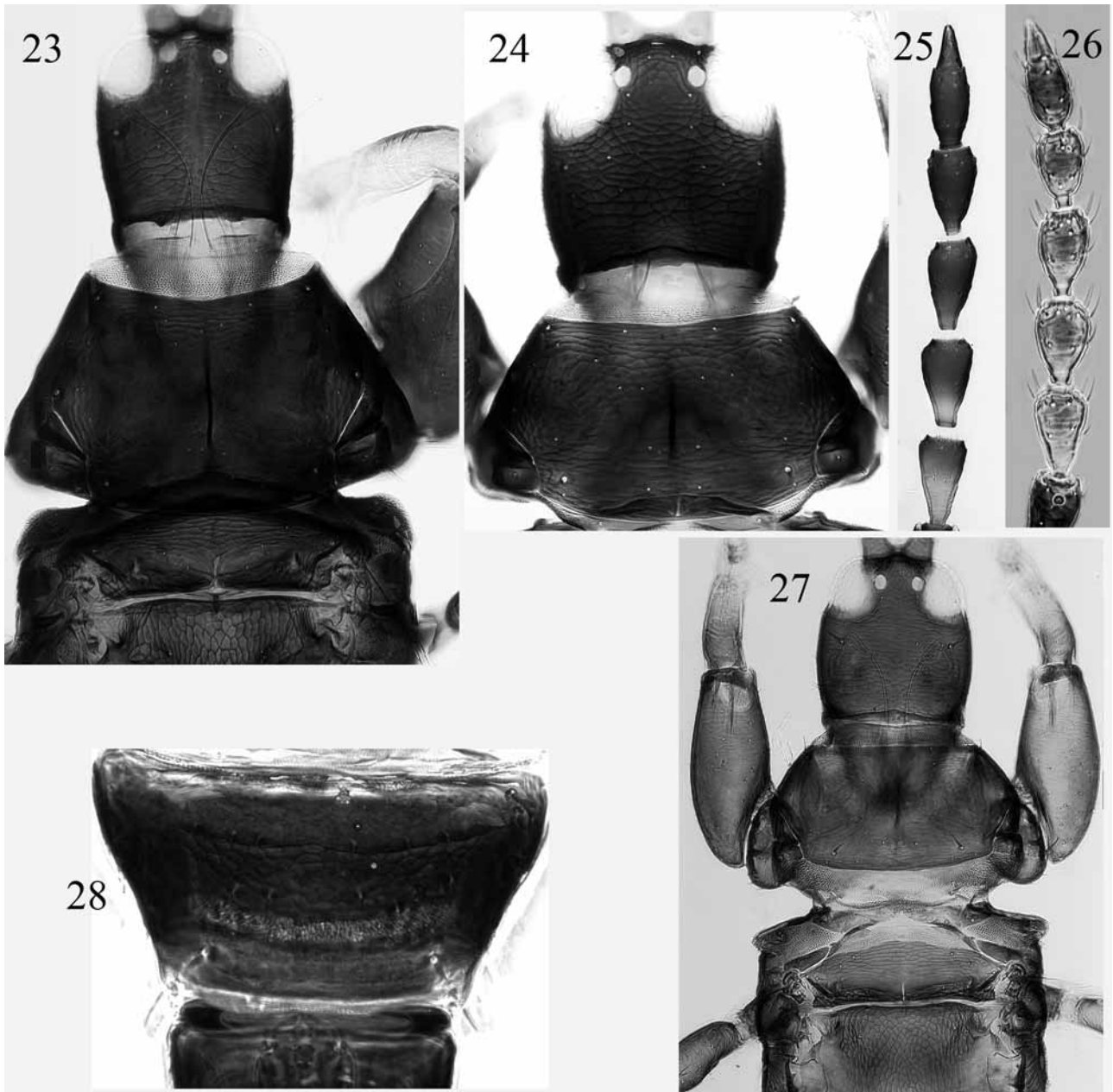
Australian species removed from *Teuchothrips*

Many of the Australian thrips associated with the name *Teuchothrips* have been transferred to other genera in earlier publications, or are transferred below.

***Callococcithrips* Mound & Wells**

Callococcithrips Mound & Wells, 2007: 58. Type species *Rhynchothrips fuscipennis* Moulton, 1968: 97, by original designation

This genus was erected for two species, one from eastern Australia and one from Western Australia. In these species, the maxillary stylets are unusually long and overlap medially in the head. Referred to the genus *Teuchothrips* by Mound & Houston (1987: 18), the type species lives within the waxy covering of an eriococcid, on which it is presumed to be predatory (Mound & Wells, 2007). The second species, *Liothrips atratus* Moulton, is known only from a single female that was collected near Perth in 1931.



FIGURES 23–28. *Teuchothrips* and *Neocecidothrips* species. (23) *T. froggatti* head & thorax. *T. simplicipennis* 24–25: (24) Head & pronotum; (25) Antenna. *N. bursariae* 26–28: (26) Antenna; (27) Head & thorax; (28) Male sternite VIII.

Gynaikothrips Zimmermann

Gynaikothrips Zimmermann, 1900: 13. Type species *Mesothrips uzeli* Zimmerman, 1900: 12 by monotypy

Currently there are 38 species listed under this generic name (Mound, 2008), distributed between Asia, Australia and islands of the Western Pacific. However, most of these remain known only from their original descriptions, and their relationships to the type species of the genus are not clear. The genus is related to *Liothrips* Uzel, and together with some smaller genera from Asia they involve at least 300 species, all of which feed on leaves. These species all have one sensorium on the third antennal segment and three sensoria (or 3⁺) on the fourth segment, and the prosternum lacks basantra, the anterior pair of sclerites. In contrast, the following Australian species is unique within this genus in having two sensoria on the third antennal segment.

***Gynaikothrips additamentus* (Karny) comb.n.**

Cryptothrips additamentus Karny, 1924: 31

Teuchothrips additamentus (Karny); Mound & Houston, 1987: 17

This species was described from one female and one male, collected at Mt Tambourine Queensland, 1910-1913 (Fig. 1). The female is here selected as **Lectotype**; not only is the male damaged, it is possibly not conspecific. This thrips lives as a kleptoparasite within the leaf roll galls induced by *Gynaikothrips australis* on *Ficus macrophylla*. It has been taken in considerable numbers both around Brisbane and in the Domain at Sydney. It is strikingly similar in general appearance to *G. australis*, differing most significantly in having two sensoria on the third antennal segment, unlike any other member of *Gynaikothrips* and related genera in the *Liothrips*-lineage. The generic placement of the species is therefore particularly difficult to assess. One possibility is that *additamentus* is distantly related to *australis*, and the two have converged in structure and sculpture. This possibility would require a new monobasic genus for *additamentus*, because no other described species is known from Australia or Asia with an equivalent combination of character states. Alternatively these two are closely related, and the extra sensorium on the third antennal segment reflects in some way the kleptoparasitic habit of the species, thus suggesting a Thysanoptera equivalent to “Emery’s Rule” in the Formicidae (Hölldobler & Wilson, 1990). In view of the nomenclatural complexities involved among the Asian leaf-feeding Phlaeothripinae and the large number of undescribed leaf-feeding phlaeothripine species in Australia, this second alternative is adopted here.

G. additamentus has the following character states: antennal segment III with 2 sensoria (Fig. 30); antennal segment VI scarcely paler at base; head with only one pair of postocular setae; pronotum of female with anteromarginal setae well developed; metanotum with a single pair of setae medially (Fig. 29); female with tube less than 3.5 times as long as basal width; male with tergite IX setae S2 distinctly capitate and about 0.5 as long as setae S1.

G. australis has the following character states: antennal segment III with one sensorium (Fig. 31); antennal segment VI sharply yellow at base; head commonly with two pairs of long postocular setae; pronotum of female with anteromarginal setae often scarcely larger than discal setae; metanotum with a group of four or more pairs of small setae anterolateral to the median pair of setae (Fig. 32); female with tube more than 4.3 times as long as basal width; male with tergite IX setae S2 acute and about 0.3 as long as setae S1.

***Heligmothrips* Mound**

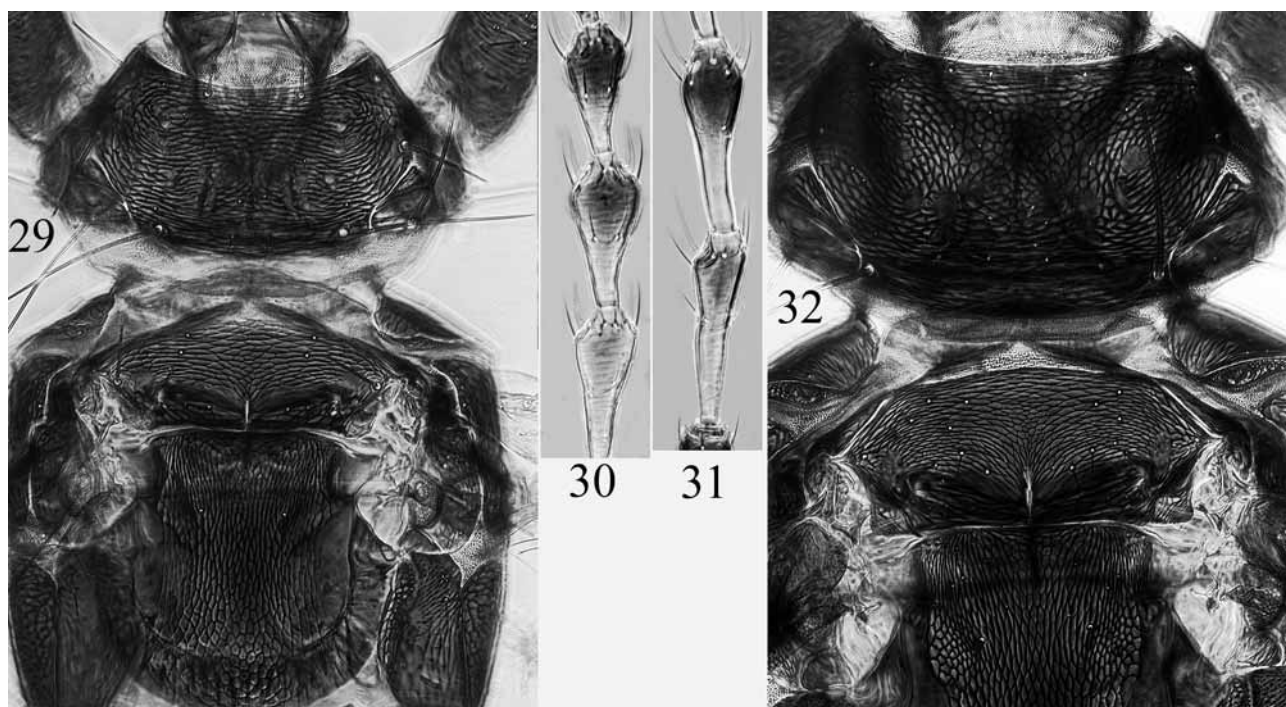
Heligmothrips Mound, 1970: 453. Type species *Trichothrips erinaceus* Karny, 1920, by original designation.

Six species of thrips, all breeding only on *Casuarina* foliage, are placed in this genus, and these include five names transferred from *Teuchothrips*. Of these, *Liothrips brevidens* Hood and *L. gracilior* Hood were two of the six species that Hood (1919) included when describing *Teuchothrips*. The other three were described in *Teuchothrips* by Moulton (1968), but are now recognised as synonyms of three species in *Heligmothrips* that were originally described by Hood (1918) or by Karny (1920) (for details see Mound, 1996).

***Klambothrips* Mound & Morris**

Klambothrips Mound & Morris, 2007: 39. Type species *K. myopori* Mound & Morris, by original designation from four species.

The type species of this genus was described from Californian specimens, in which State the thrips is a pest on a decorative shrub. However, both the thrips and the shrub are presumed to be introduced from New Zealand. The other three species in the genus are from Australia; *K. annulosus* (Priesner), *K. walsinghamsi* (Girault), and *K. oleariae* Mound & Morris, the first two having previously been placed in *Teuchothrips*. Two of these species induce leaf deformation on species of Asteraceae, but the identity of *K. walsinghamsi* has remained in doubt. Mound & Morris (2007) used the name for a thrips that is common on *Myoporum insulare* around the South East of Australia, whilst pointing out that the type specimen came from Queensland. More recently, *walsinghamsi* has been found inducing leaf deformation on *Eremophila deserti* at Taroom in southern Queensland, and this fresh material has enabled this thrips to be distinguished from the southern species that thus remains without a name. Although both *annulosus* and *walsinghamsi* were listed in *Teuchothrips* by Mound & Houston (1987), they both differ from members of that genus in having a pair of setae laterally on the head.



FIGURES 29–32. *Gynaikothrips* species. *G. additamentus* 29–30: (29) Pronotum & metanotum; (30) Antennal segments III–V. *G. australis* 31–32: (31) Antennal segments III–IV; (32) Pronotum & metanotum.

Liothrips Uzel

Liothrips Uzel, 1895: 261. Type species *Phloeothrips setinodis* Reuter.

Closely related to *Teuchothrips*, as indicated above, more than 250 species are listed worldwide in this genus (Mound, 2008). Five of these were described from Australia, but each of them remains effectively unknown. *L. brevifemur* Girault was based on a single specimen that is destroyed under the extreme edge of a cover slip, and is unrecognisable from the original description (Girault, 1928a: 2). *Adiaphorothrips pallicornis* Karny, known from a single male, was referred to *Liothrips* by Crespi et al. (2004: 124), and *L. priesneri* Karny, *L. soror* (Hood) and *L. tenuis* Hood, each known only from single females, are listed in *Liothrips* by Mound (1996).

***Neoecidothrips* Bagnall**

Neoecidothrips Bagnall, 1929: 186. Type species *Eothrips bursariae* Moulton by monotypy.

This genus was distinguished from *Teuchothrips* by Bagnall because of “the form of the antennae which have the intermediate joints much as in other gall-making genera”. The two species now recognised in *Neoecidothrips* differ from the other members of the *Teuchothrips* complex in having two major sensoria on both the third and fourth antennal segments (Fig. 26), and in having the glandular area of males on the posterior half of the eighth abdominal sternite (Fig. 28), rather than the anterior half.

Generic definition

Phlaeothripinae with both sexes macropterous or micropterous. Antennae 8-segmented, III & IV each with two sensoria; segments IV–VII with narrow pedicel, VIII broadly joined to VII. Head weakly to moderately reticulate, cheeks with one or more pairs of short stout setae; postocular setae capitate, short scarcely reaching posterior margin of eye. Maxillary stylets scarcely 0.2 of head width apart, retracted at least to postocular setae. Pronotal anteromarginal setae no larger than discal setae, remaining four pairs short and capitate, posteroangular setae arise more than their length from complete epimeral sutures. Prosternal basantra not developed, ferna large, mesopraesternum reduced to two triangles; metathoracic sternopleural sutures well-developed. Metanotum reticulate, with one pair of median setae. Fore tarsal tooth large in both sexes. Forewings parallel sided, duplicated cilia present, sub-basal setae short. Abdomen with pelta broadly triangular; tergites II–VII each with two pairs of wing-retaining setae; tergite IX setae S1 and S2 scarcely half as long as tube. Male with narrow transverse glandular area on the posterior half of sternite VIII (Fig. 28); tergite IX setae S2 shorter than setae S1.

Key to *Neoecidothrips* species

1. Antennal segments III–VI brown at least in distal half; head length about 1.3 times median width; forewings with 10 to 12 duplicated cilia; tergite IX setae S1 weakly capitate, 0.7 as long as tube *bursariae*
- . Antennal segments III–VI clear yellow; head length about 1.5 times median width; forewings with 17 to 19 duplicated cilia; tergite IX setae S1 pointed, less than 0.5 as long as tube *curviseta*

***Neoecidothrips bursariae* (Moulton)**

Eothrips bursariae Moulton, 1927: 159

Cryptothrips schilleri Girault, 1927b: 1. **syn.n.**

Teuchothrips schilleri (Girault); Mound & Houston, 1987: 18

Moulton described this species from “numerous females and males taken from galls on leaves of *Bursaria spinosa*” near Sydney. The Girault description was: “As *bursariae* but wings very short, p.o. barely as long as distance from eye, antennals 3-5 pale base only, p.l.s. unequal. A male on *Rumex*, Healesville, Vic., R. Kelly, Jan. 18, 1925.” Although not commonly collected, Priesner (1928) recorded the species from *B. spinosa* at Healesville, Victoria together with *Teuchothrips bursariicola*, and more recently considerable samples, but only of micropterae, have been taken from leaf galls on *B. spinosa* at Montmorency and Tarrawarra in Victoria.

Neoecidothrips curviseta (Girault) comb.n.

Horistothrips curviseta Girault, 1926: 2

Teuchothrips curviseta (Girault); Mound & Houston, 1987: 18

Described from an unspecified number of “Females from galls, Brisbane”, there are 15 damaged individuals of both sexes, apparently all macropterae, under two cover slips on the type slide (Fig. 1). These were the only known specimens until October 2007, when Desley Tree found the species inducing soft, thick-walled galls on the margins of leaves of *Auranticarpa rhombifolia* (Pittosporaceae) at The Gap, Brisbane. Each of the galls found at this site was very young, containing a single macropterous female. Eggs were present in only one gall, and the only male found was walking on the outside of a gall. Several of these galls also bore substantial numbers of eggs, larvae and adults of *Teuchothrips ater*, but these colonies were on the outer surface of the galls, particularly in the angle between a gall and the leaf lamina.

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