

## Invasive pest, *Thrips parvispinus* (Karny) (Thysanoptera: Thripidae) – a looming threat to Indian agriculture

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**The status and spread of notoriously destructive and invasive pest, *Thrips parvispinus* (Karny) (Thysanoptera: Terebrantia: Thripidae) on agriculturally important crops after its first report from India is reported. Description of the species and illustrations of its diagnostic characters are provided to facilitate identification. Since 2015, this species has been collected from nine host plants belonging to seven families from five Indian states, viz. Andhra Pradesh, Chhattisgarh, Karnataka, Kerala and Tamil Nadu. The establishment of this thrips species warrants special attention in India as it is a potentially damaging plant pest and has a wide host range across various plant families. Unless successful quarantine measures are put in place, the spread and subsequent depredations of cultivated crops is inevitable.**

**Keywords:** *Capsicum annuum*, quarantine, *Mangifera indica*, terebrantia.

*Thrips* Linnaeus is the largest genus in the subfamily Thripinae with 301 species known worldwide<sup>1</sup>, of which 44 are reported from India<sup>2</sup>. Only three species in this genus are notorious pests as well as tospovirus vectors<sup>3</sup>. *Thrips parvispinus* (Karny) is a cosmopolitan pest species and has been reported from Thailand to Australia and Europe<sup>4</sup>. 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, Reunion, Spain, Tanzania and the Netherlands, besides India<sup>4-6</sup>. It is a polyphagous species and has been reported on infesting beans, eggplant, papaya, pepper, potato, shallot and strawberry<sup>5,6</sup>. Chilli yield loss due to *T. parvispinus* is 23% under field conditions in Indonesia<sup>7</sup>. In addition, it inflicts injury to ornamentals, viz. *Anthurium*, *Chrysanthemum*, *Dahlia*, *Dipladenia*, *Gardenia* and *Ficus*<sup>6</sup>. In India, this species was first reported on *Carica papaya*

L. (Caricaceae) in Bengaluru<sup>5</sup> and later on *Brugmansia* sp. (Solanaceae) and *Dahlia rosea* Cav. (Asteraceae)<sup>8,9</sup>. In 2015, Tyagi *et al.*<sup>5</sup> reported this notorious pest from India for the first time. They emphasized the need for its regular monitoring in other parts of India as it is likely to acquire the pest status<sup>5</sup>. Here we highlight the present scenario as well as geographical distribution of *T. parvispinus* in India, besides providing description and illustrations of its diagnostic characters.

Surveys have been conducted to monitor the species in nine states of India, viz. Andhra Pradesh, Assam, Chhattisgarh, Gujarat, Karnataka, Kerala, Maharashtra, Odisha and Tamil Nadu. Since 2016, thrips samples have been received by the first author from different states of India in order to establish the identity of the species. A total of 849 specimens were examined from five states, viz. Andhra Pradesh (194), Chhattisgarh (94), Karnataka (378), Kerala (27) and Tamil Nadu (156). These were either personally collected or received from other organizations for identification. Our survey did not reveal any *T. parvispinus* samples from Assam, Gujarat, Maharashtra and Odisha.

Thrips were collected in the field by tapping on various agricultural crops using a long, thick stick. A broad, white tray was placed underneath the canopy to collect the fallen thrips. The collected thrips were transferred using a fine brush to a labelled vial containing collection fluid (nine parts 10% alcohol + one part glacial acetic acid + 1 ml Triton X-100 in 1000 ml of the mixture). The specimens were prepared for mounting onto microscope slides in Canada balsam<sup>10</sup>. They were identified up to species level using standard morphological key<sup>11</sup>. The slide-mounted voucher specimens were deposited in the National Insect Museum of ICAR-NBAIR. Slide-mounted adult female was observed through a microscope (Nikon Eclipse 80i) and photomicrographs were captured using a camera (Nikon DS-Vi1). These illustrations were further arranged using Adobe Photoshop CS2.

Females of *T. parvispinus* are brownish (Figure 1 a); legs yellow; forewing brown with pale base (Figure 1 i). Ocellar setae pair III small and positioned on anterior margins of ocellar triangle (Figure 1 f). Antennae 7 segmented (Figure 1 b). Metanotum with median reticulations (Figure 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 (Figure 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 (Figure 1 d).

Material examined: India: Andhra Pradesh: Guntur, 16.30°N, 80.43°E, 157♀ on *Capsicum annuum* L. (Solanaceae), 21.iii.2021, Sireesha K. coll.; same location, 37♀ on *C. annuum*, 3.iv.2021, Narasa Reddy G. coll.

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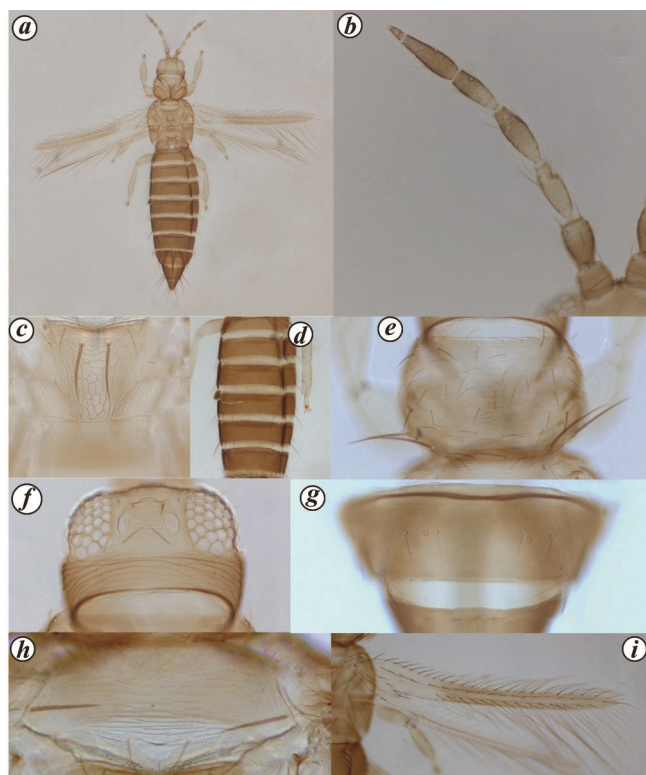
Chhattisgarh: Raipur, 21.25°N, 81.62°E, 94♀ on *C. annuum*, 30.x.2021, Nayan Taunk. coll.

Karnataka: Udupi, 12.76°N, 75.20°E, 6♀ on *Dahlia rosea* Cav. (Asteraceae), 21.viii.2015, Roselin P. coll.; same location, 12♀ on *Brugmansia* sp. (Solanaceae), 28.x.2015, Roselin P. coll.; Bengaluru, 13.03°N, 77.59°E, 38♀ on *Tagetes* sp. (Asteraceae), 19.ix.2016, Rachana R.R. coll.; Shivamogga, Navile, 12.76°N, 77.00°E, 28♀ on *Carica papaya* L. (Caricaceae), 10.i.2017, Rachana R.R. coll.; Kolar, 13.40°N, 78.05°E, 56♀ on *C. annuum*, 18.iv.2017, Rachana R.R. coll.; Bengaluru, 13.13°N, 77.47°E, 12♀ on *Citrullus lanatus* (Thunb.) Matsum. & Nakai (Cucurbitaceae), 03.vii.2019, Rachana R.R. coll.; Kolar, 13.40°N, 78.05°E, 67♀ on *C. annuum*, 03.iv.2021, Narasa Reddy G. coll.; Bengaluru, 13.09°N, 77.38°E, 62♀ on *Momordica charantia* L. (Cucurbitaceae), 15.ix.2021, Latha coll.; same location, 97♀ on *C. annuum*, 16.ix.2021, Latha coll.

Kerala: Thiruvananthapuram, 8.34°N, 77.15°E, 27♀ on *Chrysanthemum* sp. (Asteraceae), 19.viii.2021, Rachana R.R. coll.

Tamil Nadu: Coimbatore, 11.01°N, 76.95°E, 4♀ on *Gossypium* sp. (Malvaceae), 06.iv.2020, Amutha M. coll.; Krishnagiri, 12.42°N, 78.21°E, 134♀ on *Mangifera indica* L. (Anacardiaceae), 11.x.2020, Pampapathy G. coll.; Kanyakumari, 8.33°N, 77.17°E, 18♀ on *Tamarindus indica* L. (Fabaceae), 18.viii.2021, Rachana R.R. coll.

Thirteen females and two males of *T. parvispinus* collected on *Carica papaya* in February 2014 from Bengaluru formed the basis for the first definitive occurrence of this invasive species in India<sup>5</sup>. The striking difference between the 2014 and subsequent collection records is that the sexually breeding population in 2014 (two males : 13 females) perhaps transformed into thelytokous parthenogenetic; as a consequence all the 849 samples revealed the presence of only females from 2015 till date. Evidences based on the collection records indicate that this species appears to spread to other states of India. Since 2015, *T. parvispinus* has been collected from nine host plants belonging to seven families from five Indian states, viz. Andhra Pradesh, Chhattisgarh, Karnataka, Kerala and Tamil Nadu. Among the nine recorded host plants, four were fruit crops, three were ornamentals, and one each vegetable and field crop, reflecting the adaptability of this thrips species and its capability to breed in diverse agroecosystems. Serious damage was recorded in Andhra Pradesh, Chhattisgarh and Karnataka on *Capsicum annuum* and in Tamil Nadu on *Mangifera indica*. Multiple samples received from the above states for identification mentioned that the farmers were unable to control this species after repeated application of insecticides. In case of *C. annuum*, farmers were forced to abandon the crop since the species has been found to congregate in large numbers on flowers causing severe flower drop leading to huge crop loss (Figure 2). The chilli growers of Guntur district, Andhra Pradesh along with the horticultural officials estimated a loss of Rs 1 lakh per acre. It is significant to mention here that nearly 12,000 acres of capsicum was affected by thrips in Guntur district alone during the current cropping season<sup>12</sup>.



**Figure 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.



**Figure 2.** Thrips-infested chilli plant. (inset) Close-up of infested flower.

During the last few years, India has experienced the spread of two exotic thrips, namely *Frankliniella occidentalis* (Pergande)<sup>13</sup> and *T. parvispinus*<sup>5,8</sup>, of which the former is an unequivocally established vector of tospovirus besides causing feeding injury to the plant<sup>14</sup>. Both the species have spread across the world during the last two decades and are reported to be highly polyphagous<sup>4</sup>. However, *F. occidentalis* has been reported only on a few occasions in India, especially after its first appearance, and no serious economic damage on crops has been reported as yet<sup>15,16</sup>. On the contrary, the invasion of *T. parvispinus* has led to the lag phase. As a result, its population has increased alarmingly within a short duration of four years, also being influenced by its adaptability on diverse plant hosts, in addition to its tendency to expand in geographical range within the country. Lag times related to biological invasions of other exotic species documented earlier also exhibited almost the same trend<sup>17–19</sup>. The invasion by a specific taxon in yet another new environment/country is considered to be a biotic threat for the native flora and fauna. Even though trade of different commodities is essential to boost the economic growth of a country, careful vigilance would prevent the entry and dispersal of alien species into a new terrain. Further, it is imperative that the domestic quarantine mechanisms should be stringent to check the spread of this notorious pest to the rest of India.

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ACKNOWLEDGEMENT. We thank Dr M. Nagesh, Director, ICAR-National Bureau of Agricultural Insect Resources, Bengaluru for encouragement and providing the necessary facilities.

Received 9 November 2021; revised accepted 10 December 2021

doi: 10.18520/cs/v122/i2/211-213

## Temporal consistency in foraging time and bouts of a carpenter bee in a specialized pollination system

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**While site and plant fidelity are reported for bees, consistency in foraging pattern is less studied in field conditions. We monitored three marked carpenter bees – one female and two males – on the sword bean for 25 straight days of flowering to examine whether**

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