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Identification, distribution and host-plants of the pest species of *Scirtothrips* (Thysanoptera: Thripidae)

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Abstract

Notes are given on the host range, distribution and recognition of the ten species of *Scirtothrips* recorded as pests: *S. aurantii* Faure on citrus in South Africa and bananas in Yemen; *S. bispinosus* (Bagn.) on tea in S. India; *S. citri* (Moult.) on citrus in California; *S. dorsalis* Hood on groundnuts in India, tea in Japan and strawberries in Queensland; *S. inermis* Priesn. on citrus in New Zealand; *S. kenyensis* Mound on tea in Kenya; *S. longipennis* (Bagn.) in glasshouses; *S. mangiferae* Priesn. on mango in Egypt and Israel; *S. manihoti* (Bondar) on cassava in Brazil; *S. oligochaetus* (Karny) on cotton in India. *S. acaciae* Mout. from Ghana is synonymised with *S. aurantii* Faure, and *S. fragariae* (Gir.) from Queensland is synonymised with *S. dorsalis* Hood. *Drepanothrips reuteri* Uzel, a grapevine pest from Europe and America which is very similar to *Scirtothrips* species, is newly recorded from Japan on *Castanea*.

Introduction

The genus *Scirtothrips* Shull includes about 40 species throughout the tropics and subtropics (Jacot-Guillarmod, 1971). Ten of these species are known as pests, the range of crops attacked including tea, coffee, citrus, cassava, castor, chillies (*Capsicum*), bananas, mango, grapevines, groundnuts and strawberries.

These minute yellow insects, often less than one millimetre long, usually feed on, and often damage, young growing leaves. This damage is due to large numbers of individuals sucking the contents from epidermal cells using feeding-tubes formed by coadapted maxillary stylets (Mound, 1971; Milne & Manicom, 1978; Heming, 1978). However, judging from the serious leaf-distortions sometimes associated with *Scirtothrips* species, it is possible that a toxic saliva may be injected. Leaf-curl of cassava in Brazil associated with *S. manihoti* (Bondar) is apparently direct feeding damage, not a viral infection (Mound, 1973), and this is also true of leaf-curl of chilli in India (Amin, 1979). However, recent studies by Amin (1979) suggests that *S. dorsalis* Hood may be a vector of tomato spotted wilt on groundnut at Hyderabad.

Many members of the genus have a fairly limited distribution, but this may simply be a reflection of our inadequate knowledge of these very small insects. For example, *S. citri* (Moulton) is known only from California and adjacent territories, and *S. bispinosus* (Bagnall) is not known for certain outside southern India. In contrast, some species have a very wide distribution. For example, *S. aurantii* Faure, the South African citrus thrips, is here recorded throughout Africa between Cape Province and Egypt, Nigeria, Mauritius and Yemen. Similarly, *S. dorsalis* is found between Pakistan in the west, and Japan, the Solomon Islands and Queensland in the east. These appear

to be natural distributions, but *S. longipennis* (Bagnall) and *S. inermis* Priesner have evidently been transported by man artificially, and this must also apply to the Indian species *S. oligochaetus* (Karny) in Barbados (record published here).

Unfumigated plants, particularly those with young leaves, may readily carry these insects when transported around the world, and any member of the genus must be regarded as a potential pest. However, as with other Thysanoptera, *Scirtothrips* species are most likely to achieve pest status on a crop during periods of low rainfall, because heavy rain is usually accompanied by sharp reductions in thrips populations.

Species recognition in Scirtothrips

Identification of species in this genus is not easy. Most species are pale and minute, and their rather oily body contents make the preparation of undamaged but fully cleared specimens on microscope slides technically difficult. Without such fully cleared specimens, however, minute structural details cannot be studied with accuracy. As a result, most species have been defined previously only on colour and silhouette characters (number of wing setae, length of antennal segments and pronotal setae), together with host-plant and distribution data. Thus it has been particularly difficult to recognise previously described species on new host-plants or outside their known geographical range. Many species cannot be recognised with certainty even from a reexamination of their original type material (let alone their original description), and freshly collected, carefully mounted specimens are required to redefine each species. Bailey (1964) has given an excellent review of the genus, but his keys are ineffective for identification due to the problems indicated above. Without fresh material, sensible keys to the world species are impossible, the eleven species described from North America being particularly poorly characterised (see *S. citri* below).

Mound (1968*b*) introduced several new characters for the definition of *Scirtothrips* species, and the objectives of the present paper are to put on record some of the information accumulated during several years of routine identifications for the Commonwealth Institute of Entomology. The use of fine structural detail in defining these species is demonstrated by reference to all the known pest species in *Scirtothrips*. This information is summarised in Table I as well as in the form of a traditional key to species.

For accurate microscopical study, most specimens need to be fully cleared by treatment in 5% NaOH prior to mounting on to microscope slides in canada balsam (Mound & Pitkin, 1972). However, colour is a useful ancillary character and so a few unmacerated specimens should also be mounted. Diagnostic details which can be revealed by such careful preparation of specimens are discussed below, but it must be emphasised that no biologist should expect every population of a species to be identical in all characteristics, whether host relationships, life-cycle or micromorphology. Our present knowledge of the genus is clearly fragmentary, and this can only be improved by interdependent field work and museum studies.

The following depository abbreviations are used: BMNH—British Museum (Natural History) London; CAS—Californian Academy of Sciences, San Francisco; QM—Queensland Museum, Brisbane; SANIC—South African National Insect Collection, Pretoria; SMF—Senckenberg Museum, Frankfurt; USNM—US National Museum of Natural History, Washington, D.C.

Diagnostic characters (Table I)

Colour. Previous authors have relied heavily on colour differences, but these are often variable and may be unreliable due to immaturity of available specimens. Such teneral individuals, and also males, may lack darker markings. Moreover, at high population levels in hot weather individuals may be unusually small and pale. The most generally useful colour characteristic is the presence or absence of a dark ante-

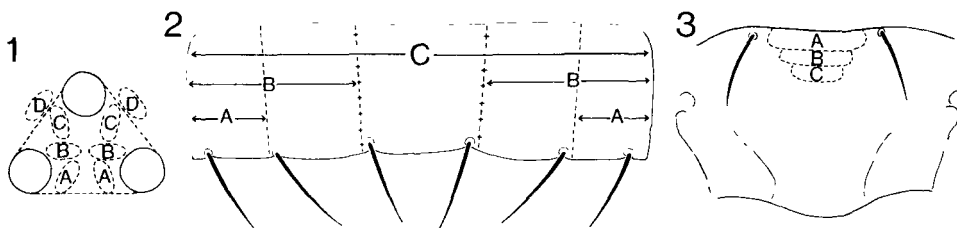


Fig. 1-3.—States of characters 4, 15 and 8 in Table I; 1, ocellar triangle, showing ocellar setae pair III position; 2, sternite showing distribution of microtrichia; 3, metanotum, showing median setae position.

costal ridge on the tergites and/or sternites, also the presence of a median shaded area on the tergites of some pale-bodied species.

Antennae. The relative lengths of antennal segments are unreliable for species recognition. Most species have antennae with eight segments, but an undescribed species from *Casuarina* in Australia has only seven segments (Palmer & Mound, 1982). The species *reuteri*, placed at present in a separate monobasic genus *Drepanothrips*, has only six segments (Fig. 4). The inner major seta on segment II is particularly large in some species.

Ocellar setae. Three pairs of ocellar setae are present in all *Scirtothrips* species, as in many other thripid genera (Mound & Palmer, 1981). Ocellar setae pair III refers to that pair which arises within (or near) the ocellar triangle, and the position of these setae is usually constant within each species (Fig. 1 & 5-8).

Postocular setae. There are usually two pairs of major median postocular setae (i.e. large setae behind the ocelli and between the compound eyes) (Fig. 5), but one pair is reduced in *S. bispinosus* (Fig. 6), and an extra pair is developed in *S. albomaculatus* Bianchi (Palmer & Mound, 1982).

Pronotum. The surface of the pronotum is covered with numerous transverse striae (Fig. 5), the density of which is variable within and between species. There are usually four pairs of pronotal posteromarginal setae (five in *S. albomaculatus*), although the two small lateral pairs (B_3 and B_4) possibly correspond to the posteroangular setae of other Thripini (Mound & Palmer, 1981). The median posteromarginals (B_1) are usually slightly longer than these lateral setae, but pair B_2 is always longest. However, both the actual and relative lengths of these setae are more variable than many previous authors have indicated.

Metanotum. The form of the metanotal sculpture is very useful in recognising species (Fig. 14-25), although subject to variation (Fig. 14, 15). The position of the median pair of setae is also useful (Fig. 3).

Forewing. The anterior margin of the forewing scale in most species bears four setae (rarely three) although there are a few species which usually have only three. The number of setae on the second vein can be particularly useful. The postero-marginal cilia are strongly wavy in some species (e.g. *S. citri*), straight in others (e.g. *S. dorsalis*) but intermediate in a few (e.g. *S. aurantii* and *S. manihoti*). In these latter species, the basal part of each cilium may be straight and the distal part wavy.

Tergites. The lateral thirds of each abdominal tergite are covered with rows of microtrichia, and each of these microtrichial fields bears three or more discal setae depending on the species (Fig. 9, 10). The number of these setae may be reduced in males. The anteromedian area of tergite VIII and the median area of tergite IX bear a few rows of microtrichia in some species, but this character can be obscured by optical distortion due to the underlying ovipositor.

TABLE I. Scirtothrips and Drepanothrips species: character distribution

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
|------------------------|---|---|---|---|---|---|-------|---|------|------|----|-----|----|----|------|----|--------------|
| <i>D. reuteri</i> | + | + | - | C | 2 | 4 | 25 | A | 4 | 3-4 | + | 3 | - | - | A | + | P, NA, SA, O |
| <i>S. aurantii</i> | + | + | + | B | 2 | 4 | 30 | A | 4 | 2-5 | + | 3 | + | - | C | + | Af |
| <i>S. bispinosus</i> | + | + | + | A | 1 | 4 | 45 | C | 3 | 0-1 | - | 3 | + | + | B | + | O |
| <i>S. citri</i> | - | - | - | C | 2 | 4 | 55 | B | 4(3) | 3 | + | 5 | + | + | A | - | NA |
| <i>S. dorsalis</i> | + | + | + | A | 2 | 4 | 25-30 | B | 4 | 2 | - | 3 | + | + | C | - | P, O, A |
| <i>S. inermis</i> | - | + | + | A | 2 | 4 | 65 | B | 4 | 2 | - | 5 | + | + | B | - | P, NA, A |
| <i>S. kenyensis</i> | + | + | + | B | 2 | 4 | 45 | A | 4(3) | 3 | - | 3 | - | - | B | + | Af |
| <i>S. longipennis</i> | - | + | + | D | 2 | 4 | 30 | B | 3 | 3 | + | 3 | + | + | A | ? | P, NA, A |
| <i>S. mangiferae</i> | - | - | - | B | 2 | 4 | 25 | A | 4 | 3(4) | + | 4-6 | + | + | B | + | P, Af |
| <i>S. manihoti</i> | + | + | - | C | 2 | 4 | 35 | A | 3 | 1-2 | + | 4 | + | + | B(C) | - | SA |
| <i>S. oligochaetus</i> | - | - | + | A | 2 | 4 | 25-30 | B | 4 | 2 | - | 4-5 | + | + | C | - | SA, Af, O |

- 1 Abdominal tergites with dark median area.
- 2 Tergal antecostal ridge dark.
- 3 Sternal antecostal ridge dark.
- 4 Ocellar setae pair III position (Fig. 1).
- 5 Number of major postocular setae medially.
- 6 Number of pronotal posteromarginal setae.
- 7 Length of pronotal B₂ setae (in μ m approx.).
- 8 Metanotal median setae position (Fig. 3).
- 9 Number of anteromarginal setae on forewing scale.
- 10 Number of second vein setae on forewing.
- 11 Forewing cilia wavy (+) or straight (-).
- 12 Number of setae on tergal microtrichial fields.
- 13 Microtrichia present anteromedially on tergite VIII.
- 14 Microtrichia present medially on tergite IX.
- 15 Distribution of microtrichia on sternites (Fig. 2).
- 16 Drepanae present on tergite IX of male.
- 17 Distribution: P = Palaearctic; NA = N. American; SA = S. American; Af = Afrotropical; O = Oriental; A = Australian.

KEY TO PEST SPECIES OF *Scirtothrips* (INCLUDING *Drepanothrips*)

- 1 Antennae 6-segmented, terminal style not developed (Fig. 4) . *Drepanothrips reuteri*
- Antennae 8-segmented, terminal style present 2
- 2 Ocellar setae III arising between posterior ocelli (Fig. 6); forewing cilia straight 3
- Ocellar setae III in more anterior position (Fig. 5, 7, 8); forewing cilia wavy (except *kenyensis*) 6
- 3 Head with only one pair of major median postocular setae (Fig. 6); median metanotal setae short, arising far from anterior margin of sclerite, median reticles with fine internal markings (Fig. 18); male with drepanae on tergite IX; southern India *bispinosus*
- Head with two pairs of major median postocular setae (cf. Fig. 5); metanotum otherwise; male without drepanae on tergite IX 4
- 4 Tergites with dark transverse antecostal ridge, also dark area occupying median third of tergites; lateral microtrichial fields on each tergite with 3 discal setae (Fig. 9); widespread from Pakistan to Japan and Australia *dorsalis*
- Tergites with or without a dark antecostal ridge but never with a dark median area; lateral microtrichial fields with 4 to 5 discal setae (cf. Fig. 10) 5
- 5 Tergites and sternites with dark antecostal ridge; sternites with no microtrichia medially between median marginal setae; pronotal posteromarginal setae B_2 about 65 μm long; widespread *inermis*
- Sternites with dark antecostal ridge but tergites clear yellow; sternites with at least one row of microtrichia medially near posterior margin; pronotal posteromarginal setae B_2 about 30 μm long; widespread *oligochaetus*
- 6 Forewing cilia straight; tergites VIII and IX with no microtrichia medially; relatively dark, robust species with dark wings, on tea in East Africa *kenyensis*
- Cilia on forewing with at least apices wavy; either tergite VIII or IX with microtrichia medially; pale species 7
- 7 Sternites with numerous microtrichia medially, except anteromedially on VII; tergite IX without microtrichia medially; male with a comb of stout setae on hind-femora; widespread in Africa *aurantii*
- Sternites with no microtrichia medially between median marginal setae; microtrichia present medially on tergite IX; male without a hind-femoral comb ... 8
- 8 Tergites with 3 discal setae on each lateral microtrichial field; tergite VIII with no microtrichia medially; ocellar setae pair III on or in front of anterior margins of ocellar triangle (Fig. 8); head shaded medially, forewings dark; in glass-houses *longipennis*
- Tergites with 4 or more discal setae on microtrichial fields (Fig. 10); tergite VIII with microtrichia medially; ocellar setae III within ocellar triangle (Fig. 5, 7) 9
- 9 Sternites broadly covered with microtrichia except between median marginal setae (Fig. 11); forewing scale with 3 setae, second vein with 1 or 2 setae; tergal antecostal ridge weakly shaded, also median area of tergites; Brazil ... *manihoti*
- Sternites with no microtrichia mesad of marginal setae B_2 (Fig. 13); forewing scale usually with 4 marginal setae, second vein with 3 or 4 setae; tergites pale 10
- 10 Pronotal posteromarginal setae B_2 about 25 μm long; ocellar setae pair III in line with anterior margins of posterior ocelli (Fig. 7); male with drepanae on tergite IX; eastern Mediterranean *mangiferae*
- Pronotal posteromarginal setae B_2 about 55 μm long; ocellar setae pair III near anterior margins of ocellar triangle (Fig. 5); male without drepanae on tergite IX; California *citri*

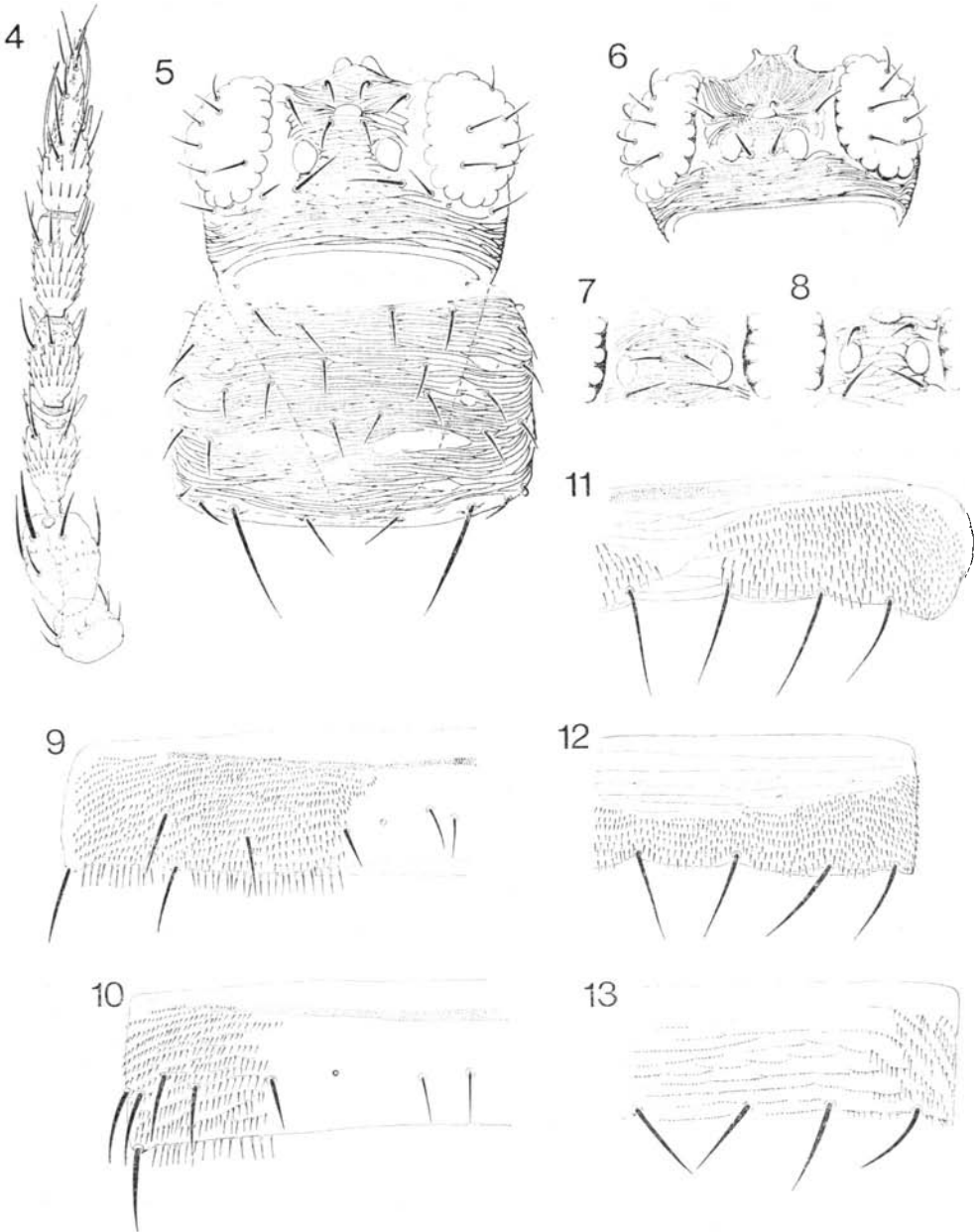


Fig. 4.—Antenna, *Drepanothrips reuteri*. Fig. 5.—Head and pronotum, *Scirtothrips citri*.
 Fig. 6.—Head, *S. bispinosus*. Fig. 7–8.—Ocellar triangles; 7, *S. mangiferae*; 8, *S. longipennis*.
 Fig. 9–10.—Tergite V; 9, *S. dorsalis*; 10, *S. citri*. Fig. 11–13.—Sternite V; 11, *S. manihoti*;
 12, *S. dorsalis*; 13, *S. citri*.

Sternites. Most species have well-developed lateral microtrichial fields, although these are relatively sparse in *S. citri* (Fig. 13) and *S. longipennis*. In some species (*S. aurantii*, *S. dorsalis*, *S. oligochaetus* and sometimes *S. manihoti*) the lateral fields are

joined medially by one or more rows of microtrichia, the number of rows being particularly variable in *S. dorsalis* (Fig. 12).

Males. In several species, males bear a pair of dark, stout, curved seta-like drepanae laterally on tergite IX. In *S. aurantii* males, the hind-femora bear a comb of stout setae.

Related genera

Only two other genera with microtrichia on the abdominal tergites are likely to be confused with *Scirtothrips*. One of these, *Drepanothrips*, is known from a single species which can only be distinguished from *Scirtothrips* by its six-segmented antennae (Fig. 4). Since this species is a pest of grapevines, and is here newly recorded from Japan, it is treated below in both the key and the text. The other genus, *Anascirtothrips* Bhatti (1961), is known from two species in India which not only have seven-segmented antennae but also lack the mesothoracic endofurcal spinula found in all *Scirtothrips* species.

Drepanothrips reuteri Uzel

Drepanothrips reuteri Uzel, 1895: 213-4. Syntypes ♂ ♀, BOHEMIA (?lost).

This species is essentially a *Scirtothrips* species but has antennal segments VII-VIII fused to segment VI (Fig. 4). In neither sex are there any other differences which warrant segregating *D. reuteri* to a separate genus. However, *Drepanothrips* is the older name and, since a name change resulting from such a generic synonymy would inconvenience the greatest number of interested entomologists, the two generic names are here retained. *D. reuteri* is variable in colour, from pale brown to yellow, the metanotum is reticulate (Fig. 25), the abdominal microtrichia relatively stout and sparse, and the tergal median setae small and relatively far apart. *D. reuteri* is known as a pest of grapevines in Europe and America, but also lives on *Quercus*, *Betula* and *Corylus* leaves (Mound et al., 1976). There are specimens in the BMNH from England, France, Italy, Greece, Latvia, Algeria, California and Japan, and the species has also been recorded from Valparaiso, Chile (Bailey & Campos-S., 1965). The specimens from Japan were collected on the leaves of a *Castanea* tree (Higashi Osaka City, Hiraoka Park, viii.1980, L. A. Mound, 1577). In view of the records of this species as a pest of grapevine elsewhere, this new finding of *D. reuteri* in Japan suggests that the position of *S. dorsalis* as a pest of grapevines in Japan (Miyahara et al., 1976) should be re-examined.

Scirtothrips aurantii Faure

Scirtothrips aurantii Faure, 1929: 3-8. Holotype ♀, SOUTH AFRICA (SANIC).

Scirtothrips acaciae Moulton, 1930: 200-1. Holotype ♀, GHANA (CAS). **Syn. n.**

Faure listed over 50 host-plants when describing this species as a serious pest of *Citrus* in South Africa and Zimbabwe. In addition, there are specimens in the BMNH from: Angola, Malawi, Tanzania, Uganda, Sudan (central and western), Ethiopia, Nigeria (south and central), Yemen, Egypt and Mauritius. Moreover, the holotype of *S. acaciae* from Ghana has been studied and is here regarded as the same species. The native host-plants across this extensive range are probably *Acacia* and *Combretum* species, but crop records include *Ricinus* in Sudan, *Asparagus* and *Gossypium* in Ethiopia, and *Arachis* in Angola and Mauritius. In Yemen, *S. aurantii* appears to be associated with serious damage involving brown spots on the fruits of Dwarf Cavendish bananas grown under irrigation (A. M. Ba-Asher in litt.).

Bailey (1964: 351) indicated that *S. acaciae* might be related to *S. fulleri* Faure from *Acacia* in South Africa, but the latter species has at least five discal setae on each tergal microtrichial field. The pronotal posteromarginal setae of *S. aurantii* tend to lie closely adpressed to the posterior margin rather than projecting, the metanotal sculp-

ture is variable but characteristic (Fig. 14, 15), and the sternites are almost covered with microtrichia.

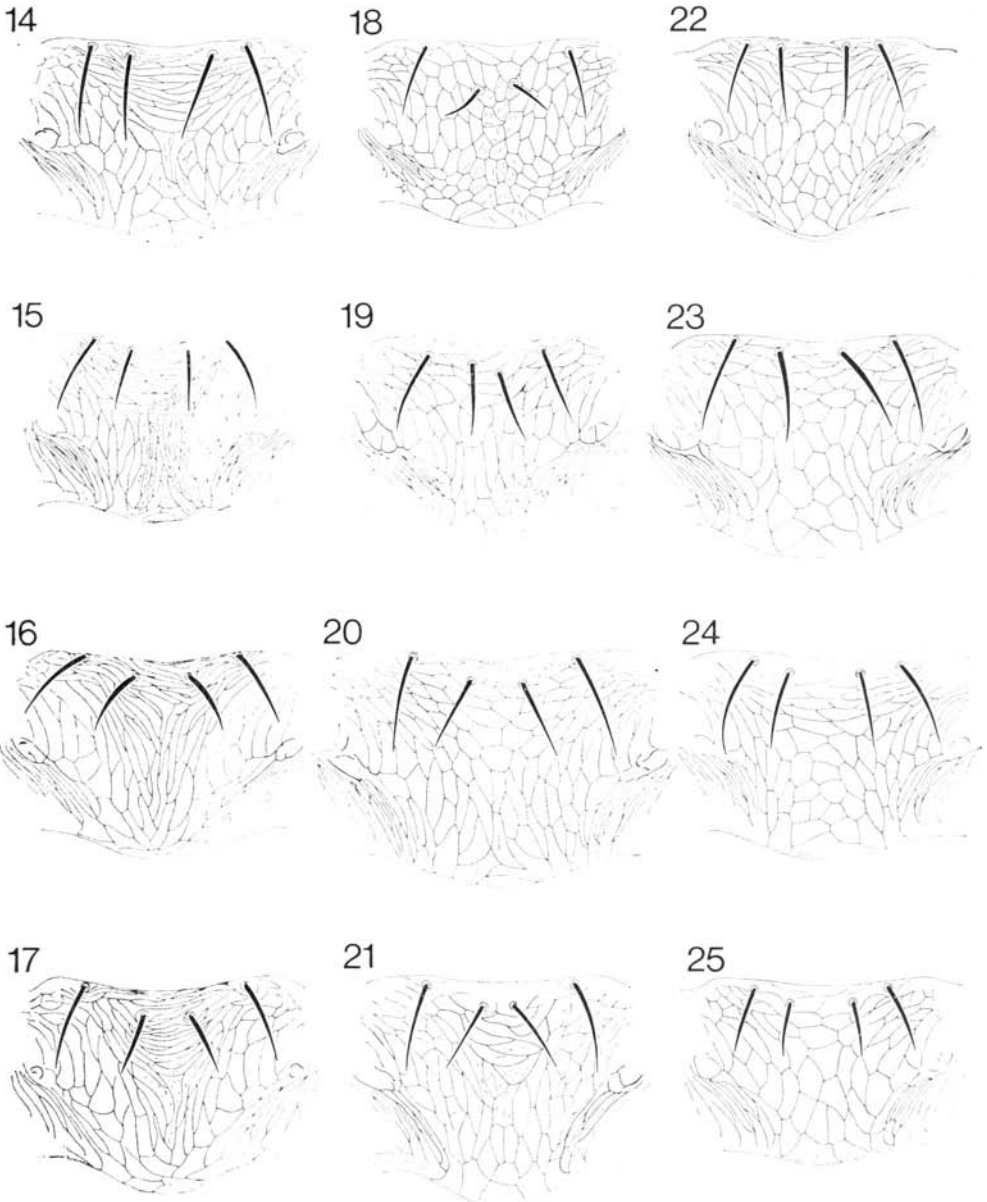


Fig. 14-25.—Metanota; 14-15, *Scirtothrips aurantii*; 16, *S. dorsalis*; 17, *S. oligochaetus*; 18, *S. bispinosus*; 19, *S. longipennis*; 20, *S. citri*; 21, *S. inermis*; 22, *S. manihoti*; 23, *S. kenyensis*; 24, *S. mangiferae*; 25, *Drepanothrips reuteri*.

Scirtothrips bispinosus (Bagnall)

Dendrothrips bispinosus Bagnall, 1924: 455. Lectotype ♀, INDIA (BMNH).

This species has also been described from southern India under the names *S. sweetmani* Bianchi and *S. titschacki* Ananthakrishnan (Mound, 1968*b*). It is widespread in southern India on coffee and tea, to which it sometimes causes damage, but there is no record of a native host-plant. The species is unusual in the genus in that the abdomen is mainly brown with the tergites slightly paler medially, the forewing frequently without setae on the second vein, and the pronotal B₂ setae almost four times as long as the other setae. One female from Kuala Lumpur, West Malaysia (in BMNH), is very similar to *S. bispinosus* but has shorter pronotal B₂ setae.

Scirtothrips citri (Moulton)

Euthrips citri Moulton, 1909: 121-2. Syntypes ♀, CALIFORNIA (CAS).

This species is a pest of *Citrus* in California and is known also from Arizona and northern Mexico. Bailey (1964) records *S. citri* from more than 20 plants, and the present authors have also identified the species from mangrove (*Rhizophora mangle*) in California (Simberloff, 1978: 152). The species has never been adequately defined in structural terms, Bailey (1964) keying the eleven species recorded from North America mainly on colour, host-plant and distributional data. Bailey indicated that *S. ruthveni* Shull (the type-species of the genus) is similar to *S. citri*, but at present only *S. citri* amongst these North American species is known from sufficient adequately cleared specimens to permit a reasonable diagnosis. The metanotum of *S. citri* is reticulate (Fig. 20), and the median reticles bear faint internal markings, moreover the abdominal microtrichia are relatively widely spaced (Fig. 13), much as in *S. longipennis* but in contrast to the *aurantii/dorsalis* group of species.

Scirtothrips dorsalis Hood

Scirtothrips dorsalis Hood, 1919: 90-1. Holotype ♀, INDIA (USNM).

Neophysopus fragariae Girault, 1927: 3. Syntypes ♀, QUEENSLAND (QM). **Syn. n.**

This widespread pest was described from 34 females collected at Coimbatore on "castor and chillies". Mound (1968*a*) recognised *Heliothrips minutissimus* Bagnall from Bombay as the same species, and Jacot-Guillarmod (1971) also lists *Anaphothrips andreae* Karny and *S. dorsalis* var. *padmae* Ramakrishna as synonyms. Moreover, the Strawberry Thrips from Australia (Galloway, 1976), *S. fragariae* (Girault), is here recognised as *S. dorsalis* after studying Girault's material as well as more recently collected specimens.

In contrast, *S. oligochaetus* (Karny), which has been regarded by several authors as the same species as *S. dorsalis*, is here recognised as a distinct valid species. In *S. oligochaetus*, which is sympatric with *S. dorsalis* in India but is apparently not usually collected with it, the tergal antecostal ridges are pale and the tergal microtrichial fields bear four discal setae, at least in females. In both species, however, the sternites bear one or many rows of microtrichia medially, although the metanotal sculpture appears to differ slightly between them (Fig. 16, 17).

There are specimens of *S. dorsalis* in the BMNH from: Pakistan, India (south, also near Delhi), Sri Lanka, Thailand, West Malaysia, Java, Sulawesi, New Guinea, Solomon Is., Japan and Australia (Queensland). The authors have attempted unsuccessfully, to distinguish individual morphological segregates from amongst this material. The number of sternal microtrichia is particularly variable, some specimens having the sternites almost covered with microtrichia whereas others have only about two rows medially joining the lateral fields. This variation has been found, however, at several widely separate sites, and so all the specimens are here regarded as representing a single, widespread, highly polyphagous species.

The main wild host-plants of *S. dorsalis* are probably *Acacia* species, as is also suggested above for *S. aurantii*. In Java, long series were collected by the senior author at Bogor Botanic Gardens on young tender leaves of *Brownea*, in flowers of *Saraca minor*, and on *Acacia* leaves (all Leguminosae). In Malaya, *Scirtothrips dorsalis* is sometimes a pest on leaves of *Hevea* and has been taken in large numbers on *Mimosa pudica*. In India, with Dr J. S. Bhatti, the senior author collected the species in large numbers on *Ricinus* at Delhi, whilst Amin (1979) regards *S. dorsalis* as a serious pest of *Arachis* at Hyderabad. Most of the specimens studied from Thailand were collected on sacred lotus (*Nelumbo*), although some came from "orange, beans and roses". Specimens from Bangladesh include *Mangifera* as host, and those from Pakistan include *Ricinus*. In Japan, *S. dorsalis* is regarded as a pest of tea and citrus (Y. Matsunaga, in litt.; Kodomari, 1978), but the only specimens studied were collected on various wild plants in southern Honshu. The record of *S. dorsalis* as a pest of grapevines in Japan (Miyahara et al., 1976) is discussed above under *Drepanothrips reuteri*. The fact that *S. dorsalis* is a pest of *Fragaria* in Queensland is surprising in view of the low-growing herb-like nature of this plant, but the senior author has collected both sexes from 'grasses' in Queensland.

Ananthakrishnan (1973: 50) indicates that *S. dorsalis* is a pest of *Ricinus*, and refers to it as the "Chillies Thrips" and as the "Assam Thrips". The present authors have studied Indian specimens from chillies and *Ricinus*, but have not seen material from Assam where *S. dorsalis* is recorded as a pest of tea. Specimens from southern India on tea have been examined, but the Assam records require confirmation, particularly as the record of *S. dorsalis* from *Prosopis* in India by Ananthakrishnan is probably a misidentification of *S. oligochaetus* q.v. In view of the confusion between these two species, other published records from India (e.g. on sunflower and cotton) also require confirmation.

Scirtothrips inermis Priesner

Scirtothrips inermis Priesner, 1933: 186-8. Syntypes ♀ ♂, CANARY IS. (SMF).

Originally based on two specimens from Grand Canary Island, this species has been found subsequently in abundance on Lanzarote and Tenerife (zur Strassen, 1969). Most specimens were collected on *Rumex*, but others were taken on various plants including *Citrus* and *Ricinus*. However, *S. inermis* is known to be widespread. It is here newly recorded from Australia, three females having been taken in water traps in the orchard of the Waite Agricultural Research Institute, Adelaide (in BMNH). Moreover, Mound & Walker (in press) record the species from New Zealand on *Citrus*, *Begonia* and *Prunus*, and refer to specimens from California (in USNM). Although never recorded as damaging crops, *S. inermis* must be regarded as a potential pest in view of its host range and distribution. Bailey (1964) suggested that it might be related to *S. citri*, but these species differ in several characters (Table I), including the metanotal sculpture, which tends to be concentric around the median setae in *S. inermis* (Fig. 20, 21).

Scirtothrips kenyensis Mound

Scirtothrips kenyensis Mound, 1968b: 535-7. Holotype ♀, KENYA (BMNH).

This is a relatively robust and dark-coloured member of the genus, which is a pest of tea in parts of East Africa. In contrast to the much larger Black Thrips of Tea, *Heliothrips haemorrhoidalis* (Bouché), which also occurs in the same area, *S. kenyensis* is likely to cause damage to very young leaves. It was described from Kericho in Kenya, as well as from Fort Portal in Uganda, but specimens from coffee at Ruanda Rubona, Zaire, have been studied recently.

Scirtothrips longipennis (Bagnall)

Euthrips longipennis Bagnall, 1909: 173-4. Syntypes ♀, BELGIUM (?lost).

This glasshouse pest has been reported from a wide range of host-plants in many parts of the world (Morison, 1957), but these records are not repeated here because of possible misidentifications. The original specimens are apparently lost (Mound, 1968a), but there are specimens in the BMNH from England, Wales, Latvia, New York, California and Australia (?Sydney). The species has not been recorded in the wild except as a pest of *Cinchona* in Puerto Rico (Gaud, 1961). The close structural similarity to *S. citri* (see Table I & Fig 5, 8, 19, 20) may indicate that *S. longipennis* is native to Central or South America. The male is unknown, but females can usually be recognised from their colour (yellow body, dark wings, dark antecostal ridges, brown patch on anterior half of head).

Scirtothrips mangiferae Priesner

Scirtothrips mangiferae Priesner, 1932: 143-5. Syntypes ♀ ♂, EGYPT (SMF).

Priesner, when describing this species, indicated that it was particularly abundant on young flush leaves of mango near Cairo in April, but that it had been found between March and August, and had also been recorded from *Parkinsonia aculeata*, *Ficus carica* and *Citrus* in Egypt, as well as from *Gossypium* buds in Sudan. Dr Y. Ben-Dov has recently collected *S. mangiferae* during September in southern Israel near Eilat, where it was causing damage to the leaves of *Mangifera indica*. In addition, there are specimens in the BMNH from cotton leaves in Aden (December 1958) and peach leaves in Libya (June 1958), and one female (in SMF) has been studied from *Arbutus unedo* on Kira, northern Sporadhes, Greece.

Scirtothrips manihoti (Bondar)

Euthrips manihoti Bondar, 1924: 217-8. Syntypes ♀ BRAZIL (?Dept. Agric., Bahia).

This species was described from Brazil in association with distorted leaves of cassava. However, Bondar pointed out that these distortions were due to feeding damage by the thrips despite looking very similar to leaf-curl disease symptoms. The original specimens have not been studied, the observations given here (Table I & Fig. 11, 22) being based on specimens from Campinas and Minas Gerais, Brazil. These specimens were taken on cassava showing leaf-curl damage, and this damage appears to be widespread in Brazil. The tergal markings of *S. manihoti* are very pale, much paler than in *S. dorsalis*.

Scirtothrips oligochaetus (Karny)

Anaphothrips oligochaetus Karny, 1926: 201-3. Lectotype ♀ here designated, INDIA (SMF).

This species was described from three females and one male, but only two specimens remain in Karny's collection at the Senckenberg Museum, Frankfurt. The female labelled as follows is here designated lectotype: "S. INDIA, Coimbatore, Pomegranate flowers, 1.ix.1923, A.G.R. coll. 4". The paralectotype is a male from "flowers and shoots of cotton". Females of *S. oligochaetus* can be distinguished from those of *S. dorsalis* by the presence of four discal setae on each tergal microtrichial field as well as by the absence of dark markings on the tergites. Males, however, cannot be recognised with certainty because males of *S. dorsalis* often lack tergal markings and males of *S. oligochaetus* often have a reduced number of tergal discal setae. The difference in metanotal sculpture is both slight and unreliable (Fig. 16, 17).

Based on the female lectotype designated above, *S. oligochaetus* is represented in the BMNH from the following Indian States: Madras, Andhra Pradesh, Maharashtra, Madhya Pradesh, Rajasthan and Uttar Pradesh. In addition, there are a few specimens

of the species from Tanzania (?Arusha), Ethiopia (Melka Werer), Nigeria (Ibadan) and Barbados in the West Indies. The latter is almost certainly an introduction, but the African records may represent a natural distribution. Thus, *S. oligochaetus* is the western replacement of the closely related *S. dorsalis*, although the two have an extensive area of sympatry in India where they are often confused with each other. Similarly, *S. oligochaetus* is possibly related to the African species *S. aurantii*, and these two have been taken at the same site in Ethiopia (*S. oligochaetus* on *Gossypium*, and *S. aurantii* on *Asparagus* and *Medicago*). The species *S. nubicus* Priesner, from *Acacia* in Sudan, differs from *S. oligochaetus* in having dark tergal antecostal ridges, ocellar setae pair III arising nearer the first ocellus (position C), and in having drepanae on tergite IX of the males.

Indian specimens of *S. oligochaetus* in the BMNH bear the following host records: *Gossypium*, *Punica*, *Solanum*, *Arachis* and *Pisum*, and moreover the senior author collected the species with Dr J. S. Bhatti at Delhi on *Prosopis*. The series of specimens from the first four of the host-plants listed above included both *S. dorsalis* and *S. oligochaetus* together, but long series (97 specimens) of *S. dorsalis* from *Arachis* around Hyderabad included only four individuals of *S. oligochaetus*.

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