



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

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ABSTRACT: Recently there has been an outbreak of invasive South East Asian thrips, *Thrips parvispinus* (Karny), in 2021 reportedly causing 80-100 per cent yield loss to chillies in the southern states of India. Systematic surveys carried out in the states of Andhra Pradesh, Karnataka and Telangana revealed *T. parvispinus* completely dominated the thrips species generally observed in chilli mainly, *Scirtothrips dorsalis*. Only a small proportion of *T. hawaiiensis*, *T. florum* and *T. palmi* were observed on chilli during the survey period and incidentally not even a single specimen of *S. dorsalis* was observed in any of the surveyed chilli fields in these states. There is a need to continue the monitoring of the thrips species in chilli, to ascertain the dominance of *T. parvispinus* over other species like *S. dorsalis*. and *T. palmi*, to know whether the present ecological observation of species dominance is temporary or permanent or season oriented. In the chilli ecosystem, apart from chilli, other hosts reported for this invasive thrips are capsicum, black gram, red gram, cotton, beans, mango, coriander, watermelon, bitter gourd, ivy gourd, jasmine are presented in this paper.

Keywords: Chilli, Thrips, species displacement, *Thrips parvispinus*, *Scirtothrips dorsalis*, invasive

INTRODUCTION

India being the world's largest producer, consumer and exporter of chillies has the largest area of 6.83 lakh ha (16.87 lakh acres) accounting for 40% of world area. India is the world leader in chilli production with 17.02 lakh tonnes followed by Thailand (3.50 lakh tonnes), China (3.30 lakh tonnes). Indian chilli is mainly exported to Asian countries like China, Sri Lanka, Malaysia, Bangladesh, Singapore, Thailand, UAE etc. In 2019-20, India had exported 4.84 lakh tonnes of chilli to China, Bangladesh, Sri Lanka, Indonesia and Thailand. The 'Byadagi' chilli grown in Karnataka has tremendous demand in the world market largely due to its rich colour and pungency.

Venugopala *et al.* (2018) studied the species composition of thrips in chilli leaves, flowers and fruits and observed existence of 5 species of thrips *viz.*, *Scirtothrips dorsalis* (Hood), *Frankliniella schultzei* (Trybom), *Thrips hawaiiensis* (Morgan), and *Thrips palmi* (Karny) under Terebrantia sub order and *Haplothrips* sp. under

Tubulifera sub order. Among the five species, *S. dorsalis* was the dominant species and this was the only species found in chilli leaves and fruits, whereas in chilli flowers *F. schultzei*, *T. hawaiiensis*, *T. palmi* and *Haplothrips* sp. were observed. Till now, chilli thrips, *S. dorsalis* is considered as the major thrips species in chilli (Butani, 1976, Venugopal *et al.*, 2018).

In India, Tyagi *et al.* (2015) reported invasive *Thrips parvispinus* for the first time on *Carica papaya* L. (Caricaceae) from Bengaluru and later on it was reported on *Dahlia rosea* Cav. (Asteraceae) (Rachana *et al.*, 2018) and *Brugmansia* sp. (Solanaceae) (Roselin *et al.*, 2021).

This invasive South East Asian thrips, *Thrips parvispinus* has been observed causing extensive damage in thousands of acres of chilli in different south Indian states causing up to 100 per cent damage in some of the fields during October-December 2021. In this regard, a systematic survey was carried out by team of scientists from ICAR-Indian Institute of Horticultural Research, Bengaluru and ICAR-National Bureau of Agriculturally

Table 1. Chilli crop surveyed areas in South Indian States

State	District	Location (Village/Taluq or Mandal/District)
Andhra Pradesh	Guntur	Bandarupalli Village, Tadikonda Mandal
		Visadala Village, Medoikonduru Mandal
		Phirangipuram Village, Phirangipuram Mandal
		Ponugupadu Village, Phirangipuram Mandal
	Prakasham	Kandukuru Village and Kandukuru Mandal
Karnataka	Chitradurga	Kandhigere/ Yerraballi Village, HiruyurTq.
		Rampur Village, Monakalmur Tq.
	Bellary	Dhanalaxmi camp, Bellary Tq.
		Joladarashi Village, Bellary Tq.
		Asundi Village, Bellary Tq.
Raichur	Talamamidi, Bellary Tq.	
	Byalamarchad Village, Manavi Tq.	
	UAS, Raichur.	
Telangana	Belgaum	Tungabhadra Village, Raichur Tq
	Bagalkot	Rajalibanda Village, Raichur Tq
	Warangal	Godihala, Belgaum Tq.
	Mahabubabad	Hungund Village, Hungund Tq.
		Chandrayapalle Village, Narsampet Mandal
Suryapet	Bodhigonda Village, PeddaGuduru Mandal	
	Khammam	Kambalapalli Village, Mahabubabad Mandal
		Mudigonda Village, Mudigonda Mandal
		Dondapadu Village, Chintalapalem Mandal

Important Insects, Bengaluru in the states of Andhra Pradesh, Karnataka and Telangana to know about the species composition of various thrips species on chilli under the present situation of outbreak of thrips.

MATERIALS AND METHODS

During November and December 2021, a systematic survey was carried out for thrips coinciding with outbreak on chilli in the states of Andhra Pradesh (Krishna, Guntur, Prakasam and Kurnool districts), Karnataka (Bagalkot, Bellary, Belgaum, Chitradurga and Raichur districts) and Telangana (Khammam, Mehabubabad, Suryapet and

Warangal Districts) (Table 1). Thrips were collected in the field by tapping on growing portions of plant parts including leaves, flowers and fruits of chilli using a long, thick stick. For the purpose of identification of alternate hosts samples were also collected from other agricultural and horticultural crops from Andhra Pradesh. 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 balsam¹⁰. They were identified up to

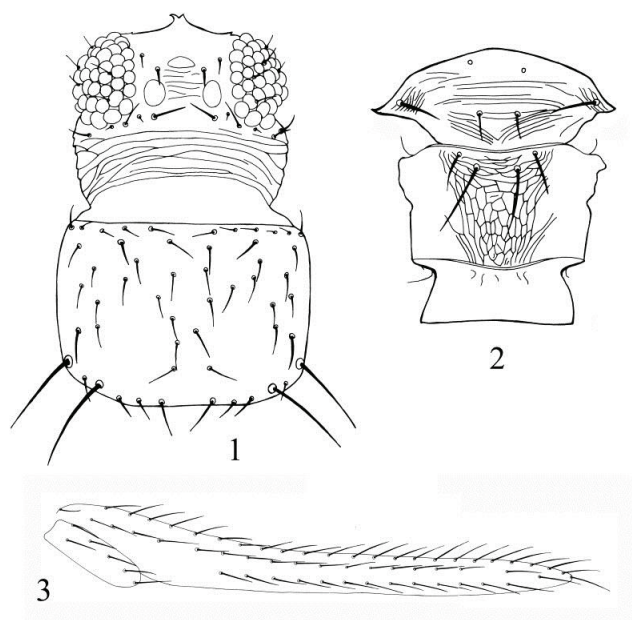
Table 2. Proportion of different species of thrips observed on chilli in three states

Species of thrips	State		
	Andhra Pradesh	Karnataka	Telangana
<i>Thrips parvispinus</i>	96 - 98	94 -96	96 - 98
<i>T. florum</i>	1	1	1
<i>T. hawaiiensis</i>	2-3	3	2-3
<i>T. palmi</i>	< 0.5	< 1	0.0
<i>Scirtothrips dorsalis</i>	0	0	0

species level using standard morphological key (Mound, 2010; Tyagi *et al.*, 2015; Rachana *et al.*, 2018). 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.

RESULTS AND DISCUSSION

The thrips species present in various fields of chilli from the three states were identified taxonomically as *T. parvispinus* Karny (Thysanoptera : Terebrantia: Thripidae) (Fig. 1-4), *T. florum*, *T. palmi* and *T. hawaiiensis* (Table 2). In different states, the *T. parvispinus* numbers were 94-98 per cent on chilli and only 2-6 per cent was of other species of thrips. The significant observation in the survey was *T. parvispinus* has completely dominated the thrips complex and displaced the species *S. dorsalis* which is a dominant thrips species on chilli (Fig. 5),



Figures 1-3. *T. parvispinus*, female (1) head and pronotum; (2) meso- and metanotum, (3) fore wing (Source : Tyagi *et al.*, 2015)

till the outbreak of *T. parvispinus* happened in the year 2021. *T. florum*, *T. palmi* and *T. hawaiiensis* together constituted only 5 % and *T. palmi* was less than 1 % of the incidence in different areas.

Hosts recorded for *T. parvispinus* from Andhra Pradesh, India

The major species of thrips on chilli was observed as *T. parvispinus* which caused 80-100 % damage to chilli crop. Other than the chilli, various other hosts on which incidence of immature and adults of *T. parvispinus* reported were mentioned in the Table 3 *viz.*, chilli, sweet pepper, brinjal, black gram, pigeon pea, common bean, bitter gourd, ivy gourd, watermelon, cucumber, bottle gourd, drumstick, coriander, marigold, chrysanthemum, jasmine, mango and cotton. Some of the reasons for flare-up of these thrips are attributed to polyphagous nature of the pest, large area of chilli as a monocropping, most favorable weather conditions for its multiplication, indiscriminate use of insecticides, probably development of resistance to various groups of insecticides *etc.* The scientific studies for knowing its sudden upsurge and replacement of the *S. dorsalis* are in progress.

Stuart and John (2002) have reviewed the competitive displacement among insects and arachnids and they



Fig. 4. *T. parvispinus* adults on chilli flower (Females – Large & Blackish; Males: Yellowish)



Fig. 5. *Scirtothrips dorsalis* adult

Table 3. Host plants of *T. parvispinus* recorded from Andhra Pradesh

Name of the host plant	Family
Chilli, <i>Capsicum annuum</i> L.	Solanaceae
Sweet pepper, <i>Capsicum annuum</i> L.	Solanaceae
Brinjal, <i>Solanum melongena</i> L.	Solanaceae
Black gram, <i>Vignamungo</i> L.	Fabaceae
Pigeon pea, <i>Cajanus cajan</i> (L.) Millsp.	Fabaceae
Common bean, <i>Phaseolus vulgaris</i> L.	Fabaceae
Bitter melon, <i>Momordica charantia</i> L.	Cucurbitaceae
Ivy gourd, <i>Coccinia grandis</i> (L.) Voigt	Cucurbitaceae
Watermelon, <i>Citrullus lanatus</i> (Thunb.) Matsum. & Nakai	Cucurbitaceae
Cucumber, <i>Cucumis sativus</i> L.	Cucurbitaceae
Bottle gourd, <i>Lagenaria siceraria</i> (Molina) Standl.	Cucurbitaceae
Drumstick, <i>Moringa oleifera</i> Lam.	Moringaceae
Coriander, <i>Coriander sativum</i> L.	Apiaceae
Marigold, <i>Tagetes</i> sp.	Asteraceae
Chrysanthemum, <i>Chrysanthemum indicum</i> L.	Asteraceae
Jasmine, <i>Jasminum</i> sp.	Oleaceae
Mango, <i>Mangifera indica</i> L.	Anacardiaceae
Cotton, <i>Gossypium</i> sp.	Malvaceae

opined competitive displacement is the most severe outcome of interspecific competition. They defined this type of displacement as the removal of a formerly established species from a habitat as a result of direct or indirect competitive interactions with another species. In Indonesia, *T. parvispinus* is one of the most important economic pests in chilli pepper (*Capsicum*) (Vos and Frinking, 1998) and has replaced *T. palmi* as the key thrips in vegetables (Murai *et al.*, 2010). For each putative case of displacement, one needs to address the following questions: (a) Is there evidence that displacement has occurred through competition? (b) If so, what mechanisms are responsible for displacement? (c) What is the extent of the displacement? (d) What impact has the displacement had on the species and systems involved? (Stuart and John, 2002).

In our present observation the erstwhile established species of chilli thrips, *S. dorsalis* was totally replaced on chilli. However, as the replacement was observed this year only, there is a need for the continuous monitoring of the various species of thrips on chilli to establish whether the present displacement of *S. dorsalis* by *T. parvispinus* is seasonal, temporary or permanent. Also there is a need to establish various mechanisms involved in the displacement. As *T. parvispinus* is a highly polyphagous pest, there is a need to monitor the thrips complex occurring on various hosts for establishing its species displacement ability on different hosts and in different seasons as *T. parvispinus* is known to be a humidity loving species. Some of the thrips species inhabiting flowers are mainly pollinators like *T.*

hawaiiensis and *T. florum* rather than pests (Varatharajan *et al.*, 2016). Our observations are in line with the species displacement studies by various authors world over. Most species displacements at global level were triggered by the introduction or invasion of an exotic species (78%), although other environmental factors may predispose a species to being displaced (Fowler, 1995; Hann, 1990; Nyffeler *et al.*, 1986; Stuart and John, 2002). Polyphagy and the lack of natural enemies often characterize invasive species that have large impacts on communities. Such invasive species typically have their greatest impact on simple and anthropogenically disturbed habitats (Lodge, 1993). Being a polyphagous pest, there is a need for understanding the dominance of *T. parvispinus* in various horticultural crops, where thrips used to occur in complex.

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