

naria psidii, it constitutes another new host for the above fungus.

The authors are grateful to Mr D. L. Shetty for technical assistance and to Dr B. C. Sutton, Head, Taxonomic and Identification Services, CAB, IMI, Kew, UK for identification of the fungus.

7 May 1988; Revised 7 June 1988

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CYCLIC NOCTURNAL OPENING AND ABCISSION OF NYCTANTHES FLOWERS WITH A NOTE ON VISITING THRIPS SPECIES

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NYCTANTHES ARBOR-TRISTIS (family Oleaceae) is a small, much branched tree that attains a height of about 5 m. A preliminary observation of the flowers showed that they are inhabited by several species of thrips. It was of interest to find out whether the thrips are casual visitors or have a specific role in pollination. There are several reports of pollination effected by thrips¹⁻¹².

Under Delhi conditions the plant is laden with flower buds and open flowers during October and November (observations made in the years 1985-1987). The first flowers appear at the tips of upper branches in the first week of September and

flowering progresses in a basipetal manner. The basal flowers mature and wither around the middle of December. Thus the main flowering period lasts for three months. Six trees growing in the college campus were selected for studying the possible role of thrips in pollination.

A fully opened flower is 2.5 cm in diameter. The inflorescence consists of a whorl of five flowers surrounded by a bract. The order of flower bud initiation was studied. For convenience, four stages of bud development were recognized on the basis of length. The measurements of various parts of four stages of buds are given in table 1.

The time taken for a bud to advance from one stage to the next was calculated in hours. It takes 48 h for a bud primordium to change to stage I and another 48 h are required for stage I bud to change to stage II. Stage II bud is transformed to stage III in another 24 h and finally stage IV bud is reached after 24 h. Stage IV bud is converted into a fully open flower the next day, i.e., after 24 h. Thus it takes seven days for a bud primordium to develop into a fully open flower. The plant blooms in the evening and spreads its fragrance. At this time the adult thrips migrate to open flower corolla from the neighbouring plants or from the soil as freshly emerged adults.

The exact time of flower opening was recorded daily during the entire flowering period. In September, October and beginning of November, the time of flower opening is between 18.00 h and 18.30 h. From mid-November to mid-December the time of opening of flowers is delayed by 3-4 h. The flowers abscise between 5.30 h and 6.30 h during October and November. However, by the end of November and December open flowers were observed to be intact even as late as 11.30 h.

To ascertain whether opening time is affected by

Table 1 Dimensions of buds* (different stages)

| Parameter | Stage I | Stage II | Stage III | Stage IV |
|---------------------------|--------------|-------------|-------------|--------------|
| | Mean ± S.E. | Mean ± S.E. | Mean ± S.E. | Mean ± S.E. |
| Length of bud | 7.00 ± 0.8 | 9.5 ± 0.5 | 12.00 ± 1.3 | 16.2 ± 1.3 |
| Length of calyx | 6.9 ± 3.08 | 6.7 ± 2.29 | 7.6 ± 3.39 | 7.5 ± 3.35 |
| Length of corolla (petal) | 4.3 ± 1.92 | 4.4 ± 1.96 | 6.2 ± 2.77 | 6.4 ± 2.82 |
| Length of anther | 1.981 ± 0.66 | 2.38 ± 1.06 | 2.6 ± 1.16 | 2.06 ± 0.92 |
| Diameter of pollen grain | 0.04 ± 0.02 | 0.05 ± 0.02 | 0.04 ± 0.02 | 0.065 ± 0.02 |
| Diameter of ovary | 1.104 ± 0.49 | 1.129 ± 0.5 | 1.125 ± 0.5 | 1.247 ± 0.55 |
| Length of style | 1.071 ± 0.48 | 1.31 ± 0.58 | 1.56 ± 0.69 | 2.2 ± 0.98 |
| Diameter of stigma | 0.51 ± 0.23 | 0.49 ± 0.22 | 0.69 ± 0.3 | 0.567 ± 0.25 |

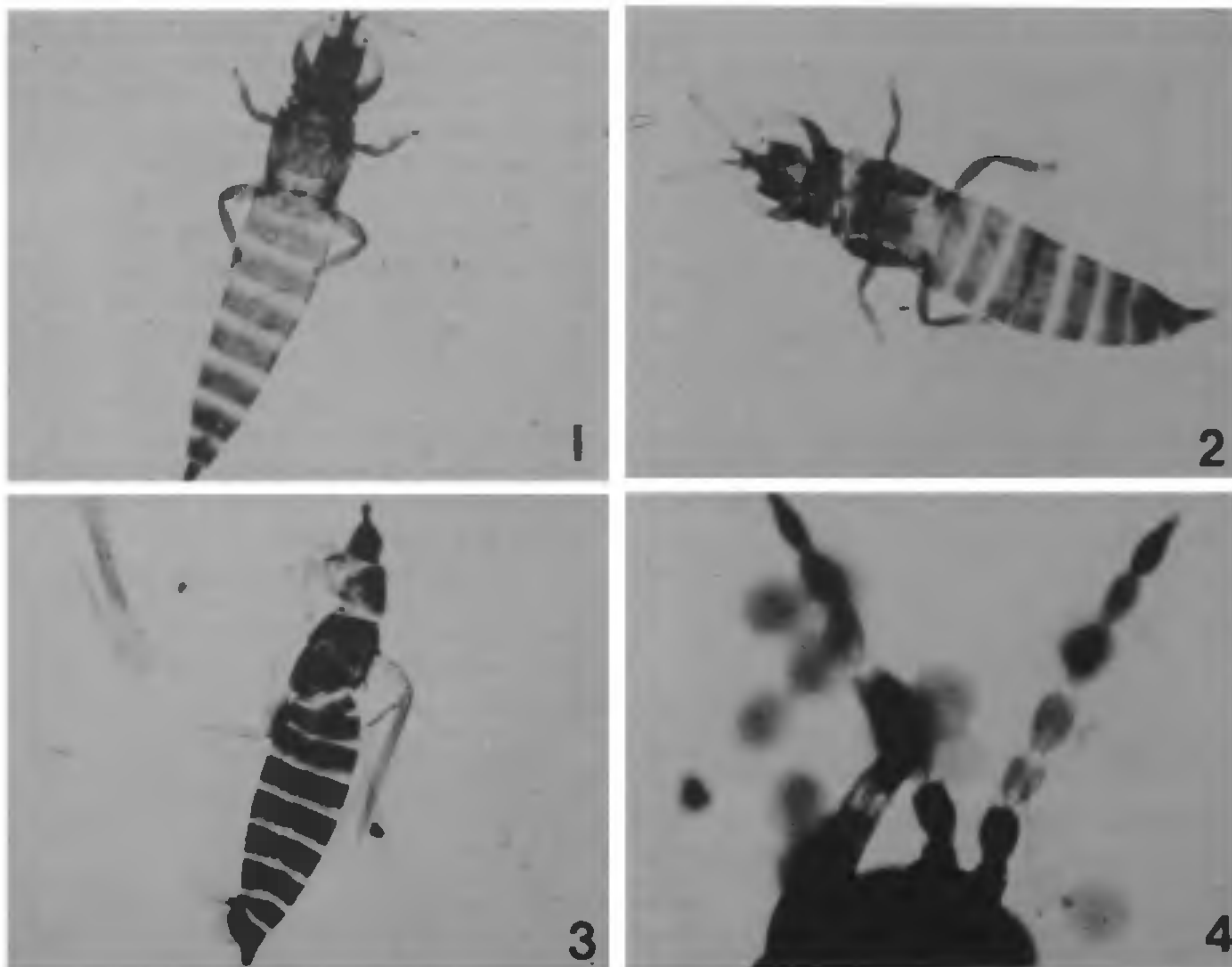
*Measurements in mm; Mean of 10 replicates with ± SE; SE = Standard Error.

light, ten twigs of equal size were cut from the tree around 17.00 h and brought to the laboratory (temp. $26^{\circ}\text{C} \pm 1^{\circ}\text{C}$) and their cut ends were dipped in glass bottles containing tap-water. Five branches were kept in the dark (in the almirah) and five in continuous light (under fluorescent light). For the first 24 h flower opening and flower fall time was the same as in the control. However after another 24 h the rhythms were upset and partly open flowers were seen drying on the twigs. Similar observations were recorded for the twigs kept in dark for more than 24 h.

The species of thrips isolated from *Nyctanthes* flowers were *Haplothrips ceylonicus* Schmutz (figure 1), *Haplothrips gowdeyi* Franklin (figure 2) and *Thrips florum* Schmutz (figure 3).

To establish whether flower colour is a primary attractant, three flowers of *Nyctanthes* were placed in a petri dish (15 cm in diameter) alternating with

apparently non scented flowers such as *Dianthus* and pomegranate and scented flower as Jasmine (figure 5). The flowers were placed in the petri dish with the pedicel facing the periphery of the dish. Ten thrips were placed in the centre of the petri dish and covered with a lid. The movement of thrips were observed. The time taken by individual thrips to reach a flower was noted. Twenty replicates were studied, It was seen that an individual thrips took 1 to 2 min to reach *Nyctanthes* and jasmine flowers. The time taken for a thrips to reach *Dianthus* flower was 3 to 5 min. For a pomegranate flower the time taken was 9–12 min. On an average, of the ten thrips released in the centre, *Nyctanthes* attracted four; jasmine attracted two; *Dianthus* attracted two and the remaining two wandered for a long time and could not decide their movement even after 90 min of release. It may be inferred from this study that the attraction of thrips is due to the combined influence



Figures 1–4. 1. *Haplothrips ceylonicus*; 2. *Haplothrips gowdeyi*; 3. *Thrips florum*, and 4. Portion of *Haplothrips* with pollen grains of *Nyctanthes*.

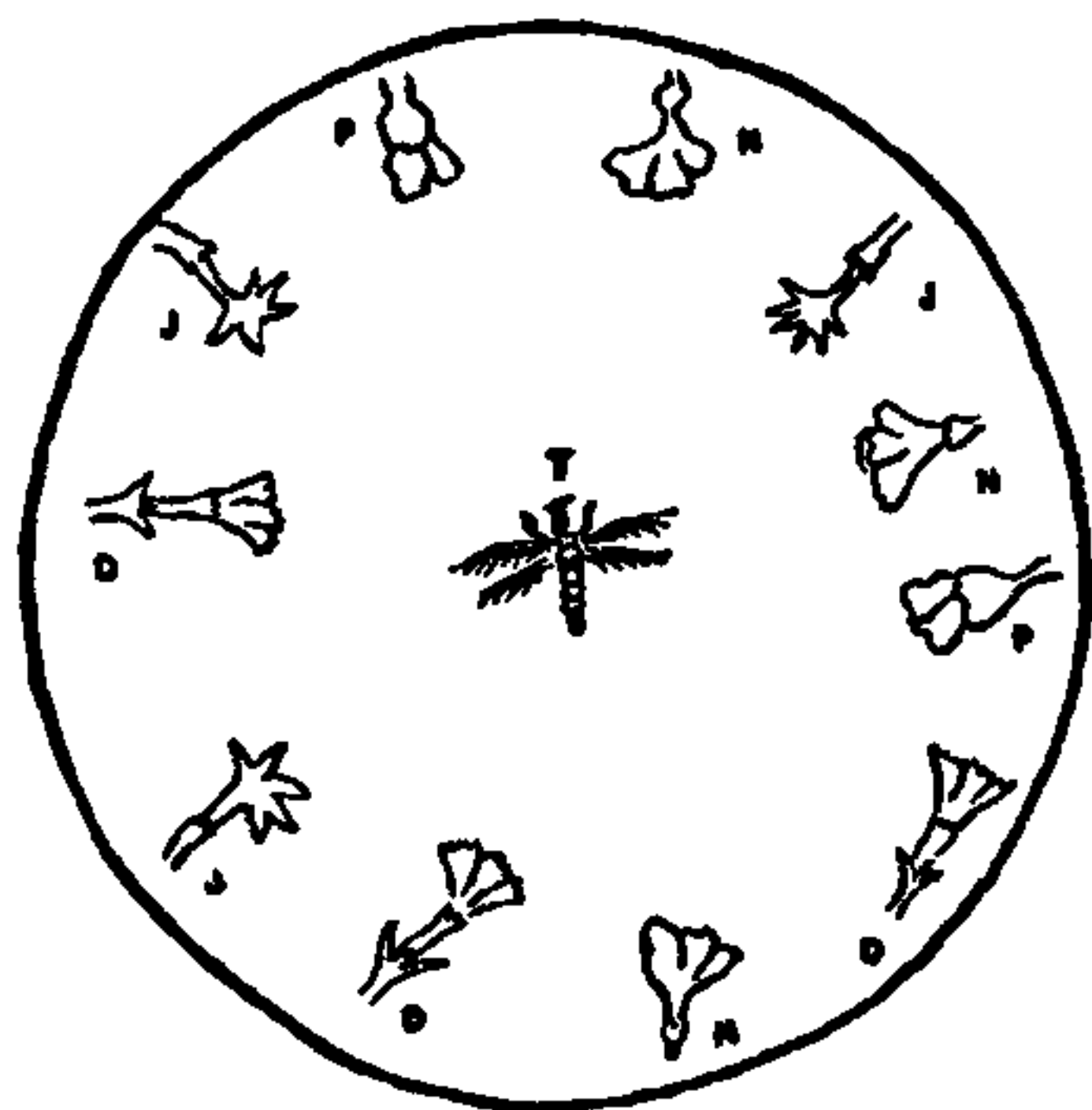


Figure 5. A diagrammatic representation of set-up used for behavioural studies on thrips (scented and nonscented flowers were arranged in a ring). Thrips were placed in the centre to study their movement to the flowers [P, pomegranate flower; J, jasmine; N, *Nyctanthes*; D, *Dianthus* and T, thrips].

of scent and colour. *Dianthus* flower having a clove-like smell and the white colour of *Nyctanthes* did attract thrips; whereas the pomegranate flower having a reddish orange colour similar to that of the stalk of *Nyctanthes* flower did not attract more than two thrips. Amongst the colours white is most attractive to the majority of thrips^{5,13-15}. The present study reveals that in *Nyctanthes* there is a combined influence of colour and scent which is probably responsible for attracting the thrips.

It is important to examine the role of thrips in pollination. Thrips are found inside the flower and the body of the adult thrips carries 55-60 pollen grains (figure 4). Of the 25-30 pollen grains seen on the stigma, 6-10 formed pollen tubes.

A seasonal incidence of *Haplothrips ceylonicus* and *Thrips florum* infesting *Nyctanthes arbor-tristis* has been studied for three consecutive years. The population density (adult and larvae) was calculated by random sampling method by bringing 25 flowers of *Nyctanthes* in glass bottle covered with bakelite lids to the laboratory. The flowers were dissected under a dissection microscope and the insect fauna was studied. This was done every alternate day and nine day's moving average was calculated from the data (figure 6). It is noteworthy that *Thrips florum* is the dominant species on *Nyctanthes*. The population density of thrips reached at its maximum during mid-November and suddenly declined in December with the decline in flowering. Finally as the flowering

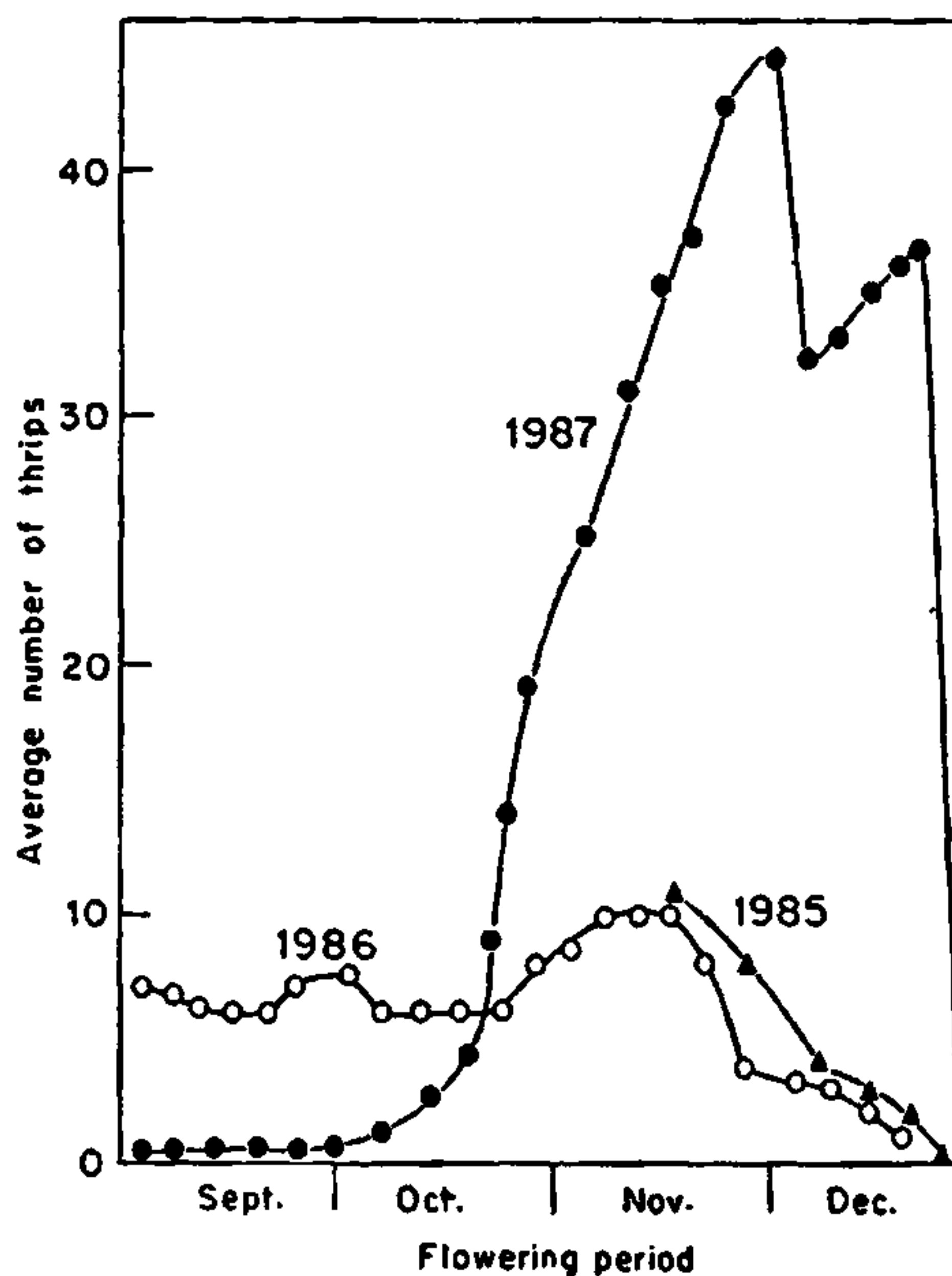


Figure 6. Population counts of thrips in 1985 from November 14, to December 23; in the year 1986 from September 8 to December 26; in the year 1987 from September 4 to December 25. The population density of thrips reached its maximum during mid to late November and suddenly declined as flowering decreased in December.

ceased in mid-January the adults migrated to other alternate hosts however the larvae were occasionally seen on the young leaves.

The authors thank DST, New Delhi for financial assistance. Thanks are also due to Miss Poonam Saxena and Miss Ruchira Mota for assistance.

21 November 1988

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