Organisation Européenne et Méditerranéenne pour la Protection des Plantes
European and Mediterranean Plant Protection Organization

Normes OEPP
EPPO Standards

Diagnostics
Diagnostic

PM 7/56

Organisation Européenne et Méditerranéenne pour la Protection des Plantes
1, rue Le Nôtre, 75016 Paris, France

Approval

EPPO Standards are approved by EPPO Council. The date of approval appears in each individual standard. In the terms of Article II of the IPPC, EPPO Standards are Regional Standards for the members of EPPO.

Review

EPPO Standards are subject to periodic review and amendment. The next review date for this EPPO Standard is decided by the EPPO Working Party on Phytosanitary Regulations.

Amendment record

Amendments will be issued as necessary, numbered and dated. The dates of amendment appear in each individual standard (as appropriate).

Distribution

EPPO Standards are distributed by the EPPO Secretariat to all EPPO member governments. Copies are available to any interested person under particular conditions upon request to the EPPO Secretariat.

Scope

EPPO Standards on Diagnostics are intended to be used by NPPOs in their capacity as bodies responsible for the application of phytosanitary measures. Standards on diagnostic protocols are concerned with the diagnosis of individual pests and describe different methods which can be used to detect and identify pests of phytosanitary concern for the EPPO region. General Standards on diagnostics are in preparation on: (1) the purpose of diagnostic protocols (which may differ according to the circumstances of their use); and (2) reporting and documentation of diagnoses.

In 1998, EPPO started a new programme to prepare diagnostic protocols for the regulated pests of the EPPO region (including the EU). The work is conducted by the EPPO Panel on Diagnostics and other specialist Panels. The objective of the programme is to develop an internationally agreed diagnostic protocol for each regulated pest. The protocols are based on the many years of experience of EPPO experts. The first drafts are prepared by an assigned expert author(s). They are written according to a 'common format and content of a diagnostic protocol' agreed by the Panel on Diagnostics, modified as necessary to fit individual pests. As a general rule, the protocol recommends a particular means of detection or identification which is considered to have advantages (of reliability, ease of use etc.) over other methods. Other methods may also be mentioned, giving their advantages/disadvantages. If a method not mentioned in the protocol is used, it should be justified.

The following general provisions apply to all EPPO Standards on Diagnostics:

- laboratory tests may involve the use of chemicals or apparatus which present a certain hazard. In all cases, local safety procedures should be strictly followed
- use of names of chemicals or equipment in these EPPO Standards implies no approval of them to the exclusion of others that may also be suitable
- laboratory procedures presented in the protocols may be adjusted to the standards of individual laboratories, provided that they are adequately validated or that proper positive and negative controls are included.

References

EPPO/CABI (1996) *Quarantine Pests for Europe*, 2nd edn. CAB International, Wallingford (GB).

EU (2000) Council Directive 2000/29/EC of 8 May 2000 on protective measures against the introduction into the Community of organisms harmful to plants or plant products and against their spread within the Community. *Official Journal of the European Communities* L169, 1–112.

FAO (1997) *International Plant Protection Convention* (new revised text). FAO, Rome (IT).

IPPC (1993) *Principles of plant quarantine as related to international trade*. ISPM no. 1. IPPC Secretariat, FAO, Rome (IT).

IPPC (2002) *Glossary of phytosanitary terms*. ISPM no. 5. IPPC Secretariat, FAO, Rome (IT).

OEPP/EPPO (2003) EPPO Standards PM 1/2(12): EPPO A1 and A2 lists of quarantine pests. *EPPO Standards PM1 General phytosanitary measures*, 5–17. OEPP/EPPO, Paris (FR).

Definitions

Regulated pest: a quarantine pest or regulated non-quarantine pest.
Quarantine pest: a pest of potential economic importance to the area endangered thereby and not yet present there, or present but not widely distributed and being officially controlled.

Outline of requirements

EPPO Standards on Diagnostics provide all the information necessary for a named pest to be detected and positively identified by an expert (i.e. a specialist in entomologist, mycology, virology, bacteriology, etc.). Each protocol begins with some short general information on the pest (its appearance, relationship with other organisms, host range, effects on host, geographical distribution and its identity) and then gives details on the detection, identification, comparison with similar species, requirements for a positive diagnosis, list of institutes or individuals where further information on that organism can be obtained, references (on the diagnosis, detection/extraction method, test methods).

Existing EPPO Standards in this series

Forty-one EPPO standards on diagnostic protocols have already been approved and published. Each standard is

numbered in the style PM 7/4 (1), meaning an EPPO Standard on Phytosanitary Measures (PM), in series no. 7 (Diagnostic Protocols), in this case standard no. 4, first version. The existing standards are:

PM 7/1 (1) *Ceratocystis fagacearum*. *Bulletin OEPP/EPPO Bulletin* **31**, 41–44

PM 7/2 (1) *Tobacco ringspot nepovirus*. *Bulletin OEPP/EPPO Bulletin* **31**, 45–51

PM 7/3 (1) *Thrips palmi*. *Bulletin OEPP/EPPO Bulletin* **31**, 53–60

PM 7/4 (1) *Bursaphelenchus xylophilus*. *Bulletin OEPP/EPPO Bulletin* **31**, 61–69

PM 7/5 (1) *Nacobbus aberrans*. *Bulletin OEPP/EPPO Bulletin* **31**, 71–77

PM 7/6 (1) *Chrysanthemum stunt pospiviroid*. *Bulletin OEPP/EPPO Bulletin* **32**, 245–253

PM 7/7 (1) *Aleurocanthus spiniferus*. *Bulletin OEPP/EPPO Bulletin* **32**, 255–259

PM 7/8 (1) *Aleurocanthus woglumi*. *Bulletin OEPP/EPPO Bulletin* **32**, 261–265

PM 7/9 (1) *Cacoecimorpha pronubana*. *Bulletin OEPP/EPPO Bulletin* **32**, 267–275

PM 7/10 (1) *Cacyreus marshalli*. *Bulletin OEPP/EPPO Bulletin* **32**, 277–279

PM 7/11 (1) *Frankliniella occidentalis*. *Bulletin OEPP/EPPO Bulletin* **32**, 281–292

PM 7/12 (1) *Parasaissetia nigra*. *Bulletin OEPP/EPPO Bulletin* **32**, 293–298

PM 7/13 (1) *Trogoderma granarium*. *Bulletin OEPP/EPPO Bulletin* **32**, 299–310

PM 7/14 (1) *Ceratocystis fimbriata* f. sp. *platani*. *Bulletin OEPP/EPPO Bulletin* **33**, 249–256

PM 7/15 (1) *Ciborinia camelliae*. *Bulletin OEPP/EPPO Bulletin* **33**, 257–264

PM 7/16 (1) *Fusarium oxysporum* f. sp. *albedinis*. *Bulletin OEPP/EPPO Bulletin* **33**, 265–270

PM 7/17 (1) *Guignardia citricarpa*. *Bulletin OEPP/EPPO Bulletin* **33**, 271–280

PM 7/18 (1) *Monilinia fructicola*. *Bulletin OEPP/EPPO Bulletin* **33**, 281–288

PM 7/19 (1) *Helicoverpa armigera*. *Bulletin OEPP/EPPO Bulletin* **33**, 289–296

PM 7/20 (1) *Erwinia amylovora*. *Bulletin OEPP/EPPO Bulletin* **34**, 159–172

PM 7/21 (1) *Ralstonia solanacearum*. *Bulletin OEPP/EPPO Bulletin* **34**, 173–178

PM 7/22 (1) *Xanthomonas arboricola* pv. *corylina*. *Bulletin OEPP/EPPO Bulletin* **34**, 179–182

PM 7/23 (1) *Xanthomonas axonopodis* pv. *dieffenbachiae*. *Bulletin OEPP/EPPO Bulletin* **34**, 183–186

PM 7/24 (1) *Xylella fastidiosa*. *Bulletin OEPP/EPPO Bulletin* **34**, 187–192

PM 7/25 (1) *Glomerella acutata*. *Bulletin OEPP/EPPO Bulletin* **34**, 193–200

PM 7/26 (1) *Phytophthora cinnamomi*. *Bulletin OEPP/EPPO Bulletin* **34**, 201–208

PM 7/27 (1) *Puccinia horiana*. *Bulletin OEPP/EPPO Bulletin* **34**, 209–212

PM 7/28 (1) *Synchytrium endobioticum*. *Bulletin OEPP/EPPO Bulletin* **34**, 213–218

PM 7/29 (1) *Tilletia indica*. *Bulletin OEPP/EPPO Bulletin* **34**, 219–228

PM 7/30 (1) *Beet necrotic yellow vein benyvirus*. *Bulletin OEPP/EPPO Bulletin* **34**, 229–238

PM 7/31 (1) *Citrus tristeza closterovirus*. *Bulletin OEPP/EPPO Bulletin* **34**, 239–246

PM 7/32 (1) *Plum pox potyvirus*. *Bulletin OEPP/EPPO Bulletin* **34**, 247–256

PM 7/33 (1) *Potato spindle tuber pospiviroid*. *Bulletin OEPP/EPPO Bulletin* **34**, 257–270

PM 7/34 (1) *Tomato spotted wilt tospovirus*. *Bulletin OEPP/EPPO Bulletin* **34**, 271–280

PM 7/35 (1) *Bemisia tabaci*. *Bulletin OEPP/EPPO Bulletin* **34**, 281–288

PM 7/36 (1) *Diabrotica virgifera*. *Bulletin OEPP/EPPO Bulletin* **34**, 289–294

PM 7/37 (1) *Thaumetopoea pityocampa*. *Bulletin OEPP/EPPO Bulletin* **34**, 295–298

PM 7/38 (1) *Unaspis citri*. *Bulletin OEPP/EPPO Bulletin* **34**, 299–302

PM 7/39 (1) *Aphelenchoides besseyi*. *Bulletin OEPP/EPPO Bulletin* **34**, 303–308

PM 7/40 (1) *Globodera rostochiensis* and *Globodera pallida*. *Bulletin OEPP/EPPO Bulletin* **34**, 309–314

PM 7/41 (1) *Meloidogyne chitwoodi* and *Meloidogyne fallax*. *Bulletin OEPP/EPPO Bulletin* **34**, 315–320

Some of the Standards of the present set result from a different drafting and consultation procedure. They are the output of the DIAGPRO Project of the Commission of the European Union (no. SMT 4-CT98-2252). This project involved four 'contractor' diagnostic laboratories (in England, Netherlands, Scotland, Spain) and 50 'inter-comparison' laboratories in many European countries (within and outside the European Union), which were involved in ring-testing the draft protocols. The DIAGPRO project was set up in full knowledge of the parallel activity of the EPPO Working Party on Phytosanitary Regulations in drafting diagnostic protocols, and covered regulated pests which were for that reason not included in the EPPO programme. The DIAGPRO protocols have been approved by the Council of EPPO as EPPO Standards in series PM 7. They will in future be subject to review by EPPO procedures, on the same terms as other members of the series.

Diagnostics[1]
Diagnostic

Scirtothrips aurantii, *Scirtothrips citri*, *Scirtothrips dorsalis*

Specific scope

This standard describes a diagnostic protocol for *Scirtothrips aurantii*, *Scirtothrips citri* and *Scirtothrips dorsalis*.

Specific approval and amendment

Approved in 2004-09.

Introduction

The genus *Scirtothrips* now includes over 100 species (Hoddle & Mound, 2003) throughout the tropics and subtropics, of which several species are of economic importance.

Scirtothrips species go through 5 developmental phases: egg, 2 active larval instars that feed, followed by 2 relatively inactive pupal instars and winged, feeding adults. Eggs are inserted into young and soft tissues of leaves, stems and fruit. The first and second larval stages are found on the green plant parts from which the second stage larvae seek out some sheltered place (leaf litter or crevices of bark) and then pass through two resting stages called propupa and pupa, respectively. Rarely, these occur beneath the calyces of fruits. Winged adults, male and female, are found normally on the green plant parts, where they feed.

Scirtothrips aurantii is native to Africa and Yemen and has recently been reported as introduced into Australia (Hoddle & Mound, 2003). Although usually noted as a pest of citrus (especially sweet orange) and sometimes mango, it is actually a very polyphagous species that can be found on more than 50 plant species in a wide range of different plant families, in genera like *Arachis*, *Asparagus*, *Gossypium*, *Musa*, *Ricinus* and *Vitis*. In Yemen, *S. aurantii* is the primary cause of banana fruit spotting.

Scirtothrips citri is a pest of citrus and one of the most important *Scirtothrips* species for international agriculture. It is also a polyphagous species found on more than 50 plant species, in genera such as *Carya*, *Gossypium*, *Magnolia*, *Medicago*, *Phoenix*, *Rosa* and *Vitis*. It occurs in the southern parts of North America (northern parts of Mexico and the states of Arizona, California and Florida in USA).

Scirtothrips dorsalis is known as a pest on many cultivated plants including *Actinidia chinensis*, *Allium cepa*, *Arachis hypogaea*, *Camellia sinensis*, *Capsicum*, *Citrus*, *Gossypium hirsutum*, *Fragaria*, *Hevea brasiliensis*, *Hydrangea*, *Mangifera*, *Nelumbo*, *Ricinus*, *Rosa*, *Tamarindus indica* and *Vitis vinifera*. In its principal range in tropical Asia, it is mainly a serious pest of vegetables, cotton and roses. Native host plants are probably various *Fabaceae*, such as species of genera *Acacia*, *Brownea*, *Mimosa* and *Saraca*. It is widespread in Asia, northern Australia and the Solomon Islands, Hawaii (USA) and South Africa. *S. dorsalis* is clearly expanding its range at the moment, e.g. Israel (EPPO Reporting Service 2003/084); Saudi Arabia (Laurence Mound, CSIRO, unpublished identification); Côte d'Ivoire (Bournier, 1999).

Identity

Name: *Scirtothrips aurantii* Faure
Synonyms: *Scirtothrips acaciae* Moulton
Taxonomic position: *Insecta: Thysanoptera: Thripidae*
EPPO computer code: SCITAU
Phytosanitary categorization: EPPO A1 list: no. 221, EU Annex designation: II/A1

Name: *Scirtothrips citri* (Moulton)
Synonyms: *Euthrips citri* Moulton, *Physothrips citri* (Moulton)
Taxonomic position: *Insecta: Thysanoptera: Thripidae*
EPPO computer code: SCITCI
Phytosanitary categorization: EPPO A1 list: no. 222, EU Annex designation: II/A1

Name: *Scirtothrips dorsalis* Hood
Synonyms: *Heliothrips minutissimus* Bagnall, *Anaphothrips andreae* Karny, *Neophysopus fragariae* Girault, *Scirtothrips dorsalis* var. *padmae* Ramakrishna

[1]The Figures in this Standard marked 'Web Fig.' are published on the EPPO website www.eppo.org.

Taxonomic position: *Insecta*: *Thysanoptera*: *Thripidae*
EPPO computer code: SCITDO
Phytosanitary categorization: EPPO A1 list: no. 223, EU Annex designation: II/A1

Detection

All stages of *Scirtothrips aurantii*, *S. citri* and *S. dorsalis* feed on epidermal and sometimes palisade cells of young leaves, and on the apex of young fruits especially when concealed under the calyx. They do not feed on mature leaves. They could be carried on plants for planting, in particular seedlings or cuttings with young growing leaf buds, and these should be examined carefully. Only young fruits are attacked, so the risk that this species is carried on harvested fruits is low. Symptoms are: silvering of the leaf surface; linear thickenings of the leaf lamina; brown frass markings on the leaves and fruits; grey to black markings on fruits often forming a conspicuous ring of scarred tissue around the apex (Web Fig. 1); ultimately fruit distortion and early senescence of leaves. For *S. citri*, examination of leaves is less useful because larvae are almost exclusively localized on young growing buds, young leaves, sepals and young fruits, so these should be examined particularly carefully. Considering the small size of this insect, direct visual search is insufficient. The electric Berlese method should be used.

For *S. citri*, confusion of symptoms with those caused by other pests and diseases is not very probable. For example, the fungus *Septoria citri* also causes spots on fruits, but the presence of pycnidia can avoid any confusion. Some mites can cause spots on fruits, but without the shape of a ring.

In *S. aurantii*, eggs are bean-shaped, minute (less than 0.2 mm). The two feeding larval stages are yellow to orange, cigar-shaped and just visible to the naked eye. The adult thrips is reddish-orange, less than 1 mm long. The two feeding larval stages of *S. citri* are yellow to orange, cigar-shaped and just visible to the naked eye.

Identification

Members of the genus *Scirtothrips* are readily distinguished from all other *Thripidae* by the following characters:

- surface of pronotum covered with many closely spaced transverse striae (Web Fig. 2d)
- abdominal tergites laterally with numerous parallel rows of tiny microtrichia (Web Fig. 2c)
- sternites with marginal setae arising at posterior margin
- metanotum with median pair of setae arising near anterior margin (Web Fig. 2e).

A species closely related to *Scirtothrips* is *Drepanothrips reuteri*, a native European pest of grapevine, but this species has antennae with 6 segments (the 3 terminal segments being fused), whereas *Scirtothrips* has 8-segmented antennae.

Of about 100 species described in *Scirtothrips*, most were defined originally by their authors on the basis of unreliable or minor characters such as colour and silhouette. The legitimacy of 32 species recently described from Mexico (Johansen & Mojica-Guzman, 1999) has been strongly challenged (Mound & zur Strassen, 2001). Mound & Palmer (1981) describe many structural details by which *Scirtothrips* spp. may be distinguished. Although not reliable in itself, natural coloration can help to distinguish species and it is useful to have some uncleared specimens showing the natural coloration. For storage, specimens should be transferred to 60% ethyl alcohol and kept in the dark, preferably at temperatures well below 0°C to prevent loss of colour.

Identification of *Scirtothrips* spp. is based on male or female adults, both of which are winged. They are pale and minute, and cleared specimens on microscopic slides are needed for identification. A magnification factor between 100 and 600 is necessary. Characters that allow identification down to the genus *Scirtothrips* are shown in Table 1.

Five *Scirtothrips* spp. are native to Europe and the Mediterranean area: *S. mangiferae* Priesner (Egypt, Israel), characterized by its dark wings, *S. inermis* Priesner (Italy,

Table 1 Key for the identification of adults of the genus *Scirtothrips*

Abdominal segment X usually conical, not tubular; serrated ovipositor present; wing surface with microtrichia	*Terebrantia*	
Ovipositor downturned at the apex; abdominal sternite VIII not developed; sense cones on antennal segments III and IV emergent, each more than twice as long as wide (Mound & Marullo, 1996: p. 41)	*Thripidae*	Web Fig. 2(a) Web Fig. 2(b)
Head and legs not strongly reticulately sculptured, abdominal tergites may be laterally sculptured; antennal segments III and IV ususally with microthrichia; terminal antennal segments rarely elongate; meso- and/or metathoracic furcae with or without spinula; forewing first vein not fused to costa	*Thripinae*	
Abdominal tergites covered with numerous microtrichia	*Scirtothrips*	Web Fig. 2(c)
Body often clear yellow		
8 antennal segments		Web Fig. 2(b)
3 ocellar setae		Web Fig. 2(d)
Posteromarginal pronotal setae B2 usually elongate		Web Fig. 2(d)
Pronotum transversely striate, regular without dark internal apodeme		Web Fig. 2(d)

Portugal (Açores, mainland), Spain (Islas Canarias, mainland)), *S. canizoi* Titschack (Spain), *S. dignus* zur Strassen (Spain, Greece) and *S. bournieri* Berzosa & Caño (Spain) (Berzosa & Caño, 1990). *S. longipennis* (Bagnall) is an introduced species, occurring in glasshouses but not common. *S. inermis* is an important pest in citrus culture in Spain (Lacasa *et al*., 1996). At present, there is no key to separate all these species from *S. aurantii*, *S. dorsalis* and *S. citri*. The European species (except for *S. bournieri*) can be identified with zur Strassen (1986). For several economically important *Scirtothrips* spp., the separation to species is based on well defined characters (Table 2). A key to the economic species was published by Mound & Palmer (1981). In addition, Nakahara (1997) described a new pest species on avocado from USA (California), *Scirtothrips perseae*, and Hoddle & Mound (2003) published a key to Australian species, including several newly described species.

Identification of *Scirtothrips* species in the larval stage is impossible; there is no suitable identification key. Miyazaki & Kudo (1986) described characteristics of the second stage larva of *S. dorsalis*, but similar descriptions for other species within this genus are not available.

Specimens detected in imported consignments, or collected in the field, can be preserved in 70% ethyl alcohol for 24–48 h. If intended for preparing permanent microscope slides, they should be preserved in AGA, a mixture of 9 parts 60% ethyl alcohol, 1 part glycerine and 1 part acetic acid, and sent to a specialist. Cleared adult specimens mounted on microscope slides are necessary for identification.

There are several methods for mounting thrips (the complete methodology is described by Palmer *et al*., 1989):

- Temporary mounts: direct observation in lactic acid, or Heinz solution, after slight heating. Advantage: can be examined directly. Disadvantage: crushing of the body and possibly deformation of some appendices.
- Semi-temporary mounts: in Faure solution. Advantage: satisfactory clearing without handling, no deformations. Disadvantage: obligatory sealing, conservation only a few months.
- Permanent mounts: in Canada balsam. Advantage: conservation for reference collection with or without maceration. Disadvantage: method is long and difficult to use.

The specimens should preferably be compared with reference material of the species, identified by a specialist. It may be necessary to consult a specialist in *Thysanoptera*.

Table 2 Taxonomic characteristics of economically important *Scirtothrips* species (after Mound & Palmer (1981), Table (1)

	Characteristics								
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
S. aurantii	**+**	**+**	**+**	**B**	**2**	**4**	**30**	**A**	**4**
S. citri	**–**	**–**	**–**	**C**	**2**	**4**	**55**	**B**	**4(3)**
S. dorsalis	**+**	**+**	**+**	**A**	**2**	**4**	**25–30**	**B**	**4**
S. inermis	–	+	+	A	2	4	65	B	4
S. longipennis	–	+	+	D	2	4	30	B	3
S. mangiferae	–	–	–	B	2	4	25	A	4
S. oligochaetus	–	–	+	A	2	4	25–30	B	4
	10	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**
S. aurantii	**2–5**	**+**	**3**	**+**	**–**	**C**	**+**	**+**	**Af**
S. citri	**3**	**+**	**5**	**+**	**+**	**A**	**–**	**–**	**NA**
S. dorsalis	**2**	**–**	**3**	**+**	**+**	**C**	**–**	**–**	**P,O,A**
S. inermis	2	–	5	+	+	B	–	–	P,NA,A
S. longipennis	3	+	3	–	+	A	?	–	P,NA,A
S. mangiferae	3(4)	+	4–6	+	+	B	+	–	P,Af
S. oligochaetus	2	–	4–5	+	+	C	–	–	SA,Af,O

Legend of characteristics (after Mound & Palmer (1981), Table (1): (1) Abdominal tergites with dark median area; (2) Tergal antecostal ridge dark; (3) Sternal antecostal ridge dark; (4) Ocellar setae pair III position. A: between hind ocelli; B: in front of hind ocelli; C: behind fore ocellus; (5) Number of major postocular setae medially; (6) Number of pronotal posteromarginal setae; (7) Length of pronotal B2 setae (in µm approximately); (8) Metanotal median setae position. A: at anterior margin, B: just behind anterior margin; (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. A: segment covered laterally for 1/3rd, B: segment covered laterally for 2/3rd, C: completely covered; (16) Drepanae present on tergite IX of male; (17) A comb of stout setae on posterior margin of hind femora of male; (18) Distribution – P: Palaearctic, O: Oriental, A: Australian, Af: afrotropical, NA: North America, SA: South America.

Description of *Scirtothrips aurantii*

Female (after Palmer *et al*., 1989): ocellar setae III situated on a line with anterior margins of posterior ocelli (Web Fig. 3a); median metanotal setae situated at anterior margin (Web Fig. 3b); tergites with median dark patch; tergites and sternites with dark antecostal ridge; tergites laterally with 3 setae on microtrichia fields (Web Fig. 3c); forewing hind vein with 2–5 setae, fringe cilia wavy; tergite VIII with microtrichia present medially, absent on IX; sternites completely spanned by microtrichia.

Adult males can be distinguished from all other members of the genus by the presence of a comb of stout setae on the posterior margin of the hind femora; also the abdominal tergite IX bears a pair of long curved dark lateral processes (drepanae) (Web Fig. 3c).

Description of *Scirtothrips citri*

Female and male (after Palmer *et al*., 1989): ocellar setae III situated within ocellar triangle near posterior margin of first ocellus (Web Fig. 4a); median metanotal setae situated behind anterior margin (Web Fig. 4b); hind vein of the forewing with three setae, fringe cilia wavy; tergites and sternites completely pale, without dark antecostal ridges; tergites laterally with five setae on microtrichia fields; tergites VIII and IX with microtrichia medially; sternites with microtrichia only between posteromarginal setae b2 and b3.

Unlike *S. aurantii*, the male of *S. citri* does not have a pair of dark lateral processes (drepanae) on the ninth abdominal tergite.

Description of *Scirtothrips dorsalis*

Female and male (after Palmer *et al*., 1989): ocellar setae III situated between posterior margin ocelli (Web Fig. 2d); median metanotal setae situated behind anterior margin (Web Fig. 2e); forewing hind vein with two setae, posterior fringe cilia straight; tergites with dark patch medially; tergites and sternites with dark antecostal ridge; median tergites each with three setae on lateral microtrichial fields (Web Fig. 2c); tergites VIII and IX with microtrichia medially; sternites completely spanned with microtrichia.

Male: unlike *S. aurantii*, tergite IX in males of *S. dorsalis* are without dark lateral drepanae.

Reporting and documentation

Guidance on reporting and documentation is given in EPPO Standard PM7/– (in preparation).

Further information

Further information on these organisms can be obtained from:

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Acknowledgements

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References

Berzosa J & Caño JM (1990) A new species of *Scirtothrips* from Spain. *Senckenbergiana Biologica* **70**, 281–285.

Bournier JP (1999) Deux thysanoptères, nouveaux déprédateurs du cotonnier en Côte d'Ivoire. *Annales de la Société Entomologique de France (Nouvelle Série)* **35**, 275–281.

EPPO/CABI (1996) *Scirtothrips aurantii, S. citri, S. dorsalis*. *Quarantine Pests for Europe*, 2nd edn, pp. 497–508. CAB International, Wallingford (GB).

Hoddle M & Mound LA (2003) The genus *Scirtothrips* in Australia. *Zootaxa* **268**, 1–40.

Johansen RM & Mojica-Guzman A (1999) The genus *Scirtothrips* in Mexico. *Folia Entomologica Mexicana* **104**, 23–108.

Lacasa A, Llorens JM & Sanchez JA (1996) [Damage caused by a *Scirtothrips* sp. on orange in Spain.]. *Boletín de Sanidad Vegetal, Plagas* **22**, 79–95 (in Spanish).

Miyazaki M & Kudo I (1986) Descriptions of thrips larvae which are noteworthy on cultivated plants (Thysanoptera: Thripidae). I. Species occurring on solanaceous and cucurbitaceous crops. *Akitu New Series* **79**, 1–26.

Mound LA & Marullo R (1996) *The Thrips of Central and South America: An Introduction. Memoirs on Entomology, International* no. 6. Associated Publishers, Gainesville (US).

Mound LA & Palmer JM (1981) Identification, distribution and host-plants of the pest species of *Scirtothrips*. *Bulletin of Entomological Research* **71**, 467–479.

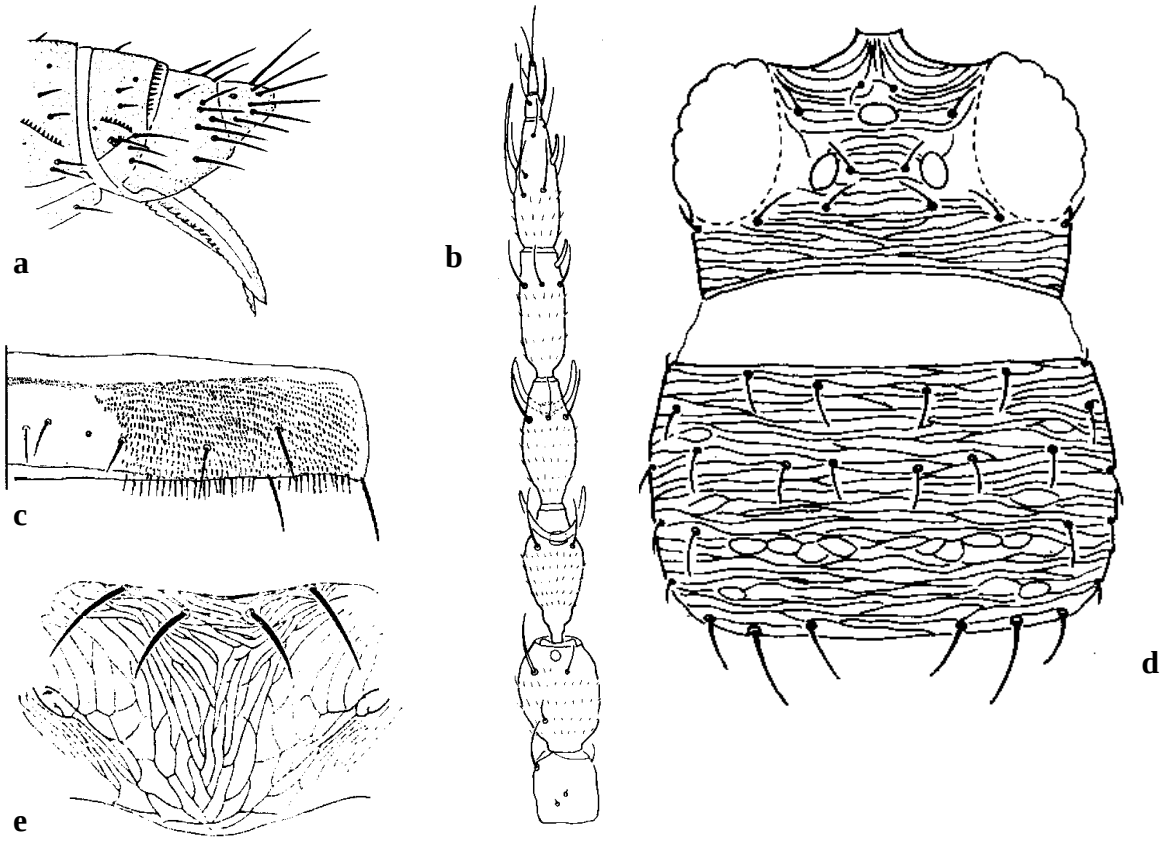
Mound LA & zur Strassen R (2001) The genus *Scirtothrips*. Mexico: a critique of the review by Johansen & Mojica-Guzman (1998). *Folia Entomologica Mexicana* **40**, 133–142.

Nakahara S (1997) *Scirtothrips perseae*, a new species infesting avocado in southern California. *Insecta Mundi* **11**, 189–192.

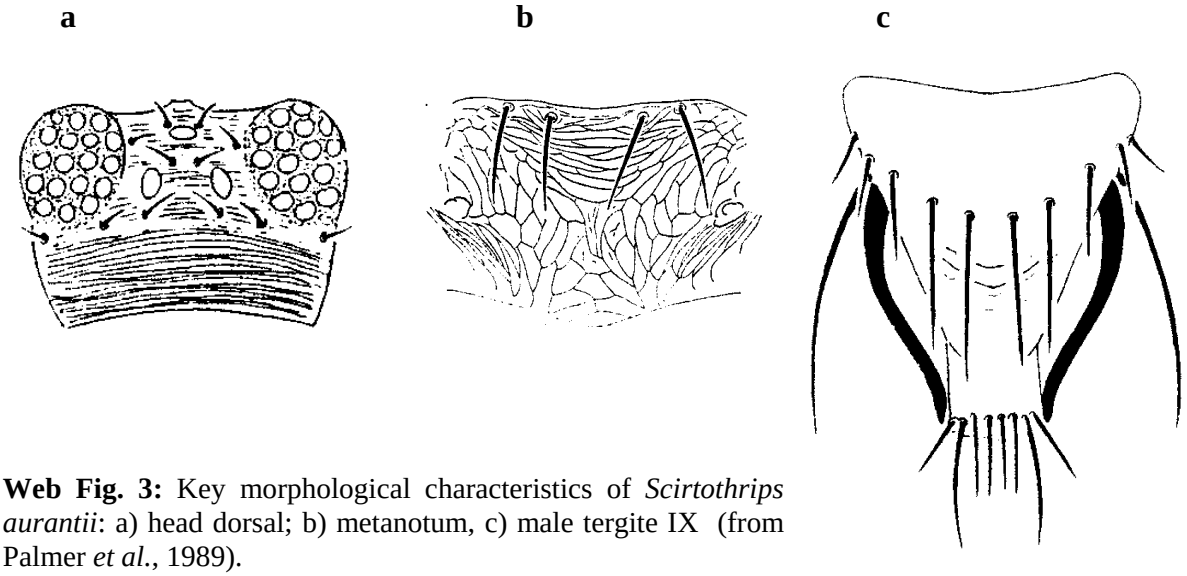
Palmer JM, Mound LA & du Heaume GJ (1989) *CIE Guides to Insects of Importance to Man. 2. Thysanoptera*. CAB International, Wallingford (GB).

zur Strassen R (1986) [Thysanoptera of the Northern Sporades in the Aegean Sea (Greece)]. *Senckenbergiana Biologica* **67**, 85–129 (in German).

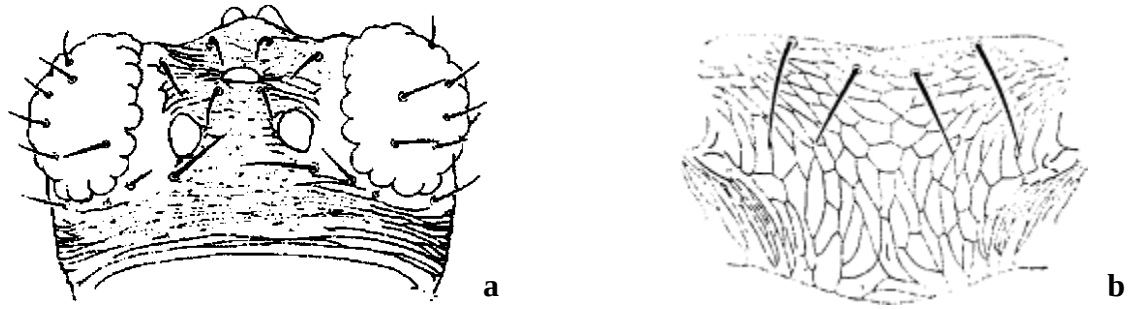
Web Fig. 1: *Scirtothrips citri* adult female (left) and damage symptoms caused by *Scirtothrips citri:*crown damage on young citrus fruit (middle) and a blemished orange (right). (University of California, Jack Kelly Clark; http://www.ipm.ucdavis.edu/PMG/r107301711.html)



Web Fig. 2: Key morphological characteristics of *Scirtothrips dorsalis*: a) ovipositor (Palmer *et al.*, 1989), b) antenna (Miyazaki & Kudo, 1986),c) right half tergite V (Mound & Kibby, 1998), d) head and pronotum (Miyazaki & Kudo, 1986); e) metanotum (Mound & Palmer, 1981).



Web Fig. 3: Key morphological characteristics of *Scirtothrips aurantii*: a) head dorsal; b) metanotum, c) male tergite IX (from Palmer *et al.*, 1989).



Web Fig. 4: Key morphological characteristics of *Scirtothrips citri*: a) head, dorsal; b) metanotum (from Palmer *et al*., 1989 and Mound & Palmer, 1981).