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SPECIES DIVERSITY OF THRIPS ON COTTON

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ABSTRACT

Exploratory surveys were conducted to study the diversity of thrips species on cotton at Coimbatore, Tamil Nadu. Taxonomic studies revealed the presence of three species, viz. *Scirtothrips dorsalis* Hood, *Thrips palmi* Karny and *Thrips tabaci* Lindeman on leaves and four species, viz. *Thrips florum* Schmutz, *Thrips hawaiiensis* (Morgan), *Frankliniella schultzei* (Trybom) and *Thrips parvispinus* (Karny) in flowers. *T. parvispinus* is one of the notorious pest species of South East Asia and also a serious pest of quarantine importance. *F. schultzei, S. dorsalis*, *T. palmi* and *T. tabaci* are notorious pests as well as vectors of plant viruses. Since these species may attain major pest status, the report demands regular monitoring and surveys in cotton.

Key words: Cotton, thrips, diversity, leaves, flowers, *Scirtothrips dorsalis*, *Thrips palmi*, *T. tabaci*, *T. florum*, *T. hawaiiensis*, *T. parvispinus*, *Frankliniella schultzei*, diversity indices

India has the largest area under cotton and is also the largest producer of cotton. The area under cotton reached a high of 133.73 lakh ha with production of 365 lakh bales and productivity of 463.99 kg/ ha in 2019-20 (cotcorp.org.in). However, it is ranked 37th in the world in terms of productivity. Cotton plant is ravaged by multitude of sucking pests and there is a constant change in pest scenario. Among these sucking pests, the increased incidence of thrips, noted in recent years (Monga, 2021). A minor pest, *Thrips tabaci* Lindeman (Thysanoptera: Thripidae), has become a serious pest on Bt cotton in India (Sarode et al. 2009). Polyphagous nature, high reproductive capacity, short generation time, high survival of cryptic instars, reproduction by parthenogenesis, and development of resistance to insecticides, this insect became a serious pest of cotton in many cotton growing regions of India (Diaz Montano et al. 2012). In extreme cases, around 30-50% of lint yield loss has been reported (Cook et al., 2011). The world record indicates the occurrence of 6312 species (ThripsWiki, 2021). In India, a total of 739 species reported from 259 genera, of which 309 species belong to the suborder Terebrantia and 430 species belong to the suborder Tubulifera (Tyagi and Kumar, 2016). Losses caused by thrips to various agricultural and horticultural crops during the past decade, resulting in huge economic loss (Thrips Wiki, 2021). Several species of thrips are known to infest cotton. Therefore, the present investigation was undertaken to study the diversity of the thrips fauna on cotton at Coimbatore, Tamil Nadu.

MATERIALS AND METHODS

Thrips samples were collected from cotton growing areas of Coimbatore including experimental farm of ICAR-Central Institute for Cotton Research, Coimbatore (11°N77°E, 427.6 masl). Ten cotton plants were randomly selected for sampling. Cotton leaves and flowers were tapped on white paper then fallen thrips were collected in vials containing preservative media (9 parts 10% alcohol + 1 part glacial acetic acid + 1 ml Triton X-100 in 1000 ml of the mixture) (Bacci, 2008). The vials were labelled with host name, location and collection date for identification. Permanent slide mounts were prepared by following maceration and digestion protocol of Bhatti (1999) and were identified using appropriate morphological keys (Ananthakrishnan and Sen, 1980; Palmer et al., 1989) and they were observed through a Nikon Eclipse 80 i microscope and micro images were captured with a Nikon DS-ViI camera mounted on this microscope. Voucher specimens are deposited with ICAR-National Bureau of Agricultural Insect Resources (ICAR-NBAIR), Bengaluru, Karnataka, India. While examining the taxonomic identification, number of samples for each species also recorded to calculate Shannon Diversity Index.

RESULTS AND DISCUSSION

The results revealed seven thrips species, of which, *Scirtothrips dorsalis* Hood, *Thrips palmi* Karny and *T. tabaci* Lindeman were identified on leaves and four species, *T. florum* Schmutz, *T. hawaiiensis* (Morgan), *Frankliniella schultzei* (Trybom) and *T. parvispinus* (Karny) were from flowers. Diagnostic characters and keys for these are given below:

Frankliniella schultzei (Fig. 1): Ocellar setae pair III arising close together between anterior margins of hind ocelli and as long as side of ocellar triangle. Postocular setae pair IV as long as distance between hind ocelli. Pronotum with 5 pairs of major setae; anteromarginal setae slightly shorter than anteroangulars, one pair of minor setae present medially between posteromarginal submedian setae. Campaniform sensilla on metanotum absent. Posteromarginal comb on tergite VIII not developed. *Scirtothrips dorsalis* (Fig. 2): Body yellow with median brown marking on tergites III–VII . Postocular and ocellar region closely striate. Ocellar setae pair III arise between posterior ocelli, well behind tangent between their anterior margins. Two pairs of post-ocellar setae as long as ocellar setae pair III. Pronotum striate closely, posteromarginal setae S2 longer than S1. *Thrips florum* (Fig. 4): Head with ocellar setae III outside ocellar triangle. Postocular seta II very much smaller than I or III. Mesonotum without sculpture lines close to anterior campaniform sensilla. Clavus with subapical seta longer than apical seta. Sternites III–VII with 6–14 discal setae. *Thrips hawaiiensis* (Fig. 3): Head with ocellar setae III outside ocellar triangle. Postocular setae I and II subequal. Mesonotum with sculpture lines close to anterior campaniform sensilla. Clavus with apical seta longer than subapical seta. Sternites III–VII with 12–25 distal setae. *Thrips palmi* (Fig. 5): Ocellar setae pair III small, arising outside ocellar triangle and postocular setae pair I slightly longer than ocellar setae III. Metanotum with irregular longitudinal lines converging to posterior margin, with anteriorly curving transverse lines; median setae arising well behind anterior margin, campaniform sensilla present. Forewing first vein with 3 distal setae. Abdominal tergite II with 4 marginal setae laterally; tergite VIII with complete comb. *Thrips parvispinus* (Fig. 6): Ocellar setae pair III at the anterior margin of ocellar triangle; postocular setae III shorter than postocular setae I and IV. Metanotum with median reticulations; median setae placed well behind the anterior margin; campaniform sensilla absent. First and second veins of fore wing with continuous setal row. Posterior margin of abdominal tergite VIII without comb. Abdominal sternites III–VI with discal setae, but absent on II and VII. *Thrips tabaci* (Fig. 7): Abdominal pleurotergites with closely spaced rows of regular, fine microtrichia; lateral margins of tergites with microtrichia on sculpture lines; tergite IX with one pair of campaniform sensilla, anterior pair absent; antennal segment V not sharply paler than IV.

Key to species

1. Antennae 8-segmented (Fig. 9).....**2**
- Antennae 7-segmented (Fig. 8).....**3**
2. Abdominal tergites with lateral side completely covered with many microtrichia (Fig. 16); forewing second vein with irregular setal row (Fig. 17)..... ..... ***Scirtothrips dorsalis* Hood**
- Abdominal tergites without microtrichia covering lateral side; forewing second vein uniform setal row (Fig. 12)..... ***Frankliniella schultzei* (Trybom)**
3. Abdominal sternites without discal setae..... .....**4**
- Abdominal sternites with discal setae..... .....**5**
4. Abdominal pleurotergites with several rows of fine ciliate microtrichia; metanotal sculpture with median reticulations (Fig. 10), campaniform sensilla absent.... .....***Thrips tabaci* Lindeman**
- Abdominal pleurotergites without fine ciliate microtrichia; metanotal sculpture longitudinally striate (Fig. 11), campaniform sensilla present ....***Thrips palmi* Karny**
5. Abdominal sternite VII without discal setae (Fig. 19) ..... ***Thrips parvispinus* (Karny)**
- Abdominal sternite VII with discal setae..... .....**6**
6. Mesonotum sculptured around campaniform sensilla near anterior margin (Fig. 14); clavus with apical seta longer than subapical seta (Fig. 13)..... .....***Thrips hawaiiensis* (Morgan)**
- Mesonotum not sculptured around campaniform sensilla near anterior margin (Fig. 15); forewing clavus with apical seta shorter than subapical seta (Fig. 18)..... ***Thrips florum* Schmutz**

The survey represents comprehensive documentation of thrips species on cotton at Coimbatore, Tamil Nadu.

S. dorsalis, *T. palmi* and *T. tabaci* were present on leaves. Whereas, *T. florum*, *T. hawaiiensis*, *F. schultzei* and *T. parvispinus* were recorded in flowers. Earlier reports documented *S. dorsalis*, *T. palmi* and *T. tabaci* in cotton ecosystem (Rajendran et al., 2018; Senguttuvan, 2019). Thrips florum breeds in flowers of a wide range of plants and causes direct damage by puncturing flowers. The species causes considerable damage in the bud condition, with the result that the flowers become smaller, the petals shrink and show feeding scars (Ananthakrishnan 1971). This is one of the most common and widespread flower thrips across Asia to the Pacific islands. On cotton, Akram et al. (2003) reported from Pakistan. *T. hawaiiensis* is also a common thrips species of various flowers. It affects the crop during vegetative growing stage, flowering stage and fruiting stage. *F. schultzei* is one of the serious polyphagous pests among the genus *Frankliniella*. It causes economic damage to various ornamental and vegetable crops. *T. parvispinus*, which is designated as

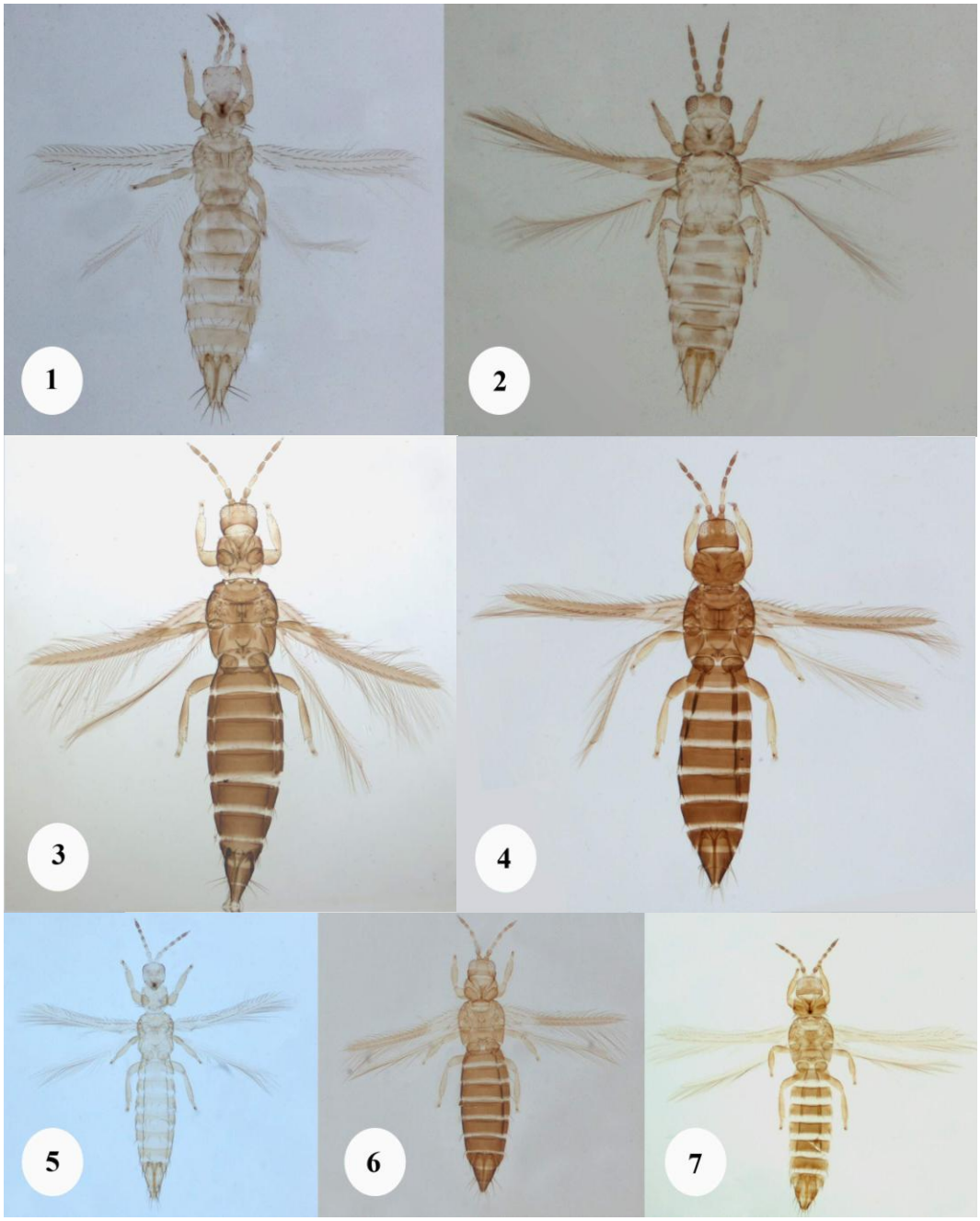

Fig. 1-7. (1) *F. schultzei*; (2) *S. dorsalis*; (3) *T. hawaiiensis*; (4) *T. florum*; (5) *T. palmi*; (6) *T. parvispinus*; (7) *T. tabaci*

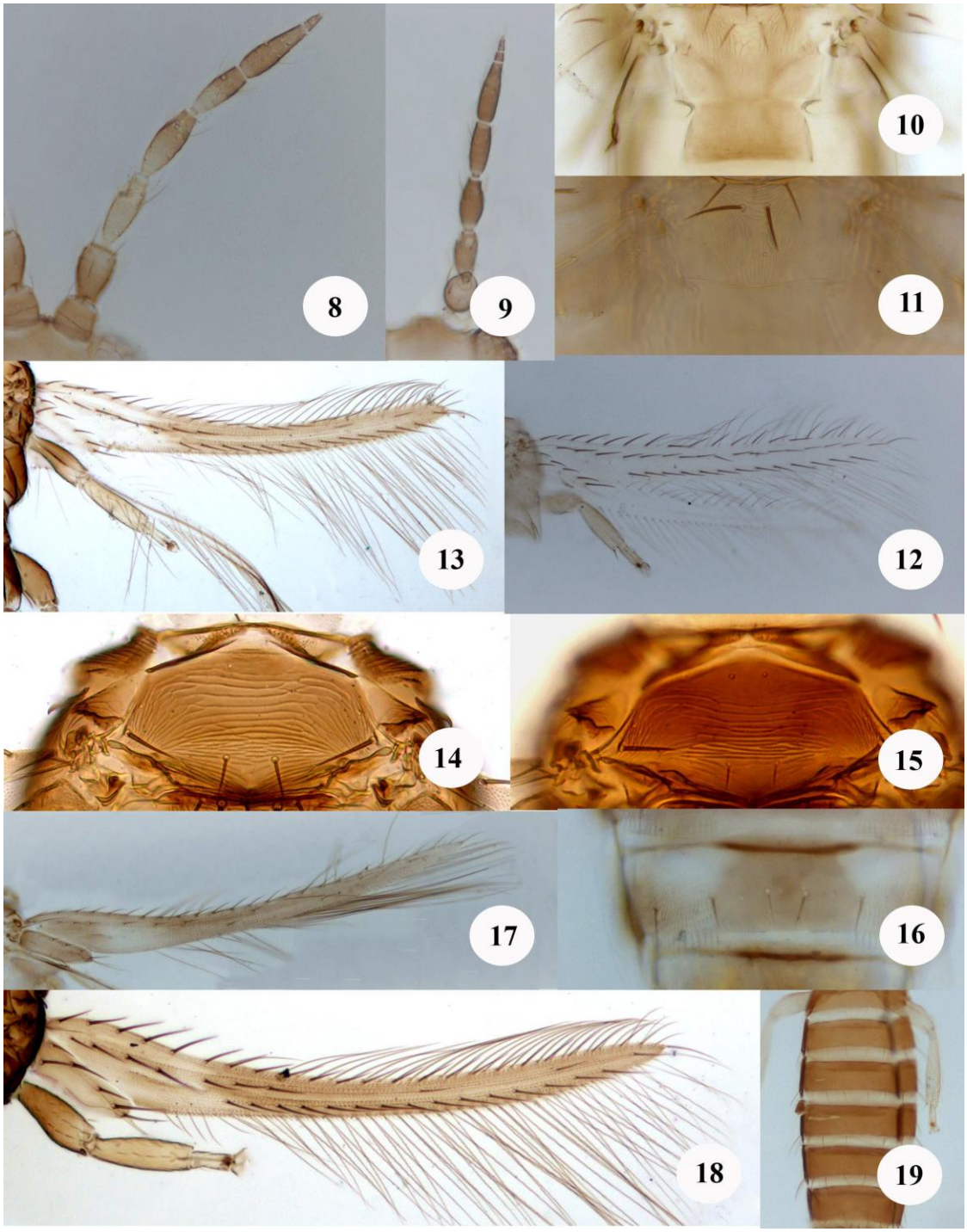

Fig. 8-19. (8) *T. parvispinus*, antenna; (9) *S. dorsalis*, antenna; (10) *T. tabaci*, metanotum; (11) *T. palmi*, metanotum; (12) *F. schultzei*, forewing; (13) *T. hawaiiensis*, forewing; (14) *T. hawaiiensis*, mesonotum; (15) *T. florum*, mesonotum; (16) *S. dorsalis*, abdominal tergite VII; (17) *S. dorsalis*, forewing; (18) *T. florum*, forewing; (19) *T. parvispinus*, abdominal sternites II-VII

Table 1. Shannon diversity index of thrips in cotton

Species	No. of individuals	Pi	In Pi	Pi In Pi
Scirtothrips dorsalis	28	0.107	-2.23	-0.239
Thrips palmi	19	0.072	-2.63	-0.189
T. tabaci	12	0.046	-3.08	-0.142
Thrips florum	109	0.414	-0.88	-0.365
Thrips hawaiiensis	89	0.338	-1.08	-0.367
Thrips parvispinus	4	0.015	-4.20	-0.063
Frankliniella schultzei	2	0.008	-4.74	-0.038
Total	263	1		

Shannon Index (H) = 1.403, Pi -Proportion of individuals

one of the notorious pest species of South East Asia, is a serious pest on numerous agricultural and horticultural crops. Occurrence of this species in India has been first reported on papaya from Bangalore (Tyagi et al., 2015). Later, on flowers of *Dahlia rosea* in Puttur, Karnataka (Rachana et al., 2018). This is the first record of *T. parvispinus* on cotton in India, which is already known for its quarantine importance. Based on the results of Shannon diversity index, *T. florum* followed by *T. hawaiiensis* found to be dominant in flowers, *S. dorsalis* found to be dominant in leaves (Table 1). Based on the dominance of thrips species, pest management practices need to be formulated. In this study seven thrips species were recorded on cotton. *T. parvispinus* is one of the notorious pest species of South East Asia and also a serious pest of quarantine importance. *F. schultzei*, *S. dorsalis*, *T. palmi* and *T. tabaci* are notorious pests as well as vectors of plant viruses. Since these species may attain major pest status, the report demands regular monitoring and surveys for them on cotton.

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