

Biology of corn leaf aphid, *Rhopalosiphum maidis* (Fitch) infesting maize

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Abstract: The infestation to know, the biology of maize aphid, *Rhopalosiphum maidis* (Fitch) in laboratory condition on maize crop was carried out at AICRP on biological control of crop pests, Anand Agricultural University, Anand during 2021-22. The aphid was found to be reproducing exclusively by viviparous parthenogenesis. Nymphs passes through four instars. Average periods of first, second, third and fourth instar were 1.20 ± 0.40 , 1.36 ± 0.48 , 1.40 ± 0.48 and 1.46 ± 0.49 days, respectively. The pre-reproduction, reproduction and post-reproduction periods of aphid on maize ranged from 3 to 7, 8 to 15 and 3 to 5 days with an average of 5.06 ± 1.15 , 11.83 ± 1.71 and 4.03 ± 0.70 days, respectively. The longevity of adult was ranged from 14 to 26 days with an average of 22.36 ± 2.60 days with average fecundity was 32.63 ± 5.83 individuals per female on maize. Total life span of aphid ranged from 18 to 36 days with an average of 28.10 ± 3.40 days.

Key words: Maize aphid, *Rhopalosiphum maidis*, Corn leaf aphid, Parthenogenesis, Maize.

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1 Introduction

The maize aphid, *Rhopalosiphum maidis* (Fitch) is the most dreaded insect, infesting the crop right from tasseling stage to maturity. The losses in fodder and grain yield caused by maize aphid was 21.81 and 19.79%, respectively (Mistry, 1973). The *R. maidis* is a significant agricultural polyphagous, multivoltine pest, also one of the most severe pests of maize. Although it has Asian origins, it may found in all tropics and temperate regions of the planet (Hill, 1987; Blackman and Eastop, 2000; Kuo *et al.*, 2006). It is found in barley, oats, maize and occasionally in wheat. It's most common wild host is Jhonson grass. Both are connected to orchards and fields of cereal. In maize aphid a sexual viviparous parthenogenic reproduction has been commonly noted. By parthenogenesis, adult females give birth to live infants. Each instar of its four nymphal stages, which last two to three days depending on the

temperature, around seven to ten days pass from birth to maturity (Kuo *et al.*, 2006).

2 Materials and Methods

To study on biology of *R. maidis* was carried out in laboratory of AICRP on biological control of crop pests, ICAR, Anand Agricultural University, Anand, during 2021-22. Aphids from the maize crop grown at the Entomology farm, AAU, Anand were used to make the initial culture of *R. maidis*. Aphids collected from the field were reared on tender shoots of maize plant about 8 to 10 cm length. The shoot was kept in small conical flask having cotton soaked in water to keep it turgid for longer period. The aphids were transferred on tender shoot with the help of soft camel hair brush. Shoot was replaced every 2

to 3 days interval and new shoot was used. Thus, laboratory culture was maintained. In a laboratory environment, *R. maidis* biology was investigated at ordinary room temperature on maize from December 2021 to February 2022. The average mean temperature 19.91°C and relative humidity 66.22% for the study periods were noted. To study the biology of *R. maidis*, the nymphs produced by female aphid were transferred into separate glass Petri dish (10 cm diameter and 2 cm height) with the help of fine moist camel hair brush. Such 30 sets were made for the study and it was observed daily with the help of magnifying lens and binocular microscope. The Petri dishes were provided with moistened filter paper to keep the host leaves turgid for longer duration. The fresh leaves of maize were provided as food for aphid and food was replaced daily in the morning during the entire period of study. Based on the presence of the nymph's exuviae, the variations in instars were noted. The entire nymphal period was calculated from the beginning of the first instar to the end of the fourth instar at interval of 24 hrs. Exuviae on the leaf or on the nymphs' tails proved that they were in the process of moulting. After fourth moult, the nymph reached to adult stage. The period after completion of nymphal stage till the adult commence giving birth to the young ones called pre-oviposition period. The period during which adult produced young ones was considered as oviposition period and the duration after oviposition period till the adult death considered as post-oviposition period. Thus, observations on pre-oviposition,

oviposition and post-oviposition periods were recorded separately. The reproductive potential of *R. maidis* was studied by daily counting the number of nymph borned during the entire life of an individual adult. Finally, adult longevity was recorded separately under laboratory condition.

3 Results and Discussion

Data on biology of *Rhopalosiphum maidis* (Fitch) are presented in Table 1 and. The data indicated that there were four nymphal stages (instars) and the adults were produced from the final nymphal instar. The duration of first, second, third and fourth instar nymphs of corn leaf aphid ranged from 1.00 to 2.00, 1.00 to 2.00, 1.00 to 2.00 and 1.00 to 2.00 days with an average of 1.20 ± 0.40 , 1.36 ± 0.48 , 1.40 ± 0.48 and 1.46 ± 0.49 days, respectively. Total nymphal period lasted for 4.00 to 7.00 days. On an average it took 5.63 ± 1.13 days to complete nymphal stage. Similar result obtained by Wildermuth and Walter (1932), Patel (2003) and Anjali *et al.* (2017) who reported that *R. maidis* has four different instars. Adults survived for 14.00 to 26.00 days with an average of 22.36 ± 2.60 days. However, in contract to above, Anjali *et al.* (2017) recorded the survival of adult as 12.27 ± 0.27 days. The variation in average days of adult longevity might be due to the effect of food and different ecological conditions prevailed at different

places where the studies were carried out. The total life span of *R. maidis* from birth of first instar nymph to death of adult ranged from 18.00 to 36.00 days with an average of $28.10 \pm$

3.40 days. This finding is in conformity with the finding of Patel (2003) who reported 16.00 to 35.00 days life span with an average of 28.16 ± 7.70 days.

Table 1: Duration of different life stages and fecundity of aphid, *R. maidis* on maize

Life Stages	No. of observations	Duration (Days)		Mean \pm S. D.
		Min.	Max.	
Nymph	30			
I instar		1.00	2.00	1.20 ± 0.40
II instar		1.00	2.00	1.36 ± 0.48
III instar		1.00	2.00	1.40 ± 0.48
IV instar		1.00	2.00	1.46 ± 0.49
Total nymphal duration		4.00	7.00	5.63 ± 1.13
Adult	30			
Adult longevity		14.00	26.00	22.36 ± 2.60
Total life span		18.00	36.00	28.10 ± 3.40
Pre-oviposition period		3.00	7.00	5.06 ± 1.15
Oviposition period		8.00	15.00	11.83 ± 1.71
Post-oviposition period		3.00	5.00	4.03 ± 0.70
Fecundity(Nymphs/female)		15.00	38.00	32.63 ± 5.83

Note: S. D. = Standard Deviation; Min. = Minimum; Max. = Maximum

Pre-oviposition, oviposition and post-oviposition period of corn leaf aphid on maize ranged from 3.00 to 7.00, 8.00 to 15.00 and 3.00 to 5.00 days with an average of 5.06 ± 1.15 , 11.83 ± 1.71 and 4.03 ± 0.70 days, respectively. This finding is deviated from the report of Patel (2003) who recorded pre-reproductive, reproductive and post-reproductive period as 0.28 ± 0.10 , 18.92 ± 0.69 and 4.44 ± 0.26 days, respectively. This may be due to difference in

rearing condition and nutritive value of food supplied during rearing. The fecundity of corn leaf aphid ranged from 15.00 to 38.00 with an average of 32.63 ± 5.83 on maize. As earlier published literature on fecundity of *R. maidis*, the present finding is more or less similar to Davis (1909) who reported that fecundity of *R. maidis* was 33.5 nymphs/female. Singh (2011) also registered an average of 34.76 ± 8.52 fecundity on barley. Anjali *et al.* (2017) also

found that each female produced nymphs with an average of 35.97 on sorghum. All these reports corroborate with the present finding. The morphological characters of different stages are given below:

3.1 First instar nymph

Freshly borned first instar nymphs were oval in shape, dorsally convex and light green in colour. The tips of head, antennae and legs were slightly darker than the body. Antennae were short, filliform and laid back towards the tip portion. A pair of tube-like structure (cornicles) was observed dorsally on the posterior region of abdomen.

3.2 Second instar nymph

The second instar nymphs found to be less active and pale green in colour. The head, abdomen and antennae were darker than the body and the legs were paler. The freshly moulted second instar nymphs were slightly darker in colour and oval in shape. They were similar in general appearance as first instar expect in body size which is slightly larger than first instar nymphs.

3.3 Third instar nymph

The general body appearance of third instar nymphs was slightly different from that of second instar. The third instar body was still pale green, but slightly darker on the sides. Shape of body was slightly changed which was slightly elongated as compared to second instar nymphs. A pair of filliform antennae was directed backward bending from the first apical end of antennal segment. Legs were well

developed, became more conspicuous and darker than the body. Cornicles were clearly visible.

3.4 Fourth instar nymph

The nymphs were dark green in colour. The cornicles were larger in size and black in colour and clearly visible. The fourth instar nymphs were similar to the third instar nymphs in general appearance and morphological characters, except body size.

3.5 Adult

The mature forms of the corn leaf aphid consist of adult with wings (alate), and adult with no wings (apterate).

3.5.1 The apterate adult

In addition to its soft body, the oval, frequently pale bluish-green adult bears black antennae, legs and cornicles. The compound eyes were dark black in colour. Abdomen was dark to black colour, shining appearance and bulged. The two cornicles were dark, relatively short, and surrounded by a dark basal area. Head, antennae, legs, siphunculi and cauda are dark green, brown, or black in colour.

3.5.2 The alate adult

The adults were oval in shape and of black colour with transparent wings. Adults were larger in body size and possessed a pair of well-developed and conspicuous black coloured cornicles on the posterior part of the abdomen. Alate adult was comparatively smaller in size than that of apterate adult. Head,

antennae, thorax, rostrum, legs, abdominal intersegmental and lateral sclerites, cauda, and anal plate were all black, the abdomen was primarily light to dark green.

4 Conclusion

The study of biology of aphid provided information regarding longer life span of adults and thereby higher food requirements leading to the visibility of the pest and symptoms, respectively, on the maize crop and can thus be utilized for proper assessment for the control measures in the field. Hence, this information will be helpful during the development of successful Integrated Pest Management Programme (IPM) for *R. maidis*.

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