Biological Forum – An International Journal **15(1): 383-387(2023)**

ISSN No. (Print): 0975-1130
ISSN No. (Online): 2249-3239

Investigation on the Temporal and Spatial Distribution of Flower Thrips Population in *Nyctanthes arbor-tristis* Linn.

Manjunath Kenchannavar[1*], M. Thippaiah[2], Y.B. Srinivasa[3] and R.R. Rachana[4]
[1]Ph.D. Scholar, Department of Agricultural Entomology,
University of Agricultural Sciences, GKVK, Bengaluru (Karnataka), India.
[2]Professor and Head, Department of Agricultural Entomology,
University of Agricultural Sciences, GKVK, Bengaluru (Karnataka), India.
[3]Tene Agriculture Solutions Pvt. Ltd. Bengaluru (Karnataka), India.
[4]Division of Germplasm Collection and Characterisation,
NBAIR, Bengaluru (Karnataka), India.

(Corresponding author: Manjunath Kenchannavar)*
(Received: 24 November 2022; Revised: 03 January, 2023; Accepted: 09 January, 2023; Published: 18 January, 2023)
(Published by Research Trend)

ABSTRACT: We made a preliminary examination of the flowers of *Nyctanthes arbor-tristis*, with longevity for about 12 hours, and their association with three species of thrips in terms of understanding their distribution and accumulation patterns. Thrips are among the most common flower feeding insect groups in the world. We compared the time of anthesis with theentry time of the thrips. We also studied the distribution of the three species of thrips across and within flowers of *Nyctanthes arbor-tristis*. *Thrips florum*, *Thrips hawaiiensis* (Thripidae; Terebratia) and one unidentified species (Phlaeothripidae; Tubulifera) were the three species occurring concurrently in the flowers of *N. arbortristis*. Flower sampling was done at three full-grown trees of *N. arbor-tristis* located at considerable distance from each other. Observations were recorded on the opening and dropping times of the flowers, and entry time of each species of thrips into the flowers and the density of individual species of thrips in each flower at various stages of flower development Flowers open between 5:10 PM and 6:45 PM the next day [Rs1]. All three species of thrips entered flowers ~1 hour prior to flower opening. The higher thrips density was recorded in freshly opened flowers with 292 thrips occupying 62%of the 180 flowers sampled. Later, both population density and flower occupancy decreased to 34 thrips in 28 flowers 24 hours post anthesis. Population density and flower occupancy were positively correlated. Interestingly, 37% of flowers were unoccupied when the population density of thrips was maximum, indicating that both threshold level of occupancy and threshold level of population density played a role in the distribution of thrips among the flowers. The proportion of empty flowers reveal aggregated distribution of thrips rather than random distribution.

Keywords: Thrips, *Nyctanthes arbour-tristis*, Population density, Occupancy, Aggregated distribution.

INTRODUCTION

In comparison with other plant parts, flowers are among the most short-lived and diverse resources for phytophagous insects. With pollen and nectar in them, flowers are also a high-quality resource. If short resource life is expected to favour generalist insect herbivores, high resource diversity and high resource quality (via increased competition) are expected to favour specialists, which, together, make it an extremely interesting system to answer some of the questions pertaining to the evolution of generalists and specialists.

Thrips are tiny insects belong to the order Thysanoptera, which includes approximately 5500 species worldwide (Mound, 2001). Majority of thrips species are phytophagous and saprophagous, and some are predatory on phytophagous mites and other thrips. About 40% thrips species are saprophagous which feed on fungal hyphae and spores growing on dead bodies, leaves and litter. Phytophagous thrips feed on flowers, leaves and some galls on stem and leaves (Childers, 1997).

Nyctanthes arbor-tristis Linn. is one of the well-known medicinal plants. It is a common wild hardy large shrub or small tree. It is native of India, distributed wild in sub Himalayan regions and southwards to Godavari, Lalitpur Nepal. *N. arbor-tristis* is commonly known as Night Jasmine or Parijata (Sandhar *et al*., 2011). The flowers start falling after midnight and by the day break, the plant appears dull (Pushpendra and Arti 2016). It is usually a shrub or a small tree having brilliant, highly fragrant flowers, which bloom at night and fall off before sunrise, giving the ground underneath a pleasing blend of white and red (Kiew and

Baas 1984). *N. arbor-tristis* is inhabited by several species of flower thrips, which feed on flowers and leaves and also aid in pollination (Usha and Anjali 1989).

The flower thrips are polyphagous in nature which feed on flowers of wide variety of plant species. The western flower thrips *Frankliniella occidentalis* (Pergande), a thrips species native to western United States, has been documented to feed on over 500 different species of host plants, including a large number of fruit, vegetable, and ornamental crops. *Thrips flavus* on of the flower thrips has the broadest host range affecting a diverse variety of plants. It can feed on both leaves and flowers of several host plants of 9 families including *N. arbor-tristis* Linn of Oleaceae family (Kirk and Terry 2003).

Previous studies on thrips infesting flowers of *N. arbor-tristis* focussed on the pest management. Studies on distribution patterns, association between different species and resource utilization are lacking. Hence, in this study we focused on the inhabitant species of thrips, their association and distribution patterns into the flowers.

METHODOLOGY

The study was conducted between the 2nd week of October and 3rd week of November 2019 in the GKVK campus of the University of Agricultural Sciences, Bengaluru (13° N & 77°35′ E; 930 m above MSL), which is classified under south eastern dry zone of Karnataka. Three full-grown trees of *N. arbor-tristis* located at considerable distance (specify) from each other were selected. Observations were recorded on the opening and dropping times of the flowers, and entry time of each species of thrips into the flowers and the density of individual species of thrips in each flower at various stages of flower development.

Time of flower opening. To find out the precise anthesis time, 30 randomly selected buds were tagged one day prior to the expected an thesis time. Observations on the time of initiation of flower opening were started at 16:30 hours the next day (preliminary studies had shown us that flowers do not open before 16:30 hours). The flowers were continuously observed until all the flowers were open. Time taken for complete flower opening was also noted for each of the tagged sample. Observations on the time of flower dropping were started at 05:00 hours the next day (it is the time when none of the flowers drop to the ground), which continued until all the tagged flowers dropped down. This process was repeated twice to record data from a total of 90 flowers per tree.

Entry time and distribution of thrips into flowers. Random samples drawn at various developmental stages of the flowers revealed the presence of thrips in fully mature buds and opened flowers only. Therefore, a large number of mature flower buds (one day prior to expected anthesis time) were tagged on each tree. Thirty buds/flowers were observed at various times (24, 12, 6 and 1hour prior to flower opening, at the initiation of flower opening, at completion of flower opening, and 1, 12, 16, 20 and 24 hours after flower opening) to note the species composition and density of thrips in each flower. Although flowers had dropped to the ground during the last three samplings, the ground below was cleared the previous evening to sample only freshly dropped flowers. Each flower sample was immediately transferred to a separate vial containing 70% alcohol. Later, the samples were observed under a stereo binocular microscope to record data on the thrips. All thrips occurring in the samples were stored in AGA media, labelled and sent for identification to the taxonomists at NBAIR, Bengaluru. Data were analysed to reveal the entry time of thrips into flowers and their distribution within and across flowers. The entire exercise was repeated three days later for each of the three trees.

RESULTS AND DISCUSSION

Time of flower opening. Initiation of flower opening was not synchronous; it lasted for about an hour for each of the three trees observed (1 hour, 1 hour and 15 minutes, and 59 minutes for trees 1, 2 and 3 respectively). Together, the first flowers started opening at 17:00 hours while the last flowers began opening at 18:45 hours (Fig. 1). The mean flower opening time, for the pooled data, was 18:07 hours (18:23, 17:52 and 18:04 hours for trees 1, 2 and 3 respectively). Usha and Anjali (1989) reported that flowers opened between 18:00 and 18:30 hours, which is similar to the results obtained in this study. However, they also report that flower opening gets delayed by 3 or 4 hours between mid-November and mid-December, which differs from our findings. One might have to consider the influence of latitudes on flower opening time before drawing conclusions here.

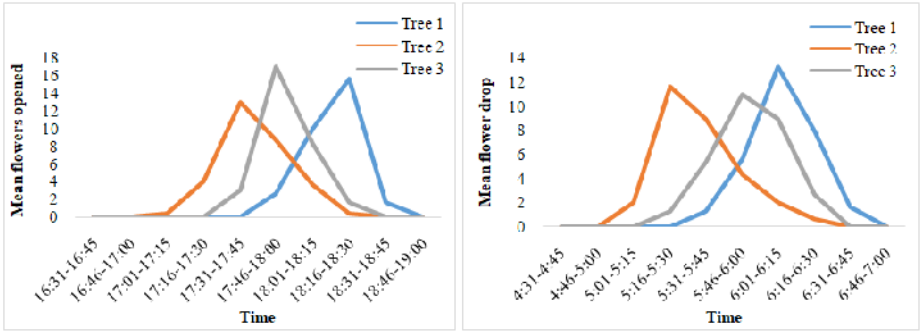

Fig. 1. Time of flower opening and flower drop at three different trees.

Time of flower drop. Recurrent flower opening/closing is not observed in *N. arbor-tristis*. Flowers dropped from the trees the following morning. Flowers of tree 1 dropped between 05:46 to 06:45 hours with mean at 06:19 hours. It was between 05:10 and 06:30 hours (mean at 05:42 hours) for tree 2 and it was between 05:30 and 06:30 hours (mean at 06:05 hours) for tree 3 (Fig. 1). The total time between dropping of the first to the last flower varied between trees. It lasted for 1 hour and 13 minutes for tree 1, 1 hour and 26 minutes for tree 2 and 1 hour and 10 minutes for tree 3). There appears to be a 13-hour time window between opening and dropping of flowers. This window is also crucial for the insects to interact with the flowers.

Thrips species. Three species of thrips were found inside the flowers of *N. arbor-tristis*. *Thrips florum* Schmutz and *Thrips hawaiiensis* (Morgan), the two species belonged to the Family Thripidae under the Sub order Terebrantia. The third species *H. gowdeyi* was identified as belonging to the family Phlaeothripidae under the Sub order Tubulifera (Plate 1). *T. florum* and *T. hawaiiensis* have been previously known to coexist (Bhatti, 1999).

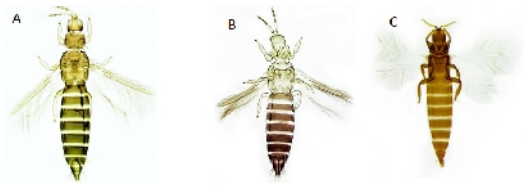

Plate 1: Thrips species observed in flowers (**A**) *T. florum*, (B) *T. hawaiiensis* (C) *H. gowdeyi*).

Time of thrips entering into flowers. The first thrips to enter the flowers of *N. arbor-tristis* was less than 6 hours before flower opening. In fact, the results suggest that thrips enter into flowers approximately 1 hour before flower opening. Thrips, both nymphs and adults, were absent in flower buds 24, 16 and 6hours before flower opening. Presence of thrips was observed from 1 hour prior to flower opening till 24 hours after flower opening. On an average 8.50 thrips were recorded at 1hour prior to flower opening (Fig. 2).

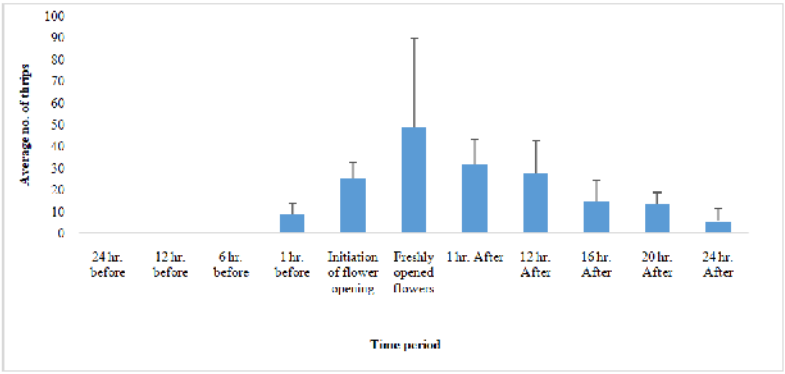

Fig. 2. Average number of thrips at different time intervals.

Interaction between thrips species. Three thrips species observed in *N. arbor-tristis* were not uniform in their distribution. It was *T. florum* first species to enter into and occupy most of the flowers. Among all three species, *T. florum* was completely dominant with high population starting from 6 hour before flower opening to 24 hours after opening. Its peak population (239 individuals) occurred at just freshly opened flowers and thereafter gradually declined to a minimum (22 individuals) at 24 hours after opening. The other two thrips species namely, *T. hawaiiensis* and *H. gowdeyi* didn't vary with each other w.r.t. number of individuals per flower and remained at minimum population level without many fluctuations at any point of sampling time (Fig. 3). The proportionate share of *T. florum* was observed to be more than 64 per cent for entire duration of flower remained open and even after it dropped on ground. While, the per cent population of both *T. hawaiiensis* and *H. gowdeyi* remained at 6 to 24 per cent for entire duration (Fig. 4).

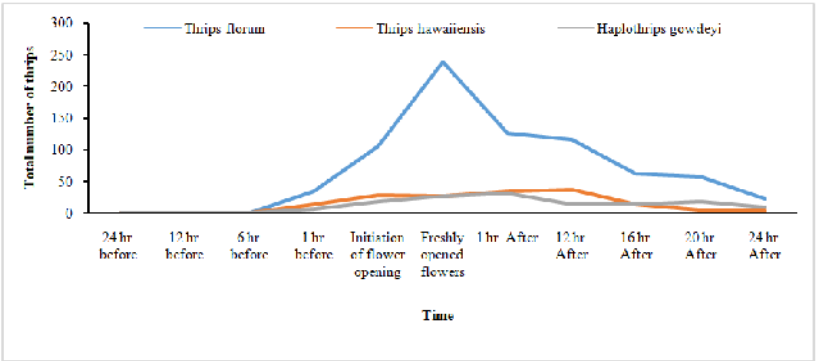

Fig. 3. Population distribution of three thrips species in *N. arbor-tristis*.

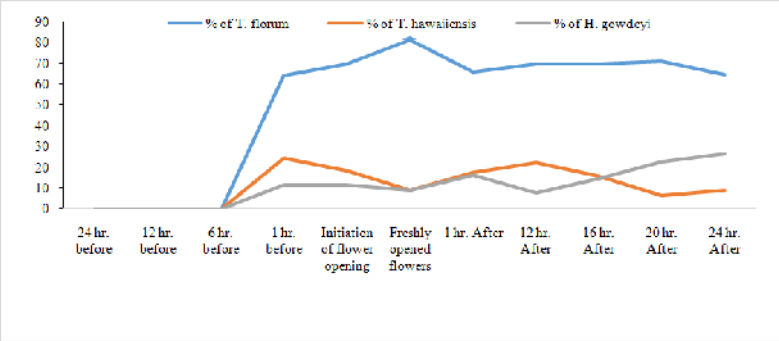

Fig. 4. Proportion of each thrips species distributed in *N. arbor-tristis.*

Distribution patterns of thrips across flowers. The number of thrips occupying flowers increased at increasing rate from 1 hour prior to complete opening of flowers. At 1 hour prior to flower opening 51 thrips were recorded from 42 flowers (n = 180 flowers). The population and occupancy increased to 150 thrips in 95 flowers and further to 292 thrips in 112 flowers during flower opening initiation and complete flower opening, respectively. Later, the population and occupancy decreased with time. The lowest was at 24 hours after flower opening when 34 thrips were recorded in 28 flowers (Fig. 5). Both flower occupancy and number of thrips were positively correlated (r=0.95). Distribution of thrips in *N. arbor-tristis* flowers seem to be much complex. Initially as the population of thrips increases the number of flowers occupied also increased. If this trend had continued and if the thrips were randomly distributing themselves among the flowers, all the flowers should have been occupied when the population of thrips exceeded the number of flowers. However, the data showed that even at the peak population of thrips, 37% of flowers were unoccupied. It appears that the thrips are tending to occupy previously occupied flowers. The above analyses do not discriminate between the three species of thrips.

The proportion of change in flower occupancy was highest (126.19 %) at initial stage of flower opening with 194.11% change in population.

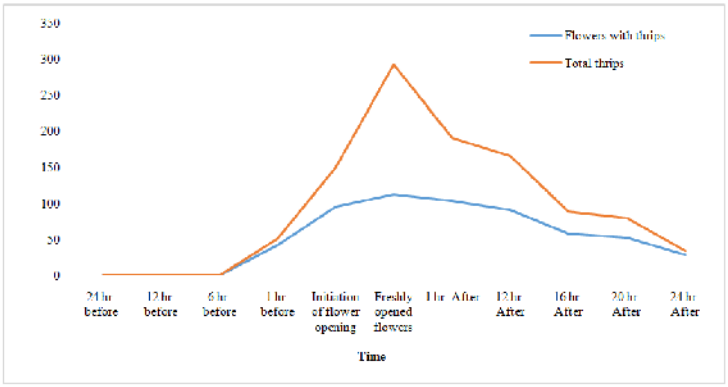

Fig. 5. Total number of flowers with thrips and total thrips sampled at time intervals.

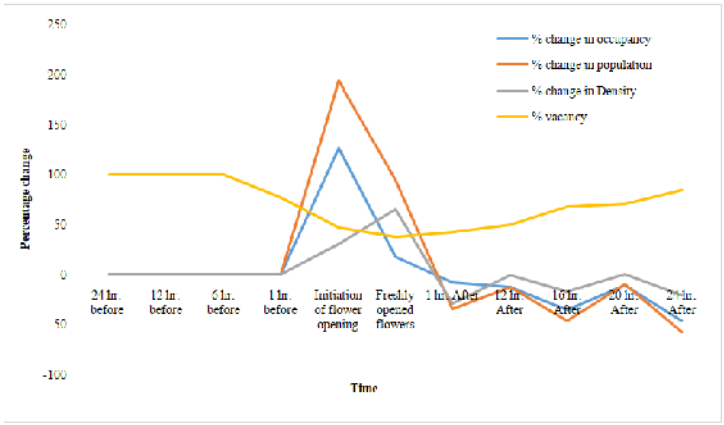

Fig. 6. Proportion of change in flower occupancy, thrips population, density and vacant flowers at different time period of sampling.

The change in density of thrips per flower was 30% at initial stage of flower opening, which increased to 65% when flowers were completely open. Thereafter, there was a decrease in the proportion of flower occupancy, population size and density of thrips per flower. The percentage of vacant flowers was 76% at 1hour before flower opening, which reduced to 42% at 1 hour after flower opening and finally to 84% at 24 hours after flower opening (Fig. 6).

Observing the percent change in the occupancy, population size and density of thrips over time and over the changing condition of the flowers, it appears that the change in population size affected occupancy more than density during the initial phase. This indicated that there was a threshold level of occupancy. However, at the later stages, with change in population size there is more reduction in density.

CONCLUSION

As a highly short duration flower *N. arbor-tristis* attracts specific flower inhabitants like thrips. Thrips species *T. florum* dominate in population, density and distribution in flowers utilising maximum resource followed by *T. hawaiiensis*. It appears that there is a threshold level of density that affects the distribution pattern of thrips. These tendencies appears to give rise to an aggregated distribution pattern among the thrips found to exist in the flowers of *N. arbor-tristis*. However, an attempt has been made in this work to theorise the different distribution patterns exhibited by thrips species with respect to the anthesis and duration of flower remain open. This can open up new directions in our understanding of thrips behaviour in inhabiting type of flowers and their distribution.

Acknowledgement. I would like to acknowledge Department of Agricultural Entomology, University of Agricultural Sciences, GKVK Bengaluru for academic support and facilities for research work.
Conflict of Interest. None.

REFERENCES

Bhatti, J. S. (1999). New characters for identification of the pest species *Thrips hawaiiensis* and *florum* (Terebrantia: Thripidae). *Thrips*, *1*, 53.

Childers, C. C. (1997). Feeding and oviposition injuries to plants. *Thrips as crop pests, CAB International*, 505-537.

Kiew, R. and Baas, P. (1984). *Nyctanthes* is a member of Oleaceae. *Proc. Ind. Acad. Sci*., *3*, 349-358.

Kirk, D. J. and Terry, I. L. (2003). The spread of the western flower thrips *Frankliniella occidentalis* (Pergande). *Agri. and For. Ent., 5*, 301–310.

Mound, L. A. (2001). So many thrips-so few tospoviruses. In Thrips, Plants, Tospoviruses: the Millennial Review Proceedings of the 7th International Symposium on Thysanoptera 15–18.

Pushpendra, K. J. and Arti, P. (2016). The wonder of Ayurvedic medicine - *Nyctanthes arbortristis*. *Int. J. Herb. Med.*, *4*(4), 09-17.

Sandhar, H. K., Kaur, M. K., Kumar and Prasher, S. (2011). An update on *Nyctanthes arbortristis* linn. *Int. Pharmaceutica Sciencia*, *1*(1), 78-86.

Usha, R. and Anjali, N. (1989). Cyclic nocturnal opening and abcission of *Nyctanthes* flowers with a note on visiting thrips species. *Cur. Sci.*, *58*(2), 93-96.

How to cite this article: Manjunath Kenchannavar, M. Thippaiah, Y.B. Srinivasa and R.R. Rachana (2023). Investigation on the Temporal and Spatial Distribution of Flower Thrips Population in *Nyctanthes arbor-tristis* Linn.. *Biological Forum – An International Journal*, *15*(1): 383-387.