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Incidence of *Microcephalothrips abdominalis* (Crawford) (Thysanoptera: Insecta) in relation to the Pollination Biology of the Weed *Ageratum conyzoides* Linn. (Compositae)

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Population trends, inter-capitular migration capacity, pollen-carrying efficiency of both larvae and adults of *Microcephalothrips abdominalis* inhabiting the capitula of *Ageratum conyzoides*, and the effects of allogamy and autogamy on viable seed production, as well as the role of thrips in the pollination of *Ageratum conyzoides*, are discussed.

Key Words: **Thrips, Cross Pollination,** *Ageratum conyzoides*

Introduction

The polyphagous thrips *Microcephalothrips abdominalis* has been known to infest several hosts belonging to Compositae (Crawford 1910, Watson 1923, Karny 1926, Ramakrishna 1928, Bailey 1937, Raizada 1963, Ananthakrishnan 1973). The occurrence of brachypterous and macropterous individuals in a population—a phenomenon that appears to be directly related to temperature and humidity—has been reported by Bailey (1937) and Raizada (1963). While the available information on the biology of *M. abdominalis* relates principally to Compositae with heterogamous heads such as *Chrysanthemum* (Karny 1926, Ramakrishna 1928), *Zinnia, Calendula, Helianthus annuus* (Bailey 1937), *Tagetes erecta, Chrysanthemum, Dahlia, Tridax procumbens* (Raizada 1963), the role of thrips in pollination has been discussed by Hagerup (1950), Hagerup and Hagerup (1953), Mathur and Mohan Ram (1978), Syed (1978), and Ananthakrishnan et al. (1981). In view of the lack of sufficient information on their comparative incidence and behavioural mechanisms in relation to the pollination of Compositae with homogamous heads, an attempt has been made to discuss the role of *M. abdominalis* in relation to the pollination biology of *Ageratum conyzoides.*

Material and Methods

Fifty heads of *A. conyzoides* were examined every week for observing the population trends of *M. abdominalis* inhabiting the

capitula. Two separate cultures (both experimental and control) of *Ageratum* were maintained under the laboratory conditions in order to observe thrips movements in the capitula, and seed viability as a result of thrips pollination. Thrips dusted with gilt powder (commonly used in printing industry) were released into the flower heads in order to study their movements between capitula. Pollen carrying efficiency of thrips and the number of pollen grains present in the syngenesious anther column of a single disc floret were calculated by marking the pollen grains using the camera lucida and counting the number of marked spots.

Table 1

Expt No.	No. of thrips marked and released per head	Time taken for migration	No. of migrated thrips
1	5	36 hr	2
2	7	24 hr	4
3	9	15 hr	5
4	11	5 hr	6
5	13	2½ hr	8
6	15	50 min	10

Observations

Thrips inhabit the capitula at a stage when the outermost row of disc florets are open. *M. abdominalis* was the dominant species with 3–8 adults and 6–12 larvae in each capitulum, while *Haplothrips gowdeyi*, *H. ganglbaueri* and *Frankliniella schultzei* occurred sporadically. *M. abdominalis* oviposited within the tissues of involucral bracts and occasionally on the upper side of the pedicels. Arrangement of groups of 8–16 capitula of different ages in a corymbose pattern perhaps helps thrips in their intercapitular movement. This was observed by maintaining a twig of *A. conyzoides* with 12 non-infested flower heads of different stages of development in the laboratory. Thrips dusted with gilt powder were released on one of the heads among the twelve non-infested flower heads. Observations were made every hour and the results are given in table 1.

Larvae of *M. abdominalis* were found to be more efficient in carrying pollen grains (figure 1 B) on their body (55–85) than the adult (32–56), (figure D). The number of pollen grains in one disc floret ranged between 198 and 264, the number of florets 81–112 and the total number of pollen grains in a capitulum 18,954–26,208. Pollen carrying efficiency in terms of the number of grains per individual of *M. abdominalis*, in general, was 330–1020 (larval forms) and 96–448 (adults).

The compact arrangement of the florets in the capitula restricts the movement of the thrips on the outer regions of the capitulum, particularly along the stigmatic lobes. Hardly any space exists between florets so that even larvae are unable to move between the florets. This restricted movement on the surface enables thrips with pollen on their body surfaces to touch the stigmatic lobes which are well projected. The space between the anther column and corolla tube (106μ) is lesser than thoracic width of larvae (I instar–113μ; II instar–149μ) and therefore, there is little chance for thrips to move towards the lower regions of the corolla tube.

Seed viability and germination capacity with respect to the cross pollination by thrips were examined by keeping separate cultures of *Ageratum* (both experimental and control). The experimental set up consisted of 5 heads of *Ageratum* (infestation stage) with thrips, while the control experiment a capitulum of the same stage was without thrips. The cultures were maintained till the seed setting stage. The presence of thrips in the experimental culture facilitates cross

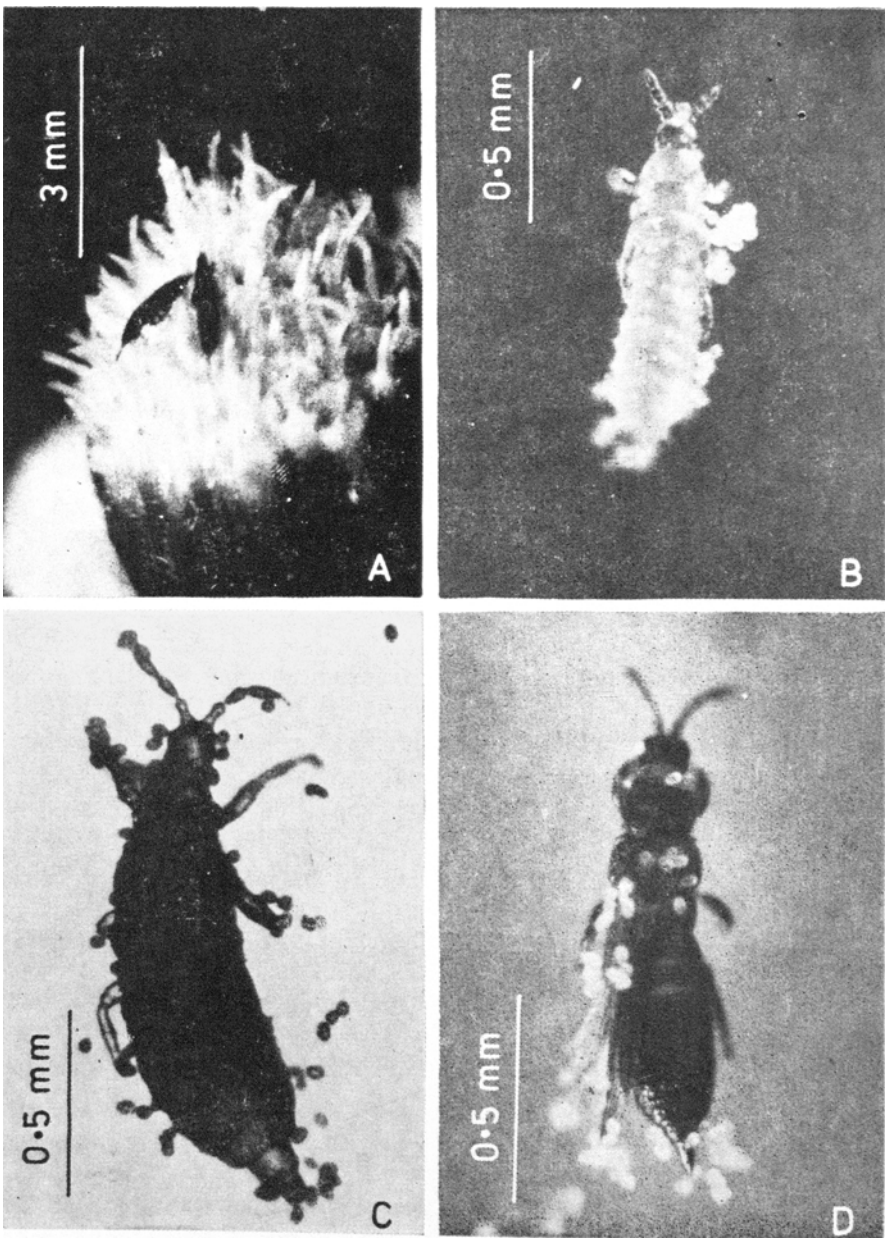

Figure 1 A–D *A*, Capitula of *Ageratum conyzoides* with *Microcephalothrips abdominalis* (with stigmas projected); *B* and *D*, I instar and adult respectively of *M. abdominalis* with numerous pollen grains on their bodies; *C*. *Haplothrips* larva, II instar

pollination, while in the control set up there was very little chance for cross pollination. Seeds were collected from both the cultures. In the experimental cultures non-viable seeds were few (5–8 per head) and in the control it was more than the former (20–35 per head). The viable and non-viable seeds could be distinguished by their characteristic black and brown colours. Dried viable seeds collected from both the cultures were sown in the field in the natural condition. 70% seeds from the experimental culture germinated, whereas only 45% of them germinated from the control series. Even though several factors appear to affect the germination, the considerable difference in the percentage of germination indicates that seeds produced by allogamy appear more viable than the seeds produced by autogamy.

Discussion

The present observations reveal that:

(a) with heavier infestation, the time taken for migration of thrips is less, since no migration occurred when the number of thrips released was low, say 2–3, and the time factor is inversely proportional to the number of thrips occurring in the heads;

(b) a minimum of five thrips can inhabit the head at a time, which is supported by the data earlier provided;

(c) when the number exceeds the minimum, intraspecific competition is high;

(d) the presence of gilt powder on the stigmas and the floral parts of the previously non-infested capitula gives sufficient evidence that the pollen grains are transferred not only among the florets of one head, but also between the adjacent capitula by thrips.

Certain patterns of floral organization seem to reflect the adaptive values in the methods adopted by, as well as the behaviour of the pollinators. For instance, in the capitula of *Ageratum*, the purpose of thrips attraction to facilitate pollination appears to be effected by the grouping of the capitula in the form of corymb, although the homogamous organization of the capitula of Compositae is generally considered to be a less advanced feature (Leppik 1970). Ecological synchronisation in terms of flowering periodicity and phenology (Ananthakrishnan et al. 1981) of the invading pollinating species is significantly controlled by the crowding of thrips, i.e., the population build up under pressure in a definite floral facility, leads to the migration of thrips. This migration is further helped by the organization of the capitula in a corymbose fashion so that very little energy is used for migration. Faegri (1978) proposes that all flower visitors are energetically inefficient if expenses exceed gains. Thus the adaptation of the pollinators in conjunction with the adaptations in the floral organization as in *Ageratum*, in terms of energy appears interesting. The present observation shows that cross pollination by thrips ensures high yield of viable seeds. This compares well with the observations of Carlson (1964), Brewer (1974), De Lange et al. (1974), Kashkovekii (1977), and Kiryukhin (1977), where also higher production of viable seeds appears considerably due to cross pollination carried out by the insects.

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