

Invasive Thrips, *Thrips parvispinus* (Karny) an Invasive Threat : A Review

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ABSTRACT

Thrips parvispinus (Karny 1922) an invasive pest, which belongs to order Thysanoptera and family Thripidae. It is a polyphagous pest on mainly fruit, vegetable and ornamental crops. Recently this pest is reported from many states of India including Gujarat. Yield loss due to the pest is ranged from 40 to 80% in chilli. It passes through five stages and complete its life cycle in 13-15 days. It feeds under side leaves, suck the sap from tender leaves, flowers and developing fruits. Old leaves gives silvered appearance. Scraping on petals resulted flower dropping and improper or malformed fruit setting. The nymph prefers to live on leaf, while adult prefers in flower. IPM based approaches viz., timely planting with plastic mulch, balanced use of nitrogenous fertilizer, installation of blue sticky traps (25–30/acre), spraying of

neem oil 3%, Azadirachtin 0.003%, (3 ml/L), *Pseudomonas fluorescens* 1% WP (4 g/L) and spraying of insecticides viz., fipronil 80 WG or cyantraniliprole 10.26 OD or acetamiprid 20 SP or spirotetramat 150 OD or spinetoram 11.7 SC or tolfenpyrad 15 EC effectively manage the thrips.

Keywords *T. parvispinus*, Host range and distribution, Identification, Life cycle, Nature of damage.

INTRODUCTION

Thrips is one of the largest genera of the insects order Thysanoptera in the family thripidae and consists of numbers of species. There were total 739 species in 259 genera listed, out of them 309 species in 116 genera of suborder *Terebrantia* and 430 species in 143 genera of suborder *Tubulifera* are reported from India (Tyagi and Kumar 2016). A total number of 44 species with new distributional records are reported from different geographical regions of India (Rachana and Varatharajan 2017). Invasive thrips, *Thrips parvispinus* (Karny 1922) (Thysanoptera : Terebrantia: Thripidae), a member of “*Thrips orientalis* group” (Mound 2005). It is also called as western thrips/ taiwanese thrips/tobacco thrips. It is an invasive pest, cosmopolitan species of quarantine important pests. Now a days, *T. parvispinus* is one of the main pests of fruit, vegetable and ornamental crops. Recently this pest was reported from different states of India viz., Andhra Pradesh, Karnataka, Telangana, Chhattisgarh, Kerala, Tamil Nadu and Gujarat. The

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insect-pests is infesting chilli and causing 70-100% damage (Sridhar *et al.* 2021). Probable reasons for invasive thrips outbreak in chilli exposure to heavy insecticides use in case of chilli resulted in resurgence of the pest (Sireesha *et al.* 2021). It is difficult to control the insect-pests because of their small size and not very easily recognized behavior. Its attack can reduce the quality of fruits, cut flowers (Lak-sanawati 1996). Hence, considering the seriousness of the damage caused due to invasive pest, an effort is made to review, about invasive thrips *T. parvispinus* at national and worldwide including its host range and distribution, identification, life cycle, extent of damage and management strategies.

Distribution

The last two decades observed a extreme extension in the geographic distribution of *T. parvispinus*. It is reported from different countries like Malaysia (Vjayasagaran 1986), Indonesia (Talekar 1991), Thailand, Singapore, Philippines, Australia and Solomon Islands (Palmer 1992), Greece (Mound and Collins 2000), Africa (Bournier 2000), Malaysia and Taiwan (Anonymous 2000). This species widely spread in other countries such as Mauritius (Mound 2010), Malaysia (Azidah 2011), China (Zhang *et al.* 2011), Hawaii (Sugano *et al.* 2013), Tanzania and Uganda (Moritz *et al.* 2013), Spain (Lacasa *et al.* 2019) and Netherlands (Anon 2019).

In India, It is first time reported from Bengaluru (Tyagi *et al.* 2015) and Karnataka (Rachana *et al.* 2018). Then subsequently its spread was noticed in chilli growing areas of Andhra Pradesh (Sireesha *et al.* 2021), Telangana (Kumari *et al.* 2021), Karnataka (Nagaraju *et al.* 2021), Andhra Pradesh, Chhattisgarh, Karnataka, Kerala and Tamil Nadu from nine different host plants (Rachana *et al.* 2022). The infestation of this pest first time recorded in major chilli growing areas of Anand, Vadodra, Kheda, Chhotaudepur, Panchmahal and Mahisagar district of Gujarat (Patel *et al.* 2022 and Lodaya *et al.* 2022).

Host range

T. parvispinus is a polyphagous insect-pest, reported its heavy damage on chilli pepper (Talekar 1991),

green house gardenia plants (Mound and Collins 2000), green bean, potato, strawberry, brinjal (Murai *et al.* 2009) and papaya (Sugano *et al.* 2013). Sartiami and Mound (2013) recorded *T. parvispinus* on different host plants viz., tuberose, coriander, cruciferous, papaya, water spinach, beans, maize, rose, hairy lychee, cucurbitaceae and solanaceae plants. The infestation of *T. parvispinus* was found highest on chilli, melon, cucumber, brinjal and squash in Indonesia (Johari *et al.* 2014, Johari and Desfaur 2018). Whereas, In Europe it was found on ornamentals in green houses : Citrus, mandevilla, ficus, gardenia, gerbera and umbrella tree (Lacasa *et al.* 2019).

It was first time reported on papaya (Tyagi *et al.* 2015) and later on trumpet tree, *Dahlia rosea* (Rachana *et al.* 2018), chilli, bell pepper, brinjal, okra, bitter gourd, potato, shallot (onion), pigeon pea, green gram, beans, sorghum, maize, gingelly, cotton, strawberry and marigold (Nagaraju *et al.* 2021 and Roselin *et al.* 2021) in India.

Taxonomic description

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 have pigmented big eyes. Compound eyes do not elongated shape. Antenna consisted of seven segments, while the second and third segments have a fork-shaped sensory organs. It does not have 1st ocellar setae, 2nd ocellar setae are shorter than 3rd ocellar setae. Pronotum have 2 pairs of long posteroangular setae and 3 pairs of shorter posteromarginal setae. *Campaniform sensila* are not present on metanotum. While, tergite VIII have a comb microtrichia. The V-VIII tergite have a ctenidia at part of lateral and at tergite VIII ctenidia located behind the spiracles. Length of wing is more than half length of the abdomen. It is dark or shaded, with a pale base, at the first and second wings vein front, there was a complete line of setae. The size and color of the body of *T. parvispinus* have variations with long, medium and short criteria (Johari *et al.* 2014).

Life cycle

The life cycle from egg to adult is dependent on tem-

perature. The full cycle took about 15 days (Lewis 1973). The average developmental period of the pre-adult phase of *T. parvispinus* lasted for 12.97 and 12.57 days in males and females, respectively. It was also observed that *T. parvispinus* has metamorphosis transition between paurometabola and holometabola (Borror *et al.* 2005). The mean fecundity and mean generation time at 20°, 25° and 30°C were 50, 69 and 56 eggs and 37.6, 24.8 and 18.8 days, respectively (Murai *et al.* 2009). Intrinsic rate of natural increase at 20°, 25° and 30°C was 0.18, 0.24 and 0.37 days respectively. Five phases of immature stages of *T. parvispinus* : Eggs, two instars nymph, prepupal and pupal period were lasted for 4.79, 1.36, 3.54, 1.08 and 1.96 days, respectively. The pre-oviposition period is 1.11 days and complete its life cycle in 13.68 days. Female longevity was 8.55 days, male longevity was six days and fecundity 33 eggs per female. The population development of *T. parvispinus* followed type III of survivorship curve with intrinsic rate of increase of 0.15 individuals per day per female (Hutasoit *et al.* 2017).

Nature of damage

T. parvispinus causes direct damage by feeding and breeding on the young leaves and flowers. Adults mainly colonize on flowers and underside of leaves, whereas larvae deeply punctures and scrap the chlorophyll from the under side of the leaf and suck the cell sap as a result corresponding portion on upper side of the leaf looks yellowish to reddish brown. Infested leaves are distorted, curled, lightly mottled and streaked. It gives silvered appearance on old leaves. Distorted leaf lamina with necrotic areas and yellow streaking was also observed. If the infestation is severe on newly emerging leaves, such leaves are dried/ blighted (Sridhar *et al.* 2021).

This invasive thrips mostly present in flowers that are white and fragrant (Mound and Collins 2000). Scraping on petals results in brownish streaks. It feeds on pollen, which results in drying and withering of flower (Maharajaya *et al.* 2011). Infestation causes heavy flower drop ultimately it is responsible reduce in fruit production. The highest flight activity of adult, *T. parvispinus* occurred at morning hours and nymph fevers live on the part of the leaf, while the adult

prefers to live in the flower (Pratiwi *et al.* 2018). The *T. parvispinus* is the most dominant species found infesting on flowers (71%) and leaves (56%) of the chilli pepper and cayenne pepper (Hutasoit *et al.* 2019).

Due to infestation of this pest on fruit resulted in improper and malformed fruit setting, fruits became button shaped (in case of bell pepper) and surface of fruit shows scratchy/rugged appearance. The fruits attained abnormal shape (Maharajaya *et al.* 2011).

Economic importance

It cause large scale shedding of flowers, malformation and dropping of chilli fruits, leading to severe yield loss in India. The chilli growers of Andhra Pradesh estimated a loss of Rs 1 lakh per acre (Anon 2021b). Damage due to *T. parvispinus* in chilli crop observed between 40-80% at various fields in Andhra Pradesh and Telangana (Anon 2022b). Chilli yield loss due to *T. parvispinus* is 23—60% under field conditions in Indonesia (Johari *et al.* 2014). The role of *T. parvispinus* also play an important role as pollinators on various tropical and subtropical crops (Varatharajan *et al.* 2016).

Management

Cultural control

Early planting of bell pepper plant reduce the population of *T. parvispinus* and per cent plant damage (Prabaningrum and Moekasan 2008). The *Capsicum annuum* AC 1979, *C. annuum* bisbas, *C. annuum* CM 331, *C. baccatum* no. 1553, *C. annuum* keystone resistant giant and *C. baccatum* aji blanco christal found to be resistant against *T. parvispinus* under three different screening methods green house, leaf disc, detached leaf tests (Maharajaya *et al.* 2011). The chilli planting pattern using plastic mulch without the combination of other crop and with the use of pesticides had the lowest average population of *T. parvispinus* during the vegetative period of chilli plants (Haerul *et al.* 2020). The mayang ratih genotype of chrysanthemum found resistance parent against *T. parvispinus* and it can be used for further resistance breeding program (Musalamah *et al.* 2021). Avoiding excessive use of nitrogenous fertilizers and application of recom-

mended and balanced use of fertilizers needs to be followed (Sireesha *et al.* 2021).

Physical measures

Exposure to 60% CO₂ atmospheres at 30°C results in 100% mortality of five different thrips species, *Frankliniella occidentalis* (Pergande), *F. intonsa*, *T. tabaci*, *T. palmi* and *T. parvispinus* (Seki and Murai 2012).

Mechanical measures

T. parvispinus was more attracted to white rather than blue or yellow color traps (Murai *et al.* 2009). The blue and yellow sticky traps attracting more *T. parvispinus* adults (Sireesha *et al.* 2021). Collect and destroy infested crop debris and uproot off-seasonal host weeds (*Parthenium* spp. and *Abutilon* spp.) from field and installation of blue sticky traps 25-35 per acre for mass trapping immediately after transplanting (Anon 2021a).

Botanicals measures

Use of neem oil, pongamia oil or soap solution in heavily infested sites (Anon 2021a). The fish poison bean, *Tephrosia vogelii*, 2.5 and 3.0%, Indonesian mahogany, *Toona sureni*, 3.0% and eucalyptus oil, 2.0% recorded more than 30.0% efficacy during vegetative stage and lowest attack of *T. parvispinus* until 75 DAP and gave highest marketable flower yields of chrysanthemum (Rahardjo *et al.* 2022).

Biological control

Use of Ladybird beetles, *Menochilus sexmaculatus* and entomopathogenic fungus, *Lecanicillium lecanii* were found effective as bio pesticide for the management of *T. parvispinus* (Prabaningrum *et al.* 2008). Application of *Pseudomonas fluorescens*-NBAIR-PFDWD @ 20 g/L or *Bacillus albus*-NBAIRBATP @ 20 g/L spray focusing on flowers and fruits of chilli could manage this pest (Anon 2021a). Among the different bio-pesticides tested, *Azadirachtin* 10000 ppm, 0.003%, 3 ml/liter and *Pseudomonas fluorescens* 1% WP, 2 × 10⁸ cfu/g, 4 g/L were found effective in

managing new invasive thrips, *T. parvispinus* infesting chilli (Anon 2022a).

Chemical control

Laboratory studies indicated that *T. parvispinus* are susceptible (Murai *et al.* 2009). Liquefied formulation of phosphine at concentration of 200 ppm for 1 hour of exposure completely killed *T. parvispinus* (Setyawan *et al.* 2015). *Fipronil* 80 WG, 0.2 g/liter or cyantraniliprole 10.26 OD, 1.25 ml/liter or acetamaprid 20 SP, 0.2 g/liter or spirotetramat 150 OD, 0.8 ml/liter or spinosad 45 SC, 0.3 ml/liter water as sequential sprays at weekly interval manage *T. parvispinus* in chilli (Kumari *et al.* 2021 and Sireesha *et al.* 2021). From spinetoram 11.7 SC, 1 ml/litre water and tolfenpyrad 15 EC, 2 ml/liter water sprayed plants recorded lower (2.39 and 2.67 thrips/flower, respectively) *T. parvispinus* population in chilli (Anon 2022a).

CONCLUSION

T. parvispinus is a cosmopolitan insect-pest species and has been reported from Thailand, Australia and Europe. The last two decades witnessed a drastic extension in the geographic distribution of *T. parvispinus* and it is now known to occur in France, Greece, Hawaii, Mauritius, Spain, Tanzania and the Netherlands. In India, this species was first reported on Papaya from Bengaluru in 2015 and considering its potential to acquire pest status, infestation of this invasive pest was reported in chilli growing areas of Andhra Pradesh, Karnataka, Telangana, Chhattisgarh, Kerala, Tamil Nadu and Gujarat caused significant damage 40 to 80%. It is a polyphagous species and has been reported infesting beans, eggplant, papaya, chilli, pepper, potato, shallot and strawberry. In addition, it inflicts injury to ornamentals, viz. Anthurium, Chrysanthemum, Dahlia, Dipladenia, Gardenia and Ficus. It passes through five stages and complete its life cycle in 13-15 days. Community approach in pest management helps in better management of thrips particularly when the incidence is flaring up at large scale. Overall, an integrated pest management approach for tackling *T. parvispinus* by including various eco-friendly tools viz., host plant resistance, biological control options like entomopathogens,

physical and mechanical control measures, use of eco-friendly insecticide molecules are advisable for its effective management.

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