

## The genus *Scirtothrips* in Australia (Insecta, Thysanoptera, Thripidae)

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## Abstract

Twenty-one species of leaf-feeding thrips from Australia in the genus *Scirtothrips*, including eleven newly described species, are here distinguished with an identification key and illustrations. Some of these species are host-specific, but with diverse host associations, including tree ferns, two different genera of cycads, *Acacia*, *Allocasuarina*, *Brachychiton*, *Hakea*, and *Kunzea*. Two new species-groups, based on *S. albomaculatus* and *S. akakia*, are distinguished, both with several species on endemic species of *Acacia*. In contrast, other species are highly polyphagous, and some of these are crop pests, including *S. dorsalis* and *S. aurantii*, the South African citrus thrips that was introduced recently to Queensland. Three species are part of the northern tropical fauna, *S. dorsalis*, *S. dobroskyi*, and *S. tenor*, whereas most of the others are endemic to the arid areas of Australia. The monotypic genus *Labiothrips* Bhatti & Mound is synonymised with *Scirtothrips* Shull, and the New Zealand species *S. pan* Palmer & Mound is removed from the Australian list as a misidentification. The species recognised are: *S. akakia* sp.n., *S. albomaculatus* Bianchi, *S. astibos*, sp.n., *S. aurantii* Faure, *S. australiae* Hood (= *auricorpus* Girault, **syn.n.**), *S. casuarinae* Palmer & Mound, *S. dobroskyi* Moulton, *S. dorsalis* Hood, *S. drepanofortis* sp. n., *S. eremicus* sp.n., *S. frondis* sp.n., *S. helenae* Palmer & Mound, *S. inermis* Priesner, *S. kirrhos* sp.n., *S. litotes* sp.n., *S. longipennis* (Bagnall), *S. moneres* sp.n., *S. pilbara* sp.n., *S. quadriseta* sp.n., *S. solus* sp.n., and *S. tenor* (Bhatti & Mound).

**Key words:** *Scirtothrips*, pests, citrus, Australian endemics, host-specificity

## Introduction

Species of the genus *Scirtothrips* are small, active thrips that breed on the young leaves of plants, although adults may at times be found in flowers. *Scirtothrips* species occur mainly in the warmer parts of the world, and several of them are serious pests on a range of unrelated plants. The Californian citrus thrips, *S. citri* (Moulton), also the South African citrus thrips, *S. aurantii* Faure that has recently become established in Australia, are both well known for causing economically important damage to citrus fruit. Similarly, *S. perseae* Nakahara, a recently introduced pest of avocados in California, causes considerable financial losses due to fruit scarring as a result of feeding by adults and larvae (Hoddle et al., 2003). In contrast, *S. dorsalis* Hood is widespread and a frequent pest in countries between Pakistan, Japan and Australia, causing damage to many crops including chillies, tea, grapes, and strawberry plants. In addition to these major pests, several other *Scirtothrips* species have been recorded as damaging crop plants, either in tropical countries or under glass in temperate countries (Mound & Palmer, 1981).

Worldwide, the number of described *Scirtothrips* species has more than doubled in the past 20 years. Bailey (1964) stated that the genus included 35 species, but this had increased to about 40 when Mound & Palmer (1981) provided a means of recognising the 10 major pest species in this genus. In contrast, with the 11 new species from Australia described here, the total number of described *Scirtothrips* is now over 100. Of this total, 32

new species were described recently from Mexico (Johansen & Mojica-Guzman 1999), although there is considerable doubt concerning the validity of many of those species (Mound & zur Strassen, 2001), for the following reasons. First, the differentiating character states used by the Mexican authors were mainly structural details that are known to be highly variable within certain well-studied pest species of *Scirtothrips* whose specific identity is not in question. Second, it is remarkable biologically that 21 of these Mexican species were stated to be associated with damage to mango trees, *Mangifera indica*, a plant that is not native to the Americas, and to which the native thrips must thus have host-shifted. Third, seven of the 32 Mexican species were collected from avocado trees, *Persea americana*, although a subsequent survey of the thrips associated with this crop in many parts of Mexico yielded only a single member of this genus, *S. perseae* Nakahara, despite over 800 specimens being slide mounted and studied (Hoddle et al. 2002).

Good taxonomic work requires that the identities of the host-plants on which thrips breed are established, so that an accurate estimate can be obtained of the natural intra-population variation in morphological structure. But establishing host-plant relationships of these insects is sometimes difficult, because adults disperse on the wind and can be collected from plants with which they have no biological association. For example, Johansen & Mojica-Guzman (1999) stated that one of their new *Scirtothrips* species from Mexico came from Poaceae, and another from mosses. These two host associations would, if true, be unique within the genus, but both species are based on single females whose host association thus remains unproven. Host plants can be determined only by finding larvae associated with their adults, thus providing evidence of breeding populations. Despite problems of determining host plant range through field collections, there is accumulating evidence that although some *Scirtothrips* species are polyphagous, many are monophagous, and the host-plants of monophagous species come from a very wide range of unrelated plant families. In considering the geographical distribution of *Scirtothrips* species, it is notable that most of the pest species in this genus are localised to particular parts of the world, and have not become widely distributed, in contrast to many pest thrips.

There are considerable technical problems in studying *Scirtothrips* species. Many have been described on inadequately prepared specimens, the descriptions including information only on colour and such character states as are readily visible in silhouette. The original specimens on which these species were based are commonly not translucent, and the resultant iridescence from the body contents obscures details of the body surface that are now considered essential to distinguish species. To define species of *Scirtothrips* accurately it is necessary to remove the contents from the typically pale bodies, so that details of surface sculpture and the distribution patterns of microtrichia and small setae are revealed. Moreover, it is essential to prepare a good series of specimens, from several localities, in order to appreciate the range of intraspecific variation (for preparation methods, see Mound & Gillespie, 1997; Moritz et al, 2001).

The objective of this paper is to provide a means of identifying the 21 *Scirtothrips* species that can be recognised currently in Australia, and in particular to distinguish the major pest species from the members of the native fauna. Palmer & Mound (1983) treated nine species from this continent, but the record of one of these, the New Zealand species *S. pan* Mound & Walker, is here considered to be a misidentification. To the eight remaining species are now added 11 new species, as well as the recently introduced South African citrus thrips, *S. aurantii*, together with a further species that was described in another genus and that is a minor pest of cultivated *Cycas* species.

### Character states for species discrimination

Details of character states that can be used in the recognition of species in the genus *Scirtothrips* were discussed and illustrated by Mound & Palmer (1981), but some endemic Australian species are remarkably variable, even between individuals collected from the same host plant and locality.

*Colour*: Most species are mainly yellow. In those species in which females have distinctive brown markings these are usually not present in males or on newly emerged adult females. Body colour must thus be used cautiously as a discriminant. The abdominal tergites often have brown shadings medially, although this is less commonly true of the sternites. The antecostal ridge of each tergite and sternite is shaded or dark in most species. The first antennal segment is usually pale, but the colour of the second segment appears to vary depending on the slide-mounting technique and chemical treatment; the distal segments are usually dark, but segments III and IV are pale in many species. The forewings are commonly shaded or even dark.

*Antennae*: Antennal segment III varies in length and shape between species, but these character states are not used in this study. Length of the antennal segments varies, particularly in relation to body size.

*Head*: Most species have the head distinctly wider than long, and in several species the mouth cone is long such that it extends to the mesosternum in slide-mounted specimens. Three pairs of ocellar setae are present in all species, but the position and length of ocellar setae III, and the form of sculpture within the ocellar triangle, are useful character states for distinguishing species. However, the precise position and length of ocellar setae III have been found to be variable within some species. A few species have four ventrolateral ommatidia of the compound eyes strongly pigmented, although these ommatidia are weakly pigmented in several species, but unpigmented in others. The number of setae in the postocular row - one, two or three setae - appears to be constant within species.

*Pronotum*: The surface of the pronotum is always transversely striate, but the striae are very close in some species (less than the diameter of the basal pore of a discal seta), but wide apart in others (twice the diameter of a setal pore). The posterior margin usually bears four pairs of setae, although there are five pairs in the members of the *S. albomacu-*

*latus* species-group. The posteromarginal setae pair S2 varies in length between species, and is thus a useful discriminant, but the length is variable within many species. The number and pattern of distribution of the pronotal discal setae varies between species, but is too variable within species to be useful as a discriminant.

*Mesonotum*: No significant variation between species has been observed in the chaetotaxy or sculpture of this sclerite.

*Metanotum*: The position and length of the median setae, and the form of the sculpture of this sclerite are useful in species recognition, despite considerable individual variation.

*Forewing*: The condition of the cilia on the posterior margin, whether straight or undulating (wavy), is a useful discriminant. However, some species have most cilia straight and only one or two undulating near the base of the forewing, and this character state is particularly variable in *S. australiae*. The number of setae on the second vein is often useful, particularly when high (more than 8) or exceptionally low (1 or 2), but varies from 1 to 5 in *S. australiae*. The number and placement of setae on the first vein is a useful discriminant in some species, but appears to be highly variable in those Australian endemic species that are associated with *Acacia*. The separation into 'groups of setae' indicated in each species description is based on whether individual setal bases are more than 2.5 times a setal length apart.

*Abdominal tergites*: The setae on the first tergite vary in length between species, but appear to be absent in a group of species associated with *Acacia*. The position of the median pair of setae on the median tergites, whether close together or widely separated from each other, is a useful discriminant. The lateral microtrichial fields usually comprise closely spaced rows, but these rows are unusually sparse in some Australian species. The posteromarginal comb on tergite VIII is interrupted medially in a few species, a character state not previously recorded in this genus, and in two species the comb on tergite VII is almost complete medially. The presence of discal microtrichia anteromedially on VIII and posteromedially on IX is useful in recognising some species.

*Abdominal sternites*: The sternal microtrichial fields are continuous medially in two species. However, in many Australian species these microtrichial fields are sparser than in most *Scirtothrips* from other countries. In *S. albomaculatus* the sternal marginal setae arise in front of the margins, and in *S. quadriseta* there are commonly four instead of three pairs of marginal setae.

*Males*: In *S. aurantii* the hind femora bear a distinctive row of stout dark setae. At least two Australian species have paired complex arrays of spines laterally on the aedeagus, although these are not found in most members of this genus. The form of the parameres is possibly useful for distinguishing species, but there are problems in orientating these for study, as well as displaying the aedeagus structure, in slide mounted individuals. Tergite IX commonly bears a pair of lateral drepanae that curve dorsally, although these are not developed in the *S. albomaculatus* species group.

### Intraspecific patterns of variation

Seven of the 11 new species described here are apparently associated with various endemic species of the genus *Acacia*. This plant genus includes approximately 1000 species in Australia, and more than 250 species of phlaeothripine Thysanoptera are known to be associated with the foliage (Crespi, Morris & Mound, in press). These Phlaeothripinae have radiated to a remarkable extent, and recognition of species in some of the genera involved has proved very difficult. Similarly, the species of *Scirtothrips* associated with *Acacia* in Australia have proved to be variable within and between sites, and much more work is needed to understand the significance of this morphological variation. Many *Acacia* species exist as a mosaic of intergrading forms, and the arid areas in which most of them grow have an unpredictable rainfall pattern that results in new foliage being produced very irregularly. Presumably, irregularity of suitable flush growth for feeding and oviposition results in rapid changes in population levels of the Thysanoptera that feed on these *Acacia* species. This is likely to enhance the founder effect on patterns of structural variation, with local populations being founded by those few females that successfully locate these patchily distributed resources. Character states such as the number of setae on the forewing veins, and the precise position of ocellar setae III within the triangle, have been found to be unusually variable amongst the available Australian material. At present, it is not possible to conclude whether the fragmentary material available particularly from the Pilbara area of Western Australia represents several undescribed species or variation within some of the species described here. Of particular interest is a new species described below from *Hakea*, because in most details of its structure this species is remarkably similar to some of the species from *Acacia*, but in contrast the mouth cone of adults and larvae is far longer and more pointed, and the male bears drepanae that are longer than in any known *Scirtothrips* species. Presumably, molecular techniques will eventually help to establish the relationships and the extent of gene flow between such populations. For the present, a conservative interpretation has been placed on the structural variation that has been observed in this study, until such time as a more comprehensive survey combining molecular techniques with morphological details can be achieved.

### Faunal and floral relationships

Of the 21 species recorded here from Australia, *S. aurantii* is native to Africa and has only recently been introduced inadvertently to Australia. The countries of origin of *S. inermis* and *S. longipennis* are more difficult to deduce, both having been recorded widely around the world. In contrast, *S. dobroskyi*, *S. dorsalis*, and *S. tenor* have a natural distribution that includes the tropical north of Australia, and each of them has been found in adjoining territories to the north of this continent. The remaining 15 species are presumably all Australian endemics, although their host associations are exceptionally diverse. Seven species

are from various species of *Acacia* (Mimosaceae), but the others have been found breeding on members of the following families: Casuarinaceae, Cyatheaceae, Cycadaceae, Dicksoniaceae, Myrtaceae, Proteaceae, Santalaceae, Sapindaceae, Sterculiaceae, and Zamiaceae.

### Species removed from Australian list

*Scirtothrips pan* Mound & Walker (1982) was described from New Zealand, where it has been taken on a wide range of native plants from both North and South Islands. Palmer & Mound (1983) tentatively recorded this species from Australia, but the specimens on which this record was based are now considered to have been misidentified. They represent several species, including *S. frondis* described below.

### Type depositaries

Holotypes of the new species described here are deposited in the Australian National Insect Collection, CSIRO Entomology, Canberra. Paratypes will be deposited where possible in the Natural History Museum London, and other major collections.

### *Scirtothrips* Shull

*Scirtothrips* Shull, 1909: 222. Type species *S. ruthveni* Shull, by monotypy.

*Labiothrips* Bhatti & Mound, 1994: 162. Type species *L. tenor* Mound & Bhatti, by monotypy. **Syn. n.**

In describing the genus *Labiothrips*, the authors emphasised the unusually elongate mouth cone of the only known species, also the head of females with the occipital ridge almost confluent with posterior margin of the compound eyes. Because of these character states, the species was not compared to any member of the genus *Scirtothrips*. Moreover, at the time of that description the male of the species was not known. However, the males are now known to have the mouth cone rather shorter than that of females, and the postocular region distinctly longer. Moreover, the males have drepanae on the ninth tergite, as is common among *Scirtothrips* species. Given the variation in mouth cone length among the species of *Scirtothrips* recorded here, as well as the variation in other character states, there seems little point in segregating this one species to a separate genus. This is discussed further under *S. tenor* below. *Anascirtothrips* is another closely related genus (Mound & Wang, 2000), but the three known species all have a fringe of microtrichia on the sternites and the posterolateral setae on the mesonotum are close to the median setae. The second antennal segment lacks microtrichia (Mound & Wang, 2000), in contrast to *Scirtothrips* species, but the pronotum of some of the new species described below has setae on the posterior half in contrast to most members of the genus worldwide.

Key to Australian *Scirtothrips* species

1. Abdominal sternites IV – VI with microtrichia extending fully across (Figs 52, 54)... 2
  - Abdominal sternites IV – VI with microtrichia not extending across median area (Figs 51, 55, 56) ..... 3
2. Forewing posteromarginal cilia straight; ocellar setae III arising between midpoint of posterior ocelli (Figs 6, 7); metanotal median setae arise well behind anterior margin; tergite IX of female with many discal microtrichia medially; male hind femora without comb of stout setae, and tergite IX without drepanae ..... *dorsalis* Hood
  - Forewing posteromarginal cilia undulating; ocellar setae III arising between anterior margins of posterior ocelli (Fig. 3); metanotal median setae arise close to anterior margin; tergite IX of female without discal microtrichia medially; male hind femora with comb of stout setae (Fig. 37), and tergite IX with drepanae ..... *aurantii* Faure
3. Postocular setal row with 3 or 4 pairs of setae each as long as ocellar setae III (Figs 2, 9, 17); males where known without drepanae on tergite IX ..... 4
  - Postocular setal row with 2 (or 1) pairs of setae as long as ocellar setae III (Figs 1, 5, 14); males usually with drepanae on tergite IX ..... 8
4. Metanotal sculpture transversely striate or reticulate on posterior as well as anterior (Fig. 35); pronotal posterior margin with 4 pairs of setae; tergites IV – VI with discal setae S1 half as long as S2, distance between bases of S1 setae more than twice their length ..... *helenae* Palmer & Mound
  - Metanotal sculpture transverse on anterior but longitudinal on posterior half (Figs 21, 32); pronotum with 5 pairs of posteromarginal setae; tergites IV – VI with discal setae S1 as long as S2, distance between bases of S1 setae about twice the diameter of their basal pores ..... 5
5. Pronotal posteromarginal setae all equally short, or at least S2 no more than 1.3 as long as S1 ..... *eremicus* sp.n.
  - Pronotal posteromarginal setae S2 longer, at least 1.5 as long as S1 ..... 6
6. Sternites IV – VI with median marginal setae arising in front of sternal margin (Fig. 55); tergite VIII marginal comb complete medially ..... *albomaculatus* Bianchi
  - Sternal marginal setae all arise at margin (Figs 53, 56); tergite VIII marginal comb often interrupted medially (Fig. 45) ..... 7
7. Pronotal discal setae short, stout and blunt ..... *astibos* sp.n.
  - Pronotal setae all slender, tapering to apex ..... *pilbara* sp.n
8. Antennae 7-segmented, suture between VII – VIII not developed ..... 9
  - Antennae 8-segmented, suture between VII – VIII usually well-developed but rarely weak ..... 10
9. Body dark brown, head very dark (Fig. 20); pronotal posteromarginal setae S2 about 30 microns long, scarcely longer than width of antennal segment II ..... *solus* sp.n.
  - Body yellow with brown markings (Fig. 5); pronotal posteromarginal setae S2 about 50 microns long, twice as long as width of antennal segment II .....



- ..... *casuarinae* Palmer & Mound
10. Abdominal tergite VII with posteromarginal fringe of microtrichia extending mesad of discal setae II, usually complete medially (Fig. 48)..... *litotes* sp.n.
- Abdominal tergite VII with posteromarginal fringe of microtrichia not extending mesad of discal setae II (Figs 45-47) ..... 11
11. Occipital ridge close to posterior margin of eye (Fig. 18), postocular region shorter than diameter of one ommatidium in female, about equal to one ommatidium in male; mouth cone unusually long and slender ..... *tenor* Bhatti & Mound
- Occipital ridge not close to posterior margin of eye, postocular region longer, equal to diameter of two ommatidia; mouth cone usually not extending beyond fore coxae... 12
12. Ocellar triangle without any regular lines of sculpture between posterior ocelli (Figs 1, 13, 19) ..... 13
- Ocellar triangle with regular lines of sculpture between posterior ocelli, either transversely striate or transversely reticulate (Figs 6, 11, 14)..... 17
13. Postocular setal row with only 1 pair of setae as long as ocellar setae III; major setae on head, thorax and forewings bluntly thickened (Fig. 16) ..... *moneres* sp.n.
- Postocular setal row with 2 pairs of setae as long as ocellar setae III; major setae all slender and setiform (Figs 13, 19)..... 14
14. Abdominal tergite I with pair of setae (figs 36, 41); mouth cone extending to mesosternum; male with drepanae on tergite IX 1.5 times as long as median length of this tergite (Fig. 57)..... *drepanofortis* sp.n.
- Abdominal tergite I with no setae (Fig. 33); mouth cone scarcely extending beyond fore coxae; male drepanae (where known) 0.6 as long as tergite ..... 15
15. Body uniformly brown; pronotal posteromarginal setae S2 scarcely 0.5 as long as median width of antennal segment II; sternites III – V commonly with 4 pairs of marginal setae (Fig. 56)..... *quadriseta* sp.n.
- Body yellow with extensive and variable brown markings on head, thorax and abdomen; pronotal posteromarginal setae S2 at least 0.8 as long as median width of antennal segment II (Fig. 13); sternites III – V with 3 pairs of marginal setae ..... 16
16. Abdominal tergites III – V with distance between basal pores of median setae less than 1.5 times the length of these setae (Fig. 33); female tergite IX with three pairs of equally stout posteromarginal setae (Fig. 38); tergite IX dark brown, darker than tergite VIII ..... *akakia* sp.n.
- Abdominal tergites III – V with distance between basal pores of median setae at least 2.5 times the length of these setae (Fig. 38); female tergite IX with two pairs of equally stout posteromarginal setae with a small slender pair of setae between them; tergite IX yellowish, paler than VIII..... *kirrhos* sp.n.
17. Forewing posterior margin with all cilia straight without any undulations ..... 18
- Forewing posterior margin with at least one or two cilia near basal half of wing not straight, sometimes with all cilia weakly to strongly undulating..... 19

18. Ocellar setae III long, about twice as long as median length of one posterior ocellus (Fig. 12); abdominal tergites with 4 to 6 setae on each lateral microtrichial field (Fig. 44); tergite VIII with microtrichia medially near anterior margin; male tergite IX without paired drepanae ..... *inermis* Priesner
- Ocellar setae III scarcely longer than median length of a posterior ocellus (Fig. 10); abdominal tergites with 3 setae on each lateral microtrichial field; tergite VIII without microtrichia medially near anterior margin; male tergite IX with pair of curved drepanae ..... *dobroskyi* Moulton
19. Ocellar setae III wide apart, arising on or outside anterior margins of ocellar triangle (Fig. 14)..... *longipennis* Bagnall
- Ocellar setae III arising within ocellar triangle, usually closer together than diameter of first ocellus (Figs 4, 11) ..... 20
20. Pronotum with transverse striae widely separated, anterior half of pronotum with several striae further apart than diameter of a discal seta basal pore (Fig. 11); ocellar setae III arising between midpoints of posterior ocelli, posterior to tangent between anterior margins of these ocelli; pronotal posterior margin with more than one pair of setae longer than maximum diameter of antennal segment III ..... *frondis* sp.n.
- Pronotum with transverse striae closely spaced, anterior half of pronotum with striae closer together than diameter of a discal seta basal pore; ocellar setae III arising on or anterior to tangent between anterior margins of posterior ocelli (Fig. 4); pronotal posterior margin with only setae S2 longer than maximum diameter of antennal segment III ..... *australiae* Hood

***Scirtothrips akakia* sp. nov.**

[Figs 1, 33, 38]

***Female macroptera.*** *Colour:* Yellow, ocellar region brown, also anterior margin of mesonotum and median area of tergites II – VIII; IX-X dark brown; antecostal ridges on tergites III-VIII dark across full width of segments, on sternites III-VII shaded full width of segments; forewings weakly shaded; antennal segment I pale, II brown, III – VIII light brown.

*Structure:* Vertex with closely spaced and transversely anastomosing striae, ocellar region lacking obvious sculpturing; ocellar setae pair III close together, distance between their bases less than four times the diameter of the basal pores, arising almost on tangent joining anterior margins of posterior ocelli; two pairs of post-ocular setae. Pronotum with transverse striae regular and closely spaced; 4 anteromarginal setae, 8-13 discal setae; 4 pairs of posteromarginal setae, S2 about twice the length of S1, S3 shorter than S1. Metanotal reticulation equiangular anteriorly but longitudinally reticulate on posterior half, median setae posterior of margin. Forewing scale with 3-4 marginal setae; first vein setae 3+2-4+1+1+0-1+0-1; second vein 1-2 setae; basal posteromarginal fringe cilia straight.

Tergite I without setae, tergites III-V median setae short, distance between bases less than two times the length of these setae; tergal microtrichial fields with 3 discal setae; VIII and IX without discal microtrichia medially, posteromarginal comb on VIII complete; tergite IX with paired minor posteromarginal setae between S1 and S2 equally as stout as these setae. Sternites III-VI with 3 pairs of posteromarginal setae; microtrichial fields if present, scarcely extending mesad of S3.

*Measurements of holotype female.* Body length 1250. Head, length 85; width 165; p.o.S1 18. Pronotum, length 100; width 190; posteromarginal setae S2 30. Forewing length 740. Antennal segments III – VI, 45, 40, 37, 47.

*Male macroptera.* Pale lacking obvious dark colorations of female especially on abdomen. Sculpture similar to female. Tergite IX with pair of rather short, pale drepanae; aedeagus without stout spines.

*Holotype female.* **Northern Territory**, Standley Chasm, West of Alice Springs from *Acacia macdonnellensis* [Leguminosae] 31-x-1999 (LAM 3759). *Paratypes:* 12 females collected with holotype; same locality and host plant, 9 females, 2 males, 1-xi-1999 (LAM 3771), 13 females, 1 second instar larva, 2-xi-1999 (LAM 3782).

**Comments.** *Scirtothrips akakia* is a member of one of the two species-groups within *Scirtothrips* that inhabit *Acacia* (the other being the *S. albomaculatus* group). Together with *S. kirrhos*, *S. moneres* and *S. quadriseta*, this species lacks definite sculpturing in the ocellar region, the first abdominal tergite lacks setae, and females exhibit obvious melanic coloration, which is especially dark on abdominal segments IX and X but with a dark area inside the ocellar triangle. The posteromarginal cilia on the forewing are straight, although a few paratypes have 1-2 of these cilia very faintly wavy.

### *Scirtothrips albomaculatus* Bianchi

[Figs 2, 39, 55]

*Scirtothrips albomaculatus* Bianchi, 1945: 263-266.

Described from a single female taken on a rose flower in Noumea, New Caledonia, this species was redescribed by Palmer & Mound (1983) from a few specimens taken widely across New South Wales and South Australia. Only once has it been found breeding in large numbers, and this was on *Dodonaea viscosa* leaves [Sapindaceae] at several sites on Lord Howe Island (Mound, 1998). However, has been collected at Mundubbera in Queensland in association with minor damage to citrus fruits. *S. albomaculatus* has been taken rarely from any *Acacia* species, but it is a member of an Australian species-group in which at least two species, *S. eremicus* and *S. pilbara* (probably also *S. astibos*), are associated with *Acacia* species. Both *Acacia* and *Dodonaea* are widespread across Australia, and this may account for the wide distribution of the thrips species. Members of the *S. albomaculatus* species group have three (not two) pairs of setae in the postocular row, five (not four)

pairs of pronotal posteromarginal setae, and the males lack drepanae on the ninth tergite. Within this species-group, indeed within the genus, *S. albomaculatus* is particularly unusual in that the marginal setae of the median sternites arise well in front of the posterior margin.

**Female macroptera.** *Colour:* Yellow, rarely with brown marking medially on tergites, antecostal ridges brown on tergites III – VIII and sternites IV – VII; forewings pale; antennal segments I – III pale, IV – VIII darker.

*Structure:* Head about twice as wide as long, postocular and ocellar region closely striate; ocellar setae pair III arise near margins of ocellar triangle; compound eyes with no ommatidia strongly pigmented; three pairs of post-ocellar setae longer than ocellar setae pair III. Pronotum closely striate, with 4 - 6 anterior marginal setae, 8 - 12 discal setae; 5 pairs of posteromarginal setae, S2 clearly longer than S1. Metanotal sculpture transverse anteriorly, longitudinally reticulate posteriorly; median pair of setae at anterior margin. Forewing scale with 4-5 marginal setae; second vein with 3 – 8 setae; posteromarginal fringe cilia all straight. Tergite I with no discal setae, III-V with bases of median setae close together; tergal microtrichial fields with 3 discal setae; VIII with discal microtrichia present anteromedially, posteromarginal comb complete; tergite IX with discal microtrichia present on posterior half. Sternites with microtrichia extending just mesad of S2; marginal setae arising in front of posterior margin.

**Male macroptera.** Similar to female in colour and sculpture, but smaller; tergite IX without drepanae; aedeagus without paired arrays of spines, but apex with series of small spines.

***Scirtothrips astibos* sp. nov.**

[Fig. 21]

**Female macroptera.** *Colour:* brown; antecostal ridge on tergites III-VIII dark across full width of segments, on sternites III-VII strongly shaded; tergite IX darker brown; forewings uniformly shaded; antennal segment II darker than I, III – IV mainly yellow, V pale at base, VI – VIII uniformly dark. Compound eyes with 4 ventrolateral ommatidia pigmented.

*Structure:* Head with postocular and ocellar region closely transversely striate; ocellar setae III short, their bases further apart than their length, arising within triangle anterior to tangent joining anterior margins of posterior ocelli; three pairs of post-ocellar setae each at least as long as ocellar setae pair III. Pronotum with 8 anterior marginal setae, 15 discal setae; 4 pairs of posteromarginal setae, S2 slightly larger than S1 or S3; pronotal setae all slightly thick and blunt. Metanotum transversely striate anteriorly, longitudinally reticulate posteriorly; median pair of setae slightly posterior of margin. Forewing scale with 4 marginal setae; first vein setae 3-4+6-7+1+1+1+1; second vein 5 setae; posteromarginal fringe cilia straight. Tergites III-V with distance between bases of median setae two or three

times the diameter of their basal pores; tergal microtrichial fields with 3 discal setae; VIII with discal microtrichia present anteromedially, posteromarginal comb complete; tergite IX with discal microtrichia on posterior half. Sternites with lateral microtrichial fields not extending mesad of S2 marginal setae.

*Measurements of holotype female.* Body length 1000. Head, length 135; width 70; p.o. S1 15. Pronotum, length 90; width 150; posteromarginal setae S1 10, S2 18. Forewing length 580. Antennal segments III – VI, 43, 35, 35, 43.

*Holotype Female.* **Western Australia**, Wittenoom, from *Lechenaultia* sp. flowers [Goodeniaceae], 24.ix.1995 (LAM 2821).

**Comments.** The setae on the head and pronotum of the single female from which this species is described are all curiously stout with the apices slightly blunt, rather similar to those of *S. moneres*, another species from Western Australia. Despite the body being brown in colour, antennal segments III and IV are noticeably pale. An *Acacia* species is more likely to be the host plant of this species than the *Lechenaultia* species from which the holotype was taken.

### *Scirtothrips aurantii* Faure

[Figs 3, 22, 28, 37, 54, 58]

*Scirtothrips aurantii* Faure, 1929: 3-8.

This species, the South African citrus thrips, was introduced to south eastern Queensland presumably around the year 2000, and by February 2003 had become established and widespread to the east of Brisbane. However, at the time of writing these populations remain associated only with members of the Crassulaceae, particularly the *Bryophyllum* species that are invasive weeds in pastures and along roadsides. This situation contrasts with that in South Africa, where *S. aurantii* is found not only on the leaves of native *Acacia* trees, but also on a very wide range of introduced plants including *Citrus* [Rutaceae] and *Bryophyllum* species, and the Australian tree *Grevillea robusta* [Proteaceae]. In Australia, only two species of *Scirtothrips* are known with microtrichial fields extending fully across the sternites. In *S. aurantii*, the microtrichia almost cover the entire surface of the sternites, whereas in *S. dorsalis* they are restricted to the posterior half of each sternite. The second instar larvae of these two species are similar in having reticulate sculpture on the pronotum (Figs 58, 59), and very similar sculptured larvae have been found in association with adults both of *S. albomaculatus* and *S. inermis*. Adults of *S. aurantii* and *S. dorsalis* are readily distinguished from each other because the forewing posteromarginal cilia are wavy in *S. aurantii* but straight in *S. dorsalis*. Moreover, within this genus of 100 species, *S. aurantii* is unique in having a comb of stout dark setae on the posterior margin of the hind femora of the males.

**Female macroptera.** *Colour:* Body yellow with brown markings medially on tergites and sternites, and antecostal ridges on tergites and sternites dark brown; forewings weakly

shaded, paler toward apex; antennal segment I pale, II dark, III – IV pale with apex shaded, V – VIII dark.

*Structure:* Head about twice as wide as long, postocular and ocellar region closely striate; ocellar setae pair III arise with ocellar triangle on or close to tangent between anterior margins of posterior ocelli, distance between their bases less than diameter of first ocellus; compound eyes with no ommatidia strongly pigmented; two pairs of post-ocellar setae longer than ocellar setae pair III. Pronotum closely striate, with 2 pairs of anterior marginal setae, 10-12 discal setae; 4 pairs of posteromarginal setae, S2 clearly longer than S1. Metanotal sculpture variable, transverse anteriorly, longitudinally reticulate posteriorly; median pair of setae at anterior margin. Forewing scale with 3-4 marginal setae; second vein with 2 – 5 setae; posteromarginal fringe cilia all weakly undulating. Tergites III-V with bases of median setae usually closer together than length of these setae; tergal microtrichial fields with 3 discal setae; VIII with discal microtrichia present anteromedially, posteromarginal comb complete; tergite IX with discal microtrichia absent. Sternites almost covered with microtrichia except anteromedially on VII; median setae on sternite VII arising slightly in front of posterior margin.

*Male macroptera.* Similar to female in colour and sculpture, but smaller; hind femur with row of 5 – 7 stout dark setae on distal posterior margin; aedeagus apparently with no armature.

### *Scirtothrips australiae* Hood

[Figs 4, 25, 40, 51]

*Scirtothrips australiae* Hood, 1918: 75

*Glaucothrips auricorpus* Girault, 1927: 1. **syn. n.**

Both Hood and Girault based their species on single females. The Hood specimen was re-studied and illustrated by Palmer & Mound (1983), but the species remained known only from this single female. Subsequently, the Girault species was recognised as a member of *Scirtothrips* by Mound & Houston (1987), but was not compared to any other member of the genus. The original, and totally inadequate, description by Girault was: "Orange, antennae pale, dark from middle of 4, wings brown, upper vein 12, lower, 5 setae. Inner posteriolateral a bristle, outer a seta. Female, Beerwah, forest, Oct." Both holotypes have now been re-examined, that of Hood loaned from the U.S. National Museum of Natural History, Washington D.C., and that of Girault from the Queensland Museum, Brisbane. Both are uncleared, and the Hood specimen has lost much of its colour presumably due to prolonged storage in alcohol. However, sufficient details are available on both specimens to consider that they represent the same species, particularly in the light of the variation observed in recently collected material, and recorded in the redescription below. The forewings of the two holotypes represent the extremes of variation in this species; the

Hood specimen has only one seta on the second vein, and all the posteromarginal cilia are straight apart from two near the base that are undulating; the Girault specimen has five setae on the second vein, and many of the posteromarginal cilia are undulating. However, variation between these extremes has been observed amongst individuals from populations around Canberra, where this thrips breeds on the leaves of *Kunzea ericoides* (sometimes identified as *Leptospermum* sp.) [Myrtaceae]. A few adults have been taken from the immature leaves of one unidentified *Eucalyptus* sapling [Myrtaceae], and a sample of both sexes was taken from *Exocarpos cupressiformis* [Santalaceae] at Nelligen near Bateman's Bay. *S. australiae* will probably prove to be widespread in eastern Australia; one female has been studied from the SW National Park of Tasmania, and another from *Melaleuca leucadendra* at Townsville, Queensland. The holotype came from Pentland, near Charters Towers, and the Girault holotype from just north of Brisbane. In contrast, a single female from New Caledonia recorded as *S. australiae* by Bournier & Mound (2000) has the pronotal striae much wider apart than in specimens from Australia, and probably represents a further undescribed species.

**Female macroptera.** *Colour:* Yellow, tergites with pale brown markings medially, also ocellar region; antecostal ridges on tergites III-VIII dark across full width of segments, on sternites III-VII shaded full width of segments; sternites III-VII with weak shading; forewings weakly shaded, paler toward apex; antennal segment 1 pale, II-VIII dark with bases of segments III-IV pale.

*Structure:* Vertex closely striate, ocellar region with weak reticulate sculpturing; ocellar setae pair III usually closer together than their length, arising just anterior to tangent between anterior margins of posterior ocelli; two pairs of post-ocular setae at least as long as ocellar setae pair III, p.o. S1 almost twice as long as length of a posterior ocellus. Pronotum with anastomosing transverse striae closely spaced; 4 anteromarginal setae, 10-14 discal setae; 4 pairs of posteromarginal setae, S2 about 50 microns long, two to three times as long as S1, S1 subequal to S3 and both longer than S4. Metanotum transversely reticulate anteriorly, longitudinally reticulate posteriorly; median setae close to anterior margin. Forewing scale with 4 marginal setae; first vein setae 1-7+1-3+1-2+0-1+0-1; second vein 1-5 setae; proximal posteromarginal fringe cilia wavy. Tergites III-V with median setae arising in-line with discal setae, relatively small and separated by at least 2.5 times their length; tergal microtrichial fields with 3 discal setae; VIII with few discal microtrichia medially, posteromarginal comb complete; IX with discal microtrichia on posterior half weakly developed. Sternites III-VI with 3 pairs of posteromarginal setae arising at margin; microtrichia extending just mesad of S2.

**Male macroptera.** Similar in colour and sculpture to female but smaller; tergite IX with pair of short dark drepanae; aedeagus apparently without spines.

***Scirtothrips casuarinae* Palmer & Mound**

[Fig. 5]

*Scirtothrips casuarinae* Palmer & Mound, 1983: 512-513.

In common with *S. solus*, the only other species in this genus with seven instead of eight antennal segments, *S. casuarinae* appears to be associated with the foliage of young *Casuarina* plants [Casuarinaceae]. Although taken at several sites in eastern New South Wales and Queensland, the species has been collected rarely. As in *S. solus*, the tergal median discal setae are further apart than in many Australian *Scirtothrips* species, and the metanotum has weak equiangular reticulation with the median setae well behind the anterior margin. The forewing posteromarginal cilia are mainly straight in this species, but two or more cilia near the base of the wing are weakly undulating. The male bears a pair of long dorsally-curving drepanae on the ninth tergite, but the aedeagus does not bear any spines or stout setae.

***Scirtothrips dobroskyi* Moulton**

[Figs 10, 31]

*Scirtothrips dobroskyi* Moulton, 1936: 264-265.

This species was described from a male and a female taken from tomato in Manila, The Philippines, and was recorded from Australia by Palmer & Mound (1983) on a single female taken near Brisbane. As in *S. australiae*, the pronotal posteromarginal setae S2 are particularly long, more than 50 microns, although the postocular setae S1 are scarcely longer than the length of a posterior ocellus. *S. dobroskyi* has now been collected from a diverse range of plants in the tropical and sub-tropical parts of Australia, from coastal areas of Northern Territory (N.T.), east through Queensland (QLD) and south into New South Wales (N.S.W.) to as far south as Bateman's Bay. Label data indicate that the species has been taken from the following plants, and an asterisk\* indicates that second instar larvae (Fig. 63) were found in association with adults:

(N.T.) *Bougainvillea* sp. [Nyctaginaceae], \**Cassytha* sp. [Lauraceae], *Citrus* sp. [Rutaceae], *Cuphea* sp. flowers [Lythraceae], *Lantana camara* flowers [Verbenaceae], \**Mangifera indica* [Anacardiaceae], pepper leaf;

(QLD) *Euodia* sp.\* [Rutaceae], *Eupatorium riparium* [Asteraceae], *Physalis minima* [Solanaceae], *Pteridium* sp.\* [Dennstaedtiaceae], chilli;

(N.S.W.) *Cissus antarcticum* [Vitaceae], *Ligustrum* sp. [Oleaceae], \**Pteridium* sp. young fronds.

**Female macroptera.** *Colour:* Yellow; frons shaded between bases of antennae; tergites without dark areas but antecostal ridges on III-VIII dark across full width of segments, on



sternites III-VII shaded full width of segments; forewings darkly shaded; antennal segments III-VIII dark with bases of segments III-IV pale, segment I pale, II variable.

*Structure:* Vertex with closely spaced and transversely anastomosing striae, ocellar region with transversely reticulate sculpturing; bases of ocellar setae pair III usually separated approximately by less than the length of these setae, arising almost on tangent between anterior margins of posterior ocelli; two pairs of post-ocular setae. Pronotum with anastomosing transverse striae widely spaced; 2-4 anteromarginal setae, 12-16 discal setae; 4 pairs of posteromarginal setae, S2 50-55 microns long, about 3 times the length of S1, S3 subequal to S4 and shorter than S1. Metanotum transversely reticulate anteriorly, but longitudinally or equiangular reticulate posteriorly; median setae not at anterior margin. Forewing scale with 3-5 marginal setae; first vein setae 3+1-3+1+1+1; second vein 2-3 setae; proximal posteromarginal fringe cilia straight. Bases of median tergal setae on III-V separated by no more than the length of these setae, positioned anterior to a line joining tergal discal setae; tergal microtrichial fields with 3 discal setae; VIII with no discal microtrichia anteromedially, posteromarginal comb complete, IX with weak microtrichia on posterior half. Sternites III-VI with 3 long pairs of posteromarginal setae; microtrichia scarcely mesad of S2.

*Male macroptera.* Similar to female in colour and sculpture; tergite IX with pair of dark drepanae curving dorsally; aedeagus apparently without spines.

### ***Scirtothrips dorsalis* Hood**

[Figs 6, 7, 26, 27, 52, 59]

*Scirtothrips dorsalis* Hood, 1919: 90-91.

This is a highly polyphagous and widespread tropical insect. It is found from Pakistan to Japan and Taiwan, and south to the Solomon Islands and northern Australia, but no specimens have been seen from south of Brisbane. It is recorded as a pest on many different crops, from chillies and lotus plants to tea and strawberries. In life it is often recognisable from the dark wings contrasting with the pale body. Amongst the *Scirtothrips* recorded in Australia, the only one with microtrichia extending across the median area of the abdominal sternites is *S. aurantii*, and these can be distinguished by means of the key above.

*Female macroptera. Colour:* Body yellow with brown marking medially on tergites III – VII, sternites without brown markings but antecostal ridges on tergites and sternites dark brown; forewings usually strongly shaded but paler toward apex; antennal segment I pale, II shaded, III – VIII dark.

*Structure:* Head about twice as wide as long, postocular and ocellar region closely striate; ocellar setae pair III arise between the posterior ocelli, well behind tangent between their anterior margins; compound eyes with no ommatidia strongly pigmented; two pairs of post-ocular setae as long as ocellar setae pair III. Pronotum closely striate, usually with

1 pair of anteromarginal setae, 10-12 discal setae; 4 pairs of posteromarginal setae, S2 30 – 35 microns, clearly longer than S1. Metanotal sculpture variable, usually transversely arcuate anteriorly, with irregular longitudinal reticulations or striations posteriorly; median pair of setae far behind anterior margin. Forewing scale with 4 marginal setae; second vein with 2 setae; posteromarginal fringe cilia all straight. Tergites III-V with bases of median setae usually closer together than length of these setae; tergal microtrichial fields with 3 discal setae; VIII with discal microtrichia present anteromedially, posteromarginal comb complete; tergite IX with discal microtrichia present posteromedially. Sternites with microtrichia extending across median area on posterior half; median setae on sternite VII arising slightly in front of posterior margin.

**Male macroptera.** Similar to female in colour and sculpture, but smaller; aedeagus apparently with no armature.

***Scirtothrips drepanofortis* sp. nov.**

[Figs 8, 36, 41, 57]

**Female macroptera.** *Colour:* Light brown to medium brown, tergite IX darker; occipital ridge of head and posterior margin of pronotum dark, also antecostal ridge on tergites II-VIII; forewings shaded with paler apex; antennae light brown, II darkest, I usually pale.

*Structure:* Antennal segments VII – VIII with suture often weakly developed. Vertex with closely spaced and transversely anastomosing striae, becoming irregular near posterior ocelli; ocellar region with no distinct lines of sculpture; ocellar setae pair III closer together than diameter of first ocellus, arising posterior to tangent joining anterior margins of posterior ocelli, but one of these setae commonly absent; two pairs of long post-ocular setae; mouth cone exceptionally long and acute, extending to mesosternum in slide-mounted specimens. Pronotum with transverse striae regular and very closely spaced; usually 4 anteromarginal setae, 8-9 discal setae; 4 pairs of posteromarginal setae, S2 less than twice the length of S1, S3 subequal to S1. Metanotal reticulation almost equiangular anteriorly but narrowly longitudinal on posterior half, median setae posterior of margin. Forewing scale with 4 marginal setae; first vein setae 3-4+3-5+0-1+1+1+1; second vein 3-4 setae; at least some posterior fringe cilia weakly undulating rather than straight. Tergite I with pair of setae medially usually extending to posterior margin; tergites III-VII median setae short, distance between bases on V about 3 times the length of these setae; lateral microtrichial fields with rows of microtrichia closely spaced, bearing 3 discal setae; VIII and IX without discal microtrichia medially, posteromarginal comb on VIII regular and complete. Sternites III-VI with 3 pairs of posteromarginal setae; microtrichial fields weak, scarcely extending to S2.

*Measurements of holotype female.* Body length 1150. Head, length 50; width 150; p.o.S1 15. Pronotum, length 100; width 175; posteromarginal setae S1 13, S2 23. Forewing length 670. Antennal segments III – VI, 47, 40, 43, 47.

**Male macroptera.** Similar in colour and sculpture to female, but smaller and paler; tergite IX with pair of exceptionally long (150 microns), curved and dark drepanae extending beyond apex of tergite X; aedeagus without stout spines.

**Holotype female.** **South Australia**, Kangaroo Island, Kelly Hill Caves, *Hakea muelleriana* inflorescence [Proteaceae], 24.xii.2002 (LAM 4260). **Paratypes:** 10 females, 7 males collected with holotype; Kangaroo Island, Remarkable Rocks, 10 females, 10 males from *Hakea aenigma* inflorescences and leaves, 24.xii.2002 (LAM 4261).

**Comments.** This species shares many character states with *S. kirrhos* and related species that are known from *Acacia* foliage. However, the mouth cone is exceptionally long, the median setae on the first abdominal tergite are well developed, and the great length of the male drepanae is unique in this genus. One male/female pair *in cop* has been studied, and in these one of the drepanae was inserted between the ovipositor valves near the base. The second instar larvae of *S. drepanofortis* also have the mouth cone unusually elongate, but the dorsal surface of the thorax has sculpture and fringed capitate major setae that are very similar to those of *S. helenae* (Fig. 61). The elongate mouth cone of this species is directed ventrally in life, whereas that of *S. tenor* is directed posteriorly.

***Scirtothrips eremicus* sp. nov.**

[Figs 9, 22]

**Female macroptera.** **Colour:** Body yellow with brown markings medially on tergites and sternites, also on head anterior to ocelli; compound eyes with no ommatidia strongly pigmented; antecostal ridges on tergites III-VIII dark across full width of segments, on sternites IV-VII strongly shaded; forewings weakly shaded; antennal segment I pale, II dark, III pale with apex shaded, IV – V darker with base pale, VI – VIII uniformly dark.

**Structure:** Head about twice as wide as long, postocular and ocellar region closely striate; ocellar setae pair III arise with ocellar triangle, distance between their bases about equal to diameter of first ocellus; compound eyes with no ommatidia strongly pigmented; three pairs of post-ocellar setae at least as long as ocellar setae pair III. Pronotum closely striate, with 3 pairs of anterior marginal setae, 13-18 discal setae; 5 pairs of posteromarginal setae, pairs I-III all approximately equal in length and thickness, S2 sometimes clearly longer than S1. Metanotum transverse striate anteriorly, longitudinally reticulate posteriorly; median pair of setae at anterior margin. Forewing scale with 3-4 marginal setae; first vein setae 3-11+1-8+1-2+0-1; second vein 5-7 setae; posteromarginal fringe cilia straight. Tergites III-V with bases of median setae usually separated <0.75 length of these setae; tergal microtrichial fields with 3 discal setae; VIII with discal microtrichia present anteromedially, posteromarginal comb interrupted medially; tergite IX with discal microtrichia absent or very weak. Sternites with lateral microtrichial fields weak, not extending mesad of S2 marginal setae; median setae on sternites IV – VI sometimes arising slightly in front of posterior margin.

*Measurements of holotype female.* Body length 1150. Head, length 75; width 170; p.o.S1 18. Pronotum, length 100; width 175; posteromarginal setae S1 15, S2 15. Forewing length 650. Antennal segments III – VI, 50, 43, 37, 45.

**Male macroptera.** Similar to female in colour and sculpture, but smaller; tergite VIII posteromarginal comb interrupted medially; segment IX without drepanae, anterior margin strongly convex, extending into segment VII; aedeagus with paired array of stout spines.

*Holotype Female.* **Queensland**, Pentland, on *Acacia shirleyi* [Leguminosae], 3.iv.1998 (LAM 3483). *Paratypes*: 6 females, 1 male collected with holotype.

*Material excluded from type series:* **Queensland**, 143km north of Adavale, 8 females from *Acacia pendula*, 5.iv.1998 (LAM 3511); Weengallon, 4 females from *Acacia* sp., 10.i.1997 (D. Morris 237). **Western Australia**, 74km south of Tom Price, 7 females 1 male from *Acacia citrinoviridis* young phyllodes, 23.iv.1997 (LAM 3198); 42km west of Paraburdoo, 2 females from *Acacia citrinoviridis*, 23.iv.1997 (LAM 3201); 20km east of Wittenoom, 2 females from *Acacia bivenosa*, 25.ix.1995 (LAM 2845); Millstream, 9 females 2 males from *Acacia* sp. phyllodes, 23.ix.1995 (LAM 2813, 2816).

#### Comments

The material excluded from the type series of *S. eremicus* exhibits a confusing pattern of character states, although the available males appear to have similar paired arrays of stout spines laterally on the aedeagus. However, ocellar setae III of most of these specimens are further apart, commonly approaching the lateral margins of the ocellar triangle, and each compound eye has four distinctive darkly pigmented ommatidia. This species, or species-group, appears to be widely distributed across northern Australia just south of the monsoon belt, presumably in association with one or more species of *Acacia*. Lancewood, *Acacia shirleyi*, the plant from which the type series was taken, is common in semi-arid and temperate areas of inland north-eastern Australia from Toowoomba, Queensland, to Victoria River, Northern Territory.

#### *Scirtothrips frondis* sp. nov.

[Figs 11, 50, 53, 60]

**Female macroptera.** *Colour*: Pale yellow, antecostal ridges on tergites III-VIII weakly shaded across full width of segments, sternites III-VII with weak shading; forewings uniformly weakly shaded; antennal segment I pale, II pale to weakly shaded, III mainly pale, V – VIII uniformly dark.

*Structure*: Vertex closely striate, ocellar triangle with reticulate pattern; bases of ocellar setae pair III closer together than length of these setae, arising between midpoints of posterior ocelli; two pairs of post-ocellar setae each at least 0.75 as long as ocellar setae pair III. Pronotum with transverse striae irregular and widely separated; with 2-7 anterior marginal setae, 9-16 discal setae; 4 pairs of posteromarginal setae, seta II sometimes longer than seta I, but often similar in length to I, seta III never longer than I and II. Metan-

otum equiangular reticulate; median setae well behind margin. Forewing scale usually with 4 marginal setae; first vein setae 3-4+1-4+1+1+0-1+0-1+0-1; second vein 4 setae; posteromarginal fringe cilia wavy. Tergite I median setae usually extend beyond posterior margin of tergite, III-V with bases of median setae separated at least 2.25 times the length of these setae; tergal microtrichial fields with 3 discal setae; VIII with posteromarginal comb of microtrichia complete, no discal microtrichia medially; tergite IX without discal microtrichia. Sternites with lateral microtrichial fields extending mesad of S2 marginal setae.

*Measurements of holotype female.* Body length 1100. Head, length 100; width 135; p.o.S1 13. Pronotum, length 85; width 150; posteromarginal setae S1 25, S2 28. Forewing length 650. Antennal segments III – VI, 45, 38, 45, 47.

*Male macroptera.* Similar in colour and sculpture to female, but smaller; sternites commonly with one transverse row of microtrichia close to antecostal ridge; abdominal segment IX with a pair of dark drepanae ventrolaterally with pointed apices curving dorsally; aedeagus without either lateral arrays of spines or terminal spines.

*Holotype female.* **Australian Capital Territory**, Tidbinbilla, from young fronds of *Dicksonia Antarctica* [Dicksoniaceae], 20.xi.2002 (LAM 4229). *Paratypes*: 6 females collected with holotype; **New South Wales**, Nimmitabel, 8 females, 2 males, and 4 instar II larvae, from tree fern (?*Dicksonia* sp.), 19.iii.1999 (LAM 3676); Mt. Dromedary, 8 females, 5 males from *Dicksonia* sp. young fronds, 20.iii.1999 (LAM 3679); Monga, 7 females, 2 males, and 7 instar II larvae from *Dicksonia antarctica* young fronds, 13.i.1999 (LAM 3659), same site and plants, 20 females 3 males, 23.xi.2002 (LAM 4232), same site and plants, 16 females 6 males, 30.iv.2003 (LAM 4309-12); 20km west of Kiama, Jamberoo Mt Road, 9 females from young fronds of *Cyathea* sp. [Cyatheaceae], 3.xi.2002 (LAM 4207).

**Comments.** This species breeds on newly emerged fronds of tree ferns, and the larvae are similar in appearance to those of *S. dobroskyi* (Figs 60, 63). Although it has been found commonly on *Dicksonia antarctica*, one sample was taken from very young fronds of a *Cyathea* species. Tree ferns of the genus *Dicksonia* are widespread and abundant from sheltered gullies within dry sclerophyll forest to rainforest. It is the most common of the tree ferns accounting for 95% of this group in southeast Australia. Four females recorded by Palmer and Mound (1983) from tree ferns in Victoria as being close to *S. pan* Mound & Walker from New Zealand, presumably represent *S. frondis*. The New Zealand species differs from *S. frondis* in having ocellar setae III anterior to the tangent joining the anterior margins of the posterior ocelli, antennal segment III is brown, and the setae on abdominal tergite I are not long enough to reach the posterior margin of this tergite. The pronotal transverse striae of this species are more widely separated than in any other Australian member of the genus.

***Scirtothrips helenae* Palmer & Mound**

[Figs 35, 61]

*Scirtothrips helenae* Palmer & Mound, 1983: 514-515.

Worldwide, this species is unique in the genus in having the metanotal sculpture transverse over the entire surface. Although not mentioned in the original description, tergite VII has the posteromarginal comb of microtrichia extending medially and sometimes complete, as in *S. litotes*. The aedeagus of the male has an extensive paired array of spines laterally, much as in *S. eremicus*. The presence of three pairs of setae in the postocular series suggests that this species is related to *S. albomaculatus*, and it also resembles that species in lacking drepanae on the ninth tergite of males. *S. helenae* is recorded only from *Brachychiton populneus* [Sterculiaceae] and on this tree the thrips is often abundant on the youngest leaves that surround the flowers. This is a popular street tree in much of southern Australia, and *S. helenae* has probably been distributed by the horticultural trade. The thrips may also occur further north on other members of *Brachychiton*, but the currently available material from Queensland cannot be identified with certainty. The second instar larvae (Fig. 61) have capitate setae and no reticulate sculpture on the pronotum.

***Scirtothrips inermis* Priesner**

[Figs 12, 44]

*Scirtothrips inermis* Priesner, 1933: 186-188.

Described from the Canary Islands, this species has been recorded from California, New Zealand and South Australia (Palmer & Mound, 1983), and has been taken from a wide range of unrelated trees and herbs. It is similar to the tropical species *S. dobroskyi* in having unusually long posteromarginal setae S2 on the pronotum, but the ocellar setae pair III are longer than in any endemic Australian species. *S. inermis* usually has at least one more discal seta on the tergal microtrichial fields than in other members of the genus. The male is described as lacking drepanae on the ninth tergite, but no males have been seen from Australia. The second instar larvae have the pronotum with reticulate sculpture, much as in *S. aurantii*. Several females have been studied from near Adelaide (ix.1994) on *Viburnum* [Caprifoliaceae], also females and larvae from cultivated *Gerbera* [Asteraceae] at Silvan in Victoria (x.2002).

**Female macroptera.** *Colour:* Yellow, antecostal ridges on tergites and sternites dark; forewings shaded near base but pale distally; antennal segment I pale, II – VIII darker.

*Structure:* Vertex closely striate, ocellar region with several transverse lines; ocellar setae pair III about twice as long as diameter of one posterior ocellus, close together between midpoints of posterior ocelli; two pairs of post-ocular setae. Pronotum with trans-

verse striae not closely spaced, distance between lines about equal to diameter of a discal setal pore; 2 anteromarginal setae, about 10 discal setae; 4 pairs of posteromarginal setae, S2 50 – 65 microns long, more than twice diameter of antennal segment II. Metanotal reticulation arcuate anteriorly but almost equiangular on posterior half, median setae close to margin. Forewing scale with 4 marginal setae; first vein setae with about 10 setae; second vein 2-3 setae; all posteromarginal fringe cilia straight. Tergite I without long discal setae, III-V median setae longer than distance between bases; tergal microtrichial fields with 4 – 6 discal setae; VIII with discal microtrichia anteromedially, posteromarginal comb complete; IX without discal microtrichia. Sternites III-VI with 3 pairs of posteromarginal setae; microtrichial fields extending just mesad of S2.

***Scirtothrips kirrhos* sp. nov.**

[Figs 13, 42]

***Female macroptera.*** *Colour:* Yellow, ocellar region brown, also anterior margin of mesonotum and median area of tergites II – VIII; antecostal ridges on tergites III-VIII dark across full width of segments, on sternites III-VII shaded full width of segments; forewings weakly shaded; antennal segment I pale, II variably light brown, III – IV mainly yellow with apex brown, V-VIII dark.

*Structure:* Vertex with closely spaced and transversely anastomosing striae, ocellar region with lines of sculpture scarcely visible; ocellar setae pair III close together, distance between their bases less than three times the diameter of the basal pores, arising almost on tangent joining anterior margins of posterior ocelli; two pairs of post-ocular setae. Pronotum with transverse striae regular and closely spaced; 4-5 anteromarginal setae, 14-17 discal setae; 4 pairs of posteromarginal setae, S2 about twice the length of S1, S3 subequal to S1. Metanotal reticulation transverse anteriorly but almost equiangular on posterior half, median setae posterior of margin. Forewing scale with 4 marginal setae; first vein setae 10-12+1-2+1-2+0-1+0-1; second vein 2-4 setae; basal posteromarginal fringe cilia wavy but distal cilia straight. Tergites III-V median setae short, distance between bases about 3 times the length of these setae; tergal microtrichial fields with 3 discal setae; VIII and IX without discal microtrichia medially, posteromarginal comb on VIII complete. Sternites III-VI with 3 pairs of posteromarginal setae; microtrichial fields weak, scarcely extending mesad of S3.

*Measurements of holotype female.* Body length 1050. Head, length 60; width 150; p.o.S1 20. Pronotum, length 90; width 160; posteromarginal setae S1 15, S2 30. Forewing length 600. Antennal segments III – VI, 38, 35, 35, 40.

***Male macroptera.*** Similar in colour and sculpture to female, but smaller; tergite IX with pair of rather short, pale drepanae; aedeagus without stout spines.

*Holotype female.* **South Australia**, 30 km northwest of Whyalla, from *Acacia papyrocarpa* [Leguminosae], 29.xii.1997 (LAM 3375). *Paratypes:* 30 females and 5 males collected with holotype.

*Material excluded from type series:* **Northern Territory**, Standley Chasm, 20 females from *Acacia kempeana*, 31-x-1999 (LAM 3760); Serpentine Gorge, 3 females from *A. kempeana*, 1-xi-1999 (LAM 3768); Standley Chasm, 35 females 2 males from *Acacia macdonnellensis*, 31-x-1999 (LAM 3759), 1-xi-1999 (LAM 3771), and 2-xi-1999 (LAM 3782).

**Comments.** This is part of a species complex on *Acacia* foliage, together with the new species *S. akakia*, *S. moneres* and *S. quadriseta*, in which the ocellar region lacks definite sculpture, and the first abdominal tergite lacks setae, but in which the patterns of inter-population variation are difficult to interpret. The non-paratypic specimens listed above are very similar to those of the type series but generally have none of the posteromarginal cilia on the forewing undulating, although a few have one or more of these cilia faintly wavy. Moreover, these specimens from central Australia have the pronotal striae more widely spaced than the members of the type series, and some of those from *Acacia macdonnellensis* have pronotal setae S2 shorter than the width of the second antennal segment. Also, the specimens from *A. kempeana* and *A. macdonnellensis* have the median setae on tergites four and five more closely spaced; the interval between them being little more than their length, and the posterior half of tergite IX usually bears many microtrichia. It is not possible to know if such small differences are stable population differences or merely the result of a localised founder effect. One female collected with the holotype contained in the abdomen two larval Hymenoptera – Perilampidae. This slide has been deposited with John Heraty, Department of Entomology, University of California at Riverside, U.S.A.

***Scirtothrips litotes* sp. nov.**

[Figs 15, 48]

***Female macroptera.* Colour:** Light brown, tergites paler laterally, mesonotum pale on posterior half; antecostal ridges on tergites III-VIII dark across full width of segments, on sternites III-VII shaded full width of segments; forewings uniformly deeply shaded; antennal segment I pale, II dark, segments III-V dark with base paler, VI – VIII uniformly dark.

***Structure:*** Head slightly wider than long, mouth cone long but projecting ventrally; vertex with transversely anastomosing striae, ocellar region reticulate; bases of ocellar setae pair III separated approximately by the length of these setae, arising anterior to tangent between anterior margins of posterior ocelli; two pairs of post-ocular setae approximately 0.75 as long as ocellar setae pair III. Pronotum with transverse striae irregular and widely separated; with 2 pairs of anteromarginal setae, 9-11 discal setae; 4 pairs of posteromarginal setae, S2 about three times the length of S1, S3 subequal to S1. Metanotal reticulation almost equiangular, median setae on anterior margin. Forewing scale with 3-4 marginal setae; first vein setae 2-7+1-7+1-3+1+0-1+0-1; second vein 3-4 setae; posteromarginal fringe cilia wavy. Tergites III-V median setae long and widely spaced, distance between bases at least 2 times the length of these setae; tergal microtrichial fields with 3



discal setae; VII with posteromarginal comb extending mesad of discal seta II, usually complete medially; VIII with no discal microtrichia medially, posteromarginal comb complete; tergite IX with discal microtrichia scarcely visible. Sternal microtrichial fields weak, not extending mesad of marginal setae II.

*Measurements of holotype female.* Body length 1250. Head, length 85; width 140; p.o.S1 12. Pronotum, length 100; width 150; posteromarginal setae S1 10, S2 38. Forewing length 700. Antennal segments III – VI, 45, 45, 40, 45.

*Male macroptera.* Similar in colour and sculpture to female, but smaller; tergite VII without posteromarginal microtrichia; abdominal segment IX with pair of dark drepanae with acute apices curving dorsally; parameres each with rounded knob on external margin near base, aedeagus without spines.

*Holotype Female.* **Queensland**, Brisbane, from *Lepidozamia peroffskyana* [Zamiaceae], 2.xii.2000 (J. Hall). *Paratypes*: 19 females and 2 males collected with the holotype.

**Comments.** This species is unusual in the genus *Scirtothrips* in having the posteromarginal comb of microtrichia on tergite VII complete or almost complete, a character state that it shares only with *S. helenae* amongst the Australian species. Moreover, it has an unusually long mouth cone, although not as long as in the other Australian member of this genus that lives on cycads, *S. tenor* (Bhatti & Mound). The native range of the cycad, *L. peroffskyana*, is south-eastern Queensland and north-eastern New South Wales, from the ranges north-west of Brisbane to the Manning River district. Typically it is found scattered through wet sclerophyll forests or on rainforest margins, but is cultivated as an ornamental in sub-tropical areas.

### *Scirtothrips longipennis* (Bagnall)

[Fig. 14]

*Euthrips longipennis* Bagnall, 1909: 173-174.

Described from specimens taken in a greenhouse in Brussels, this species was at one time reported to be a widespread minor pest under glass, apparently associated with begonia plants. Despite this, very few specimens are available in museum collections, and only two females have been seen from Australia. The descriptive notes and illustrations given here are from one of these, a female taken recently on Lord Howe Island. The male is unknown.

*Female macroptera.* *Colour*: Yellow, anterior margin of head light brown; antecostal ridges dark on tergites III-VIII and on sternites V-VII; forewings strongly shaded in basal half but paler toward apex; antennal segment I pale, III – VIII dark.

*Structure*: Vertex with transversely anastomosing striae, ocellar region transversely striate; ocellar setae pair III further apart than their length, rising near margins of ocellar triangle; two pairs of post-ocular setae longer than ocellar setae III. Pronotum with trans-

verse striae wavy and widely separated; 2 anteromarginal setae, 8 discal setae; 4 pairs of posteromarginal setae, S2 slightly longer than width of antennal segment II. Metanotum weakly longitudinally reticulate, median setae close to margin. Forewing scale with 3 marginal setae; first vein setae 3+2+1+1+1; second vein 2 setae; posteromarginal fringe cilia undulating except near apex. Tergite I without discal setae, III-V median setae longer than distance between bases; tergal microtrichial fields with 3 discal setae; VIII with no discal microtrichia medially, posteromarginal comb complete; tergite IX with discal microtrichia on posterior half. Sternites with microtrichial fields extending almost to S2.

***Scirtothrips moneres* sp. nov.**

[Figs 16, 30, 43]

***Female macroptera.*** *Colour:* Mainly yellow, brown markings in ocellar triangle, on mesonotum, and medially on tergites II – VII, tergite IX light brown; antecostal ridges dark on tergites III-VIII across full width of segments, on sternites III-VII shaded full width of segments; forewings weakly shaded, paler toward apex; antennal segment I pale, II dark, III – IV pale in basal half, V – VIII dark.

*Structure:* Vertex with closely spaced, transversely anastomosing striae, but ocellar region without sculpture lines; bases of ocellar setae pair III separated approximately by the length of these setae, arising within triangle in front of tangent joining anterior margins of posterior ocelli; only one pair of post-ocular setae; ocellar and postocular setae stout with apices blunt. Pronotum with transverse striae weak, irregular and widely separated; 4-6 anteromarginal setae, 7-11 discal setae; 4 pairs of posteromarginal setae, S2 about twice length of S1, S3 subequal to S1; pronotal setae all slightly flattened and blunt. Metanotum weakly and irregularly reticulate, median setae posterior of margin. Forewing scale with 3-4 marginal setae; first vein setae 3-4+1-7+1-4+1-2+1; second vein 1-2 setae; posteromarginal fringe cilia straight. Tergite I without discal setae, III-V median setae short, distance between bases at least 1.5 times the length of these setae; tergal microtrichial fields with few rows of microtrichia and 3 discal setae, the lateral pairs much stouter than the median pairs; VIII with no discal microtrichia medially, posteromarginal comb complete; tergite IX with very weak discal microtrichia on posterior half. Sternites with microtrichial fields weak or absent.

*Measurements of holotype female.* Body length 1050. Head, length 70; width 150; p.o.S1 18. Pronotum, length 85; width 165; posteromarginal setae S1 12, S2 30. Forewing length 650. Antennal segments III – VI, 40, 33, 33, 37.

***Male macroptera.*** Similar in colour and sculpture to female, but smaller; abdominal segment IX with pair of dark grooved drepanae with pointed apices curving dorsally; aedeagus without paired array of spines.

*Holotype Female.* **Western Australia**, Wittenoom Gorge, from *Acacia* sp., 25.ix.1995 (LAM 2846). *Paratypes:* 9 females collected with holotype. **Northern Territory**, 30 km

south of Elliot, 17 females, 1 male from *Acacia* sp., 17.v.1999 (LAM 3719); Humpty Doo, 1 female from *Melaleuca white* flowers, 29-xii-1995 (LAM 2925); **Queensland**, 5 km north of Hughenden, 5 females from *Acacia* sp. gall, 31.vii.1993 (LAM 2557).

*Material excluded from type series:* **Western Australia** 30 km west of Hamersley Gorge, 7 females from *Acacia ?atkinsiana*, 26-ix-1995 (LAM 2857); 80 km northwest of Wittenoom, 4 females from *Acacia* sp., 23-ix-1995 (LAM 2819); **Northern Territory**, 150 km north of Tenant Creek, 3 females from *Acacia* sp. 25-vii-1993 (LAM 2521).

**Comments.** *S. moneres* has the major setae unusually stout and blunt, but is similar to *S. tenor* in having the tergal microtrichial fields exceptionally weak and the sternites almost devoid of microtrichia, in contrast to most members of the genus *Scirtothrips*. However, these two species are only the extremes of the range of variation in microtrichia development that is exhibited by Australian *Scirtothrips* species. In lacking sculpture within the ocellar triangle and in lacking setae on the first abdominal tergite, *S. moneres* appears closely related to two of the other *Acacia*-living *Scirtothrips* species described here, *S. kirrhos* and *S. quadriseta*. It has a wide geographic range in northern Australia, probably in association with more than one species of *Acacia*. The series taken from galls on *Acacia* in Queensland is almost certainly an opportunistic exploitation of a protective structure, but the single female collected from *Melaleuca* was presumably a vagrant and not associated with flowers on this plant. The *S. moneres* holotype and paratypes listed above all have most of the setae on the dorsal surface of the head and thorax curiously blunt and flattened rather than setiform. The specimens listed as excluded from the type series all have typical setiform setae, long and slender with a tapering point, as in other species of *Scirtothrips*. Despite the difference in form of their setae, no other differences have been noted on these specimens that might distinguish them from *S. moneres*. Currently it is not possible to decide whether they might be distinct genetically, or if the setal form is the result of local environmental conditions.

***Scirtothrips pilbara* sp. nov.**

[Figs 17, 45]

**Female macroptera.** *Colour:* Yellow, compound eyes with 4 ommatidia weakly to deeply shaded; tergites II – VIII brown medially, ocellar triangle and anterior half of mesonotum sometimes brown; antecostal ridges on tergites III-VIII dark medially but paler laterally; sternal antecostal ridges on III-VII dark; forewings uniformly weakly shaded; antennal segment I pale, II variable, III – IV pale with apex shaded, V - VIII dark.

*Structure:* Vertex closely striate, ocellar triangle with transverse lines; bases of ocellar setae pair III usually separated by at least the length of these setae, arising well anterior of tangent to anterior margins of posterior ocelli toward margins of ocellar triangle; three pairs of post-ocular setae at least as long as ocellar setae pair III; mouth cone long, extending to mesosternum. Pronotum with anastomosing transverse striae closely spaced; 6-8

anteromarginal setae, 12-20 discal setae; 5 pairs of posteromarginal setae, S2 about twice the length of S1, S1 subequal to S3 and both longer than S4 and S5. Metanotal sculpture transversely reticulate anteriorly and longitudinally reticulate posteriorly; median setae close to margin. Forewing scale with 4-5 marginal setae; first vein setae 3-14+1-9+1-2+0-1+0-1; second vein 4-6 setae; proximal posteromarginal fringe cilia straight. Bases of median tergal setae on segments III-V almost in-line with tergal discal setae, separated by no more than 0.75 times the length of these setae; tergal microtrichial fields with 3 discal setae; VIII with a few discal microtrichia anteromedially, posteromarginal comb interrupted medially; tergite IX with microtrichia on posterior half. Sternites III-VI with 3 pairs of posteromarginal setae; microtrichia reduced, scarcely extending mesad of S3.

*Measurements of holotype female.* Body length 1300. Head, length 75; width 175; p.o.S1 20. Pronotum, length 125; width 190; posteromarginal setae S1 13, S2 30. Forewing length 750. Antennal segments III – VI, 52, 47, 35, 47.

*Male macroptera.* Similar in colour and sculpture to female, but smaller; abdominal segment IX without paired drepanae, anterior margin convex and extending into segment VIII; aedeagus without paired array of spines laterally, but with group of small spines at apex.

*Holotype female.* **Western Australia**, 20 km west of Millstream, from *Acacia xiphophylla* [Leguminosae], 23.ix.1995. (LAM 2810). *Paratypes*: 7 females and 1 male collected with holotype; 40 km southwest of Yalgoo, 3 females from *Acacia ramulosa*, 26.iv.1997 (LAM 3237);

*Material excluded from type series:* **Western Australia**, 50 km south east of Wittenoom, 9 females from ?*Crotalaria* flowers, 24.ix.1995 (LAM 2823); 170 km south of Carnarvon, 1 female from *Acacia grasbyi* 25.iv.1997 (LAM 3219); 75 km southwest of Yalgoo, 1 female collected from *Acacia* sp. 26.iv.1997 (LAM 3239); 100 km west of Paraburdoo, 1 female collected from *Acacia* sp. 23.iv.1997 (LAM 3207); **Queensland**, 15 km west of Mt Glorious, 3 females and 3 males collected from *Acacia bipinnate* sp., 19.iii.2002 (LAM 4127); **Australian Capital Territory**, Casuarina Sands, 1 female collected from *Acacia mearnsii*, 6.xii.1994 (LAM 2606).

**Comments.** The three paratypes from *Acacia ramulosa* have a clearly defined brown area medially on the tergites, whereas the females taken with the holotype have this area with weak and diffuse shading. The non-paratypic females listed above from *Crotalaria* flowers near Wittenoom are all considerably darker than the type series. They not only have the tergites extensively brown, but the forewing second vein bears 8 – 12 setae, and ocellar setae pair III arise further apart close to the anterior margins of the ocellar triangle. In contrast, the specimens from Mt Glorious, Queensland, are considerably smaller and clear yellow, with ocellar setae III separated by no more than the diameter of the first ocellus. Moreover the males in this sample have a paired array of slender spines laterally on the aedeagus. The pattern of variation amongst these specimens excluded from the type series of *S. pilbara* is such that it is not possible to conclude how many species might be

involved. Even the single female taken from near Canberra cannot be distinguished with confidence from the Western Australian specimens. Presumably this species-group, in which the mouth cone usually extends to the mesosternum, is associated with various species of *Acacia*.

***Scirtothrips quadriseta* sp. nov.**

[Figs 19, 29, 46, 56]

**Female macroptera.** *Colour:* Dark brown, head and tergites IX-X darkest; antecostal ridges on tergites III-VIII dark across full width of segments, on sternites III-VII shaded full width of segments; forewings uniformly light brown; antennal segments brown, I and III – VIII paler than head.

*Structure:* Vertex with closely spaced and transversely anastomosing striae, but ocellar region without lines of sculpturing; bases of ocellar setae pair III arising within ocellar triangle, separated approximately by the length of these setae, arising anterior to tangent between anterior margins of posterior ocelli; two pairs of post-ocular setae. Pronotum with transverse striae closely spaced but irregular; 4-8 anteromarginal setae, 15-22 discal setae; 4 pairs of posteromarginal setae, S2 variable but no more than 1.5 times as long as S1, S3 subequal to S1. Metanotum transversely reticulate anteriorly, equiangular medially, but longitudinally reticulate on posterior half, median setae posterior to margin. Forewing scale with 3-5 marginal setae; first vein with 10 – 14 setae, 1-4+1-5+1-3+1-2+1-2+0-1+0-1+0-1; second vein 2-4 setae; posteromarginal fringe cilia mainly straight but wavy near base of wing. Tergites III-IV median setae short, distance between bases at least 1.25 times the length of these setae; tergal microtrichial fields with 3 discal setae; VIII with no discal microtrichia medially, posteromarginal comb complete; tergite IX with discal microtrichia on posterior half. Sternites III-VI usually with 4 pairs of posteromarginal setae; microtrichial fields reduced to 5 or 6 rows of microtrichia anterolaterally.

*Measurements of holotype female.* Body length 1050. Head, length 70; width 150; p.o.S1 15. Pronotum, length 95; width 190; posteromarginal setae S1 12, S2 20. Forewing length 650. Antennal segments III – VI, 38, 35, 35, 38.

*Holotype Female.* **Western Australia**, 20 km south of Yalgoo, from *Acacia aneura* [Leguminosae], 26.iv.1997 (LAM 3230). *Paratypes:* 9 females collected with holotype; **Western Australia**, 6 km north of Meekatharra, 9 females from *Acacia brachystachia*, 20.iv.1997 (LAM 3163).

**Comments.** This species is related to *S. kirrhos* and *S. moneres*, but has short pronotal posteromarginal setae. Moreover, many of the available specimens are remarkable in having four pairs of posteromarginal setae on the sternites, a character state that otherwise has been seen only in a few individuals of *S. tenor*.

***Scirtothrips solus* sp. nov.**

[Figs 20, 34]

**Female macroptera.** *Colour:* Dark brown, head almost black; antecostal ridges on tergites III-VIII dark across full width of segments, on sternites III-VII shaded; forewings uniformly but weakly shaded; antennal segments dark, segments III-V paler near base.

*Structure:* Head broad across eyes, constricted to base; vertex not closely striate, with striae transversely anastomosing, ocellar region without lines of sculpture; bases of ocellar setae pair III closer together than length of these setae, arising between midpoints of posterior ocelli; two pairs of post-ocular setae approximately as long as ocellar setae pair III; mouth cone long, extending between fore coxae. Antennae with 7 segments. Pronotum with transverse striae irregular and widely separated; with 1 pair of anteromarginal setae, 6-8 discal setae; 4 pairs of posteromarginal setae, S2 about twice length of S1, S3 subequal to S1. Metanotal reticulation almost equiangular, median setae well behind margin. Forewing scale with 3-4 marginal setae; first vein setae 3-4+6-7+1+1+0-1+0-1; second vein with 1 seta; posteromarginal fringe cilia straight. Tergites III-V median setae small and widely spaced, distance between bases at least 3.5 times the length of these setae; tergal microtrichial fields with 3 discal setae; VIII with no discal microtrichia, posteromarginal comb complete; tergite IX with no discal microtrichia. Sternites with lateral microtrichial fields weak, extending mesad of S3 marginal setae, apparently absent on sternite VII.

*Measurements of holotype female.* Body length 1150. Head, length 100; width 200; p.o.S1 20. Pronotum, length 75; width 180; posteromarginal setae S1 13, S2 25. Forewing length 750. Antennal segments III – VI, 42, 40, 40, 50.

*Holotype Female.* **Western Australia**, 10km west of Wave Rock, near Hyden, from *Allocasuarina* sp. [Casuarinaceae], 4.x.1995 (LAM 2896). *Paratypes:* 4 females collected with holotype; **Western Australia**, Kalbari, 1 female on *Acacia* sp. branches, 4.x.1995 (LAM 3797).

**Comments.** Only one other member of this genus is known with seven segmented antennae. That is *S. casuarinae*, a species that was also taken on the foliage of a young specimen of the Casuarinaceae. *Allocasuarina* and *Casuarina* species are similar xerophytic plants with highly modified “drooping” foliage. This thrips was associated with the young foliage of a small shrubby species.

***Scirtothrips tenor* (Bhatti & Mound) comb. nov.**

[Figs 18, 49, 62]

*Labiothrips tenor* Bhatti & Mound, 1994: 163.

This species was described from specimens collected in a water trap at Port Moresby, Papua New Guinea, but has been found commonly in the Northern Territory around Dar-

win and on Bathurst Island breeding on the young flush leaves of *Cycas armstrongi* [Cycadaceae] as well as on cultivated specimens of *Cycas revoluta* at Darwin and at Burpengary in Queensland. Although described as the type species of the monotypic genus *Labiothrips*, the species fits within the pattern of variation of Australian *Scirtothrips* discussed here. The mouth cone is unusually elongate, and in life it is directed posteriorly rather than ventrally as in other *Scirtothrips* species. However, its length is no greater than that of *S. drepanofortis* described above, nor of *S. muscoaffinis* Johansen and Mojica described from Mexico, and it is not a great deal longer than found in *S. litotes* and *S. pilbara* described above. Presumably associated in some way with the orientation of the mouth cone, the vertex of the females of *S. tenor* is exceptionally short, with the posterior margin of the head almost confluent with the posterior margin of the eyes. However, in males the length of the vertex is at least equal to the width of one ommatidium. The pronotum has four pairs of posteromarginal setae, none longer than 15 microns, but several of the new species described here have similar short setae. However, the striae on the head and pronotum are weaker than on typical *Scirtothrips* species, and the postocular region of the head in females is exceptionally short. As in *S. moneres*, the microtrichia are reduced on the anterior lines of sculpture on each tergite, and the sternal microtrichial fields are much reduced scarcely extending mesad of setae S3. The number of sternal posteromarginal setae is not constant, several specimens having been examined with four instead of three setae on more than one sternite. The males have a pair of curved drepanae on the ninth tergite, but the aedeagus does not have an array of spines. The second instar larvae have broadly capitate setae on the pronotum (Fig. 62).

### Acknowledgements

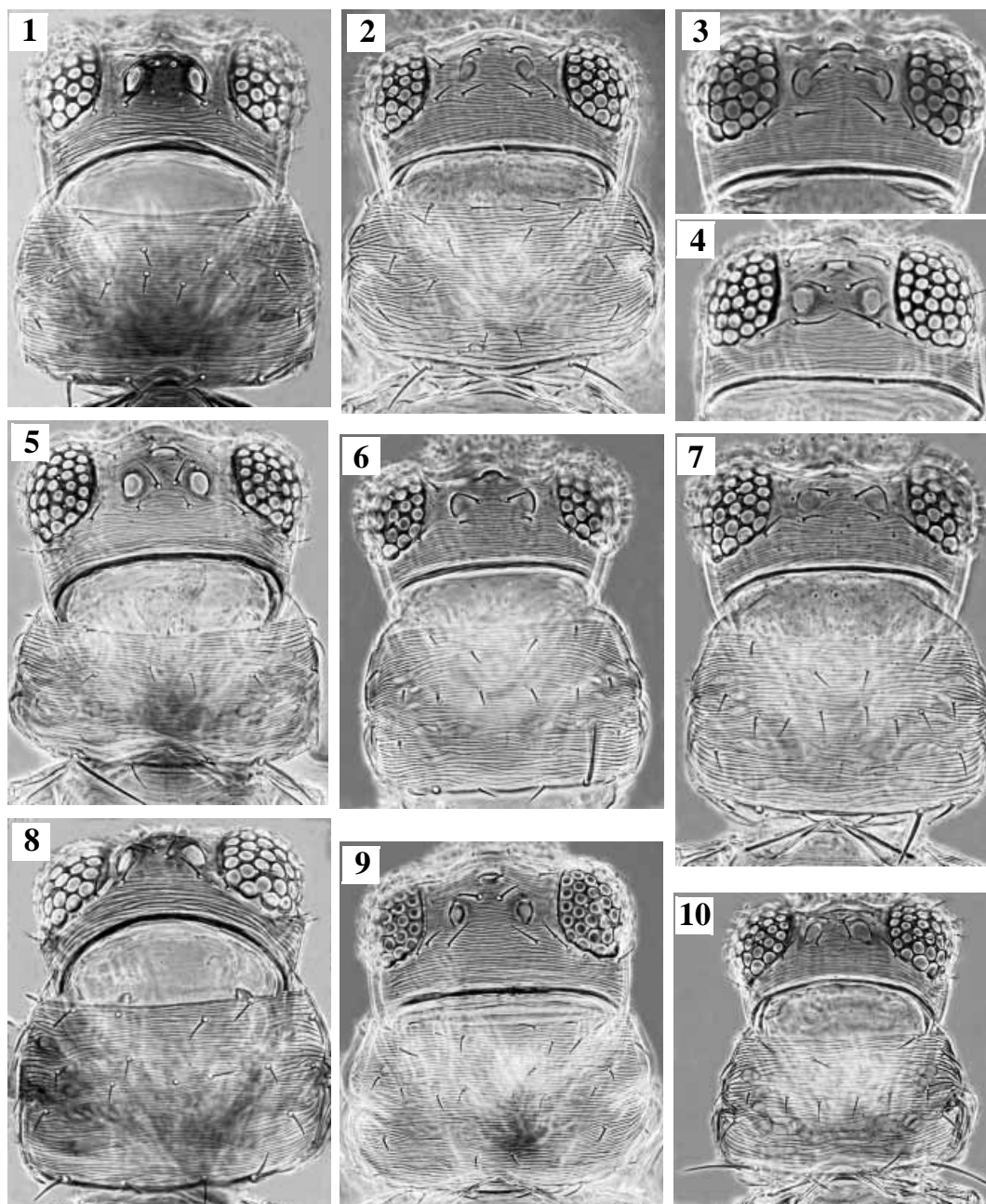
The authors are grateful to Chris Burwell, Queensland Museum, for frequent support in providing access to the Girault Thysanoptera types, to Steve Nakahara and Dave Nickle for arranging loans from the US National Museum of Natural History, to Bruno Michel for loaning a specimen from the CIRAD collection, Montpellier, and to Alice Wells for continued help with field studies and plant identifications.

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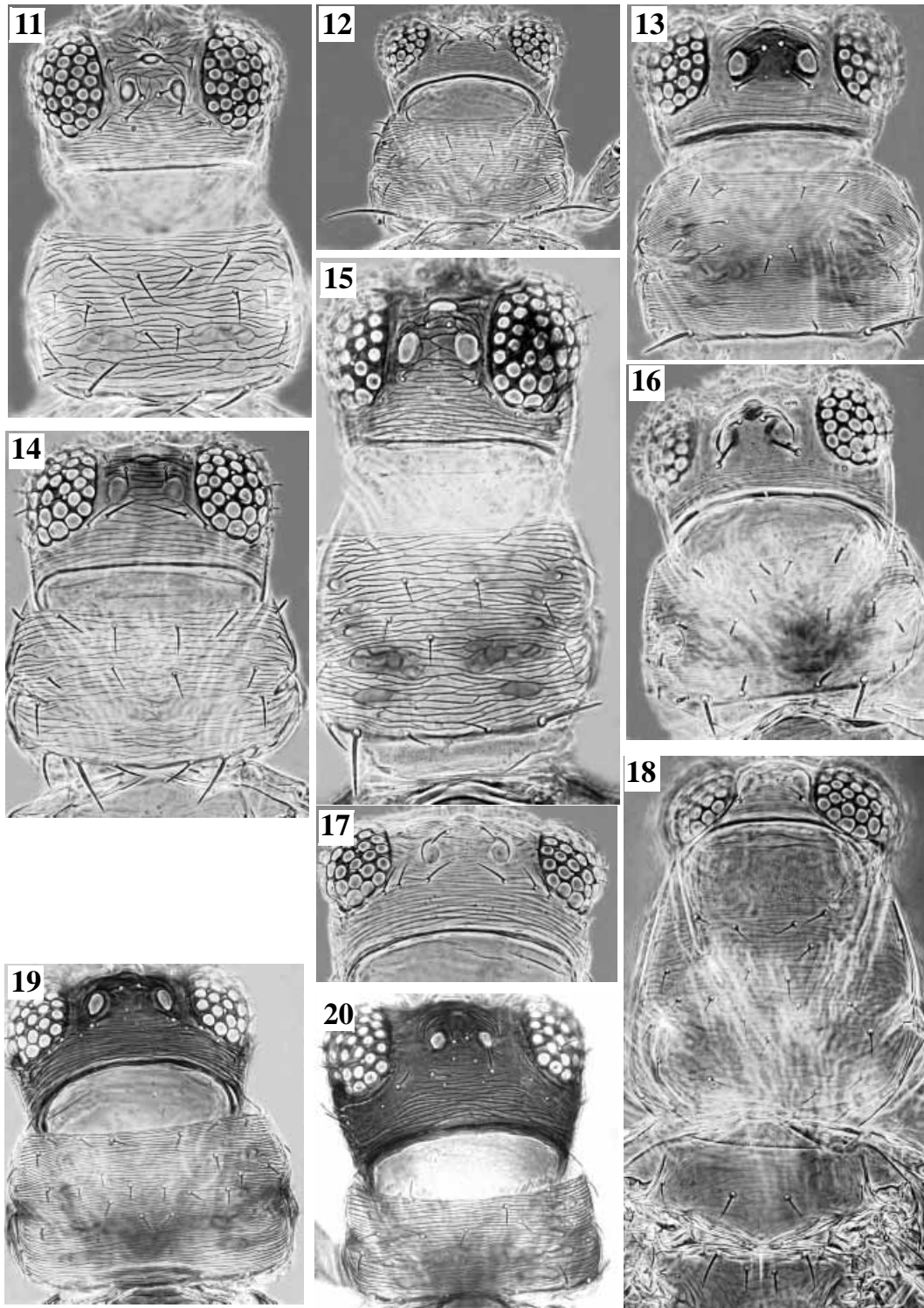
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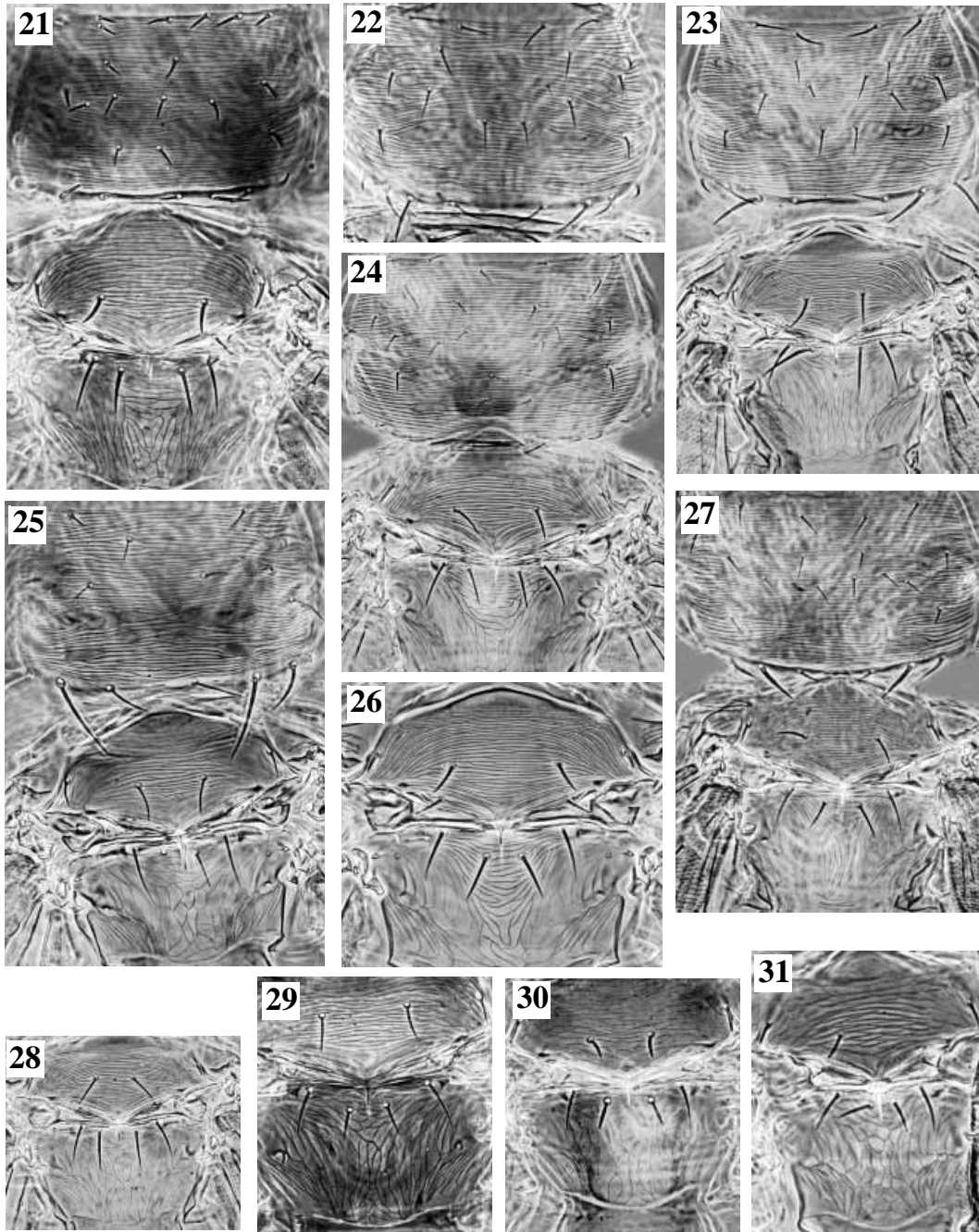




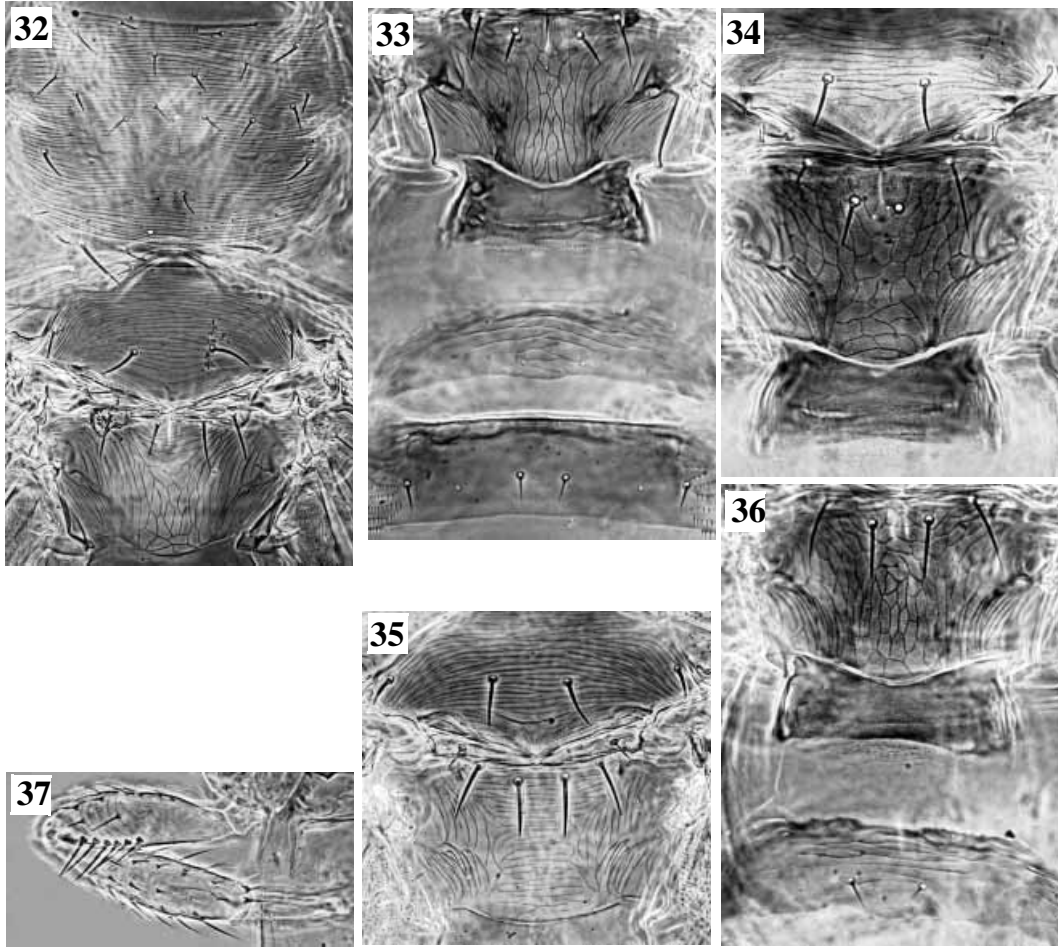
**FIGURES 1-10.** *Scirtothrips* heads and pronota. 1, *akakia*; 2, *albomaculatus*; 3, *aurantii*; 4, *australiae*; 5, *casuarinae*; 6, *dorsalis*; 7, *dorsalis*; 8, *drepanofortis*; 9, *eremicus*; 10, *dobroskyi*.



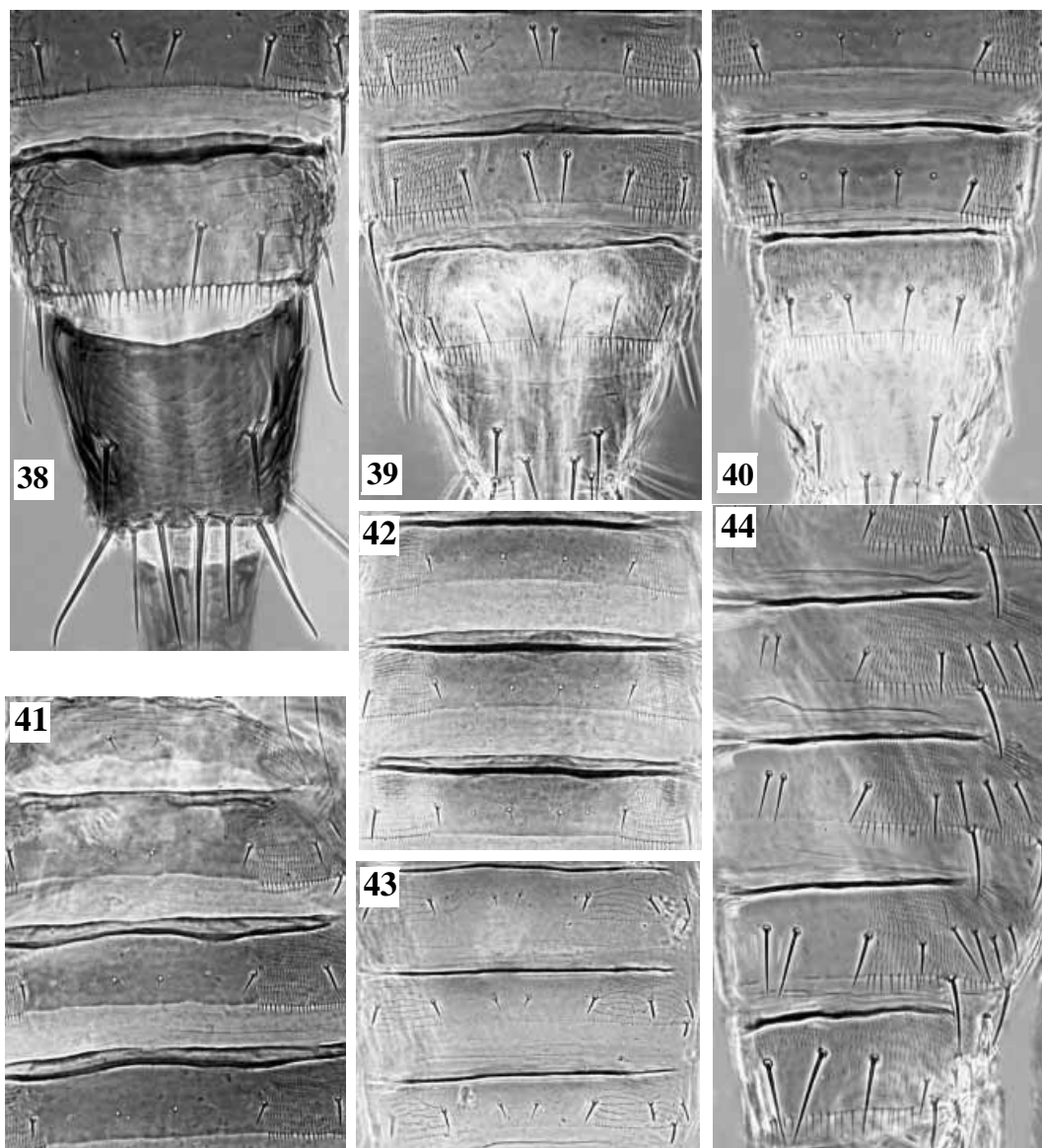
**FIGURES 11-20.** *Scirtothrips* heads and pronota. 11, *frondis*; 12, *inermis*; 13, *kirrhos*; 14, *longipennis*; 15, *litotes*; 16, *moneres*; 17, *pilbara*; 18, *tenor*; 19, *quadriseta*; 20, *solus*.



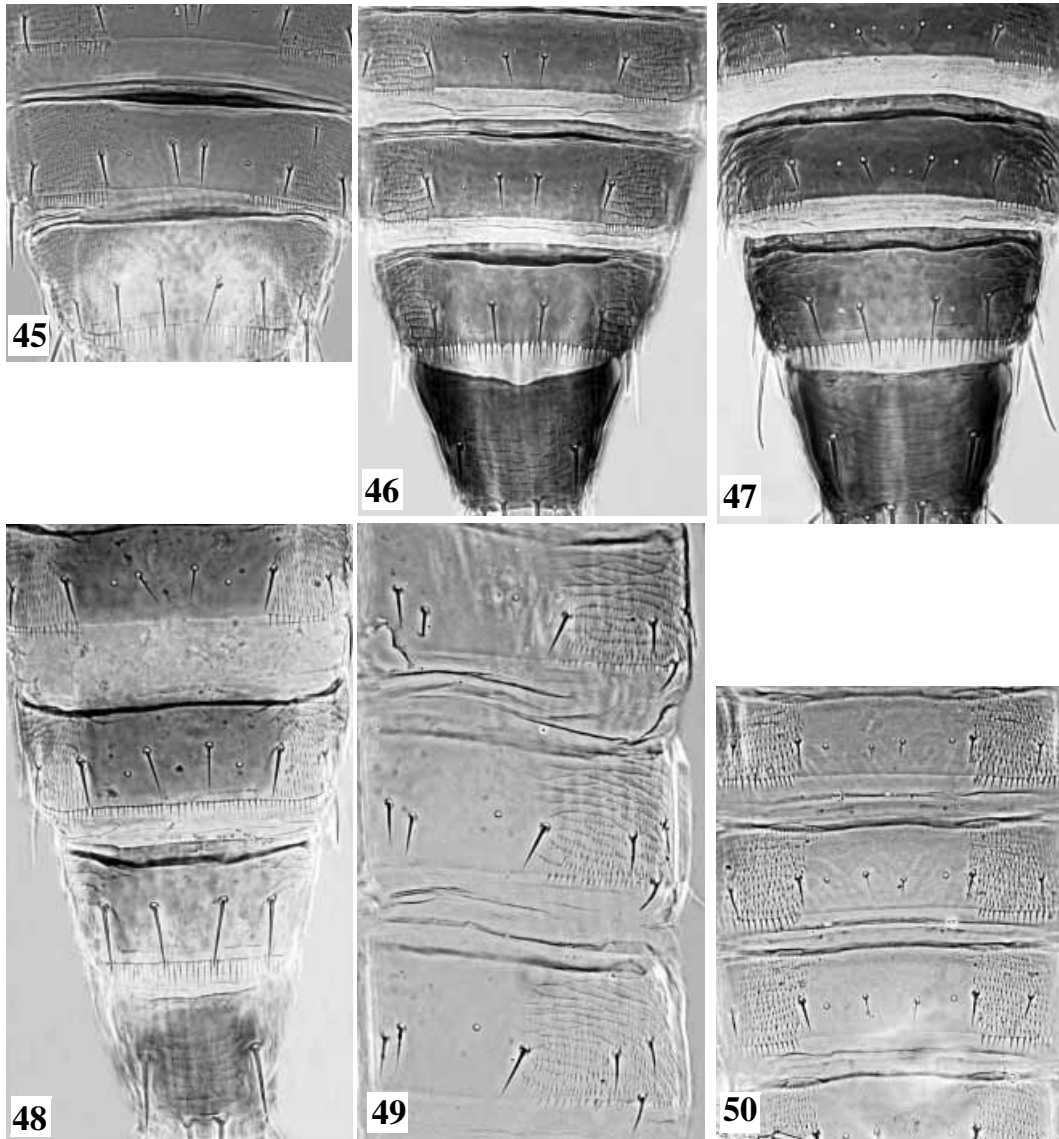
**FIGURES 21-31.** *Scirtothrips* pro- meso- and metanota. 21, *astibos*; 22, *aurantii*; 23, *aurantii*; 24, *eremicus*; 25, *australiae*; 26, *dorsalis*; 27, *dorsalis*; 28, *aurantii*; 29, *quadriseta*; 30, *moneres*; 31, *dobroskyi*.



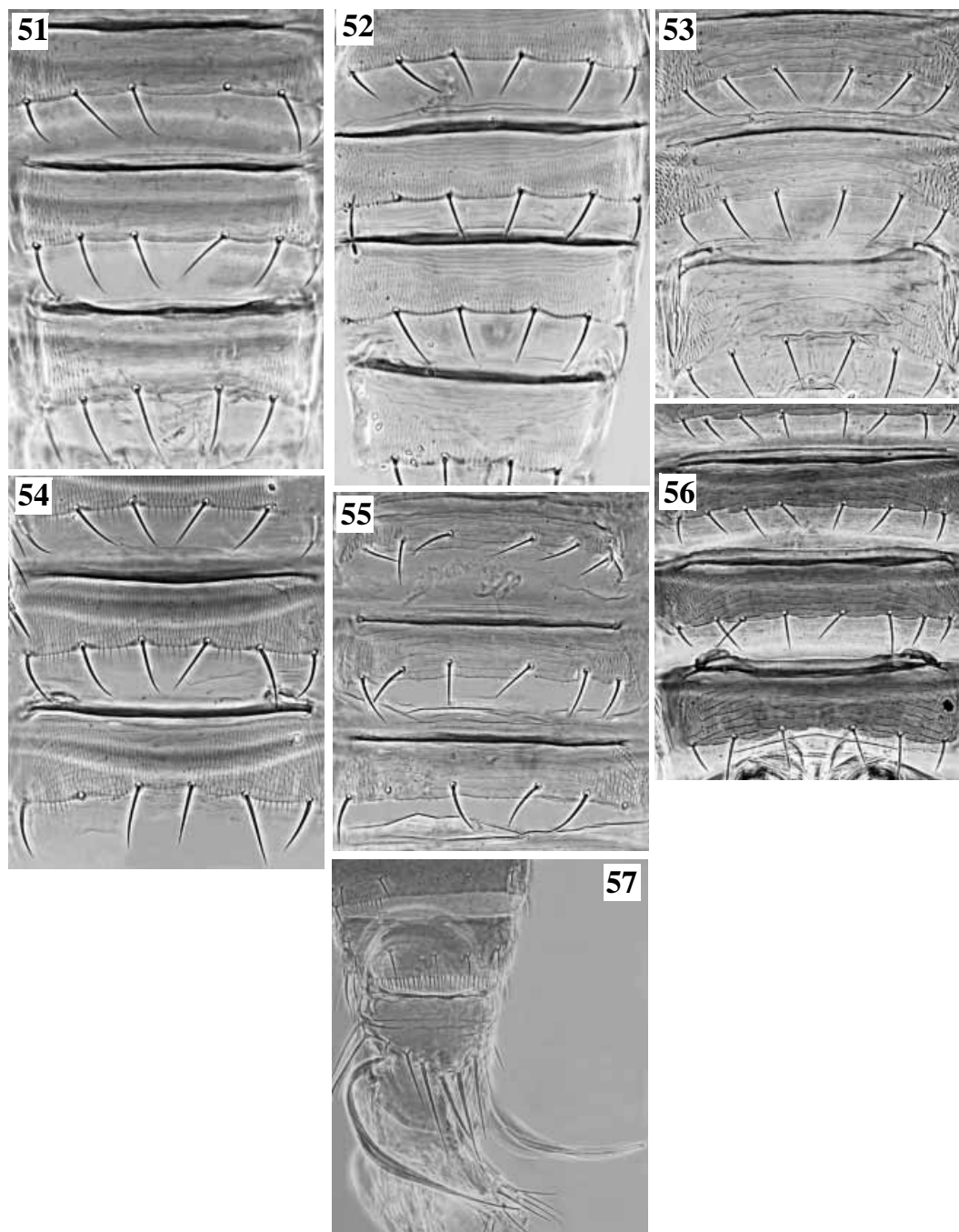
**FIGURES 32-37.** *Scirtothrips* pro- meso- and metanota. 32, *pilbara*; 33, *akakia*; 34, *solus*; 35, *helena*; 36, *drepanofortis*; 37, *aurantii* male hind leg.



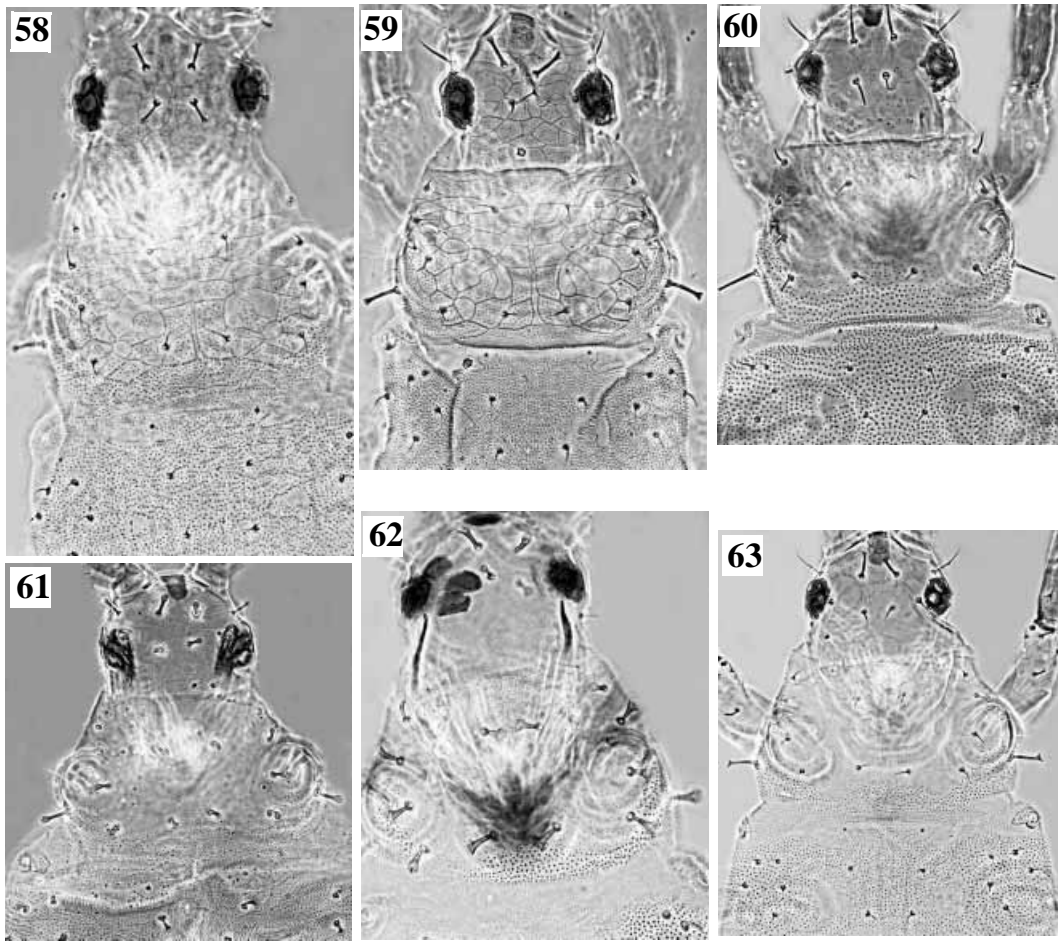
**FIGURES 38-44.** *Scirtothrips* abdominal tergites. 38, *akakia*; 39, *albomaculatus* VI-IX; 40, *australiae* VI-IX; 41, *drepanoformis* I-IV; 42, *kirrhos* IV-VI; 43, *moneres* IV-VI; 44, *inermis* IV-VIII.



**FIGURES 45-50.** *Scirtothrips* abdominal tergites. 45, *pilbara* VI-VIII; 46, *quadriseta* VI-IX; 47, *solus* VI-IX; 48, *litotes* VI-IX; 49, *tenor* IV-VI; 50, *frondis* IV-VII.



**FIGURES 51-56.** *Scirtothrips* abdominal sternites. 51, *australiae* V-VII; 52, *dorsalis* IV-VII; 53, *frondis* V-VII; 54, *aurantii* sternites V-VII; 55, *albomaculatus* sternites IV-VI; 56, *quadriseta* IV-VII; 57, *drepanofortis* male tergites VIII-IX.



**FIGURES 58-63.** *Scirtothrips* second instar larvae, head and pronotum. 58, *aurantii*; 59, *dorsalis*; 60, *frondis*; 61, *helenae*; 62, *tenor*; 63, *dobroskyi*.