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New host record of *Thrips parvispinus* (Karny) (Thysanoptera: Thripidae) in India

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ABSTRACT: The invasion and infestation of *Thrips parvispinus* (Karny)(Thysanoptera: Thripidae) on Guava (*Psidium guajava* L.) (Myrtales: Myrtaceae) is reported for the first time in India. Taxonomical and molecular identification of *T. parvispinus*, its nature of damage, symptoms, severity and its impact on guava cultivation and its export is discussed. Larvae and adult were found feeding on flowers. The feeding damage manifested on fruits however, mature fruits were found free of live infestation at the harvesting stage.

Keywords: *Thrips parvispinus,* guava, *Psidium guajava,* India*,* impact, invasive species

INTRODUCTION

Guava, *Psidium guajava* L., is native to Mexico and grows in all the tropical and subtropical areas of the world (Stone, 1970) and is grown commercially in Brazil, China, Columbia, Cuba, Egypt, Hawaii, India, Indonesia, Mexico, New Zealand, Philippines, South Africa, Thailand, United States of America, Venezuela, Vietnam, West Indies and Yemen (Wilson, 1980; Yadava, 1996; Le *et al.*, 1998; Tate, 2000). It is popular due to its all-season availability, rich nutritional and medicinal value, affordable price, suitability for transportation and handling (Nimisha *et al*., 2013). In India, Guava is being infested by many insect pests including two species of thrips *viz.*, *Selenothrips rubrocinctus* (Giard) and *Rhipiphorothrips cruentatus* Hood (Butani, 1979).

Thrips parvispinus commonly known as Tobacco thrips/South-East Asian thrips has gained cosmic importance in recent times due to the severe damage caused in chilli and other crops. Being native to the tropical regions of Asia, its presence had also been documented in Australia, China, France, Greece, Hawaii, India, Indonesia, Malaysia, Mauritius, Netherlands, Philippines, Reunion, Singapore, Solomon Islands, Spain, Taiwan, Tanzania and Thailand (Mound and Collins, 2000; Mound *et al.*,2016). It was first reported by Tyagi *et al.* (2015) in India followed by, Rachana *et al.*(2018), Roselin *et al.* (2021) and Verghese (2021) in papaya, *Dalhia rosea*, *Brugmansia* sp. and chilli respectively. It had also been found on cotton, bitter gourd, chrysanthemum, watermelon, mango, tamarind and marigold (Nagaraj *et al.*, 2021; Rachana *et al.* 2022).

Thrips parvispinus has become a major threat to chilli growing regions in India, due to which chilli growing farmers have incurred a great economic loss during 2021-22. Following that a lot of studies were taken up to find the host range of *T. parvipsinus*, their feeding behaviour, nature of damage and damage symptoms and its management practices. Although *T. parvispinus* is polyphagous by its nature, it has never been reported from Guava in India. The purpose of this article is to document *T. parvipsinus* as a pest of guava in India, and to illustrate the important diagnostic characters of the species collected on that host.

MATERIALS AND METHODS

During regular survey by Regional Central Integrated Pest Management Centre (RCIPMC), Bengaluru during 2020-21 and 2021-2022, infestation by *T. parvispinus* was observed in a five-year-old guava orchard (Variety: Taiwan Pink) at Avalahalli village (15°25'54.75"N, 76°31'53.33"E) in Gangavathi taluk of Koppal district, Karnataka, India. *T. parvispinus* population was determined by documenting the number of thrips/flowers during morning hours using standard beating method and the dislodged thrips were transferred to Eppendorf tubes containing AGA medium (9 parts of 10% ethyl alcohol; 1 part of glacial acetic acid; 1 ml of Triton X-100 in 1,000 ml of the mixture). It was observed that most of the thrips were resting in flowers and population ranged from 4-12 thrips/flower and the presence of thrips was recorded in 46.80%of the flowers sampled (Table 1).

The adult thrips specimens were removed from the preservative medium, kept in 2% NaOH for 30 min,

Table 1. Incidence of *T. parvispinus* in guava flowers and on mature fruits

Tree #	Flowers			Mature fruits*		
	# flowers	# thrips	Per cent incidence	No. of fruits	No. damaged	Per cent damage
1	2	2	100	4	0	0
2	3	1	33.33	2	0	0
3	1	0	0	4	2	50
4	2	0	0	7	2	28.57
5	3	2	66.67	2	0	0
6	3	3	0	0	0	0
7	0	0	0	4	1	25
8	3	3	100	0	0	0
9	3	1	33.33	0	0	0
10	6	0	0	0	0	0
11	3	0	0	0	0	0
12	0	0	0	2	0	0
13	3	1	33.33	0	0	0
14	3	2	66.67	0	0	0
15	3	1	33.33	1	0	0
16	4	4	100	2	0	0
17	2	2	100	3	1	33.33
18	0	0	0	2	1	50
19	1	0	0	0	0	0
20	2	0	0	2	1	50
	47	**22**	**46.80**	**35**	**8**	**22.85**

***No live thrips were found**

transferred to 60% ethyl alcohol and left for a day after which the specimens were dehydrated through a series of 70–100% ethyl alcohol washes. The specimens were cleared in clove oil for 5–10 min before mounting individually on microscope slides in Canada balsam. Finally, the slides were dried at 45°C for 30 min in an oven. Microscope slide-mounted adults were observed under a Nikon Eclipse 80i microscope (4× and 10×) and photomicrographs of habitus, antennae, head, prothorax, pterothorax, forewing, and abdomen of the species were acquired using a Nikon DS-Vi1 camera mounted on this microscope. The plate was formed using Adobe Photoshop CS2 software. Measurements (µm) of the important diagnostic characters were taken for female specimen using an ocular micrometer installed in an Olympus BX51 research microscope.

RESULTS

The species was morphologically identified as *Thrips parvispinus* (Karny) (Thysanoptera: Thripidae) using appropriate keys (Mound and Azidah, 2009). The specimens were deposited in the National Insect Museum at the Indian Council of Agricultural Research – National Bureau of Agricultural Insect Resources in Bengaluru, India.

Females of *T. parvispinus* are brownish (1175µm) (Fig. 1 A); legs yellow; forewing brown with pale base (650µm) (Fig. 1 I). Ocellar setae pair III small and positioned on anterior margins of ocellar triangle (10µm) (Fig. 1 F). Antennae 7 segmented (Fig. 1 B). Metanotum with median reticulations (Fig. 1 C); median setae long and placed behind anterior margin; without campaniform sensilla. Forewing first and second veins with complete setae rows. Abdominal tergite VIII without posteromarginal comb, a few microtrichia laterally present (Fig. 1 G); pleurotergites without discal setae. Abdominal sternite II with two marginal setae pairs, III–VII with three pairs, VII with median setae pair arising in front of posterior margin; II and VII without discal setae, III–VI with about 6–12 discal setae arranged in an irregular row (Fig. 1 D).

Molecular identification of *T. parvispinus*

Genomic DNA was isolated from an individual thrips specimen by using QIAGEN DNeasy® blood and tissue kit, Germany, following the manufacturer's

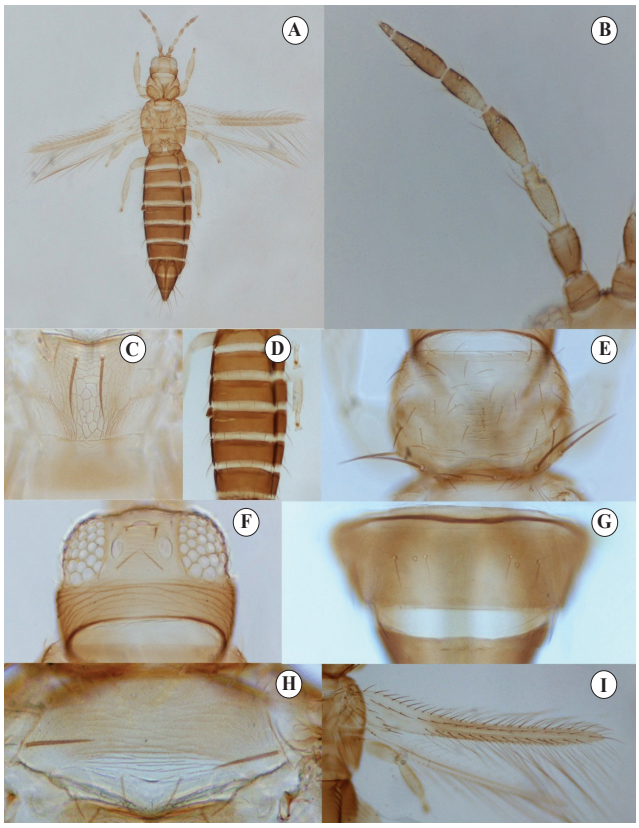

Fig 1. *Thrips parvispinus*. A, Female; B, Antenna; C, Metanotum; D, Discal setae on abdominal sternites III-VI; E, Pronotum; F, Head, dorsal; G, Abdominal tergite VIII; H, Mesonotum; I, Forewing.

protocols. The remaining specimens were kept as voucher specimens at −80 °C in absolute ethanol. The DNA was then subjected to PCR amplification using an iGENE Labserve gradient thermal cycler. The PCR reaction of 50 µL consisted of 5 µL of 10X Genei™ Taq Buffer B (Tris without $MgCl_2$), 8 µL of 10 mM Genei™ dNTP mix, 5 µL of 25 mM Genei™ $MgCl_2$, 1 µL (20 pmol/µL) each of the universal COI primer pair- 5′-ATTCAACCAATCATAAAGATATTGG-3′ and TTCTGGATGTCCAAAAAATCA-3′ (Hebert *et al.*, 2004), 1 µL of Genei™ Taq DNA polymerase (1 U/µL), 4 µL of DNA template (50 ng/µL), and 25 µL of water (Protease, DNase, RNase Free). The conditions for PCR for the study was an initial denaturation of 95 °C for 5 min, which was followed by 30 cycles of denaturation at 95 °C for 1 min, annealing at 46°C for 30 seconds, extension at 72 °C for 1 minute. The amplified products were analyzed on 1.5% agarose gel electrophoresis. The PCR products were then bi-directionally sequenced and checked for homology, insertions and deletions, stop codons, and frame shifts by using NCBI-BLAST and ORF finder. The sequence was then deposited in NCBI GenBank and Barcode of Life Database.

Molecular analysis of the thrips specimens collected from Guava corroborated the morphological identification. The sequence showed 100% similarity to *T. parvispinus* (OM453924.1) through BLAST sequence analysis. The sequence was submitted to NCBI and the accession number was retrieved (GenBank Acc. No. ON303614) and DNA barcode was obtained from BOLD systems (BIN No. AAM8085).

Further surveys were conducted to assess the *T. parvispinus* population and intensity of damage on twenty randomly selected five-year-old guava trees in a two-acre farm where the damage was reported.The infestation due to thrips was more during December to March. Larvae and adult thrips were found in groups feeding on the petals of unopened flower buds. They were also seen in small numbers on the calyx region. In opened flower, both larvae and adults were found among anthers and the damage symptoms were documented in early fruit setting stage and medium to large sized fruits and the peculiar symptom caused by thrips i.e. scraping / lacerating the young tissues was found in the early fruit setting stage (10 days old) (Fig. 2), Scarring and/or marking around the calyx of young fruits was also observed. The initial lacerations on developing fruits manifested as brownish corky irregular patches on developed fruit. However, neither larvae nor adult thrips were found associated with the matured fruits (Fig. 2), The extent of damaged fruits in the present study was to the tune of 22.85% (Table 1).

DISCUSSION

Although *T. parvispinus* has already been documented as a pest in *Carica papaya* (Tyagi *et al.,* 2015), *D. rosea* (Rachana *et al.*2018), *Brugmansia* sp. (Roselin *et al.* 2021) and chilli (Verghese 2021) in India it has never been documented as a pest in guava which is an important fruit crop in India. Guava is cultivated covering an area of 2,90,000 ha with a productivity of 4359 MT during 2019-20 (dacnet.nic.in) and have gained an export value amounting 53.26 crores with 1269.75 MT of fresh and dried guavas exported to various countries (agricoop.nic.in), thus *T. parvispinus* as a pest in Guava acquires significance. *T. parvispinus* was found causing scarring symptoms in the fruit whereas lacerating symptom and drying of early fruit forming stage was observed during the study which is distinctive damage symptom caused by Thysanoptera. It is concluded that, the thrips population was seen on most of the flowers and are able to infect the fruits, the damage done by thrips to guava fruit is minimal and the reason behind this may be due to the spraying of pesticides and botanicals by the farmer at regular intervals and also

Fig 2. Thrips infestation and damage symptoms on unopened flowers, calyx and fruits of guava

the inability of the thrips to survive as they are unable to inflict serious damage. Further *T. parvispinus* might have infected the guava plant from the adjacent chilli growing fields, which was seriously affected by the same thrips species during September-October months. The thrips species which completely destroyed chilli crop during 2021 was never found to be a threat in Guava fruit as the damage incurred by them are manageable. As *T. parvispinus* has already been documented as a serious invasive pest in chilli, extensive studies have to be done to document its possible alternate hosts, its damage severity on alternate hosts and predominantly its impact on the economic yield of alternate hosts. Further, campaigns should be organized by the extension workers/scientists/NGOs to educate the farmers about the alarming thrips species, its management strategies and an organized programme to contain its spread and development is timely needed.

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