

Occurrence of *Thrips parvispinus* (Karny) (Thripidae: Thysanoptera) in major chilli (*Capsicum annum*) growing areas of Karnataka

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Thrips parvispinus (Karny) (Thripidae: Thysanoptera) is a polyphagous pest on many fruits, vegetables and flower crops. This species is native to the tropics of Asia and has been reported from Indonesia, India, Thailand, Malaysia, Singapore, Taiwan, China, Philippines, Australia, the Solomon Islands, Greece, France, Spain, The Netherlands, Tanzania, Mauritius, Reunion and Hawaii (Mound and Collins 2000; Mound *et al.* 2016). Mound and Collins (2000) reported its occurrence in India. Subsequently Tyagi *et al.* (2015) reported it on papaya (*Carica papaya*) and Rachana *et al.* (2018) on *Dahlia rosea* Cav.

T. parvispinus is polyphagous and is reported to feed on papaya, peppers, potatoes, eggplants, beans, shallots and strawberries. The damage is inflicted by direct feeding of larvae and adults on leaves and growing buds. In papaya, *Cladosporium* a saprophytic fungus is known to cause a secondary infection on tissue damaged by the thrips (Lim, 1989). Ornamentals such as dahlia, chrysanthemum, gardenia, dipladenia, Anthurium, hoya and Ficus are affected in green houses.

Female and male thrips of *T. parvispinus* differ in size and color. Females are nearly one mm long, with brown head and prothorax, yellowish brown meso- and metathorax and black abdomen; forewings are dark, with light colored base. The third antennal segment and the base of the fourth and fifth segments are light colored (either yellow or white). Males are 0.6 mm long and evenly yellow (Hutasoit *et al.* 2017).

Eggs are inserted into leaves and incubation period lasts for four to five days. Larvae feed on leaves and flowers. Larvae go through two molts in four to five days, mature and pupate. The two pupal stages last for two to three days. The life cycle is completed in 13–14 days. Reproduction is sexual and on average females lay 15 eggs. Mated females live for nine days. Adult males live for six days on chilli under controlled conditions in greenhouses (Hutasoit *et al.* 2017).

The species has been reported as pest on chilli flowers in Guntur District of Andhra Pradesh during 2020-21 (Verghese, 2021). With

an objective to know its occurrence and severity in Karnataka, intensive surveys were undertaken in major chilli growing areas of Karnataka such as Chitradurga, Bellary and Raichur districts during November and December 2021. The current status, distribution, hosts plants, possible management strategies and impact of such upsurges on the export are discussed in this paper.

Material and methods

During the survey, flowers and terminal shoots of chilli pepper and sweet pepper were individually plucked and collected in 10% ethyl alcohol in plastic vials (3 cm diameter and 8 cm length). A minimum of 20 terminal shoots and flowers were sampled from each field. The vials were coded using location and the crop. Similarly, crop species such as maize *Zea mays* subsp. *mays*, okra *Abelmoschus esculentus*, green gram, *Vigna radiata*, red gram, *Cajanus cajan*, cotton, *Gossypium*, field bean, *Vicia faba*, tomato, *Solanum lycopersicum*, marigold *Tagetes*, gingelly, *Sesamum indicum*, sorghum, *Sorghum bicolor*, bitter gourd, *Momordica charantia*, etc. observed in and around chilli fields were also surveyed, and shoots and flowers were collected in 10% ethyl alcohol. Tree species of neem, *Azadirachta indica* and pongamia, *Millettia pinnata* and weed species of parthenium, *Amaranthus* sp., *Axonopus* sp., *Ageratum* sp. *Alternanthera* sp. *Thunbergia* sp. etc found in and around chilli crops were also

surveyed. Wherever necessary flowers and shoots were beaten on light coloured trays to find the thrips incidence. Information on the variety, cropping pattern, pest scenario crop management practices followed during the cropping season were gathered from farmers, officers of State Horticulture Department, seed industry personnel available there during the survey.

The plant materials sampled were shifted to the laboratory at the Regional Central Integrated Pest Management Centre (RCIPMC), Bangalore for further observations. Plastic funnels (8 cm diameter) were placed in a conical flask (100 ml) and a layer of blotting paper was placed in the funnels. The contents of individual plastic vials were poured on to the blotting paper to facilitate to strain of alcohol into the conical flask. The material retained on the tissue paper was carefully observed under stereo binocular microscope.

The terminal shoots were counted for the number of open, unopen and flowers buds. Observations on the number of females, males, nymphs of *T. parvispinus* and other species of thrips, and other insects were recorded. Characters given by Rachana *et al.* (2018) were used to identify males and females of *T. parvispinus*.

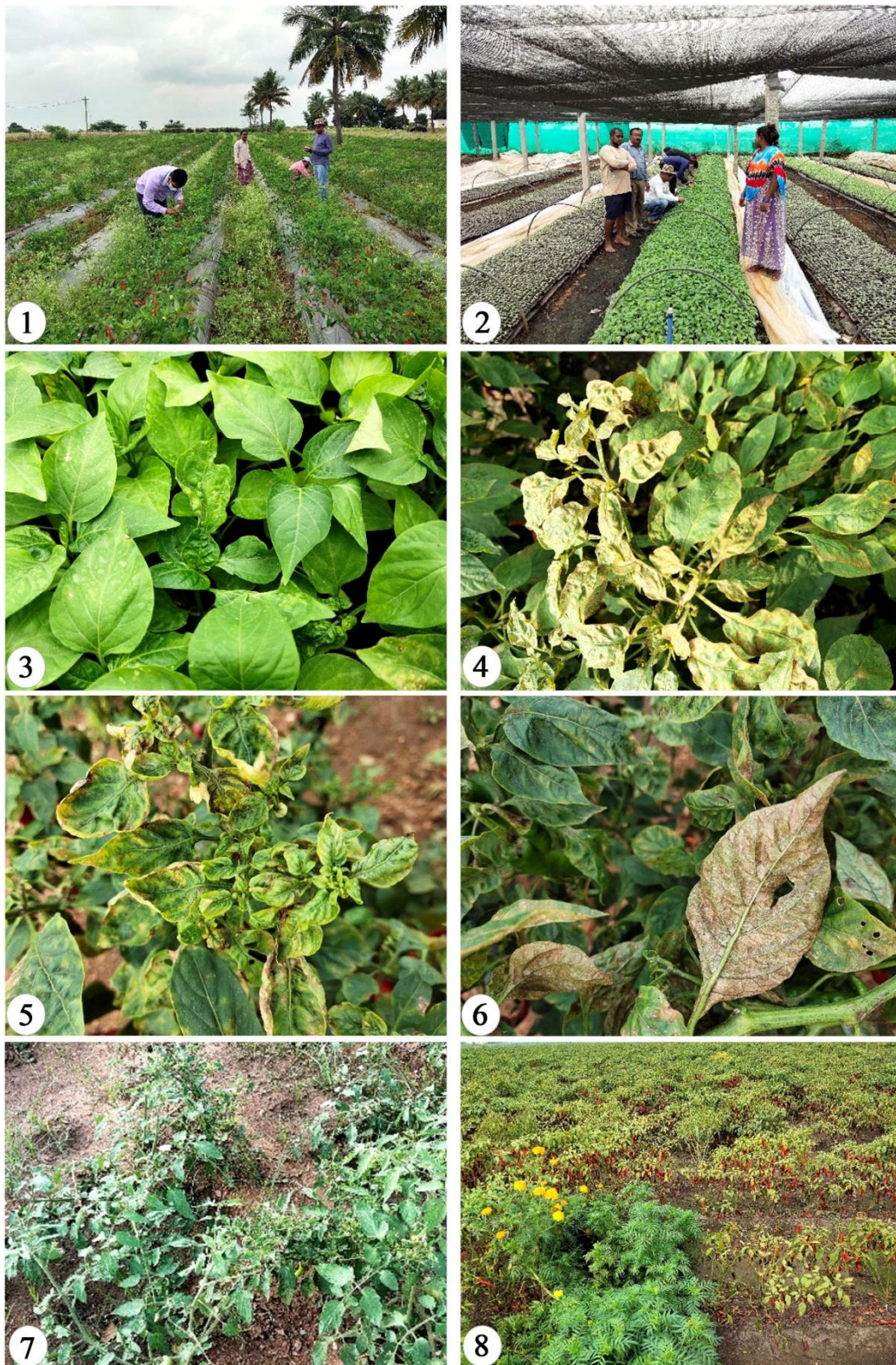


Figure 1 Chilli field, 2. Nursery, 3. Infested plants in nursery, 4, 5, 6. Infested chilli plants, 7 & 8. Bronzing of leaves.

Results

Thrips parvispinus infestation on chilli was observed in almost all chilli growing districts surveyed. Chilli crops were found infested with a mean of 7.98 ♀ and 0.84 ♂ thrips/flower in Bellary, 7.41 ♀ and 0.38 ♂/flower in Chitradurga, 6.3 ♀ and 1.8 ♂/flower in Gadag, 2.00 ♀ and 0.28 ♂/flower in Koppal and 4.4 ♀ and 0.5 ♂/flower in Raichur.

Bell pepper cultivated in an open field was observed infested with a mean of 4.1 ♀ and 0.85 ♂ thrips/flower in Raichur district. It was observed that, both tender shoots and flowers of chilli and bell pepper were infested. However, number of thrips were more in flowers compared to tender shoots in all the locations surveyed. Number of females to male ratio on tender shoots was approximately 4:1, respectively. It is interesting to note that *T. parvispinus* infestation on foliage of crops other than chilli and bell pepper was negligible. The correlation between number of open leaves and females was negatively correlated ($r = -0.210135961, p=0.2$).

Though more number of thrips was found on flowers, evident thrips damage was not found on fruits both in chilli and bell pepper. However, flowers exhibited symptoms

of discoloration and tender leaves showed upward curling. Whereas, ventral sides of older leaves exhibited browning/bronzing and were brittle due to extensive feeding by thrips.

In addition, flowers of pigeon pea flowers (2.94 ♀ and 0.50 ♂/flower), green gram (1.11 ♀ and 0.50 ♂/flower), gingelly (1.80 ♀ and 0.20 ♂/flower), bhendi, field bean and maize grown as border crops were associated with *T. parvispinus*. Tomato flowers (0.68 ♀ and 0.16 ♂/flower) grown as mixed and that of marigold (32.00 ♀ and 2 ♂/flower) grown as trap crops were observed to have *T. parvispinus* infestation. Flowers of sorghum, maize, cotton and bitter gourd plants found in and around chilli crops were also found with thrips. Among different flowers, cotton (34 – 36.50 ♀ and 2 – 7 ♂/flower) recorded highest number of thrips followed by bitter gourd (15.50 ♀ and 1 ♂/flower). Nymphs and other species put together were also more on cotton (7 – 28/flower) and bitter gourd (6.5/flower). The infested flowers showed brownish specks and discolouration.

Flowers of weeds species namely Parthenium, *Amaranthus* sp., *Axonopus* sp., *Ageratum* sp. *Alternanthera* sp. *Thunbergia* sp. found in chilli fields and foliage of neem and pongamia bordering chilli fields were also found infested with thrips.

Table 1. Incidence of *Thrips parvispinus* on flowers (mean/flower)

District	Crop	# Females	# Males	# Nymphs & other species
Bellary	Chilli	7.98	0.84	1.64
	Gingelly	1.80	0.20	0.00
	Sorghum	0.90	0.00	0.40
	Bitter gourd	15.50	1.00	6.50
	Cotton	34.00	7.00	28.00
Chitradurga	Chrysanthemum	0.80	0.50	0.00
	Chilli	7.41	0.38	0.37
	Cotton	36.50	1.50	7.00
	Pigeon pea	2.94	0.50	0.13
	Green gram	1.00	0.50	0.50
	Marigold	32.00	2.00	2.00
	Tomato	0.68	0.16	0.21
Gadag	Chilli	6.3	1.8	2.00
Koppal	Chilli	1.04 – 2.00	0.28	0.60 – 0.96
Raichur	Chilli	4.4	0.5	1.5
	Capsicum	4.1	0.85	0.85

Table 2. Incidence of *Thrips parvispinus* on shoots of different crops (mean range/shoot)

District	Crop	# Females	# Males	# Nymphs & Other species
Bellary	Chilli	5.40 - 7.80	1.20 - 1.80	3.40 - 4.60
Chitradurga	Chilli	0.00 – 6.10	0.00 - 0.80	0.00 - 0.40
	Tomato	0.00	0.00	0.00
Gadag	Chilli	6.3	1.8	2.00
Koppal	Chilli			
Raichur	Capsicum	1.50	0.00	0.25
	Chilli	1.67	0.00	1.00

Table 3. Relationship between chilli shoot parameters and thrips infestation

Parameters	Correlation Co-efficients (r)				
	# open leaves	# unopened leaves	# flower buds	# females	# males
# females	-0.210135961*	0.055108	-0.12982		
# males	-0.201149591	0.003209	-0.24706*	0.294397*	
# nymphs	0.069494993	0.149958	-0.1537	0.158282	0.376961*

N = 36, * Significance at $p = 0.2$

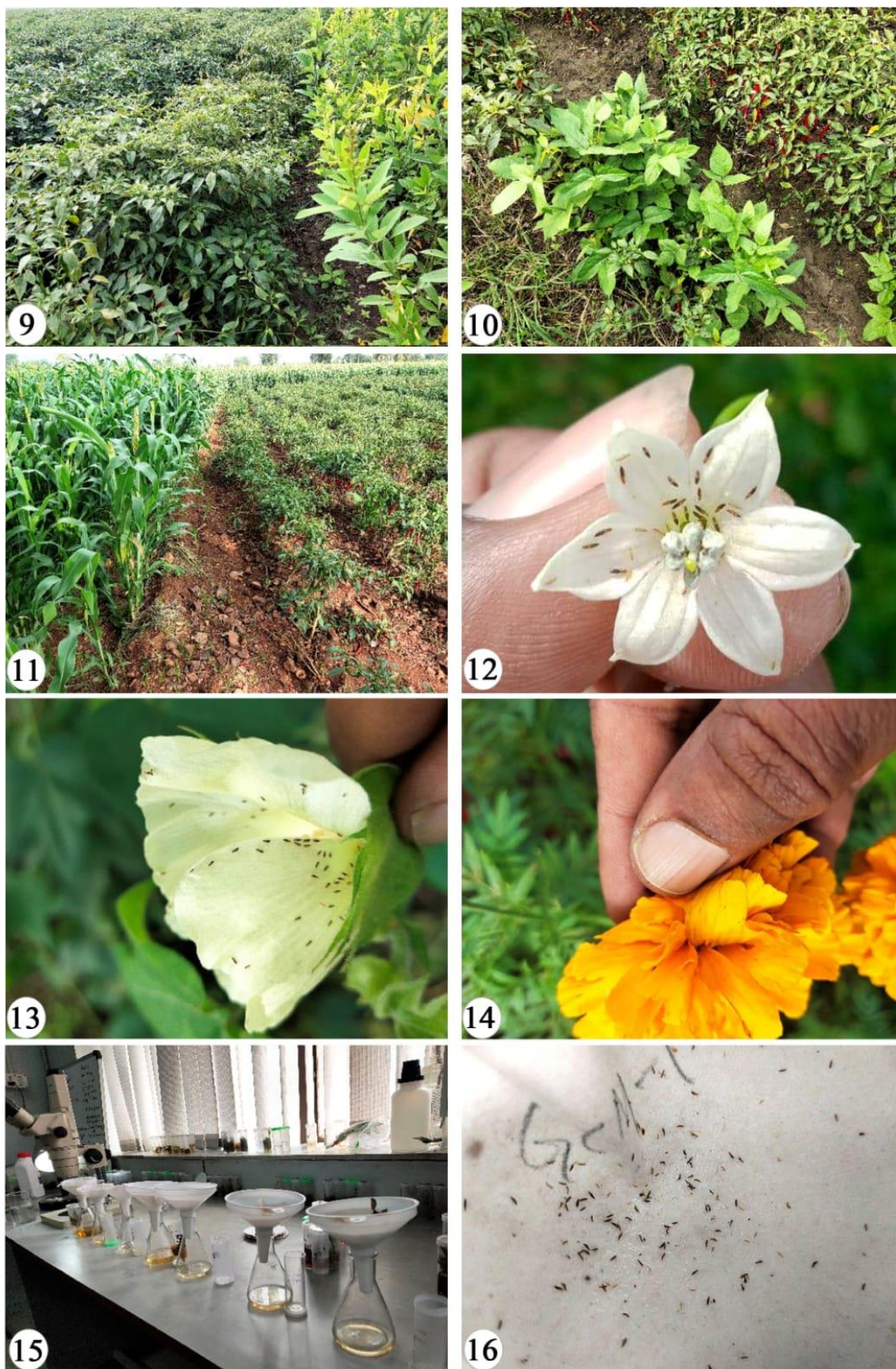


Figure 9. Pigeon pea as border crop, 10. Green gram as border crop, 11. Sorghum as border crop, 12. Thrips on chilli flowers, 13. Thrips on cotton flowers, 14. Thrips on marigold flower, 15 & 16. Extraction of thrips in laboratory.

Discussion

Chilli is being extensively grown in Bellary, Chitradurga, Gadag, Koppal and Raichur districts (Fig 17). BHH 5531, BHH 2043, 355-Kalsa, Indo 5, Commercial dubbi, Commercial Kaddi, Byadagi dabbi, Byadagi Kaddi, etc are the some of the major hybrids/varieties found in the field during the survey. Chilli crop in all the districts surveyed were heavily infected by Anthracnose and Powdery Mildew due to unseasonal rains received during the fruiting stage of the crop. *T. parvispinus* commonly called as tobacco thrips has further aggravated the farmers' woes during the current season. None of the farmers had noticed tobacco Thrips infestation during the previous year. The infestation noticed during November 2021 in Bellary has spread to all the areas. Farmers are of the opinion that, the thrips have been introduced along with planting materials from neighbouring Andhra Pradesh, Telangana where thrips infestation was noticed in Vijayawada, Nellore and Guntur during January 2020 itself. Farmers have procured seedling of a variety called Vajra (5531) from the seedling nurseries from neighbouring districts of Andhra Pradesh, which is believed to be carrier of thrips to chilli growing regions of Bellary. Thrips infestation was noticed even in nurseries during the present survey corroborate the fact that nurseries could aid breeding and spread of pests to new locations.

The infestation was more on flowers compared to tender shoots. It is interesting to note the thrips presence in almost all flowers found in and around the chilli crops. In cotton, marigold and okra, thrips were found in groups

at the base of the stamen and moved upwards upon disturbance. Their presence could be detected only by careful observation or by beating on a white surface. Whereas, thrips were easily detectable in open flowers like chilli and capsicum.

Cotton and bitter gourd harboured more number of thrips in flowers. It will be interesting to study the effect of flower size, colour of petals, arrangement of petals, quantity and quality of the pollen, and quantity and quality of nectar on population dynamics of thrips. Though more thrips were found in flowers, foliage of all crop plants and weeds except chilli and bell pepper were completely devoid of thrips as well as damage symptoms.

Farmers have sprayed number of pesticides in cocktails to contain thrips and anthracnose in chilli in the current season. Insecticides such as Fipronil 5% SC, Acetamiprid 10% SC, Spinetoram 11.7% SC, Spinosad 45% SC, Imidacloprid 40% WG and many of them in combination are being sprayed by farmers regularly. Use of these insecticides could have limited otherwise regular sucking pests of chilli such as *Scirtothrips dorsalis* Hood, *Bemisia tabaci* Genn., *Aphis gossypii* Glover, *Polyphagotarsonemus latus* Banks, etc. and eliminated all natural enemies of sucking pests in general and thrips in particular. In present survey, none of the predators could be observed on tender shoots and flowers. This could be the possible reason for upsurge of *T. parvinpinus* in chilli and all major chilli growing areas. Use of bio-pesticides, pheromone traps, sticky traps, botanicals was almost nil in all the areas surveyed.



Figure 17. Districts affected by *T. parvispinus*.

Thrips parvispinus is major pest of chilli in Indonesia and Tyagi *et al.* (2015) opined that Indonesia could be the probable source of Invasion. Plants and planting materials if imported from Indonesia could have been the source of this exotic thrips. However, India has a very strong interdisciplinary Plant Quarantine setup to prevent entry and establishment of such quarantine pests. Plant Quarantine (Regulation of Import into India) Order 2003 issued under the aegis of Destructive Insect Pest Act (DIPA) 1914, empowers the plant quarantine authorities to inspect and detect the exotic pests on arrival at least at two stages. Plants for planting/propagation are allowed to import only through Regional Plant Quarantine Stations (RPQS) located at New Delhi, Mumbai, Chennai, Amritsar, Kolkatta and Bangalore, who carry out the first inspection on arrival at point of entry and issues provisional Import Release Order (IRO), if found free of Quarantine Pests. Subsequently, the planting materials are shifted to approved Post Entry Quarantine Facilities (PEQ) of the Authorized Importers where, they are kept under the supervision of Designated Inspection Authorities (DIA) for a specified period of time. State Agricultural Universities (SAUs), ICAR institutes, etc are performing the duties and responsibilities of a DIA. The final release will be given by the DIA, if satisfied on the freedom from exotic pests. In spite of all these regulatory measures, it is surprising that India is witnessing frequent pest incursions of known invasive pests on major crops of India, which needs immediate scientific scrutiny.

Now, the pest has been introduced into India and is threatening cultivation of Chilli in major chilli production areas. Immediate steps needs to be taken on containing the pest from further spread to other areas using effective monitoring and IPM techniques. Use of insecticide alone is a futile exercise and farmers also have realized the same. Instead, the pesticides have eliminated all major natural enemies supposed to be there in chilli ecosystem. It is pertinent to mention here that, Fall Army Worm (FAW) an introduced invasive was pest introduced into India in the year 2018. FAW which was expected to be a threat for Maize production has been kept under control by the action of parasitoids, predators and entomopathogenic fungi. Use of fewer pesticides and microclimate with high RH due to good rain in maize ecosystem has made this possible. There is a need to explore the effective natural enemies of *T. parvispinus* in the native range and if necessary, Classical Biological Control needs to be employed immediately.

India is a leading exporter of cut flowers to many countries. Therefore, it is necessary that the movement of pests to rose and Gerbera cultivating polyhouses should be monitored and immediate steps to be taken to contain the pest. Otherwise it is of great concern to India in export of cut flowers, green leafy vegetables, fresh fruits and vegetables. The relation between upsurge of *T. parvispinus* and diseases such as Anthracnose and Powdery Mildew together needs to be studied, as thrips are known to predispose the fruits for secondary infection.

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