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SCIENTIFIC OPINION

# Scientific Opinion on the pest categorisation of *Scirtothrips dorsalis*[1]

**EFSA Panel on Plant Health (PLH)**[2,3]

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## ABSTRACT

The EFSA Panel on Plant Health undertook a pest categorisation for the insect *Scirtothrips dorsalis* for the European Union. Although there are reports that this is a species complex and there are host-specific races, it is generally treated as a distinct taxon. Both morphological and molecular methods are required to confirm identification. Apart from one long-term outbreak in a botanic garden glasshouse in England, it is absent from the EU. Native to southern and eastern Asia, this species has been introduced to tropical and subtropical areas of Africa, Australasia and the Americas in recent years. It is highly polyphagous, with over 225 known hosts, which include many important EU crops. Southern areas of the EU are potentially suitable for outdoor establishment and it could establish in protected cultivation throughout the EU. Based on its phenology, the Panel showed that the climate in southern Europe could allow a similar number of generations to develop as in Japan and South Korea, where significant damage occurs to citrus and other crops outdoors. In protected cultivation, even though control methods used against other thrips species may be effective in keeping populations at low densities, damage can still occur at these densities owing to the transmission of tospoviruses. Despite being highly polyphagous, *S. dorsalis* is an insect listed in Annex IIAI of Council Directive 2000/29/EC only in relation to *Citrus*, *Fortunella* and *Poncirus* plants. These hosts are also regulated in Annex III and Annex V. They are also explicitly mentioned in Council Directive 2008/90/EC.



## KEY WORDS

chilli thrips, yellow tea thrips, strawberry thrips, quarantine pest, regulated non-quarantine pest, *Scirtothrips dorsalis*

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## TABLE OF CONTENTS

## LIST OF TABLES AND FIGURES

### TABLES



### FIGURES

## BACKGROUND AS PROVIDED BY THE EUROPEAN COMMISSION

The current European Union plant health regime is established by Council Directive 2000/29/EC on protective measures against the introduction into the Community of organisms harmful to plants or plant products and against their spread within the Community (OJ L 169, 10.7.2000, p. 1).

The Directive lays down, amongst others, the technical phytosanitary provisions to be met by plants and plant products and the control checks to be carried out at the place of origin on plants and plant products destined for the Union or to be moved within the Union, the list of harmful organisms whose introduction into or spread within the Union is prohibited and the control measures to be carried out at the outer border of the Union on arrival of plants and plant products.

The Commission is currently carrying out a revision of the regulatory status of organisms listed in the Annexes of Directive 2000/29/EC. This revision targets mainly organisms which are already locally present in the EU territory and that in many cases are regulated in the EU since a long time. Therefore it is considered to be appropriate to evaluate whether these organisms still deserve to remain regulated under Council Directive 2000/29/EC, or whether, if appropriate, they should be regulated in the context of the marketing of plant propagation material, or be deregulated. The revision of the regulatory status of these organisms is also in line with the outcome of the recent evaluation of the EU Plant Health Regime, which called for a modernisation of the system through more focus on prevention and better risk targeting (prioritisation).

In order to carry out this evaluation, a recent pest risk analysis is needed which takes into account the latest scientific and technical knowledge on these organisms, including data on their agronomic and environmental impact, as well as their present distribution in the EU territory. In this context, EFSA has already been asked to prepare risk assessments for some organisms listed in Annex IIAII. The current request concerns 23 additional organisms listed in Annex II, Part A, Section II as well as five organisms listed in Annex I, Part A, Section I, one listed in Annex I, Part A, Section II and nine organisms listed in Annex II, Part A, Section I of Council Directive 2000/29/EC. The organisms in question are the following:

Organisms listed in Annex II, Part A, Section II:

- *Ditylenchus destructor* Thorne
- *Circulifer haematoceps*
- *Circulifer tenellus*
- *Helicoverpa armigera* (Hübner)
- *Radopholus similis* (Cobb) Thorne (could be addressed together with the IIAI organism *Radopholus citrophilus* Huettel Dickson and Kaplan)
- *Paysandisia archon* (Burmeister)
- *Clavibacter michiganensis* spp. *insidiosus* (McCulloch) Davis et al.
- *Erwinia amylovora* (Burr.) Winsl. et al. (also listed in Annex IIB)
- *Pseudomonas syringae* pv. *persicae* (Prunier et al.) Young et al.
- *Xanthomonas campestris* pv. *phaseoli* (Smith) Dye
- *Xanthomonas campestris* pv. *pruni* (Smith) Dye
- *Xylophilus ampelinus* (Panagopoulos) Willems et al.
- *Ceratocystis fimbriata* f. sp. *platani* Walter (also listed in Annex IIB)
- *Cryphonectria parasitica* (Murrill) Barr (also listed in Annex IIB)
- *Phoma tracheiphila* (Petri) Kanchaveli and Gikashvili
- *Verticillium albo-atrum* Reinke and Berthold
- *Verticillium dahliae* Klebahn
- Beet leaf curl virus
- Citrus tristeza virus (European isolates) (also listed in Annex IIB)

- Grapevine flavescence dorée MLO (also listed in Annex IIB)
- Potato stolbur mycoplasma
- *Spiroplasma citri* Saglio et al.
- Tomato yellow leaf curl virus

Organisms listed in Annex I, Part A, Section I:

- *Rhagoletis cingulata* (Loew)
- *Rhagoletis ribicola* Doane
- Strawberry vein banding virus
- Strawberry latent C virus
- Elm phloem necrosis mycoplasm

Organisms listed in Annex I, Part A, Section II:

- *Spodoptera littoralis* (Boisd.)

Organisms listed in Annex II, Part A, Section I:

- *Aculops fuchsiae* Keifer
- *Aonidiella citrina* Coquillet
- Prunus necrotic ringspot virus
- Cherry leafroll virus
- *Radopholus citrophilus* Huettel Dickson and Kaplan (could be addressed together with IIAII organism *Radopholus similis* (Cobb) Thorne
- *Scirtothrips dorsalis* Hood
- *Atropellis* spp.
- *Eotetranychus lewisi* McGregor
- *Diaporthe vaccinii* Shear.

## TERMS OF REFERENCE AS PROVIDED BY THE EUROPEAN COMMISSION

EFSA is requested, pursuant to Article 29(1) and Article 22(5) of Regulation (EC) No 178/2002, to provide a pest risk assessment of *Ditylenchus destructor* Thorne, *Circulifer haematoceps*, *Circulifer tenellus*, *Helicoverpa armigera* (Hübner), *Radopholus similis* (Cobb) Thorne, *Paysandisia archon* (Burmeister), *Clavibacter michiganensis* spp. *insidiosus* (McCulloch) Davis et al., *Erwinia amylovora* (Burr.) Winsl. et al., *Pseudomonas syringae pv. persicae* (Prunier et al.*)* Young et al. *Xanthomonas campestris* pv. *phaseoli* (Smith) Dye, *Xanthomonas campestris* pv. *pruni* (Smith) Dye, *Xyîophilus ampelinus* (Panagopoulos) Willems et al., *Ceratocystis fimbriata* f. sp. *platani* Walter, *Cryphonectria parasitica* (Murrill) Barr, *Phoma tracheiphila* (Petri) Kanchaveli and Gikashvili, *Verticillium alboatrum* Reinke and Berthold, *Verticillium dahliae* Klebahn, Beet leaf curl virus, Citrus tristeza virus (European isolates), Grapevine flavescence dorée MLO, Potato stolbur mycoplasma, *Spiroplasma citri* Saglio et al., Tomato yellow leaf curl virus, *Rhagoletis cingulata* (Loew), *Rhagoletis ribicola* Doane, Strawberry vein banding virus, Strawberry latent C virus, Elm phloem necrosis mycoplasma, *Spodoptera littoralis* (Boisd.), *Aculops fuchsiae* Keifer, *Aonidiella citrina* Coquillet, Prunus necrotic ringspot virus, Cherry leafroll virus, *Radopholus citrophilus* Huettel Dickson and Kaplan (to address with the IIAII *Radopholus similis* (Cobb) Thorne), *Scirtothrips dorsalis* Hood, *Atropellis* spp., *Eotetranychus lewisi* McGregor and *Diaporthe vaccinii* Shear, for the EU territory.

In line with the experience gained with the previous two batches of pest risk assessments of organisms listed in Annex II, Part A, Section II, requested to EFSA, and in order to further streamline the preparation of risk assessments for regulated pests, the work should be split in two stages, each with a specific output. EFSA is requested to prepare and deliver first a pest categorisation for each of these 38 regulated pests (step 1). Upon receipt and analysis of this output, the Commission will inform

EFSA for which organisms it is necessary to complete the pest risk assessment, to identify risk reduction options and to provide an assessment of the effectiveness of current EU phytosanitary requirements (step 2). *Clavibacter michiganensis* spp. *michiganensis* (Smith) Davis et al. and *Xanthomonas campestris* pv. *vesicatoria* (Doidge) Dye, from the second batch of risk assessment requests for Annex IIAII organisms requested to EFSA (ARES(2012)880155), could be used as pilot cases for this approach, given that the working group for the preparation of their pest risk assessments has been constituted and it is currently dealing with the step 1 "pest categorisation". This proposed modification of previous request would allow a rapid delivery by EFSA by May 2014 of the first two outputs for step 1 "pest categorisation", that could be used as pilot case for this request and obtain a prompt feedback on its fitness for purpose from the risk manager's point of view.

As indicated in previous requests of risk assessments for regulated pests, in order to target its level of detail to the needs of the risk manager, and thereby to rationalise the resources used for their preparation and to speed up their delivery, for the preparation of the pest categorisations EFSA is requested, in order to define the potential for establishment, spread and impact in the risk assessment area, to concentrate in particular on the analysis of the present distribution of the organism in comparison with the distribution of the main hosts and on the analysis of the observed impacts of the organism in the risk assessment area.

## ASSESSMENT

# 1. Introduction

## 1.1. Purpose

This document presents a pest categorisation prepared by the EFSA Scientific Panel on Plant Health (hereinafter referred to as the Panel) for the species *Scirtothrips dorsalis* in response to a request from the European Commission.

## 1.2. Scope

The risk assessment area is the territory of the European Union (hereinafter referred to as the EU) with 28 Member States (hereinafter referred to as MSs), restricted to the area of application of Council Directive 2000/29/EC.

# 2. Methodology and data

## 2.1. Methodology

The Panel performed the pest categorisation for *Xx* following guiding principles and steps presented in the EFSA Guidance on a harmonised framework for pest risk assessment (EFSA PLH Panel, 2010) and as defined in the International Standards for Phytosanitary Measures (ISPM) No 11 (FAO, 2013) and ISPM No 21 (FAO, 2004).

In accordance with the Guidance on a harmonised framework for pest risk assessment in the EU (EFSA PLH Panel, 2010), this work is initiated as result of the review or revision of phytosanitary policies and priorities. As explained in the background of the European Commission request, the objective of this mandate is to provide updated scientific advice to the European risk managers for their evaluation of whether these organisms listed in the Annexes of the Directive 2000/29/EC still deserve to remain regulated under Council Directive 2000/29/EC, or whether they should be regulated in the context of the marketing of plant propagation material, or be deregulated. Therefore, to facilitate the decision making process, in the conclusions of the pest categorisation, the Panel addresses explicitly each criterion for quarantine pest according to ISPM 11 (FAO, 2013) but also for regulated non-quarantine pest according to ISPM 21 (FAO, 2004) and includes additional information required as per the specific terms of reference received by the European Commission. In addition, for each conclusion the Panel provides a short description of its associated uncertainty.

Table 1 presents the ISPM 11 (FAO, 2013) and ISPM 21 (FAO, 2004) pest categorisation criteria against which the Panel provides its conclusions. It should be noted that the Panel's conclusions are formulated respecting its remit and particularly with regards to the principle of separation between risk assessment and risk management (EFSA founding regulation[4]), therefore, instead of determining whether the pest is likely to have an unacceptable impact, the Panel will present a summary of the observed pest impacts. Economic impacts are expressed in terms of yield and quality losses and not in monetary terms, in agreement with the Guidance on a harmonised framework for pest risk assessment (EFSA PLH Panel, 2010).

[4] Regulation (EC) No 178/2002 of the European Parliament and of the Council of 28 January 2002 laying down the general principles and requirements of food law, establishing the European Food Safety Authority and laying down procedures in matters of food safety. OJ L 31/1, 1.2.2002, p. 1–24.

**Table 1:** International Standards for Phytosanitary Measures ISPM 11 (FAO, 2013) and ISPM 21 (FAO, 2004) pest categorisation criteria under evaluation

| Pest categorisation criteria | ISPM 11 for being a potential quarantine pest | ISPM 21 for being a potential regulated non-quarantine pest |
|---|---|---|
| **Identity of the pest** | The identity of the pest should be clearly defined to ensure that the assessment is being performed on a distinct organism, and that biological and other information used in the assessment is relevant to the organism in question. If this is not possible because the causal agent of particular symptoms has not yet been fully identified, then it should have been shown to produce consistent symptoms and to be transmissible | The identity of the pest is clearly defined |
| **Presence (ISPM 11) or absence (ISPM 21) in the PRA area** | The pest should be **absent from all or a defined part of the PRA area** | The pest is **present** in the PRA area |
| **Regulatory status** | If the pest is present but not widely distributed in the PRA area, it should be under official control or expected to be under official control in the near future | The pest is under official control (or being considered for official control) in the PRA area with respect to the specified plants for planting |
| **Potential for establishment and spread in the PRA area** | The PRA area should have ecological/climatic conditions including those in protected conditions suitable for the establishment and spread of the pest and, where relevant, host species (or near relatives), alternate hosts and vectors should be present in the PRA area | – |
| **Association of the pest with the plants for planting and the effect on their intended use** | – | Plants for planting are a pathway for introduction and spread of this pest |
| **Potential for consequences (including environmental consequences) in the PRA area** | There should be clear indications that the pest is likely to have an unacceptable economic impact (including environmental impact) in the PRA area | – |
| **Indication of impact(s) of the pest on the intended use of the plants for planting** | – | The pest may cause severe economic impact on the intended use of the plants for planting |
| **Conclusion** | If it has been determined that the pest has the potential to be a quarantine pest, the PRA process should continue. If a pest does not fulfil all of the criteria for a quarantine pest, the PRA process for that pest may stop. In the absence of sufficient information, the uncertainties should be identified and the PRA process should continue | If a pest does not fulfil all the criteria for a regulated non-quarantine pest, the PRA process may stop |

In addition, in order to reply to the specific questions listed in the terms of reference, three issues are specifically discussed only for pests already present in the EU: the analysis of the present EU distribution of the organism in comparison with the EU distribution of the main hosts, the analysis of the observed impacts of the organism in the EU and the pest control and cultural measures currently implemented in the EU.

The Panel will not indicate in its conclusions of the pest categorisation whether to continue the risk assessment process as it is clearly stated in the terms of reference that at the end the pest categorisation the European Commission will indicate if further risk assessment work is required following their analysis of the Panel's scientific opinion.

## 2.2. Data

### 2.2.1. Literature search

A literature search on *S. dorsalis* was conducted at the beginning of the mandate. The search was conducted for the synonyms of the scientific name of the pest together with the most frequently used common names on the ISI Web of Knowledge database, CAB Abstracts and web based search engines such as Google Scholar. Further references and information were obtained from experts, from citations within the references and from grey literature. The datasheets on surveys for *S. dorsalis* provided by the PERSEUS project was also used as a source of references (Bell et al., 2014).

### 2.2.2. Data collection

To complement the information concerning the current situation of the pest provided by the literature and online databases on pest distribution, damage and management, the PLH Panel sent a short questionnaire on the current situation at country level, based on the information available in the European and Mediterranean Plant Protection Organization (EPPO) Plant Quarantine Retrieval (PQR) system, to the National Plant Protection Organisation (NPPO) of the 28 EU Member States, and of Iceland and Norway. Iceland and Norway are part of the European Free Trade Association (EFTA) and are contributing to EFSA data collection activities, as part of the agreements EFSA has with these two countries. A summary of the pest status based on EPPO PQR and NPPO replies is presented in Table 2.

In its analyses the Panel also considered the Pest Risk Analysis prepared by the Central Science Laboratory, UK (MacLeod and Collins, 2006), and the Plant Protection services of the Netherlands (Vierbergen and van der Gaag, 2009).

# 3. Pest categorisation

## 3.1. Identity and biology of the pest

### 3.1.1. Taxonomy

The organism under assessment currently has the following valid scientific name:

**Name:**

*Scirtothrips dorsalis* (Hood, 1919)

**Synonyms:**

*Anaphothrips andreae* Karny

*Anaphothrips fragariae* Giard

*Heliothrips minutissimus* Bagnall

*Neophysopus fragariae* Girault

*Scirtothrips dorsalis* var. *padmae* Ramakrishna

**Most frequently used common names:**

Chilli thrips, yellow tea thrips, strawberry thrips (English), thrips jaune du théier (French)

**Taxonomic position:**

Domain: Eukaryota
Kingdom: Metazoa
Phylum: Arthropoda
Subphylum: Uniramia
Class: Insecta
Order: Thysanoptera
Family: Thripidae
Genus: *Scirtothrips*
Species: *Scirtothrips dorsalis*

### 3.1.2. Pest biology

The life cycle of *S. dorsalis* comprises the following stages: egg, two active feeding larval instars, a prepupa and a pupa, both of which are relatively inactive, and a winged, feeding adult stage (Kumar et al., 2013). The feeding stages are usually found on the green parts of the plant, as thrips feed mainly on actively growing plant tissues (Ananthakrishnan, 1993).

*S. dorsalis* reproduces by arrhenotoky, i.e. unfertilised eggs produce males and fertilised eggs produce females. A higher proportion of fertilised eggs are laid. The eggs are laid into the soft parts of plants above the soil. On chilli, a female lays 2–4 eggs per day over ca. 32 days with a total number of 60 to 200 eggs in her life time (Seal and Klassen, 2012). Eggs hatch after 5–8 days, the larval stages need 8–10 days before transforming into pupae and pupal stages are completed in 2.6–3.3 days (Kumar et al., 2013). Developmental times depend on the host species on which they are feeding and on environmental conditions, particularly temperature. Temperature requirements range between 9.7 °C and 33.0 °C, with 265 degree-days (DD) from egg to adult and 281 DD from egg to egg.

*S. dorsalis* is multivoltine in India, and no diapause is reported (Toda et al., 2014). However, in Japan, adult females diapause in temperate regions (Shibao and Tanaka, 2003; cited by Toda et al., 2014) and more than five generations occur per year (Tatara, 1994). Up to 18 generations in the most favourable conditions of North America were predicted by Nietschke et al. (2008) using North Carolina State University (NCSU) Animal and Public Health Information System (APHIS) Plant Pest Forecasting System (NAPPFAST). In Japan, *S. dorsalis* starts to lay eggs in late March or early April (Shibao et al., 1991). *S. dorsalis* is excluded from areas with a cold climate; minimum daily temperatures of –4 °C or below for at least five days per year (Nietschke et al., 2008). Population densities were found to be higher during prolonged dry conditions (Kumar et al., 2013).

### 3.1.3. Intraspecific diversity

Hoddle et al. (2008) identified molecular differences between morphologically indistinguishable populations, suggesting that *S. dorsalis* may be a complex of species including at least three taxa. The authors suggested the importance of further field studies combining observations on host plant preferences and population phenology from different populations within the *S. dorsalis* species group. Using polymerase chain reaction (PCR) tests, Rugman-Jones et al. (2006) found that Indian and South African specimens that were identified morphologically as *S. dorsalis* belonged to different species. The genetic differences between these samples was considered to be too great to support the conclusion that separate host races were present. According to Seal et al. (2010), different populations of this pest have host preferences without substantial modifications to life history traits such as development, survival and fecundity. Toda et al. (2014) found a new strain of *S. dorsalis* infesting capsicum in addition to mango and tea in Japan.

### 3.1.4. Detection and identification of the pest

Since *Scirtothrips* spp. primarily infest young growing buds, these should be examined particularly carefully. There are no reports that the pest feeds on mature host tissues; it feeds only on young epidermal and, sometimes, palisade cells, as well as on the apex of young fruits, especially when hidden under the calyx (Kumar et al., 2013). On many hosts, *S. dorsalis* may feed on the upper surface of leaves when infestation levels are high. Larvae and adults are often found on the mid-vein or near the damaged part of leaf tissues. Pupae can be detected in the leaf litter, on leaf axils, in curled leaves or under the calyx (Kumar et al., 2013).

Symptoms of an infestation are a silvering of the leaf surface, linear thickenings of the leaf lamina, brown frass found on leaves and fruits, grey to black markings on fruits, often forming a ring of scarred tissue around the apex, and, ultimately, fruit distortion and early senescence of leaves. Sometimes, infested plants appear similar to plants damaged by broad mites (Kumar et al., 2013).

Since adults of *S. dorsalis* are very small (< 2 mm in length), with thigmotactic behaviour and morphological similarities with other thrips species, detection in fresh vegetation and identification of species is challenging for non-experts (Kumar et al., 2013). Owing to the small size of the insect, EPPO (2005) suggests combining direct visual search with the electric Berlese method.

Detection is also possible, to some extent, by direct plant sampling, shaking plants to remove thrips and using sticky suction traps and emergence traps to capture individuals for taxonomic identification. However, this is ineffective for early detection when numbers are still low. Yellowish-green traps collect more adult *S. dorsalis* than other coloured traps (Tsuchiya et al., 1995). Aliakbarpour and Rawri (2010) compared additional detection methods (e.g. shaking mango panicles over a plastic tray, washing the panicle with ethanol, immobilising the thrips with $CO_2$ and applying yellow sticky traps) and concluded that, although the $CO_2$ method was the most effective non-destructive method, yellow sticky traps seemed to be the easiest to use. Chu et al. (2006) compared sticky traps, plastic cup traps and blue D traps. Yellow sticky traps caught more thrips than the plastic cup traps, but also a large number of non-target insects. The blue D trap did not consistently capture greater numbers than the plastic cup trap. In general, sticky traps were less labour intensive, and required less component assembly and less expertise in trap placement, than the plastic cup traps.

A morphological description of all the stages is provided by CABI (2014) and Mound et al. (2014), who also provide a series of illustrations. EPPO (2005) provides the key characteristics distinguishing *Scirtothrips* spp. from all other Thripidae. However, at that time, it was impossible to identify larvae of *Scirtothrips* species because there was no reliable identification key. Only later did Vierbergen et al. (2010) develop a key to the second instar larvae of 130 species of Thripidae. The morphological identification of *S. dorsalis* larvae can be based on those authors and on Kumar et al. (2013).

Rugman-Jones et al. (2006) published a method to identify *S. dorsalis* using multiplex PCR. The amplified internal transcribed spacer 1 and 2 (ITS1 and ITS2) regions of nuclear rRNA and subsequent enzymatic restriction polymorphism analysis provided a set of simple diagnostic characteristics for important *Scirtothrips* species, including *S. dorsalis*. The method is useful at the species level. A molecular marker (rDNA ITS2) was developed by Farris et al. (2010) for the species-specific identification of *S. dorsalis* specimens. A new identification method combining both morphological and molecular methods has been published by Kumar (2012) and can be applied to a single specimen.

## 3.2. Current distribution

### 3.2.1. Global distribution

*S. dorsalis* is native to Bangladesh, Myanmar, Pakistan, Sri Lanka, Taiwan and Thailand, but has become more widespread in the past 20 years, expanding its host range because of increased globalisation and open agricultural trade (Kumar et al., 2013). It is an important pest in southern and eastern Asia, Africa and Oceania (Ananthakrishnan, 1993).

In Asia, the pest is present in Bangladesh, Brunei, Cambodia, China, India, Indonesia, Israel, Japan, the Republic of Korea, Malaysia, Myanmar, Pakistan, the Philippines, Sri Lanka, Taiwan, Thailand and Vietnam. In Oceania, *S. dorsalis* is found in northern Australia, Papua New Guinea and the Solomon Islands. On the African continent, *S. dorsalis* is reported in South Africa, although here Rugman-Jones et al. (2006) considered it to be a different species (see section 3.1.4), and Côte d'Ivoire. Plant quarantine interceptions suggest that it is also distributed across West Africa and East Africa (Kenya). In North America, the establishment of *S. dorsalis* was first reported in Florida, in 2005. Since then it has become a serious pest of diverse economically important host crops in the south-eastern parts of the United States. In Central America and the Caribbean, the pest is present in Barbados, Jamaica, Puerto Rico, St Lucia, St Vincent and the Grenadines and Trinidad and Tobago. In South America, *S. dorsalis* has caused serious damage to grapevine in western Venezuela and in Suriname (MacLeod and Collins, 2006; Kumar et al., 2013; CABI, 2014).

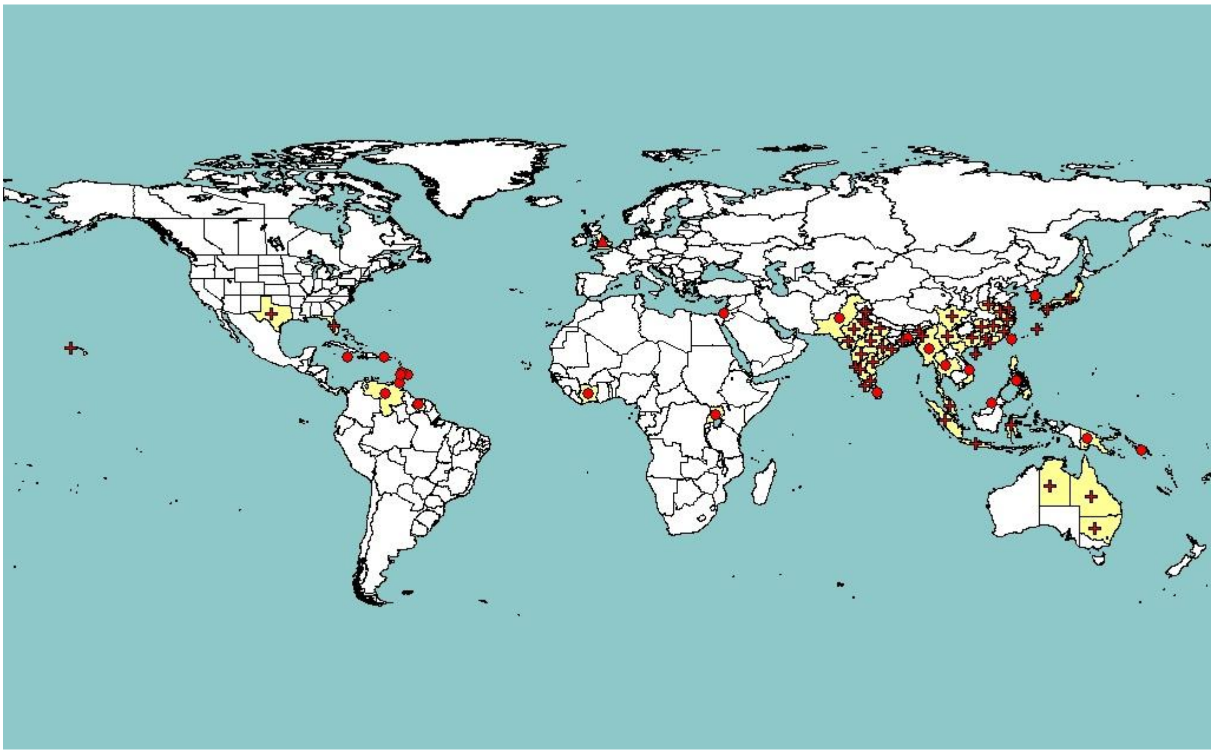

**Figure 1:** Global distribution of *Scirtothrips dorsalis* (extracted from EPPO PQR (2012) (version 5.3.1), accessed September 2014). Red circles represent pest presence as national records and crosses show pest presence as subnational records

### 3.2.2. Distribution in the EU

The current distribution of *S. dorsalis* in the EU, based on answers received from the NPPOs, is provided in Table 2. In the EU, presence of the pest was reported only in the UK. Information from the UK, from February 2012 (Richard McIntosh, Plant Health Division, Defra, York, UK, personal communication, 2012), reveals that the local outbreak from 2008 of *S. dorsalis* in one glasshouse of southern England (IPPC, 2009) is still ongoing, as confirmed by the response of the UK NPPO in 2014 (see Table 2). Therefore, the pest is not known to have spread to new locations.

*S. dorsalis* was also reported indoors on potted plants of ornamentals in the Netherlands, in 2009 (Fytosignalering, 2009), where it was eradicated.

However, *S. dorsalis* continues to be intercepted in the EU. According to the EUROPHYT database, 39 interceptions have been reported since 2000 (5 interceptions in 2013) on different commodities at introduction into the EU: 5 on plants for planting, 1 on cut flowers and branches with foliage and 33 on fruit and vegetables. The Panel notes that no interceptions have been reported on the hosts for which the pest is regulated. However, the interceptions reported provide only an indication of the introduction of the pest into the EU, and are not a reliable estimate of the frequency of pest introduction. For example, Vierbergen and van der Gaag (2009) reported that *S. dorsalis* was intercepted in the Netherlands up to 60 times each year from 1997 to 2009 on cut flowers and fruits and vegetables (interceptions not reported in EUROPHYT).

These reports indicate that there are three main pathways for introduction of the pest into the EU: plants intended for planting, cut flowers and fruits and vegetables from host species of *S. dorsalis*.

Table 2 also shows that the pest is absent in the Netherlands and Belgium, although it has been intercepted.

**Table 2:** Current distribution of *Scirtothrips dorsalis* in the 28 EU MSs, Iceland and Norway, based on the answers received via email from the NPPOs or, in absence of reply, on information from EPPO PQR (2012)

| Country | NPPO answer |
|---|---|
| Austria | Absent, no pest records |
| Belgium | Absent, intercepted only (Interception in 2013) |
| Bulgaria | Absent |
| Croatia | Absent, no pest records |
| Cyprus | – |
| Czech Republic | Absent, no pest records |
| Denmark | Not known to occur |
| Estonia | Absent, no pest records |
| Finland | Absent, no pest records |
| France | – |
| Germany | Absent, no pest records |
| Greece [(a)] | – |
| Hungary | Absent, no pest records |
| Ireland | Absent, no pest records |
| Italy | Never reported |
| Latvia [(a)] | – |
| Lithuania [(a)] | – |
| Luxembourg [(a)] | – |
| Malta | Absent, no pest records |
| Netherlands | Absent, intercepted only, confirmed by survey |
| Poland | Absent, no pest records |
| Portugal | No records |
| Romania [(a)] | – |
| Slovak Republic | Absent, no pest record |
| Slovenia | Absent, no pest records on *Citrus* L., *Fortunella* Swingle, *Poncirus* Raf. |
| Spain | Absent |
| Sweden | Absent, no pest records |
| United Kingdom | Present, under official control (only present in one glasshouse) |
| Iceland[( a)] | – |
| Norway [(a)] | – |

(a): When no information was made available to EFSA, the pest status in the EPPO PQR (2012) was used.
–, No information available.
EPPO PQR, European and Mediterranean Plant Protection Organization Plant Quarantine Data Retrieval System; NPPO, National Plant Protection Organisation.

## 3.3. Regulatory status

### 3.3.1. EU regulation

***Scirtothrips dorsalis***

This species is a regulated harmful organism in the EU and listed in Council Directive 2000/29/EC in Annex IIAI as shown in Table 3.

**Table 3:** *Scirtothrips dorsalis* in Council Directive 2000/29/EC

| | | |
|---|---|---|
| **Annex II, Part A** | Harmful organisms whose introduction into, and spread within, all Member States shall be banned if they are present on certain plants or plant products | |
| **Section I** | Harmful organisms not known to occur in the Community and relevant for the entire Community | |
| **(a)** | Insects, mites and nematodes, at all stages of their development | |
| | Species | Subject of contamination |
| **26.** | *Scirtothrips dorsalis* Hood | Plants of *Citrus* L., *Fortunella* Swingle, *Poncirus* Raf., and their hybrids, other than fruit and seeds |

**Regulated hosts for *Scirtothrips dorsalis***

*S. dorsalis* is a polyphagous pest with over 225 host plant species (see section 3.4.1), and the pest has many more potential hosts than those for which it is regulated in Annex IIAI. In addition, it is important to mention that other specific commodities could act as a pathway for pest introduction in the risk assessment area, such as soil and growing media, cut flowers and fruits and vegetables of the host plants.

In Table 4, specific requirements of Annex III and Annex V of the Council Directive 2000/29/EC are presented only for the host plants and commodities regulated for *S. dorsalis* in Annex IIAI (see Table 3).

**Table 4:** Regulated hosts for *Scirtothrips dorsalis* in Annexes III and V of Council Directive 2000/29/EC

| | | |
|---|---|---|
| **Annex III, Part A** | Plants, plant products and other objects the introduction of which shall be prohibited in all Member States | |
| | Description | Country of origin |
| **16** | Plants of *Citrus* L., *Fortunella* Swingle, *Poncirus* Raf., and their hybrids, other than fruit and seeds | Third countries |
| **Annex V** | Plants, plant products and other objects which must be subject to a plant health inspection (at the place of production if originating in the Community, before being moved within the Community—in the country of origin or the consignor country, if originating outside the Community) before being permitted to enter the Community | |
| **Part A** | Plants, plant products and other objects originating in the Community | |
| **Section I** | Plants, plant products and other objects which are potential carriers of harmful organisms of relevance for the entire Community and which must be accompanied by a plant passport | |
| **1** | Plants and plant products | |
| **1.4** | Plants of *Fortunella* Swingle, *Poncirus* Raf., and their hybrids [...], other than fruit and seeds | |
| **1.5** | […] plants of *Citrus* L. and their hybrids other than fruit and seeds | |
| **2** | Plants, plant products and other objects produced by producers whose production and sale is authorised to persons professionally engaged in plant production, other than those plants, plant products and other objects which are prepared and ready for sale to the final consumer, and for which it is ensured by the responsible official bodies of the Member States, that the production thereof is clearly separate from that of other products | |
| **2.1** | Plants intended for planting other than seeds of the genera […] and other plants of herbaceous species, other than plants of the family Gramineae, intended for planting, and other than bulbs, corms, rhizomes, seeds and tubers | |

### 3.3.2. Marketing directives

Species which are regulated hosts of *S. dorsalis* are explicitly mentioned in Council Directive 2008/90/EC[5]: *Citrus* sp., […], *Fortunella* Swingle, […], *Poncirus* Raf., […]

## 3.4. Elements to assess the potential for establishment and spread in the EU

### 3.4.1. Host range

*S. dorsalis* is polyphagous. Currently, it is reported to feed on at least 225 plant species within 72 families and 32 orders. Its host range expands when it spreads to new areas. Host plants include various fruit, ornamental and vegetable crops. However, it does not appear to reproduce on all of them, so not all of those plants can be considered to be true hosts (Kumar et al., 2013). Since the risk of misidentification is very high (section 3.1.4), it is also possible that the number of hosts is actually an overestimate of the host range of this species.

Hosts of this pest which are of economic importance, include banana, bean, cashew, castor, chilli pepper, chrysanthemum, citrus, cocoa, maize, cotton, aubergine, ficus, grapes, kiwi, lychee, longan, mango, melon, onion, peanut, pepper, poplar, pumpkin, rose, strawberry, sweet potato, tea, tobacco, tomato and wild yams (*Dioscorea* spp.) (Venette and Davis, 2004; Kumar et al., 2013). The main wild host plants belong to the family Fabaceae, which includes *Acacia*, *Brownea*, *Mimosa* and *Saraca* (Kumar et al., 2013; CABI, 2014).

Differences in the host plants of *S. dorsalis* have been reported from separate geographical regions. These differences can be interpreted as the outcome of factors such as the level of competition, predation and parasitism suffered in the region of invasion, the availability of hosts and the suitability of the environmental conditions (Derksen, 2009). Host selection could also depend on the different *S. dorsalis* biotypes/cryptic species (Hoddle et al., 2008; Kumar et al., 2013).

### 3.4.2. EU distribution of main host plants

Even though host preferences occur, the host range of *S. dorsalis* in the EU is expected to include various fruit, ornamental and vegetable crops, as well as wild plant species. Most of these hosts are widely distributed in the risk assessment area, both in open field and/or in glasshouses (Vierbergen and van der Gaag, 2009).

### 3.4.3. Analysis of the potential distribution in the EU

At present, *S. dorsalis* has a tropical and subtropical distribution outdoors. Different development thresholds and DD summations have been reported in the literature, and these also depend on the host plants (Derksen, 2009). For example, Tatara (1994) identified 9.7 °C as the lower developmental threshold, with 265 DD as the DD summation from egg to adult on *Citrus reticulata* (mandarin orange), while Shibao (1996) recorded 8.5 °C with 294.1 DD on *Vitis*. Furthermore, information on the lethal cold temperatures is available. *S. dorsalis* cannot overwinter outdoors in areas where the minimum temperature reaches –4 °C, or below, for five or more days during the year (Seal and Klassen, 2008; Vierbergen and van der Gaag, 2009).

These results suggest that *S. dorsalis* is most likely to establish outdoors in the warmer (e.g. southern) regions of Europe and that the climate in central and northern Europe is unfavourable for its establishment, despite host availability (MacLeod and Collins, 2006). Host plants are very widely distributed in the EU and therefore do not represent a limiting factor for establishment. As the host range of *S. dorsalis* includes a number of protected vegetable crops and some flower crops, glasshouses enable the pest to be present also in central and northern parts of the EU (Vierbergen and

[5] Council Directive 2008/90/EC of 29 September 2008 on the marketing of fruit plant propagating material and fruit plants intended for fruit production. OJ L 267/8, 8.10.2008, p. 8–22.

van der Gaag, 2009), with transient populations occurring outdoors having the potential to give rise to outbreaks (MacLeod and Collins, 2006).

Within the area of potential distribution of the pest, which is mainly determined by climatic factors, regional variations in population abundance and impact are expected because of variations in abiotic conditions, competition with established herbivore and predator communities, availability of a given host in an area and different standards for local integrated pest management. In addition, the possible presence of regional locally adapted populations of *S. dorsalis* could result in different population dynamics and impact (Derksen, 2009).

Considering the climatic requirements of *S. dorsalis* and the analysis of similarity between the climate in Europe and in areas where the species is already established outdoors, the Panel considers that the Mediterranean area in the EU is suitable for the establishment of the pest. Uncertainty affecting establishment mainly relates to the role of winter temperatures in limiting potential establishment far from the Mediterranean coast and the role other abiotic factors, as well as biological factors, in preventing the potential to build up populations in new areas.

### 3.4.4. Spread capacity

Facilitated by globalisation and trade, *S. dorsalis* has considerably expanded its range. EPPO (1997) recognised that this pest has a significant potential for global expansion. This is confirmed by its recent invasion history (MacLeod and Collins, 2006). Since many hosts are frequently traded and widely distributed within the EU, these factors present a high risk of new entries and spread throughout the EU.

The difficulty of detecting *S. dorsalis* when it is present in low numbers increases the probability of it remaining undetected during transport, and this in turn influences the probability of spread. This is particularly the case for eggs, which can be overlooked when inserted into leaves. In addition, pupae can be hidden in leaf axils, in leaf curls and under the calyces of flowers and fruits, as well as in the soil (MacLeod and Collins, 2006). In the past, mature fruits were not considered a potential pathway, but detections in consignments of harvested fruit have significantly changed this view (MacLeod and Collins, 2006). During transport, the host plant provides a controlled environment with moisture and nutrients, protecting the thrips from extreme temperatures, topical pesticides and vigorous washes that do not penetrate the tight folds of buds to remove or exterminate the thrips (Derksen, 2009). These aspects can be regarded as factors that increase the survival of the pest during transport.

Some other characteristics that influence the spread capacity of *S. dorsalis* include:

- Active flight of thrips is mainly important for local dispersal (Derksen, 2009). Adults fly actively for short distances as soon as the population density at their reproduction sites reaches the peak density in each period (Masui, 2007a). Passive dispersal on wind currents enables long-distance spread and is favoured by thrips' low mass and high surface area, attributable to their fringed wings (Derksen, 2009).
- Since thrips are parthenogenetic insects with a short-generation time, a few individuals can produce a self-sustaining population able to establish in a new area. This has been supported by experimental evidence (Derksen, 2009).
- Sensitivity to population density and intraspecific competition may be increased by conditions affecting host quality, resulting in mass dispersal to relieve population pressures. It may be that reduced host quality triggers the thrips to disperse, causing additional outbreaks. There is some evidence supporting this hypothesis with regard to *S. dorsalis* (Derksen, 2009).
- Given the high polyphagy of *S. dorsalis*, many wild plant species can serve as a reservoir for dispersal to cultivated plants (Seal et al., 2010). The availability of the host plants significantly increases the success of dispersal.

- The biological characteristics of the pest and the association of different pathways, as well as the passive dispersal on wind currents, enable long-distance spread and support the conclusion that *S. dorsalis* has a high spread capacity with low uncertainty.

## 3.5. Elements to assess the potential for consequences in the EU

### 3.5.1. Potential pest effects

*S. dorsalis* feeds on tender plant tissues above the soil surface, such as meristems and terminals, producing feeding scars, leaf distortions and discoloration of buds, flowers and young fruits.

The extraction of individual epidermal cells contents with piercing and sucking mouthparts produces plant tissue necrosis. The colour of affected parts changes from silvery to brown or black, leaves curl upwards and the abscission of tender leaves and buds leads to complete defoliations and yield losses. Infested fruits develop corky tissues (Kumar et al., 2013), rendering them unsuitable for marketing.

*S. dorsalis* has been reported as a major threat to citrus and grapes in Japan and vegetable production in China and the USA (Kumar et al., 2013). Heub et al. (2013) reported serious damage to citrus production in South Korea.

In Asia, *S. dorsalis* affects citrus production by causing leaf and flower deformation, fruit damage and yield reduction (Masui, 2007b). On grapes, heavy infestations have resulted in reduced fruit set and reduced marketability of afflicted fruits (Ananthakrishnan, 1971). Damage, from fruit scarring to total plant defoliation, have been observed on mango in Taiwan (Lee and Wen, 1982); the pest feeds on the underside of leaf surfaces at the midrib and on fruits (Zaman and Maiti, 1994). Yield losses on chilli peppers range from 20 % (Ahmed et al., 1987) to nearly 50 % (Sanap and Nawale, 1987; Varadarajan and Veeravel, 1996), with deformation of leaves reaching almost 75 % in some varieties (CAPS, 2007). In cotton, *S. dorsalis* was responsible, with other sucking pests, of reducing the yield of seed by 77 %, in addition to a drop in fibre yield and quality (Gupta and Gupta, 1999). Estimated yield loss of 25 to 67 % has been recorded when the population density is high. On tea, feeding was also observed on older leaves, producing browning and defoliation (Ananthakrishnan, 1971). *S. dorsalis* on roses represents a major pest for the Indian cut-flower industry, affecting the quality, number, size and appearance of flowers (Onkarappa and Mallik, 1998; Duraimurugan and Jagadish 2004). On this host, the order of preference of *S. dorsalis* is buds > larger flowers > smaller flowers > leaves, as observed by Mannion et al. (2013).

In its summary of phytosanitary risk, EPPO (2007) stated that: "*S. dorsalis* is mainly a tropical species, but its occurrence in citrus-growing areas with a subtropical climate suggests that it could possibly establish on citrus in southern Europe and the Mediterranean area" and Macleod and Collins (2006) noted that it "is a risk to a broad range of crops grown outdoors in southern Europe". However, there has been no detailed assessment of the potential impacts to outdoor crops in southern parts of the EU. Although many factors affect the magnitude of impacts, the suitability of the climate and the number of generations that can develop per year have been used by Nietschke et al. (2008) to assess the potential for impacts in North America.

The Panel adopted a similar approach to explore the potential for impacts in the EU by comparing the number of possible generations in summer in southern Europe with two locations north of the tropics where *S. dorsalis* has been reported as causing severe damage to citrus. These locations are (i) Jeju Island in southern South Korea (latitude 126° E, longitude 30° N), where Heub et al. (2013) found that the damage to citrus was related to the population density of the third and sixth generations of *S. dorsalis* and the suitability of host plants surrounding the orchards; and (ii) Shizuoka (latitude 138° E, longitude 35° N) in southern Japan (Tatara and Furuhashi, 1992). Nietschke et al. (2008) mapped the number of generations in North America possible for *S. dorsalis* based on the minimum threshold of development of 9.7 °C with 281 DD for each generation obtained by Tatara (1994) and a minimum lethal temperature of –4 °C based on a related species, *Thrips palmi*, with a similar development threshold and DD requirement (McDonald et al., 2000). The Panel applied these DD calculations and lethal temperature limits to a 10′ latitude and 10′ longitude gridded 1961–1990 monthly climatology (New et al., 2002) and mapped the number of generations possible in a geographic information system (ArcGIS). Figure 2 shows that six or more generations are possible at the two locations in southern Japan and South Korea, and Figure 3 shows that similar numbers of generations could occur in southern Europe. Although this climatic comparison indicates that summer temperatures in many parts of southern EU MSs are suitable for a similar number of generations of *S. dorsalis* as locations where serious economic damage occurs in South Korea and Japan, there are numerous uncertainties. In addition to the imprecision in the thresholds applied and the uncertainties caused by the use of monthly averaged data, southern Europe has much drier summers than South Korea and southern Japan, and Nietschke et al. (2008) note that humidity and rainfall may either favour thrips development or increase mortality, as for *Frankliniella occidentalis* in southern California and Israel (Chyzik and Orna-Ucko, 2002).

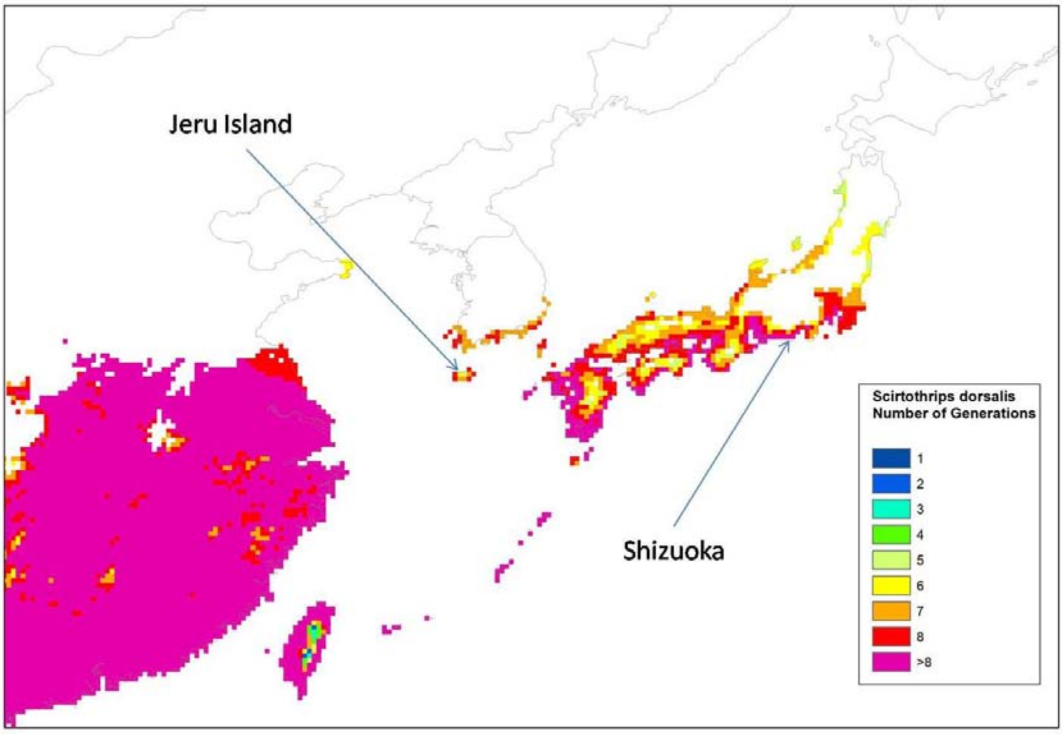


**Figure 2:** The estimated numbers of generations of *Scirtothrips dorsalis* in southern Japan and South Korea based on a minimum development threshold of 9.7 °C and 281 DD per generation, excluding areas with a minimum lethal temperature of –4 °C, calculated with a 10′ latitude and 10′ longitude gridded 1961–1990 monthly climatology © EFSA

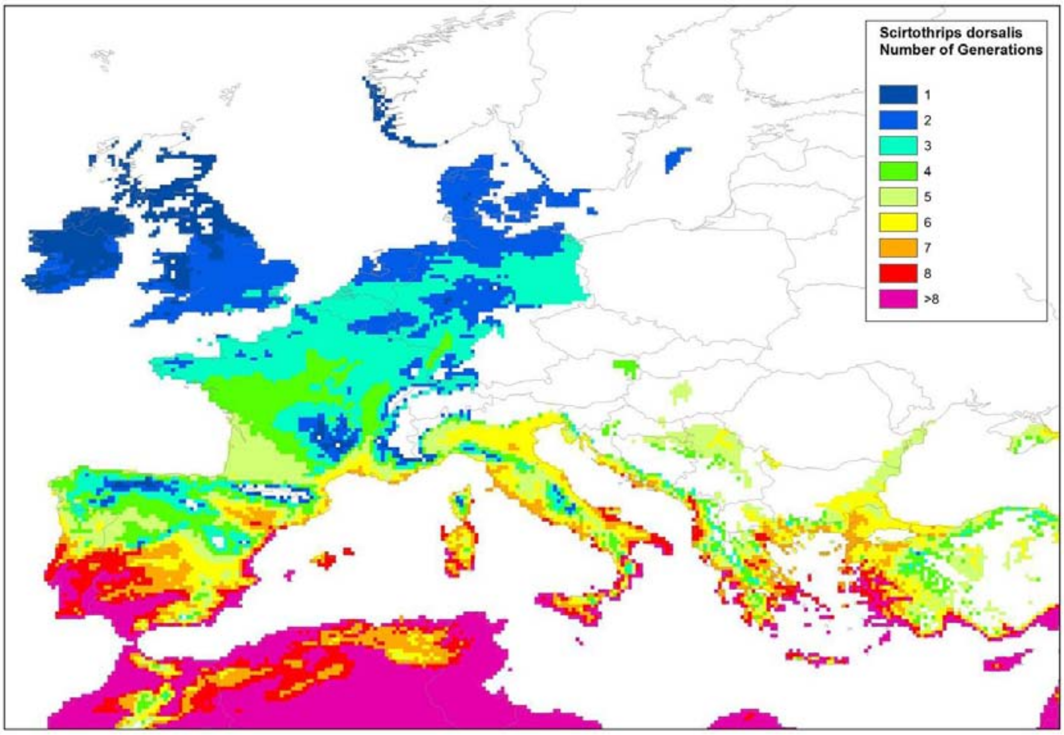


**Figure 3:** The estimated numbers of generations of *Scirtothrips dorsalis* in Europe based on a minimum development threshold of 9.7 °C and 281 DD per generation, excluding areas with a minimum lethal temperature of –4 °C, calculated with a 10′ latitude and 10′ longitude gridded 1961–1990 monthly climatology © EFSA

The pest risk analyses prepared by the Central Science Laboratory, UK (MacLeod and Collins, 2006), and the Plant Protection services of the Netherlands (Vierbergen and van der Gaag, 2009) describe the potential consequences that could be caused by the pest under protected conditions in specific locations. Vierbergen and van der Gaag (2009) concluded that the impact of *S. dorsalis* in Dutch glasshouses will be low because existing pest management practices are expected to keep the pest population below the economic threshold. However, they also noted that there is medium uncertainty for this assessment because of poor information on the behaviour of *S. dorsalis* in glasshouses and limits to the efficacy of the control methods available. Although the UK has experienced difficulty in eradicating its single outbreak of *S. dorsalis*, no damage has been reported (see section 3.5.2), reinforcing the conclusions drawn by Vierbergen and van der Gaag (2009).

*S. dorsalis* is also an efficient vector of many viruses and, in particular, of three tospoviruses: groundnut bud necrosis virus (GBNV), groundnut chlorotic fan-spot virus (GCFSV) and groundnut yellow spot virus (GYSV) (EFSA PLH Panel, 2012). Host plants for these viruses are not grown in the EU. The pest's capacity also to vector tomato spotted wilt virus (TSWV) remains under discussion (Seal et al., 2010). However, a new strain of *S. dorsalis* infesting capsicum, and also mango and tea, in Japan was identified as a potential vector of TSWV in capsicum (Toda et al., 2014).

*S. dorsalis* is also mentioned as a vector of the chilli leaf curl virus (CLCV) and tobacco streak virus (TSV) (Prasada Rao et al., 2003).

*S. dorsalis* can cause defoliations and yield losses and render fruit unsuitable for marketing. Most reported damage occurs in tropical areas and in Japan, where the climate is temperate to subtropical. The crops affected include those grown outdoors in subtropical areas and/or under protected cultivation in the EU, such as citrus, grapes, roses, a large range of vegetables and other crops. Damage is reported, in particular, when the density of the thrips is high, but there is also a risk when populations are low since *S. dorsalis* may also transmit various plant viruses.

### 3.5.2. Observed pest impact in the EU

Although thrips have been detected in one glasshouse in a botanical garden in southern England, where it is still under eradication, and in the Netherlands, where it has been successfully eradicated, no impacts have been reported.

## 3.6. Currently applied control methods

### 3.6.1. Outside the EU

Kumar et al. (2013) provide a review of the control measures used against *S. dorsalis*.

Cultural, chemical and biological control is applied against *S. dorsalis*, but control methods are still under development. There are recommendations for crop rotation, weed removal, insecticide rotation, favouring natural enemies and synthetic reflective (vinyl) film to protect citrus crops. Some plants seem to have a natural resistance to feeding *S. dorsalis* (e.g. varieties of pepper plants).

#### 3.6.1.1. Chemical control

Kumar et al. (2013) list a wide spectrum of active ingredients that can be used in controlling the thrips. These authors show, in Table 3 of their publication, the combinations of chemical compounds that are used. These chemicals include organophosphates, such as quinalphos, dimethoate, phosphamidon, malathion, fenthion and monocrotophos, are applied, as well as the carbamate carbaryl. Ten novel chemical insecticides have been reported to provide good control of the pest. Suppression of the pest seems to last longer if three or more insecticides from different action classes are applied in rotation.

Seal et al. (2006) compared several insecticides against *S. dorsalis* on field-grown pepper in Florida. Chlorfenapyr was the most effective, followed by spinosad and imidacloprid. The other insecticides, novaluron, abamectin, spiromesifen, cyfluthrin, methiocarb and azadirachtin, performed inconsistently, but all were effective when applied repeatedly.

Owing to the frequent use of insecticides, *S. dorsalis* developed resistance to some compounds. Resistance to organochlorine (dichlorodiphenyltrichloroethane (DDT), benzene hexachloride (BHC) and endosulfan), organophosphate (acephate, dimethoate, phosalone, methyl-o-demeton, monocrotophos and triazophos) and carbamate (carbaryl) insecticides was recorded. Rotation of insecticides decreases the problem of resistance (Kumar et al., 2013).

#### 3.6.1.2. Biological control

In fields in Japan, several predatory mites of the family Phytoseiidae have been shown to suppress *S. dorsalis* populations satisfactorily (Mochizuki, 2003; Shibao et al., 2004).

*Orius* spp. (Hemiptera: Anthocoridae) and the phytoseiid mites *Neoseiulus cucumeris* and *Amblyseius swirskii* have been identified as being effective on pepper (Kumar et al., 2013). The authors also indicate that the predatory mite *Euseius sojaensis* was effective in regulating *S. dorsalis* on grapes. Other predatory phytoseiid mites that showed promise for use as a biological control include *E. hibisci* and *E. tularensis* (Kumar et al., 2013).

### 3.6.2. In the EU

According to the UK NPPO: "*S. dorsalis* was detected at a botanic garden in southern England in 2007 and is still present in one glasshouse. The pest was initially found in three glasshouses at the botanic garden, but after an eradication campaign, the pest is now restricted to one glasshouse where it is under containment. Statutory measures are in place to reduce the risk of the pest being moved to new locations. The following insecticides were used as part of the eradication campaign: spinosad, abamectin, thiacloprid, *Beauveria bassiana* and SB Plant Invigorator (Carbonic acid diamide/urea). In addition, a restricted plant health pesticide approval was obtained for the use of methiocarb.

Methiocarb is one of the most effective compounds for use against thrips, but the restricted approval has now expired and will not be renewed" (UK NPPO, 2014, unpublished data).

According to Vierbergen (2007), *S. dorsalis* can be more exposed on plants than *F. occidentalis*, whose larvae are often difficult to reach with insecticides, and chemical treatment could therefore be more effective. In glasshouses in the Netherlands, the existing pest management practices applied against other pests in Dutch glasshouses were expected to keep the pest population at low levels (Vierbergen and van der Gaag, 2009).

In addition, for crops produced under protected cultivation, the use of screens to reduce insect entry into greenhouses has become a common practice in many countries. Anti-insect nets with an appropriate mesh are used to prevent thrips species from reaching the crops (Teitle, 2007) and could also contain the thrips in the greenhouse.

### 3.7. Uncertainty

- <u>Uncertainty on pest presence and/or absence in the EU</u>: only the Netherlands confirmed the absence of the pest through survey. Surveys have not been performed on this pest in all EU MSs.
- <u>Uncertainty on potential establishment</u>: mainly relates to the role of winter temperature in limiting the potential for establishment away from the Mediterranean coast and the role of other abiotic and biotic factors in preventing the potential for establishment in new areas. Moreover, despite continuing interceptions in the EU, it is currently established in only one glasshouse in southern England.
- <u>Uncertainty on virus transmission</u>: the Panel did not explore the potential consequences that could be caused by the introduction of non-European viruses vectored by *S. dorsalis*.

## CONCLUSIONS

The Panel summarises in the tables below its conclusions on the key elements addressed in this scientific opinion in consideration of the pest categorisation criteria defined in ISPM 11 and ISPM 21 and of the additional questions formulated in the terms of reference.

**Table 5:** The Panel's conclusions on the pest categorisation criteria defined in the International Standards for Phytosanitary Measures No 11 and No 21, and on the additional questions formulated in the terms of reference

| Criterion for pest categorisation | Panel's conclusions on ISPM 11 criterion | Panel's conclusions on ISPM 21 criterion | Uncertainties |
|---|---|---|---|
| **Identity of the pest** | *Is the identity of the pest clearly defined? Do clearly discriminative detection methods exist for the pest?*<br>*Scirtothrips dorsalis* is generally treated as a distinct taxon although some authors consider *S. dorsalis* to be a species complex of at least three separate species<br>Reliable identification of *S. dorsalis* requires a combination of morphological and molecular methods | | Some researchers consider *S. dorsalis* to be a species complex that may comprise at least three separate species |

| Criterion for pest categorisation | Panel's conclusions on ISPM 11 criterion | Panel's conclusions on ISPM 21 criterion | Uncertainties |
|---|---|---|---|
| **Absence/presence of the pest in the risk assessment area** | *Is the pest absent from all or a defined part of the risk assessment area?*<br><br>The pest is not established in the EU; however, there is an outbreak in a botanic garden glasshouse in the UK subject to official control | *Is the pest present in the risk assessment area?*<br><br>The pest is not established in the EU; however, there is an outbreak in a botanic garden glasshouse in the UK subject to official control | Only one MS confirmed the absence of the pest through survey. Surveys have not been performed on this pest in all EU MSs |
| **Regulatory status** | *Mention in which annexes of 2000/29/EC and the marketing directives the pest and associated hosts are listed without further analysis. Indicate also whether the hosts and/or commodities for which the pest is regulated in AIIAI or II are comprehensive of the host range.*<br><br>This species is a regulated harmful organism in the EU and listed in Council Directive 2000/29/EC in Annex IIAI. *S. dorsalis* is a polyphagous pest with over 225 host plant species, and the pest has many more potential hosts than those for which it is regulated in Annex IIAI. In addition, it is important to mention that other specific commodities could also be a pathway of introduction of the pest in the risk assessment area, such as soil and growing media, cut flowers and fruits and vegetables of the host plants | | |
| **Potential establishment and spread** | *Does the risk assessment area have ecological conditions (including climate and those in protected conditions) suitable for the establishment and spread of the pest?*<br><br>*Indicate whether the host plants are also grown in areas of the EU where the pest is absent*<br><br>*And, where relevant, are host species (or near relatives), alternate hosts and vectors present in the risk assessment area?*<br><br>Outdoors, in southern areas of the EU, conditions are suitable for the pest to establish and spread<br><br>Under protected conditions the pest could establish and spread throughout the EU<br><br>Considering the climatic requirements of *S. dorsalis*, and the analysis of similarity between the climate in Europe and in areas where the species is already established, the Panel considers that the Mediterranean area of the EU is suitable for the establishment of the pest. The biological characteristics of the pest and the association of different pathways, as well as the passive dispersal on wind currents, enable long-distance spread and support the conclusion that *S. dorsalis* has a high spread capacity | *Are plants for planting a pathway for introduction and spread of the pest?*<br><br>Plants for planting are a pathway for introduction and spread. However, all kinds of host plant material can also act as a pathway | Uncertainty affecting establishment mainly relates to the role of winter temperatures in limiting the potential for establishment away from the Mediterranean coast and the role other abiotic factors, as well as biological factors, can have in preventing the possibility of populations establishing in new areas |

| Criterion for pest categorisation | Panel's conclusions on ISPM 11 criterion | Panel's conclusions on ISPM 21 criterion | Uncertainties |
|---|---|---|---|
| **Potential for consequences in the risk assessment area** | *What are the potential for consequences in the risk assessment area? Provide a summary of impact in terms of yield and quality losses and environmental consequences*<br><br>*S. dorsalis* can cause defoliations and yield losses, rendering fruits unsuitable for marketing, as reported in tropical areas and in Japan, where the climate is temperate to subtropical. The crops affected include those grown outdoors, especially in southern areas of the EU, and/or under protected cultivation, such as citrus, grapes, roses, a large range of vegetables and other crops. Damage is reported, in particular, when the density of the thrips is high, but there is also a risk when populations are low since *S. dorsalis* may also transmit various plant viruses. Based on its phenology, the Panel showed that the climate in southern Europe could enable a similar number of generations to develop, as in Japan and South Korea where significant damage occurs to citrus and other crops outdoors | *If applicable is there indication of impact(s) of the pest as a result of the intended use of the plants for planting?*<br><br>As a result of the trade in plants for planting, introductions and impacts may occur | Uncertainty remains on the non-European viruses potentially vectored by *S. dorsalis* |
| **Conclusion on pest categorisation** | *S. dorsalis* is a well-defined organism, although there is some evidence from Japan to show that there is a strain with a host preference for capsicum that can be distinguished with molecular methods<br><br>The species is highly polyphagous, and its hosts include many important crops that are grown in the EU (e.g. citrus, grapes, capsicum and roses). The ecological conditions exist in the EU for its establishment and spread outdoors and in protected cultivation<br><br>Large areas of southern Europe have similar climatic conditions to locations in Asia where serious damage occurs to citrus. In addition, *S. dorsalis* may also transmit various plant viruses<br><br>Currently, the pest is established in only one botanic garden glasshouse in southern England | *S. dorsalis* is a well-defined organism. Plants for planting and cuttings are considered as a pathway for introduction and spread of the pest | However, although it continues to be intercepted in the EU, it is currently only established in one glasshouse in southern England |

| Criterion for pest categorisation | Panel's conclusions on ISPM 11 criterion | Panel's conclusions on ISPM 21 criterion | Uncertainties |
|---|---|---|---|
| **Conclusion on specific terms of reference questions** | *Provide*<br>*- a brief summary of the analysis of the present distribution of the organism in comparison with the distribution of the main hosts, and the distribution of hardiness/climate zones, indicating in particular if in the risk assessment area, the pest is absent from areas where host plants are present and where the ecological conditions (including climate and those in protected conditions) are suitable for its establishment*<br>*S. dorsalis* is not present in the EU, except in one glasshouse in a botanic garden in southern England, UK. Regarding its potential area of establishment, it is absent from southern EU and from protected cultivation where its hosts are present and the climatic conditions are suitable<br>- *the analysis of the observed impacts of the organism*<br>No impacts have been observed at its single location in a botanic garden glasshouse in southern England | | |

## REFERENCES


Ahmed K, Mohammed MG and Murthy NSR, 1987. Yield losses due to various pests in hot pepper. Capsicum Newsletter, 6, 83–84.

Aliakbarpour H and Rawi CSM, 2010. Diurnal activity of four species of thrips (Thysanoptera: Thripidae) and efficiencies of three nondestructive sampling techniques for thrips in mango inflorescences. Journal of Economic Entomology, 103, 631–640.

Ananthakrishnan TN, 1971. Thrips in agriculture, horticulture and forestry—diagnosis, bionomics and control. Journal of Scientific and Industrial Research (CSIR) (New Delhi), 30, 130–146.

Ananthakrishnan TN, 1993. Bionomics of thrips. Annual Review of Entomology, 38, 71–92.

Bell H, Wakefield M, Macarthur R, Stein J, Collins D, Hart A, Roques A, Augustin S, Yart A, Péré C, Schrader G, Wendt C, Battisti A, Faccoli M, Marini L and Petrucco Toffolo E, 2014. A review of the literature relevant to the monitoring of regulated plant health pests in Europe. Datasheet on *Scirtothrips dorsalis.* Appendix C to the Plant health surveys for the EU territory: an analysis of data quality and methodologies and the resulting uncertainties for pest risk assessment (PERSEUS). EFSA Supporting Publications 2014, EN-676, 551–553. Available online at: http://www.efsa.europa.eu/en/supporting/doc/676e.pdf.

CABI (CAB International), 2014. Report—*Scirtothrips dorsalis*—Report generated on 25/08/2014. Invasive Species Compendium. Datasheets, maps, images, abstracts and full text on invasive species of the world. CABI, Wallingford, UK. Available online at: http://www.cabi.org/isc/datasheetreport?dsid=49065.

CAPS (Cooperative Agricultural Pest Survey), 2007. Grape commodity based survey reference. cooperative agricultural pest survey. Animal and Plant Health Inspection Service (APHIS), United States Department of Agriculture (USDA). 227pp. Available online at: http://www.aphis.usda.gov/plant_health/plant_pest_info/pest_detection/index.shtml.

Chu CC, Ciomperlik MA, Chang NT, Richards M and Henneberry TJ, 2006. Developing and evaluating traps for monitoring *Scirtothrips dorsalis* (Thysanoptera: Thripidae). The Florida Entomologist, 89, 47–55.

Chyzik R and Orna-Ucko J, 2002. Seasonal abundance of the western flower thrips *Frankliniella occidentalis* in the Arava Valley of Israel. Phytoparasitica, 30, 335–346.

Derksen AI, 2009. Host susceptibility and population dynamics of *Scirtothrips dorsalis* Hood (Thysanoptera: Thripidae) on select ornamental hosts in Southern Florida. Masters Thesis, University of Florida, Gainesville, FL, USA, 136 pp.

Duraimurugan P and Jagadish A, 2004. Evaluation of suitable techniques and determination of appropriate stage for sampling thrips in rose flowers. Food, Agriculture and Environment, 2, 187–189.

EFSA PLH Panel (EFSA Panel on Plant Health), 2010. PLH Guidance on a harmonised framework for pest risk assessment and the identification and evaluation of pest risk management options by EFSA. EFSA Journal 2010;8(2):1495, 68 pp. doi:10.2093/j.efsa.2010.1495.

EFSA PLH Panel (EFSA Panel on Plant Health), 2012. Scientific Opinion on the pest categorisation of the tospoviruses. EFSA Journal 2012;10(7):2772, 101 pp. doi:10.2903/j.efsa.2012.2772.

EPPO (European and Mediterranean Plant Protection Organization), 1997. *Scirtothrips dorsalis*, In: Quarantine pests for Europe, 2nd Edn. Eds Smith IM, McNamara DG, Scott PR and Holderness M. CABI/EPPO, Wallingford, UK, 1 425 pp.

EPPO (European and Mediterranean Plant Protection Organization), 2005. Diagnostic PM 7/56. *Scirtothrips aurantii*, *Scirtothrips citri*, *Scirtothrips dorsalis*. OEPP/EPPO, Bulletin OEPP/EPPO Bulletin, 35, 271–273.

EPPO (European and Mediterranean Plant Protection Organization) PQR (Plant Quarantine Data Retrieval System version 5.3.1.), 2012. EPPO database on quarantine pests.

FAO (Food and Agriculture Organization of the United Nations), 2004. ISPM (International Standards for Phytosanitary Measures) 21—Pest risk analysis of regulated non-quarantine pests. FAO, Rome, 30 pp. Available online at: https://www.ippc.int/core-activities/standards-setting/ispms

FAO (Food and Agriculture Organization of the United Nations), 2013. ISPM (International Standard for Phytosanitary Measures) 11—Pest risk analysis for quarantine pests. FAO, Rome, 36 pp. Available online at: https://www.ippc.int/core-activities/standards-setting/ispms.

Farris RE, Ruiz-Arce R, Ciomperlik M, Vasquez JD and Deleon R, 2010. Development of a ribosomal DNA ITS2 marker for the identification of the thrips, *Scirtothrips dorsalis*. Journal of Insect Science, 10, 1–15.

Fytosignalering, 2009. Fytosanitaire signalering 2009. Plantenziektenkundige Dienst, Ministerie van Landbouw, Nederland. Natuur en Voedselkwaliteit, p. 7.

Gupta MP and Gupta DP, 1999. Effect of incidence of insect pests and their control measures on fibre quality of cotton hybrids. Journal of Insect Science, 12, 58–62.

Heub SJ, Seog KC, Taek YY, Yeong HS and Chan LS, 2013. Annual occurrent pattern of *Scirtothrips dorsalis* (Thysanoptera: Thripidae) on citrus trees and surrounding host plants. SO Korean Journal of Applied Entomology, 52(3), 185–191.

Hoddle MS, Heraty JM, Rugman-Jones PF, Mound LA and Stouthamer R, 2008. Relationships among species of *Scirtothrips* (Thysanoptera: Thripidae, Thripinae) using molecular and morphological data. Annals of the Entomological Society of America, 101, 491–500.

IPPC (Intergovernmental Panel on Climate Change), 2009. *Scirtothrips dorsalis*. Report GBR-13/1. Available online at: https://www.ippc.int/index.php?id=1110879&frompage=122&tx_pestreport_pi1%5bshowUid%5d=209954&type=pestreport&L=0.

Kumar V, 2012. Characterizing phenotypic and genetic variations in the invasive chilli thrips, *Scirtothrips dorsalis* Hood (Thysanoptera: Thripidae). PhD Thesis. University of Florida, Gainesville, FL, USA.

Kumar V, Kakkar G, McKenzie CL, Seal DR and Osborne LS, 2013. An overview of chilli thrips, *Scirtothrips dorsalis* (Thysanoptera: Thripidae) biology, distribution and management. In: Weeds and pest control – conventional and new challenges, 53–77.

Lee H and Wen H, 1982. Seasonal occurrence of and injury caused by thrips and their control on mangoes. Plant Protection Bulletin (Taiwan), 24, 179–187.

McDonald JR, Head J, Bale JS and Walters KFA, 2000. Cold tolerance, overwintering and establishment potential of *Thrips palmi*. Physiological Entomology, 25, 159–166.

MacLeod A and Collins D, 2006. CSL pest risk analysis for *Scirtothrips dorsalis*. CSL (Central Science Laboratory), 8 pp. Available online: http://www.fera.defra.gov.uk/plants/plantHealth/pestsDiseases/documents/scirto.pdf

Mannion CM, Derksen AI, Seal DR, Osborne LS and Martin CG, 2013. Effects of rose cultivars and fertilization rates on populations of *Scirtothrips dorsalis* (Thysanoptera: Thripidae) in Southern Florida. Florida Entomologist, 96, 403–411.

Masui S, 2007a. Timing and distance of dispersal by flight of adult yellow tea thrips, *Scirtothrips dorsalis* Hood (Thysanoptera: Thripidae). Japanese Journal of Applied Entomology and Zoology, 51, 137–140.

Masui S, 2007b. Synchronism of immigration of adult yellow tea thrips, *Scirtothrips dorsalis* Hood (Thysanoptera: Thripidae) to citrus orchards with reference to their occurrence on surrounding host plants. Applied Entomology and Zoology, 42, 517–523.

Mochizuki M, 2003. Studies on use of the pesticide resistant predatory mite *Amblyseius womersleyi* Schicha (Acari: Phytoseiidae) for integrated pest management on tea plants. Bulletin of the National Institute of Vegetable and Tea Science, 2, 93–138.

Mound LA, Tree DJ and Paris D, 2014. *Scirtothrips dorsalis*—Recognition data. IOzThrips, Thysanoptera in Australia. Available online: http://www.ozthrips.org/terebrantia/thripidae/thripinae/scirtothrips-dorsalis/.

New M, Lister D, Hulme M and Makin I 2002. A high-resolution data set of surface climate over global land areas. Climate Research, 21, 1–25.

Nietschke BS, Borchert DM, Magarey RD and Ciomperlik MA, 2008. Climatological potential for *Scirtothrips dorsalis* (Thysanoptera: Thripidae) establishment in the United States. Florida Entomologist, 91, 79–86.

Onkarappa S, and Mallik B, 1998. Distribution and management of *Scirtothrips dorsalis* Hood (Thysanoptera: Thripidae) on rose, In: Advances in IPM for horticultural crops. Eds Reddy PP, Kumar NK and Verghese A. Indian Institute of Horticultural Research, Bangalore, India, 165–167.

Prasada Rao RDVJ, Reddy AS, Reddy SV, Thirumala-Devi K, Chander Rao S, Manoj Kumar V, Subramaniam K, Yellamanda Reddy T, Nigam SN and Reddy DVR, 2003. The host range of Tobacco streak virus in India and transmission by thrips. Annals of Applied Biology, 142, 365–368.

Rugman-Jones PF, Hoddle MS, Mound LA and Stouthamer R, 2006. Molecular identification key for pest species of *Scirtothrips* (Thysanoptera: Thripidae). Journal of Economic Entomology, 99, 1813–1819.

Sanap MM and Nawale RN, 1987. Chemical control of chilli thrips, *Scirtothrips dorsalis*. Vegetable Science, 14, 195–199.

Seal DR and Klassen W, 2008. Chilli thrips, *Scirtothrips dorsalis* Hood (Thysanoptera: Thripidae). In: Encyclopedia of Entomology, 2nd Edn. Ed. Capinera J L, Springer. 844–849.

Seal DR and Klassen W, 2012. Chilli thrips (castor thrips, Assam thrips, yellow tea thrips, strawberry thrips), *Scirtothrips dorsalis* Hood, provisional management guidelines. University of Florida, Gainesville, FL, 3 pp.

Seal DR, Ciomperlik M, Richards ML and Klassen, 2006. Distribution of the Chilli thrips, *Scirtothrips dorsalis* Hood (Thysanoptera: Thripidae), within pepper plants and within pepper fields on St. Vincent. The Florida Entomologist, 89, 311–320.

Seal DR, Klassen W and Kumar V, 2010. Biological parameters of *Scirtothrips dorsalis* (Thysanoptera: Thripidae) on selected hosts. Environmental Entomology, 39, 1389–1398.

Shibao M, 1996. Effects of temperature on development of the chilli thrips, *Scirtothrips dorsalis* Hood (Thysanoptera: Thripidae), on grape. Applied Entomology and Zoology, 31, 81–86.

Shibao M, Tanaka F, Tsukuda R and Fujisaki K, 1991. Overwintering sites and stages of the chilli thrips, *Scirtothrips dorsalis* Hood (Thysanoptera: Thripidae) in grape fields. Japanese Journal of Applied Entomology and Zoology, 35, 161–163.

Shibao M and Tanaka H, 2003. The effects of the photoperiod on the development and reproductive diapause of yellow tea thrips, *Scirtothrips dorsalis* Hood on grape. Japanese Journal of Applied Entomology and Zoology (Chugoku Branch), 45, 11–15.

Shibao M, Ehara S, Hosomi A and Tanaka H, 2004. Seasonal fluctuation in population density of phytoseiid mites and the yellow tea thrips, *Scirtothrips dorsalis* Hood (Thysanoptera: Thripidae) on grape, and predation of the thrips by *Euseius sojaensis* (Ehara) (Acari: Phytoseiidae). Applied Entomology and Zoology, 39(4), 727–730.

Tatara A, 1994. Effect of temperature and host plant on the development, fertility and longevity of *Scirtothrips dorsalis* Hood (Thysanoptera: Thripidae). Applied Entomology and Zoology, 29, 31–37.

Tatara A and Furuhashi, 1992. Analytical study on damage to Satsuma Mandarin fruit by *Scirtothrips dorsalis* Hood (Thysanoptera: Thripidae), with particular reference to pest density. Japanese Journal of Applied Entomology and Zoology, 36(4), 217–223.

Teitel M, 2007. The effect of screened openings on greenhouse microclimate. Agricultural and Forest Meteorology, 143, 159–175.

Toda S, Hirose T, Kakiuchi K, Kodama H, Kijima K and Mochizuki M, 2014. Occurrence of a novel strain of *Scirtothrips dorsalis* (Thysanoptera: Thripidae) in Japan and development of its molecular diagnostics, Applied Entomology and Zoology, 49, 231–239.

Tsuchiya M, Masui S and Kuboyama N, 1995. Color attraction of yellow tea thrips (*Scirtothrips dorsalis* Hood). Japanese Journal of Applied Entomology and Zoology, 39, 299–303.

Varadarajan S and Veeravel R, 1996. Evaluation of chilli accessions resistant to thrips, *Scirtothrips dorsalis* Hood (Thysanoptera: Thripidae). Pest Management and Economic Zoology, 4, 85–90.

Venette RC and Davis EE, 2004. Chilli thrips/yellow tea thrips, *Scirtothrips dorsalis* Hood [Thysanoptera: Thripidae]. Mini pest risk assessment. University of Minnesota, St. Paul, MN, USA, 31 pp.

Vierbergen GB, 2007. Increased significance of *Scirtothrips* (Thysanoptera: Thripidae) in the international trade of plants and plant products. Entomofauna-Carpathica, 19, 6–10.

Vierbergen GB and van der Gaag DJ, 2009. Pest risk assessment *Scirtothrips dorsalis*. Plant Protection Service, Ministry of Agriculture, Nature and Food Quality, Wageningen, the Netherlands, 9 pp.

Vierbergen GB, Kucharczyk H and Kirk WDJ, 2010. A key to the second instar larvae of the Thripidae of the Western Palaearctic region (Thysanoptera). Tijdschrift voor Entomologische, 153, 99–119.

Zaman Z and Maiti M, 1994. Insects and mites infesting seedlings of mango in West Bengal. Environment and Ecology, 12, 734–736.

## Abbreviations

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| DD | degree days |
| EFSA | European Food Safety Authority |
| EFTA | European Free Trade Association |
| EPPO | European and Mediterranean Plant Protection Organization |
| EPPO PQR | European and Mediterranean Plant Protection Organization Plant Quarantine Retrieval System |
| ISPM | International Standards for Phytosanitary Measures |
| ITS | internal transcribed spacer |
| MS(s) | Member State(s) |
| NPPO | National Plant Protection Organisation |
| PCR | polymerase chain reaction |
| PLH | EFSA Scientific Panel on Plant Health |
| PRA | pest risk analysis |