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Biological Control of the Invasive Pest *Thrips parvispinus* in Chilli

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Thrips parvispinus (Karny) (Thysanoptera: Terebrantia: Thripidae) is a highly destructive, invasive, and polyphagous insect pest, known for its quarantine importance and rapid spread across globe (Rachana *et al*., 2022; Hulagappa *et al*., 2022; Raghavendra *et al*., 2023*)*. This pest is native to Asia's tropics and has widely spread across Africa, Asia, Australia, North America and Europe during the last three decades (Ahmed et al., 2023). The species is thought to have originated in Thailand (Mound and Collins, 2000), and its rapid spread to new locations has been mostly driven by worldwide plant commerce (Waterhouse, 1993; Zhang et al., 2011). In India, *Thrips parvispinus* (Karny) infestation was first time recorded on papaya (*Carica papaya* L) (Tyagi *et al*., 2015) Globally, this invasive thrips has been found to infest at least 43 host plant species from 19 different families, including fibre crops, fruits, legumes, tobacco, ornamental plants, and vegetables (Ahmed et al., 2023). Molecular data suggests that Indonesia and India share the haplotypes of *T. parvispinus*, indicating that genetic material is migrating between the two countries and Indonesia is a likely source of the species invasion into India (Raghavendra et al., 2023; Tyagi et al., 2015). A recent *T. parvispinus* infestation in the southern Indian states of Andhra Pradesh, Karnataka, and Telangana caused severe damage, ranging from 70 to 100%, regardless of the chilli cultivars produced by farmers (Sridhar et al., 2021; Raghavendra et al., 2023).

Mode of feeding of *Thrips parvipsinus*

T. parvispinus damages the chilli plants by leaving deep punctures and scratches on the underside of the leaves. During infestation, the underside of the leaves becomes reddish brown, while the upper side becomes yellowish in colour. Yellow streaks and distorted leaf lamina with necrotic areas were the common symptoms. It was observed that badly damaged leaves showed upward curling, and scraping of the petals resulted in brownish streaks on flower. Damaged flowers dry up and wither, resulting in diminished fruit set (Sireesha et al., 2021; Sridhar et al., 2021). Large groups of these thrips were seen feeding on the nectar-rich parts of chilli flowers, resulting in a major loss of crop yield due to huge flower drop (Raghavendra et al., 2023).

Life cycle of *Thrips parvipsinus*

Life cycle of the *Thrips parvispinus* depends upon the temperature. Female thrips lay about 15 eggs on average and insert them into the leaves, petioles, bracts, petals and developing fruits. The eggs are hatched within 4-5 days. The larvae feed on leaves and flowers and complete two moults in four to five days. The larvae then mature into pupae, and emerges into adult after two to three days (Ahmed *et al*., 2023). They can complete their life cycle in about 15–17 days under optimal conditions (a temperature of 27 ± 1 °C and a relative humidity of 65% ± 5%), resulting in over 20 generations per year.

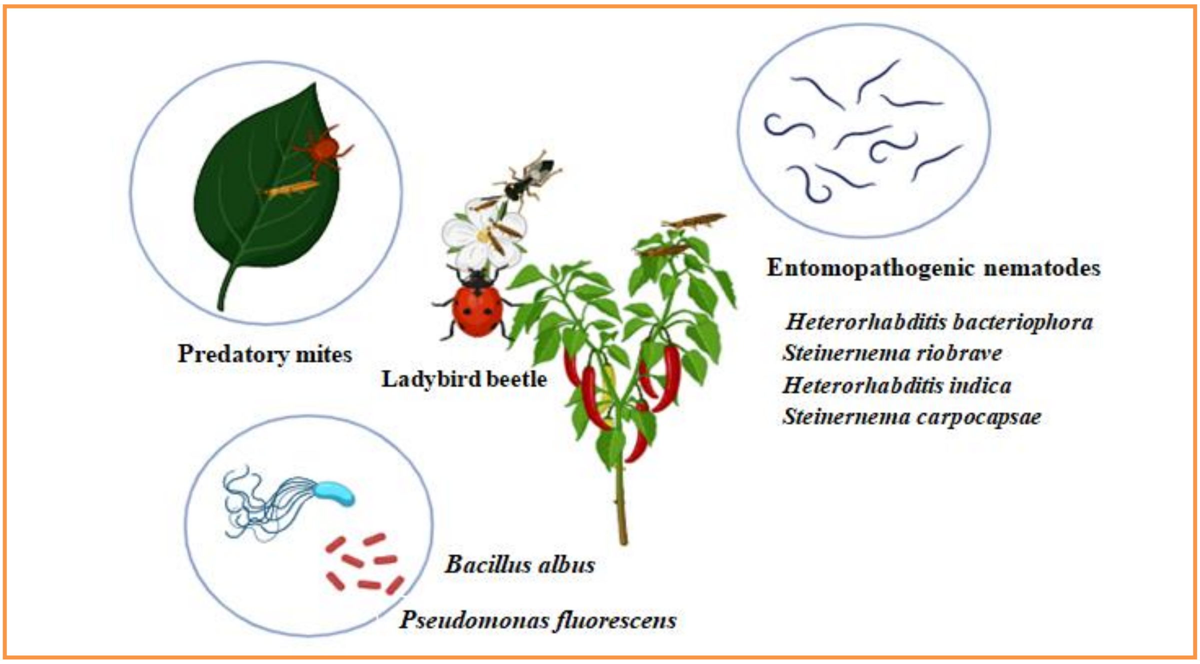

Figure 1: Biocontrol agents for the management of *Thrips parvispinus*

Biological control agents for controlling *Thrips parvispinus*

Biological control agents and botanical formulations in Integrated Pest Management (IPM) systems show promise for long-term crop protection (Mouden et al., 2017). The two predatory mites, *Amblyseius swirskii* (Athias-Henriot) and *Euseius degenerans* (Berlese), were found to be promising predators in control of first instar larvae of *T. parvispinus* with maximum predation and oviposition rates was observed in *A. swirskii* than those of *E. degenerans* (Sierra *et al*., 2025). In another study female pirate bug *Orius insidiosus* and predatory mite *Anystis baccarum* out of 40 thrips consumed 21 and 18 thrips respectively in 24 h. Similarly in glass house trial they showed successful establishment by reducing the thrips population by 80% (Saito *et al*., 2025). The Entomopathogenic Nematodes *viz*., *H. bacteriophora*, *S. riobrave*, *H. indica*, and *S. carpocapsae* showed their efficacy in targeting the pest's prepupal and pupal soil-dwelling phases reducing the adult thrips recovery by 20-36%. In greenhouse trials *S. riobrave* and *S. carpocapsae* reduced the adult thrips recovery by 60% (Vargas et al., 2025). *Menochilus sexmaculatus*, a ladybird beetle, and *Lecanicillium lecanii*, an entomopathogenic fungus, were proven to be efficient biopesticides for controlling *T. parvispinus* (Prabaningrum *et al.* 2008). Application of *Pseudomonas fluorescens*-NBAIRPFDWD @ 20 g/L or *Bacillus albus*-NBAIRBATP @ 20 g/L spray focusing on flowers and fruits of chilli were found effective in managing new invasive thrips (Anonymus 2021).The predatory bug *Blaptostethus pallescens* was a promising biocontrol agent with predatory potential of 17.3, 24.9 and 25.5 in fourth instar, fifth instar and adults bugs respectively when exposed to 50 adult *Thrips parvipsinus*. Adult *Blaptostethus pallescens* showed maximum predation rate (1.329) followed by fourth instar and fifth instar nymphs (Varshney and Budhlakoti, 2026)

Conclusion

Thrips parvispinus is a major invasive pest that causes significant yield losses due to its wide spread, cryptic nature and short life cycle. Indiscriminate use of chemical pesticides for control is unsustainable and has harmful effect on the environment. Biological control methods have significant potential for effectively managing this pest. Predatory mites, bugs, entomopathogenic nematodes, fungus, and beneficial bacteria have all shown significant reductions in thrips populations. These biocontrol agents target different life stages of thrips and work efficiently. The successful establishment of predators in greenhouse and field levels demonstrates their practical utility. Integrating these biocontrol agents into IPM programs provides an environmentally friendly and sustainable approach. Such approaches reduce pesticide dependence and support agro-ecosystem health. Further optimization and field validation will enhance their adoption by farmers.

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