

BIOLOGICAL ATTRIBUTES OF CHRYSANTHEMUM APHID, *MACROSIPHONIELLA SANBORNI* (GILLETTE)

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ABSTRACT : The studies on biology of chrysanthemum aphid, *M. sanborni* revealed that before reaching the adult stage, the nymph passed through four different instars. The duration of the first, second, third and fourth instar nymph as well as adult were 6.33 ± 1.18 days, 1.83 ± 0.38 days, 1.47 ± 0.51 days, 1.5 ± 0.51 days, 1.53 ± 0.63 days and 6.73 ± 2 days, respectively. The average length of the first, second, third and fourth instar nymph as well as adult was 0.61 ± 0.08 mm, 0.99 ± 0.13 mm, 1.14 ± 0.2 mm, 1.43 ± 0.16 mm and 1.98 ± 0.14 mm, respectively and breadth was measured as 0.3 ± 0.03 mm, 0.62 ± 0.06 mm, 0.86 ± 0.16 mm, 0.98 ± 0.14 mm and 1.44 ± 0.23 mm, respectively. The antennae were longer than the body length with six segments and length was 1.99 ± 0.16 mm. The average pre reproductive, reproductive, post reproductive and reproductive potential of *M. sanborni* were 1.2 ± 0.41 days, 4.37 ± 1.87 days, 1.17 ± 0.38 days and 14 ± 8.68 nymphs, respectively. The total life cycle of aphid, *M. sanborni* was completed in 13.07 ± 2.18 days.

Key words : Biology, chrysanthemum aphid, *Macrosiphoniella sanborni*.

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INTRODUCTION

Chrysanthemums (*Dendranthema grandiflora* Tzvelev), sometimes called mums or chrysanthus are flowering plants of the genus chrysanthemum of the family Asteraceae. Countless horticultural varieties and cultivars of this flower exist. Presently, 2000 varieties are grown around the world and in India, about 1000 varieties are grown (Datta and Bhattacharjee, 2001). As many as seven insect pests are reported damaging to this crop right from germination to harvesting of the crop. The important insect pests attacking to chrysanthemum are Aphid, *Macrosiphoniella sanborni* (Gillette); Thrips, *Haplothrips ramakrishnae* Krishna; Chrysanthemum caterpillar, *Diacrisia oblique* Walker; Grub, *Holotrichia spp.* and Leaf miner, *Hytomyza syngesine* (Hardy). The Chrysanthemum aphid, *M. sanborni* is a widespread pest on cultivated chrysanthemum throughout the world. It is a holocyclic species of East Asian origin (Heie, 1995). It feeds mainly on young leaves and developing flower buds and could become very abundant on them. In case of high infestation, the aphid causes significant damage which results in deformation and disturbance of flower development and it also acts as a vector to Vein mottle

and Virus B (Blackman and Eastop, 1984; Chan *et al*, 1991). All these factors together becomes herby significant and responsible for economic damage to chrysanthemum by decreasing the beauty and value of cut flowers (Zahedi, 1999). Pal and Sarkar (2009) reported *M. sanborni* as the major sucking pest of chrysanthemum in hilly regions of West Bengal area by conducting field surveys. Considerations the importance of chrysanthemum aphid as an important pest and now a day's chrysanthemum is one of important flower crop of South Gujarat, the incidence of this aphid species noticed during cropping season, the present investigation was carried out to know the biology of the aphid, *M. sanborni*.

MATERIALS AND METHODS

The biology of chrysanthemum aphid, *M. sanborni* was carried out at Post Graduate Research Laboratory, Department of Entomology, N. M. College of Agriculture, Navsari Agricultural University, Navsari during the month of January 2020-21. The adults of chrysanthemum aphid were collected from Floriculture Research Farm, ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari and reared under the laboratory

conditions. The tender chrysanthemum leaves with their basal stalks wrapped with cotton wool wetted with water were kept in Petri dishes and adult aphids were released on it. Food was replaced daily in the morning. This laboratory reared culture was further utilized for studying the biology. For maintenance of aphid culture, the chrysanthemum plants were grown in pots. After 24 hours of exposure, the females were removed from the Petri dish. The nymphs produced by the mother were transferred with the help of wetted camel hair brush in separate Petri dishes containing fresh chrysanthemum leaves and reared individually for studying their detailed biology.

Nymph : To study the nymphal duration, the newly born nymphs were transferred individually in individual Petri dish containing fresh chrysanthemum leaves. They were observed daily. The change of instar was considered on the presence of cast skins of the nymphs. The different nymphal instars were reared in different Petri dishes in order to study the shape, size, colour and duration of immature stages. The time taken for each moult was recorded for each instar and considered as nymphal duration. The colour and shape of each nymphal instar was observed visually. The size of each nymphal instar *i.e* length and breadth of different instars were measured under the stereo trinocular microscope fitted with brand Catcam-130 camera with software power Scope photo (Version 3.1). The duration of different instars and longevity were also being recorded.

Adult : The adult emerged from the nymph after fourth molting was critically observed under microscope for their colour, shape and size. The adult longevity was also recorded.

Pre reproductive, reproductive, post reproductive period and reproductive potential : In order to study the pre-reproductive period, reproductive period, post-reproductive period and reproductive potential, the newly emerged females of *M. sanborni* were reared separately in Petri dish on fresh chrysanthemum leaves. Pre reproductive period was calculated from the date of emergence of adult to the date of giving birth to their first young ones, while the reproductive period was calculated from the date of giving birth to their young ones to date of stopping birth to their young ones, the post reproductive period was calculated from the date of stopping birth to their young ones to death of adult aphids. To determine the reproductive potential, the number of nymphs produced by individual adult aphid was recorded till the death.

RESULTS AND DISCUSSION

The biology and morphometrical study of chrysanthemum aphid was carried out under laboratory conditions at $20.7\pm 2.3^{\circ}\text{C}$ temperature and 65.33 ± 14.18 per cent relative humidity during January 2021. The results of the investigation on biology of *M. sanborni* carried out in laboratory conditions are presented and discussed below.

Nymph : The nymphs were passed through four different instars before reaching to the adult stage and they were determined from the exuvia cast off at each molting stage. The instar wise details are as:

First instar : The first instar nymph was dull brick red in colour with a soft body. The body was wingless with relatively long legs and antennae. The nymph was oval in shape, having cornicles that are not well developed. The length of the first instar nymph of *M. sanborni* varied between 0.4 to 0.69 mm with an average of 0.61 ± 0.08 mm and breadth was measured between 0.24 to 0.34 mm with an average of 0.3 ± 0.03 mm (Table 1). The duration of the first instar nymphal stage ranged between 1 to 2 days with an average of 1.83 ± 0.38 days (Table 2).

Second instar : The second instar nymph was similar in shape and colour to the first instar nymph but was slightly larger than them. The cornicles were short and dark while the antennae were longer than the body. The second instar nymph measured about 0.74 to 1.17 mm in length with an average of 0.99 ± 0.13 mm and 0.51 to 0.69 mm in breadth with an average of 0.62 ± 0.06 mm (Table 1). The duration of the second instar nymph varied from 1 to 2 days with an average of 1.47 ± 0.51 days (Table 2).

Third instar : The third instar nymph of *M. sanborni* was brick red in colour and it is more or less similar to the colour pattern of the second instar nymph except in size. The cornicles are slightly longer than the second instar nymphs. The legs were transparent whitish coloured alternated with dark black colour. The antennae are longer than the body. In the winged aphids, the wing buds are slightly visible. The length and width of the third instar nymph ranged from 0.79 to 1.42 mm with an average of 1.14 ± 0.2 mm and 0.59 to 1.08 mm in width with an average of 0.86 ± 0.16 mm, respectively (Table 1). The duration of the third instar nymph was 1 to 2 days with an average of 1.5 ± 0.51 days (Table 2).

Fourth instar : The body colour of the fourth instar nymph was dark brick red. The cornicles were clearly visible at the tip of the abdomen having dark black colour. The antenna was even longer than the body. The body length measured from 1.11 to 1.65 mm with an average of 1.43 ± 0.16 mm (Table 1) while, the breadth was

Table 1 : Details of life cycle of *M. sanborni* on chrysanthemum (cv Ratlam Selection).

Particular	Period (Days)		
	Minimum	Maximum	Mean±SD
Nymphal period			
First instar	1.0	2.0	1.83±0.38
Second instar	1.0	2.0	1.47±0.51
Third instar	1.0	2.0	1.5±0.51
Fourth instar	1.0	3.0	1.53±0.63
Total	4.0	9.0	6.33±1.18
Adult longevity (Apterous female)	4.0	12.0	6.73±2
Pre reproductive period	1.0	2.0	1.2±0.41
Reproductive period	2.0	8.0	4.37±1.87
Post reproductive period	1.0	2.0	1.17±0.38
Reproductive potential	2.0	36.0	14±8.68
Total life cycle	9.0	20.0	13.07±2.18
Temperature (°C)	16.0	24.0	20.07±2.3
Relative humidity (%)	45.0	89.0	65.33±14.18

Table 2 : Morphometrical studies of *M. sanborni* under laboratory condition on chrysanthemum.

Particular		Minimum	Maximum	Mean±SD
Nymphal stage				
First instar	Length	0.40	0.69	0.61 ±0.08
	Breadth	0.24	0.34	0.3 ±0.03
Second instar	Length	0.74	1.17	0.99 ±0.13
	Breadth	0.51	0.69	0.62 ±0.06
Third instar	Length	0.79	1.42	1.14 ±0.2
	Breadth	0.59	1.08	0.86 ±0.16
Fourth instar	Length	1.11	1.65	1.43 ±0.16
	Breadth	0.73	1.23	0.98 ±0.14
Adult	Length	1.78	2.26	1.98 ±0.14
	Breadth	1.05	1.89	1.44 ±0.23

measured from 0.73 to 1.23 mm with an average of 0.98 ± 0.14 mm. The duration of the fourth instar nymph varied from 1 to 3 days with an average of 1.53 ± 0.63 days (Table 2). The morphology of *M. sanborni* was studied by various scientists at different places. The body colour of apterous aphid was blackish coffee and light brown to nearly dark brown (Miller and Stoetzel, 1997), while the body colour and shape of the winged aphid was similar to the wingless. Further, Ghosh (1969) reported that the antenna of chrysanthemum aphid, *M. sanborni* was longer than its body. Biswas *et al* (1994) observed four distinct nymphal stages of *M. sanborni*. Thus these earlier reports closely support the present findings.

Total nymphal period : The total nymphal period of *M. sanborni* ranged from 4 to 9 days with an average of 6.33 ± 1.18 days (Table 1). The present findings are more or less in accordance with the earlier work carried out by Sood and Kakar (1991) reported that four nymphal instars occupy 2.25, 2.25, 2.70 and 3.05 days, respectively. In present study, slight difference in nymphal periods were observed, it may due to the change in climatic condition and difference in the host plant varieties.

Adults : The adults of chrysanthemum aphid, *M. sanborni* were similar to the fourth instar nymph except in size of the body. Apterous viviparous females were shiny from dark reddish-brown to almost black, without wax powder with black, relatively short and thick is siphunculi. Antennae brown with almost whole antennae III paler (except the distal end). The pair of brownish cornicles was seen at the tip of the abdomen. In the case of winged aphids, the wings were fully developed. The alate viviparous females are very similar in colouration, shiny dark reddish-brown to black with only basal parts of antennae III, proximal parts of femora and middle

sections of tibiae yellow. The antenna was, even more, larger than the body size. Miller and Stoetzel (1997) also describe similar morphological features of *M. sanborni*, this closely support the present findings. The longevity of adult apterous female of chrysanthemum aphid, *M. sanborni* varied between 4 to 12 days with an average of 6.73 ± 2 days (Table 1). The length of the adult varied from 1.78 to 2.26 mm with an average of 1.98 ± 0.14 mm while, the breadth varied from 1.05 to 1.89 mm with an average of 1.44 ± 0.23 mm (Table 2). The antennae were longer than the body length with six segments and length varied from 2.00 to 2.40 mm with an average of 1.99 ± 0.16 mm. Sood and Kakar (1991) reported this period

as 10.35 days which is more or less similar to the present findings, however slight variations may be due to change in environmental condition and varieties of host plants.

Pre-reproductive period : Pre-reproductive period was calculated from the date of emergence of adult to the date of giving birth to their first young ones. The pre-reproductive period of *M. sanborni* varied from 1 to 2 days with an average of 1.2 ± 0.41 days (Table 1).

Reproductive period : The reproductive period was calculated from the date of giving birth to their young ones to date of stopping birth to their young ones. The reproductive period varied from 2 to 8 days with an average of 4.37 ± 1.87 days (Table 1).

Post-reproductive period : The post reproductive period was calculated from the date of stopping birth to their young ones to death of adult aphids. The post reproductive period varied from 1 to 2 days with an average of 1.17 ± 0.38 days (Table 1). In a study of Sood and Kakar (1991) reported pre reproductive, reproductive and post reproductive period of 0.9, 19.5 and 4.8 days, respectively. The present data vary slight with earlier work due to difference in environmental conditions and difference in the varieties of host plant.

Reproductive potential : To determine the reproductive potential, the number of nymphs produced by individual adult aphid was recorded till the death. The result obtained on the reproductive potential of chrysanthemum aphid, *M. sanborni* is presented in Table 1 and indicated that the fecundity of gravid female who laid 2 and 36 nymphs with an average of 14 ± 8.68 nymphs in her life span. The findings are partially supported by the earlier work carried out by Sood and Kakar (1991) who reported that fecundity as 61 nymphs per female, which is quite higher than the present findings. The difference in fecundity may be due to the variation of environmental conditions and the host plant varieties. However, the present findings closely supported by Zamani *et al* (2008), who recorded daily and total fecundity as 2.17 and 29.1, respectively.

Total life cycle : The total life cycle of *M. sanborni* varied from 9 to 20 days with an average of 13.07 ± 2.18 days (Table 1). The present findings are in closely agreement with the findings of Zamani *et al* (2008), who reported the total life periods as 20.4 days.

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