Plant Protection Service
Ministry of Agriculture, Nature and Food Quality

Pest Risk Assessment *Scirtothrips dorsalis*

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Ministry of Agriculture, Nature and Food Quality
P.O. BOX 9102
6700 EH Wageningen, The Netherlands

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Assessors: Bert Vierbergen & Dirk Jan van der Gaag

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Pest Risk Assessment

Scirtothrips dorsalis

1. Reason for performing the PRA

The reason for this short PRA is the interception of *Scirtothrips dorsalis* on Mangrove pot plants (*Bruguiera* sp.) imported from Thailand in the Netherlands in November 2008. Larvae and adults were present and possibly also eggs but eggs are present in the plant tissue and cannot be detected by eye. In April 2009, the pest was also intercepted on Crinum plants from Thailand. The first interception was on a *Ficus* bonsai imported from China together with *Thrips palmi* in 2006 (source: NPPO of the Netherlands). Since 1997, *S. dorsalis* has been intercepted in the Netherlands on end produce (cut flowers, vegetables) many times, up to about 60 times per year (source: NPPO of the Netherlands). *S. dorsalis* is regulated in the EU on plants of *Citrus*, *Fortunella*, *Poncirus* and their hybrids, other than fruits and seeds. *S. dorsalis* has, however, a wide host range and known as a pest on many other crops (Venette & Davis, 2004; Macleod & Collins, 2006). For that reason it has been suggested by Macleod & Collins (2006) to extend measures to all plants for planting. Import of infested plants in the Netherlands could be a pathway leading to establishment of the pest in Dutch greenhouses. The organism is known as a pest causing significant damage in tropical and subtropical regions but it is yet unclear how much damage it can cause in greenhouse crops in regions with a temperate climate, like the Netherlands. Two PRA's and an extended pathway evaluation on *S. dorsalis* are known: a mini-risk assessment for the USA (Venette & Davis, 2004) and one PRA made for the whole EU (Macleod & Collins, 2006). In addition, Meissner et al., (2005) have made an elaborate pathway-analysis for the USA. These PRA's do not contain an impact assessment for greenhouse crops in temperate climates and hence the present short PRA mainly focuses on the potential impact of *S. dorsalis* in greenhouses in the Netherlands and does not include a pathway-analysis.

2. Scientific names and taxonomy

Class: Insecta
Order: Thysanoptera
Family: Thripidae
Genus: *Scirtothrips*
Species: *dorsalis* Hood, 1919

Common names: Chilli thrips, Yellow tea thrips

Source: EPPO/CABI, 1997

3. Key aspects of biology (Optional, e.g. size, development time, natural dispersal abilities, feeding biology, fecundity, longevity, natural enemies)

S. dorsalis goes through five developmental phases: egg, two 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. 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 pest has no diapause.

Source: EPPO/CABI, 1997

4. PRA-area
The Netherlands

5. Host plant range (Worldwide)
S. dorsalis is highly polyphagous, including many economically important crops like citrus, roses, sweet and chilli pepper, cotton, groundnuts, tea, strawberry and grapevine (Holtz, 2006).

6. Host plant range (PRA area, including acreage)
Many agricultural crops and plants grown in non-agricultural areas are host plant (e.g. roses, sweet pepper, strawberry and tomato).

7. What is the current area of distribution of the pest?
S. dorsalis is present in tropical Asia (from Pakistan to Japan), in Oceania, Subsaharan Africa, Venezuela and Central America. It has been recently introduced into the USA (Hawaii, Texas and Florida) (Holtz, 2006; see also Macleod & Collins (2006). In 2008, *S. dorsalis* was found in a glasshouse in a botanical garden in the UK. Statutary actions were taken to eradicate the pest (official pest report on https://www.ippc.int/servlet/; visited February 2009).

8. What is the international phytosanitary status?
EU: IIAI, regulated on plants of *Citrus*, *Fortunella*, *Poncirus* en their hybrids, other than fruits and seeds.
EPPO: A2 (source: EPPO PQR, 2008)
USA: *S. dorsalis* is listed as reportable/actionable in the PIN309 Database (Query 2/16/06), and has been intercepted 51 times at ports of entry. *S. dorsalis* is not listed on the Aphis Regulated Plant Pest List (Query 2/16/06) (Holtz, 2006).
Canada: quarantine pest (source: EPPO PQR, 2008)
New Zealand: actionable pest (source: New Zealand NPPO, 2007)

9. Does it occur in the Netherlands?
No. In 1992, an outbreak was detected in a greenhouse on *Cuphea* and *Ficus* and successfully eradicated (Vierbergen, 1994). In 2006, *S. dorsalis* and *Thrips palmi* were found on a consignment of *Ficus* plants during import inspection. The consignment was destroyed (source: NPPO of the Netherlands). *S. dorsalis* was not found during official surveys performed at 125 locations (greenhouses of sweet pepper and roses) in 2007 and 2008 (source: NPPO of the Netherlands).

10. Probability of entry: preliminary pathway analysis
Not included in this short PRA (see also the answer on question 1)

11. Probability of establishment?
(a) Outdoors
It is believed that *S. dorsalis* cannot overwinter outdoors in areas were the minimum temperature reaches –4 degrees Celcius or below for five or more days during the year (Seal & Klassen, 2008). Lethal cold temperatures were not available for *S. dorsalis* but Seal & Klassen (2008) used data reported for *Thrips palmi*, which also has a tropical – sub-tropical distribution. In the Netherlands, temperatures usually reach –4 degrees Celcius or below during five or more days except for some regions very close to the North Sea. For example, Vlissingen, which is located directly along the coast, has on an average 3 days with a minimum temperature below –5°C and 11 days below 0°C. Rotterdam, however, which is about 20 – 25 km located from the North Sea already has 11 days with a minimum temperature below –5°C and 51 days below 0°C (source: http://www.knmi.nl/; website visited February 2009).

Probability of establishment outdoors: Low (uncertainty: medium)

(b) In protected cultivation

A few reports are available on introduction of *S. dorsalis* in greenhouses in regions with a temperate climate (Vierbergen, 1994; Vierbergen et al., 2006; Vierbergen, 2007). On Honshu (Japan), the pest has been reported from plastic greenhouses on tomato in Ibaraki (Nakagaki et al., 1984), as overwintering stages in a greenhouse with grapes in Okayama (Shibao et al., 1991)

and on potted Hydrangea in Saitama and Chiba (Kuriyama et al., 1991) ; In the Republic of Korea, the pest has been reported from plastic greenhouses with grapes on Cheju Island (Moon DooYoung & Lee DonKyun, 1995) In 1992, *S. dorsalis* was found in low numbers in a greenhouse in Hoek van Holland (the Netherlands) on *Cuphea, Ficus* and an unknown plant species. No serious damage to the infested plants was observed. The pest was easily eradicated by chemical treatment from the greenhouse within a few weeks (Vierbergen, 1994). Without the eradication measures, the pest may have established. Recently, *S. dorsalis* was found in a glasshouse in the UK (see question 7). Widespread settlement of *S. dorsalis* in greenhouses in the Netherlands is, however, not very likely because existing pest management practices against pests already present will probably control or even eradicate *Scirtothrips* from the greenhouse (see question 13).

Probability of establishment in protected cultivation: moderate (uncertainty: medium)

Endangered area: most of the crops grown in greenhouses. The total glasshouse area in the Netherlands is about 10,000 ha (source: CBS Statistics Netherlands, http://statline.cbs.nl/StatWeb/publication/).

12. How likely is the pest to spread in the PRA-area? (*naturally and by human assistance*)

(a) human assistance
Spread could be facilitated via trade of host plants. Thrips are especially difficult to detect in low numbers. Eggs are inserted into leaves and difficult to detect. *S. dorsalis* has been found/intercepted on pot plants in the Netherlands in 1992, 2006 and 2008 (source: NPPO of the Netherlands) and on *Epidendrum* pot plants in Denmark in 2000 (source: Europhyt). In Denmark the pest was found on plants that had been imported from Thailand in 1998 and 1999. After the finding, the pest was eradicated by appropriate treatment (source: Europhyt). Many hosts are widely distributed and commonly transported within the PRA area. Thus, because of the difficulties to detect the pest at low infestation levels and the wide host range, spread by movement of plant material can be extensive.

Probability of spread by human assistance: medium – high (uncertainty: medium)

(b) natural spread
Few data are available on flight distances or spread of *S. dorsalis.* Seal et al (2006) showed that *S. dorsalis* adults had a patchy distribution in 48 m^2 -plots and smaller plots in pepper fields in Florida which suggests that adults usually do not fly over large distances. Seal et al (2008) also observed that infestations proceeded with the prevailing wind direction. Kuriyama et al (1991) concluded that introduction of S. dorsalis in a greenhouse was rather due to introduction of infested seedlings than by aerial immigration of the thrips from outside. Their observations also suggest that *S. dorsalis* is not a strong flier.

In glasshouses flight activity of insects is usually lower than in the field as many insects are known to be restricted in their flight activity by covering of greenhouses with UV absorbing materials, glass included (Hemming et al., 2006: http://library.wur.nl/way/bestanden/clc/1807803.pdf [17-2-2009]. Moreover, wind does not play an important role in spread of insects within glasshouses in the Netherlands since glasshouses are generally well isolated.

Probability of spread naturally: low (uncertainty: medium)

13. What is the potential damage when the pest would become introduced? (*without the use of extra control measures*)
Despite the wide area of distribution and the invasive and opportunistic behaviour of *S. dorsalis* no serious outbreaks in greenhouses in regions with a temperate climate have been reported up to know. In (sub-)tropical India, *S. dorsalis* has been reported as a serious pest of roses (in Bangalore) and cassava and taro (in Kerela) under greenhouse conditions (Srdihar & Rani, 2003; Rajamma et al., 2004). Greenhouse conditions in these (sub)tropical areas (http://koeppen-geiger.vu-wien.ac.at/ [February 2009]) are, however, not comparable to those in the Netherlands. Greenhouses in the (sub)tropics are usually not from glass, but transparant plastics and usually

have large openings and pests can easily invade the greenhouses. Because the pest is also present outdoors in India, there will be a continuous influx into the greenhouses which limit the efficacy of control measures inside the greenhouses. Moreover, greenhouse temperatures will be much higher than in the Netherlands. *S. dorsalis* is also present in Israel and Florida where they also grow greenhouse crops. However, the pest has not been reported as a serious pest in greenhouse crops in Israel or Florida. In Japan, few reports are available on *S. dorsalis* in greenhouses (see question 11). Seasonal population dynamics of the pest in greenhouses in Saitama and Chiba prefectures with potted *Hydrangea* was explained by introduction of infested seedlings into the greenhouse rather than by seasonal dynamics of greenhouse populations (Kuriyama et al., 1991). Apparently, greenhouse conditions are much less favourable for *S. dorsalis* than for other thrips species, like *Frankliniella occidentalis*, as the latter one is especially known as a major pest on greenhouse crops both in subtropical as in moderate climates (CABI, 2007).

The thrips species *Frankliniella occidentalis* is commonly present in Dutch greenhouse and growers use insecticides (abamectine, spinosad, methiocarb) and/or biological control agents (predatory mites of the family Phytoseiidae) against this pest (see also question 14). These control measures will probably also control *S. dorsalis*. In 2004, it was reported by the NPPO of Israel that *S. dorsalis* was widespread in the country and that current phytosanitary actions against other thrips species are adequate to control the pest (EPPO Pest Report, 2004). The exposed way of life of *S. dorsalis* on green parts of plants increases the chance to be hit by chemical and biological treatments and it is expected that current pest management practices are for that reason more effective against *S. dorsalis* than against *F. occidentalis* because *F. occidentalis* has a more hidden way of life (e.g. larvae are often present in flower buds where they are difficult to reach with insecticides) (Vierbergen, 2007).

Thus, it is expected that existing pest management practices already applied against other pests in Dutch glasshouses will keep *S. dorsalis* populations below the economic threshold in most glasshouse crops. The wide host plant range of *S. dorsalis*, however, increases the risk of the presence of a currently unknown susceptible greenhouse crop in which pest management practices currently used are not satisfactorily sufficient to control the pest below the economic threshold.

The species may be a vector of peanut bud necrosis virus, peanut yellow spot virus en peanut chlorotic fan-spot virus (Mould, 1996) but these viruses are not considered to form a serious threat to Dutch crops.

Potential economic impact without extra control measures: low - medium (uncertainty: high)

14. Which control measures are available?
(*indicate efficacy of available pesticides and non-chemical methods; also discuss the availability of control measures in the future taking into account the possibility of resistance development against pesticides and possible withdrawal of pesticides*)

Pesticides:
Seal et al. (2006a) 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 inconsistent but all were effective whene applied repeatedly. Chlorfenapyr is not registered in the Netherlands and has not been included on the EU-list of registered active substances (http://ec.europa.eu/food/plant/protection/evaluation/index_en.htm). Spinosad is registered in the following greenhouse grown crops: all floricultural crops, cucumber, tomato, sweet pepper and chilli pepper. Imidacloprid is registered in floricultural crops (application by spraying and drip irrigation), various fruit vegetables (drip irrigation only) grown under protected conditions and various field grown crops (http://www.ctb.agro.nl/). Of the other insecticides mentioned above, abamectin, spiromesifen, methiocarb and azadirachtin are also registered for use in various greenhouse crops in the Netherlands. Cyfluthrin is not registered but the related compound deltamethrin (also a pyrethroid) is expected to be equally effective.

Biological control:
In fields in Japan, several predatory mites of the family Phytoseiidae have shown to suppress *Scirtothrips dorsalis* populations satisfactorily (Mochizuki, 2003; Shibao et al., 2004). These predatory mites were other species that those presently used in the Netherlands against the trips species *Frankliniella occidentalis*. However, predatory mites are not very host specific and mites used in greenhouses in the Netherlands against trips will probably have similar effects on *S. dorsalis* as those studied in Japan (Shibao et al., 2004). It is expected that the currently used Phytoseiidae against trips in Dutch greenhouses are effective against outbreaks of *S. dorsalis*. They even may protect the crop completely against introductions of the thrips.

15. What is the expected damage when the pest would become introduced?
(*with the use of available control measures*)

It is expected that existing pest management practices will sufficiently control the pest in most cases including integrated pest management systems (see question 13 and 14). However, studies on the control of *S. dorsalis* in greenhouses are lacking and in certain cropping systems extra control measures may be needed to prevent damage by *S. dorsalis*. In those cases predatory mites or insecticides (spinosad, and imidacloprid) could be applied. Spinosad and imidacloprid are, however, harmful to biological control agents and their use is not compatible with integrated pest management systems commonly used in tomato and pepper greenhouses. In roses, an increasing number of growers is using biological control agents against pests and this relatively young integrated pest management system will also be negatively affected by sprays of spinosad or imidacloprid. The other insecticides mentioned above (question 14) are also harmful to biological control agents except azadirachtin (http://www.koppert.nl/Neveneffecten.html#). Azadirachtin was, however, least effective against *S. dorsalis* in field experiments performed in Florida (Seal et al, 2006) and is probably not effective enough against *S. dorsalis* in greenhouses in the Netherlands. Thus, additional applications of insecticides to control *S. dorsalis* can negatively affect biological control systems. However, *S. dorsalis* was shown to have a patchy distribution in pepper fields in Florida (Seal et al,, 2006b). It is expected to have a patchy distribution in greenhouses as well. Spot treatments will, therefore, probably be sufficient (if already needed) to control the pest which will have limited effect on the biological control system. Moreover and as stated before, available predatory mites against trips can probably sufficiently control *S. dorsalis*.

In conclusion, it is believed that the impact of *S. dorsalis* will be low in case it would establish in Dutch glasshouses. Existing pest management practices are expected to keep the pest population below the economic threshold. Incidentally, additional (spot) application of insecticides may be needed. There is, however, uncertainty since information on the behaviour of *S. dorsalis* in glasshouses and the efficacy of control methods presently used in Dutch greenhouses is limited.

Potential economic impact: low (uncertainty: medium)

16. Export markets
When the pest would become established in greenhouses in the PRA area, export of greenhouse products could be affected. *S. dorsalis* is a regulated pest in the USA and Canada for all kinds of products. Infested consignments will be rejected at import by these countries. In New Zealand, the pest is regulated for nursery stock of various plant species (http://www.biosecurity.govt.nz/). In the EU, *S. dorsalis* is presently only regulated for plants of *Citrus*, *Fortunella*, *Poncirus* and their hybrids, other than fruits and seeds. It has been suggested to regulate *S. dorsalis* for all plants for planting because of its wide host range (Macleod & Collins, 2006). Establishment of the pest in greenhouses in the Netherlands may lead to emergency measures by the UK and other EU-countries to prevent introduction of the pest by trade within the EU. Official inspection and certification may be needed if the pest would establish in the Netherlands or other parts of the EU to prevent further spread of the pest. In conclusion, establishment of *S. dorsalis* in Dutch greenhouses could affect export markets to third countries and other EU-countries.

Potential impact for export markets: medium – high (uncertainty: medium)

17. Conclusion

The present regulation of *Scirtothrips dorsalis* by the EU on *Citrus, Fortunella, Poncirus* and their hybrids is likely not enough to prevent introduction in Dutch greenhouses, since it has been found/intercepted on *Ficus, Bruguiera* and *Crinum* pot plants in recent years (2006, 2008 and 2009). It can probably establish in Dutch greenhouses but it is not expected to cause much damage or increase pest control costs significantly. The pest can probably easily be controlled and there are no examples of *S. dorsalis* causing significant damage in greenhouse crops in temperate regions. Establishment in Dutch greenhouses is, however, expected to affect export markets since it is a regulated or actionable pest in Canada, New Zealand and the USA and an EU-quarantine pest for plants of *Citrus*, *Fortunella*, *Poncirus* and their hybrids, other than fruits and seeds.

Economic impact by affecting production systems in Dutch greenhouses (yield losses and production costs): low (uncertainty: medium)

Impact by affecting trade (export markets): medium – high (uncertainty: medium)

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