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Spatial and Seasonal Distribution Patterns of Some Phytophagous Thrips (Thysanoptera: Insecta) Infesting *Ricinus communis* Linn. (Euphorbiaceae) and *Achyranthes aspera* Linn. (Amarantaceae)

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A critical assessment of the distribution pattern of thrips infesting *Ricinus communis* and *Achyranthes aspera* indicates dual aspects, viz., (i) characteristic vertical patterns in relation to space, and (ii) selection of specific areas like buds of *Ricinus communis* and inflorescence of *Achyranthes aspera* for infestation. Correlation of the seasonal trends of various species with the seasonal distributional patterns reveals that the same crop could be infested by various species of thrips during different seasons of their growth period.

Key Words: Thrips, Population, Distribution

Introduction

Knowledge of spatial and seasonal distribution patterns of phytophagous thrips is important in relation to damage potential to crop plants. Available information concerning the distributional patterns in relation to the population trends appear meager in thrips, although some casual references have been made for barley (*Hordeum vulgare* Linn.) and oat (*Avena sativa* Linn). (Cecderholm 1963), castor (*Ricinus communis* Linn.) (Raizada 1965 and Ananthakrishnan 1973), ragi (*Pennisetum typhoideum* Rich.) (Ananthakrishnan & Thirumalai 1978), some oil-seed crops (Rai 1976), and soybean (*Glycine max* (Linn.) Merrill) (Irwin 1979). In this paper an attempt has been made to investigate site-selection, distribution in terms of aggregational faculties, and population trends in a few species inhabiting on the shoot systems of *Ricinus communis* and *Achyranthes aspera*.

Material and Methods

Adults and larvae of seven phytophagous thrips from *Ricinus communis* and four from *Achyranthes aspera* were collected. Population sampling of *Scirtothrips dorsalis* Hood, *Toxothrips ricinus* Bhatti and *Chiridothrips indicus* Ramakrishna and Margabandhu were made by the

dry-count techniques of the Delayed Counting Method (Irwin et al. 1979) and *Rhipiphorothrips cruentatus* Hood, *Retithrips syriacus* (Mayet), *Zaniothrips ricini* Bhatti, *Astrothrips tumiceps* Karny, *Ayyaria chaetophora* Karny, *Caliothrips indicus* (Bagnall), and *Frankliniella schultzei* (Trybom) were made by the Direct Count Method (Irwin et al. 1979) from the host-foliage in the field. Monthly field surveys around Tindivanam and Madras were carried out to assess the population trends of these thrips species.

Site Selection

(*a*) *Castor*

Site restrictions of thrips on *Ricinus communis* indicate a characteristic distributional pattern. *Toxothrips ricinus*, a highly host-specific species was restricted to the bracts covering the tender buds, with stray cases of the larvae occurring on the leaves of the first node. *Scirtothrips dorsalis*, a polyphagous species and a pest of castor, is abundant both on the upper and lower sides of the tender leaves of first and second nodes, rarely occurring on the third nodal leaves and inflorescence. The common polyphagous species, *Retithrips syriacus*, a recognised pest of castor (Ananthakrishnan 1973), mostly occurs on the leaves of third node downwards. However, not withstanding their distribution in patches throughout the obviously-older-leaves below the third node, a comparatively large population of *R. syriacus* was observed on both surfaces of the leaves of the fourth and the fifth nodes. A meager population of *Rhipiphorothrips cruentatus* was also present from the third to seventh nodes along with *R. syriacus*. A similar low trend of population was observed in *Astrothrips tumiceps*. Another highly host-specific species, *Zaniothrips ricini*, infests the lower surface of the leaves from the fourth to the seventh nodes, while adults and larvae of *Ayyaria chaetophora* exist from the fourth node onwards; rarely adults alone were found on the tender leaves along the apical region. From the third to the seventh nodes, a mixed population of *A. tumiceps*, *A. chaetophora*, *R. syriacus*, *R. cruentatus*, and *Z. ricini* was observed.

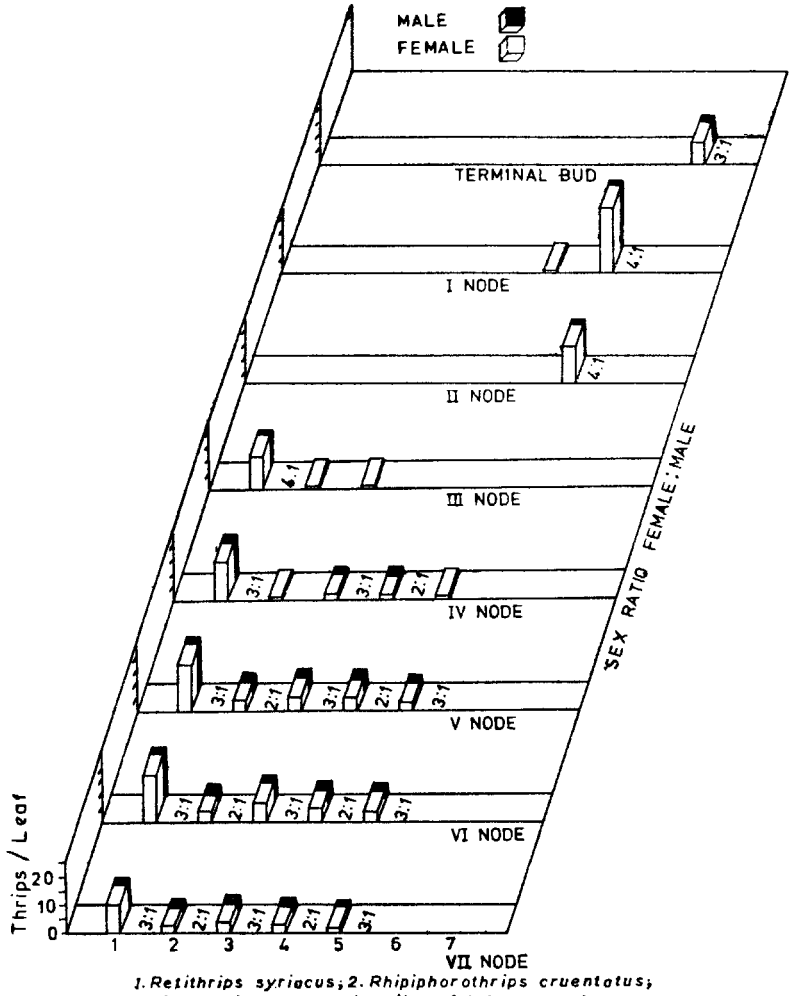
(*b*) *Achyranthes Aspera*

Thrips on *Achyranthes aspera* appeared to select a definite site for feeding, resting, and reproduction. These species exhibit a distinct vertical distributional pattern on the host plant. *C. indicus*, a tubuliferan, recorded earlier infesting grasses (Ramakrishna & Margabhandhu 1939) was found to be a major species feeding on and breeding in the spikes of *Achyranthes aspera*, as both larvae and adults were collected over the period. *F. schultzei*, the pollen-feeding anthophilous species occurred along the adaxial sides of the first nodal leaves of the plants bearing inflorescence, feeding mainly on the pollen grains shed from the flowers. Although no larvae could be collected from the first nodal leaves, adults were available. Selection of the site by this species appears to be mainly for feeding and *F. schultzei* was completely absent during the non-flowering season of the plant. The second nodal leaves were generally occupied by *A. chaetophora* and *C. indicus*, with both sexes of *A. chaetophora* but only the gravid females in case of *C. indicus*. It thus appears that *C. indicus* prefer the second nodal leaves for egg-laying and they move out to other (3 or 4 nodal leaves) for feeding. When the second nodal leaves become third node due to the

production of a new pair of leaves, the gravid females migrate to the fresh second nodal leaves for egg-laying. Leaves of each node showed variation in the sex-ratio of the same thrips species (figures 1–2).

Pattern of Distribution

R. syriacus aggregates in patches both on the upper and lower leaf surfaces of *Ricinus communis*, and a similar distributional pattern (but generally restricted to upper surface alone) is exhibited by the adults of *C. indicus* on the leaves of *Achyranthes aspera*. *Z. ricini*, *A. tumiceps*, *A chaetophora*, *S. dorsalis*, and *F. schultzei* are restricted only to the upper surface of leaves, while *S. dorsalis* are found rarely on the lower surfaces, *Z. ricini* was strictly confined to the lower surface of the infested leaves. On the other hand, *T. ricinus* and *C. indicus*



1. Retithrips syriacus; 2. Rhipiphorothrips cruentatus; 3. Austrothrips tumiceps; 4. Zaniothrips ricini; 5. Ayyario chaetophora; 6. Scirtothrips dorsalis; 7. Toxothrips ricinus

Figure 1 Vertical distribution of thrips on *Ricinus communis*

inhabited only on limited areas such as axillary and terminal buds (of *Ricinus communis*) and flowers (of *Achyranthes aspera*) respectively, and therefore, observations on the distributional patterns of these thrips became difficult.

Population trends

S. dorsalis and *T. ricinus* on *Ricinus communis* and *C. indicus* on *Achyranthes aspera* occur almost throughout the year. The population of *S. dorsalis* builds up in January, reaches its peak in March and April and declines during August–December. *T. ricinus* was absent during the months of July and August while *C. indicus* increased in number by September, maximum population occurring only in February, with a considerably low population from late May to early September. *Ayyaria chaetophora* appeared on *Achyranthes aspera* in October with its population peak in November and they disappear completely by January. On *Ricinus communis* build-up of *Ayyaria chaetophora* population was in September, but suddenly disappeared in late October and reappeared again in late January. *Chiridothrips indicus* occurred only during flowering seasons of *Achyranthes aspera*, i.e., January–June and their population reached the maxi-

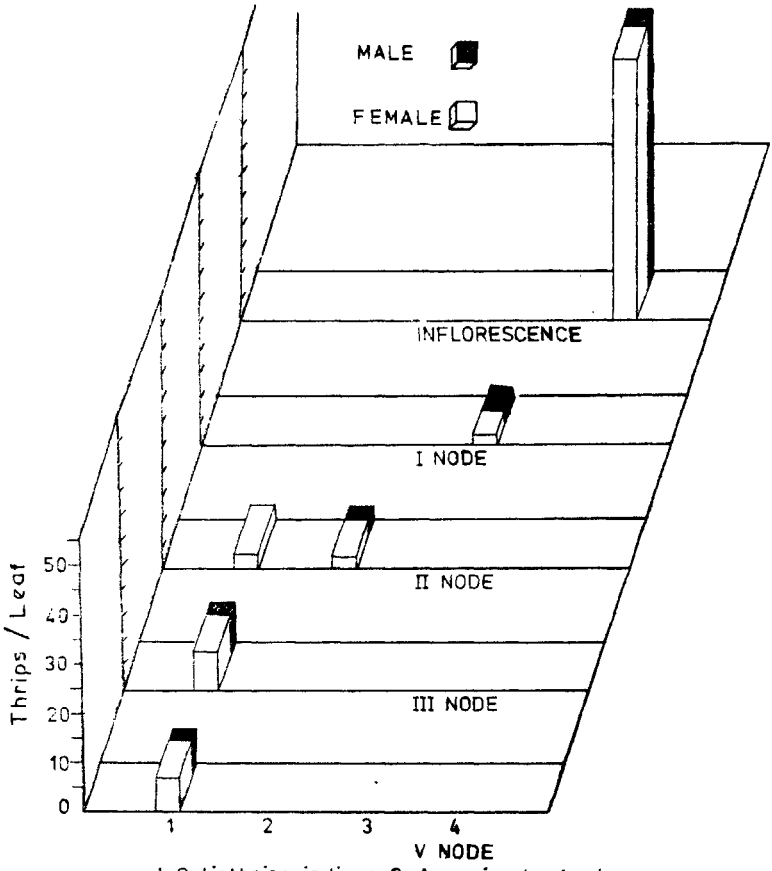


Figure 2 Vertical distribution of thrips on *Achyranthes aspera*

mum in April. Population of *F. schultzei* was continuously maintained on a low level throughout from March to June. The occurrence of *R. syriacus* steadily increased in number from January onwards and reached its maximum during May. It was completely absent during August-December. *Z. ricini* started appearing in September and reached its peak during December, progressively declining thereafter, and being completely absent in the months of May–August, while *R. cruentatus* occurred on the plant in January–April. Population build-up of *A. tumiceps* occurred in January, attaining its peak in April, and thereafter declining from July–December (figures 3 & 4).

Discussion

Four thrips species from *Achyranthes aspera* and seven species from *Ricinus communis* were collected during this work

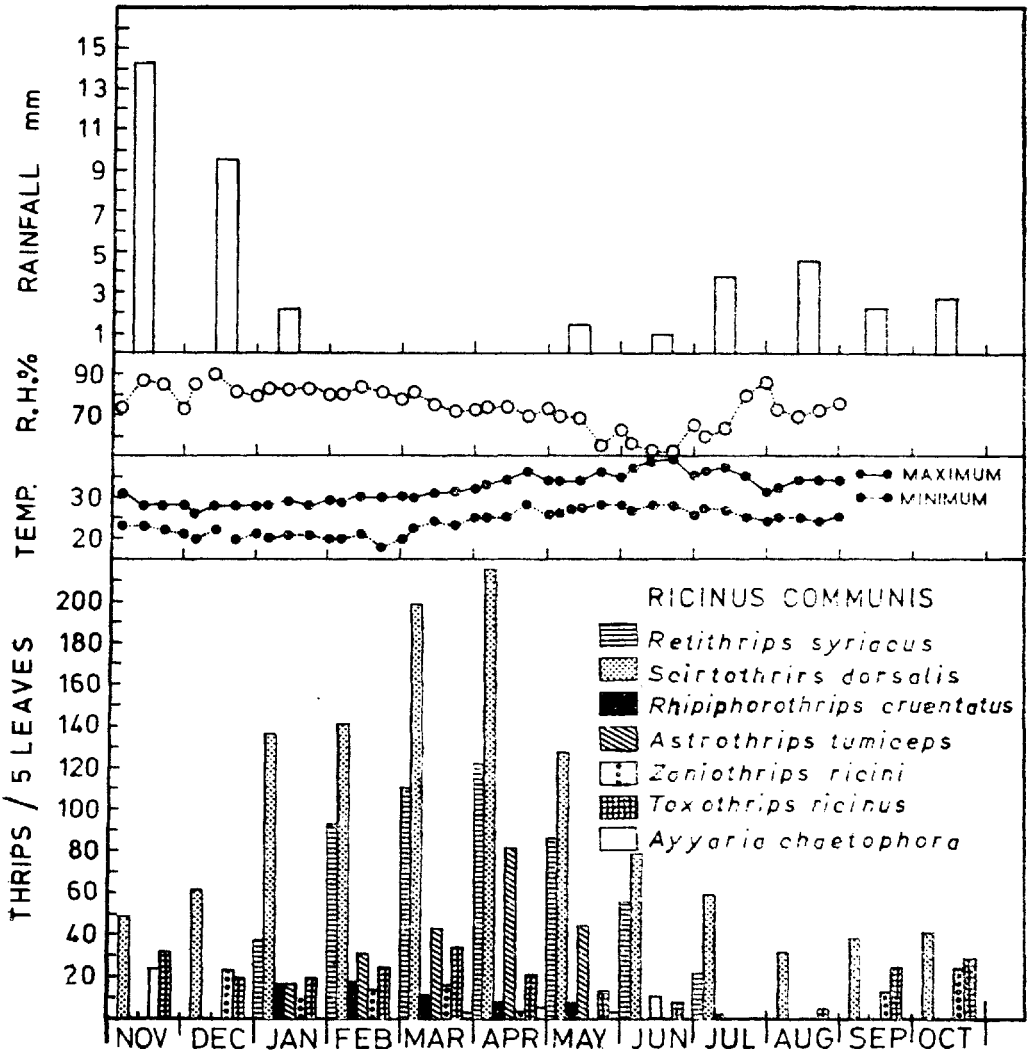


Figure 3 Population trends of thrips on *Ricinus communis*

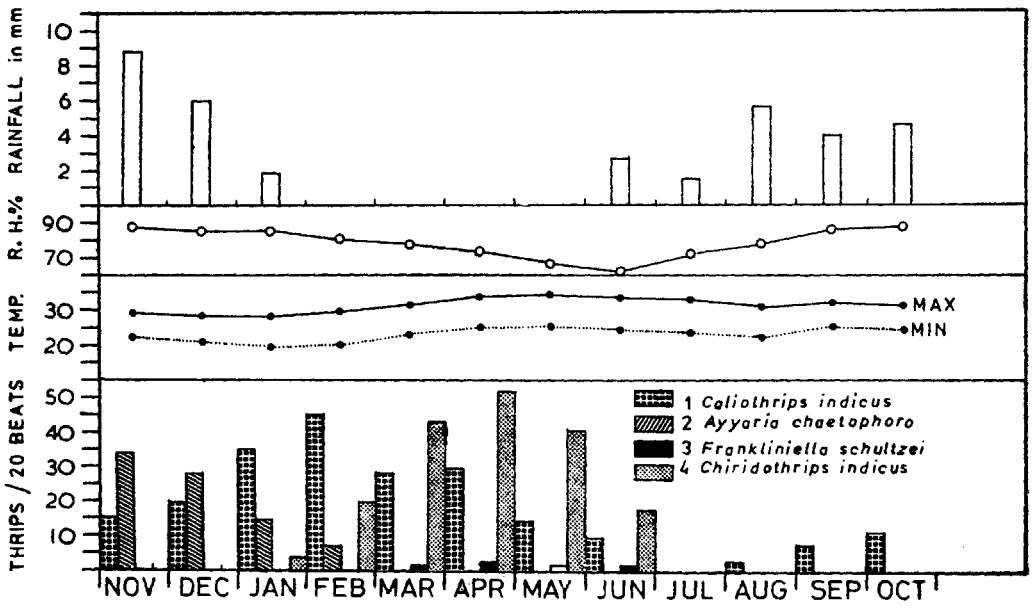


Figure 4 Population trends of thrips on *Achyranthes aspera*

in different periods of the growing season, indicating that the same crop could be subjected to infestation of various species of thrips during their growth, as also observed on soybean infested by different thrips species (Irwin et al. 1979). Spatial distribution of the adults, first and second instars of two species, *Sericothrips variabilis* (Beach) and *Frankliniella tritici* (Fitch) on the soybean plant shows a vertical distribution from the terminal bud downwards (Irwin et al. 1979). The present study indicates that this type of vertical distribution is also exhibited by the different species of thrips infesting the plants during various seasons when they grow. The infestation of *R. syriacus* and *Caliothrips indicus* was noticed on both the surface of the leaves. But the distribution of *Z. ricini* only on the abaxial side and that of *S. dorsalis*, *A. Chaetophora*, *R. cruentatus*, and *A. tumiceps* generally on the adaxial side is very unique, the reasons for this type of spatial disposition is not known. Probably the infestation of thrips on both surfaces of the leaves of *Ricinus communis* and *Achyranthes aspera* has some relationship to the incidence of stomata on both the sides of these leaves (Ananthakrishnan 1955). The restricted distribution of *Toxothrips ricinus* (only in the buds of *R. communis*) and *Chiridothrips indicus* (only in the inflorescence of *A. aspera*) is equally unexplainable. Based on their relative incidence, *S. dorsalis*, *T. ricinus*, and *C. indicus* (available almost throughout the year) and *R. syriacus*, *A. tumiceps*, *Z. ricini* and *Chiridothrips indicus* (available for 5–6 months) can be considered as primary and secondary thrips pests respectively, while *A. chaetophora*, *R. cruentatus*, and *F. schultzei* (available for 3–4 months) from the tertiary thrips pests (Ananthakrishnan & Thirumalai 1978). The population of *S. dorsalis* increases with decreasing humidity and increasing temperature, the maximum population was noticed during the period when the

maximum temperature 30–40°C and the relative humidity 72–74.5 per cent (March–April) as in *Anaphothrips sudanensis* Trybom (= *A. flavicinctes)* observed by Ananthakrishnan (1973). The population of parthenogenetic thrips species is greater in the warm seasons (Lewis 1973) and *S. dorsalis*, a parthenogenetic species (Raizada 1965), also appeared in maximum during the warm seasons (March-April). The population of *R. syriacus* showed a single peak within their period of infestation, during April. Ananthakrishnan (1956) has reported its maximum population during July. The difference may be due to the early rainfall which, along with temperature control thrips population (Andrewartha & Birch 1954). Like in *A. sudanensis* (Ananthakrishnan & Jagdish 1968), there was a decline in the population of all the eleven species, due to high humidity and low temperature during July and August.

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