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Invasive Thrips (*Thrips parvispinus*) and Their Management in Chilies

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Abstract

Thrips parvispinus (Karny) is an invasive pest belonging to the family Thripidae and order Thysanoptera. In chilli, yield loss can vary from 40 to 80%. It feeds between the margins of leaves, sucking the sap from young leaves, blossoms and budding fruits. Old leaves have a silvery look. Scraping the petals causes the flower to drop and the fruit to set abnormally. While the adult prefers to live in flowers, the nymph prefers to live on leaves. Community approach in pest management helps in better management of thrips particularly when the incidence is flaring up at large scale.

1. Introduction

Chilli is regarded as a major commercial spice and vegetable crop, as well as a widely used global spice known as "wonder spice." During the *kharif* and *rabi* seasons, it is grown practically throughout the country (Anonymous, 2021). Thrips are a prominent group of sucking pests that inflict significant economic losses in numerous horticultural crops and carriers of deadly plant viruses. There have been reports of sucking pest outbreaks such as thrips in various countries because of changes in agricultural production patterns, pesticide use and climate change. More recently, an invasion of *Thrips parvispinus* (Karny) (Thysanoptera: Thripidae) native to Thailand has widespread occurrence in other Southeast Asian countries. Hence, it is called South East Asian thrips (Mound, 2005). *T. parvispinus* outbreak has recently been reported in Andhra Pradesh, Karnataka and Telangana causing 50-80% damage to chilli crops (Rachana et al., 2022). It is a member of the "Thrips orientalis group," which is a widespread pest of quarantine relevance. This species was initially identified in India on papaya from Bengaluru in (Tyagi et al., 2016). As compared to other thrips species, this is larger in size, with a dark brown to black coloured body. After the initial report, it was regularly monitored in different regions of

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India due to its potential to become a problem. These species are significant pests that either directly harm crops by feeding and egg-laying or indirectly harm crops by spreading several pathogenic tospoviruses. Their well-developed left mandible is used to rasp and suck sap from various areas of the plant, causing harm. With the use of an ovipositor that resembles a saw, gravid females deposit their eggs into plant tissues. Thrips are the only insects that carry the Tospovirus (genus Tospovirus, family Bunyaviridae), which affects many plant species from different plant families all over the world.

2. Common Names

Tobacco thrips, Black flower thrips, Taiwanese thrips and Southeast Asian Thrips.

3. Distribution

Over the past years, it has seen a dramatic expansion in its global range; in addition to India, it is now known to occur in France, Greece, Hawaii, Mauritius, Reunion, Spain, Tanzania Netherlands, Thailand, Australia and Europe (Sridhar et al., 2021). In India, it is first time reported from Bengaluru, Karnataka. The emergence of chilli blossom thrips was initially observed in January 2021 in the districts of Guntur and Chilakaloripeta of Andhra Pradesh state. It has been observed that the invasive thrips, which are small, slender insects, have spread to all the regions of Andhra Pradesh that grow chillies. In November 2021, these thrips were also reported in all chilli-growing districts of Telangana state, including Warangal, Mahabubabad, Khammam and Suryapet (Sireesha et al., 2021). The occurrence of these thrips was also reported in important chilli-growing districts of Karnataka, such as Chitradurga, Bellary, Gadag, Koppal and Raichur, during November and December 2021 (Nagaraju et al., 2021). Furthermore, these thrips have been spotted in other states such as Chhattisgarh, Kerala, Tamil Nadu and Gujarat.

4. Host Range

As a polyphagous species, it has been documented to infest beans, eggplant, potatoes, shallots, chilli and papaya. Furthermore, it damages ornamentals such as Ficus, Dahlia, Dipladenia, Gardenia, Anthurium, green bean, strawberry, tuberose, coriander, cruciferous, water spinach, beans, maize, rose, hairy lychee, melon, cucumber (Palanisamy et al., 2023).

5. Identification

5.1. Scirtothrips dorsalis

Antennae have eight segments; the lateral third of tergites has rows of tiny microtrichia placed closely apart; the forewing second vein has two distal setae.

5.2. Thrips parvispinus

Adult of the *T. parvispinus* has brown to dark brown, head and thorax are brighter than the abdomen. Head is strong with reticulation patterns and has pigmented big eyes. Seven segmented antennae, while the second and third segments have fork-shaped sensory organs, a complete setae row in the forewing second vein and a lateral third of tergites devoid of closely spaced rows of minute microtrichia.

5.3. Life cycle

The temperature affects the life cycle of an egg to an adult. It takes around 15 days to complete the cycle. *T. parvispinus* goes through five stages of immaturity: eggs, two nymphal instars, prepupal and pupal.

6. Nature of Damage

6.1. Scirtothrips dorsalis

The primary cause of crop damage in dry weather conditions is unirrigated fields. Larvae and adults cause damage by sucking sap primarily from the underside of leaves and developing fruits, which causes crinkling and upward curling and drying of leaves, flower dropping, stunted growth, and scraping of chilli fruits.

6.2. Thrips parvispinus

The larvae feed on the sap beneath the leaves, while the adults primarily colonize flowers and the underside of leaves. Fruit yield is decreased by infestation, which also results in high blossom drop. Unlike other thrips species, its infestation rises amid the northeast monsoon's strong rains.

6.2.1. On leaves

Thrips prefer areas adjacent to veins for colonizing and feeding. The leaves have deep scars and punctures on the underside. The matching area on the upper side of the leaves appears blotchy and yellowish because of sucking in cell sap and scraping off chlorophyll from the underside of the leaves. Discoloration beneath the leaf surface that is reddish-brown. Distorted leaf lamina featuring yellow streaks and necrotic patches. If there is a severe infection, the new flesh should be entirely dry or blighted.

6.2.2. On floral parts

They have reddish marks on them from thrips scraping

the petals. Pollination may be impacted by feeding on pollen. The drying and withering of the flower affect the fruit set. This pest's infestation of fruit caused incorrect and deformed fruit settings, button-shaped fruits (in the case of bell peppers) and a rough, scratchy surface.

Figure 1: *Scirtothrips dorsalis* damage

Figure 2: *Thrips parvispinus* damage

Figure 3: *Scirtothrips dorsalis*

7. Economic Importance

It causes widespread flower shedding, deformity, and chilli fruit dropping, which severely reduces India's harvest. *T. parvispinus* damage to the chilli crop has been found in 40–80% of the farms in Andhra Pradesh and Telangana (Veeranna et al., 2022). In Indonesian fields,

Figure 4: *Thrips parvispinus*

T. parvispinus causes a 23–60% reduction in chilli yield. Moreover, *T. parvispinus* is crucial to the pollination of a variety of tropical and subtropical crops (Varatharajan., 2016).

8. Integrated Pest Management (IPM) Approaches

The following IPM practices are suggested for the management of thrips complex on chilli. The IPM practices must be followed under a wide area basis/ community approach for better results.

8.1. Cultural methods

Deep summer ploughing to destroy pupae and residual stages of thrips and other pests. Advance cropping season and avoid staggered planting. Application of well decomposed farmyard manure (FYM) or compost, enriched with *Metarhizium anisopliae* or *Pseudomonas fluorescens* @ 2 kg t^{-1} along with recommended doses of farm yard manure. Soil application of 500 kg of Neem cake and 1.50–2.00 tons of vermicompost/ha to induce resistance against thrips. Growing resistant or early/ short-duration varieties if available to escape the peak incidence of thrips. Seed treatment with Imidacloprid 70 WS @10 g kg^{-1} seed. Seedling root dip for 30 minutes with Imidacloprid 17.8% SL @ 0.5 ml l^{-1}. Follow recommended spacing (60×30 cm^2 or 45×45 cm^2) and avoid close spacing, as the high-density planting favours the pest incidence and multiplication. Balanced fertilization with enhanced potash application along with nitrogen and phosphorous fertilizers to induce plant resistance against the pest. Mulching with silver-coloured polythene sheets of 25–30-micron thickness to reduce pupation of thrips in the soil. Border cropping with 2–3

rows of tall growing crops like sorghum/maize/bajra/fodder grasses etc. acts as a barrier for thrips movement. Intercropping chilli with maize/sorghum and cowpea at 10:3:1 as barrier and reservoir crops for natural enemy multiplication, leading to biological control of thrips. Frequent inter-cultivation (earthing up/raking of soil) operations to destroy soil inhabiting pupae of thrips. Clean cultivation and maintaining weed-free bunds are crucial for the management of pests. Uprooting and destruction of weeds such as *Parthenium hysterophorus*, *Prosopis* sp., *Lantana camara*, *Calotropis* sp., *Tecoma* sp., *Abutilon* sp., wild *Solanum* sp., etc. present in the vicinity of field bunds which act as off-season and alternate host for thrips. Crop rotation with crops belonging to the family Poaceae or Gramineae (cereals).

8.2. Mechanical methods

Nipping and destruction of severely infested apical shoots at vegetative stage for destruction of thrips residing over apical parts. Mechanical destruction of severely infested plants by uprooting and burying or incineration. Erection of blue or yellow/white sticky traps at 65–75 traps ha^{-1} at crop canopy height for mass trapping purpose and 20–25 traps ha^{-1} for monitoring purpose. Adopting sprinkler irrigation system instead of flood irrigation since the jet of water spray from sprinklers disrupts the growth and multiplication of thrips.

8.3. Biological methods

Conservation of native natural enemies by avoiding spraying of chemical pesticides to the extent possible. Spraying of microbial-based insecticides like *Beauveria bassiana* or *Lecanicilium lecanii* at 4 g or ml l^{-1} (spore load-1x10^8cfu g^{-1} or ml^{-1}), *Pseudomonas fluorescence* – NBAIRPFDWD at 20 g l^{-1} or *Bacillus albus* – NBAIR-BATP @ 20 g l^{-1} uniformly covering whole plant. Foliar spray of Entomo-Pathogenic Nematode (EPN), *Steinernema carpocapsae* formulation at 10 g l^{-1}+1 g wetting agent. Soil application of EPNs, *Steinernema carpocapsae or*, *Heterorhabditis indica* at 7.50–12.50 kg ha^{-1}. It can be applied as soil drenching after mixing in 500–750 l of water.

8.4. Botanical/ organic methods

Spraying 5% Neem Seed Kernel Extract (NSKE) or 5% Neem Seed Powder Extract or 0.50% Neem oil (5 ml l^{-1}), 0.50% Pongamia oil (5 ml l^{-1}) and 5% *Vitex negundo* extract (50 ml L^{-1}). Spraying of commercial formulation of neem-based insecticide (Azadirachtin 3000 PPM) @ 2 ml L^{-1}. Spraying of 2% Fish Oil Rosin Soap (FORS) (20 ml l^{-1}) solely or in combination with Neem Seed Kernel Extract. Spraying of seaweed (*Kappaphycus alvarezii*) extract @ 2 ml l^{-1} for inducing resistance in plants to withstand the severe incidence of thrips.

8.5. Chemical methods

As a final resort, need-based and judicious spray of label claim insecticides as given in table below. Repeated spraying of chemical insecticides with the same mode of action and spraying of sub-lethal doses to be avoided to overcome thrips resurgence (sudden outbreak).

Table 1: List of insecticides for the management of thrips (*T. parvispinus*)

Insecticide	Dosage ha^{-1}
Cyantraniliprole 10.26% OD	600 g 500 l^{-1}
Fipronil 80% WG	50–62.5 g 500 l^{-1}
Lambda-cyhalothrin 5%EC	300 ml 400–600 l^{-1}
Tolfenpyrad 15% EC	1 l 500 l^{-1}
Emamectin Benzoate 1.50%+ Fipronil 3.5% SC	500–750 g 500 l^{-1}
Emamectin benzoate 5% w/w+ Lufenuron 40% w/w WG	60 g 500 l^{-1}

8.6. Legal control/export

It is observed that mature leaves and fruits harbour a smaller number of thrips. Therefore, the possibility of association of thrips on fully mature green chilli fruits is remote. However, the petiole region of the chilli has to be thoroughly inspected during routine phytosanitary inspections of the export shipments. For red chilli export, fully ripened and partially withered pods should be harvested. Therefore, *T. parvispinus* or any other species of thrips for that matter do not impede the export of red chilli.

9. Conclusion

Over the past few years, India has witnessed an invasion followed by an outbreak of the exotic thrips *T. parvispinus*. In addition to harming the plants by feeding, thrips are a well-established vector of tospoviruses. Thrips are difficult to control because of their small size, cosmopolitan distribution, high reproductive rate, polyphagous habits, invasive and limited options for biological control through known natural enemies. Overall, an integrated pest management approach for tackling *T. parvispinus* by including various eco-friendly tools.

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