Proc. Indian natn. Sci Acad. **B47** No. 6 pp. 811–815 (1981)

Seasonal Periodicity of Thrips Infesting Some Compositae in Relation to Pollination

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(Recieved on 30 August 1981)

Population trends of four species of anthophilous thrips infesting some weeds of Compositae are discussed in terms of species aggregation, relative dominance and seasonal migration as well as the impact of varying populations, in relation to the pollination of homogamous and heterogamous capitula.

Keywords: Thrips, Pollination, Compositae, Migration

Introduction

Synchronisation in terms of flowering periodicity and phenology of the pollinating thrips appears to be controlled by the population build-up of thrips, eventually leading to migration. In the course of studies on pollination by thrips and production of viable seeds in Compositae, the seasonal incidence of host plants as well as thrips inhabiting them has enabled the analysis of the trends of infestation of these species on various hosts in relation to biotic as well as abiotic factors (Ananthakrishnan et al. 1981, and Gopinathan et al. 1981). The discussion presented here is confined to the assessment of the complex phenomenon of Thrips-Compositae interaction with reference to seasonal periodicity of different species of Compositae and thrips populations in terms of species-packing, dominant species, migration and population impact on pollination of homogamous and heterogamous capitula.

Material and Methods

Periodical sampling of different species of thrips i.e., *Microcephalothrips abdominalis* (Crawford), *Frankliniella schultzei* (Trybom), *Haplothrips gowdeyi* (Franklin), *Haplothrips tardus* Priesner, *Haplothrips ganglbaueri* Schmutz and *Microthrips fasciatus* Ananthakrishnan was carried out by collecting 50 capitula of each of the following plants which occur in different seasons: perennials such as *Wedelia chinensis* (Osbeck) Merr. and Tridax procumbens L., and annuals like *Ageratum conyzoides* Linn., *Synedrella nodiflora* Gaertn., and *Vernonia cineria* Less. Care was taken to choose capitula of the same age (i.e., the maximum infestation stage) from marked plots of 4 sq. m. The relative efficiency of pollination by thrips in homogamous and heterogamous heads was studied with respect to their population build-up in the capitula of different species by observing the behavioural patterns of larvae and adults, as well as by count of pollen on their bodies.

Observations

Of the host plants mentioned, flowering in *W. chinensis*, *S. nodiflora* and *A. conyzoides* is seasonal, restricted to May–November, November–January and December–March respectively, whereas *T. procumbens* and *V. cineria* flower throughout the year. *Wedelia*, *Tridax*, *Vernonia* grow together in the field, but *Synedrella* and *Ageratum* occur randomly distributed in widely-separated areas, though as large groups.

Species-packing was observed in *T. procumbens* and *W. chinensis* with all the four species, viz., *H. tardus*, *H. gowdeyi*, *F. schultzei* and *M. abdominalis* within a single inflorescence, *M. fasciatus* and *H. ganglbaueri* occurred only as occasional visitors. Fluctuations in species-packing was found in both the cases, sometimes with only 2 or 3 species in a single capitulum. However, *M. abdominalis* was always the dominant species in *Wedelia*, and *H. tardus* in Tridax. Observations on species-packing in a capitulum showed a peculiar behavioural pattern that terebrantians which are smaller did not enter a floret while species of *Haplothrips* which are larger existed there. Considering the dominance of population of the invading species in a flower, *M. abdominalis* seemed to show preference for *Wedelia*, *Synedrella* and *Ageratum*, and *H. tardus* for *Tridax*, and *H. gowdeyi* for *Vernonia*.

Abundance of anthophilous thrips population is mainly determined by (i) the

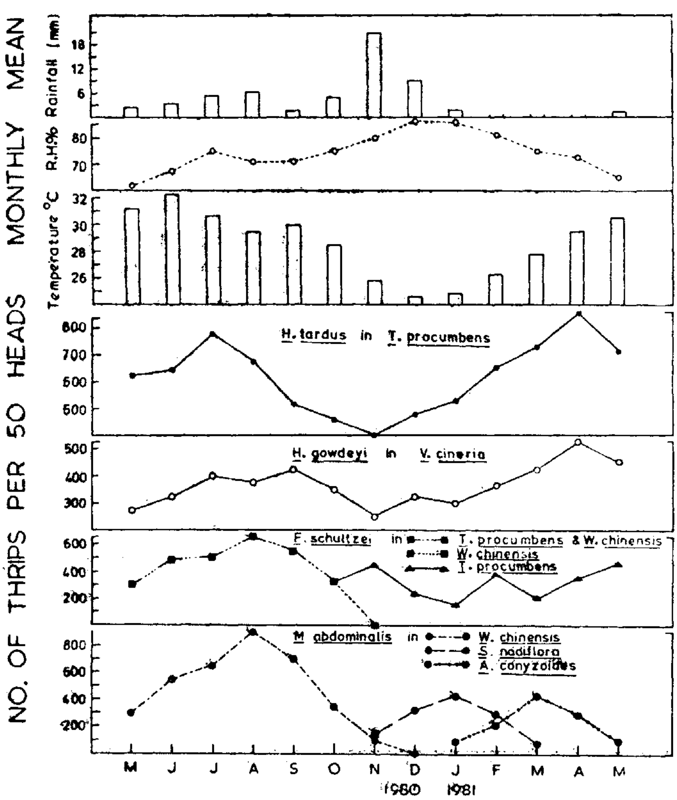

Figure 1 Population dynamics of different species of thrips infesting flowers of Compositae

flowering season of the host plants, (ii) the effect of abiotic factors like temperature, rainfall, and relative humidity, and (iii) the influence of predators (figure 1). *M. abdominalis* was found dominant in *Wedelia* from May–November, its maximum population being in the month of August (900 thrips/50 heads), probably due to the availability of a large number of flowers as well as less rainfall (5 mm) and optimum temperature (30°C). The sudden fall of *M. abdominalis* and *F. schultzei* population in the month of November in *Wedelia* can be accounted for by the ending of its flowering season and also the predatory efficiency of the anthocorid bugs *Orius indicus*. As soon as the flowering season of *Wedelia* terminated, *Synedrella* started blooming followed sequentially by *Ageratum*. The continuous availability of different host plants possibly prevented the complete decline of thrips populations. In the case of *H. tardus*, though the flower was available throughout the year, a higher population of thrips in the month of July and August slightly decreased because of high rainfall (20 mm) and high humidity (80%) in the month of November. Its high population (850 thrips per 50 heads) in the summer season (March–May) suggests an increased reproductive efficiency due to higher temperature. *H. gowdeyi* population in *Vernonia* was maintained (400 thrips 50/heads) from June end to March and the maximum population 550 per head was attained during April. In *Wedelia* the anthocorid population was maximum during September and from April to June in *Tridax*.

Migration of different species of thrips to diverse host-plants was observed during off-seasons of flowering (figure 2). *M. abdominalis* showed a cycle of migration among *Wedelia*, *Synedrella* and *Ageratum* in a year, being abundant in *Wedelia* flowers from May–November. The onset of flowering season of *Synedrella* coincides with the end of flowering

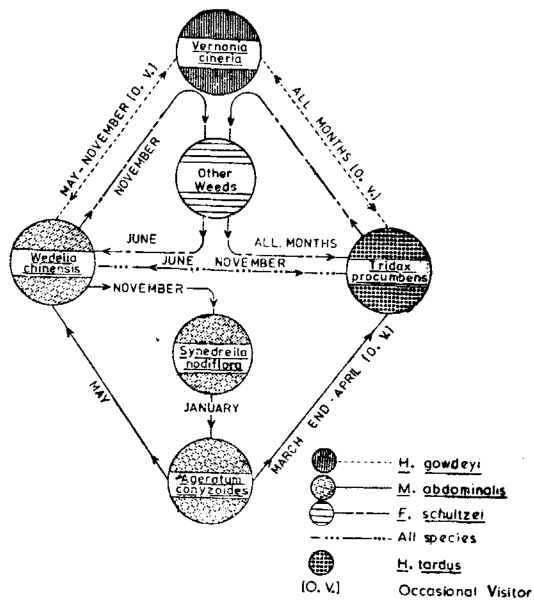

Figure 2 Migatory trends in different species of thrips infesting five species of Compositae

of *Wedelia*, resulting in the migration of thrips to *Synedrella*, while blooming of *Ageratum* in December synchronised well with the end of flowering season of *Synedrella*. This availability of different host plants in different months enabled *M. abdominalis* to maintain its population throughout the year, though occasional visits of *M. abdominalis* from *Ageratum* to *Tridax* were observed from March end to April. All the four species of thrips in *Wedelia* and *Tridax* were found to intermigrate between the two, since both occurred in the same field. According to their flowering periodicity, *H. gowdeyi* occurs in *Wedelia chinensis* from May–November and during all months in *T. procumbens*. *F. schultzei*, a polyphagous species, migrates to *W. chinensis* during June, and returns to the other non-Compositae weeds by November, whereas in *Tridax* it is found visiting in all months. This sort of a migration between flowers of different species indicates that migration mainly depends on floral availability in different seasons, which provides shelter and food towards build-up of their population.

Abundance of population has a direct effect on pollination. The large and showy heterogamous heads of *Tridax* and *Wedelia* provide enough space and food for different species to survive, while *Synedrella*, with smaller and less attractive heterogamous head is inhabited only by the terebrantian, *M. abdominalis* which are able to move freely within the inflorescence. The homogamous heads of *Ageratum* and *Vernonia*, which are smaller in size due to their compact arrangement of florets, provide little space for adult thrips to move within and between the florets. But the organization of the capitula in a corymbose fashion in the homogamous heads helps the pollinators to utilise very little energy for their inter-capitular migration (Gopinathan et al. 1981). Only the larvae of *M. abdominalis* and *H. gowdeyi* are found moving inside the florets of both the homogamous heads and when the pollen load was calculated, larvae showed the maximum ability. In contrast to this, heterogamous heads showed a free movement of both larvae and adults in between the individual florets, and adults showed the maximum pollen load on the body (Ananthakrishnan et al. 1981). As such, larvae are generally found to be efficient pollinators of homogamous heads, and adults in the heterogamous heads. It seems that the corymbose pattern of arrangement of the inflorescence in the homogamous heads provides an excellent opportunity for the larvae for inter-capitular movements, thereby effecting pollination.

A study of the populations of various species of thrips in *Wedelia*, *Tridax* and *Vernonia* indicated that during October–December there is a sharp decline in populations due to heavy rainfall thereby interfering with pollination efficiency. Conversely, during certain periods of higher larval abundance, considerable differences are evident in the pollen carrying efficiency in *Ageratum* as for instance during January and February, and in *Vernonia* during June, July, January and February. Larval populations of *M. abdominalis* and *H. gowdeyi* in *Ageratum* and *Vernonia* were 260 and 375 per 50 heads and their pollen carrying capacity was 55–85 and 70–90 respectively as also reported earlier (Ananthakrishnan et al. 1981). This high incidence of larval population during the beginning of the flowering period enables an increase in the pollen load transfer in homogamous heads leading to the production of more viable seeds by cross pollination. In the heterogamous heads, thrips larvae could be considered as the more-efficient pollinators during their periods of maximum abundance in different months. Larvae of *M. abdominalis* were found maximum in *Wedelia* and *Synedrella* in the months of June, July and December, January respectively. The abundance of both adults as well as larval populations has an indirect role in pollination, which in turn enables host plant multiplication.

Discussion

Our observations include the incidence of *Orius indicus* along with thrips populations inhabiting the capitula of Compositae, and the role of density-independent factors like temperature, rainfall, and relative humidity; yet the population build-up, and the decline due to migratory patterns among anthophilous Thysanoptera seems to be largely controlled by the flowering phenology of host-plants.

The continuous build-up of thrips population in a flower leads to inter-, and intra-specific competitions among thrips species which bring about migration, ultimately enhancing the possibilities for cross-pollination. Effective cross-pollination mainly depends on the (i) blooming time of the flowers, (ii) amount of food reward (nectar/

pollen) for the pollinator, and (iii) structures facilitating access to the flowers and food. These facilities are very clearly evident in the examined system, with a characteristic synchronisation in the relative abundance of thrips as well as the species-packing in the capitula of the plants studied. Incidentally, a limitation of the food reward from the flower to the forager encourages them to visit other plants of the same species. The species living in the heterogamous heads of Compositae with solitary inflorescences, seem to spend more energy for their visit to other flowers where the food reward is high. In contrast, thrips in homogamous capitula spend lesser energy for their migration due to corymbose arrangement where the nectar availability is also less (Gopinathan et al. 1981). Thus, a balance, as visualised by Heinrich and Raven (1972), exists between the nectar/pollen availability and the incidental calorific reward of a flower on the one hand, and the energy expenditure by the pollinator on the other.

Acknowledgement

This work was done during the tenure of a Council of Scientific & Industrial Research Project.

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