

Species of the genus *Thrips* (Thysanoptera) from Peninsular Malaysia, with a checklist of recorded Thripidae

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Abstract

An illustrated key is provided to 23 species of the genus *Thrips* from Peninsular Malaysia, including one new species and seven species not previously recorded from this country. Most of the specimens came from a recent survey of crop plants, and this survey produced several interesting species of other genera of Thripidae. The invasive pest species, *Frankliniella occidentalis* and *Frankliniella intonsa*, were abundant in highland areas, and an African species not previously known from Asia, *Ceratothripoides brunneus*, was found commonly particularly in lowland areas. A checklist is provided of 78 species of Thripidae recorded from Peninsular Malaysia.

Key words: *Thrips*, Thripinae, new species, *Ceratothripoides*

Introduction

Southeastern Asia is one of the most biologically diverse parts of the world, and agricultural production in this area is affected by a wide diversity of pest insects. Despite this, identification literature and general overviews of particular insect groups are surprisingly absent from this region, and this is particularly true of the order Thysanoptera, the thrips. Only for the Philippines is there a Thysanoptera faunal account, with keys to 190 species in 90 genera (Reyes, 1994). For Thailand there are keys in the Thai language to about 40 common species of the suborder Terebrantia, including 12 species of the genus *Thrips* (Poonchaisri, 2001). For Japan, there is a fully illustrated account of the species and genera in the suborder Tubulifera (Okajima, 2006), and identification keys are available for the Thysanoptera fauna of India (Ananthakrishnan and Sen, 1980). For Indonesia, there is a list of the thrips species recorded from each of the main islands (zur Strassen, 1994), but for the other countries of South East Asia, including Malaysia, there are neither regional lists nor texts that would help students and agricultural entomologists to start to identify the common or pest thrips species.

The objective of the present paper is to provide a basis for identifying members of the genus *Thrips* in Malaysia, in the hope of stimulating local studies on the rich Thysanoptera fauna of this region. The project developed around a survey of thrips associated with various crops in Peninsular Malaysia, including samples taken from the different faunas that exist in the lowland and highland areas of this country. In addition to samples taken at the Institute of Biological Sciences and Rimba Ilmu at the University of Malaya (UM), Kuala Lumpur, the sampling sites were as follows: SELANGOR [Serdang (Federated Experimental Station; MARDI; University Putra Malaysia; Rice Industry Centre); Taman Serdang Raya, Seri Kembangan; Parit 5, Sekinchan; Taman Agrotek, Batang Berjuntai]; PAHANG [Cameron Highlands (MARDI and Taman Sedia, Tanah Rata; Brinchang; Kampong Raja)]; KELANTAN [Loajing, Gua Musang]; TERENGGANU [MARDI, Jerangau]; PERAK [Kampung Ijok, Kuala Kurau].

The published checklist of thrips from Indonesia records just over 125 species of Thripidae, whereas only

78 species of this family are listed here from Peninsular Malaysia (Table 1). Comparing these two lists, only 37 species appear on both, and several more Thripidae species are known only from Thailand including that part of the Peninsular just north of the Malaysian border. This suggests a high level of diversity in the area. One measure of thrips diversity in Southeastern Asia comes from unpublished data at the Natural History Museum, London, derived from studies in Brunei by Nigel Stork during the 1980's. This work involved passing an insecticide fog up into the canopy of forest trees, and resulted in 850 specimens of Thysanoptera being collected from just nine trees. Of these specimens, 350 belonged to a single species. Among the remaining 500 specimens 130 putative species were distinguished, but only 33 of these could be recognised as described species, with a further 60 species recognizable only to genus. A total of 37 species did not correspond satisfactorily with any described genus. The diversity of Thysanoptera in this area is thus both high and poorly documented. Many described species remain known only from a few old, slide-mounted specimens, and, because technical methods of slide preparation in the 1930's did not involve satisfactory clearing of body contents, some of these species remain difficult to recognize and associate with recently collected material (Mound, 2005).

TABLE 1. Thripidae species recorded from Peninsular Malaysia.

[For details, see: <http://www.ento.csiro.au/thysanoptera/worldthrips.html>]

Panchaetothripinae

- Anisopilothrips venustulus* Priesner, 1923
- Astrothrips aureolus* Stannard and Mitri, 1962
- Astrothrips chisinliaensis* Chen, 1980
- Astrothrips globiceps* Karny, 1913
- Copidothrips octarticulatus* Schmutz, 1913
- Elixothrips brevisetis* Bagnall, 1919
- Helionothrips annosus* Wang, 1993
- Helionothrips cephalicus* Hood, 1954
- Helionothrips longisensibilis* Kudo, 1995
- Heliothrips haemorrhoidalis* Bouche, 1833
- Oneilliella pallidizonata* Kudo, 1995
- Panchaetothrips holtmanni* Wilson, 1975
- Phibalothrips peringueyi* Faure, 1925
- Phibalothrips rugosus* Kudo, 1979
- Rhipiphorothrips concoloratus* Zhang and Tong, 1993
- Rhipiphorothrips pulchellus* Morgan, 1913
- Selenothrips rubrocinctus* Giard, 1901

Sericothripinae

- Hydatothrips latisensibilis* Kudo, 1997
- Hydatothrips multipunctatus* Kudo 1997
- Neohydatothrips medius* Wang, 1994
- Neohydatothrips kenidai* Kudo, 1997
- Neohydatothrips tabulifer* Priesner, 1935
- Neohydatothrips plynopygus* Karny, 1925

Thripinae

- Ayyaria chaetophora* Karny, 1927
 - Bathrips melanicornis* Shumsher, 1946
 - Bolacothrips striatopennatus* Schmutz, 1913
 - Ceratothripoides brunneus* Bagnall, 1918
 - Chaetanaphothrips ipomoeae* Nonaka and Okajima, 1992
-

to be continued.

TABLE 1. (continued)

<i>Chaetanaphothrips machili</i> Hood, 1954
<i>Chaetanaphothrips orchidii</i> Moulton, 1907
<i>Craspedothrips antennalis</i> Karny, 1915
<i>Danothrips alis</i> Bhatti, 1980
<i>Dendrothripoides innoxius</i> Karny, 1914
<i>Dendrothripoides poni</i> Kudo, 1977
<i>Dichromothrips corbetti</i> Priesner, 1936
<i>Dichromothrips smithi</i> Zimmermann, 1900
<i>Ernothrips lobatus</i> Bhatti, 1967
<i>Filipinothrips ananthakrishnani</i> Tyagi, Kumar and Mound, 2008
<i>Frankliniella intonsa</i> Trybom, 1895
<i>Frankliniella occidentalis</i> Pergande, 1895
<i>Frankliniella williamsi</i> Hood, 1915
<i>Indusiothrips seshadrii</i> Priesner, 1952
<i>Isunidothrips serangga</i> Kudo, 1992
<i>Megalurothrips mucunae</i> Priesner, 1938
<i>Megalurothrips typicus</i> Bagnall, 1915
<i>Megalurothrips usitatus</i> Bagnall, 1913
<i>Microcephalothrips abdominalis</i> Crawford DL, 1910
<i>Mycterothrips fasciatus</i> Masumoto and Okajima, 2006
<i>Octothrips bhattii</i> Wilson, 1972
<i>Oxyrhinothrips scolopax</i> Priesner, 1933
<i>Paithrips circularis</i> Nonaka and Jangvitaya, 1994
<i>Parabaliorthrips coluckus</i> Kudo, 1977
<i>Scirtothrips dorsalis</i> Hood, 1919
<i>Thrips alatus</i> Bhatti, 1980
<i>Thrips alius</i> Palmer, 1992
<i>Thrips aspinus</i> Mound and Masumoto, 2005
<i>Thrips coloratus</i> Schmutz, 1913
<i>Thrips decens</i> Palmer, 1992
<i>Thrips facetus</i> Palmer, 1992
<i>Thrips flavus</i> Schrank, 1776
<i>Thrips florum</i> Schmutz, 1913
<i>Thrips hanifahii</i> sp.n.
<i>Thrips hawaiiensis</i> Morgan, 1913
<i>Thrips javanicus</i> Priesner, 1934
<i>Thrips leeuwenii</i> Priesner, 1938
<i>Thrips levatus</i> Bhatti, 1980
<i>Thrips malloti</i> Priesner, 1934
<i>Thrips melastomae</i> Priesner, 1934
<i>Thrips mirus</i> Bhatti, 1967
<i>Thrips morindae</i> Priesner, 1934
<i>Thrips orientalis</i> Bagnall, 1915
<i>Thrips palmi</i> Karny, 1925
<i>Thrips parvispinus</i> Karny, 1922
<i>Thrips simplex</i> Morison, 1930
<i>Thrips unispinus</i> Moulton, 1940
<i>Thrips vitticornis</i> Karny, 1922
<i>Trichromothrips trifasciatus</i> Priesner, 1936
<i>Tusothrips sumatrensis</i> Karny, 1925

In more recent years there have been various studies on particular groups of Thysanoptera from the Malaysian area (Kudo, 1992, 1996, 1997; Nonaka and Jangvitaya, 1993, 1994; Okajima, 1995a-d; Palmer 1992; Palmer and Mound, 1978; Tyagi, et al., 2008). However, these studies were not directed at pest thrips, and none is useful to agricultural entomologists, nor to students in southeastern Asia wanting to start work on this group of insects. For a general introduction to Thysanoptera, it is necessary to refer students to overseas studies (Mound and Marullo, 1996), or keys to worldwide pest thrips (Mound and Kibby, 1998; Moritz et al, 2001), despite these including few Asian species. Thus there remains a need for a broad introduction to the Thysanoptera fauna of Malaysia, and field studies are needed on particular species to determine the extent of their variation in colour and structure, and also their precise host plants. For each of the species mentioned in this paper full nomenclatural and bibliographic details are available in a web-based catalogue (Mound, 2008), and are not repeated here.

Survey results

This paper is based largely on specimens collected recently from the flowers of cultivated plants in various areas of Peninsular Malaysia. Many of the specimens collected were members of the genus *Thrips*, and this has facilitated the review of the Malaysian species of that genus given below. However, some comments are appropriate on species of other genera that were taken during this crop survey, and that are relevant to crop protection as well as to studies on biodiversity and distribution patterns. In the Cameron Highlands, the most abundant species found at various sites was the introduced major pest, western flower thrips, *Frankliniella occidentalis*. This species was taken from many different plants, including species of *Capsicum*, *Fragaria*, *Gerbera*, *Gladiolus*, *Hibiscus*, *Impatiens*, *Nasturtium*, *Rosa*, *Solanum* and *Zantedeschia*. Also common in these highlands, and taken from a similar range of plants, was the European flower thrips, *Frankliniella intonsa*. In the lowlands at Serdang, Selangor, a single sample of *F. intonsa* was taken, but no western flower thrips were found at any lowland site. A third species of this genus, *Frankliniella williamsi*, was taken from *Zea mays* at Serdang in March 2008, and this thrips is widespread in tropical countries on maize. Of particular interest is the fact that *F. schultzei*, a widespread tropical and sub-tropical virus-vector thrips, was not taken at any time during this survey.

At the lowland sites, the thrips species most commonly taken was an African species, *Ceratothripoides brunneus*. Although this has been seen from many localities across Africa, it has not previously been recorded from anywhere in Asia. It has presumably been transported by the horticultural trade, because specimens have been seen from the Netherlands, taken on *Ensete* in a greenhouse, and moreover two males have been studied recently from Puerto Rico. This thrips species was found at UM, at several sites in Serdang, Selangor, and also at a highland site at Gua Musang, Kelantan, and adults were taken from plants of the following genera, *Asystasia*, *Hibiscus*, *Impatiens*, *Ocimum*, *Orthosiphon*, *Rhodomirtus*, *Salvia*, *Solanum*, *Tabernaemontana* and *Thunbergia*. Curiously, no specimens of *Ceratothripoides claratris* have been seen from Malaysia, although this Asian species is recorded as a pest of tomatoes in Thailand (Dammini et al., 2005).

A widespread Asian lowland species, *Bathrips melanicornis*, was collected both at UM and in Serdang. This was taken on *Ocimum* and also on *Bougainvillea*, and although there is no evidence of its pest status, specimens have been seen from various crops as well as other plants from India, Thailand, Malaysia, Bali, Java, Taiwan, East Timor, and Australia (Queensland). An Asian orchid thrips, *Dichromothrips smithi*, that is a pest of cultivated *Vanilla* in India, was found in Malaysia on *Arundina*. The worldwide sunflower thrips, *Microcephalothrips abdominalis* was taken in Selangor as well as Kelantan, the later sample being from *Tagetes*. The Asian bean thrips, *Megalurothrips usitatus*, was found at highland and lowland sites, on *Vigna* and *Sesbania* as well as on several other plants, and the related species *M. typicus* was found at lowland sites on *Averrhoa carambola*, *Mangifera* and *Melastoma*. A third species of this genus, *M. mucunae*, has been found at UM breeding in the flowers of the leguminous tree, *Callerya atropurpurea*, and this thrips has also been taken in low numbers from the canopy of various unrelated tree species. Recognition of species in the

genus *Megalurothrips* continues to be problematical, despite the studies by Palmer (1987).

Of other pest species, *Scirtothrips dorsalis* was found commonly on various plants, but the greenhouse thrips, *Heliothrips haemorrhoidalis*, was taken once only, on *Cucumis melo* at Serdang, Selangor. Several other interesting Thripidae were also found. *Octothrips bhattii* occurs in large numbers at UM on climbing *Lygodium* ferns, and two particularly unusual species were taken at UM from *Capsicum*. A single male of *Danorthrips alis* represents a species previously known only from a single male from the Genting Highlands; and several specimens of both sexes of *Trichromothrips trifasciatus* represent a species known until recently only from a single female from Sumatra (Bhatti, 2000), but with a further new record from two Pacific islands (Hoddle et al., 2008). *Filipinothrips ananthakrishnani* was described recently from specimens taken at UM in the flowers of a species of *Xanthophyllum* (Tyagi et al., 2008), and two females of *Craspedothrips antennalis* (Karny) known only from Java were also collected during this survey; one from *Tabernaemontana* flowers at MARDI, Serdang, and one from *Averrhoa carambola* at UM. Finally, *Oxyrrhinothrips scolopax*, previously known only from Sumatra, was studied recently in the Senckenberg Museum, Frankfurt, collected from *Macaranga* flowers at Ulu Gombak near Kuala Lumpur.

***Thrips* Linnaeus**

This is the largest genus in the Thysanoptera, with 286 species listed worldwide (Mound, 2008). Almost 100 of these species are known to occur in the area between the Indian peninsular, Australia and the Pacific islands (Palmer, 1992). Some of these are well known as pests, but for many species there is little available information on their biology, geographical distributions, host associations and structural variation. Because of this lack of biological information, accurate identification continues to be a problem in some groups of species. Differences quoted in published literature for species such as *T. javanicus*, *T. levatus* and *T. morindae* are based on very few specimens, and thus cannot be expected to be entirely reliable.

Many *Thrips* species breed only in flowers, although a considerable number of species breed on leaves, and pest species often breed in both places. Within the genus, there is much variation between species in body size, body colour, number of antennal segments, and detailed chaetotaxy of the body and wings, such that 17 genus-group names are now placed as synonyms of *Thrips* (Mound and Masumoto, 2005). Membership of the genus is determined by the presence of paired ctenidia laterally on the abdominal tergites, these ctenidia being posteromesad of the spiracles on tergite VIII, whereas they are anterolateral to the spiracles in species of *Frankliniella* (Mound 2002). Descriptive details of the Asian species of *Thrips* genus are available in Bhatti (1980), Palmer (1992), also Mound and Masumoto (2005).

Key to the species of *Thrips* from Peninsular Malaysia

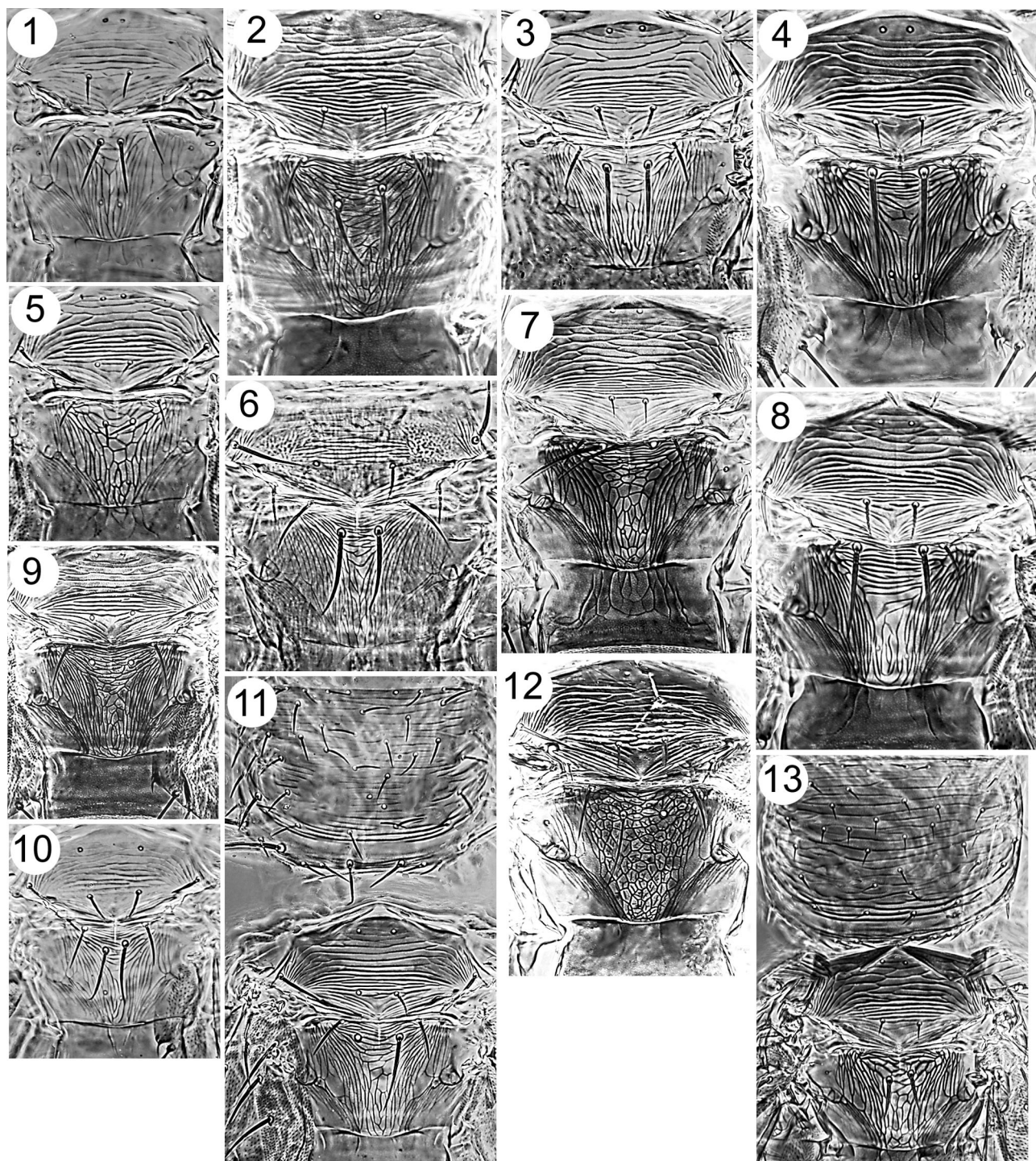
1. Sternites IV–VI with discal setae as well as posteromarginal setae (Figs 27–28)..... 2
- . Sternites IV–VI with no discal setae, only with posteromarginal setae 16
2. Pronotum with no prominent posteroangular setae (Figs 13, 21)..... 3
- . Pronotum with 1 or 2 pairs of prominent posteroangular setae 5
3. Sternites with at least 10 marginal setae (Fig. 25); pleurotergites with discal setae *aspinus*
- . Sternites with only 6 marginal setae (Fig. 28); pleurotergites without discal setae 4
4. Pronotum with one pair of posteroangular setae about 15 microns long, clearly longer than discal setae (Fig. 13); antennal segment VI uniformly brown *mirus*
- . Pronotum with no posteromarginal or posteroangular setae longer than discal setae (Fig. 21); antennal segment VI yellow in basal half *hanifahii* sp.n.
5. Pronotum with only 1 pair of long posteroangular setae..... *unispinus*
- . Pronotum with 2 pairs of long posteroangular setae..... 6
6. Abdominal sternite VII with no discal setae (Fig. 26) [forewing first vein setal row almost complete, at least with more than 8 setae on distal half] 7

-.	Abdominal sternite VII with discal setae (Fig. 27) [forewing first vein setal row never complete, usually with less than 8 setae on distal half].....	9
7.	Forewing clavus apical seta shorter than subapical seta (cf. Fig. 17) [forewing dark at base; metanotal sculptured reticles equiangular and with internal markings (Fig. 12)]	<i>orientalis</i>
-.	Forewing clavus apical seta longer than subapical seta [forewing usually paler at base; metanotal reticles longitudinal or with no internal markings]	8
8.	Metanotal reticles without, or with few, internal markings (Fig. 15)	<i>parvispinus</i>
-.	Metanotal reticles with many internal markings.....	<i>decens</i>
9.	Tergite VIII marginal comb absent or at least not developed medially (Fig. 23).....	10
-.	Tergite VIII marginal comb complete (Fig. 22).....	11
10.	Metanotum with some reticulation medially (Fig. 7).....	<i>leeuweni</i>
-.	Metanotum closely striate medially (Fig. 16).....	<i>vitticornis</i>
11.	Metanotal median setae arising at anterior margin (Figs 4, 8)	12
-.	Metanotal median setae arising behind anterior margin (Fig. 14)	14
12.	Pronotal posteroangular setae short, inner pair no longer than maximum width of fore tibia	<i>melastomae</i>
-.	Pronotal posteroangular setae long, inner pair 1.1 to 1.7 as long as maximum width of fore tibia	13
13.	Forewing clavus apical seta longer than subapical seta (Fig. 18); mesonotum with sculpture lines surrounding anterior pair of campaniform sensilla (Fig. 8).....	<i>hawaiiensis</i>
-.	Forewing clavus apical seta shorter than subapical seta (Fig. 17); mesonotum with no sculpture lines surrounding anterior pair of campaniform sensilla (Fig. 4)	<i>florum</i>
14.	Metanotal reticles usually with prominent internal markings (Fig. 14)	<i>simplex</i>
-.	Metanotal reticles with no internal markings (Fig. 3)	15
15.	Abdominal pleurotergites with discal setae	<i>facetus</i>
-.	Abdominal pleurotergites with no discal setae	<i>coloratus</i>
16.	Tergite VIII posteromarginal comb complete; females mainly yellow	17
-.	Tergite VIII posteromarginal comb incomplete or absent; females mainly brown	19
17.	Head with ocellar setae III close together behind fore ocellus (Fig. 20).....	<i>flavus</i>
-.	Head with ocellar setae III posterolateral to fore ocellus	18
18.	Metanotal sculpture lines converging near posterior margin (Fig. 10).....	<i>palmi</i>
-.	Metanotal sculpture lines irregularly sub-parallel, scarcely converging (Fig. 1)	<i>alatus</i>
19.	Forewing first vein with complete row of setae	<i>malloti</i>
-.	Forewing first vein setal row incomplete, with wide interval	20
20.	Forewing first vein with at least 12 basal setae	<i>javanicus</i>
-.	Forewing first vein with no more than 8 setae on basal half	21
21.	Metasternum with no more than 20 discal setae; antennal segments IV–V largely yellow	<i>alius</i>
-.	Metasternum with more than 20 discal setae; antennal segments IV–V brown.....	22
22.	Femora yellow; metanotal reticles with few internal markings and only on anterior half of metanotum (Fig. 11); male yellow.....	<i>levatus</i>
-.	Femora brown; metanotal reticles with internal markings on posterior as well as anterior half of metanotum (Fig. 9); male brown.....	<i>morindae</i>

***Thrips alatus* Bhatti.** The original specimens of this species came from Uttar Pradesh in India, and also from Nepal. It is closely similar to *Thrips palmi*, of which it was described as “the Himalayan counterpart”. The metanotal sculpture differs slightly between these two, as indicated in the key above (Figs 1, 10), but no other consistent differences have been observed. The species is here recorded from Malaysia on the basis of four females collected from *Nasturtium* flowers in the Cameron Highlands in March 2008. One female has also been studied from this same locality, collected in July, 1984 (in the Ewart Collection, Riverside, University of California).

***Thrips alius* Palmer.** This species was described from banana flowers at Davao in The Philippines, and also recorded from the same plant in Yunnan, China. In the Rimba Ilmu at the University of Malaya, 7 females and 1 male were taken from the flowers of *Alpinia speciosa* (Zingiberaceae) in July 2006. The antennae of this species are unusually pale, with segments IV and V lightly shaded only in the apical third, and even the sixth segment shaded lightly only in the apical half. Similarly, the femora are extensively yellow with only light brown shading. The male is essentially yellow, with light brown shadings on the anterior margins of the head

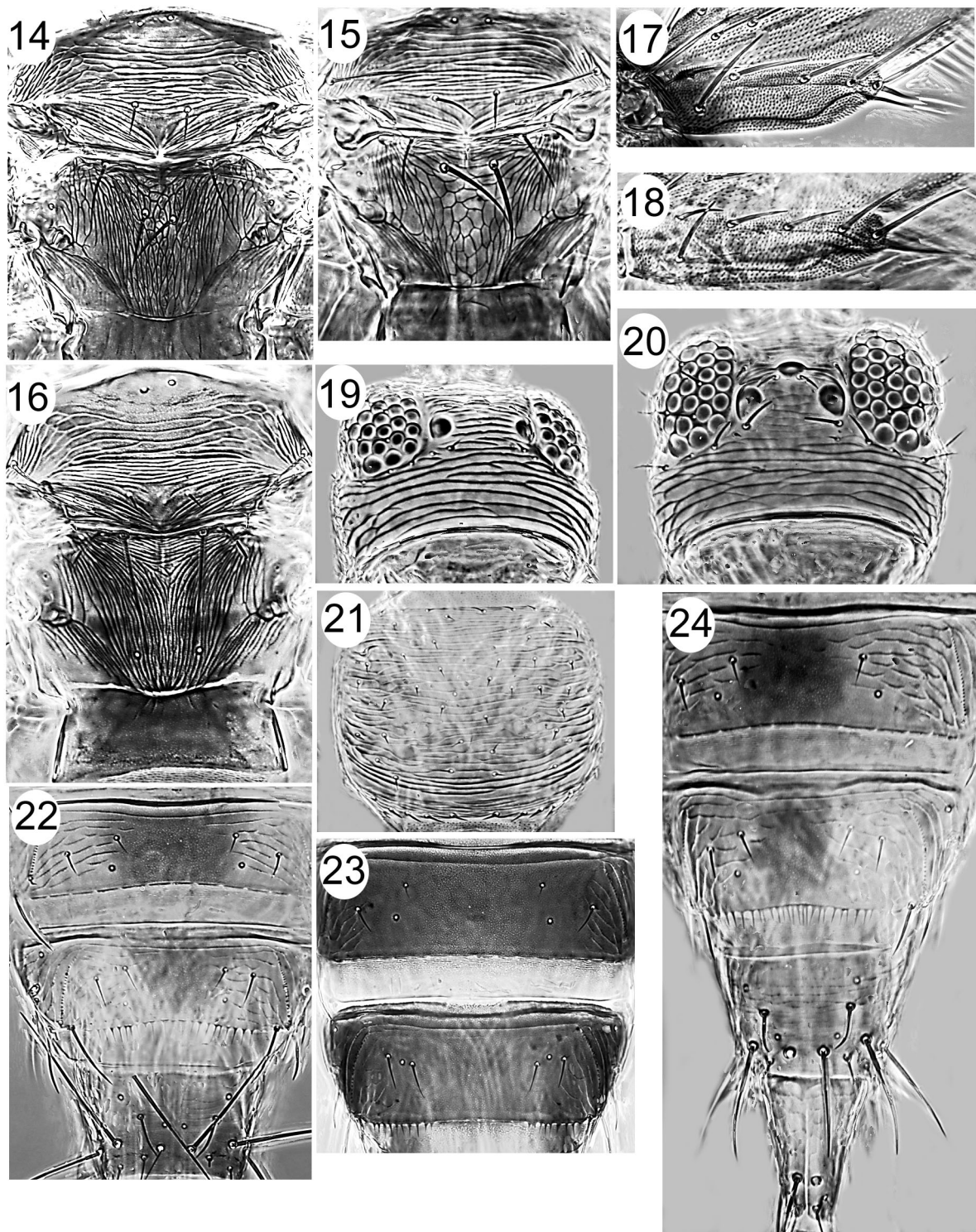
as well as on the tergites. A further Asian species that is closely similar in structure is *Thrips pectiniprivus* Priesner, known only from Krakatau. The type specimens of that species have been re-examined; the body of males is brown, and in females antennal segments IV–V are brown in the distal half with VI fully brown.



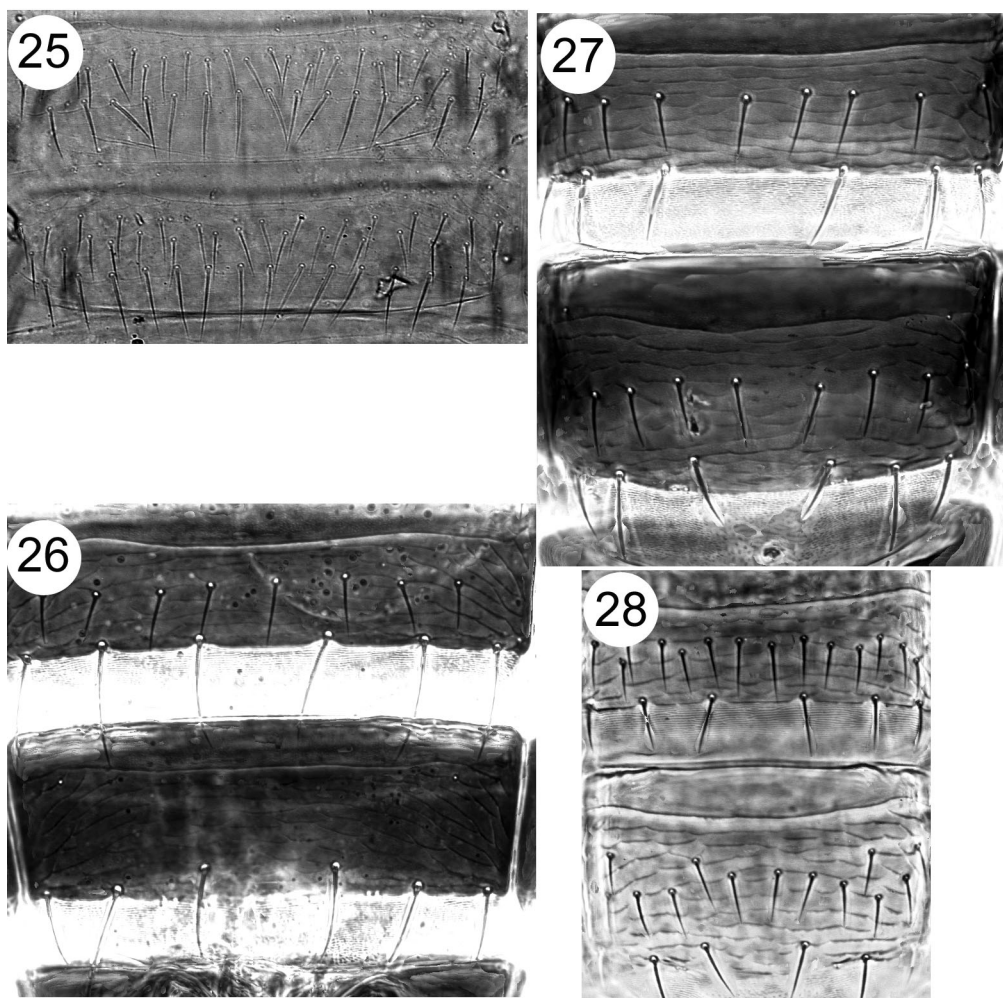
FIGURES 1–13. *Thrips* species meso and metanota. (1) *T. alatus*; (2) *T. alius*; (3) *T. coloratus*; (4) *T. florum*; (5) *T. hanifahii*; (6) *T. flavus*; (7) *T. leeuwenii*; (8) *T. hawaiiensis*; (9) *T. morindae*; (10) *T. palmi*; (11) *T. levatus* (with pronotum); (12) *T. orientalis*; (13) *T. mirus* (with pronotum).

***Thrips aspinus* Mound and Masumoto.** Described from mango flowers in the northeastern coastal region of Australia, a single female of this species has been studied from Kubang Pasu, Kedah, in northern Peninsular Malaysia, collected from mango flowers in December 2006. A closely related Oriental species that is likely to

be found in Malaysia is *T. subnudula* (Karny), but that has two pairs of pronotal posteroangular setae that are about twice as long as the pronotal discal setae (Mound and Masumoto, 2005). Both species have numerous, irregularly arranged, discal setae on the sternites and the pleurotergites (Fig. 25).



FIGURES 14–24. *Thrips* species. (14) *T. simplex* meso and metanotum; (15) *T. parvispinus* meso and metanotum; (16) *T. vitticornis* meso and metanotum; (17) *T. florum* forewing clavus; (18) *T. hawaiiensis* forewing clavus; (19) *T. hanifah* head; (20) *T. flavus* head; (21) *T. hanifah* pronotum; (22) *T. coloratus* tergites VII–VIII; (23) *T. leeuwenii* tergites VII–VIII; (24) *T. hanifah* tergites VII–X.



FIGURES 25–28. Sternites of *Thrips* species. (25) *T. aspinus* sternites V–VI; (26) *T. parvispinus* sternites VI–VII; (27) *T. vitticornis* sternites VI–VII; (28) *T. hanifah* sternites VI–VII.

***Thrips coloratus* Schmutz.** This is a widespread species across Asia, between Pakistan, Japan, New Guinea and northern Australia. It is usually not found in large numbers, and is particularly variable in colour and chaetotaxy (Bhatti, 1980). Three females have been seen from Serdang, Selangor on different plants, and in the Natural History Museum, London there are three females from Kuala Lumpur. Also, in the Senckenberg Museum, Frankfurt, there are 12 females and one male from *Macaranga* flowers at Ulu Gombak near Kuala Lumpur. In females, the abdomen is generally yellow with a median brown mark on each tergite, but with the tenth tergite dark brown.

***Thrips decens* Palmer.** This species is known only from a series of both sexes taken in the Genting Highlands, Malaysia, from *Mussaenda* flowers in October 1973. It is similar to *T. javanicus* in having a large number of setae at the base of the forewing first vein (10–14), but it has only a small number of discal setae on the sternites (0–6). The patterns of variation within and between populations require further study.

***Thrips facetus* Palmer.** Known only from three females, two from the Cameron Highlands and one from Bangladesh, this species has the metanotal median pair of setae uniquely thickened, and the pronotal setae are also exceptionally robust. The number of abdominal pleurotergal discal setae varies from four to eight, and the median sternites have as many as 20 long discal setae.

***Thrips flavus* Schrank.** Widespread across the northern hemisphere, this polyphagous species is similar to *T. palmi* in appearance, but has ocellar setae pair III close together behind the first ocellus (Fig. 20). The metanotal sculpture lines form elongate reticles medially (Fig. 6), and do not form an inverted arch at the posterior margin as is usual in *T. palmi*. The species is common in northern India, but a series of specimens has been seen from Malaysia, at MARDI, Serdang, Selangor, from *Melastoma* flowers in March 2008. There is also a series of both sexes in the Natural History Museum, London, taken from *Gaultheria* flowers at Tanah Rata.

***Thrips florum* Schmutz.** The identity of this species, and its separation from the even more widespread species *T. hawaiiensis*, has been the subject of considerable study (Palmer and Wetton, 1987; Bhatti, 1999). In addition to the two character states indicated in the key, specimens of *T. florum* usually have postocular setae pair II much shorter than pairs I and III. The three character state differences between these two species are not entirely consistent, and several specimens from different localities in Malaysia have been studied that have one or other of these characters intermediate between the two species.

***Thrips hanifah* sp.n.**

Female macroptera. Body, legs and antennae yellow, tergites III–VIII with a pale brown area medially, X light brown at apex; antennal segment IV light brown in apical third, V light brown at apex, VI light brown in apical half; forewings pale; major setae on abdomen slightly shaded. Head wider than long; ocellar setae III small, anterolateral to ocellar triangle; vertex and ocellar region with transverse lines (Fig. 19). Antennae 7-segmented. Pronotum midline with about 28 transverse faint striae; posteromarginal, posteroangular and discal setae all small (Fig. 21). Mesonotum with transverse striae, anteromedian campaniform sensilla present. Metanotum reticulate, median setae far from anterior margin, campaniform sensilla present (Fig. 5). Forewing first vein with 7 setae on basal half, 3 setae on distal half; second vein with 11 setae; clavus terminal seta longer than subterminal seta. Abdominal tergites I–IV with one or more transverse sculpture lines medially, V–VII with lines extending to median pair of setae; tergite VIII posterior margin concave medially (Fig. 24), comb teeth long with relatively broad bases; IX with 2 pairs of campaniform sensilla; median split on X extending almost full length of tergite. Pleurotergites without discal setae; sternites III–VII with about 15 discal setae (Fig. 28), II with about 3 discal setae; sternites III–VII with 6 posteromarginal setae; ovipositor long, extending beyond abdominal apex.

Measurements (holotype female in microns). Body length 1250. Head, length 70; width 140; ocellar setae III length 10. Pronotum, length 130; width 175; posteromarginal setae 10. Forewing, length 620; distal setae on first vein length 15–20.

Type material: Holotype female, **Peninsular Malaysia**, Selangor, Serdang, MARDI, from flower of *Melaleuca leucadendron*, 6.iii.2008 (Hanifah), in the Natural History Museum, London.

Paratypes, 4 females collected with holotype; 6 females, same plant, locality and collector, 13.vi.2008; 1 female from *Averrhoa carambola* flowers, University of Malaya, 5.iii.2008; paratypes in Zoological Museum, University of Malaya, Australian National Insect Collection, Natural History Museum, London, and Senckenberg Museum, Frankfurt. .

Comments: As indicated in the key above, this is one of the few species of genus *Thrips* that lack two pairs of elongate setae on the pronotum. There are now seven such species described. Two of these have a single pair of elongate pronotal posteroangular setae, *T. unispinus*, also *T. antiaropsidis* Zerega et al. from New Guinea. Three species have a single pair of such setae that are only about 15 microns long, *T. brevisetosus* Trybom from Africa, and two oriental species, *T. subnudula* (Karny) and *T. mirus*, and two species have no pronotal posteroangular setae longer than the discal setae. Of these two, *T. hanifah* differs from *T. aspinus* in having only six marginal setae on the sternites, and in lacking discal setae on the pleurotergites. *Anaphothrips cuthbertsoni* Moulton, based on a single female from Zambia, is considered a

synonym of *T. brevisetosus* from Kenya (Bhatti, 1978), and this single female is very similar in sculpture and chaetotaxy to *T. hanifahii* apart from the darker body colour and difference in length of the pronotal posteroangular setae. The recorded host plant, *Melaleuca leucadendron*, is considered to be a complex of species distributed from northern Australia to Malaysia.

***Thrips hawaiiensis* Morgan.** This is the most common flower living thrips of much of Asia, and is now widespread throughout much of the tropics (Palmer, 1992). It is discussed above under *T. florum*.

***Thrips javanicus* Priesner.** The identity of this species is not entirely clear. The name is currently restricted to females that have at least 12 setae on the basal half of the first vein of the forewing, followed by a distinct interval then two setae near the wing apex. The associated males are yellow, whereas in *T. morindae* the males are brown. *T. javanicus* was described from an orchid in Java, and only one female has been seen from Malaysia, collected at Terengganu in March 1974 (Mound, 2005).

***Thrips leeuwenii* Priesner.** Described on a few females from Singapore, one female and one male of this species were taken from mango flowers at Serdang, Selangor in April 2008. The female is large and brown, but the male is smaller and yellow. The metanotal median setae arise at the anterior margin of this sclerite, the comb on tergite VIII is widely interrupted medially but with long teeth laterally, and the ovipositor is unusually long and protrudes from the abdominal apex.

***Thrips levatus* Bhatti.** Described from specimens collected in western India, this species is here recognized as being common in Malaysia. It has been found in considerable numbers in the flowers of starfruit (*Averrhoa carambola*) at UM and in Serdang, Selangor, but adults have also been taken from other plants, including *Capsicum*, *Nephelium* and *Sesbania*. The original description refers to the species as yellow with abdominal segments IX–X dark brown. This description seems likely to be based on individuals that had retained their teneral colouring; one female paratype has been studied in which the yellow abdomen has an increasingly brown area medially on tergites III–VIII. The females from carambola in Malaysia vary in body colour from almost entirely yellow with abdominal segments IX–X brown, to bicoloured with the abdomen uniformly brown but the head and thorax brownish-yellow and the legs yellow; the male is uniformly yellow. In the Natural History Museum, London, there are 12 females from India, Orissa, collected in 1993 from *Tabernaemontana*, *Aganosoma* (Apocynaceae), *Jasminum* (Oleaceae) and *Murraya* (Rutaceae). These show a similar range in body colour to the specimens from Malaysia.

***Thrips malloti* Priesner.** Described from Java, with a synonymic species from Taiwan, this species is reported to be widespread from India to Australia and Okinawa. However, only a few specimens have been studied. The record from Malaysia in Palmer (1992) possibly refers to specimens from Sabah in the Natural History Museum, London. The females are dark brown with the base of the forewing paler, and the first vein bears a continuous row of setae.

***Thrips melastomae* Priesner.** Described from Java, this species is probably widespread in Southeast Asia in the flowers of *Melastoma* species (Palmer 1992), and a series of both sexes from this plant at Genting is in the Natural History Museum, London. The females are brown, with sternal discal setae and a wide interval in the setal row on the forewing first vein, but unlike the common species *T. hawaiiensis*, the pronotal posteroangular setae are unusually short.

***Thrips mirus* Bhatti.** Known only from India, with the holotype female from Mumbai, and four females under the synonymic name *T. heveae* Ananthakrishnan and Jagadish from Tamil Nadu, one female identified as this species has been studied from Malaysia. This was collected from mango flowers at Serdang, Selangor, in April 2008. The species differs from the new species described here, *T. hanifahii*, in having one pair of

moderately prominent pronotal posteroangular setae that are about 15 microns long.

***Thrips morindae* Priesner.** Described from Java, and recorded from Thailand (Mound, 2005), this species has the males brown in colour in contrast to the yellow males of *T. javanicus*. One female from Malaysia is here identified as *T. morindae*, collected from flowers of *Melaleuca* at MARDI, Serdang in March 2008. However, this identification requires further confirmation through the collection of more specimens of both sexes.

***Thrips orientalis* Bagnall.** Widespread from India throughout southeastern Asia to northern Australia and Hawaii, this species is also recorded from Florida and the Caribbean. The metanotum is distinctively reticulate with markings inside the reticles, and the forewing is uniformly dark, however, the number of sternal discal setae is low and variable. In Malaysia, *T. orientalis* has been seen in considerable numbers, but only from Kuala Lumpur.

***Thrips palmi* Karny.** This widespread Asian species has become distributed around other tropical countries in recent years, and can cause serious damage to various crops. A pale yellow thrips, it is similar to *T. flavus* in general appearance, but has ocellar setae pair III posterolateral to the fore ocellus, and the median striae of the metanotum converge near the posterior margin to form an inverted arch. In Malaysia the species is found both in the highlands and in the lowlands, and is common on various crops including *Capsicum*, *Cucumis* and *Solanum* species. A severe attack on *Solanum melongena* can lead to almost complete defoliation.

***Thrips parvispinus* Karny.** Described from Thailand, and found commonly between that country and the Solomon Islands and northern Australia, this is considered to be the same species as *Thrips taiwanus* Takahashi (Mound and Collins, 2000). This is a highly polyphagous species, and is likely to be a pest in some areas. It has been found widely in Peninsular Malaysia, from sites in Kelantan, Pahang, Perak, Selangor, and Terengganu, on *Capsicum*, *Carica*, *Citrus*, *Cucumis*, *Hibiscus*, *Solanum* and *Vigna*. The forewing first vein has an uninterrupted row of setae, the metanotum has reticulate sculpture but rarely has any markings within any of the reticles, and although most sternites have discal setae, sternite VII has none (rarely a single weak discal seta is present medially).

***Thrips simplex* Morison.** The gladiolus thrips is widespread around the world wherever these flowers are grown. The metanotal sculpture has markings within the reticulations, the forewing first vein has 6 to 8 setae on the distal half, and the ocellar setae are unusually short, scarcely longer than the diameter of an ocellus. The species is recorded from Malaysia on a single female taken from *Zantedeschia* in the Cameron Highlands in March 2008.

***Thrips unispinus* Moulton.** Common in northern Australia in the flowers of various trees including mango, this species is recorded from Brunei, New Guinea and the Solomon Islands (Mound and Masumoto, 2005). One female has been seen from Malaysia, taken on *Averrhoa carambola* at UM, in April 2008. The species is remarkable for the presence of only one pair of pronotal posteroangular setae. It appears to be related to *T. mirus* in lacking discal setae on the pleurotergites.

***Thrips vitticornis* Karny.** Described from Thailand, this species is widespread from India through southeast Asia to the islands of the Pacific, including northern Australia. It is recorded from Malaysia on a few specimens taken from white flowers at Tioman Is. Among the species discussed here from Malaysia, the metanotal sculpture of *T. vitticornis* is characteristic with its closely spaced longitudinal striae, but the variation from 3 to 8 in the number of setae on the distal half of the forewing first vein can be confusing.

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