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Thrips parvispinus (Karny, 1922) (Insecta: Thysanoptera: Thripidae): A New Invasive Pest[1]

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The Featured Creatures collection provides in-depth profiles of insects, nematodes, arachnids and other organisms relevant to Florida. These profiles are intended for the use of interested laypersons with some knowledge of biology as well as academic audiences.

Introduction

Thrips parvispinus (Karny, 1922) (Figure 1) is a member of the "*Thrips orientalis* group" (Mound 2005). *Thrips parvispinus* is commonly known as Taiwanese thrips or Southeast Asia thrips (Shridhar et al 2021). *Thrips parvispinus* was identified as a serious pest of several plant species in Southeast Asia and a species of quarantine importance. *Thrips parvispinus* was reported in 2020 for the first time in the United States in Orange County, Florida (Soto-Adames 2020).

Synonymy

Isoneurothrips parvispinus Karny, 1922

Isoneurothrips jenseni Karny, 1925

Isoneurothrips pallipes Moulton, 1928

Thrips (Isoneurothrips) taiwanus Takahashi, 1936

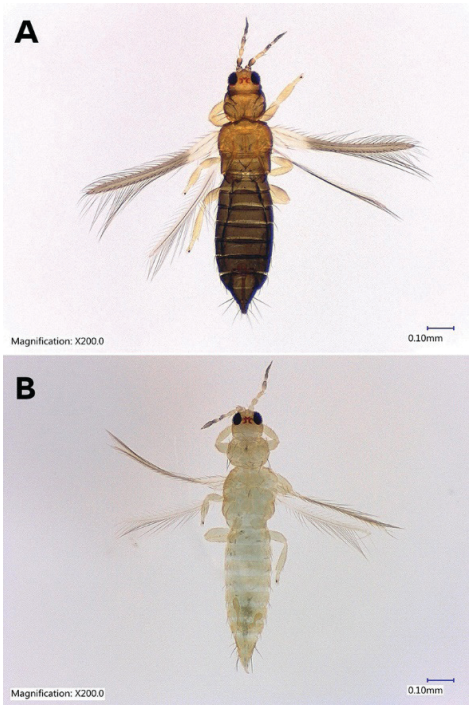

Figure 1. Adult female (A) and male (B) Taiwanese thrips, *Thrips parvispinus* (Karny) (dorsal view).
Credits: A. Khan, UF/IFAS Entomology and Nematology Department

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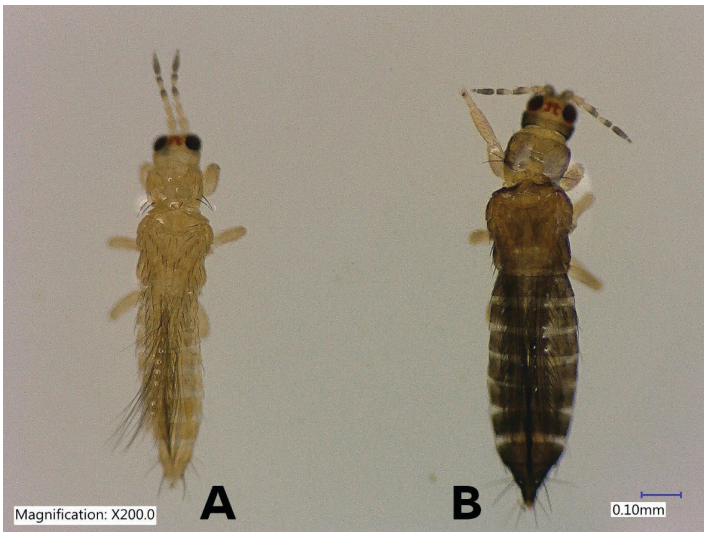

Figure 2. Size comparisonof adult male (A) and female (B) Taiwanese thrips, *Thrips parvispinus* (Karny) (dorsal view).
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Taxonomic Position

Family: Thripidae Stephens, 1829

Subfamily: Thripinae (Stephens) Karny, 1921

Genus: *Thrips* Linnaeus, 1758

Species: *Thrips parvispinus* (Karny, 1922)

Distribution

Thrips parvispinus is native to the Asian tropics and has been reported from Indonesia, Thailand, Malaysia, Singapore, Taiwan (Mound and Masumoto 2005), Yunnan-China (Zhang et al. 2011), the Philippines (Reyes 1994), Australia, the Solomon Islands (Palmer 1992), India (Tyagi 2015; Rachana et al. 2018), and New Zealand (Moritz et al. 2013). In Africa, *T. parvispinus* was found in the French overseas department of La Réunion (Bournier 2000), Mauritius (Mound 2010), and the mainland in Tanzania (Dar-el Salaam) and Uganda (Kampala) (Moritz et al. 2013). In Europe, *Thrips parvispinus* has been reported in Greece (Mound and Collins 2000), Spain (Lacasa et al. 2019), and France (EFSA 2019). *Thrips parvispinus* was recorded in Hawaii in 2006 (Sugano et al. 2013). Recently, *Thrips parvispinus* was reported from Barbados in the Caribbean and in Orange County, Florida, in the continental United States (Soto-Adames 2020).

Identification

The female *Thrips parvispinus* is dark brown, with the head and thorax paler than the abdomen (Figure 1A, Figure 2). The legs are yellow. Head is one and a half times as wide as long, cheeks arched darker than the median area. Antennal segment III and the basal half of IV–V are yellow. Forewings are brown with a base sharply pale. Antennae are 7-segmented (Figure 3), III–IV constricted at apex, VII small. Head is wider than long, ocellar setae pair III small and arising on anterior margins of the triangle (Figure 4A); postocular setae pairs I and III slightly longer than ocellar setae III, pair II minute. Posterior margin of the pronotum has 3 pairs of setae. Metanotum is reticulate medially, reticles varying in shape and sometimes with faint internal markings; median setae long and arising behind anterior margin; campaniform sensilla absent (Figure 5A and 5B). First and second veins of fore wings with complete rows of setae; clavus with 5 marginal setae (Figure 6). Tergite II with 3 lateral marginal setae; posterior margin of tergite VIII with comb absent, a few microtrichia present laterally (Figure 7A and 7B); pleurotergites without discal setae. Sternites II & VII without discal setae, III–VI with about 6 to 12 discal setae in an irregular row. Both female and male *Thrips parvispinus* are macropterous (i.e., with long or large wings).

The male *Thrips parvispinus* is yellow (Figure 1 B and Figure 2). There is no posteromarginal comb on the tergite VIII (Figure 8). The sternites III–VII have a small transverse pore plate while discal setae arise laterally (Karny 1922).

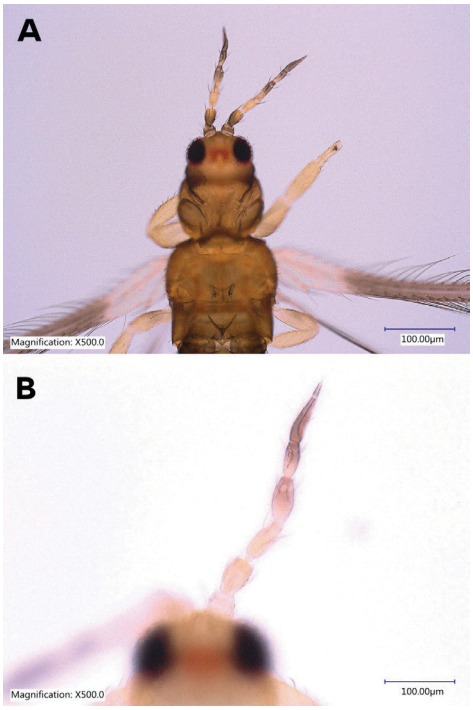

Figure 3. Head with antennae of adult female (A) and enlarged antenna of adult female (B) Taiwanese thrips, *Thrips parvispinus* (Karny) (dorsal view).
Credits: Rafia A. Khan, UF/IFAS Entomology and Nematology Department

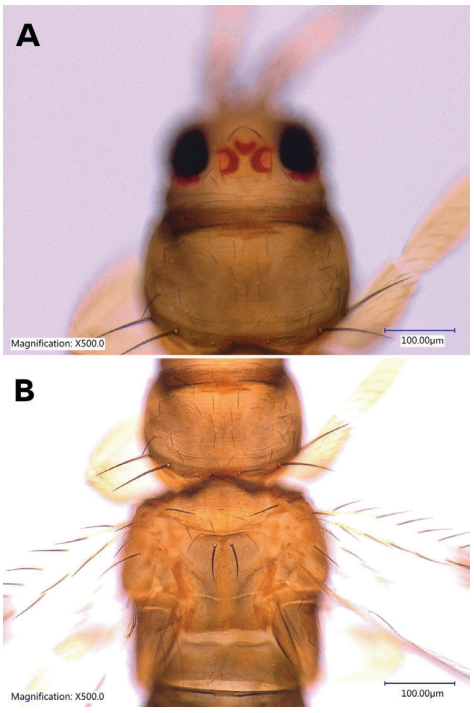

Figure 4. Head and prothorax of adult female Taiwanese thrips, *Thrips parvispinus* (Karny) (dorsal view) showing ocellus and ocellar setae (A). Thoracic segments of adult female Taiwanese thrips, *Thrips parvispinus* (Karny) (dorsal view) (B).
Credits: Rafia A. Khan, UF/IFAS Entomology and Nematology Department

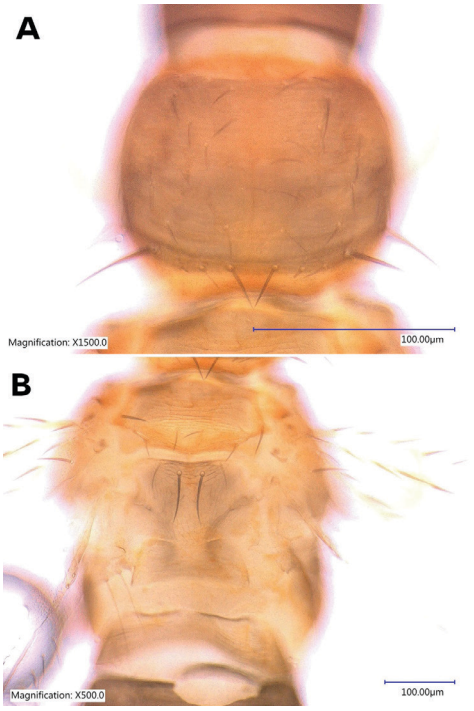

Figure 5. Prothorax (A) and meso-metathorax (B) of adult female Taiwanese thrips, *Thrips parvispinus* (Karny) (dorsal view) at higher magnification showing thoracic setae.
Credits: Rafia A. Khan, UF/IFAS Entomology and Nematology Department

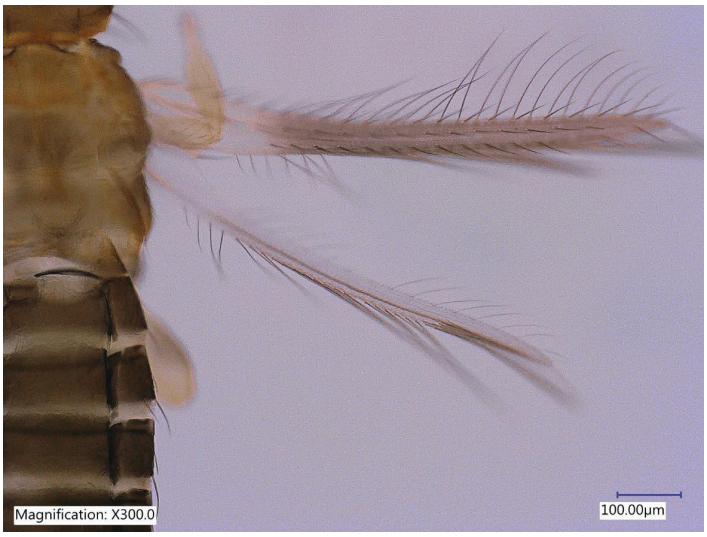

Figure 6. Wings of adult female Taiwanese thrips, *Thrips parvispinus* (Karny) (dorsal view) showing thoracic setae.
Credits: Rafia A. Khan, UF/IFAS Entomology and Nematology Department

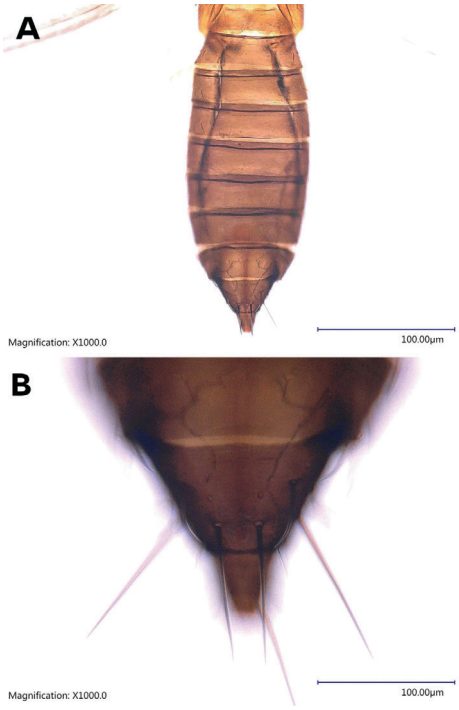

Figure 7. Whole abdomen (A) and last abdominal segments (B) of adult female Taiwanese thrips, *Thrips parvispinus* (Karny) (dorsal view) at higher magnification showing abdominal setae.
Credits: Rafia A. Khan, UF/IFAS Entomology and Nematology Department

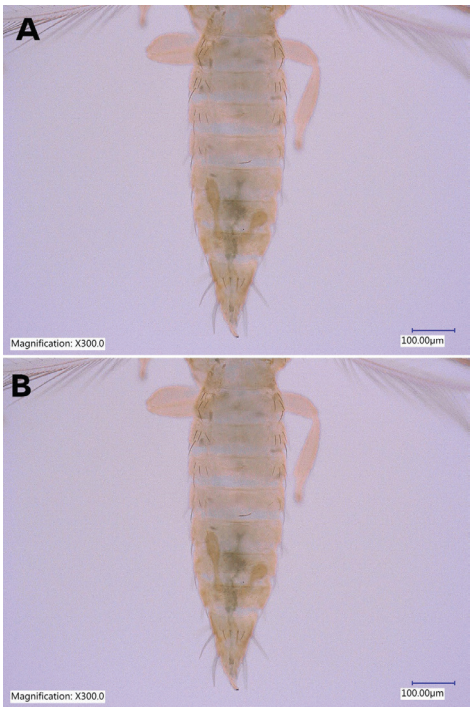

Figure 8. Whole abdomen (A) and last abdominal segments (B) of adult male Taiwanese thrips, *Thrips parvispinus* (Karny) (dorsal view) at higher magnification showing abdominal setae.
Credits: Rafia A. Khan, UF/IFAS Entomology and Nematology Department

Related Species

Thrips orientalis: Sternites lll–Vl with 6–13 discal setae in an irregular row.

Thrips australis, Thrips microchaetus, Thrips subnudula and *Thrips tenellus*: sternites lll–Vll with at least 1 pair of discal setae and pleurotergites with discal setae.

Thrips acacia, Thrips brevisetosus, Thrips florum, Thrips gowdeyi, Thrips hawaiiensis and *Thrips simplex*: sternites lll–vll with at least 1 pair of discal setae and pleurotergites without discal setae.

Thrips nigropilosus, Thrips palmi, Thrips pusillus and Thrips tabaci: sternites and pleurites without discal setae

Potential to Spread and Species Replacement Capabilities

Thrips parvispinus originated from Thailand and was spread through international trade of ornamental and vegetable materials to other countries including Indonesia, Thailand, Cambodia, and Vietnam (Mound and Collins 2000, Vos 1994, Murai 2002, Sartiami and Mound 2013, Johari 2015). *Thrips parvispinus* was intercepted in the Netherlands in 1996 from shipments of cut flowers from Indonesia and Asia. *Thrips parvispinus* also arrived in the Netherlands through *Ixora* sp. potted plants from Thailand in 2005 and through a *Whrightia* sp. potted plant from Indonesia in 2013. It was intercepted in the UK from *Gardenia* sp. from Indonesia (Mound and Collins 2000), and through orchid plants from Malaysia (Collins 2010). In Switzerland, *Thrips parvisinus* was reported to come from *Rosa* spp. from Thailand, *Momordica charantia* from Sri Lanka and a vegetable shipment of *Solanum aethiotipum* from Uganda (EPPO, 2016). *Thrips parvispinus* arrived in France on *Momordica charantia* from Cambodia (EPPO 2014). In Japar, *Thrips parvispinus* was first recorded on *Heliconia* sp. from Mauritius (Masumoto et al. 2003). *Thrips parvispinus* was found to replace *Thrips palmi* Karny populations, which was the major thrips pest of vegetable crops in Indonesia (Murai et al. 2010). Sridhar et al. (2021) observed that the population of *Thrips parvispinus* displaced the well-established chili thrips, *Scirtothrips dorsalis* Hood,population in chili (*Capsicum frutescens* L.) ecosystems in Andhra Pradesh, Karnataka, and Telengana States of India. *Thrips pavispinus* invaded Florida in 2020 (Soto-Adames 2020).

Life Cycle and Biology

Thrips parvispinus reproduces sexually and life stages consist of an egg, two larval stages, a prepupa, a pupa, and an adult. The female prefers to oviposit on young leaves and flowers. Hutasoit et al. (2017) observed the biology of *Thrips parvispinus* on chili pepper leaves. The female *Thrips parvispinus* lays 15.33 eggs on average. The incubation period is four to five days after the female inserts eggs into the leaves. The duration of different life stages is 4.79 days for egg, 1.36 days for first larval instar, 3.54 days for second larval instar, 1.08 days for prepupa, and 1.96 days for pupa. The longevity of females and males is 8.55 days and 6.00 days, respectively. The preoviposition period of *Thrips parvispinus* is 1.11 days. *Thrips parvispinus* can complete their life cycle within 13.68 days. The intrinsic rate of increase of *Thrips parvispinus* was 0.15 individuals per day per female; the net reproductive rate was 5.71 individual per female per generation. The generation time of *Thrips parvispinus* was found to be 11.49 days and the doubling time was 4.57 days. The mean fecundity and mean generation time of *Thrips parvipinus* at 20°, 25°, and 30° C were 50, 69, and 56 eggs, and 37.6, 24.8, and 18.8 days, respectively (Hutasoit et al. 2017). The intrinsic rate of natural increase of *Thrips parvispinus* was 0.18, 0.24, and 0.37 at 20°, 25°, and 30° C, respectively. There can be several generations of *Thrips parvispinus* in a year depending on environmental factors (Murai et al. 2010). The highest flight activity of adult *Thrips parvispinus* was found at 9:00–10:00 and the lowest was at 18:00–19:00 (6:00–7:00pm). The larval stages of

Thrips parvispinus were more abundant on leaves while the adults were more abundant in flowers (Pratiwi et al. 2018).

Hosts

Thrips parvispinus is a polyphagous species and has a wide host range including fruits, vegetables, and ornamental plants (EPPO 2001, Masumoto et al. 2003, EPPO, 2016, Azidah 2011, Moritz et al. 2013, Tyagi et al. 2015, Hutasoit et al. 2017, NPPO 2019, Nagaraju et al. 2021, Johari et al. 2014, Sridhar et al. 2021, Prasannakumar et al. 2021) listed below.

The host preference of *Thrips parvispinus* varies with its geographical distribution. In the established region of *Thrips parvispinus*, papaya, peppers, potatoes, eggplant, beans, shallots, and strawberries were reported as the most affected crops.

Injury

Host plant injury is caused by feeding and breeding on young leaves and flowers. The symptoms of injury include deep punctures and scratches on the underside of leaves, reddish brown leaf undersides and yellowish tops, necrotic areas on distorted leaf lamina with yellow streaking, brownish streaks on petals, drying and withering of flowers, and affected fruit set. *Thrips parvispinus* affects plant growth because of feeding on growing portions of the plant (Sireesha et al. 2021). Infested leaves showed irregular color and streak lines (Moritz et al. 2013) followed by leaf curling and deformation.

Thrips parvispinus is a serious pest of chili pepper (Vos and Frinking 1998) in Indonesia and has replaced melon thrips (*Thrips palmi* Karny) on various vegetable crops (Murai et al. 2010). Feeding damage caused scarring of fruits and foliage of papaya in Hawaii (Sugano et al. 2013). In Florida, feeding injury of *Thrips parvispinus* was observed on *Anthurium* leaves, *Hoya* buds, and *Gardenia* sp. leaves (Figure 9A and 9B) at nursery facilities.

Disease Transmission

The feeding damage of *Thrips parvispinus* has been observed to be associated with the saprophytic fungus *Cladosporium oxysporum* Berk. & M. A. Curtis on papaya fruit cause bunchy-top disease (malformed leaves and shot holes on new flushes) (Lim 1989). *Thrips parvispinus* has been reported as a vector of tobacco streak virus, a pollen-borne plant virus transmitted by thrips while feeding (Klose et al. 1996). There is no report of *Thrips parvispinus* as a vector tospovirus.

Figure 9. Gardenia (*Gardenia* sp.) plants (A) and top shoots (B) infested by Taiwanese thrips, *Thrips parvispinus* (Karny) in Nursury at Miami, FL. Credits: Rafia A. Khan, UF/IFAS Entomology and Nematology Department

Quarantine Significance

Thrips parvispinus originated in intensive agriculture and acquired the habit of polyphagy, spreading in diverse habitats. It is related to western flower thrips (*Frankliniella occidentalis* Pergande) and melon thrips (*Thrips palmi* Karny) which also originated in agriculture-rich intensive horticulture and emerged as international pests of economic importance (Mound and Collins 2000). *Thrips parvispinus* feeds on various horticultural plants and vegetables which have trading value. Through these host plants, *Thrips parvispinus* could extend its distribution. A strong quarantine action is warranted to limit its movement between the states in the United States.

Management

Sampling

White sticky traps attracted more *Thrips parvispinus* than blue or yellow traps (Murai et al. 2010). The survey of constant systematic monitoring and inspection is urgent in newly infested areas with susceptible crops (Sridhar et al. 2021). Shireesha et al (2021) reported that the establishment of blue and yellow sticky traps at a density of 30 traps per acre can be helpful to monitor *Thrips parvispinus* as well as to reduce adult populations in chili field (Sireesha et al. 2021).

Cultural Control

The use of healthy and pest-free seedlings, removal of infested plants from the field, and destruction of highly infested fields can reduce the future spread (Sridhar et al.

2021). Avoiding establishing crops near any infected hosts and destroying weed and wild hosts near the crop field can reduce infestations. Higher *Thrips parvispinus* populations were observed in coriander flowers. Thus, coriander can be used as a trap crop around the highly infested crops (Prasannakumar et al. 2021). Sridhar et al. (2021) recommended avoiding excessive nitrogen fertilizer. In addition, split fertilizer (nitrogen and potash) applications during crop growth can be helpful to reduce *Thrips parvispinus* incidence in the susceptible crops (Sireesha et al. 2021, Sridhar et al. 2021). A resistant line of chili pepper has been identified against *Thrips parvispinus* (Maharijaya et al. 2011).

Chemical Control

Laboratory studies revealed that spinosad is effective in controlling *T. parvispinus* but not acetamiprid (Murai et al. 2010). Prassanakumar et al. (2021) observed that rotation with biopesticides such as *Beauveria bassiana* or *Lecanicillium lecanii*, Arka neem and ponagamia soaps, and neem oil with insecticidal sprays such as Spinosad 45SC can reduce the pest population in chili. Rotation of insecticides with a different mode of action can reduce the probability of insecticide resistance in *Thrips parvispinus*. Targeting sprays at flowers and growing buds can be used as efficient use of chemicals as *Thrips parvispinus* lives and feeds on them (Sugano et al. 2013). When there is a *Thrips parvispinus* outbreak, rotation of insecticides viz., fipronil, fipronil + imidacloprid, cyantraniliprole, acetamiprid, and spirotetramat can be used (Sireesha et al., 2021). Sequential spray with fipronil or cyantraniliprole or acetamiprid or spinosad water at weekly intervals can be effective to manage *Thrips parvispinus* (Anitha Kumari et al. 2021). However, heavy insecticide exposure in chili, the most susceptible crop, can result in the resurgence of *Thrips parvispinus* (Sireesha et al. 2021). Thus, growers need to follow the label rate to use any chemical insecticides and fertilizers, and follow the local regions/Universities/Departments recommendation (ICAR-NBAIR, Pest Alert, 2021).

Biocontrol Agents

Ladybird beetles, *Menochilus sexmaculatus* Fabricius and *Coccinella transversalis* Fabricius, and entomopathogenic fungus *Lecanicillium lecanii* R. Zare & W. Gams are potential natural enemies of *Thrips parvispinus*. The use of *M. sexmaculatus* and *L. lecanii* was as effective in controlling *Thrips parvispinus* and increasing the yield of the crop (Prabaningrum et al. 2008). Microbial biopesticides such as *Pseudomonas fluorescence* NBAIRPFDWD or *Bacillus albus* NBAIR-BATP are also effective in suppressing *Thrips parvispinus* when sprayed on flowers and fruits (Sridhar et al. 2021).

Conclusion

Thrips parvispinus is a cosmopolitan species and a species of pest significance. *Thrips parvispinus* is polyphagous and exposure to heavy insecticide applications revealed characteristics comparable to those of *Frankliniella occidentalis* and *Thrips palmi*, which are some of the most important pests of cultivated crops worldwide. It is important to establish strong monitoring capabilities to evaluate the presence of *Thrips parvispinus* in the imported crops, grains, cut flowers, ornamentals, and fruits. *Thrips parvisponus* is an invasive pest of concern for the Florida nursery industry. Though *Thrips parvispinus* is now confined to Florida in the USA, proper management should be implemented to mitigate the spread of this species to other states.

Acknowledgment

The information about the invasion of *Thrips parvispinus* in Barbados was brought to our attention by Dr. Matthew Ciomperlik, Laboratory Director, USDA-APHIS-PPQ-S & T Mission and Phoenix Laboratories. Dr. Ciomperlik also provided information about *Thrips parvispinus* damage potential and quarantine significance.

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Table 1.

Type of Host	Common name	Scientific name	Plant Family
Crop	Coffee	*Coffea* sp. L.	Rubiaceae
	Potato	*Solanum tuberosum* L.	Solanaceae
	Tobacco	*Nicotiana tabacum* L.	Solanaceae
	Sunflower	*Helianthus* sp. L.	Asteraceae
	Sorghum	*Sorghum bicolor* (L.) Moench	Poaceae
	Rattlepods	*Crotalaria* L.	Fabaceae
Vegetable	Green bean	*Phaseolus vulgaris* L.	Fabaceae
	Vigna	*Vigna* sp. Savi	Fabaceae
	Eggplant	*Solanum melongena* L.	Solanaceae
	Chilli pepper	*Capsicum frutescens* L.	Solanaceae
	Paprika	*Capsicum annuum* L.	Solanaceae
	Bitter tomato	*Solanum aethiopicum* L.	Solanaceae
	Drumstick	*Moringa oleifera* Lam.	Moringaceae
	Bottle gourd	*Lagenaria siceraria* (Molina) Standl.	Cucurbitaceae
	Bitter gourd	*Momordica charantia* L.	Cucurbitaceae
	Cucumber	*Cucumis sativus* L.	Cucurbitaceae
	Coriander	*Coriandrum sativum* L.	Apiaceae
	Shallot	*Allium cepa var. aggregatum* G. Don	Amaryllidaceae
	Broccoli	*Brassica oleracea* L.	Brassicaceae
Fruit	Papaya	*Carica papaya* L.	Cariaceae
	Watermelon	*Citrullus lanatus* (Thunb.) Matsum. And Nakai	Cucurbitaceae
	Mango	*Mangifera indica* L.	Anacardiaceae
Ornamentals	Gardenia	*Gardenia jasminoides* J. Ellis	Rubiaceae
	Anthurium	*Anthurium* sp. Schott	Araceae
	Chrysanthemum	*Aster* sp.L.	Asteraceae
	Dahlia	*Dahlia pinnata* Cav.	Asteraceae
	Marigold	*Tagetes* sp. L.	Asteraceae
	Gerbera	*Gerbera* sp. L.	Asteraceae
	Rocktrumpet	*Mandevilla* sp.Lindl.	Apocynaceae
	West Indian jasmine	*Ixora* L.	Rubiaceae
	Weeping fig	*Ficus* sp.L.	Moraceae
	Hoya	*Hoya* sp. R. Br.	Apocynaceae
	Lobster-claws	*Heliconia* sp.L.	Heliconiaceae
	Rose	*Rosa* sp.L.	Rosaceae
	Dwarf umbrella tree	*Schefflera* sp.J. R. Forst. & G. Forst.	Araliaceae
	Snowflakes	*Wrightia* sp.R.Br.	Apocynaceae
Weed	Black-Jack	*Bidens polisa* L.	Asteraceae
	Parthenium	*Parthenium* sp. L.	Asteraceae
	Pigweed	*Amaranthus* sp. L.	Amaranthaceae
	Carpet grass	*Axonopus* sp. P. Beauv.	Poaceae

Type of Host	Common name	Scientific name	Plant Family
	Joyweeds	*Alternanthera* sp. Forssk.	Amaranthaceae
	Black-eyed Susan vine	*Thunbergia* sp. Retz.	Acanthaceae
Tree	Pongame oiltree	*Millettia pinnata* (L.) Panigrahi	Fabaceae
	Neem	*Azadirachta indica* A. Juss	Meliaceae