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Publisher: Taylor & Francis

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Journal of Natural History

Publication details, including instructions for authors and subscription information:

<http://www.tandfonline.com/loi/tnah20>

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Published online: 31 Dec 2007.

To cite this article: Laurence A. Mound & Kambiz Minaei (2007) Australian thrips of the Haplothrips lineage (Insecta: Thysanoptera), *Journal of Natural History*, 41:45-48, 2919-2978, DOI: [10.1080/00222930701783219](https://doi.org/10.1080/00222930701783219)

To link to this article: <http://dx.doi.org/10.1080/00222930701783219>

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Australian thrips of the *Haplothrips* lineage (Insecta: Thysanoptera)

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(Accepted 2 November 2007)

Abstract

Keys are presented to the 11 genera and 50 species, including 21 new species, of Thysanoptera in Australia that are related to the worldwide genus *Haplothrips* Amyot and Serville. These taxa belong to what, in recent literature, has been called the “*Haplothrips*-lineage”, that is, one of the three major radiations among the 2700 species and 350 genera of Thysanoptera Phlaeothripinae. The group is redefined, and the available tribal name Haplothripini shown to be appropriate. The character states on which the definition is based are discussed, and a list given of the 34 genera worldwide that can be included. The Australian species in these genera exhibit a diversity of biologies. Three genera involve species that invade galls induced by other thrips: *Androthrips monsterae* (Moulton) from New Guinea is newly recorded from Australia; *Mesothrips jordani* Zimmermann from South-East Asia is newly recorded from Australia, with two new synonyms; the Asia-Pacific genus, *Euoplothrips* Hood, includes two species in northern Australia. Three haplothripine genera are associated with grasses: one widespread genus, *Apterygothrips* Priesner, considered polyphyletic, includes only one Australian species; the only known species of *Dyothrips* Kudo is Oriental but extends into tropical Australia; *Podothrips* Hood, a circum-tropical genus of thrips predatory on grass-living coccoids, has 11 Australian species, six newly described. One grass-associated genus, *Bamboosiella* Ananthakrishnan, is excluded from the Haplothripini. An Oriental genus of leaf- and flower-living species, *Dolichothrips* Karny, includes one species in northern Australia, *D. reuteri* (Karny); *Membrothrips* Bhatti in which this species has been placed is considered a synonym. *Karnyothrips* Watson includes two species introduced to Australia, both predators of coccoids. *Priesneria* Bagnall includes three species from Australia, of which one fungus-feeding species is newly described. *Xylaplothrips* Priesner is a widespread but ill-defined, polyphyletic genus that currently includes three little-known Australian species. *Haplothrips* is the main focus of this study, and character state variation among the Australian species is discussed. In total 24 species of *Haplothrips* from Australia are recognised, 14 being new species. Also included are the following, one new generic synonym, four new species synonyms, and one new combination. The 250 species worldwide in the genus are usually associated with the flowers of Asteraceae and Poaceae. In Australia, several of the species are specific to flowers, particularly of Poaceae and Cyperaceae but not Asteraceae. Almost half of these Australian species are presumed to be predatory on other small arthropods, and two have unusual host associations—with salt marsh Chenopodiaceae, and with the sori of *Dicksonia* tree ferns.

Keywords: Flower-feeding, Haplothripini, Phlaeothripidae, predators, systematics

Introduction

The classification of the 5800 species currently recognised worldwide in the insect order Thysanoptera is the subject of considerable disagreement, and is not based on sound phylogenetic principles (Mound and Morris 2003). Two sub-orders are recognised, and molecular evidence increasingly supports a sister-group relationship between these (Morris and Mound 2003; Terry et al. 2005). The first sub-order, Terebrantia, includes eight families with a total of about 2400 species. A recent “reorganisation” by Bhatti (2006), recognising 28 families and six superfamilies within an “Order Terebrantia”, is non-phylogenetic, remaining within the phenetic tradition followed by that author in earlier publications (see Grimaldi and Engel 2005). In contrast the second sub-order, Tubulifera, includes a single family with about 3400 species (Mound 2007). This family, the Phlaeothripidae, comprises two subfamilies, and the morpho-systematics of the smaller of these, the Idolothripinae with about 700 species, has been examined extensively (Mound and Palmer 1983). In contrast, the systematic relationships amongst the species of Phlaeothripinae remain unclear, with the only proposals for formal supra-generic groupings being essentially phenetic (Priesner 1961; Bhatti 1994, 1998) through emphasising the significance of unusual autapomorphies. In examining the Thysanoptera fauna of such a geographically large and ecologically diverse area as Australia, there are thus two serious impediments: very large numbers of undescribed species exist, and there is no satisfactory classification within which to deal with them. This paper is part of a continuing effort (Crespi et al. 2004) to overcome these problems, and is focused on the species within one sub-group of the Phlaeothripinae.

Despite an increase in the past 30 years in the number of recognised Australian species of the insect order Thysanoptera from 287 to over 700 (Mound and Minaei 2006), the current total probably represents less than 50% of the real fauna. In the two most species-rich groups, the Terebrantia family Thripidae, and the Tubulifera subfamily Phlaeothripinae, there are many undescribed taxa represented in the Australian National Insect Collection, Canberra, and field surveys for these small insects have been essentially non-targeted over most parts of this continent. The primary objective of this paper is to give some account of the species diversity within the genus *Haplothrips*, this being one of the two thrips genera most frequently encountered by entomologists in Australia, and thus a group about which questions arise frequently. The second genus of particular general interest, *Thrips* Linnaeus, was fully examined recently (Mound and Masumoto 2005). A secondary objective of this paper is to reconsider one part of the weak suprageneric classification within the Phlaeothripinae, targeting those genera that are considered to be related to *Haplothrips* Amyot and Serville, and focusing particularly on genera currently known from Australia. Although far from a phylogenetic analysis, this is the first attempt in 50 years to consider the systematic relationships and biological diversity of this substantial group of insects.

Systematic problems in the Phlaeothripinae

The Phlaeothripidae is the only family recognised in the suborder Tubulifera (Mound and Morris 2007). The monophyly of this family is beyond question, and of the two recognised subfamilies, the Idolothripinae also seems likely to prove essentially monophyletic (Terry et al. 2005). However, the Phlaeothripinae is probably paraphyletic with respect to the Idolothripinae, and for the 2700 species in 360 genera currently recognised in the subfamily

there is no satisfactory suprageneric classification. Priesner (1961) proposed 10 tribal and 18 subtribal names within this group, but his system was essentially phenetic, with many of his subgroups based on particularly unusual autapomorphies that are considered now to have little phylogenetic significance. Similarly, Bhatti (1994, 1998) recognised 10 small families in this group, each comprising between one and 30 species, but with over 3000 species in the single-family Phlaeothripidae. An alternative approach to the Phlaeothripinae (Mound and Marullo 1996) built on original work by Stannard (1957) and recognised three informal lineages—the “*Haplothrips*-lineage”, the “*Liothrips*-lineage”, and the “*Phlaeothrips*-lineage”. These were weakly defined on a set of character states, both morphological and biological, and the present paper concerns the members of the first and smallest of the three. Presented here is the first attempt to discuss the character states on which membership of the lineage might be based, and to list the genera that might be considered members of this lineage.

In one of 10 proposed tribes of Phlaeothripinae, the Haplothripini, Priesner listed 34 generic names, although four of these are now placed as synonyms of *Haplothrips* and two of *Podothrips* Hood. Moreover, a few genera that he listed seem only distantly related to *Haplothrips*. The Australian genus *Asemothrips* Hood has rather broad maxillary stylets and is currently placed in the phlaeothripine tribe Docessissophothripini (Mound and Palmer 1983). Similarly, as discussed below, *Bamboosiella* Ananthakrishnan (= *Antillothrips* Stannard) is best considered a member of the “*Phlaeothrips*-lineage”, and this also applies to two Neotropical genera, *Epomisothis* Hood and *Zaliothrips* Hood, listed by Priesner (Table I); the former with rather broad maxillary stylets, and the latter with the terminal antennal segments fused (Mound and Marullo 1996). More difficult to assess are the relationships of the South African genus *Talitha* Faure, and also the rather similar *Agrothrips* Jacot-Guillarmod. Both of these involve species that are divergent from the *Haplothrips* group in the form of the male genitalia, and have a sternal glandular area in males. Unfortunately, neither of these genera is clearly defined, and the relationships of the species remain equivocal. With these changes, the Haplothripini of Priesner represents the “*Haplothrips*-lineage” of Mound and Marullo, and this tribe is redefined below.

Radiation within the Haplothripini

Of the 34 genera listed here as members of this tribe (Table II) four have not been re-examined and are included because Priesner (1961) listed them as Haplothripini. As interpreted here, this group is largely from the Old World. Only three New World radiations are involved: the small genus *Bagnalliella* Karny in which the species are all associated with the leaves of *Yucca*, and two genera of predatory species, *Leptothrips* Hood and *Karnyothrips* Watson. A fourth New World genus, *Goniiothrips* Hood, comprises a single aberrant *Haplothrips* species with the third antennal segment strongly asymmetric and

Table I. Genera excluded from the *Haplothrips* lineage.

	World distribution
<i>Antillothrips</i> Stannard = <i>Bamboosiella</i>	
<i>Asemothrips</i> Hood, 1919	Australia
<i>Bamboosiella</i> Ananthakrishnan, 1957	Oriental
<i>Epomisothis</i> Hood, 1954	Neotropical
<i>Zaliothrips</i> Hood, 1938	Neotropical

Table II. Genera of Haplothripini.

	No. of species	World distribution
<i>Agrothrips</i> Jacot-Guillarmod, 1939	8	Nearctic, Oriental, Ethiopian
<i>Ananthakrishmana</i> Bhatti, 1967	1	Oriental
<i>Androthrips</i> Karny, 1911	12	Oriental
<i>Apterygothrips</i> Priesner, 1933	41	All regions
<i>Aulothrips</i> Priesner, 1950 ^a	1	Ethiopian
<i>Bagnalliella</i> Karny, 1920	9	Nearctic
<i>Boothrips</i> Priesner, 1949 ^a	1	Ethiopian
<i>Chiraplothrips</i> Priesner, 1931	3	Ethiopian
<i>Dolicholepta</i> Priesner, 1932	10	Ethiopian and Oriental
<i>Dolichothrips</i> Karny, 1912	18	Oriental
<i>Dyothrips</i> Kudo, 1974	1	Oriental
<i>Eparsothrips</i> Strassen, 1968	1	Ethiopian
<i>Euoplothrips</i> Hood, 1918	6	Oriental and Pacific
<i>Euryaplothrips</i> Ramak. and Margab., 1931	1	Oriental
<i>Goniothrips</i> Hood, 1927	1	Nearctic
<i>Hadothrips</i> Priesner, 1925 ^a	1	Palearctic
<i>Hapedothrips</i> Bhatti, 1995	1	Palearctic
<i>Haplothrips</i> Amyot and Serville, 1843	250	All regions
<i>Karnyothrips</i> Watson, 1923	45	All regions
<i>Leptothrips</i> Hood, 1909	41	Nearctic and Neotropical
<i>Logadothrips</i> Priesner, 1929 ^a	1	Oriental
<i>Membrothrips</i> Bhatti, 1978	2	Oriental
<i>Mesothrips</i> Zimmermann, 1900	44	Oriental
<i>Neoheegeria</i> Schmutz, 1909	4	Southern Palearctic
<i>Plicothrips</i> Bhatti, 1979	2	Oriental
<i>Podothrips</i> Hood, 1913	24	All regions
<i>Praepodothrips</i> Priesner and Seshadri, 1952	7	Oriental
<i>Priesneria</i> Bagnall, 1926	2	Australia
<i>Senegathrips</i> Bournier, 1971	1	Ethiopian
<i>Sinuothrips</i> Collins, 2000	1	Southern Palearctic
<i>Talitha</i> Faure, 1958	3	Ethiopian
<i>Tamilthrips</i> Bhatti, 1995	1	Oriental
<i>Tetragonothrips</i> Moulton, 1940	1	Pacific
<i>Xylaplothrips</i> Priesner, 1925	23	All regions except Neotropical

^aNot studied; included here according to Priesner (1961).

bearing a single small sensorium. This species breeds in grass flowers in several southern States of the USA (Mound and Marullo 1996). Moreover, of the 250 recognised species of *Haplothrips* less than 20 are considered endemic to the New World, all of these being Nearctic (Mound and Marullo 1996) apart from three species of the subgenus *Trybomiella* Bagnall from south of the Tropic of Capricorn (Mound and Zapater 2003).

Systematic studies on the Thysanoptera have come largely from the northern hemisphere, thus traditionally the genus *Haplothrips* has been seen as the typical element in the Haplothripini. However, 70% of *Haplothrips* species are Holarctic, none is from the Neotropics, and most species are associated with the flowers of Asteraceae and Poaceae. This suggests that much of the radiation in the genus may have occurred relatively recently, after the separation of Africa from South America. Most species of *Haplothrips* genus have the third antennal segment bearing only one or two sensoria, and these states, as discussed below, are assumed to be derived by reduction from a plesiotypic condition involving three sensoria on the third antennal segment. This plesiotypic condition occurs in the members

of six genera in the tribe. Four of these, *Androthrips* Karny, *Euoplothrips* Hood, *Mesothrips* Zimmermann, and *Dolichothrips* Karny, are endemic to the Asian/Pacific area. Species in the first three of these live in galls induced by other thrips species, whereas species of *Dolichothrips* live in flowers and flower buds. A fifth genus, *Xylaplothrips* Priesner, constitutes a difficult systematic problem because, although many species have the plesiotypic antennal sensorium arrangement and are found invading the galls of other thrips species, the type species of the genus is probably not congeneric with these kleptoparasitic species, as discussed further below. The sixth genus, *Neoheegeria* Schmutz, is now considered to comprise a small group of southern Palaearctic species that are often associated with the flowers of Lamiaceae such as *Stachys* (Minaei et al. 2007); other species that were treated in this genus by earlier authors (Priesner, 1964) are now placed in *Haplothrips*. An undescribed species known to be the pollinator of *Macaranga* trees in South-East Asia (Moog et al. 2002), and referred to as “*Neoheegeria* sp.”, is more appropriately considered a species of *Dolichothrips*. Also similar to *Dolichothrips* is the monobasic New Guinea genus *Tetragonothrips* Moulton, despite the presence of unusually stout tergal marginal setae. The Haplothripini thus may have originated from a group of tropical leaf-feeding species, including kleptoparasitic species in galls, and radiated subsequently into the northern hemisphere as flower-feeders and as predators.

Biological diversity in the Haplothripini

This tribe apparently comprises about 34 genera worldwide, *Haplothrips* being the largest with almost 250 species, and 14 of the genera being monotypic. Most *Haplothrips* species feed and breed in flowers; very few live on leaves without feeding in flowers, although a considerable number are predators on other arthropods. Moreover, the predatory habit is typical of species in several of the smaller genera related to *Haplothrips*, and some of these are gall-invading species in the palaeotropics. Despite this, most of the gall-invading species in this tribe appear to be kleptoparasitic phytophages rather than predators. The preponderance of flower-living and predatory species in the Haplothripini can be contrasted with the situation in the two larger lineages of Phlaeothripinae: the “*Phlaeothrips*-lineage”, in which species are mainly fungus-feeding, and the “*Liothrips*-lineage” in which species are mainly leaf-feeding (Mound and Marullo 1996).

Within *Haplothrips*, about 70% of the described species are Holarctic, where they breed particularly in the flowers of Asteraceae and Poaceae. A few breed in the flowers of several other unrelated plant families, but remarkably few feed only on leaves (Mound and Zapater 2003). Predatory species of *Haplothrips* in the Holarctic are typically members of the *Haplothrips minutus* species-group, and commonly feed on mites on the branches of trees (Mound et al. 1976; Palmer and Mound 1990). But the predatory habit also occurs amongst various unrelated species within the genus in other parts of the world, including Australia (Bailey and Caon 1986) and Japan (Kakimoto et al. 2006). Moreover, within the Haplothripini there are predatory species in at least four smaller genera. *Podothrips* comprises about 30 species, mainly from the Old World tropics, and these are considered to be predators of Coccoidea living on Poaceae and Bambusaceae. *Leptothrips* comprises about 30 species from the New World that are predators of mites and Lepidoptera eggs. Members of the two genera *Karnyothrips* and *Xylaplothrips* are usually considered to be generalist predators on other small arthropods, although there is a lack of direct evidence for most of the species (Palmer and Mound 1990; Mound and Marullo 1996). In contrast, the Asian genus *Dolichothrips* is a group of phytophagous species commonly associated with

young buds, but with one undescribed species known to be a pollinator (Moog et al. 2002). Most of the species in the genera mentioned above are essentially monomorphic, with a body size rarely exceeding 2 mm. In contrast, the body size in species of *Euoplothrips* and *Mesothrips* is considerably larger, and these species are structurally polymorphic both within and between sexes. These species live in leaf galls, probably as kleptoparasites of other thrips species rather than as primary gall-inducers (Marullo 2001; Mound and Morris 2005).

Biological diversity amongst Australian Haplothripini

In the northern hemisphere *Haplothrips* species are particularly associated with the flowers of Asteraceae and Poaceae, and in Britain the genus comprises 10% of the total Thysanoptera fauna. In contrast, the composition of the Australian insect fauna is very different (Austin et al. 2004). Not only do the species of *Haplothrips* comprise scarcely 3% of the known thrips fauna of Australia, but they include no species specific to any of the highly diverse flora of Asteraceae on this continent, and very few that are specific to the equally large family Poaceae. The black plague thrips, *H. froggatti*, is abundant in grass flowers across much of Australia, and *H. bellisi* is associated with grasses near Darwin. *H. anceps* occurs in grass flowers but is particularly common in the inflorescences of certain Cyperaceae, and this family also provides the host plants for *H. gahniae* and *H. driesseni*, and possibly also for *H. avius*. Two native species are associated with a range of flowers, *H. victoriensis* in the south and *H. haideae* in the north, and three apparently introduced species are also found in flowers—*H. leucanthemi* in the south, *H. gowdeyi* in the north, and *H. robustus* across much of the continent. Two species breed in the flowers of Amaranthaceae, *H. gomphrena* and *H. varius*, and this is possibly also true for *H. ordi* despite the type series having been taken from Sapindaceae. Two species have particularly unusual host associations: *H. dicksoniae* is associated with the sori of a tree fern, and *H. salicorniae* with saltmarsh Chenopodiaceae. Two species are predatory on other small arthropods, *H. bituberculatus* and *H. collyerae*, and this is probably also true of *H. howei*, *H. lyndi*, and *H. ficii*. Also possibly predatory is *H. acaciae* that is widespread across the continent, living amongst *Acacia* phyllodes that have been webbed by spiders. The host associations of these Australian *Haplothrips* species are thus very different from the host associations found in the northern hemisphere.

The other Australian members of the Haplothripini exhibit a diversity of biologies. The species of *Euoplothrips* and *Mesothrips* appear to be leaf-feeding kleptoparasites in the galls of other thrips, particularly on *Ficus*, whereas *Androthrips* species are probably predatory on gall thrips. *Dolichothrips* species seem to be associated with flower buds. The species in *Apterygothrips* and *Dyothrips* live in grasses and are probably phytophagous, whereas *Podothrips* species all live in grasses but appear to be predators on coccoids. The two recorded species of *Karnyothrips*, both introduced, are also scale insect predators.

Character states in the Haplothripini

Members of the Haplothripini share most of the following character states: antennal segment III with one, two or three sensoria, IV with four (rarely fewer) sensoria; antennal segment VIII distinct but broadly-based; head with maxillary bridge present; compound eyes not reduced; pronotum with notopleural sutures complete and five pairs of major

setae developed; prosternal basantra well developed; metathoracic sternopleural sutures not developed; macropterous, fore wing constricted medially; pelta triangular; male with tergite IX setae S2 short and stout, sternite VIII without glandular area, pseudovirga slender.

Antennal segment III sensoria

In this tribe, the plesiomorphic condition of the third antennal segment presumably involved three sensoria, two on the outer apical margin and one on the inner. However, this condition is retained in only a few members of the tribe, including *Androthrips*, *Dolichothrips*, *Euoplothrips*, *Mesothrips*, and *Neoheegeria*, together with some of the species currently placed in *Xylaplothrips*. Most haplothripine species bear only two sensoria on this segment, one on the outer and one on the inner apical margins, but within *Haplothrips*, and also within *Podothrips*, a considerable number of apparently unrelated species have lost the inner sensorium and thus bear only one of these structures. Of particular interest is a new species described below, *H. fici*, in which most of the available specimens have one sensorium on the third segment, but a few specimens from the same series have two equally large sensoria. Recent examination of one paratype of the African genus *Senegathrips* failed to confirm the presence of more than two sensoria on the third antennal segment, despite the original description reporting four sensoria. Observations on the number of antennal sensoria require specimens to be slide mounted to a high standard, and often require the use of a $\times 100$ oil-immersion lens.

Antennal segment IV sensoria

The plesiomorphic condition of the fourth antennal segment presumably involved four sensoria, two on the outer apical margin and two on the inner, and this condition is retained in most species of Haplothripini. However, the number has been reduced to three or to two in several unrelated groups of species, including species of *Apterygothrips*, *Podothrips*, and *Haplothrips*. In South Africa, *H. stoffbergi* Faure was described as having only three sensoria on this segment, and *H. callani* Faure as having only two. In Australia, *H. bituberculatus* usually has four sensoria on segment IV but often has only three, and the left and right antennae of single individuals commonly have a different number of sensoria. *H. collyerae*, described originally from New Zealand in *Apterygothrips*, has two major sensoria together with a third small one on the fourth segment, and two new species are described below with only two sensoria on the fourth segment, including the continent-wide *H. acaciae*. Most of the *Haplothrips* species mentioned in this paragraph have two sensoria on the third antennal segment; the exceptions are *H. stoffbergi* and a new Australian species, *H. dicksoniae*, both of which have one sensorium on the third segment and three on the fourth (also *H. fici* in which the third segment has either one or two sensoria). Reduction in the number of sensoria on both of these antennal segments is therefore assumed to have occurred independently more than once within the Haplothripini, and this must be taken into account when considering relationships.

Antennal segment shape

The members of Haplothripini have eight distinct antennal segments, but the eighth is more or less broadly based in almost all of the species (Figures 16–28). In contrast, the

seventh segment is usually pedicellate, but is broadly based in two grass-living species in Australia. The third segment varies in shape in association with the number of sensoria that it bears; it tends to be more symmetrical when two sensoria are present than when three or only one are present. The base of the third segment is swollen into a ring-shaped ridge in the species placed in *Priesneria* (Figure 5), but this structure is probably not a good indicator of relationships, because two species of *Podothrips* are now known with a similar swelling (Figure 28), and a ring at the base of this segment occurs in one or more species within distantly related genera, including *Jacotia* (see Mound 1995) and *Carientothrips* (see Mound 1974).

Maxillary bridge

The anterior ends of the maxillary guides are linked by a maxillary bridge in the head of all members of the Haplothripini, and the length of this bridge, that is, the distance between the maxillary stylets, differs between species. However, a maxillary bridge occurs also in a few unrelated taxa in the “*Phlaeothrips*-lineage”, its presence thus being either plesiomorphic or homoplastic. The form of the bridge, and the extent to which the maxillary stylets are retracted into the head, are characters that must be used with caution, because they are often distorted during microslide preparation.

Compound eyes

Reduction in size of the compound eyes, sometimes to only a few ommatidia, is widespread amongst members of the “*Phlaeothrips*-lineage”, but it is rare in the “*Liothrips*-lineage” and the Haplothripini.

Prothoracic notopleural sutures

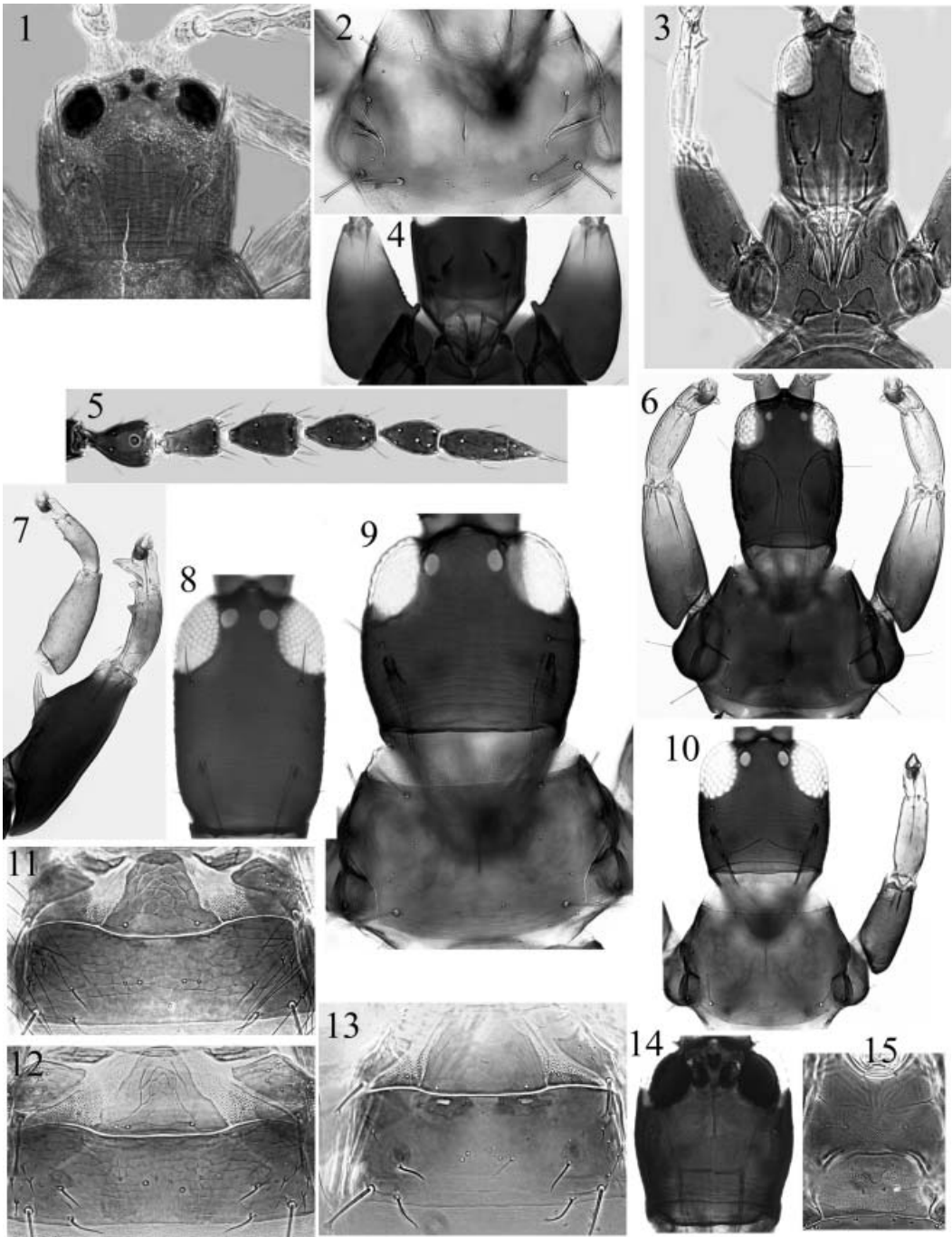
These sutures (=epimeral sutures) delimit a pair of sclerites at the posterolateral angles of the pronotum. They are complete, extending to the posterior margin of the pronotum, in almost all the members of the Haplothripini, one exception in Australia being *Dyothrips pallescens* (Figure 2).

Pronotal setae

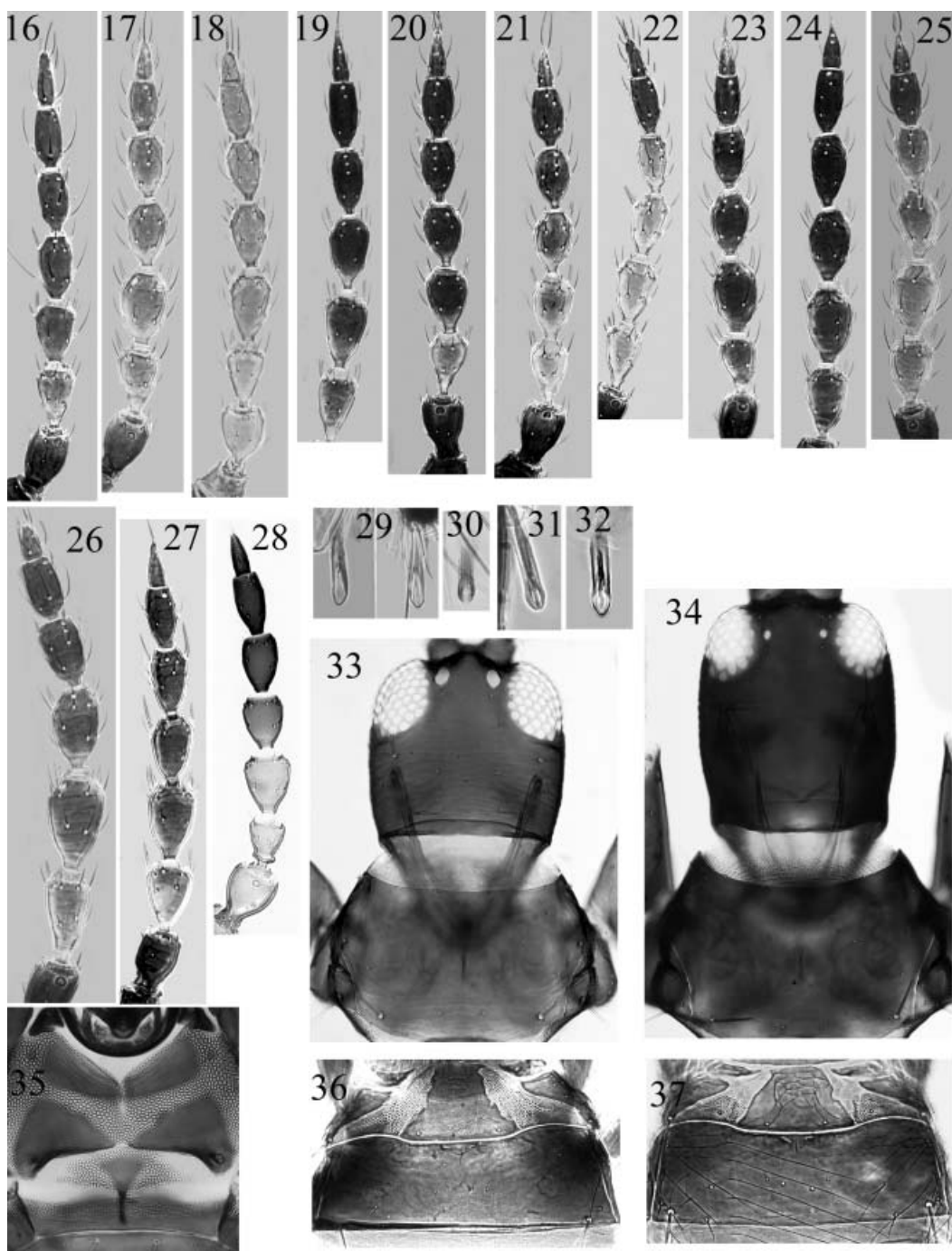
The pronotum of Phlaeothripidae plesiotypically bears five pairs of major setae: anteromarginals (am), anteroangulars (aa), midlaterals (ml), epimerals (ep), and posteromarginals (pa). Many species in the Haplothripini have all five pairs of these setae well developed, but reduction of one or more pairs is not uncommon, and *Haplothrips timori* is described below with only the epimeral setae developed. The form of the apices of the major setae is often considered in the descriptions of these thrips, being variously described as “pointed” or “blunt”, but the interpretation of such differences often depends on the magnification and type of microscope illumination used.

Prosternal basantra

The presence of well-developed basantra (=praepectus) appears to be an autapomorphy for the Haplothripini. However, these structures also occur in some members of the



Figures 1–15. (1) *Bagnalliella nigricoxae*, holotype. (2) *Dyothrips pallescens*, pronotum. (3) *Dolichothrips reuteri*, mouth cone. (4) *Androthrips monsterae*, fore femora. (5) *Priesneria peronis*, antenna. (6) *Karnyothrips melaleucus*, head, pronotum, and fore legs. (7) *Euoplothrips bagnalli*, fore legs of small and large males. (8) *Mesothrips jordani*, head. (9) *Haplothrips acaciae*, head and pronotum. (10) *H. anceps*, head, pronotum, and right fore leg. (11) *H. acaciae*, pelta. (12) *H. anceps* pelta. (13) *H. angusi* pelta. (14) *H. avius*, head. (15) *H. angusi*, prosternites.



Figures 16–37. (16–28) Antennae: (16) *Haplothrips acaciae*; (17) *H. anceps*; (18) *H. angus*; (19) *H. avius*; (20) *H. collyerae*; (21) *H. dicksoniae*; (22) *H. fici*; (23) *H. froggatti*; (24) *H. gomphrenae*; (25) *H. gowdeyi*; (26) *H. timor*; (27) *H. victoriensis*; (28) *Podothrips barrowi*. (29–32) Pseudovirgae: (29) *H. anceps*, pseudovirga of two males; (30) *H. driesseni*; (31) *H. leucanthemi*; (32) *H. victoriensis*. (33) *H. bellisi*, head and pronotum. (34) *H. collyerae*, macroptera, head, and pronotum. (35) *H. collyerae*, prosternites. (36) *H. collyerae*, pelta. (37) *H. dicksoniae*, pelta.

“*Phlaeothrips*-lineage”, and the weak sclerotisation of the basantra in *Bamboosiella* species suggests that this genus is probably not related to *Haplothrips*.

Fore leg armature and polymorphism

The fore tarsus of many species in this lineage bears a triangular tooth on the inner margin, this being particularly large in larger males. In the species of *Karnyothrips* this tooth arises closer to the apex of the fore tarsus and is directed forwards rather than at right angles to the tarsal axis (Figure 6). A similar tarsal tooth (Figure 41) occurs in several species of Australian *Haplothrips*. This “fore tarsal tooth” appears to be homologous with the “inner hamus”, a prolongation of the inner apex of the fore tarsus. The different shapes and positions of the tooth presumably result from differing developmental growth rates of the tissues around the inner apex of the tarsus. This is particularly evident in species such as *H. gomphrenae*, in which the male has the tarsal tooth lateral but the female has a small distal tooth. The fore tibia in most *Podothrips* species bears a sub-apical tubercle on the inner margin (Figure 64). In *Euoplothrips* species the fore tibia bears a series of tubercles on the inner margin, and the fore femur bears a long stout tubercle medially, particularly in large individuals (Figure 7). *Androthrips* species have a particularly characteristic swollen fore femur, with a series of minute tubercles distal to a pointed sub-basal spur (Figure 4). Enlarged fore legs occur in large males of various *Haplothrips* species, but polymorphism and enlarged fore legs are much less common in the Haplothripini than in species of the other two lineages, suggesting that male/male competition is of lesser significance among these species.

Mesopresternum

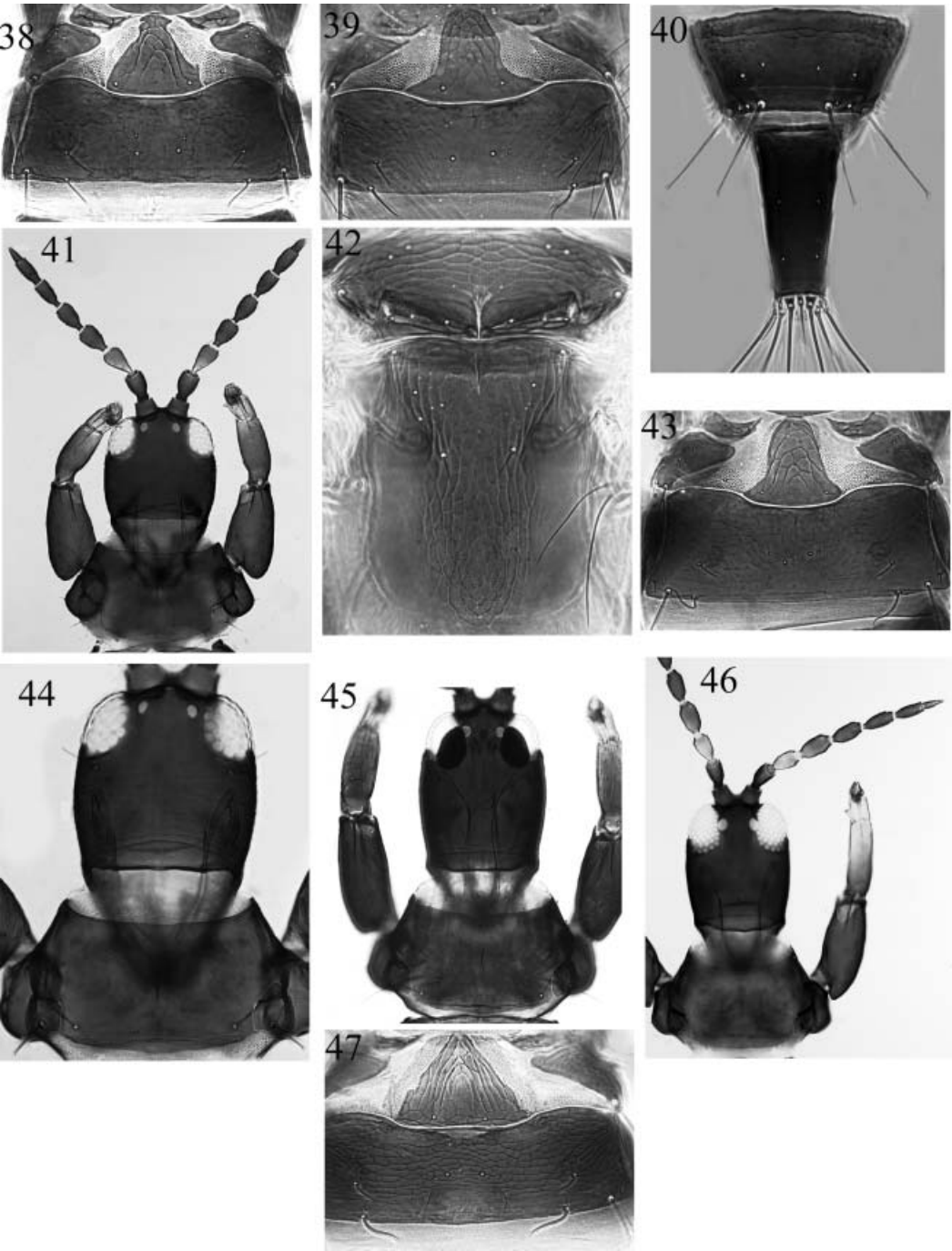
This sclerite is usually transverse and boat-shaped in the members of Haplothripini (Figures 35, 63). However, it is often eroded medially and thus reduced to a pair of lateral triangles on the meso-eusternal anterior margin (Figure 15).

Metathoracic sternopleural sutures

These sutures, extending posteriorly from the mid-coxal cavities, are usually present in Phlaeothripidae, but are generally not developed, or only faintly indicated, in members of the Haplothripini. They are well developed in species of *Talitha*, and also occur in one species of *Neoheegeria* (Minaei et al. 2007).

Wing development and shape

The fore wings of members of the Haplothripini are more or less constricted medially, and this appears to constitute another autapomorphy of the group. Moreover, wing reduction is not common among the members of this tribe. Micropterous and apterous species are rare, and such species are usually segregated to the genus *Apterygothrips*; the phylogenetic significance of this is clearly limited. Two new species are described below in the genus *Haplothrips* of which one is known only from apterous adults of both sexes, and the other has short-winged males and fully winged females. Moreover, *Apterygothrips collyerae*, in which wings are present or absent, is here transferred to *Haplothrips*. Similarly difficult to assess is the absence of duplicated wing cilia from the posterior margin near the fore wing



Figures 38–47. (38) *Haplothrips driesseni*, pelta. (39) *H. fici*, pelta. (40) *H. fici*, tergites IX and X. (41) *H. gahniae*, head and pronotum. (42) *H. froggatti*, meso and metanota. (43) *H. gahniae*, pelta. (44) *H. dicksoniae*, head and pronotum. (45) *H. driesseni*, head and pronotum. (46) *H. gomphrenae*, male, head and pronotum. (47) *H. gomphrenae*, pelta.

apex. Species of *Haplothrips* that lack duplicated cilia are usually placed in a subgenus, *Haplothrips* (*Trybomiella*), but this group also appears to be polyphyletic, being based on this single “loss apomorphy”.

Pelta

The first abdominal tergite is reduced to a median pelta in Phlaeothripidae, the shape of which often seems to be a good indicator of relationships (Figures 11, 13). Within the Haplothripini the pelta is usually triangular, whereas in members of the “*Phlaeothrips*-lineage” the posterior margin of the pelta is broader, thus producing a bell-shaped structure as is found in members of the genus *Bamboosiella*.

Tergal chaetotaxy

The abdominal tergites of Phlaeothripidae typically bear two pairs of sigmoid wing-retaining setae, although these setae are reduced or even absent in wingless individuals such as some members of *Apterygothrips*. Within the Haplothripini, species of *Euoplothrips* and *Mesothrips* have at least one extra pair of small sigmoid setae anterolateral to the main two pairs, and this is also true in Asian species of *Dolichothrips*. Most *Haplothrips* species have a series of small straight discal setae on tergites II–IV lateral to the wing-retaining setae. However, new species are described below that lack these setae. The anal setae are usually no more than 1.5 times as long as the tube, although in *Karnyothrips* species they are more than 2.0 times longer than the tube.

Male tergite nine

Phlaeothripidae typically have three pairs of major setae on the ninth abdominal tergite, and males in the Phlaeothripinae usually have the second pair, S2, much shorter and stouter than S1 and S3. This condition is constant among the members of the Haplothripini, although it is variable in the “*Liothrips*-lineage” sometimes even within species (Del-Claro and Mound 1996).

Male sternal glandular areas

In contrast to males in the Idolothripinae, the males of Phlaeothripinae commonly have a glandular area on the eighth abdominal sternite. Despite this, within the Haplothripini a glandular area is developed rarely on this sternite, being found only in some New World species that are placed in *Karnyothrips*, as well as in species of *Talitha* and *Agrothrips*.

Male pseudovirga

The shape of the apex of the aedeagus has been used as a species discriminant in the genus *Haplothrips*. However, microslide preparation of male genitalia is difficult, and no author ever states how many such slides have been prepared and studied. There is thus no statistical basis for evaluating the possibility of variation in these structures. In the studies reported here, only one Australian species, *H. froggatti*, has been noted to have a distinctive narrow apex to the pseudovirga, sometimes with a pair of small apical swellings; this has been confirmed with many slides but is very difficult to photograph. In contrast, despite the

preparation of many slides, no differences have been found between the pseudovirgal apices of the Australian species *H. anceps*, *H. driesseni*, and *H. victoriensis*, these being essentially similar to the genitalia of the European species *H. leucanthemi* (Figures 29–32).

Australian taxa excluded from Haplothripini

Contrary to Pitkin (1973, 1976) the following taxa are considered here to be unrelated to *Haplothrips*.

“*Bagnalliella*” *nigricoxae* Girault

Bagnalliella nigricoxae Girault 1929, p 1.

Described from a single inadequately slide-mounted specimen (Figure 1), this is one of several species described by Girault that cannot at present be recognised satisfactorily (Mound 1996). Superficially it is similar to *Haplothrips lyndi* described below, but it has a much longer basal stem to the fourth antennal segment and is probably only distantly related. The third antennal segment bears only one sensorium, the fore wings have no duplicated cilia and are possibly not constricted medially, and the maxillary bridge, prosternal sclerites, and pelta are not visible. There is thus no reason to consider the species a member of *Haplothrips*, as decided provisionally by Pitkin (1973), although placement in the North American genus *Bagnalliella* is equally unjustified.

Bamboosiella Ananthakrishnan

Bamboosiella Ananthakrishnan 1957, p 65. Type species: *Bamboosiella bicoloripes* Ananthakrishnan.

Antillothrips Stannard 1957, p 35. Type species: *Antillothrips graminatus* Stannard.

This genus was treated by Pitkin (1973, 1976, 1977), under the synonymic name *Antillothrips*, as being related to *Haplothrips*. However, it seems more likely to be a member of the “*Phlaeothrips*-lineage” (Okajima 2006), because the expanded base of the pelta is unlike that of any member of the Haplothripini, the maxillary bridge is not developed, and the prosternal basantra are very weakly developed or entirely absent. In total, 27 species are listed in the genus, mostly from South-East Asia (Okajima 1995), with one species widespread around the world in association with various Poaceae, and two known from Australia.

Recognition

Body bicoloured, maxillary stylets short and scarcely retracted anterior to postoccipital ridge; antennae eight-segmented, III with two sensoria, IV with three sensoria; fore tarsus without tooth; fore wings usually without duplicated cilia; tergite IX setae S1 as long as tube; male without sternal glandular area.

Key to *Bamboosiella* species from Australia

1. Abdominal segments VIII–IX dark brown; pronotal anteromarginal setae capitate and as long as anteroangulars *cingulata*

- Abdominal segments VIII–IX as yellow as IV–V; pronotal anteromarginal setae acute and shorter than anteroangulars *australis*

***Bamboosiella cingulata* (Hood)**

Zygothrips cingulatus Hood 1919, p 80.

Although widespread on grasses around the tropics (Pitkin 1977), the male of this species is not known. Females have been studied from Australia only from north of the Tropic of Capricorn, from the vicinity of Townsville, Cairns, and Darwin.

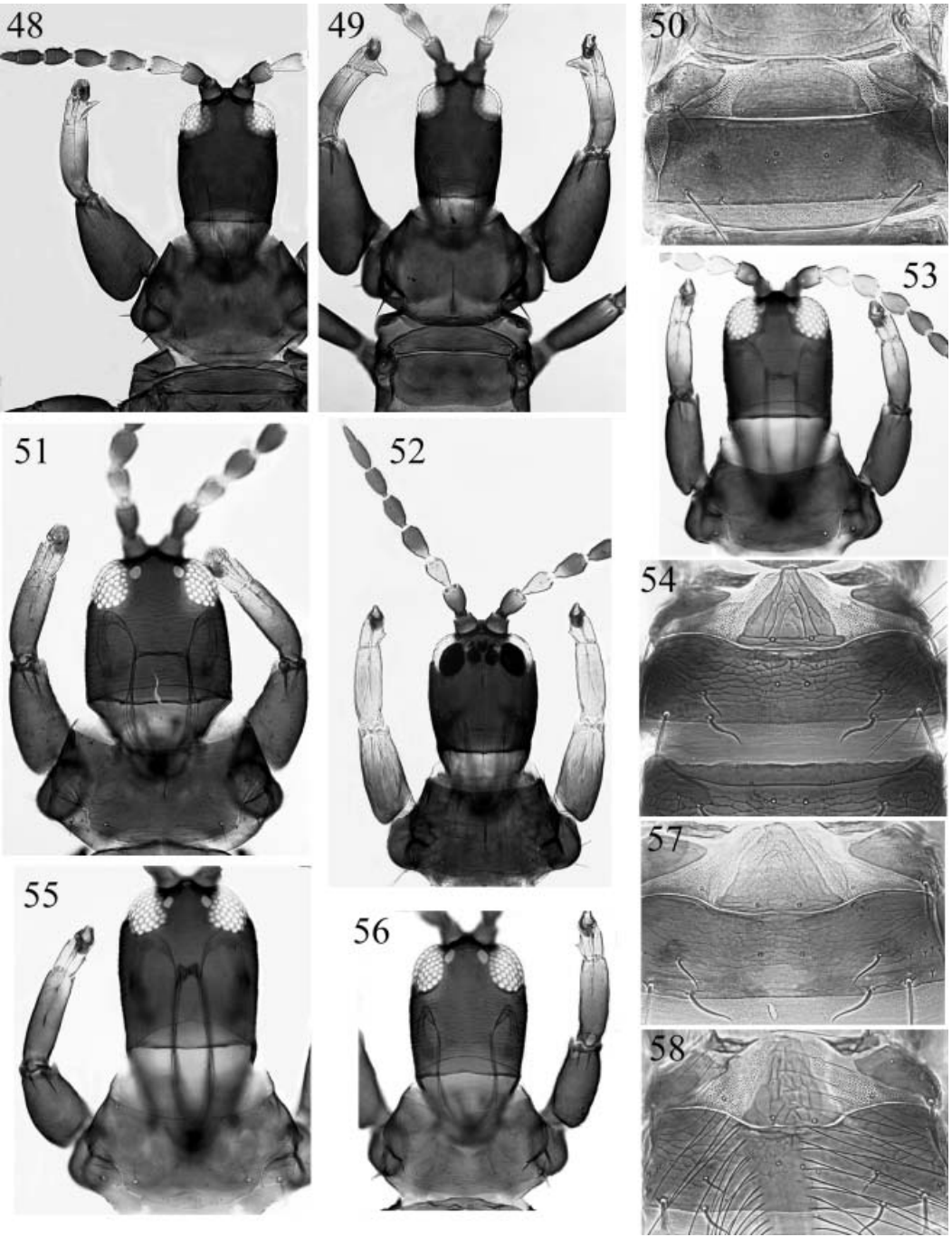
***Bamboosiella australis* (Pitkin)**

Antillothrips australis Pitkin 1977, p 54.

Known only from a few specimens of both sexes taken in eastern Australia (SE Queensland, and NSW near Sydney and Bateman's Bay), this species closely resembles *B. cingulata* apart from the differences noted in the key above.

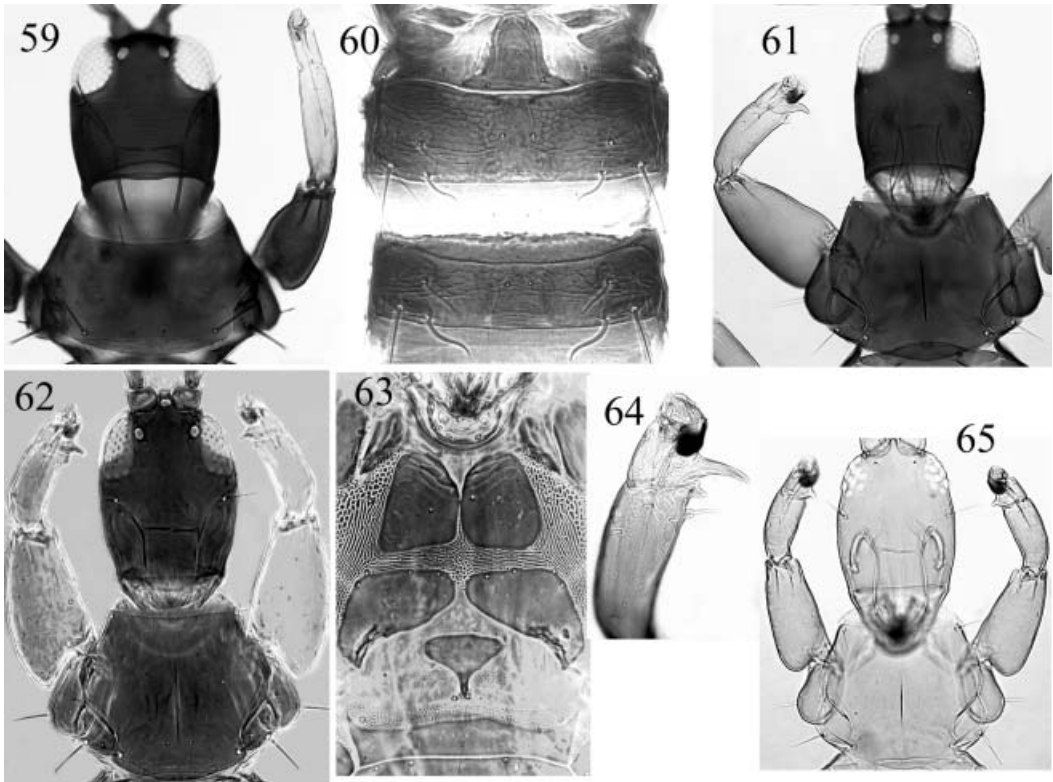
Key to genera of Haplothripini from Australia

1. Antennal segment III with three sensoria 2
 - Antennal segment III with none or one or two sensoria 6
2. Fore femur inner margin with a tubercle either medially or near base 3
 - Fore femur without tubercles on inner margin 4
3. Fore femur inner margin with a tubercle near base and an irregular row of small papillae medially (Figure 4); fore tibia without tubercles on inner margin . . . *Androthrips*
 - Fore femur inner margin with pointed tubercle medially (Figure 7), fore tibia with one or more tubercles on inner surface *Euoplothrips*
4. Mesopresternum complete and boat-shaped (cf. Figure 63); mouth cone rounded *Xylaplothrips*
 - Mesopresternum divided into paired lateral triangles (Figure 3); mouth cone pointed 5
5. Mouth cone long and pointed, extending posteriorly between fore coxae (Figure 3); head with no setae on cheeks; in flowers and buds. *Dolichothrips*
 - Mouth cone long and pointed but directed ventrally; head sharply constricted to basal neck, with several prominent setae on cheeks (Figure 8); in galls . . . *Mesothrips*
6. Pronotum with notopleural sutures incomplete (Figure 2) [fore wings slender without duplicated cilia; antennal segment III with one sensorium, IV with four sensoria; body sharply bicoloured, metathorax and abdominal segment I yellow in contrast to brown body] *Dyothrips*



Figures 48–58. (48) *Haplothrips howei* holotype. (49) *H. howei*, male. (50) *H. howei*, pelta. (51) *H. leucanthemi*, head and pronotum. (52) *H. lyndi*, head and pronotum. (53) *H. ordi*, head and pronotum. (54) *H. ordi*, pelta. (55) *H. salicorniae*, head and pronotum. (56) *H. timori*, head and pronotum. (57) *H. salicorniae*, pelta. (58) *H. timori*, pelta.

- Pronotum with notopleural sutures complete 7
- 7. Fore tibia inner margin with a sub-apical tubercle; prosternal basantra longer than wide (Figure 63) *Podothrips*
- Fore tibia inner margin without a sub-apical tubercle; basantra at most as long as wide 8
- 8. Antennal segment III with sub-basal ring (Figure 5) *Priesneria*
- Antennal segment III without a sub-basal ring (Figures 16–28) 9
- 9. Wings usually absent; antennal segment III with one sensorium, IV with two sensoria *Apterygothrips*
- Wings usually fully developed; antennal segment III with one or two sensoria, IV usually with four sensoria, rarely with three or two 10
- 10. Anal setae at least 2.0 times as long as tube; fore tarsal tooth directed forwards at inner apex of fore tarsus (Figure 6); pronotal anteromarginal setae no longer than discal



Figures 59–65. (59) *Haplothrips victoriensis*, head and pronotum. (60) *H. victoriensis*, pelta. (61) *Podothrips ardis*, head and pronotum. (62) *P. australis*, head and pronotum. (63) *P. australis*, prosternites. (64) *P. lucasseni*, fore tibia. (65) *P. barrowi*, head and pronotum.

setae *Karnyothrips*

- Anal setae shorter, no more than 1.5 times as long as tube; fore tarsal tooth present or absent and varying in structure; pronotal anteromarginal setae usually longer than discal setae *Haplothrips*

Androthrips Karny

Androthrips Karny 1911, p 560. Type species: *Mesothrips melastomae* Zimmermann.

The species in this genus are considered “gall thrips” but they are probably kleptoparasites or predators rather than gall inducers. A total of 12 species have been named, but apart from a key to five species from India (Ananthakrishnan and Sen 1980), most of these cannot be identified without re-examining original material. Of these named species, 11 are from the Oriental Region: four were described from India or Sri Lanka, four from Indonesia between Java and Papua, and one each from China, Taiwan, and the Philippines. The 12th species is based on a single male specimen from Cameroon that is presumed to have been lost (Pitkin and Mound 1973).

Androthrips monsterae (Moulton)

Podothrips monsterae Moulton 1940, p 267.

Androthrips monsterae (Moulton) Ritchie 1974, p 264.

Described from two females and one male taken on the leaves of *Monstera deliciosa* at Koitaki, New Guinea, this species is here recorded from Australia for the first time. It has been taken from rolled leaf galls on five unrelated plants in the Northern Territory: *Alyxia spicata* (Apocynaceae), *Antidesma ghesembilla* (Euphorbiaceae) and *Smilax australis* (Smilacaceae) at Darwin, *Timonius timor* (Rubiaceae) at Kakadu, and *Choriceras tricornis* (Euphorbiaceae) on the Cobourg Peninsula. The galls on these plants were induced by different undescribed species of the *Teuchothrips* complex. As indicated by Ritchie (1974), this species is similar to *A. flavitibia* Moulton, described on one female from northern India. It is also similar to *A. kurosawai* Priesner from the Philippines, although Reyes (1994) incorrectly stated that that species has only two sensoria on the third antennal segment whereas it actually has three (pers. comm. Richard zur Strassen, in litt. 2006). These three names possibly represent a single widespread species that has brown femora but yellow tibiae.

Recognition

Varying considerably in body size; body and femora brown, tibiae and tarsi yellow; antennal segments III–VI largely yellow; fore wings pale. Antennae eight-segmented, III with three sensoria, IV with four. Postocular setae longer than distance between eyes, weakly capitate. Pronotal am setae minute, four pairs of major setae long and capitate. Fore femur inner margin in both sexes with sub-basal spur and an irregular row of small tubercles (Figure 4), this spur and also fore tarsal tooth largest in large individuals. Prosternal basantra present; mesopresternum almost complete medially. Metanotum with several small setae on anterior half. Fore wings constricted medially, with 5–10 duplicated cilia. Tergites II–VI with two pairs of sigmoid setae; tergite IX setae S1 weakly capitate and about 0.8 as long as tube. Male tergite IX S2 short and stout.

***Apterygothrips* Priesner**

Apterygothrips Priesner 1933, p 1. Type species: *Apterygothrips haloxyl* Priesner.

This genus was last redefined by zur Strassen (1966) to include eight species, but has been used subsequently to include any species resembling *Haplothrips* in general appearance but either lacking wings or with the wing-retaining setae reduced. Currently there are 41 species worldwide that are listed in this genus, but these are unlikely to represent a single lineage. Wing reduction and wing loss have clearly occurred more than once within the Haplothripini, and not always in closely related species, and *Apterygothrips* is presumably a polyphyletic assemblage. Furthermore, in this paper one fully apterous species is described in *Haplothrips*, a second new species is described in which the females are macropterous but the males micropterous, and the wing polymorphic species, *Apterygothrips collyerae*, is here transferred to *Haplothrips*.

Among the species currently placed in *Apterygothrips* there appears to be one species-group of grass-living thrips, and the only known Australian member of the genus, *A. australis*, belongs to this group. A second Australian species of wingless Haplothripini has been studied from Kununurra in the north of Western Australia. This species was living on dead twigs, and apparently represents an undescribed apterous species that is related to the “*Apterygothrips*” species from dead wood in India (Pitkin 1976). One of these Indian species, with two sensoria on the fourth antennal segment and the pterothorax exceptionally apteriform, was designated type species of *Tamilthrips* Bhatti (1995), but the phylogenetic significance of such a genus based essentially on extreme wing loss remains open to question.

***Apterygothrips australis* Pitkin**

Apterygothrips australis Pitkin 1973, p 328.

This is a common species in grasses that is widespread across southern Australia, having been taken near Brisbane, Sydney, Canberra, Adelaide, and Perth. Pitkin (1973) refers to two macropterous females out of a total of 71 specimens examined, but pointed out that some micropterous individuals have the tergal wing-retaining setae more or less developed.

Recognition

Usually micropterous, wing lobe less than 0.25 of thorax width; colour light brown, antennal segment III and all tarsi yellow; antennal segment III with one sensorium, IV with two; head with maxillary stylets not retracted to postocular setae, about one-third of head width apart; postocular setae capitate, also all five pronotal setae, one sub-basal wing seta, and setae S1 and S2 on tergite IX; fore tarsus with small tooth.

***Dolichothrips* Karny**

Dolichothrips Karny 1912, p 299. Type species: *Dolichothrips longicollis* Karny.

Membrothrips Bhatti 1978, p 226. Type species: *Neoheegeria indica* Hood, 1919. syn. n.

The genus *Membrothrips* was erected for a single species, and the Australian species discussed below was added subsequently. The genus was differentiated from the South-East Asian genus *Dolichothrips* because of the absence of additional pairs of sigmoid setae lateral to the two pairs of tergal wing-retaining setae, and also because the pseudovirga of the male genitalia is not slender. The first of these character states appears to be related to

body size, and the second fails to take into account the variation in male genitalia amongst Haplothripini that are not associated with flowers. *M. indicus* has not been re-examined for this paper, but *M. reuteri* is essentially similar in structure and colour to *Dolichothrips macaranga* Moulton that lives on *Macaranga tanarius* in Taiwan. The differences between them in tergal chaetotaxy appear to be related to the differences in their body size. All of the *D. reuteri* specimens collected from *Macaranga* in Australia are much smaller than those collected from this plant in Taiwan. These smaller specimens all lack the additional tergal sigmoid setae that are present in the Taiwan specimens. Moreover, the species that is known to pollinate *Macaranga* species in Asia (Moog et al. 2002), and was referred to as “*Neoheegeria* sp.”, varies considerably in size, and the larger individuals have additional sigmoid setae on the tergites but not the smaller specimens from the same series. The genus *Dolichothrips* is closely related to the genus *Mesothrips*, although the species of one live in flowers and buds, whereas the species of the second live in galls.

Recognition

Dark brown species with little sexual dimorphism; antennae eight-segmented, III with three sensoria, IV with four; head longer than wide, postocular setae acute, mouth cone pointed and extending between fore coxae (Figure 3); fore tarsus with tooth minute in female, larger in male; fore wing constricted medially, with duplicated cilia; basantra well developed, mesopresternum forming two triangles; metanotum weakly reticulate; tergites usually with additional pairs of wing-retaining setae lateral to the two major pairs; tergite IX setae long and acute.

Dolichothrips reuteri (Karny)

Liothrips reuteri Karny 1920, p 40.

Reported to be based originally on a single female collected at “Cedar Creek” Queensland (deposited in the Museum at Stockholm), a second female with identical data is present in the collections of the Senckenberg Museum, Frankfurt. This dark brown species with bright yellow tibiae has been collected more recently in considerable numbers at Paluma and Cape Tribulation in northern Queensland, and also around Darwin in Northern Territory. At these localities it was found in the apical buds of both *Macaranga tanarius* and *Hibiscus tiliaceus*, two plants that grow commonly along the shore. None of the available specimens has additional sigmoid setae on the abdominal tergites.

Dyothrips Kudo

Haplothrips (*Dyothrips*) Kudo 1974, p 114. Type species: *Haplothrips* (*Trybomiella*) *cingulatus* Pelikan, now considered a synonym of *Zygothrips pallescens* Hood.

Although considered a genus by Bhatti (1995), the phylogenetic position of the single species involved possibly lies within the genus *Haplothrips*. It differs from the species in that genus in having the prothoracic notopleural sutures incomplete (Figure 2). The statement by Bhatti (1995) that it also differs in having a complete mesopresternum is incorrect, because this character state occurs in *H. aculeatus*, the type species of *Haplothrips*, as well as several other members of the genus. Although stated by Kudo to have a long mouth cone, the apparent length of this structure depends largely on slide-mounting procedures, because the mouth cone is directed ventrally in life and can rotate posteriorly under coverslip pressure. Despite the lack of duplicated wing cilia, the relationships of *Dyothrips*

probably do not involve *Trybomiella*, but the genus is retained here until such time as molecular data become available.

***Dyothrips pallescens* Hood**

Zygothrips pallescens Hood 1919, p 78.

Described originally from Queensland, and subsequently from China, the synonyms of this species are listed by Pitkin (1973). It is now recorded from Australia, Bangladesh, China, Fiji, India, Pakistan, Thailand, Taiwan, and Japan (Okajima 2006), and also New Caledonia (Bournier and Mound 2000). A grass-living species, specimens have been seen in Australia from coastal regions between Brisbane and Cairns, and also around Darwin.

Recognition

Macropterous and distinctively bicoloured; body light brown with metathorax and first abdominal segment yellow, antennal segments III–VI yellow, also all tarsi and apices of tibiae; wing pale. Head longer than wide, antennal segment III with one sensorium, IV with four; postocular setae capitate, also all five pronotal setae and tergite IX S1 and S2; fore tarsal tooth not present in either sex; prothoracic notopleural sutures incomplete.

***Euoplothrips* Hood**

Euoplothrips Hood 1918, p 140. Type species: *Euoplothrips bagnalli* Hood.

Six species are known in this genus, two from Australia, three from Pacific islands, and one from India, although the identity and affinities of the latter species remain in doubt. Marullo (2001) provided a key to these species, and indicated that they appear to be kleptoparasites within leaf galls induced by other thrips species. In general *Euoplothrips* are associated with *Gynaikothrips* species in *Ficus* rolled leaves, although *E. bagnalli* occurs in leaves galled by various thrips species on several unrelated plants.

Recognition

Dark brown species exhibiting size-correlated polymorphism in fore leg armature; antennae eight-segmented, III and IV each with three sensoria; fore femur of both sexes with median spur on inner margin (Figure 7), fore tibia with two small tubercles on inner margin, fore tarsus with stout tooth; prosternal basantra small; fore wings constricted medially; tergites II–VI with additional sigmoid setae lateral to the major wing-retaining setae.

Key to *Euoplothrips* species from Australia

1. Antennal segment III with light brown marking; fore tibial median tubercle almost parallel-sided and arising laterally on inner margin. *bagnalli*
- Antennal segment III clear yellow; fore tibial median tubercle broadly conical and arising dorso-laterally *platypodae*

***Euoplothrips bagnalli* Hood**

Euoplothrips bagnalli Hood 1918, p 141.

Described from northern Queensland, this species has been found along the east coast as far south as Sydney, and was described under a synonymic name from Papua New Guinea (Marullo 2001). It has been taken from thrips galls on the following unrelated plants: *Alyxia spicata* (Apocynaceae), *Citriobatus pauciflorus* (Pittosporaceae), *Ficus macrophylla* (Moraceae), *Smilax australis* (Smilacaceae), and *Tetrastigma nitens* (Vitaceae). The smallest male has the tubercles scarcely developed on the fore femur and fore tibia.

***Euoplothrips platypodae* Marullo**

Euoplothrips platypodae Marullo 2001, p 97.

This species is closely similar to *E. bagnalli*, but is known only from *Ficus platypoda* in the northern part of Western Australia, where it was found living in galls induced by an undescribed species of *Gynaikothrips*.

***Haplothrips* Amyot and Serville**

Haplothrips Amyot and Serville 1843, p 640. Type species: *Phloeothrips albipennis* Burmeister.

Haplothrips (*Trybomiella*) Bagnall 1926, p 548. Type species: *Anthothrips bagnalli* Trybom.

The subgenus *Trybomiella* has been used to include 18 species of *Haplothrips*, each of which lacks fore wing duplicated cilia, but the variation amongst these species suggests that the subgenus is probably polyphyletic. Despite this, some of the species from Australia, South Africa, and southern South America (Mound and Zapater 2003) are sufficiently similar to each other to suggest that they might constitute a lineage distinct from the rest of the genus. In the absence of any molecular data bearing on this morphologically homogeneous group, the genus *Haplothrips* is interpreted broadly. Molecular data are needed to test relationships, both within this large genus, and with such satellite genera as *Apterygothrips*, *Karnyothrips*, and *Xylaplothrips*. The genus now includes rather more than 260 described species worldwide.

Recognition

Usually macropterous, rarely with wings reduced or absent. Body colour usually brown, antennal segment III commonly paler, fore wings usually pale except for basal area. Head usually a little longer than wide, maxillary stylets deeply retracted, rarely less than one-third of head width apart, maxillary bridge well developed. Vertex not strongly sculptured, postocular setae usually capitate and extending beyond posterior margin of eyes, rarely short and acute. Antennal segment III with one or two sensoria (rarely none), segment IV usually with four sensoria but sometimes only two or three; antennal segment VIII usually short and broad at base. Pronotum usually with five pairs of capitate setae, but sometimes one or more of these no larger than discal setae; epimeral sutures complete; prosternum with four sclerites, paired basantra and paired ferna, also a median spinasternum; mesopresternum either complete, or eroded to paired lateral triangles. Metanotum weakly sculptured, median pair of setae usually arising on anterior half of sclerite. Fore tarsus usually with tooth present laterally or near inner apex; tooth sometimes large in large males; mid and hind tarsi with ventrolateral hamus present. Fore wing constricted medially, duplicated cilia usually present; three pairs of sub-basal setae. Male with no glandular area on sternite VIII; tergite IX setae S2 short and stout; pseudovirga of aedeagus slender.

Key to *Haplothrips* species from Australia

1. Antennal segment III with one sensorium, at outer apical margin only 2
 - Antennal segment III with two sensoria, one at outer apical margin and one at inner 8
2. Metanotum with one or more pairs of small setae anterior to median pair of setae (Figure 42); antennal segment VII broad at base (Figure 23) 3
 - Metanotum with no discal setae apart from major pair; antennal segment VII pedicellate (Figures 16–22) 4
3. Antennal segment III more than 1.5 times as long as wide, IV with two sensoria; pronotal anteromarginal setae small, scarcely different from discal setae (Figure 33) *bellisi*
 - Antennal segment III less than 1.5 times as long as wide (Figure 23), IV with four sensoria; pronotal anteromarginal setae long and capitate, at least twice as long as discal setae *froggatti*
4. Antennal segment IV with four sensoria; hind tibiae brown; both sexes with fore wings fully developed and with duplicated cilia 5
 - Antennal segment IV with three or two sensoria; hind tibiae yellow or with brown shading basally and along external margin; male sometimes micropterous 6
5. Mid and hind tarsi as dark as tibiae; pronotal epimeral setae deeply shaded; fore wing with margins shaded and often with basal half slightly darker than distal half; second instar larvae red, sometimes with thorax yellowish; in flowers of various plant families *victoriensis*
 - Mid and hind tarsi paler than tibiae; pronotal epimeral setae pale, scarcely darker than sub-basal wing setae; fore wing uniformly pale except for shaded area around sub-basal setae; second instar larvae white with prominent transverse red bands on prothorax, metathorax, and abdominal segments III–IV and VIII–IX; in flowers of Poaceae and Cyperaceae *anceps*
6. Body and femora largely yellow; mesopresternum eroded and slender medially; tergite IX setae S1 finely acute and as long as tube; female with fore tarsal tooth minute; pelta with rounded margins *angusi*
 - Body and femora largely brown; mesopresternum transverse, well-developed medially; tergite IX setae S1 no more than 0.7 as long as tube, not finely acute; female with fore tarsal tooth small to large; pelta not as above 7
7. Tergite IX setae S1 and S2 distinctly capitate (Figure 40); pronotal am setae long and capitate; antennal segments IV–V scarcely darker than III (Figure 22; pelta rounded at anterior and with lateral margins concave (Figure 39)) *fici* [in part]
 - Tergite IX setae S1 blunt to very weakly capitate, S2 acute; pronotal am setae scarcely larger than discal setae (Figure 44); antennal segments IV–V light brown, darker than

- III (Figure 21); pelta trapezoidal with anterior margin almost transverse (Figure 37) *dicksoniae*
8. Antennal segment IV with two or three sensoria 9
 – Antennal segment IV with four sensoria 14
9. Antennal segment IV with two sensoria 10
 – Antennal segment IV with two⁺¹ or three sensoria 11
10. Antennal segment VIII constricted to small basal pedicel (Figure 16); pronotal anteromarginal setae long and capitate (Figure 9); fore wing sub-basal setae all capitate; tergite IX setae S1 less than 0.7 as long as tube *acaciae*
 – Antennal segment VIII broad at base (Figure 41); pronotal anteromarginal setae no longer than discal setae; fore wing sub-basal setae bluntly pointed; tergite IX setae S1 about 1.2 as long as tube *gahniae*
11. Pronotal anteromarginal setae no longer than discal setae (Figure 34); antennal segment IV with two major plus one minor sensorium; fore wing sub-basal setae S3 blunt and about 0.7 of distal wing width; usually micropterous *collyerae*
 – Pronotal anteromarginal setae long and capitate; antennal segment IV with three major sensoria; fore wing sub-basal setae S3 capitate and longer than distal wing width; macropterous 12
12. Antennal segments III–V yellow with weak shading, VI much paler than VII (Figure 22); tergite IX setae S1 and S2 capitate *fici* [in part]
 – Antennal segments IV–VIII brown in contrast to yellow segment III (Figure 52); tergite IX setae S2 pointed, S1 blunt or weakly capitate 13
13. Fore wing shaded, with four to seven duplicated cilia; all femora brown; tergite IX setae with apices bluntly pointed *bituberculatus* [in part]
 – Fore wing pale, with only one or no duplicated cilia; fore femora yellow in distal half; tergite IX setae S1 slender but weakly capitate *lyndi*
14. Wings and ocelli absent; abdominal tergites II–VII each with anterior pair of wing-retaining setae absent or no longer than discal setae and posterior pair short and straight *howei*
 – Wings and ocelli fully developed; at least tergites IV–VI with sigmoid setae 15
15. Fore wings with duplicated cilia present on posterior margin before wing apex 16
 – Fore wings with no duplicated cilia 19
16. Postocular setae acute, not extending to posterior margin of eyes; pronotal setae pointed or blunt. *leucanthemi*

- Postocular setae capitate, extending beyond posterior margin of eyes; pronotal setae capitate 17

- 17. Tergite IX setae S1 finely acute and as long as tube; antennal segment IV yellow with no brown shading *gowdeyi*
- Tergite IX setae S1 softly pointed but not acute, less than 0.8 of tube length; antennal segment IV usually with some brown shading 18

- 18. Hind tibiae brown with apex yellow; metanotum often with two or more small setae anterior to median pair; fore wing usually completely pale; fore tarsal tooth absent in female, small in male and arising in basal half of tarsus; male fore tibia with no tubercles on inner margin *haideeae*
- Hind tibiae always yellow at least at base and apex; metanotum never with any discal setae anterior to median pair; fore wing distinctly shaded medially; fore tarsal tooth small in female, large in male and occupying inner margin of tarsus; fore tibia of large males with two small tubercles on inner margin *bituberculatus* [in part]

- 19. Abdominal tergites I–III lateral to wing-retaining setae with neither lines of sculpture nor discal setae; fore tarsal tooth small and directed forward in both sexes; fore wings shaded medially but with apex pale 20
- Abdominal tergites I–III lateral to wing-retaining setae with several lines of sculpture and one or more discal setae; fore tarsal tooth usually directed laterally; fore wings pale or scarcely shaded 21

- 20. Pronotal anteromarginal setae acute and no longer than discal setae (Figure 45); antennal segment III largely brown, mid and hind tibiae brown at apex *driesseni*
- Pronotal anteromarginal setae capitate, as long as anteroangular setae; antennal segment III yellow, mid and hind tibiae yellow at apex *avius*

- 21. Pronotal mid-lateral setae well developed *varius*
- Pronotal mid-lateral setae scarcely longer than discal setae 22

- 22. Postocular setae and all pronotal major setae except epimerals no larger than discal setae (Figure 56) *timori*
- Postocular setae extend beyond posterior margin of eyes, pronotal posteroangular setae well developed 23

- 23. Head with maxillary bridge short (Figure 55), stylets scarcely 0.2 of head width apart, converging medially in head and almost parallel *salicorniae*
- Maxillary bridge at least 0.3 as long as head width (Figure 53), stylets converging basally and not parallel. 24

- 24. Antennal segment IV less than 1.4 times as long as wide, segment III yellow, IV brownish yellow; tergite IX setae S1 and S2 weakly capitate *ordi*

- Antennal segment IV 1.7 times as long as wide, segment III light brown, IV as dark brown as V–VI; tergite IX setae S1 blunt or pointed 25
- 25. Pronotal anteromarginal setae small, no more than 0.5 as long as fore tarsal width; postocular setae about 0.6 as long as antennal segment III *gomphrenae*
- Pronotal anteromarginal setae well developed, longer than fore tarsal width; postocular setae slightly longer than antennal segment III *robustus*

***Haplothrips acaciae* sp. nov.**

Female macroptera. Body colour light brown to brown, mid and hind tarsi brownish yellow, fore tarsi and basal half of antennal segment III yellow; major setae weakly shaded, fore wing shaded at base, then pale but variably shaded medially and distally. Head as broad as long, maxillary stylets wide apart, retracted to postocular setae, maxillary bridge complete (Figure 9); postocular setae capitate, extending beyond posterior margin of compound eyes. Antennal segments III–IV each with two sensoria; segment VIII distinctly constricted at base (Figure 16). Pronotum with five pairs of long, capitate setae. Metanotum reticulate medially, median setae arise on anterior half of sclerite. Mesopresternum transversely boat-shaped but slender medially. Fore tarsal tooth small, acute, directed forwards. Fore wing with about five duplicated cilia, sub-basal setae capitate. Tergite II (Figure 11) with wing-retaining setae weak, III–VII with anterior pair weaker than posterior pair; posteromarginal setae S1 long and capitate on tergites II–VII, but shorter on VIII; tergite IX setae S1 bluntly pointed, S2 finely acute.

Measurements of holotype female (in μm). Body length 1520. Head, length 145; median width 155; postocular setae 30. Pronotum, length 110; width 200; major setae am 30, aa 24, ml 36, epim 48, pa 42. Fore wing length 560; sub-basal setae 34, 40, 52. Tergite IX setae S1 55, S2 75, S3 ?. Tube length 100; basal width 55; anal setae 120. Antennal segments III–VIII length 24, 42, 44, 40, 36, 24.

Male macroptera. Similar to female, fore tarsal tooth slightly larger; tergite IX setae S2 short and stout; apex of pseudovirga narrowly spoon-shaped.

Measurements of paratype male (in μm). Body length 1300. Head, length 140; median width 130; postocular setae 25. Pronotum, length 100; width 175; major setae am 25, aa 30, ml 35, epim 44, pa 40. Fore wing length 400; sub-basal setae 30, 35, 45. Tergite IX setae S1 40, S2 20, S3 75. Tube length 75; basal width 40; anal setae 90. Antennal segments III–VIII length 30, 30, 40, 38, 35, 30.

Material examined

Holotype ♀ macroptera: South Australia, Middleback, 30 km NW of Whyalla, from *Acacia papyrocarpa* phyllodes webbed by spider, 18 March 1996 (LAM 3008). Paratypes: 8♀, 1♂ collected with holotype; 7♀, 1♂ same locality, 29 December 1997; 5♀, 5♂ with larvae, same locality, 4 May 1995. Western Australia, 108 km S of Newman, 6♀, 4♂ with larvae, in phyllodes webbed by ?Lepidoptera larvae, 21 April 1997. New South Wales, Baldranal 20 km W, 1♂ in old gall, 6 May 1995; 10 km N of Peak Hill, 2♀ from *Callitris*, 8 December

2001. Queensland, Aramac 37 km NE, 2♀, 1♂ from old spider nest of phyllodes on *Acacia microcephala*, 31 April 1998.

Comments

On four occasions colonies of this species have been taken from webbed phyllodes of *Acacia* species, and at three of these sites the webbing was certainly produced by spiders not by Lepidoptera (for the fourth sample the field notes remain equivocal). Despite this association, it is not known if the species is predatory or phytophagous. It is one of only two known species in *Haplothrips* with two sensoria on both the third and fourth antennal segments.

Haplothrips anceps Hood

Haplothrips anceps Hood 1918, p 129.

Haplothrips angustus Hood 1919, p 77. syn. n.

No consistent differences have been found between specimens, including type specimens, identified as *H. anceps* and as *H. angustus*, despite the statement by the original author that the latter species has longer antennal segments. Pitkin (1973) suggested that there was a difference in the length/width ratio of the third antennal segment (1.3–1.8 in *anceps*, but 1.8–2.2 in *angustus*), but this does not appear to be a satisfactory discriminant because of the variation within individual field samples. Moreover, it does not correlate satisfactorily with any other structural differences, such as the form of setal apices, and the male genitalia of the two forms are identical. Although treated here as one species, specimens from northern Australia commonly have the third antennal segment rather shorter (*anceps*-form) than specimens from southern Australia (*angustus*-form), but some genetic differences are to be expected between populations spread over an area from Adelaide to Cape York. In structure this species is closely similar to *H. victoriensis*, and the male pseudovirga of these species cannot be distinguished satisfactorily. This group of common thrips requires more detailed study, with particular attention to the host plants on which breeding occurs. In southern Australia *H. anceps* appears to be associated with flowering sedges such as *Eleocharis* (Cyperaceae), but samples are often taken from various Poaceae. The host records from northern Australia are less clear.

Recognition

Body and legs dark brown, mid and hind tarsi brownish yellow, fore tarsi and apex of fore tibiae yellow, at least basal half of antennal segment III yellow, IV light brown; pronotal major setae weakly shaded; fore wings pale except at base. Head with maxillary stylets about one-third of head width apart (Figure 10). Antennal segment III with one sensorium, IV with four. Pronotum with five pairs of capitate setae, am setae short; mesopresternum transverse and boat-shaped. Fore tarsal tooth in female minute but variably large in male. Metanotum weakly reticulate medially, median setal pair arising on anterior half; fore wing sub-basal setae S1 and S2 capitate, S3 capitate or pointed; about eight duplicated cilia present. Pelta triangular (Figure 12); tergite IX setae S1 and S2 blunt. Male pseudovirga with apex spoon-shaped (Figure 29).

Measurements of one female (in µm) (Northern Territory, Daly River, May 2002). Body length 1980. Head, length 165; median width 155; postocular setae 28. Pronotum, length 130;

width 240; major setae am 22, aa 18, ml 18, epim 38, pa 30. Fore wing length 700; sub-basal setae 28, 28, 40. Tergite IX setae S1 62, S2 70, S3 90. Tube length 105; basal width 55; anal setae 145. Antennal segments III–VIII length 38, 44, 40, 34, 32, 20.

***Haplothrips angusi* sp. nov.**

Female macroptera. Body colour light brown, legs extensively yellow; antennal segment III yellow, IV–VIII brown; major setae pale; fore wings weakly shaded. Head longer than wide, maxillary stylets slightly less than one-third of head width apart, retracted just anterior to postocular setae, maxillary bridge faint; postocular setae long and capitate. Antennal segment III conical with one small sensorium, IV with two sensoria; segment VIII broad at base (Figure 18). Pronotum with five pairs of long, capitate setae; basantra unusually small; mesopresternum eroded and very slender medially (Figure 15). Mesonotal lateral setae capitate. Metanotum with no sculpture medially, median setae arise on anterior half of sclerite. Fore tarsal tooth minute, scarcely visible. Fore wing with five duplicated cilia, sub-basal setae capitate. Pelta relatively large with rounded lateral margins (Figure 13). Tergites II–VII with posteromarginal setae S1 long and capitate; tergite IX setae S1 long and acute; tube short, anal setae long.

Measurements of holotype female (in μm). Body length 1700. Head, length 170; median width 130; postocular setae 40. Pronotum, length 120; width 220; major setae am 26, aa 14, ml 36, epim 46, pa 32. Fore wing length 550; sub-basal setae 32, 36, 36. Tergite IX setae S1 100, S2 130, S3 115. Tube length 90; basal width 55; anal setae 170. Antennal segments III–VIII length 36, 42, 40, 38, 38, 18.

Material examined

Holotype ♀ macroptera: Western Australia, Kununurra Gorge, on dead twig, 23 February 2005 (LAM 4569).

Comments

The single specimen on which this species is based is presumably teneral, and more mature individuals can be expected to have the body and basal antennal segments darker. However, the species has an unusual group of character states, including the antennal sensorium formula, the minute fore tarsal tooth, and the reduced prosternal sclerites (Figure 15), and would be very difficult to place to genus using the concepts of previous authors.

***Haplothrips avius* sp. nov.**

Female macroptera. Body colour brown, all tarsi and apices of tibiae yellow, antennal segment III yellow, major setae pale, fore wing shaded medially and at base. Head slightly longer than wide, maxillary stylets one-third of head width apart, retracted anterior to postocular setae, maxillary bridge complete medially (Figure 14); postocular setae capitate, extending just beyond posterior margin of compound eyes. Antennal segment III with two sensoria, IV with four sensoria; segment VIII relatively elongate (Figure 19). Pronotum with five pairs of capitate setae. Mesonotal lateral setae capitate. Metanotal median setae arise on anterior half of sclerite, with no small discal setae on anterior half.

Mesopresternum transverse but slender medially. Fore tarsal tooth very small, represented by slight recurving of inner apex of tarsus. Fore wing with no duplicated cilia, sub-basal setae capitate. Tergites II–III with no discal setae lateral to wing-retaining setae; posteromarginal setae S1 broadly capitate on tergites II–VII, capitate on VIII; tergite IX setae S1 and S2 capitate.

Measurements of holotype female (in μm). Body length 1720. Head, length 175; median width 140; postocular setae 26. Pronotum, length 110; width 230; major setae am 28, aa 22, ml 22, epim 46, pa 38. Fore wing length 700; sub-basal setae 36, 36, 38. Tergite IX setae S1 75, S2 70, S3 75. Tube length 110; basal width 50; anal setae 155. Antennal segments III–VIII length 42, 44, 46, 38, 34, 28.

Material examined

Holotype ♀ macroptera: South Australia, Cox Scrub, 50 km SE of Adelaide, beaten from low herbs, 14 January 2002 (LAM 4099). Paratypes: 1♂ taken with holotype; 20 km E of Meningie, 1♀ from *Lycium ferossissimum*, 9 February 2003; Kangaroo Island, 1♀ beaten from *Acacia paradoxa*, 25 December 2002. Queensland, 40 Mile Scrub, 1♀ beaten from foliage, 3 July 1995.

Comments

Despite being collected at sites more than 2000 km apart no significant differences can be seen between the specimens from South Australia and the one from northern Queensland. This is a much smaller species than *H. driessemi* described below, with the maxillary stylets further apart, but it is probably yet another species that is associated with the inflorescences of particular Cyperaceae. Despite the lack of fore wing duplicated cilia, neither of these species is closely similar in other character states to the typical members of subgenus *Trybomiella*, such as *H. robustus* or even *H. timori*.

***Haplothrips bellisi* sp. nov.**

Female macroptera. Body colour light brown to brown, all tarsi and apices of fore tibiae yellow, antennal segment III brownish yellow, IV light brown, major setae and fore wing pale. Head as broad as long, maxillary stylets wide apart, almost V-shaped, not retracted to postocular setae, maxillary bridge incomplete medially; postocular setae capitate, extending beyond posterior margin of compound eyes. Antennal segments III–IV relatively short with sensoria well-developed, one on III and two on IV; segment VII broad at base. Pronotal am setae no larger than discal setae (Figure 33), four pairs of major setae capitate. Mesonotal lateral setae minute. Metanotal median setae arise on posterior half of sclerite, with 4–10 small discal setae on anterior half. Mesopresternum usually fully divided into two triangles. Fore femur with external apical margin slightly thickened; fore tarsal tooth small, acute, arising at inner apex of tarsus. Fore wing with two to five duplicated cilia, sub-basal setae S1 and S2 capitate, S3 longer and acute. Tergites II–III with only one or two discal setae lateral to wing-retaining setae; posteromarginal setae S1 broadly capitate on tergites II–VII, but weakly capitate on VIII–IX; S2 on IX blunt.

Measurements of holotype female (in μm). Body length 1600. Head, length 145; median width 150; postocular setae 20. Pronotum, length 120; width 240; major setae am 7, aa 10,

ml 10, epim 30, pa 26. Fore wing length 620; sub-basal setae 18, 16, 54. Tergite IX setae S1 52, S2 52, S3 50. Tube length 95; basal width 50; anal setae 125. Antennal segments III–VIII length 40, 36, 40, 34, 32, 18.

Male macroptera. Similar to female except fore tarsal tooth massive in large male; tergite IX setae S1 capitate, S2 stout; apex of pseudovirga broad and weakly sclerotised.

Measurements of paratype female (in μm). Body length 1520. Head, length 155; median width 150; postocular setae 30. Pronotum, length 165; width 265; major setae am 3, aa 22, ml 18, epim 30, pa 34. Fore wing length 600; sub-basal setae 18, 24, 48. Tergite IX setae S1 60, S2 35, S3 90. Tube length 105; basal width 45; anal setae 125. Antennal segments III–VIII length 44, 44, 44, 38, 32, 24.

Material examined

Holotype ♀ macroptera: Northern Territory, Humpty Doo, from grasses, 15 May 1999 (LAM 3713). Paratypes: 3♀, 2♂ collected with holotype; 3♀, 2♂ from grasses, Kakadu, 11 May 1999; 1♀ from grass, Melville Is., 14 May 1999; 4♀, 4♂ from grasses, Darwin, 24 March 2003.

Comments

This is one of two new species described here, in addition to the widespread *H. froggatti*, in which the anterior area of the metanotum bears several minor setae. *H. bellisi* also resembles *H. froggatti* in having antennal segment VII broad at the base, not pedicellate. However, the external apical margin of the fore femora is slightly recurved, particularly in males, much as in species of the Ethiopian genus *Chiraplothrips*. Similar fore femora are also known in the unrelated species of the Thripidae genera, *Chirothrips* Haliday and *Arorathrips* Bhatti as well as in the Aeolothripidae species, *Desmothrips chirus* Mound and Marullo (1998), and it is probably significant that all of these thrips live in grass flowers.

***Haplothrips bituberculatus* (Girault)**

Podothrips bituberculatus Girault 1927, p 2.

This species is widespread but never abundant across the whole continent of Australia. Judging from collecting records it is probably predatory on other small arthropods, because only a few specimens are ever taken at one time, and these are found on dead twigs, in galls, and on leaves. In structure it is variable both within and between sites. The number of sensoria on the fourth antennal segment is either three or four, even on the same individual, although most specimens studied from southern Australia have four, and most specimens studied from northern Australia have three. In males, the pronotal anteromarginal setae are often shorter, and the fourth antennal segment longer, than in females. The fore wings are distinctly shaded medially, although specimens from Kununurra in the north of Western Australia have the wings paler.

Recognition

Body and femora dark brown, tarsi yellow, hind tibiae yellow at base and apex but variably brown medially; antennal segment III brownish yellow, remaining segments brown;

pronotal major setae light brown; fore wings shaded medially. Head slightly longer than wide; maxillary stylets almost V-shaped, maxillary bridge about one-third of head width; antennal segment III with two sensoria, IV with three or four. Pronotum with five pairs of capitate setae, am setae slender; mesopresternum transverse. Fore tarsal tooth in female small but variably large in male. Metanotum very weakly reticulate medially, median setal pair arising on anterior half; fore wing sub-basal setae capitate; five to seven duplicated cilia present. Tergite IX setae S1 and S2 pointed but not acute.

Large males with two small, seta-bearing tubercles on inner margin of fore tibiae, and fore femora and fore tarsal tooth enlarged; small males with slender fore legs and no tibial tubercles; pronotal anteromarginal setae sometimes small, even no larger than discal setae.

Measurements of one female (in μm) (Western Australia, Yanchep, September 1967). Body length 1640. Head, length 170; median width 168; postocular setae 40. Pronotum, length 130; width 270; major setae am 22, aa 28, ml 36, epim 50, pa 36. Fore wing length 625; sub-basal setae 36, 40, 74. Tergite IX setae S1 80, S2 110, S3 105. Tube length 125; basal width 60; anal setae 160. Antennal segments III–VIII length 44, 46, 46, 42, 40, 28.

Haplothrips collyerae (Mound and Walker) comb. n.

Apterygothrips collyerae Mound and Walker 1986, p 40.

This species was described as widespread in the North and South Islands of New Zealand, where it was recognised as a predator on the eggs of the mite species, *Panonychus ulmi*. The original description also referred to two specimens collected near Hobart, Tasmania, and recent observations by John Ireson (Tasmanian Institute of Agricultural Research) indicate that the larvae of this thrips are predatory on the larvae of a thrips species (*Sericothrips staphylinus*) that is useful in the biological control of gorse (*Ulex europea*). A single specimen has also been studied from north-western Tasmania, near Trowutta.

As discussed above, the genus *Apterygothrips* is a poorly defined assemblage of species that lack wings, or have the tergal wing-retaining setae reduced or absent, and there is no clear evidence that it is anything other than polyphyletic. Considering the variation in wing form and development, also the number of antennal sensoria, among the Australian species of the genus *Haplothrips* it seems most appropriate to place *collyerae* in this genus.

Recognition

Macropterous or micropterous. Body colour brown, mid and hind tibiae yellow at base but shaded brown distally and along external margin; all tarsi yellow; antennal segment III yellow, remaining segments brown (Figure 20); major setae pale, fore wing shaded except in basal quarter. Head longer than wide, maxillary stylets about one-third of head width apart, retracted to postocular setae, maxillary bridge complete (Figure 34); postocular setae blunt. Antennal segments III–IV with sensoria slender two on III and two⁺¹ on IV. Pronotal am setae no larger than discal setae, aa and ml setae also short. Mesonotum and metanotum without sculpture medially. Mesopresternum transverse (Figure 35). Fore tarsal tooth small, acute, arising at inner apex of tarsus. Fore wing without duplicated cilia, sub-basal setae blunt; fore wing of micropterae shorter than width of thorax. Tergite II with wing-retaining setae minute (Figure 36), III–VII each with two pairs; tergites II–VII posteromarginal setae S1 weakly capitate to blunt; tergite IX setae acute.

Measurements of macropterous female (in μm) (Tasmania, Hobart, May 2005). Body length 1635. Head, length 175; median width 135; postocular setae 32. Pronotum, length 120; width 235; major setae am 3, aa 20, ml 5, epim 38, pa 38. Fore wing length 600; sub-basal setae 18, 12, 26. Tergite IX setae S1 75, S2 90, S3 100. Tube length 115; basal width 55; anal setae 120. Antennal segments III–VIII length 34, 40, 40, 38, 38, 28.

***Haplothrips dicksoniae* sp. nov.**

Female macroptera. Body colour brown to light brown, all tarsi and apices of tibiae yellow, hind tibiae more extensively yellow except at base; antennal segment III yellow, IV–V light brown, remaining segments dark (Figure 21); major setae light brown, fore wing weakly shaded medially. Head slightly longer than wide (Figure 44); maxillary stylets at least one-third of head width apart, retracted to postocular setae, maxillary bridge complete; postocular setae capitate, extending beyond posterior margin of compound eyes. Antennal segment III slender (Figure 21), with one sensorium, IV with two or three sensoria. Pronotal am setae no larger than discal setae, four pairs of major setae capitate. Mesonotal lateral setae capitate. Metanotal median setae arise on anterior half of sclerite. Mesopresternum transverse. Fore tarsal tooth small, directed forwards at inner apex of tarsus. Fore wing with three to four duplicated cilia, sub-basal setae capitate. Tergites II–III with almost no sculpture and only one or two discal setae lateral to wing-retaining setae (Figure 37); posteromarginal setae S1 long and capitate on tergites II–VII, but short and capitate on VIII; tergite IX S1 long and blunt, S2 acute; wing-retaining setae on tergite II small, III–VI with anterior pair smaller than posterior pair.

Measurements of holotype female (in μm). Body length 1540. Head, length 165; median width 135; postocular setae 26. Pronotum, length 100; width 230; major setae am 3, aa 10, ml 18, epim 32, pa 30. Fore wing length 470; sub-basal setae 26, 30, 40. Tergite IX setae S1 75, S2 80, S3 70. Tube length 115; basal width 50; anal setae 140. Antennal segments III–VIII length 40, 40, 40, 38, 38, 26.

Male microptera. Similar to female, but fore wing slightly shorter than width of pterothorax; fore tarsal tooth very small; tergite IX setae S1 weakly capitate, S2 short and stout; apex of pseudovirga broad.

Measurements of paratype male (in μm). Body length 1160. Head, length 155; median width 130; postocular setae 24. Pronotum, length 90; width 195; major setae am 3, aa 10, ml 24, epim 32, pa 30. Fore wing length 155; sub-basal setae 24, 28, 34. Tergite IX setae S1 70, S2 30, S3 115. Tube length 105; basal width 45; anal setae 135. Antennal segments III–VIII length 38, 38, 38, 38, 38, 28.

Material examined

Holotype ♀ macroptera: Australian Capital Territory, Tidbinbilla, from *Dicksonia* fronds with sori, 25 April 1999 (LAM 3685). Paratypes: 3♀, 5♂ taken with holotype; same locality and plant species, 1♀, 3♂ with larvae and pupa, 16 January 1999; 3♀, 2♂, 31 July 1999; 7♀, 5♂ with larvae, 30 September 2001. New South Wales, 35 km SE of Queanbeyan, Tallaganda Forest, 15♀, 15♂ with larvae from *Dicksonia* fronds with sori, 24 June 2006.

Comments

This relatively small species is unusual within the genus, both in biology and structure. It has been found, together with its bright red larvae and pupae, among the sori on mature fronds of the tree fern, *Dicksonia antarctica*. Moreover, it has been found only where the tree ferns were growing in particularly moist situations, almost within the splash zone of a stream. The species has not been taken from the similar-looking *Cyathea* tree ferns where these grow in the same area. The first abdominal tergite, the pelta, is unusual in shape, with the anterior margin usually transverse (Figure 37), and all of the available males are micropterous with a rather broad apex to the aedeagus. The shaded fore wings resemble those of the widespread species, *H. bituberculatus*, but the hind tibiae are brown at the base but yellow medially.

Haplothrips driesseni sp. nov.

Female macroptera. Body colour brown to dark brown, tarsi and base of antennal segment III yellowish brown; fore wing shaded medially. Head longer than wide (Figure 45); maxillary stylets less than one-fifth of head width apart, retracted anterior to postocular setae, maxillary bridge complete; postocular setae capitate, extending to posterior margin of compound eyes. Antennal segment III with two slender sensoria, IV with four sensoria. Pronotal am setae no larger than discal setae, four pairs of major setae capitate but aa and ml small. Mesonotal lateral setae capitate. Metanotum without sculpture medially, median setae arise medially on sclerite. Mesopresternum transverse. Fore tarsal tooth small, at inner apex of tarsus. Fore wing with no duplicated cilia, sub-basal setae capitate. Tergites II–III with neither sculpture nor discal setae lateral to wing-retaining setae (Figure 38); posteromarginal setae S1 long and capitate on tergites II–VII; tergite IX S1 capitate, S2 weakly capitate.

Measurements of holotype female (in µm). Body length 1950. Head, length 200; median width 160; postocular setae 35. Pronotum, length 120; width 210; major setae am 3, aa 15, ml 15, epim 50, pa 30. Fore wing length 750; sub-basal setae 20, 25, 40. Tergite IX setae S1 80, S2 70, S3 80. Tube length 125; basal width 55; anal setae 130. Antennal segments III–VIII length 50, 60, 60, 35, 35, 30.

Male macroptera. Similar to female in colour and structure; tergite IX setae S2 short and stout; apex of pseudovirga narrowly spoon-shaped.

Measurements of paratype female (in µm). Body length 1580. Head, length 185; median width 135; postocular setae 35. Pronotum length 115; width 200; major setae am 5, aa 15, ml 20, epim 35, pa 35. Fore wing length 620; sub-basal setae 20, 30, 35. Tergite IX setae S1 100, S2 40, S3 130. Tube length 120; basal width 50; anal setae 130. Antennal segments III–VIII length 50, 55, 53, 50, 48, 35.

Material examined

Holotype ♀ macroptera: Tasmania, Lake Pedder, McPartlan Pass, 13 January 2000 (M. Driessen). Paratypes: 3♀, 1♂ taken with holotype; from various localities around Lake Pedder, 2♀, 1♂, 24 February 2004; 8♀, 1♂ February to March 2004; Lake St Clair, 3♀, February to March 2004. Australian Capital Territory, Mt Gingera, 1♀ from *Podocarpus*, 25

December 2003. New Zealand, South Island, Nelson, Wainui, 1♀ from *Juncus*, 23 November 2003.

Comments

The host plant of this species remains unknown, although it is likely to be a montane species of Juncaceae or Cyperaceae. The head is relatively long and the stylets relatively close together, and it is one of the few *Haplothrips* species with a distinctly shaded fore wing.

Haplothrips fici sp. nov.

Female macroptera. Body colour brown, tarsi and tibiae yellow, femora yellow washed with brown on external margins; antennal segments III–V largely yellow, VI brownish yellow, VII–VIII brown (Figure 22); major setae and fore wing pale. Head longer than wide, maxillary stylets more than one-third of head width apart, maxillary bridge complete; postocular setae long and capitate, arising close to posterior margin of compound eyes. Antennal segment III with two sensoria or with only one (inner sensorium reduced or absent), IV with three sensoria; segment VIII broad at base. Pronotum with five pairs of long broadly capitate setae. Mesonotal lateral setae capitate. Metanotum with longitudinal lines of sculpture on posterior half, median setae arise on anterior half of sclerite. Mesopresternum boat-shaped. Fore tarsal tooth well developed. Fore wing with three to five duplicated cilia, sub-basal setae capitate. Tergite II with sculpture but no discal setae lateral to wing-retaining setae (Figure 39); tergites II–VIII with posteromarginal setae S1 long and capitate; tergite IX setae S1 and S2 long and capitate (Figure 40).

Measurements of holotype female (in µm). Body length 1500. Head, length 160; median width 120; postocular setae 16. Pronotum, length 110; width 220; major setae am 20, aa 14, ml 22, epim 40, pa 36. Fore wing length 520; sub-basal setae 28, 30, 48. Tergite IX setae S1 50, S2 60, S3 70. Tube length 100; basal width 50; anal setae 110. Antennal segments III–VIII length 34, 36, 38, 38, 36, 24.

Male macroptera. Similar to female; fore femora and fore tarsal tooth sometimes large; tergite IX setae S2 short and pointed.

Measurements of paratype female (in µm). Body length 1400. Head, length 140; median width 125; postocular setae 30. Pronotum, length 120; width 235; major setae am 26, aa 22, ml 28, epim 42, pa 40. Fore wing length 550; sub-basal setae 34, 38, 62. Tergite IX setae S1 65, S2 25, S3 110. Tube length 100; basal width 45; anal setae 120. Antennal segments III–VIII length 38, 40, 36, 34, 32, 22.

Material examined

Holotype ♀ macroptera: Western Australia, Lake Argyle, from *Ficus opposita* leaves, 25 February 2005 (LAM 4612). Paratypes: 17♀, 14♂ taken with holotype; Kununurra, Packsaddle, 2♀, 1♂ and larvae from *Ficus opposita* leaves, 22 February 2005; Northern Territory, Bathurst Island, 1♀ from *Ficus opposita* leaves, 14 May 1999.

Comments

This species is remarkable, both for its antennal sensorium formula and for the capitate setae on the ninth abdominal segment. The variation in number of sensoria on the third antennal segment is particularly curious, because such variation is usually accompanied by variation in size of the affected sensoria. But in the available specimens of this species the sensorium on the inner apex of the third segment is either well developed and equal in size to the outer sensorium, or entirely absent. All of the specimens from Lake Argyle have only one sensorium present on both antennae, and this is also true of one of the females from Kununurra, but the other two female paratypes and one male paratype have two large sensoria on the third segment of both antennae. At two localities this thrips was taken from leaves in association with *Ascirtothrips arafura* Mound, on whose larvae it was possibly feeding. The larvae of *H. fici* are predominantly yellow, although the pupae have a little red pigment.

***Haplothrips froggatti* Hood**

Haplothrips froggatti Hood 1918, p 130.

This species has been referred to as “the black plague thrips”, because it sometimes occurs in such vast numbers across Central Australia. It is distinguished from all but two other members of the genus in Australia by the presence of extra setae on the anterior half of the metanotum (Figure 42), also by the unusually short and dark third antennal segment (Figure 23). It is a grass-living species and, although widespread across Australia, it is associated primarily with the arid areas. No specimens have been studied from Tasmania, Victoria, southern South Australia, or southern Western Australia. Similarly no specimens have been seen from the moist areas of north-eastern Queensland nor from Darwin, although it is common around Kununurra in the north of Western Australia.

Recognition

Body and legs dark brown, fore tarsi and base of antennal segments III and IV lighter. Maxillary stylets more than one-third of head width apart; antennal segment III short with one sensorium, IV with four. Pronotum with five pairs of capitate setae; mesopresternum transverse. Fore tarsal tooth absent in female, usually small in male. Metanotum with several pairs of minor setae on anterior half; fore wing with sub-basal setae all capitate, 7–13 duplicated cilia present. Tergite IX S1 long and weakly capitate, S2 acute. Male pseudovirga with apex slender and bearing distinctive apical lobes.

Measurements of one female (in µm) (Queensland, Birdsville, April 1998). Body length 2050. Head, length 195; median width 180; postocular setae 40. Pronotum, length 140; width 265; major setae am 32, aa 24, ml 24, epim 52, pa 48. Fore wing length 840; sub-basal setae 46, 40, 68. Tergite IX setae S1 90, S2 125, S3 100. Tube length 130; basal width 65; anal setae 180. Antennal segments III–VIII length 42, 48, 44, 44, 36, 26.

***Haplothrips gahniae* sp. nov.**

Female macroptera. Body colour brown, tarsi yellowish brown, antennal segment III mainly light brown but with base yellow, remaining segments brown; major setae pale, fore wing shaded medially. Head as broad as long, maxillary stylets about one-third of head width

apart, maxillary bridge complete; postocular setae acute, arising close to posterior margin of compound eyes. Antennal segments III and IV each with two sensoria; segment VIII broad at base, VII with pedicel relatively broad, VI with apex broadly truncate (Figure 41). Pronotum with setae aa, am, and ml scarcely longer than discal setae, epim and pa setae bluntly pointed. Mesonotal lateral setae small and pointed. Metanotum very weakly reticulate medially, median setae arise on anterior half of sclerite. Mesopresternum transversely boat-shaped but extending forward medially toward spinasternum. Fore tarsal tooth small, acute and slightly hooked, arising at anterior margin of tarsus. Fore wing with about five duplicated cilia, sub-basal setae S1 and S2 blunt, S3 acute. Tergites II–III with no discal setae lateral to wing-retaining setae (Figure 43); tergites II–V with posteromarginal setae S1 long and capitate, VI–VII with these setae acute; tergite IX setae long and finely acute.

Measurements of holotype female (in μm). Body length 1720. Head, length 153; median width 155; postocular setae 34. Pronotum, length 130; width 250; major setae am 5, aa 5, ml 5, epim 30, pa 28. Fore wing length 680; sub-basal setae 20, 24, 24. Tergite IX setae S1 100, S2 90, S3 100. Tube length 100; basal width 55; anal setae 150. Antennal segments III–VIII length 46, 42, 44, 40, 40, 24.

Male macroptera. Similar to female; tergite IX setae S2 short and stout; apex of pseudovirga broadly spoon-shaped.

Measurements of paratype female (in μm). Body length 1350. Head, length 150; median width 155; postocular setae 40. Pronotum, length 100; width 160; major setae am 3, aa 5, ml 5, epim 30, pa 20. Fore wing length 550; sub-basal setae 15, 18, 30. Tergite IX setae S1 75, S2 30, S3 85. Tube length 75. basal width 45; anal setae 135. Antennal segments III–VIII length 40, 35, 35, 33, 35, 25.

Material examined

Holotype ♀ macroptera: South Australia, Adelaide Hills, Wottons Scrub, from *Gahnia* sp. inflorescence, 10. i. 2006 (LAM 4796). Paratypes: 7♀, 6♂ collected with holotype; Kangaroo Island, 4♀, 5♂ from *Gahnia* sp. inflorescence, 3. x. 2007 (LAM 5098).

Comments

Taken only from the inflorescences, not the leaves, of *Gahnia*, this species was considered in the field to be the common *H. anceps* that occurs widely on Cyperaceae. Subsequent examination indicated that it is one of only two *Haplothrips* species with two sensoria on both the third and fourth antennal segments. It is an unusual species in that only two pairs of pronotal setae are larger than the discal setae, and the pedicel of antennal segment VII is relatively broad.

***Haplothrips gomphrenae* sp. nov.**

Female macroptera. Body colour brown with red internal pigment, fore tarsi and apices of fore tibiae paler, also antennal segment III (Figure 24); major setae pale, fore wings pale except at base. Head as wide as long, maxillary stylets slightly less than one-third of head width apart, retracted to compound eyes, maxillary bridge complete; postocular setae small

but capitate, extending just beyond posterior margin of compound eyes. Antennal segment III with two sensoria, IV with four sensoria. Pronotum with four pairs of weakly capitate setae, ml setae no larger than discals, am setae scarcely twice as long as discals. Mesonotal lateral setae capitate. Metanotum reticulate medially, median setae arise on anterior half of sclerite. Mesopresternum eroded to two small lateral triangles. Fore tarsal tooth very small, arising at inner apex of tarsus. Fore wing with no duplicated cilia, sub-basal setae capitate. Pelta triangular; tergites II–IV with many lines of sculpture and several discal setae lateral to wing-retaining setae; posteromarginal setae S1 capitate on tergites II–VIII; tergite IX setae S1 and S2 bluntly rounded.

Measurements of holotype female (in μm). Body length 1850. Head, length 180; median width 180; postocular setae 28. Pronotum, length 120; width 275; major setae am 18, aa 18, ml 7, epim 40, pa 36. Fore wing length 750; sub-basal setae 34, 36, 38. Tergite IX setae S1 85, S2 85, S3 85. Tube length 110; basal width 60; anal setae 135. Antennal segments III–VIII length 44, 50, 48, 48, 44, 34.

Male macroptera. Similar to female; pronotal am setae no larger than discal setae; fore tarsal tooth well developed and occupying inner margin of tarsus (Figure 46), large male with fore tarsal tooth large and fore femora swollen; tergite IX setae S2 short and stout; apex of pseudovirga with large terminal lobe.

Measurements of paratype female (in μm). Body length 1630. Head, length 180; median width 160; postocular setae 26. Pronotum, length 110; width 270; major setae am 16, aa 24, ml 5, epim 34, pa 26. Fore wing length 650; sub-basal setae 28, 28, 32. Tergite IX setae S1 100, S2 35, S3 105. Tube length 120; basal width 55; anal setae 110. Antennal segments III–VIII length 42, 52, 46, 44, 40, 34.

Material examined

Holotype ♀ macroptera: Western Australia, 100 km W of Fitzroy Crossing, from *Gomphrena brachystylis* flowers, 27 February 2005 (LAM 4631). Paratypes: 2♀, 5♂ collected with holotype; Northern Territory, Elliot, 8♀, 8♂ with larvae from *Ptilotus helipteroides*, 24 July 1993; 100 km W of Katherine, 14♀, 9♂ from *Ptilotus helipteroides*, 20 July 1993.

Comments

This species and *H. varius* are both associated with the flowers of Amaranthaceae in the arid zone, but the setal lengths are strikingly different in the available samples, as indicated in the key. It is smaller than *H. robustus*, with the major setae much smaller and the male genitalia distinctive. The larvae are bright red.

***Haplothrips gowdeyi* (Franklin)**

Anthothrips gowdeyi Franklin 1908, p 724.

Although described from Barbados, this species is probably African in origin (Mound and Marullo 1996) but is now widespread around the tropics and sub-tropics in various flowers. In Australia it is not commonly collected, and males have not been found here. It seems to be associated with areas of domestic gardens, having been collected around Sydney and

Brisbane, as well as at Port Douglas, Kununurra, and Melville Island. It is fairly distinctive in appearance, with the fourth antennal rather large and yellow, and the setae on the ninth tergite longer than the tube and acute.

Recognition

Body colour brown to dark brown, fore tarsi and apices of fore tibiae yellow, antennal segments III–V yellow (Figure 25), VI yellow with apex shaded; major pronotal setae brown, fore wing pale. Head slightly longer than wide, maxillary stylets one-third of head width apart, retracted to postocular setae, maxillary bridge complete; postocular setae weakly capitate. Antennal segment III with two sensoria, IV with four sensoria. Pronotum with five pairs of capitate setae. Metanotum weakly reticulate medially, median setae arise on anterior half of sclerite. Mesopresternum broadly boat-shaped but slender medially. Fore tarsal tooth minute in female (larger in male). Fore wing with about seven duplicated cilia, sub-basal setae capitate. Tergite IX setae S1 and S2 finely acute, slightly longer than tube.

Measurements of female (in μm) (from Timor Leste, Dili, February 2005). Body length 2150. Head, length 190; median width 180; postocular setae 62. Pronotum, length 146; width 284; major setae am 40, aa 28, ml 38, epim 62, pa 70. Fore wing length 800; sub-basal setae 48, 52, 70. Tergite IX setae S1 125, S2 125, S3 120. Tube length 120; basal width 65; anal setae 145. Antennal segments III–VIII length 48, 54, 50, 44, 40, 30.

Haplothrips haideeae sp. nov.

Female macroptera. Body colour light brown to brown; all tarsi yellow, also apical fifth of hind tibiae, apical third of mid-tibiae, and most of the fore tibiae; antennal segments III–VI yellow with varying shades of brown apically; major pronotal setae light brown, fore wing pale. Head almost as broad as long, maxillary stylets at least one-third of head width apart, retracted almost to postocular setae, maxillary bridge complete; postocular setae weakly capitate. Antennal segment III with two sensoria, IV with four sensoria. Pronotum with five pairs of capitate setae. Mesonotal lateral setae capitate. Metanotal median setae arise medially on sclerite, usually with two to four small discal setae on anterior half. Mesopresternum broadly boat-shaped. Fore tarsal tooth absent. Fore wing with about 10 duplicated cilia, sub-basal setae S1 and S2 capitate, S3 longer and bluntly pointed. Tergite II with no discal setae lateral to wing-retaining setae; posteromarginal setae S1 long and capitate on tergites II–VI, but blunt on VII–VIII; tergite IX S1 bluntly pointed, S2 finely acute.

Measurements of holotype female (in μm). Body length 1920. Head, length 172; median width 170; postocular setae 40. Pronotum, length 132; width 284; major setae am 34, aa 24, ml 24, epim 50, pa 44. Fore wing length 720; sub-basal setae 40, 38, 80. Tergite IX setae S1 80, S2 90, S3 114. Tube length 124; basal width 56; anal setae 162. Antennal segments III–VIII length 46, 52, 46, 44, 38, 24.

Male macroptera. Similar to female but smaller; fore tarsal tooth small, arising on basal half of tarsus; tergite IX setae S1 very weakly capitate, S2 short and stout; apex of pseudovirga narrowly spoon-shaped.

Measurements of paratype female (in μm). Body length 1480. Head, length 190; median width 150; postocular setae 34. Pronotum, length 114; width 224; major setae am 24, aa 24, ml 26, epim 40, pa 32. Fore wing length 584; sub-basal setae 28, ?, 48. Tergite IX setae S1 74, S2 20, S3 98. Tube length 110; basal width 46; anal setae ? Antennal segments III–VIII length 42, 54, 44, 44, 38, 22.

Material examined

Holotype ♀ macroptera: Queensland, Mossman 20 km S, from flowers of *Mangifera*, 10 August 2004 (LAM 4467). Paratypes: 1♀, 2♂ collected with holotype; 4♀ same host and locality, 7 August 2004; Cape York, Laura, 1♀ from mango, August 1990; Stephens Is., 1♀, 1♂ on *Syzygium*, 1 November 1989; Cape Tribulation, 1♀ from mango flowers, 8 July 1995; Cairns, 1♀ from tree flowers, 16 January 1998; Tully, 1♀ from *Musa*, 23 June 1970; Kennedy, 1♀ from *Musa*, 29 April 1970; Townsville, 4♀, 3♂ from *Melaleuca leucadendron*, 31 August 1992; Flaxton, 1♀ from *Wisteria*, 27 August 2005. New South Wales, Taree 20 km S, Kiwarra State Forest, 3♀, 3♂ from *Austrosteenisia blacki*, 14 April 2002. Northern Territory, Darwin, Holmes Jungle, 2♀, 1♂ from *Livistona humilis* flowers, 20 December 1996; Berrimah Farm, 1♂ predatory, on eggplant, 25 August 1994, 7♀, 6♂ on mango flowers, 28 August 1996, 1♀ on mango flowers, 18 July 2003; Cotton Park, 2♀ on mango flowers, 22 August 1996; Berry Springs, 1♀ on *Nephelium*, 15 August 2002; Katherine, 1♀, 1♂ from mango flowers, August 1999, June 2004. Western Australia, Kununurra, 3♀, 2♂ in mango flowers, 5 August 2004; Broome, 1♀ from *Glycine tomentella* flowers, 4 March 2005.

Comments

The sharply yellow apex of the middle and hind tibiae appears to be diagnostic for this species, but the available specimens from the southern part of the range, in New South Wales, have slightly darker antennal segments and the fore wings slightly shaded medially, in contrast to the specimens from tropical Australia. Moreover, the additional setae on the anterior half of the metanotum have not been seen on any of the paratypes from Kununurra in Western Australia. It is possible that this is the species that was referred to as predatory on *Thrips palmi* on eggplant at Darwin by Young and Zhang (2001), as the only remaining voucher specimen from those observations is listed above as a male paratype. The name of this species recognises the work of Haidee Brown in identifying so many thrips species in the Darwin area.

Haplothrips howei sp. nov.

Female aptera. Body colour brown with extensive red pigment internally, fore tarsi and antennal segment III yellowish; major setae brown. Head longer than wide (Figure 48), ocelli absent, maxillary stylets more than one-third of head width apart, maxillary bridge complete; postocular setae finely acute. Antennal segment III with two sensoria, IV with four sensoria; segment VII strongly pedicellate, VIII broad at base. Pronotum with setae aa, am, and ml scarcely longer than discal setae, epim and pa setae bluntly pointed. Mesonotal lateral setae minute. Metanotum transverse with no sculpture medially. Mesopresternum slender medially or eroded to small paired lateral triangles. Fore tarsal tooth long and acute. Fore wing lobe very small. Pelta D-shaped (Figure 50); tergal wing-retaining setae small and straight; tergites II–IX with posteromarginal setae S1 long and finely acute.

Measurements of holotype female (in μm). Body length 1730. Head, length 110; median width 154; postocular setae 46. Pronotum, length 150; width 284; major setae am 5, aa 5, ml 5, epim 30, pa 24. Fore wing length 35. Tergite IX setae S1 100, S2 74, S3 70. Tube length 120; basal width 60; anal setae 108. Antennal segments III–VIII length 58, 58, 50, 46, 40, 30.

Male aptera. Similar to female, but large males with head more elongate (Figure 49), fore femora and prothorax swollen, pronotal ml setae longer; tergite IX setae S2 short and stout; apex of pseudovirga slender.

Measurements of paratype female (in μm). Body length 1500. Head, length 196; median width 136; postocular setae 40. Pronotum, length 154; width 268; major setae am 5, aa 5, ml 5, epim 32, pa 22. Fore wing length 20. Tergite IX setae S1 110, S2 25, S3 100. Tube length 105; basal width 48; anal setae 100. Antennal segments III–VIII length 58, 60, 50, 42, 40, 26.

Material examined

Holotype ♀ aptera: Lord Howe Island, near Settlement Beach, beaten from *Smilax australis* on dead branch, 20 November 1996 (LAM 3046). Paratypes: 5♀, 5♂ with larvae taken with holotype; Erskine Valley, 1♀, 2♂ beating *Symplocus candelabrum*, 22 November 1996; Soldiers Creek, 1♂ from dead branches, 24 November 1996; Goat House, 1♂ from dead branches, 25 December 2001.

Comments

The biology of this species and its bright red larvae is not known, but all of the specimens were collected in association with dead twigs and branches, and they were probably predatory on mites rather than phytophagous. This is the first fully apterous species to be placed in the genus *Haplothrips*. Despite the absence of wings, it is not considered to be related to any *Apterygothrips* species, particularly because of the body size polymorphism in males.

***Haplothrips leucanthemi* (Schrank)**

Thrips leucanthemi Schrank 1781, p 298.

Phloeothrips nigra Osborn 1883, p 154.

Much of the European literature refers to this species under two separate names: *Haplothrips niger* from red clover flowers (*Trifolium*), and *H. leucanthemi* from ox-eye daisy flowers (*Chrysanthemum leucanthemum*). However, the measurements given as discriminants by Priesner (1964), and also by Schliephake and Klimt (1979, p 254), overlap considerably without distinguishing two entities. All of the specimens identified as *H. niger* in Britain (Morison 1949) were subsequently re-identified as *H. leucanthemi* (Mound et al. 1976) because of the great variation in body size and setal lengths amongst specimens taken together in England in the same flowers. Mound and Walker (1986) pointed out that although *H. niger* is abundant in New Zealand in red clover flowers no males had been found. These authors therefore suggested that *H. niger* is a parthenogenetic form of *H. leucanthemi* that is specific to clover flowers. In Australia, only a few specimens of this species, all females, have been studied, collected near Sydney, Wagga, Melbourne, and

Adelaide. The pseudovirga of males from *C. leucanthemum* flowers in England have the apex weakly swollen (Figure 31).

Recognition

Body colour brown to dark brown, fore tarsi and base of antennal segment III yellow; fore wing with base extensively shaded. Head slightly longer than wide, maxillary stylets one-third of head width apart, retracted to postocular setae, maxillary bridge complete; postocular setae acute, usually not reaching posterior margin of compound eyes (Figure 51). Antennal segment III with two sensoria, IV with four sensoria. Pronotal setae small and acute, am and ml setae not longer than discs. Metanotum weakly reticulate medially, median setae arise on anterior half of sclerite. Mesopresternum eroded medially into two triangular sclerites. Fore tarsal tooth minute in female (large in large male). Fore wing with 7–12 duplicated cilia, sub-basal setae acute or blunt. Tergite IX setae S1 bluntly pointed, much shorter than tube, S2 acute.

Measurements of female (in µm) (South Australia, Adelaide, November 2000). Body length 1950. Head, length 194; median width 174; postocular setae 12. Pronotum, length 120; width 296; major setae am 8, aa 10, ml 10, epim 22, pa 22. Fore wing length 800; sub-basal setae 30, 34, 40. Tergite IX setae S1 62, S2 62, S3 76. Tube length 144; basal width 56; anal setae 116. Antennal segments III–VIII length 42, 46, 44, 40, 42, 32.

Haplothrips lyndi sp. nov.

Female macroptera. Body colour light brown to brown, tarsi yellow, tibiae yellow washed with brown on external margins, fore femora yellow distally, antennal segment III and base of IV yellow, remaining segments brown; major setae and fore wing pale. Head longer than wide (Figure 52), maxillary stylets about one-third of head width apart, retracted to postocular setae, maxillary bridge complete; postocular setae capitate, extending beyond posterior margin of compound eyes. Antennal segment III with two sensoria, IV with three sensoria; segment VIII broad at base. Pronotum with five pairs of long capitate setae. Mesonotal lateral setae capitate. Metanotum weakly reticulate medially, median setae arise on anterior half of sclerite. Mesopresternum transverse. Fore tarsal tooth small. Fore wing with one or no duplicated cilia, sub-basal setae capitate. Tergite II with no discal setae lateral to wing-retaining setae; tergites II–VII with posteromarginal setae S1 long and capitate; tergite IX setae S1 long and slender but weakly capitate, S2 blunt.

Measurements of holotype female (in µm). Body length 1680. Head, length 158; median width 126; postocular setae 32. Pronotum, length 108; width 220; major setae am 24, aa 22, ml 24, epim 46, pa 42. Fore wing length 620; sub-basal setae 34, 40, 50. Tergite IX setae S1 68, S2 74, S3 70. Tube length 60; basal width 28; anal setae 124. Antennal segments III–VIII length 46, 42, 42, 40, 40, 24.

Material examined

Holotype ♀ macroptera: Queensland, 40 Mile Scrub, beaten from shrubs, 3 July 1995 (LAM 2704). Paratypes: 2♀ taken with holotype. Northern Territory, Lichfield Park, 1♀ from dead twigs, 13 May 1999.

Comments

The shape of the head and antennal segment III (Figure 52), also the long capitate pronotal setae, resemble “*Bagnalliella nigricoxa* Girault” that was referred to the genus *Haplothrips* by Pitkin (1973). However, the single specimen on which that species is based has only one sensorium on the third antennal segment, and a long basal stem to the fourth segment (Figure 1). In contrast, *H. lyndi* is probably related to the widespread *Haplothrips bituberculatus*.

***Haplothrips ordi* sp. nov.**

Female macroptera. Body and legs brown, fore tarsi and apices of fore tibiae yellow; antennal segment III largely yellow, IV pale brownish yellow, V–VIII brown; pronotal major setae and fore wing pale. Head longer than wide, maxillary stylets retracted to compound eyes, one-quarter of head width apart, maxillary bridge complete (Figure 53); postocular setae capitate, extending beyond posterior margin of compound eyes. Antennal segment III with two sensoria, IV with four sensoria; segment VIII broad at base. Pronotum with four pairs of capitate setae, ml setae no longer than discals. Mesonotal lateral setae capitate. Metanotum reticulate medially, median setae arise on anterior half of sclerite. Mesopresternum eroded to two small lateral triangles. Fore tarsal tooth very small, at inner apex of tarsus. Fore wing with no duplicated cilia, sub-basal setae capitate, their bases arranged in a triangle. Pelta triangular (Figure 54); tergites II–IV lateral to wing-retaining setae with sculpture and one or more discal setae; tergites II–VIII with posteromarginal setae S1 long and capitate; tergite IX setae S1 and S2 long and capitate.

Measurements of holotype female (in µm). Body length 1650. Head, length 160; median width 144; postocular setae 30. Pronotum, length 102; width 114; major setae am 30, aa 32, ml 3, epim 32, pa 44. Fore wing length 640; sub-basal setae 40, 40, 44. Tergite IX setae S1 70, S2 56, S3 68. Tube length 110; basal width 54; anal setae 116. Antennal segments III–VIII length 40, 40, 42, 40, 34, 28.

Male macroptera. Similar to female; fore tarsal tooth well developed; tergite IX setae S2 short and pointed; pseudovirga with small apical lobe.

Measurements of paratype female (in µm). Body length 1550. Head, length 164; median width 142; postocular setae 30. Pronotum, length 110; width 240; major setae am 28, aa 30, ml 3, epim 36, pa 36. Fore wing length 640; sub-basal setae 30, 34, 38. Tergite IX setae S1 72, S2 30, S3 80. Tube length 120; basal width 48; anal setae 122.

Material examined

Holotype ♀ macroptera: Western Australia, Kununurra, Ivanhoe, from *Distichostemon hispidulus* (Sapindaceae), 25 February 2005 (LAM 4610). Paratypes: 5♀, 6♂ collected with holotype.

Comments

This is a typical member of the *Haplothrips* (*Trybomiella*) group, with short stout antennal segments. It is smaller than the two common species, *H. robustus* and *H. varius*, with distinctively paler antennae, and the pseudovirga of the male has an unusual, small, terminal lobe.

Haplothrips robustus* BagnallHaplothrips robustus* Bagnall 1918, p 209.*Haplothrips* (*Trybomiella*) *robustus* Bagnall; Pitkin 1973, p 333.

Recorded only from Australia, and taken widely between Tasmania and Torres Strait Islands, this species is known only from females. Moreover, it has been collected from a wide range of flowers, including many that are not native to this continent. These observations suggest that *H. robustus* may have been introduced to Australia from some other part of the world, such as eastern Africa. The females are closely similar to the females of *H. clarisetis* Priesner, an Afrotropical species that is known between South Africa, Egypt, and Iran. In that species, the fore wing sub-basal setae S3 are at least 1.5 times as long as the other sub-basal setae, and setae S1 on the ninth abdominal tergite are acute. In contrast, in *H. robustus*, the fore wing sub-basal setae S3 are much shorter, scarcely 1.3 times as long as the nearest seta, and setae S1 on the ninth tergite have blunt apices.

Recognition

Macropterous female, body and legs dark brown, fore tarsi, apices of fore tibiae, and sometimes antennal segment III lighter; pronotal major setae and fore wings pale except at base. Maxillary stylets about one-quarter of head width apart; antennal segment III with two sensoria, IV with four sensoria. Pronotum with four pairs of capitate setae, ml setae no larger than discals; mesopresternum eroded medially into two lateral triangles. Fore tarsal tooth very small. Mesonotal lateral setae capitate. Metanotum reticulate medially, median setal pair arising on anterior half. Fore wing exceptionally broad distally, with no duplicated cilia; sub-basal setae capitate with bases forming a triangle. Pelta broadly triangular; tergites II–IV lateral to wing-retaining setae with lines of sculpture and several small setae; tergites II–VIII with setae S1 capitate; tergite IX setae S1 and S2 bluntly rounded.

Measurements of one female (in μm) (New South Wales, Hillston, September 1959). Body length 2040. Head, length 190; median width 168; postocular setae 44. Pronotum, length 128; width 284; major setae am 38, aa 32, ml 3, epim 48, pa 52. Fore wing length 850; sub-basal setae 38, 48, 64. Tergite IX setae S1 100, S2 100, S3 90. Tube length 138; basal width 70; anal setae 134. Antennal segments III–VIII length 50, 56, 50, 46, 42, 34.

Haplothrips salicorniae* Mound and WalkerHaplothrips* (*Trybomiella*) *salicorniae* Mound and Walker 1986, p 54.

Described from New Zealand on the saltmarsh plants known as marsh samphire or glasswort, identified at that time as a species of *Salicornia*, this thrips has been found widely across Australia. It is associated with the flowers of the native plants in the genera *Halosarcia* or *Sarcocornia* (Chenopodiaceae) that grow both near the coast and on inland salt flats. Males have not been seen.

Recognition

Macropterous. Body and legs brown, fore tarsi and base of antennal segment III paler; major setae and fore wings pale. Head longer than wide, maxillary stylets close together medially (Figure 55), maxillary bridge complete; postocular setae variable, usually and capitate and extending beyond posterior margin of compound eyes but sometimes short

and pointed. Antennal segment III with two sensoria, IV with four sensoria. Pronotal am, aa, and ml setae variable, pa and epim setae capitate. Mesonotal lateral setae capitate. Metanotum weakly reticulate medially, median setae arise on anterior half of sclerite. Mesopresternum eroded to two lateral triangles. Fore tarsal tooth very small at inner apex of tarsus. Fore wing with no duplicated cilia, sub-basal setae capitate with bases in a triangle. Tergites II–IV with sculpture and discal setae lateral to wing-retaining setae; tergites II–VIII with posteromarginal setae S1 weakly capitate to blunt; tergite IX setae S1 and S2 blunt.

Measurements of one female (in μm) (Western Australia, Jerramungup, December 1999). Body length 2050. Head, length 206; median width 170; postocular setae 30. Pronotum, length 112; width 304; major setae am 24, aa 10, ml 3, epim 40, pa 30. Fore wing length 780; sub-basal setae 24, 38, 36. Tergite IX setae S1 78, S2 68, S3 55. Tube length 116; basal width 66; anal setae 134. Antennal segments III–VIII length 44, 50, 50, 42, 40, 30.

***Haplothrips timori* sp. nov.**

Male macroptera. Body and legs brown, fore tarsi and apices of fore tibiae yellow, antennal segment III yellowish brown on external margin at base (Figure 26); major setae and fore wing pale. Head longer than wide, maxillary stylets about one-third of head width apart, maxillary bridge complete (Figure 56); postocular setae no larger than minor setae on vertex. Antennal segment III with two sensoria, IV with four sensoria; segment VIII broad at base. Pronotal major setae no larger than discal setae, except capitate epimeral setae. Mesonotal lateral setae small. Metanotum reticulate medially, median setae arise on anterior half of sclerite. Mesopresternum eroded to two lateral triangles. Fore tarsal tooth small on inner margin of tarsus. Fore wing with no duplicated cilia; sub-basal setae capitate, arising in a straight line. Tergite II with dentate sculpture but no discal setae lateral to wing-retaining setae (Figure 58); tergites II–VII with posteromarginal setae S1 strongly capitate; tergite VIII S1 short and pointed; tergite IX setae S1 and S3 capitate, S2 short and stout with apex blunt.

Measurements of holotype female (in μm). Body length 1480. Head, length 170; median width 148; postocular setae 5. Pronotum, length 102; width 240; major setae am 2, aa 2, ml 2, epim 10, pa 2. Fore wing length 580; sub-basal setae 16, 16, 22. Tergite IX setae S1 62, S2 26, S3 68. Tube length 118; basal width 50; anal setae 84. Antennal segments III–VIII length 42, 44, 42, 42, 38, 28.

Material examined

Holotype ♂ macroptera: Northern Territory, Humpty Doo, Lambell's Lagoon, from mango dead leaves, 29 December 1995 (LAM 2923).

Comments

The single male specimen on which this species is described is unique amongst the described *Haplothrips* (*Trybomiella*) species in having only the epimeral setae on the pronotum well developed. Moreover, the presence of two pairs of capitate setae on the ninth abdominal tergite has not previously been reported for any male in this group. This is probably an Indonesian species, and a single female specimen collected at Dili, Timor

Leste, appears to be conspecific, although the maxillary stylets are only 15% of the head width apart.

***Haplothrips varius* Hood**

Haplothrips varius Hood 1918, p 128.

Haplothrips (*Trybomiella*) *varius* Hood; Pitkin 1973, p 333.

With its dark antennae and broad fore wings lacking duplicated cilia, this is a typical member of the subgenus *Trybomiella*. It breeds in the flowers of *Ptilotus* species, an Australian genus of *Amaranthaceae*, and has been collected widely across the arid zone, from Canberra in the south-east to Karratha and the Fitzroy River in the north of Western Australia.

Recognition

Macropterous, body and legs dark brown, fore tarsi and antennal segment III lighter; pronotal major setae and fore wings pale. Maxillary stylets about one-quarter of head width apart; antennal segment III with two sensoria, IV with four sensoria. Pronotum with five pairs of capitate setae; mesopresternum eroded medially into two lateral triangles. Fore tarsal tooth in female very small, in male well developed. Mesonotal lateral setae capitate. Metanotum weakly sculptured medially, median setal pair arising on anterior half. Fore wing exceptionally broad distally, with no duplicated cilia; sub-basal setae capitate with bases forming a triangle. Pelta broadly triangular; tergites II–IV lateral to wing-retaining setae with lines of sculpture and several small setae; tergites II–VII with setae S1 weakly capitate to blunt; tergite IX setae S1 blunt, S2 pointed. Male pseudovirga with apex transverse.

Measurements of one female (in μm) (Western Australia, Wittenoom, September 1995). Body length 2400. Head, length 206; median width 188; postocular setae 52. Pronotum, length 164; width 320; major setae am 42, aa 54, ml 48, epim 78, pa 76. Fore wing length 1000; sub-basal setae 42, 54, 62. Tergite IX setae S1 114, S2 120, S3 90. Tube length 130; basal width 68; anal setae 160. Antennal segments III–VIII length 48, 52, 50, 48, 44, 32.

***Haplothrips victoriensis* Bagnall**

Haplothrips victoriensis Bagnall 1918, p 208.

Haplothrips jarvisi Kelly in Kelly and Mayne 1934, p 46. syn. n.

This is the most commonly encountered member of the genus in Australia, from south of the Tropic of Capricorn to Tasmania. No valid records from Northern Territory have been found, and in Queensland the most northerly valid record is from Nambour. In contrast, one female has been studied from Kununurra in northern Western Australia. This thrips lives in the flowers of many plants, but despite its abundance it seems to be of limited economic significance. In Tasmania it has caused contamination problems by entering the fruits of raspberries (pers. comm. Margaret Williams), but there is evidence that it can be a useful predator of mites (Bailey and Caon 1986). Both in general body structure and in the structure of the male genitalia this species is very similar to *H. anceps*, the colour character states given in the key above being the only recognised differences in adults, although the colour of the larvae is strikingly different. However, *H. victoriensis* is associated with flowers, whereas in southern Australia *H. anceps* is associated with grasses and sedges. The

published description of *H. jarvisi* is totally inadequate, and in the absence of any specimens this name is placed as a synonym of *H. victoriensis* that is abundant at the type locality.

Recognition

Macropterous, body and legs dark brown, fore tarsi and base of antennal segments III and IV lighter (Figure 27); pronotal major setae dark brown; fore wing with margins distinctly shaded. Maxillary stylets about one-third of head width apart (Figure 59); antennal segment III about 1.8 times as long as wide, with one sensorium, IV with four. Pronotum with five pairs of capitate setae; mesopresternum transverse and boat-shaped. Fore tarsal tooth in female minute or absent, in male usually small and arising in basal half of tarsus. Metanotum weakly sculptured, median setal pair arising on anterior half; fore wing sub-basal setae S1 and S2 capitate, S3 bluntly pointed; about 12 duplicated cilia present. Tergite IX setae long and acute. Male pseudovirga with apex spoon-shaped (Figure 32).

Measurements of one female (in µm) (Tasmania, November 1999). Body length 2200. Head, length 206; median width 178; postocular setae 44. Pronotum, length 140; width 296; major setae am 30, aa 24, ml 24, epim 62, pa 50. Fore wing length 950; sub-basal setae 50, 50, 80. Tergite IX setae S1 94, S2 112, S3 102. Tube length 150; basal width 66; anal setae 150. Antennal segments III–VIII length 52, 60, 50, 44, 42, 22.

Karnyothrips Watson

Karnyothrips Watson 1923, p 23. Type species: *Karynia weigeli* Watson.

This poorly defined genus currently includes 45 species, of which 30 are from North, Central or South America (Mound and Marullo 1996), with one from Ghana, three from India, two from the Philippines, and nine from Japan (Okajima 2006). Two species are widespread around the world, including Australia, and both of them have many synonyms. These two species are known to be predatory on scale insects (Palmer and Mound 1990), and other members of the genus possibly have a similar biology. *Karnyothrips* is currently considered polyphyletic, and there is no satisfactory definition of the genus. The included species are very similar to *Haplothrips* species, but usually have the fore tarsal tooth projecting forwards from the anterior margin of the tarsus (Figure 6), the prosternal basantra usually slightly longer than wide, the pronotal anteromarginal setae no longer than the discal setae, and the anal setae twice as long as the tube. In both species considered here, antennal segment III bears two small sensoria and segment IV bears three or four.

Key to *Karnyothrips* species from Australia

1. Maxillary stylets about 40% of head width apart; body uniformly brown; mid and hind femora brown with tibiae mainly yellowish; tergite IX setae S1 capitate, about 0.8 as long as tube *flavipes*
- Maxillary stylets scarcely 20% of head width apart; body bicoloured, abdominal segments I–VIII yellow; mid and hind legs yellow; tergite IX setae S1 finely acute, about 1.3 as long as tube *melaleucus*

Karnyothrips flavipes (Jones)

Anthothrips flavipes Jones 1912, p 18.

This is the type species of the genus, because *K. weigeli* Watson is one of 11 junior synonyms. The maxillary stylets are deeply retracted into the head but are widely separated. The antennae are brown, except for segment III that is yellowish, and the mid and hind tibiae are often yellow. In Australia, specimens have been studied from northern Queensland and Lord Howe Island, in association with grass tussocks.

***Karnyothrips melaleucus* (Bagnall)**

Hindsiana melaleuca Bagnall 1911, p 61.

Although described from a greenhouse in Denmark, this species has been seen from many tropical localities around the world (Mound and Marullo 1996). In Australia it has been studied from Lord Howe Island, northern Queensland, and Darwin in association with grasses. It is a striking species, with the head and thorax brown, also abdominal segments IX and X, but with the rest of the abdomen and the mid and hind legs yellow. The maxillary stylets are closer together than in any other described species in the genus.

***Mesothrips* Zimmermann**

Mesothrips Zimmermann 1900, p 12. Type species: *Mesothrips jordani* Zimmermann.

A total of 44 species is described in this genus, all from South-East Asia, particularly Indonesia, India, and Vietnam, but with two from Australia and one from Guam. In the absence of revisionary studies the significance of many of these species must remain in doubt, because one species discussed below is now recognised as highly variable. Moreover, although they are all “gall thrips” there appears to be little evidence that any of them induce galls. These thrips are commonly found in association with other thrips species, and they are probably phytophagous kleptoparasites rather than gall inducers. This suggestion is supported by the fact that both sexes vary greatly in body size, as in the related genus *Euoplothrips*. Although apparently differing in biology, *Mesothrips* species are closely related to those of *Dolichothrips*, as discussed above. Two species have been described from Australia, but these are here considered synonymous with the type species of the genus.

Recognition

Dark brown species exhibiting size-correlated polymorphism in fore tarsal tooth development; antennae eight-segmented, III with three sensoria, IV with four sensoria; head sharply constricted to basal neck (Figure 8) with a few small stout setae on cheeks, maxillary stylets retracted about half-way to postocular setae; prosternal basantra small, mesopresternum divided; fore tarsal tooth large in large individuals of both sexes; fore wing constricted medially; tergites II–V with additional sigmoid setae lateral to the major wing-retaining setae.

***Mesothrips jordani* Zimmermann**

Mesothrips jordani Zimmermann 1900, p 16.

Mesothrips australiae Hood 1918, p 139. syn. n.

Mesothrips bianchii Ananthakrishnan 1976, p 191. syn. n.

The character states given for *M. bianchii* by Ananthakrishnan do not distinguish this from the species described by Hood, and neither of these can be distinguished satisfactorily from

the widespread Oriental species *M. jordani* Zimmermann. In describing the species, Hood (1918) stated that *M. australiae* was perhaps merely a race of *M. jordani*, and in view of the wide range of variation within samples from any single locality there is no good evidence that more than one species is represented by these three names. Moreover, considering the variation that has been observed in samples both from Australia and from Kuala Lumpur, some of the other nominal species recognised in this genus by Ananthakrishnan (1976) are likely to be synonymous.

Prof. Shuji Okajima of Tokyo kindly provided the following information concerning variation in length (in μm) of the pronotal posteroangular setae amongst samples of *M. jordani* that he has collected in South-East Asia: Bali (17 females) 40–85; Singapore (two females) 65–80; Taiwan (about 50 females) 80–130; India (one female) 60; Japan Ryukyus (one large female) 130–140. The species is known from India, West Malaysia, Indonesia, Taiwan, China, and southern Japan (Ryuku Islands) (Okajima 2006). In Australia, it has been taken widely in the coastal rainforests of Queensland, including the Botanic Gardens at Mt Cootha, Brisbane, at Noosa Head, Gordonvale, and Atherton. Although living in leaf-roll galls of *Ficus* species, the wide range of structural variation in both sexes suggests that this thrips is a phytophagous kleptoparasite in the galls of *Gynaikothrips* species, rather than a gall-inducer.

Podothrips Hood

Podothrips Hood 1913, p 67. Type species: *Podothrips semiflavus* Hood.

The members of this worldwide genus all appear to be coccid predators living on Poaceae. An account of 18 species in this genus was given by Ritchie (1974), including a list of four generic synonyms, although subsequently four further species have been described from South-East Asia and two from New Zealand. The Australian fauna of this genus now comprises 10 species plus the Asian species, *P. lucasseni*. Nine of the 10 species constitute a single lineage, the *P. australis* group, in that they share the following character states: fore tibial inner margin with sub-apical setal-bearing tubercle but no apical tooth; antennal segments III and IV each with two sensoria; fore wing with no duplicated cilia; tergite VII with wing-retaining setae small and straight. The 10th species is divergent, in that it is apterous, and antennal segment III lacks sensoria and has a pronounced sub-basal ring, but the fore tibial sub-apical tubercle is similar to the other members of the *P. australis* group. As is typical of *Podothrips*, in all of the Australian species the prosternal basantra are longer than wide, and the pronotal anteromarginal setae are minute. The range of body colour within the genus is remarkable, from largely clear yellow to uniformly brown, but with most Australian species strikingly bicoloured. As in *Karnyothrips melaleucus*, the anal setae of most species are particularly long.

Key to *Podothrips* species from Australia

1. Abdominal tergite I comprising median pelta and two lateral sclerites; antennal segment III with one sensorium; fore tibia inner margin with apical tooth, basal to which is a prominent setal-bearing tubercle (Figure 64); fore femur inner margin with pronounced hump or at least rugose with several minute tubercles. *lucasseni*
- Abdominal tergite I comprising median pelta only; antennal segment III with two sensoria; fore tibia inner margin without an apical tooth, sub-apical setal-bearing tubercle present but sometimes small; fore femur inner margin smooth 2

2. Tergite IX setae S1 (both sexes) and S2 (females) capitate 3
- Tergite IX setae S1 and S2 acute. 5

3. Body yellow except head and abdominal segments VIII–X brown (Figure 71); both sexes micropterous, females rarely macropterous *websteri*
- At least thorax dark brown; both sexes macropterous 4

4. Body uniformly brown, legs all yellow (Figure 66); metathoracic sternopleural sutures long and well developed *australis*
- Body brown with basal abdominal segments variably yellow; all femora brown, tibiae yellow; metathoracic sternopleural sutures not developed *regina*

5. Head and body yellow except abdominal segments VIII–X brown (Figure 72); antennal segment III with sub-basal ring but no sensoria *barrowi*
- Head brown, body more extensively brown; antennal segment III without prominent sub-basal ring, with two sensoria 6

6. Body and legs brown except for apices of tibiae *orion*
- Body distinctly bicoloured, tibiae yellow. 7

7. Setae S1 on tergite VIII with apices acute; postocular setae acute 8
- Setae S1 on tergite VIII with apices capitate; postocular setae usually capitate 9

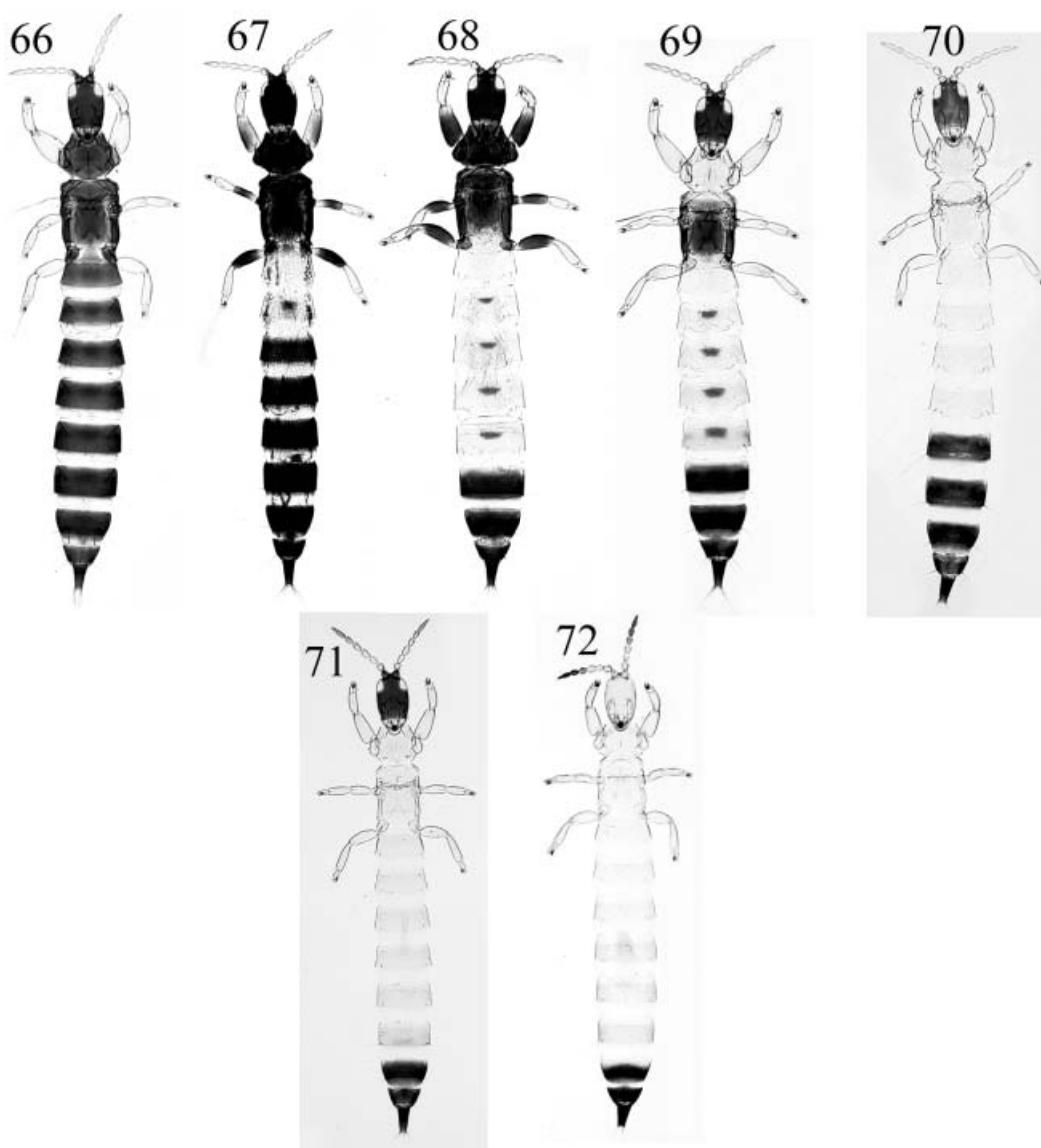
8. Body and femora largely brown except abdominal segments I–IV largely yellow; pronotal posteroangular setae acute *ardis*
- Body and femora largely yellow, head and abdominal segments VI–X brown (Figure 70); pronotal posteroangular setae capitate. *ritchiei*

9. Prothorax, abdominal segments I–II, and all legs yellow (Figure 69), abdominal tergites III–VI variably yellow with brown area medially *moundi*
- Prothorax and usually all femora brown 10

10. Abdominal tergites I–II yellow, III–VI yellow but usually with dark median area, VII–X dark brown (Figure 68). *xanthopus*
- Abdominal tergites I light brown, II yellow, III–IV with variable median brown area, V–X brown (Figure 67) *anomalus*

***Podothrips anomalus* sp. nov.**

Female macroptera. Bicoloured, head, thorax, and abdominal segments IV–X brown, I light brown, II yellow, III yellow with brown median area; antennal segments I and most of II brown, remaining segments yellow but VIII a little darker; tibiae and tarsi yellow, fore femora yellowish brown, mid and hind femora brown with base sometimes paler. Structure typical of group; major setae all capitate except S2 on abdominal segment VII, also S1 and



Figures 66–72. *Podothrips* species. (66) *P. australis*. (67) *P. anomalus*. (68) *P. xanthopus*. (69) *P. moundi*. (70) *P. richiei*. (71) *P. websteri*. (72) *P. barrowi*.

S2 on IX; antennal segment III relatively short with sensoria small; fore wing sub-basal seta S3 weakly capitate.

Measurements of holotype female (in μm). Body length 2130. Head, length 206; median width 144; postocular setae 26. Pronotum, length 172; width 256; major setae am 2, aa 18, ml 3, epim 38, pa 38. Fore wing length 710; sub-basal setae 14, 20, 28. Tergite IX setae S1 125, S2 134, S3 100. Tube length 124; basal width 58; anal setae 190. Antennal segments III–VIII length 46, 48, 44, 35, 44, 26.

Material examined

Holotype ♀ macroptera: Western Australia, Kununurra, from *Echinochloa*, 22 February 2005 (LAM 4556). Paratypes: Kununurra, Packsaddle, from grasses, 1♀, 2♂, 24 February 2005, 1♀, 3♂, 25 February 2005; Broome, 1♀, 2♂ from grasses, 28 February 2005; 20 km E of Broome, 1♀ from *Cenchrus setiger* (Poaceae), 1 March 2005.

Non-paratypes: Western Australia, Barrow Island, 1♀, April/May 2005; Northern Territory, Humpty Doo, 1♂ from grass, 24 December 1996; Queensland, Mareeba, 1♀ from grass tussock, 26 July 2004; Townsville, 1♀, 1♂ from grasses, 13 July 1995, 1♀ from *Salicornia*, 16 July 1995; Charters Towers, 1♂ from grasses, 3 July 1995; Paluma, 1♀ from grasses, 15 July 1995.

Comments

Specimens in the type series from Kununurra and Broome vary little in colour or structure. Moreover, in all of the specimens listed the setal form is constant, except that in some of the non-paratypic specimens the fore wing sub-basal seta S3 is acute. The female from Barrow Island has yellow femora and abdominal segment IV is yellow with a brown median area. Among the specimens from Queensland, the colour of the mid and hind femora varies from brown, to bicoloured, to yellow, and abdominal segment IV is yellow in some of these specimens. This probably represents a single widespread species across northern Australia, with an east–west variation in colour pattern.

***Podothrips ardis* sp. nov.**

Female macroptera. Bicoloured, head (Figure 61), thorax and abdominal segments VI–X brown, I–II yellow, III–IV yellow with a brown patch medially, V yellowish brown; antennal segments I and most of II brown, remaining segments yellow with VIII darker; tibiae and tarsi yellow, femora yellowish brown. Structure typical of group, but major setae acute except epimerals, coxals, tergite I laterals, and S2 on tergites III–V and VIII; antennal segment III relatively short with sensoria small; fore wing with two capitate and one acute sub-basal setae.

Measurements of holotype female (in µm). Body length 2250. Head, length 210; median width 160; postocular setae 50. Pronotum, length 205; width 305; major setae am 5, aa 35, ml 8, epim 45, pa 58. Fore wing length 700; sub-basal setae 20, 32, 25. Tergite IX setae S1 130, S2 140, S3 100. Tube length 120; basal width 62; anal setae 160? Antennal segments III–VIII length 44, 50, 48, 42, 46, 28.

Material examined

Holotype ♀ macroptera: Western Australia, Kununurra Gorge, from native grass, 23 February 2005 (LAM 4574).

Comments

Known only from a single female, this species is closely related to *P. anomalus* but is unusual in having most of the major setae acute.

Podothrips australis* RitchiePodothrips australis* Ritchie 1974, p 266.

The brown body and yellow legs of this species (Figure 66) constitute a uniform pattern that has been found in samples taken at the base of grasses at many sites across the dry inland areas of Australia, between the Spencer Gulf in South Australia, Rockhampton in Queensland, and the Hamersley Range of Western Australia. It is one of only three species in which the setae on tergite IX are not acute, and is also one of only three species treated here that have the metathoracic sternopleural sutures developed.

***Podothrips barrowi* sp. nov.**

Female aptera. Bicoloured, body and legs yellow except abdominal segments VIII–X and antennal segments V–VIII (Figure 72). Head with no ocelli, compound eyes reduced to less than 20 facets; postocular setae long and capitate; vertex without sculpture; antennal segment III short with pronounced sub-basal ring but no sensoria (Figure 28), IV with two sensoria. Fore tibial inner margin with sub-apical papilla small and bearing a seta; fore tarsal tooth not large. Meso and metanota without sculpture, wing axillary sclerites not developed; mesopresternum eroded into several pieces; metathoracic sternopleural sutures well developed. Pelta broad, without sculpture; tergites with wing-retaining setae no larger than median discal setae; tergite VIII with S1 and S2 capitate, IX with S1 and S2 acute.

Measurements of holotype female (in µm). Body length 1900. Head, length 172; median width 132; postocular setae 42. Pronotum, length 155; width 175; major setae am 3, aa 30, ml 3, epim 44, pa 42. Tergite IX setae S1 68, S2 102, S3 80. Tube length 100; basal width 60; anal setae 152. Antennal segments III–VIII length 32, 40, 34, 36, 36, 26.

Material examined

Holotype ♀ aptera: Western Australia, Barrow Island, collected with vacuum sampler, April/May 2005 (Jonathan Majer). Paratypes: 5♀ apterae collected with holotype.

Comments

Ananthakrishnan (1967) proposed a sub-genus *Saucrothrips* for a single species from India with antennal segment III very similar to *barrowi*. However, these two are not likely to be closely related, because the Indian species, *S. scitulus*, has the typical tooth-like tubercle at the inner apex of the fore tibiae that is found in many *Podothrips* species from around the world. In contrast, all members of the *P. australis* group discussed here lack this tubercle, and *P. barrowi* is probably an Australian endemic derived from within this group. It is the only species discussed here that has the metathoracic sternopleural sutures developed, apart from *P. australis* and *P. lucasseni*. Unlike so many of the species in this genus, the apical antennal segments are brown not yellow.

Podothrips lucasseni* (Krüger)Phloeothrips lucasseni* Krüger 1890, p 105.

This is a widespread Asian species that is sometimes associated with sugar cane or even rice. It is recorded by Ritchie (1974) from Hawaii to Bangladesh, with both *hawaiiensis*

Moulton and *oryzae* Priesner placed as synonyms. It differs from all of the Australian species in this genus in the character states indicated in the key (Figure 64), and also in the uniform brown body and femora contrasting with the yellow tibiae. Two small females have been studied from Darwin.

***Podothrips moundsi* Ritchie**

Podothrips moundsi Ritchie 1974, p 274.

Described from Port Moresby, New Guinea, this species is here recorded from Australia based on specimens taken at several sites near Darwin and Kakadu in Northern Territory, and also from 15 km east of Broome in Western Australia. The postocular and pronotal posteroangular setae are capitate in the type specimens, but vary in the Australian specimens, both pairs of setae sometimes being acute. The legs are generally yellow (Figure 69), but the hind femora are sometimes shaded brown.

***Podothrips orion* Ritchie**

Podothrips orion Ritchie 1974, p 277.

This is the only member of the Australian lineage within *Podothrips* that is uniformly brown with brown legs. Despite the colour, it is similar in structure to the other species, with the major setae all capitate except for those on tergite IX, and the fore tibia with a sub-apical setal-bearing tubercle. It is known only from the dry areas of South Australia near Port Augusta.

***Podothrips regina* sp. nov.**

Female macroptera. Bicoloured, head, antennal segment I, and thorax dark brown, also all femora and abdominal segments VI–X; abdominal segments I–IV yellow, V yellow shaded with brown; tibiae, tarsi, and antennal segments II–VIII yellow. Structure typical of group, all major setae capitate except S3 on tergites VII and IX; three capitate sub-basal wing setae; tergite VII with anterior pair of wing-retaining setae small and sigmoid but posterior pair small and straight.

Measurements of holotype female (in µm). Body length 1750. Head, length 186; median width 150; postocular setae 28. Pronotum, length 178; width 232; major setae am 3, aa 16, ml 3, epim 36, pa 32. Fore wing length 710; sub-basal setae 18, 22, 24. Tergite IX setae S1 50, S2 75, S3 100 ? Tube length 96; basal width 58; anal setae 180. Antennal segments III–VIII length 46, 44, 36, 40, 40, 28.

Material examined

Holotype ♀ macroptera: Queensland, Dalby, Lake Broadwater, from roadside grasses, 19 July 1995 (LAM 2774). Paratypes: 1♀ collected with holotype; Queensland, 15 km S of Charters Towers, 1♀ from roadside grasses, 2 July 1995.

Non-paratypes: Northern Territory, Elliott, 2♂ from grasses, 24 July 1993.

Comments

Very similar to *P. australis* in structure, apart from the fore wing sub-basal setae and lack of metathoracic sternopleural sutures, this species is readily distinguished by the colour of the

body and legs. The two males excluded as paratypes have the anterior abdominal segments more extensively shaded brown.

***Podothrips ritchiei* sp. nov.**

Female macroptera. Bicoloured, head and abdominal segments VI–X brown, pronotum yellow with anterior margin lightly shaded, pterothorax and abdominal segments I–V yellow (Figure 70); antennal segment I brown, rest yellow. Structure typical of group, except postocular, pronotal posteroangular, and tergite VIII S1 setae all acute, remaining major setae capitate; tergite IX major setae long and acute, tergite VII with S3 setae long and acute; tergites III–V each with two pairs of sigmoid wing-retaining setae of which each anterior pair is small; tergites II, VI, and VII with these setae short and straight. Fore wing with one short and one minute sub-basal setae.

Measurements of holotype female (in μm). Body length 2200. Head, length 200; median width 150; postocular setae 40. Pronotum, length 170; width 185; major setae am 5, aa 15, ml 5, epim 45, pa 35. Fore wing length 750; sub-basal setae 8, ?, 18. Tergite IX setae S1 80, S2 100, S3 75. Tube length 120; basal width 65; anal setae 150? Antennal segments III–VIII length 40, 43, 40, 40, 45, 25.

Material examined

Holotype ♀ macroptera: Northern Territory, Dunmarra, from base of Spinifex grasses, 24 July 1993 (LAM 2510). Paratypes: 5♀ taken with holotype.

Comments

Similar in colour pattern to *P. websteri*, but with the abdomen slightly less extensively yellow, this species also differs in having several pairs of major setae acute not capitate.

***Podothrips websteri* sp. nov.**

Female microptera. Bicoloured, head, antennal segment I, and base of II brown, also abdominal segments VIII–X, rest of body and legs yellow (Figure 71). Structure typical of group, except antennal segment III conical without lateral swelling; fore tarsal tooth not large; fore tibia with sub-apical setal-bearing tubercle very small; fore wing shorter than width of thorax; mesopresternum fully developed; tergites II–VII with anterior pair of wing-retaining setae very small and straight, also posterior pair on II and VII; major setae all capitate except S3 on tergite IX.

Measurements of holotype female (in μm). Body length 1950. Head, length 196; median width 272; postocular setae 28. Pronotum, length 152; width 220; major setae am 3, aa 12, ml 3, epim 28, pa 24. Fore wing length 120. Tergite IX setae S1 50, S2 78, S3 88. Tube length 116; basal width 56; anal setae 80. Antennal segments III–VIII length 40, 46, 44, 40, 42, 30.

Male microptera. Similar to female but smaller. Tergite IX setae S2 stout but 0.8 as long as setae S1.

Female macroptera. Similar to micropterae. Fore wing pale without duplicated cilia; sub-basal setae scarcely 15 µm; anterior pair of tergal setae small and straight.

Material examined

Holotype ♀ microptera: Australian Capital Territory, Black Mtn, base of native *Poa*, 8 August 2003 (Kenneth Webster). Paratypes: 1♀, 1♂ taken with holotype; 1♀ at same site, 7 December 2003; 1♂ ditto, 9 April 1995; New South Wales, 20 km W of Coonabarabran, 4♀ micropterae, 1♀ macroptera from base of native *Poa*, 12 March 2006.

Comments

One female paratype collected with the holotype has the tube unusually short and presumably aberrant. Although some of the character states in the description are associated with micropterae, the body colour of this species is unique.

***Podothrips xanthopus* Hood**

Podothrips xanthopus Hood 1919, p 82.

This is a widespread species in the coastal regions of Queensland and New South Wales north of Sydney, but has also been taken in the central parts of Northern Territory near Tennant Creek. Throughout this range, *P. xanthopus* is uniform in structure and colour pattern (Figure 68). In contrast, the new species *P. anomalus* varies in colour pattern, judging from specimens taken widely across the tropical parts of northern Australia.

***Priesneria* Bagnall**

Priesneria Bagnall 1926, p 549. Type species: *Priesneria kellyana* Bagnall.

Although treated by Pitkin (1973) as a genus with two species from Australia and one each from India and New Caledonia, the phylogenetic position of these taxa is far from clear. They all share a curious ring-like swelling near the base of the third antennal segment (Figure 5), but a similar structure occurs in various species within unrelated genera, as discussed above under character states of the Haplothripini. The type species of the genus has the two terminal antennal segments broadly joined, forming a single outline, and there is only one sensorium on the third segment and two on the fourth; these character states also occur in the closely related new species described below. The pseudovirga at the apex of the aedeagus in males of these two species is slender but apparently rather shorter than is described for any *Haplothrips* species. In contrast, the Australian species, *P. longistylota*, has the eighth antennal segment long and slender, unlike that of any other member of the Haplothripini, and has two sensoria on the third segment and four on the fourth. This species seems unlikely to be closely related to the first two species. The two non-Australian species have two sensoria on the third and fourth antennal segments, but have not been re-examined for this study. A macropterous female and an apterous male from Mt Tamborine, Queensland, considered by Pitkin (1973) to represent this genus, possibly belong to the South African genus *Talitha* Faure, otherwise unknown in Australia, because the male has a glandular area on sternite VIII and the setae on the ninth tergite are longer than the tube.

Key to *Priesneria* species from Australia

1. Antennal segment VIII slender, about five times as long as wide and as long as segment VII; segment III with two sensoria, IV with four sensoria. *longistylota*
- Antennal segment VIII broadly joined to VII, scarcely twice as long as basal width and about 0.6 as long as VII; segment III with one sensorium, IV with two sensoria 2
2. Major setae on head, pronotum and abdomen capitate, including tergite IX setae S1 and S2 *kellyana*
- Major setae on head, pronotum and abdomen finely acute, only S2 on tergite VIII capitate *peronis*

***Priesneria kellyana* Bagnall**

Priesneria kellyana Bagnall 1926, p 549.

Described from a single apterous female taken at Melbourne, a second female has been studied that was collected from dead twigs at Canberra in 1994. Moreover, two males that apparently represent this species were collected on dead twigs of *Acacia* 140 km south of Broome in the north of Western Australia. These males have all of the major dorsal and lateral setae capitate, except that setae S2 on tergite IX are short and pointed, and S3 finely acute.

***Priesneria longistylota* Pitkin**

Priesneria longistylota Pitkin 1973, p 327.

Known only from three macropterous females taken from leaf litter at Trangie, New South Wales, the antennae of this species are unique in the Phlaeothripidae, with the eighth segment long and slender but the third segment with a sub-basal ring-like swelling.

***Priesneria peronis* sp. nov.**

Female aptera. Body, antennae, and legs light brown, mid and hind tarsi yellow with apices of these tibiae variably yellow. Head longer than wide, without ocelli; maxillary stylets retracted to postocular setae and about one-third of head width apart, maxillary bridge complete. Antennae with segment VIII closely joined to VII; segment III with one sensorium, IV with two sensoria; segment III with distinctive sub-basal swelling (Figure 5). Pronotum with four pairs of major, acute, setae, am setae not much larger than discal setae. Fore tarsus with very small tooth at inner apex. Metanotum with no sculpture medially. Mesopresternum fully eroded medially; metathoracic sternopleural sutures long. Pelta with rounded margins; wing-retaining setae short and straight, major setae all acute except S2 on tergite VIII.

Measurements of holotype female (in µm). Body length 1850. Head, length 190; median width 140; postocular setae 44. Pronotum, length 122; width 232; major setae am 12, aa 24, ml 24, epim 42, pa 30. Tergite IX setae S1 76, S2 80, S3 118. Tube length 106; basal width 56; anal setae 166. Antennal segments III–VIII length 44, 48, 44, 38, 42, 24.

Male microptera. Similar to female but smaller. Tergite IX setae S2 short and stout; pseudovirga slender with pointed apex.

Material examined

Holotype ♀ microptera: Australian Capital Territory, Black Mtn, from *Eucalyptus* dead branch, 23 April 2004 (LAM 4416). Paratypes: 1♀, 1♂ from dead twigs at type locality, 18 October 2005, 1♂ ditto, 13 April 2006, 4♀, 2♂ ditto, 2 October 2006; Australian Capital Territory, Namadji, 1♀, 1♂ from dead twigs, 16 July 2005.

Comments

When alive on the collecting tray, the adults of this species exhibited a curious worm-like motion. The fact that they have been collected from dead branches, one specimen at a time, might indicate that the species is predatory rather than fungivorous. This new species is essentially similar to the type species of the genus, and both species have been taken from the same locality at Canberra. Two specimens of this genus mentioned by Pitkin (1973) from near Biloela, Queensland, possibly represent a further species. These have the postocular setae finely acute but the epimeral and lateral abdominal setae capitate.

Xylaplothrips Priesner

Haplothrips (*Xylaplothrips*) Priesner 1928, p 572. Type species: *Cryptothrips fuliginosa* Schille.

The type species of this genus is from Europe, where it is widespread on dead branches. However, unlike fungus-feeding Phlaeothripinae it is never found in large numbers, and it is therefore probably a predator of mites on dead wood rather than a fungus feeder. In both biology and structure it seems unlikely to be related to many, or even most, of the species currently placed in *Xylaplothrips*. In *X. fuliginosus* the third and the fourth antennal segments both bear only two sensoria, whereas the genus has been widely interpreted (Pitkin 1976; Okajima 2006) as including species with three sensoria on the third antennal segment and four sensoria on the fourth segment. In Australia, species with this antennal sensorium formula are associated with the galls of other thrips species, but the currently available material is too inadequate to draw any conclusions concerning either their biology or systematic relationships. Pitkin (1973) distinguished three species from Australia, all with three sensoria on the third antennal segment. However, *X. darci* (Girault, 1930) and *X. clavipes* (Karny, 1920) are both known only from single specimens, although *X. reedi* Pitkin has been taken at several sites from tree leaves webbed together by caterpillars.

Acknowledgements

Many Australian entomologists have contributed over the past 10 years toward the studies reported here, particularly Haidee Brown and Glenn Bellis at Darwin, Tony Postle at Broome and Cairns, Angus Wilson at Kununurra, Margaret Williams and John Ireson at Hobart, Desley Tree at Indooroopilly, and Alice Wells at Canberra. Richard zur Strassen at the Senckenberg Museum, Frankfurt, Steve Nakahara and Dave Nickle at USDA, Beltsville, MD, and Jon Martin at the Natural History Museum, London, have arranged many loans from, and provided critical observations on, the thrips collections in their care. The second author received funding from the Ministry of Science Research and Technology, Iran, also the University of Tehran, in support of a study visit to Canberra, where research facilities were provided by CSIRO Entomology. Holotypes of the new

species described here are deposited in the Australian National Insect Collection, Canberra; paratypes of several species together with many other specimens are deposited in the Natural History Museum, London.

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