

Identification of groundnut Thysanoptera

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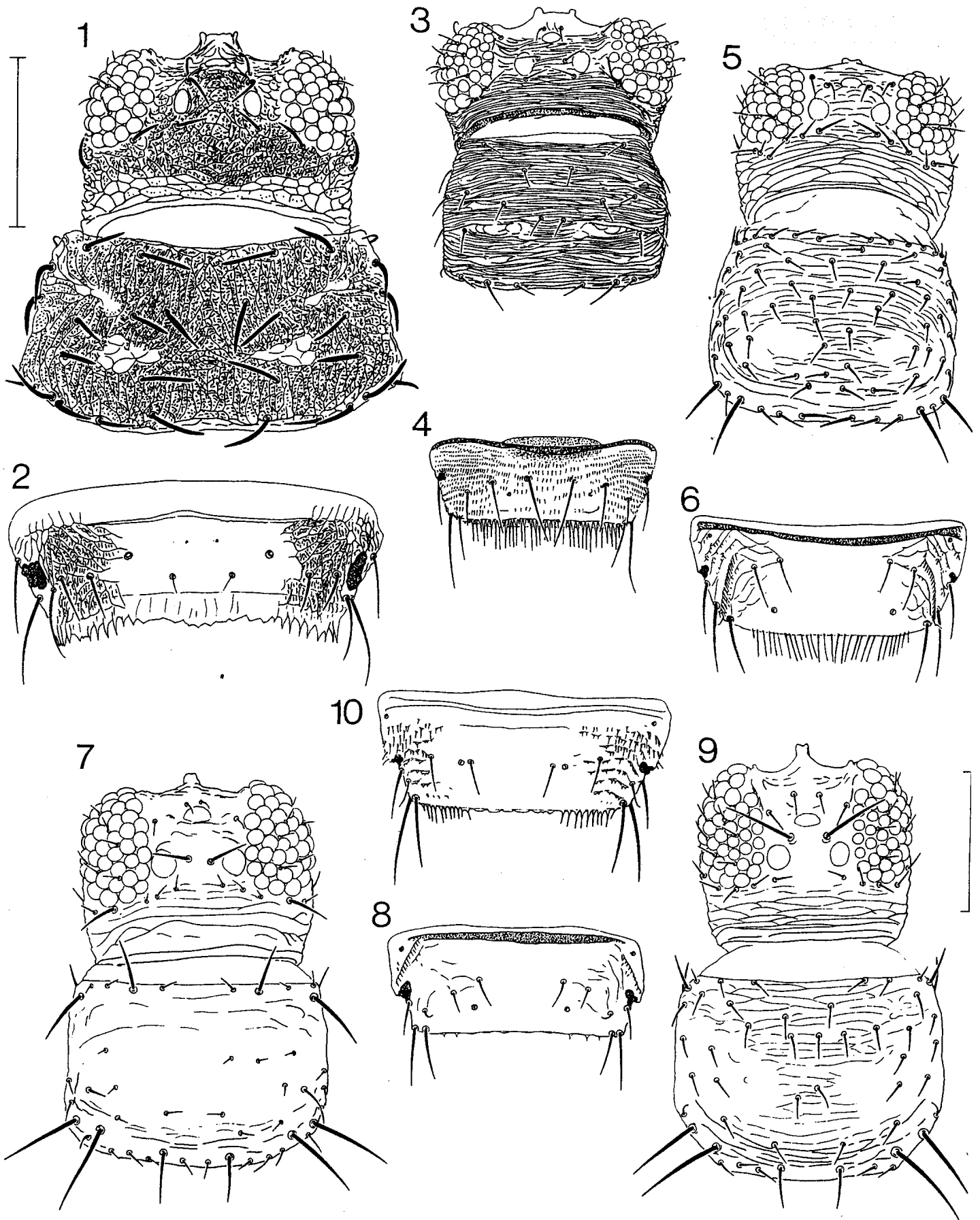
Abstract. Notes given on taxonomic characters, and feeding injury symptoms of the four common thrips pests *Frankliniella schultzei* (Trybom), *Scirtothrips dorsalis* Hood, *Megalurothrips usitatus* (Bagnall) and *Caliothrips indicus* (Bagnall) can help in correct identification of groundnut Thysanoptera. A description of *Thrips tabaci* Lind. is also included, this species being an important vector of tomato spotted wilt virus the world over, although not in India. Identification under field conditions can be made from specific injury symptoms; *F. schultzei* feeding results in scars on young foliage, *S. dorsalis* injury appears as light green patches on the upper surface of young foliage and brown necrotic areas on the lower surface of older leaves; and *C. indicus* causes stippling on older leaves. Duration of egg incubation period for *F. schultzei* and *S. dorsalis* was 6-8 days, of larval instars 6-7 days and prepupal and pupal stages 2-4 days. For *C. indicus*, the duration of egg instar was slightly longer, 7-10 days, and was similar to *F. schultzei* and *S. dorsalis* for other development stages. *C. indicus* produced many more progeny than the other two species.

Introduction

Of the four common thrips pests of groundnut, *Frankliniella schultzei* is an important vector of tomato spotted wilt virus (TSWV) which causes bud necrosis disease (BND) of groundnut, leaf curl disease of mung bean and urd bean, and necrosis in tomato (Amin *et al.*, 1981; Ghanekar *et al.*, 1979). *Scirtothrips dorsalis* is an important yield reducer in Karnataka (Thimmaiah and Panchbhavi, 1973), Orissa (Senapati and Patnaik, 1973) and Maharashtra (Saboo and Puri, 1978). *Caliothrips indicus* (Bagnall) has been reported as a 'menace' to groundnut, particularly in dry years (Ananthakrishnan, 1973). *Megalurothrips usitatus* (Bagnall) is a flower-living species that is most commonly found in legumes. Its pest status has not been determined so far. Since all these species can occur simultaneously on groundnut, confusion in their identity can result particularly between *F. schultzei* and *S. dorsalis* and also between *C. indicus* and *M. usitatus*. For example, injury symptoms of *S. dorsalis* have been previously attributed to *Heliothrips indicus* (Panchbhavi and Thimmaiah, 1973). This paper reports the features that can clearly distinguish between these species. In addition, a description of *Thrips tabaci* is included for two reasons: (1) this species is an important world-wide vector of TSWV, except in India, and (2) although it has not been recorded on groundnut in India, a single record in the literature (Sachan, 1959) can be confirmed by using this description.

Key to species

1. Body covered with distinct, reticulate sculpture (Figures 1 and 2); wings with three pale bands and dark at apex (Figure 11) ... *Caliothrips indicus* (Bagnall)
- 1'. Body not covered with reticulate sculpture; wings, if banded, with only two pale bands (Figure 15) 2
2. Head and pronotum with closely striate, transverse sculpture, pronotal posteroangular setae not distinctly longer than discal setae (Figure 3); abdominal tergites with a dark median patch, tergites (Figure 4) and sternites each with a contrasting dark anterior margin and covered with rows of microtrichia, tergite VIII with a complete comb of long fine microtrichia on posterior margin *Scirtothrips dorsalis* Hood.
- 2'. Head and pronotal sculpture not closely striate, pronotum with two pairs of long posteroangular setae; abdominal tergites and sternites not densely covered with microtrichia; comb on tergite VIII variable 3
3. Head with only two pairs of ocellar setae (pair I absent) (Figure 5); antennae seven-segmented; tergite VIII with a pair of ctenidia (a row of microtrichia along a line of sculpture) situated postero-medially to the spiracle, also a complete comb of long fine microtrichia along posterior margin (Figure 6); forewings pale, usually with four (rarely three to seven) setae on first vein in distal half (Figure 13) *Thrips tabaci* Lindeman
- 3'. Head with three pairs of ocellar setae (pair I present) (Figures 7 and 9); antennae eight-segmented; microtrichia on tergite VIII either not arranged along a single line of sculpture or in a ctenidium situated anterolaterally to the spiracle, posteromarginal comb not complete; wing setae more numerous on first vein 4
4. Forewings pale with two complete rows of setae (Figure 14); pronotum with well developed anteroangular and anteromarginal setae and with a pair of small setae between the median posteromarginals (Figure 7); ctenidia on tergite VIII situated anterolateral to the spiracle, posteromarginal comb usually represented by only a few small teeth laterally (Figure 8) *Frankliniella schultzei* (Trybom)



Figures 1-10. Head and pronotum, 0 tergite VIII. Figures 1, 2. *Caliothrips indicus*. Figures 3, 4. *Scirtothrips dorsalis*. Figures 5, 6. *Thrips tabaci*. Figures 7, 8. *Frankliniella schultzei*. Figures 9, 10. *Megalurothrips usitatus*. All illustrations drawn to same scale except for *Megalurothrips*. Scale bars = 0.1 mm.

4. Forewings banded with a gap in the front row of first vein setae coinciding with the distal pale band (Figure 15); pronotal anteromarginal setae not well developed; median pair of small posteromarginal setae absent (Figure 9); tergite VIII laterally with microtrichia arranged irregularly, posteromarginal comb of long microtrichia present laterally (Figure 10) *Megalurothrips usitatus* (Bagnall)

Caliothrips indicus (Bagnall)

This species has also been recorded in the literature as *Heliathrips indicus* and *Hercathrips indicus*.

Blackish brown species of Panchaetothripinae with basal stems of antennal segments III and IV yellow, apices of femora and tibiae yellow, and forewings with three narrow pale bands and dark apex (Figure 11). Cheeks parallel sided (Figure 1); antennal segments III and IV with forked sense-cones; tarsi one-segmented; tergal sculpture restricted to lateral thirds comprising elongate reticulations enclosing numerous wrinkles, tergite VIII with posteromarginal comb of microtrichia absent medially (Figure 2).

Two other species of *Caliothrips* are recorded from India. They are *C. graminicola* and *C. striatopterus*. *C. indicus* may be distinguished from them by the colour of the forewings and the form and extent of the tergal sculpture.

These thrips are prolific breeders. An average of 37 progenies were produced by individual females ($N = 65$). The incubation period of eggs was 7–10 days, the larval period

6–7 days, and the prepupal and pupal periods 2–3 days. The adults live for up to 20 days at $25^{\circ}\text{C} \pm 1^{\circ}\text{C}$.

Feeding injury

Both adults and nymphs inhabit older leaves and feed on the upper surface. Feeding results in white spots or streaks (Figure 16(b)). In severe infestations the plants are stunted with stippled leaves and ultimately such leaves dry. High populations of this thrips occur during hot dry periods. In our surveys at Karnataka and Andhra Pradesh States *C. indicus* infestations were observed to be less common than that of *F. schultzei* and *S. dorsalis*.

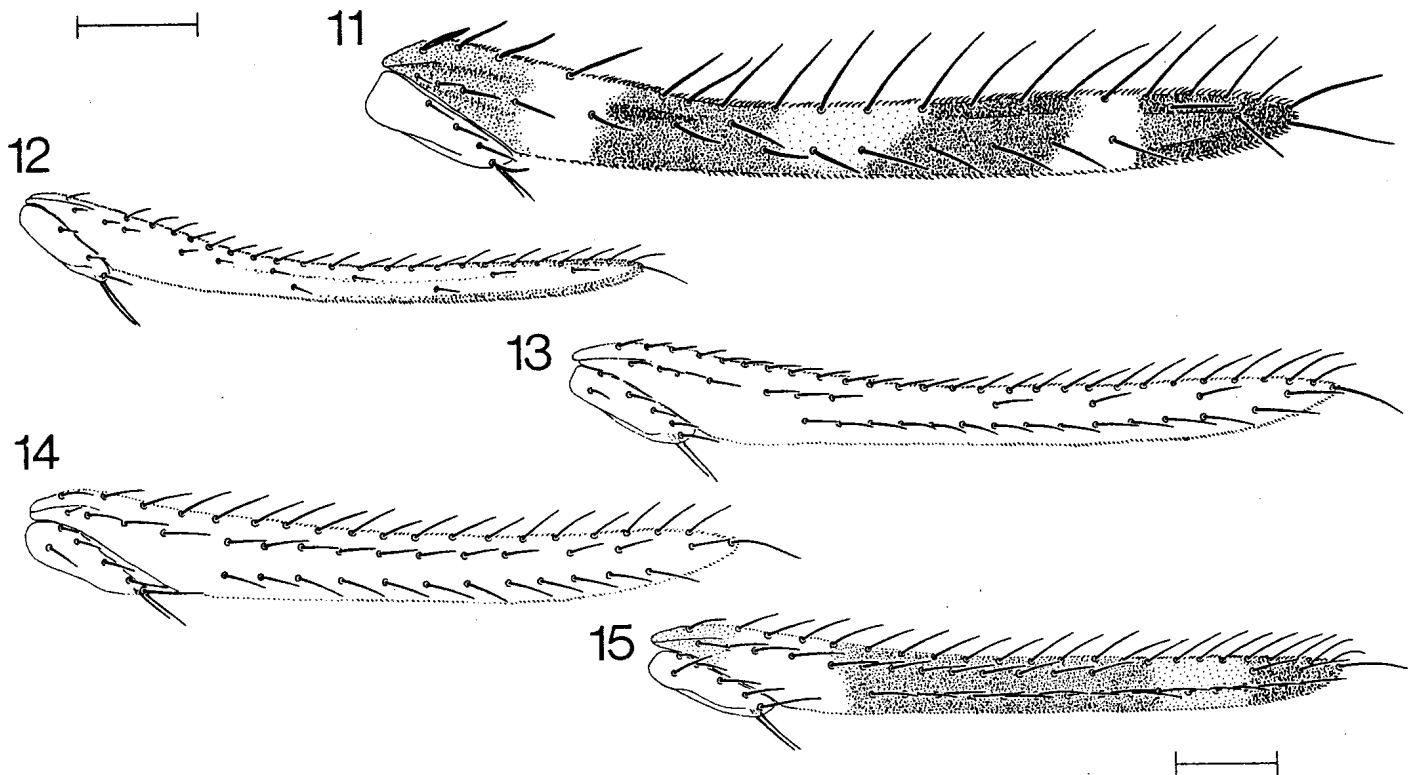
Frankliniella schultzei (Trybom)

This species is also recorded in the literature as *F. dampfi*, *F. sulphurea*, *Physopus schultzei* and others.

Yellow to pale brown species of Thripinae. Antennae eight-segmented, a forked sense cone on each of segments III and IV; head with three pairs of ocellar setae; pronotum with two pairs of long posteroangular setae, one pair of long anteroangulars, one pair of long anteromarginals and a pair of small setae between the median posteromarginals (Figure 7); forewings pale with two complete rows of wing vein setae (Figure 14); abdominal tergites IV to VIII with lateral ctendidia, those on tergite VIII situated anterolaterally to the spiracles; tergite VIII with posteromarginal comb represented by only a few small teeth laterally (Figure 8).

This is the only species of *Frankliniella* known at present from India.

Nymphs, when newly hatched, are white in colour but



Figures 11–15. Forewing. Figure 11. *Caliothrips indicus*. Figure 12. *Scirtothrips dorsalis*. Figure 13. *Thrips tabaci*. Figure 14. *Frankliniella schultzei*. Figure 15. *Megalurothrips usitatus*. All illustrations drawn to same scale except *Megalurothrips*. Scale bars = 0.1 mm.

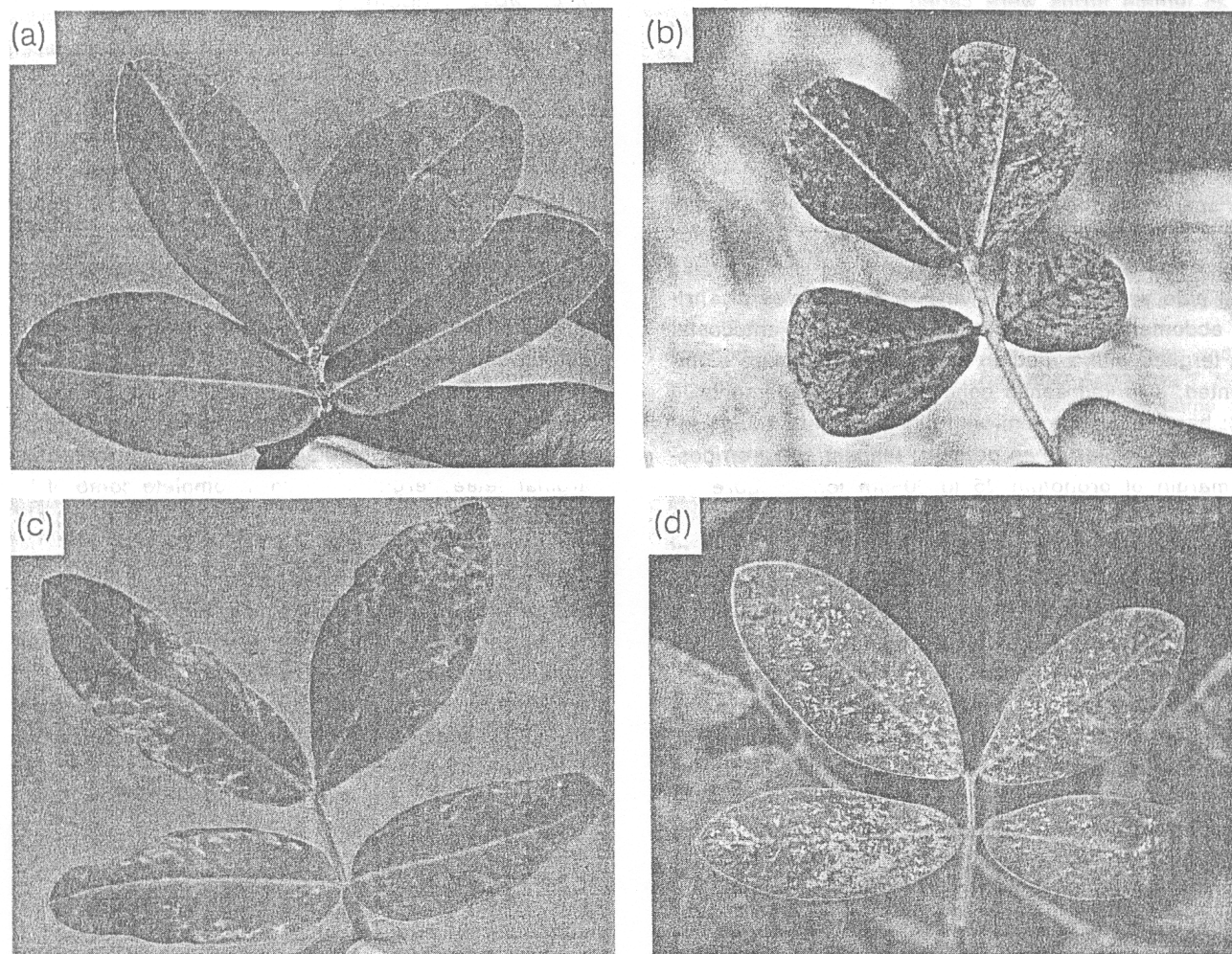


Figure 16. (a) Healthy leaf. Feeding injury symptoms caused by (b) *Scirtothrips dorsalis*; (c) *Frankliniella schultzei*; (d) *Caliothrips indicus*.

become light yellow with age. They move slowly and bend their abdomens while turning. Both nymphs and adults deposit black excreta on the leaf while feeding. The nymphs feed gregariously.

The cylindrical, slightly kidney-shaped eggs are laid inside the leaf tissue. They measure about 0.2 mm in length and 0.1 mm in width. The incubation of eggs was completed in 6–8 days, larval development in 6–8 days, and prepupal and pupal periods in 2–4 days at 28°C daytime and 21°C nighttime temperatures. The mean adult longevity was 8 days ($N = 16$) and the mean fecundity was 25 eggs per female ($N = 80$) at the above temperatures. Eggs from unmated females gave rise to males. Both longevity, and fecundity was increased when the leaf diet was supplemented with pollen. These thrips are commonly found in flowers of many crops and weeds.

Feeding injury

Adults and nymphs inhabit the terminal leaves of groundnut plants and remain hidden in the crevices around the leaf bud. The feeding injury to young unopened leaves or leaf buds appears as light green patches. As the leaves grow, this injury develops into white scars (Figure 16(c)). In severe infestations the leaflets remain small, become puckered and their margins become distorted. The affected plants remain stunted and lose their normal

green colour. The thrips also inhabit flowers and feed on pollen. The periods from August to September and January to February are the peak periods of activity at ICRISAT.

Megalurothrips usitatus (Bagnall)

This species is also recorded in the literature as *Frankliniella nigricornis*, *F. obscuricornis*, *Physothrips usitatus*, *P. u cinctipennis*, *Taeniothrips distalis*, (misidentification) and *T. longistylus*.

Large, dark brown species of Thripinae with banded wings and antennal segment III slightly paler than II or IV. Antennae eight-segmented, a forked sense cone on each of segments III and IV; head with three pairs of ocellar setae; pronotum with two pairs of long posteroangular setae (Figure 9); forewings with a gap in the row of first vein setae (Figure 15); abdominal tergites without ctenidia; tergite VIII with an irregular group of microtrichia anterior to the spiracles, posteromarginal comb absent medially (Figure 10).

This species may be distinguished with difficulty from the two other species of *Megalurothrips* known from India mainly by the colour of the antennae and the extent of the gap in wing vein setae.

This species does not survive on groundnut leaves.

When 25 female thrips were caged on groundnut leaves they survived for less than 5 days and produced a total of 44 eggs.

Scirtothrips dorsalis Hood

This species is also recorded in literature as *Anaphothrips dorsalis*, *Caliothrips minutissimus*, *Scirtothrips andraeae*, and *S. padmae*.

Small pale yellow to white, very active species of Thripinae, abdomen with dark tergal and sternal antecostal ridges, tergites with a median dark patch. Antennae eight-segmented, a forked sense cone on each of segments III and IV; head and pronotum with closely striate sculpture; three pairs of ocellar setae present; longest setae on posterior margin of pronotum 25 to 30 μm long (Figure 3); forewings with few small setae on the veins, hind vein with only two setae (Figure 12); tergites with numerous rows of microtrichia laterally and with three pairs of discal setae; tergite VIII with a complete comb of long fine microtrichia on posterior margin (Figure 4); abdominal sternites covered with numerous rows of microtrichia.

There are three other species of *Scirtothrips* known from India but *dorsalis* may be distinguished from them by the body colour, length of posteroangular setae, extent of sternal microtrichia and the number of discal setae.

Scirtothrips dorsalis, commonly called chillies thrips, are small insects with yellowish bodies. They measure 0.74 to 0.77 mm in length and 0.075 to 0.076 mm in width. Both adults and nymphs actively move in a darting fashion.

The kidney-shaped eggs, 0.075 mm long and 0.070 mm wide, are embedded in the leaf tissue. The incubation period was completed in 6–8 days, the nymphal development in 6–7 days, and the prepupal and pupal periods in 2–3 days. Maximum life length was up to 22 days with an average of 11 days ($N = 50$) and the fecundity up to 60 eggs per female with an average of 17 ($N = 46$) was observed at 28°C day and 21°C night temperatures. Reproduction was both by sexual and as well as arrhenotokous modes. *Scirtothrips dorsalis* does not feed on pollen. In field populations, the number of females is usually more than males but the ratio is variable. For example, the sex ratios were 13 : 1 in the month of December and 3 : 1 in January.

Feeding injury

Feeding results in the formation of dull yellowish green patches on the upper surface and brown necrotic areas and silvery sheen on the lower surface of the leaf (Figure 16(b)) as in chilli peppers (Amin, 1979). The leaves become thickened and some curling also occurs. In severe infestations the plants are stunted and the leaves become blighted. High populations of this thrips occur from February to April, but breeding continues throughout the year. This thrips is a major pest of groundnut in the Raichur and Bellary districts of Karnataka, and West Godavari, Visakhapatnam and Srikakulam districts of Andhra Pradesh and Sambalpur district of Orissa (Senapati and Patnaik, 1973).

Thrips tabaci Lindeman

Yellow to pale brown species of Thripinae, with ocellar pigment grey instead of red. Head with two pairs of ocellar setae (pair I absent) (Figure 5); a forked sense cone on each of antennal segments III and IV; pronotum with two pairs of long posteroangular setae; ctenidia present laterally on tergites IV to VIII, those on VIII situated postero-medially to the spiracles (Figure 6).

Thrips tabaci may be distinguished from the many other species of the genus *Thrips* found in India by the following characteristics: antennae seven-segmented; forewings pale with four (rarely three to seven) distal setae on first vein (Figure 13); abdominal sternites without discal setae; laterotergites with rows of ciliate microtrichia; tergites pale brown or shaded medially; tergite II with three lateral marginal setae; tergite VIII with a complete comb of long, fine microtrichia (Figure 6); tergite IX with one pair of pores (anterior pair absent).

Thrips tabaci, when caged on groundnut leaves, survived for only a few days producing less than two progeny ($N = 25$) per female. The nymphs when caged on tobacco *Nicotiana tabacum* failed to survive for more than 2 days but they survived normally on urdbean, *Vigna mungo* (cv. UPU 2). This species is now being cultured on onion plants in the greenhouse at 25–35°C temperature.

Discussion

Frankliniella schultzei is an important vector of TSWV which affects legumes and solanaceous crops. This species is recorded here on groundnut for the first time. It is questionable whether *F. schultzei* has recently adapted to groundnut or went unobserved in the past. There is still confusion regarding the identity of this thrips. Ananthkrishnan (1969) regards it as a separate species from *F. sulphurea* Schmutz whereas Mound (1968) synonymizes it with *F. sulphurea* and *F. dampfi*. There is a need to remove this confusion as although *F. schultzei* is of economic importance as a vector of TSWV in India, the yellow form known as *F. sulphurea*, which is widely distributed in the Indo-Malay-Oceanic region is not a vector of TSWV (Sakimura, 1962).

Scirtothrips dorsalis has been recorded as an important pest in Karnataka State (Thimmaiah and Panchabhavi, 1973) as well as in the north eastern districts of Andhra Pradesh and in Orissa (Senapati and Patnaik, 1973).

Reports of *Thrips tabaci* Lind. infesting groundnut in the Uttar Pradesh (Sachan, 1959) need confirmation because of its importance as a vector of TSWV elsewhere (Pittman, 1927) and possibly in India, (Ananthkrishnan, 1973; Sakimura, 1962). These thrips were not recorded on groundnut at ICRISAT though they were abundant on onion crops about 10 km away from the ICRISAT centre.

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