

MORPHOLOGICAL CONFIRMATION OF THE INVASIVE SOUTHEAST ASIAN THRIPS, *Thrips parvispinus* (Karny) INFESTING CHILLI IN TELANGANA, INDIA

S. SRINIVAS NAIK¹, K. VIJAYA LAKSHMI², S. OMPRAKASH³, N. BALRAM⁴ and G. KIRAN REDDY⁵

¹Department of Entomology, Agricultural College, Warangal, PJTAU, Hyderabad, Telangana

²Department of Entomology, College of Agriculture, Hyderabad, PJTAU, Hyderabad, Telangana

³Regional Agricultural Research Station (RARS), Warangal, PJTAU, Hyderabad, Telangana

⁴Seed Research and Technology Centre, Rajendranagar, PJTAU, Hyderabad, Telangana

⁵Department of Soil Science & Agricultural Chemistry, Agricultural College, Huzurnagar, PJTAU, Hyderabad, Telangana

Date of Receipt: 23-05-2024

Date of Acceptance: 31-09-2024

ABSTRACT

The invasive Southeast Asian thrips, *Thrips parvispinus* (Karny) (Thysanoptera: Thripidae), has recently emerged as serious invasive pest in chilli causing significant economic loss through severe damage to leaves, flowers, and fruits. Taxonomic confirmation is essential for distinguishing this invasive species from morphologically similar thrips species and also important for implementing effective integrated pest management (IPM) strategies. The present study was undertaken to confirm the taxonomic identity of *T. parvispinus* in major chilli-growing districts of Telangana through roving survey during kharif, 2023. Thrips samples were collected from infested leaves, flowers and fruits. Further, permanent slide mounts were prepared and identified using standard taxonomic keys. Based on the taxonomic characters the species was confirmed and diagnosed as *T. parvispinus*. The taxonomic confirmation from three zones (Northern, Central and Southern) highlight its successful establishment and adaptation to different agro-climatic conditions of the state. This information provides essential foundation for continuing research on its population demographic studies which include population count, dynamics, associated natural enemies and competitive displacement ability for developing integrated pest management (IPM) strategies.

Keywords: Chilli, *Thrips parvispinus*, taxonomic confirmation, Telangana, IPM

Chilli, *Capsicum annuum* L. (Solanales: Solanaceae) is one of the important commercial spice cum vegetable crops cultivated widely in the world. Chilli peppers are primarily used as a spice to add flavour and pungency to food and also used in various culinary preparations. Capsaicin, the compound responsible for the pungency in chilli peppers is being used in traditional medicine to cure various human ailments like arthritis, muscle pain and neuropathy (Srinivasnaik et al., 2024). Mexico was considered to be the native home of chilli and it was first introduced in to India by the Portuguese in Goa in the middle of 17th century. India is the largest producer, consumer and exporter of chilli, contributing about 40% of the world's chilli production followed by China, Thailand, Ethiopia and Indonesia (FAO statistical yearbook, 2024).

Globally, this crop is cultivated in an area of 16.46 lakh ha with production of 49.10 lakh tonnes and productivity of 2.98 tonnes ha⁻¹. In India it is cultivated in an area of 8.44 lakh ha, accounting for 51.27 per cent of world cultivable area with a total production of 22.79 lakh tonnes and productivity of

2.70 tonnes ha⁻¹ (Indiastat, 2024) and a total of 5.17 lakh tonnes of chilli worth of Rs.1045.00 crores rupees was exported to different countries during 2022-23 (Indiastat, 2024). In India, the major chilli growing states include Andhra Pradesh (10.25 lakh tonnes), Telangana (5.07 lakh tonnes), Madhya Pradesh (2.80 lakh tonnes) and Karnataka (1.68 lakh tonnes) accounting for 44.97, 22.24, 12.28 and 7.34 per cent of Indian dry chilli production, respectively (Indiastat, 2024).

The chilli crop is attacked by about 57 insect and non-insect pests (Venugopal *et al.*, 2018) of which the yellow thrips, *Scirtothrips dorsalis* Hood (Thripidae: Thysanoptera) and tarsonemid mite, *Polyphagotarsonemus latus* (Banks) (Tarsonemidae: Acari) are the most devastating pests. The thrips and mites have relatively short life cycle, complete several generations in a single crop season and multiply at a faster rate accounting for huge losses. Affected leaves curl upward and down ward resulting in a typical damage symptom known as "leaf curl syndrome/murda complex". The crop is attacked at both vegetative and reproductive stages by the

regular pest, *S. dorsalis* which causes a quantitative yield loss of 11 to 75 per cent and 60 to 80 per cent, qualitatively (Venugopal *et al.*, 2019).

During recent times, India witnessed the entry of invasive alien insect species, called South East Asian thrips (*Thrips parvispinus* (Karny)) during 2015 (Tyagi *et al.*, 2015) on papaya in Bengaluru. Later a severe outbreak of *T. parvispinus* has been recorded from southern states of India (Andhra Pradesh, Karnataka and Telangana) on chilli crop causing 70-100 per cent damage and devastated chilli cultivation during 2021-22 (Rachana *et al.*, 2022). Its incidence on chilli and also on many other alternate hosts was reported by many workers from India like Telangana (Anithakumari *et al.* (2021), Veeranna *et al.* (2022) and Srinivasnaik *et al.* (2024)), Andhra Pradesh (Sireesha *et al.* (2021), Sridhar *et al.* (2021a & 2021b), Rachana *et al.* (2022) and Raghavendra *et al.* (2023)), Karnataka (Basavaraj *et al.* (2022), Nagaraju *et al.* (2021), NBAIR (2021), Prasannakumar *et al.* (2021), Roselin *et al.* (2021) and Ranjith *et al.* (2022)), Gujarat (Lodaya *et al.* (2022) and Patel *et al.* (2022)), Tamil Nadu (Amutha and Rachana (2023) and Palaniswamy *et al.* (2023)), Uttar Pradesh (Sethy *et al.* (2023)) and West Bengal (Chatterjee *et al.* (2024)) and Further, the observations made by Sridhar *et al.* (2021b) during 2021 revealed that the invasive thrips has completely dominated the established species of chilli thrips, *S. dorsalis* and other thrips species infesting different plant parts of chilli. It is quite common that any invasive species which was introduced in to new ecosystem, would cause serious damage for few years and after words, its intensity on the crop decreases. To ascertain whether the displacement of previously existing thrips species by *T. parvispinus* is seasonal, temporary or permanent, the collected thrips species from major chilli growing areas of Telangana state were identified by using standard taxonomic keys (Mound and Masumoto, 2005 and Mound and Morris, 2007).

It is hypothesized that the thrips populations associated with chilli in Telangana belong to the invasive species *Thrips parvispinus* (Karny) and can be unequivocally distinguished from other thrips species through detailed morphological characterization. Accurate taxonomic confirmation will provide the foundation for reliable surveillance, distribution studies, and the development of effective

integrated pest management (IPM) strategies. Hence this study mainly focused on taxonomic confirmation.

MATERIAL AND METHODS

The incidence of *T. parvispinus* in chilli crop was confirmed by conduct of a roving survey in six major chilli growing districts comprising of all the three zones of Telangana state (Northern, Central and Southern) during *kharif*, 2023. For the survey, two districts were selected from each zone *viz.*, Jagtial and Peddapalli from Northern Telangana Zone (NTZ), Khammam and Mahabubabad from Central Telangana Zone (CTZ) and Jogulamba Gadwal and Nagarkurnool from Southern Telangana Zone (STZ) (Fig.1). From each district, 2 mandals and in each mandal, 2 villages and in each village, 2 farmer fields were selected for sample collection.

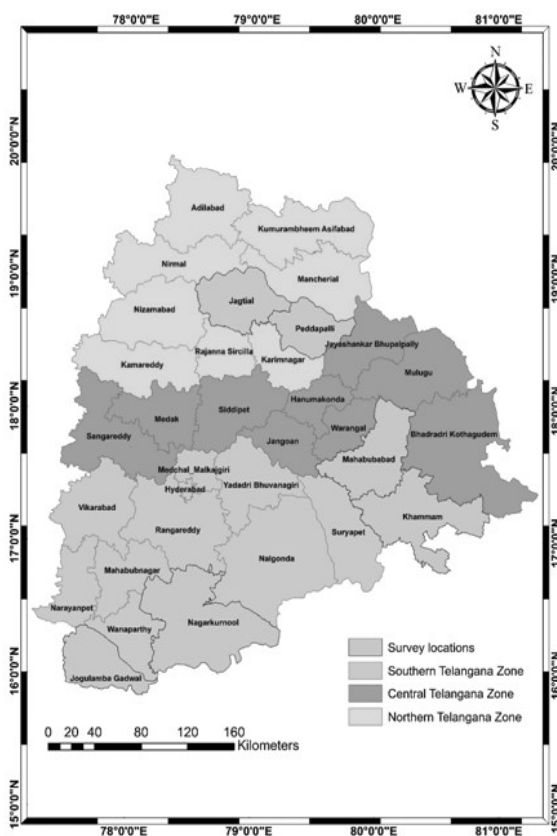


Fig.1. Survey locations selected for the collection of *Thrips parvispinus* (Karny) in major chilli growing districts of Telangana state

In each field the sampling was done at five spots (four spots from the corners, at least 5 feet inside of the field borders and one in the centre). In each spot, five plants were randomly selected and in each plant 10 leaf terminals, 10 flowers and 10 fruits were collected for collections of the thrips samples

(Niles, 1980, Venugopal *et al.*, 2019 & NPPO-India, 2022). The thrips collected in the 70 per cent ethyl alcohol solution were brought to laboratory and observed under microscope after making permanent and temporary slides and confirmed based on the taxonomic keys described by Mound and Morris (2007). The morphological characters were documented by using stereo zoom trinocular phase contrast microscope (N-207N) with 5MP CMOS camera with inbuilt Tcapture software at Central Instrumentation Cell, PJTAU, Rajendranagar as described in plate 1a-h. After identification of thrips species based on taxonomic keys, for further confirmation of the thrips as well as permanent slides were sent to National Bureau of Agricultural Insect Resources (NBAIR), Bengaluru.

RESULTS AND DISCUSSION

Species identification of *T. parvispinus* was carried out based on detailed examination of diagnostic morphological characters using standard taxonomic keys and original species descriptions. Diagnostic features assessed included body colouration, antennal segmentation and colour pattern, position of the ocellar setae, pronotal chaetotaxy, metanotal sculpture, forewing venation and setal arrangement, and the morphology of the abdominal tergites. The *T. parvispinus* body colour of male adult is yellow and the female adult is brown to dark brown. Antennae 7 segmented. III segment, basal half of IV and V antennal segments are yellow and antennal segment III similar in length to segment



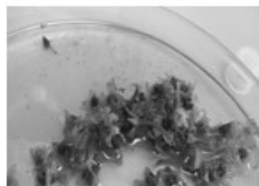
a. Recording observations



b. Collection of samples into 100 ml container



c. Labelling of leaf/Flower/Fruit samples



d. Separation of thrips species



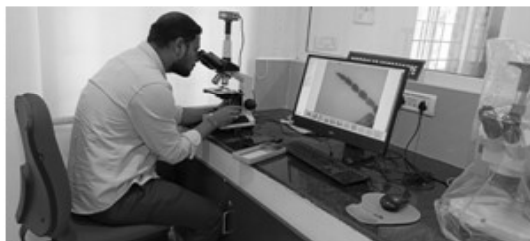
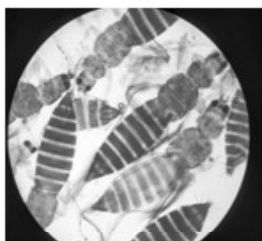
e. Separated thrips collected in vials



f. Labelling of vials



g. Preliminary separation of *T. parvispinus* and other thrips species under 10X magnification



h. Documentation of individual taxonomic characters

Plate 1a-h. Taxonomic characterization of *T. parvispinus* and other thrips species collected from different districts of Telangana

IV. Head not prolonged in front of compound eyes, Ocellar setae I is absent, Ocellar pair III arises at the anterior margin of ocellar triangle, post ocular setae III shorter than post ocular setae I and IV. Pronotum with 2 pairs of long posteroangular setae and 3-4 posteromarginal minor setae. Metanotum reticulate medially, median setae long and placed well behind the anterior margin, campaniform sensilla absent. Fore and hind wings present, more than half as long as abdomen and uniformly dark or shaded, but with base or sub-base is pale first and second vein of forewing with continuous row of setae. The legs are yellow in colour. Posterior margin of tergite VIII without comb. Abdominal sternites III-VI with discal setae, but absent on II and VII (Plate 2a-h).

The present investigation confirmed the presence of the invasive, *T. parvispinus*, on chilli in Telangana through the morphological

characterization. This identification of invasive thrips species is a prerequisite for understanding its biology, host association, distribution, and dynamics for developing effective IPM strategies. Morphological identification remains the primary and appropriate approach for initial diagnosis. These taxonomic characters are clearly distinguished

T. parvispinus from other thrips species such as *Scirtothrips dorsalis*, *T. hawaiiensis* and *Haplothrips* spp. which frequently associated with chilli ecosystem. These diagnostic characters are identified in the species are in accordance with the identification key given by Mound and Collins (2000), Tyagi *et al.* (2015) and Rachana *et al.* (2022). The present findings further confirm that the species has become well established in Telangana and is now an important invasive pest threatening chilli cultivation in the state.



a). Male Adult



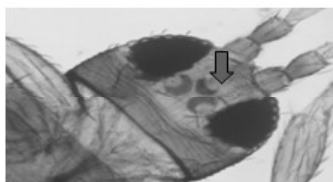
b). Female adult



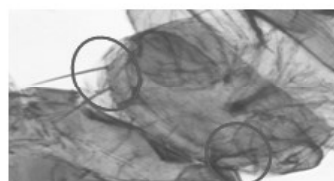
c). III, basal half of IV & V antennal segments are yellow



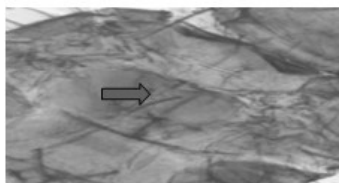
d). Forewing with two complete rows of setae and clavus with 5 setae



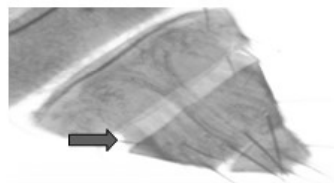
e). Ocellar setae III arising on anterior margins of ocellar triangle



f). Pronotum with 2 pairs of long posteroangular setae



g). Metanotum with median reticulations & long median setae



h). Posteromarginal comb on VIII tergite was absent

Plate 2a-h Documentation of taxonomic characters of *T. parvispinus* for its species confirmation

CONCLUSION

The present roving survey investigation helped in the identification of this notorious thrips,

T. parvispinus, infesting chilli crop in three zones of Telangana through detailed taxonomic characterization. The diagnostic features identified in this species conferred with the standard taxonomic descriptions of the species, thereby eliminating confusion with other closely related thrips species occurring in chilli crop. This taxonomic confirmation enabled that *T. parvispinus* as the predominant invasive thrips species associated with chilli cultivation in Telangana. The taxonomic confirmation from three zones (Northern, Central and Southern Telangana) highlight its successful establishment and adaptation to different agro-climatic conditions of the state. This information may provides essential foundation for continuing research on its population demographic studies which include population count, dynamics, associated natural enemies and competitive displacement ability for developing effective integrated pest management (IPM) strategies.

REFERENCES

- Amutha, M and Rachana, R.R. 2023. A new host record for the invasive thrips, *Thrips parvispinus* (Karny) from India. *Indian Journal of Entomology*. 85(4): 1009-1011.
- Anithakumari, D.A., Bhasker, K and Suresh, V. 2021. A new invasive chilli thrips (*Thrips parvispinus*) in Telangana State. *Insect Environment*. 24(4): 520-522.
- Basavaraj, K., Sreenivas, A.G., Badari Prasad, P.R and Rachana, R.R. 2022. First report of invasive thrips, *Thrips parvispinus* (Karny) (Thysanoptera: Thripidae) infesting chilli, *Capsicum annum* L. in Kalaburagi, Karnataka, India. *Journal of Experimental Zoology India*. 25(1): 191-194.
- Chatterjee, M., Biswas, A., Chakraborty, Debanjan, Patra, B and Sahoo, S.K. 2024. First report of invasive thrips, *Thrips parvispinus* (Karny) (Thysanoptera: Thripidae) in chilli from Alipurduar District of West Bengal, India. *Journal of Scientific Research and Reports*. 30(5): 618-624.
- Chilliwiki.1 May 2024.https://en.wikipedia.org/wiki/Chili_pepper.
- FAO statistical yearbook. 2024. FAOSTAT-Chilli production indices. 1 May 2024. <https://www.fao.org/faostat/en/#data/QI>.
- Indiastat. Chilli area, production and productivity. 1 May 2024. <https://www.indiastatagri.com/data/agriculture/agricultural-area-land-use>.
- Lodaya, J.P., Suthar, M., Patel, H.C., Sisodiya, D.B., Acharya, R.R., Raval, A.T., Trivedi, N.P and Mohapatra, A.R. 2022. Status of invasive species of thrips, *Thrips parvispinus* (Karny) infesting chilli grown in middle Gujarat. *The Pharma Innovation Journal*. 11(3): 1298-1302.
- Mound, L.A and Collins, D.W. 2000. A South East Asian pest species newly recorded from Europe: *Thrips parvispinus* (Thysanoptera: Thripidae), its confused identity and potential quarantine significance. *European Journal of Entomology*. 97: 197-200.
- Mound, L.A and Masumoto, M. 2005. The genus *Thrips* (Thysanoptera, Thripidae) in Australia, New Caledonia and New Zealand. *Zootaxa*. 64.
- Mound, L.A and Morris D. C. 2007. The insect order Thysanoptera: classification versus systematics. *Zootaxa*. 1668: 395-411.
- Nagaraju, D.K., Uppar, V., Ranjith, M., Sriharsha, Ramesh, G., Verma, O.M and Prakash, R. 2021. Occurrence of *Thrips parvispinus* (Karny) (Thripidae: Thysanoptera) in major chilli (*Capsicum annum*) growing areas of Karnataka. *Insect Environment*. 24(4): 523-532.
- NBAIR. 2021. Pest alert report on invasive thrips, *Thrips parvispinus* (Karny) threatening chilli cultivation in India. 4.
- Niles, G. A. 1980. Breeding cotton for resistance to insect pests, In Maxwell P.G. and Jennings, P.R (eds.)-*Breeding plant resistance to insects*. John Wiley and Sons, New York. 337-369.
- NPPO (National Plant Protection Organization)-India. 2022. Technical booklet on monitoring, diagnosis and management of South East Asian thrips, *Thrips parvispinus* in chilli. 26.

- Palaniswamy, A., Murugan, M., Chitra, N., Balasubramani, V., Karthikeyan, G and Pugalandhi, L. 2023. Invasive flower thrips, *Thrips parvispinus* (Karny) occurrence, host expansion and genetic diversification in a tropical poly-crop ecosystem. *Molecular Biology Reports*. 50: 9909-9923.
- Patel, N.B., Bhagora, J.K., Raghunandan, B.L and Patel, N.M. 2022. First report of new invasive thrips, *Thrips parvispinus* (Karny) (Thripidae: Thysanoptera) in chilli fields of Umreth in Anand District of Gujarat State. *International Journal of Environment and Climate Change*. 12(3): 73-78.
- Prasannakumar, N.R., Venkataravanappa, V., Rachana, R.R., Sridhar, V., Govindappa, M.R., Basavarajappa, M.P., Hemalatha, K.J., Aswathnarayana, D.S., Krishna reddy, M and Samuel, D.K. 2021. Status of the outbreak of *Thrips parvispinus* (Karny) on chilli in Karnataka. *Pest Management in Horticultural Ecosystems*. 27(2): 286-290.
- Rachana, R.R., Roselin, P., Amutha, M., Sireesha, K and Narasa Reddy, G. 2022. Invasive pest, *Thrips parvispinus* (Karny) (Thysanoptera: Thripidae) - A looming threat to Indian agriculture. *Current Science*. 122(2): 211-213.
- Raghavendra, K.V., Ramesh, K.B., Rachana, R.R., Mahendra, C., Singh, S.K and Chander, S. 2023. Genetic diversity analysis of severely infesting invasive thrips, *Thrips parvispinus* (Karny) in chilli (*Capsicum annuum* L.) in India. *Phytoparasitica*. 51: 227-239.
- Ranjith, M., Nagaraju, D., Rachana, R., Ramya, R., Verma, O.P and Prakash, R. 2022. New host record of *Thrips parvispinus* (Karny) (Thysanoptera: Thripidae) in India. *Pest Management in Horticultural Ecosystems*. 28(1): 33-37.
- Roselin, P., Sharma, K and Rachana, R, R. 2021. Diversity of floral thrips from Western Ghats of Karnataka. *Indian Journal of Entomology*. 83(3): 407-410.
- Sethy, S., Narayana, S., Twinkle, Arya, V and Sunda, S. 2023. First report of invasive thrips, *Thrips parvispinus* (Karny) infestation on chilli from Eastern part of India. *Ecology Environment and Conservation*. 29: 498-503.
- Sireesha, K., Prasanna, B.V.L., Vijaya Lakshmi, T and Reddy, R.V.S.K. 2021. Outbreak of invasive thrips species *Thrips parvispinus* in chilli growing areas of Andhra Pradesh. *Insect Environment*. 24(4): 514-519.
- Sridhar, V., Rachana, R.R., Prasannakumar, N.R., Venkataravanappa, V., Sireesha, K., Kumari, D.A., Madhavi Reddy, K., Onkara S. Naik, Sree Chandana, P and M. Krishna Reddy. 2021b. Dominance of invasive species, *Thrips parvispinus* (Karny) over the existing chilli thrips, *Scirtothrips dorsalis* Hood on chilli in the southern states of India with a note on its host range: A likely case of species displacement. *Pest Management in Horticultural Ecosystems*. 27(2): 132-136.
- Sridhar, V., Chandana, P.S and Rachana, R.R. 2021a. Global status of *Thrips parvispinus* (karny, 1922), an invasive pest. *The Journal of Research PJTSAU*. 49(4): 1-11.
- Srinivasnaik, S., K. Vijaya Lakshmi, S. Omprakash, N. Balram and G. Kiran Reddy. 2024. Indiscriminate insecticides use in chilli exacerbates *T. parvispinus* infestation: A case study in major chilli growing areas of Telangana State, India. *AATCC Review*. 12(4): 599-605.
- Tyagi, K., Kumar, V., Singha, D and Rajasree, C. 2015. Morphological and DNA barcoding evidence for invasive pest thrips, *Thrips parvispinus* (Thripidae: Thysanoptera), newly recorded from India. *Journal of Insect Science*. 15(1): 1-4.
- Veeranna, D., Uma Reddy, R., Madhu, M and Padmaja, G. 2022. Report on heavy infestation and damage by invasive thrips species, *Thrips parvispinus* (Karny) on chilli in Telangana state of India. *The Pharma Innovation Journal*. 11(7): 3845-3848.
- Venugopal, G., Vijaya Lakshmi, K., Sarath Babu, B and Kishore Varma, P. 2018. Species composition of thrips infesting chilli crop. *International Journal of Agricultural and Biosystems Engineering*. 3(2): 46-56.
- Venugopal, G., Vijaya Lakshmi, K., Sarath Babu, B and Kishore Varma, P. 2019. Screening of chilli accessions against chilli thrips, *Scirtothrips dorsalis* Hood (Thysanoptera: Thripidae). *Journal of Entomology and Zoology Studies*. 7(3): 1374-1380.