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Bionomics of the Aphidophagous Cecidomyiid *Monobremia rishikeshensis* Grover (Diptera) in India

B.K. AGARWALA, A.K. BHAUMIK AND S. DAS
Department of Life Science, Tripura University, Agartala 799 004

ABSTRACT

Monobremia rishikeshensis Grover (Diptera, Cecidomyiidae) a predator of *Aphis citricola* Goot (Homoptera, Aphididae) infesting *Chromolina odorata* L., a common shrub weed in north-east India oviposit in aphid colonies and the larvae fed on the body fluids by piercing the prey. Pre-adult development took 17.5 - 19.6 days. In winter months, larvae spun cocoons and entered diapause until the rains in early summer. Observations on the life cycle and an inter-relationship in predator-prey-host plant are presented.

KEY WORDS : *Monobremia rishikeshensis*, predator, *Aphis citricola*, bionomics

Cecidomyiids are usually gall-making phytophagous insects but zoophagous species are not uncommon (Nijveldt, 1969). Some of the zoophagous species are aphidophagous, the most common being *Aphidoletes aphidimyza* (Rond.), a predator of many aphids in the continental, Europe and Africa (Harris, 1973). In the Indian subcontinent many species of gall-forming midges have been recorded by Mani (1973). Agarwala *et al.* (1987) first recorded *Monobremia rishikeshensis* Grover (Diptera, Cecidomyiidae) as a predator of *Aphis citricola* Goot (Homoptera, Aphididae). Grover (1979) provided a taxonomic description of this gall-midge based on a stray collection from Rishikesh (U.P.). Subsequently, the discovery of its occurrence in Tripura in north-east India was an indication of its wide distribution in the sub-Himalayan and adjoining territories. This paper reports investigations on the life cycle, feeding habit, survival, sex ratio and predator-prey-host plant interrelationship of *M. rishikeshensis*:

MATERIALS AND METHODS

Aphid-infested leaves of *Chromolina. odorata* L. were brought to the laboratory and observed under a zoom stereoscopic microscope for eggs of *M. rishikeshensis*. Individual eggs were gently removed by the tip of a fine camel hair brush and kept on young uninfested leaves of *C. odorata*. Each such egg was confined in perspex box (5.5 x 4.5 x 2.5 cm) with sufficient number of aphids obtained from natural infestations. A wad of moistened cotton wool was provided each day to maintain humidity. Observations at 24 - h intervals were taken on development and feeding habit. The length of larvae was measured 12-h after emergence from the egg and again when they approached quiesence before pupation. For this purpose the larvae were placed on a slide against an mm scale.

Six to nine replications were maintained in room conditions where average minimum and maximum temperatures were 24°C and 14°C and RH 37% and 67%.

Mature larvae were transferred to 5 cm thick soil in plastic petri dishes for adult emergence. Paired adults were kept in muslin covered glass jars (23 cm long) with freshly obtained floral twigs of *C. odorata* and *Mikania scandens*. A cotton wad dipped in aqueous solution of honey (1 : 3) and tied to a glass rod was kept in the jar as food.

RESULTS AND DISCUSSION

In the laboratory, the development time from egg to adult varied from 17.5 - 19.5 days. The mean duration of egg, larval and pupal periods respectively were 2.5 ± 0.5, $3.7 + 0.5$ and 9.0 ± 1.5 days. Newly laid eggs were elongate with rounded ends. Chorion was smooth, soft, translucent, and light-orange which turned dark with age. Eggs were laid singly on the stem and undersurface of leaves in the aphid colonies. On an average, each egg measured 0.29 mm long and 0.11 mm wide in the middle. Incubation period ranged from 1 - 2 days. Newly hatched larva measured 0.3 x 0.1 mm, nearly yellow or light-orange. It emerged through the anterior part of the egg. Soon after emergence, it started feeding on nearby aphids. The rate of feeding increased as the larva grew. The larval period lasted for 4 - 6 days. The grown-up larva (1.7 x 0.38 mm) stopped feeding a few hours before dropping to the soil for pupation. Soon after dropping, the larva constructed a small silken cocoon just below the soil surface and pupated within 1 - 2 days. The adults emerged after 7-14 days, depending on temperature.

Adult emergence took place during day time but the adult was nocturnal. Oviposition occurred in the dark. The longevity was 2-5 days when provided with food (honey solution and flowering twigs of *C. odorata*).

The adult fed on nectar and honey in the laboratory. The larva fed exclusively on aphids. The feeding capacity of a larva was meagre, the average per day being 4.52 aphids and a total of 20.5 aphids (n=4). The larva usually attacked the prey by piercing a leg joint or some other body joint. It seemed that a toxin was injected which paralysed the body, as aphid was rapidly immobilised once attacked. Once the prey had been seized and immobilised, the larva settled to feed by extracting the body fluids.

All the eggs kept under observation survived and larva from each of them reached the adult stage (Table 1) during the period 4th September to 24th October '86. After this period, no oviposition was noticed in the field or laboratory and all the larvae underwent diapause for 43 - 185 days and the adults emerged in the following summer (Table 2). Average sex ratio was found to be 1 ♂ : 1.6 ♀♀.

Predator-prey-host plant interrelation

So far, *M. rishikeshensis* has been recorded from the exclusive habitat of *C. odorata* infested by *A. citricola* and, therefore, the incidence of this predator was dependent on the occurrence of the prey species and its weed host. The weed host germinated with the first rains in early summer (March) and grew profusely through the summer and rainy months (April - September). Flowering occurred in December - January. In the intervening months (January - March), the plants remained in a dormant condition (Fig. 1). *A. citricola* appeared first in the 2 - 3 leaf stage of the weed in March. Infestation, thereafter, increased gradually from 3.12 aphids / leaf in March to 17.30 aphids / leaf in November during the vegetative growth phase of the host plant. With the advent of flowering in December, aphid population declined (5.25 aphids / leaf) and no aphid incidence was noticed until the following summer. The diapausing cocoons of *M. rishikeshensis* ecloded in March after 143 - 185 days of dormancy in soil (Table 3). Eggs and larvae were first seen in April and their incidence continued until the end of October. The incidence sharply declined in November when the surviving mature larvae entered diapause. Adults of *M. rishikeshensis* appearing during the vegetative growth phase of *C. odorata* foraged on the flowering twigs of *Ageratum conyzoides* and *M. scandens*.

The role of several weed species has been evaluated as alternate source of food and shelter for many natural enemies of crop pests (Agarwala and Raychaudhuri, 1979; Buggs *et al.*, 1987). Further studies of this gall-midge predator will help to determine whether it is a specific or polyphagous species and its ecological role in association with *C. odorata*.

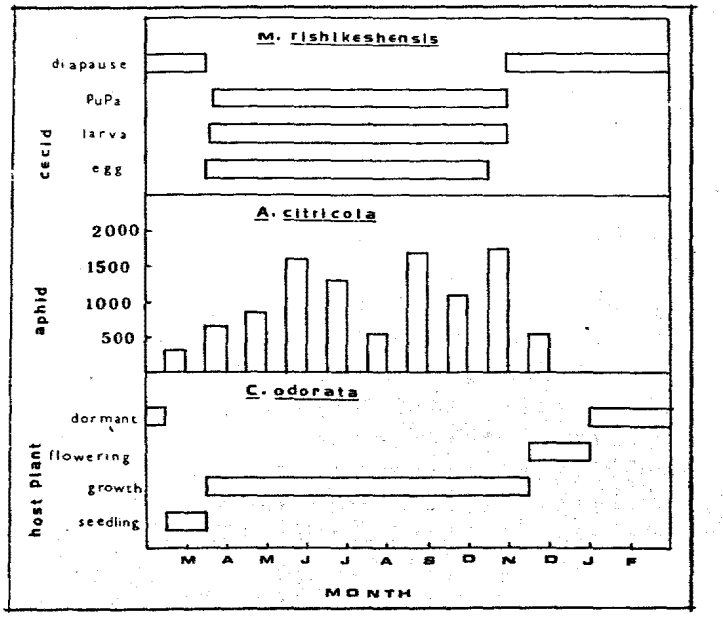

TABLE 1 : Survival rate and sex ratio of *M. rishikeshensis* in the laboratory.

Date of observation	Number			Survival rate (%)	Sex ratio	
	Eggs	Larvae hatched	Adults ecloded		Male	Female
September '88						
6	7	7	7	100	3	4
12	2	2	2	100	2	--
18	19	19	19	100	7	12
24	5	5	5	100	--	5
30	69	69	69	100	32	37
October '88						
6	5	5	5	100	2	3
12	23	23	23	100	9	14
18	21	21	21	100	15	6
24	16	16	16	100	4	12

TABLE 2 : Duration of diapause in *M. rishikeshensis* in the laboratory

n	Date of start	Date of break	Total duration (days)	Length of Adult (mm)
2	11.10.86	5.3.87	143	4.80
4	11.10.86	11.3.87	154	5.13
2	12.10.86	12.4.87	185	6.17
4	16.10.86	16.3.87	158	5.27
4	23.10.86	4.4.87	162	5.40

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