



ISSN (E): 2277-7695

ISSN (P): 2349-8242

NAAS Rating: 5.23

TPI 2022; 11(9): 1426-1429

© 2022 TPI

www.thepharmajournal.com

Received: 11-06-2022

Accepted: 20-08-2022

Nalini Kapoor

Department of Entomology,
School of Agriculture, Abhilashi
University Mandi Himachal
Pradesh, India

Vinod Kumar

Department of Entomology,
School of Agriculture, Abhilashi
University, Mandi, Himachal
Pradesh, India

Anupam Kumar

Department of Plant Pathology,
School of Agriculture, Abhilashi
University, Mandi, Himachal
Pradesh, India

Alok Kumar

Department of Seed Science and
Technology, School of
Agriculture, Abhilashi
University, Mandi, Himachal
Pradesh, India

Kailash Sati

Department of Horticulture,
School of Agriculture, Abhilashi
University, Mandi, Himachal
Pradesh, India

Om Prakash

Department of Entomology,
School of Agriculture, Abhilashi
University, Mandi, Himachal
Pradesh, India

Neha Kumari

Department of Entomology,
School of Agriculture, Abhilashi
University, Mandi, Himachal
Pradesh, India

Corresponding Author:

Vinod Kumar

Department of Entomology,
School of Agriculture, Abhilashi
University, Mandi, Himachal
Pradesh, India

Biology of mustard aphid (*Lipaphis erysimi* Kaltentbach) under laboratory condition

Nalini Kapoor, Vinod Kumar, Anupam Kumar, Alok Kumar, Kailash Sati, Om Prakash, and Neha Kumari

Abstract

The present investigation entitled "Biology of mustard aphid (*Lipaphis erysimi* Kaltentbach)" in Mandi District of Himachal Pradesh" were carried out at Laboratory of Abhilashi University Mandi (Chail-chowk), during Rabi season 2021-2022, Studies on *Lipaphis erysimi* Kalt. Revealed that the nymph passed through four distinct instars before attaining the adult stage. Total nymphal period was considered from birth of first instar to the end of fourth instar. It ranged from 6 to 9 days with an average of 7.25 ± 0.22 days. The entire life period (birth of young ones to death of adult) was minimum of 8-17.5 days with an average of 16 ± 0.48 days.

Keywords: Biology, Mustard aphid, *Lipaphis erysimi* (kalt.)

Introduction

An important short-lived oilseed crop in India is rapeseed mustard or *Brassica juncea* L., popularly known as Indian mustard. World rapeseed-mustard production in 2019-2020 was, 1990 kg/ha, 71.489 million tonnes and 35.95 million hectares. Rapeseed-mustard production in India reached, 1331 kg/ha, 9.12 million tonnes, and 6.86 mha in 2019-2020 (according to ICAR-DRMR report). Globally, India continues to be rank 2nd after Canada in land (19.81%) and rank 4th after Canada, European Union and China in production. After closely observing and studying the brassica group of oilseed crops, it is quite evident that Indian mustard is securing huge amount of land and is holding the hugest amount of mustard production in Asian territory. (Rao *et al.*, 2013).

Rapeseed-mustard is the most edible oil crop in India after Groundnut. (Chand *et al.*, 2017). Mustard seed is a spice that may be used in many different dishes. Mustard oil is used in the manufacture of medicines as well as a hair conditioner. The yellow condiment known as prepared mustard is made by grinding and combining seeds with water, vinegar, or similar liquids. Mustard crop oil is particularly significant in Northern, North-Western, Central, Eastern, and North-Eastern states for cooking medium and nutritional purposes, and it is also quite frequent in pickling and food preservation (Gautam *et al.*, 2019) [3].

In India, more than 43 insect pest species have been found to infest the rapeseed mustard crop, with the sawfly (*Athalia lugens proxima*), mustard aphid (*L. erysimi* Kalt.), and leaf minor being the most common. Mustard aphid (*L. erysimi* Kalt.) is the main limiting factor, causing yield losses of up to 66 percent and a 15-16 percent reduction in oil content. (Gautam *et al.*, 2018). Mustard aphid (*Lipaphis erysimi* Kalt.) belongs to family Aphididae and order Hemiptera is a major pest distributed in all the agro-climatic zones of India.

L. erysimi Kalt. has caused severe reduction to rapeseed-mustard up to 66-96% in yield (Singh and Sachan, 1997) to 75.70% (Sekhon *et al.*, 1996) and 66-96% and 27- 68% on *B. compestris* and *B. juncea*, respectively (Bakhetia, 1979). Later on Singh and Sachan (1994) reported seed yield of described crop could go down up to 91.35% during severe infestation. However, in different agro climatic zones seed yield reduction is about 11-96% (Phadke, 1985).

L. erysimi Kalt is a soft bodied, minute, light green and pear shaped having a pair of short tubes called cornicles on 5th-6th poster dorsal region of abdomen. The adults could be winged or wingless. The wingless are predominantly in early stage of infestation. The wings when present are long and held vertically up over the body. Mustard aphid breed parthenogenetically. (Koirala 2020) [6].

Materials and Methods

The studies on the biology of *L. Erysimi* Kalt. Were carried out in the Department of Entomology, Abhilashi University, School of Agriculture Mandi (Chail-chowk) H.P., from Feb-March during 2022. To start with, five apterous adult females were collected a day earlier, from a field of mustard and liberated on potted plants. Five out of total young ones produced by these aphids by next morning were caged and their mother was discarded. The cage was made of netting cloth supported by wire stand. The caged mustard aphids were placed in covered space by muslin cloth, the surrounding of which stimulated the actual field conditions. When aphid attained maturity, two of them were selected for undertaking further study on their biology. These were transferred separately to other mustard plants and caged. The remaining three aphids were kept alive for replacing any of the two aphids, in case any of them dead. With the commencement of reproduction by two selected aphids, the remaining three, kept as reserve stock, were dispensed with. The two aphids were marked as A and B.

The biological data of A were included here, while B served as substitute, the record of which was used in case of unnatural death of a caused by handling or any other such accident. All the aphids under study were observed daily to make sure of their proper attachment to the leaf and for recording observations. Pre-reproductive period: The date of birth of the aphid and the date on which it produced her first young ones were observed. The interval period of the two dates from the pre -reproductive period. Reproductive period and daily birth: The dates on which the aphid produced her first and last young ones were noted and the period between these two dates constituted the reproductive period of aphid. The number of young ones produced daily by the aphid was counted and young ones were removed from the leaf with a fine brush. The operation was done carefully without disturbing the mother aphid. Post-reproductive period: The study on the aphid after the birth of her last young one was continued until the date of her death to assess the pre-reproductive period.

Pre-reproductive period

The date of birth of the aphid and the date on which it produced her first young ones were observed. The interval period of the two dates from the pre -reproductive period.

Reproductive period and daily birth

The dates on which the aphid produced her first and last young ones were noted and the period between these two dates constituted the reproductive period of aphid. The number of young ones produced daily by the aphid was counted and young ones were removed from the leaf with a fine brush. The operation was done carefully without disturbing the mother aphid.

Post-reproductive period

The study on the aphid after the birth of her last young one was continued until the date of her death to assess the prereproductive period.

Result and Discussion

The present investigation entitled "Biology of mustard aphid (*Lipaphis erysimi* Kaltenbech)" in Mandi District of Himachal Pradesh" were carried out at Laboratory of Abhilashi

University Mandi (Chail-chowk), during Rabi season 2021-2022.

Nymphal instars

The nymph passed through four distinct instars before attaining the adult stage. The instars were determined from the exuviated casted off at each moult.

First instar

Freshly borne first instar nymph was elongated wingless, delicate, and transparent and pale yellowish or light greenish in colour. Later, the body shape became oval and colour changed from light green to green. Compound eyes were small, placed just behind the base of the antennae and were reddish black. The antennae was setaceous type with five segments. Three pairs of thoracic legs were developed and were colourless. Duration of first instar nymphs were recorded minimum of 1 and maximum of 2 days with an average of 1.25 ± 0.10 days, respectively.

The present findings of First instar nymphs were recorded as partially similar findings of K. Jana and S. Pal (2015) reported that the duration of first instar nymph ranges 1-2 days.

Second instar

Freshly moulted second instar nymph differed from first instar in its comparative size and appearance. Nymph was little dark green in colour at lateral sides of abdomen and slightly bulged. Compound eyes were similar to first instar both in colour and shape. Second instar was very active and avoids light. The duration of second instar nymph was observed minimum 1 and maximum 2 days with an average of 1.65 ± 0.09 days.

The present findings of Second instar nymph were recorded as partially similar findings of K. Jana and S. Pal (2015) reported that the duration of second instar nymph was observed minimum 1 and maximum 2 days with an average of 1.65 ± 0.09 days.

Third instar

The third instar nymph was dark yellowish in colour. The compound eyes were round, little bigger than second instar and blackish in colour. The antennae was six segmented. Duration of third instar nymphs was 0.5 to 4.0 days with an average of 1.86 ± 0.10 days respectively.

The present studies results were partially similar with the findings of A. Imran and S.P. Singh (2014) ^[4] reported that the third instar nymphs was 0.5 to 4 days with an average of 1.86 ± 0.10 days.

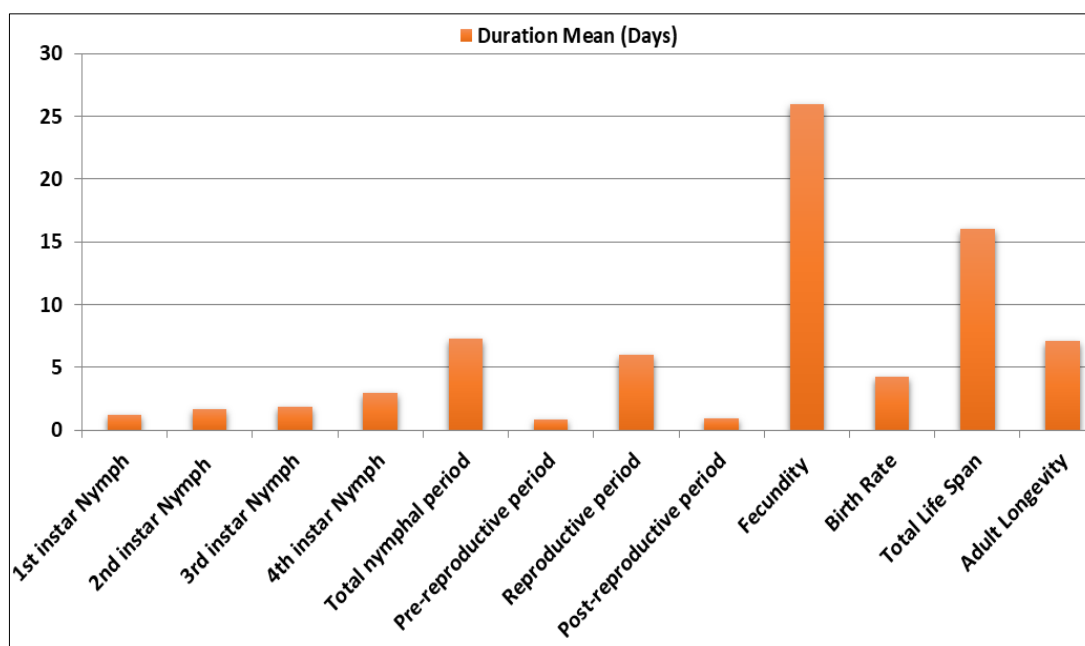
Fourth instar

Fourth instar nymph was dark in colour and elongated in shape. The compound eyes were still enlarged and were dark black in colour. The nymph was very active and looked like adult except that it did not acquire deep green colour and fully developed wings. The cornicles were clearly visible with naked eyes. It possess six segmented antennae. Minimum and maximum duration of the fourth instar nymph was 1 to 4 days, respectively with an average duration of 2.96 ± 0.10 days.

The present studies results were partially similar with the findings of A. Imran and S.P. Singh (2014) ^[4] reported that the minimum and maximum duration of the fourth instar nymph was 1 to 4 days, respectively with an average duration of 2.96 ± 0.10 days.

Table 1: Biology of mustard aphid (*Lipaphis erysimi* Kalt.) under laboratory condition

S. No.	Developmental Stages	Duration in days		
		Range (Min. and Max)	Mean \pm SD	
1	Nymphal period	1 st instar (days)	1-2	1.25 \pm 0.10
		2 nd instar (days)	1-2	1.65 \pm 0.09
		3 rd instar (days)	0.5-4	1.86 \pm 0.10
		4 th instar (days)	1-4	2.96 \pm 0.10
2	Total nymphal period	6-9	7.25 \pm 0.22	
3	Pre-reproductive period	0-2	0.85 \pm 0.03	
4	Reproductive period	2-9	6.04 \pm 0.18	
5	Post-reproductive period	0-2	0.96 \pm 0.03	
6	Fecundity	2-61	26 \pm 0.78	
7	Birth Rate	1-6.77	4.25 \pm 0.13	
8	Total Life Span	8-17.5	16 \pm 0.48	
9	Adult Longevity	2-9	7.15 \pm 0.21	

**Fig 1:** Biology of mustard aphid (*Lipaphis erysimi* Kalt.) under laboratory condition.**Total nymphal period**

Total nymphal period was considered from birth of first instar to the end of fourth instar. It ranged from 6 to 9 days with an average of 7.25 \pm 0.22 days.

These findings are partial similar to A. Imran and S.P. Singh (2014) [4] reported that total nymphal period ranged 6-9 days, respectively.

Apterous adult and Alates adult

The apterate adults were dark deep olive green in colour with spindle shaped to elongated preform body. The compound eyes were dark black in colour and were bulged. The antenna composed of six segments and shorter than the body lengths. Legs were rather stout, long and covered with small hairs. Third pair of leg was longer than first and second ones. Abdomen was dark to black colour, shining appearance and bulged. The cornicles, a prominent morphological feature of adult aphid was in pair of long tubes and greenish in colour. Cauda was prominently visible in adult. Alate adult was similar to the apterate adult except in the presence of wings. Both, fore and hind wings were transparent and oblong in shape but forewing was greater in length and width as compared to hind wing. Alate adult was comparatively smaller in size than that of apterate adult and six segmented

antenna. The longevity of adult was recorded minimum 2.0 and maximum 9.0 days with an average of 7.15 \pm 0.21 days. These findings are partial similar to M. Aslam *et al.*, (2011) reported that the apterate adults were dark deep olive green in colour with spindle shaped to elongated preform body. The compound eyes were dark black in colour and were bulged. Alate adult was similar to the apterate adult except in the presence of wings. Both, fore and hind wings were transparent and oblong in shape but forewing was greater in length and width as compared to hind wing.

Pre-reproduction

Minimum and maximum pre-reproduction period was 0.0 and 2 days with an average of 0.85 \pm 0.03 day, respectively. The present findings were found more or less similar results with the findings of S. A. Dwivedi *et al.*, (2018) [2].

Reproduction

The adult period in which it produced young ones was considered as reproduction period. It was recorded minimum. 2 and maximum of 9 days with an average of 6.04 \pm 0.18 days. S. A. Dwivedi *et al.*, (2018) [2] were found more or less similar results on Reproduction.

Post-reproduction period

The adult period after reproduction up to the death was considered as post reproduction period. It was recorded minimum of 0.0 and maximum of 2.0 days with an average of 0.96 ± 0.03 days. S. A. Dwivedi *et al.*, (2018) [2] were found more or less similar results on Post- Reproduction.

Fecundity

The reproductive potential of *L.erysimi* Kalt. Was recorded by counting the number of individuals produced by each adult aphid during its reproduction period. Each female produced minimum of 2 and maximum of 61 individuals with an average of 26 ± 0.78 individuals. These findings are partial similar to Mandavi Pal and Rajendra Singh (2013) reported that each female produced minimum of 2 and maximum of 61 individuals with an average of 26 ± 0.78 individuals.

Total life span

The entire life period (birth of young ones to death of adult) was minimum of 8 and maximum of 17.5 days with an average of 16 ± 0.48 days. In the present study, total life span was 8-17.5 days. These findings are partial similar to Mandavi Pal and Rajendra Singh (2013) reported that total life span was 8-17.5 days.

Summary and Conclusion

The present studies entitled "Biology of mustard aphid (*Lipaphis erysimi* Kalt.)" were carried out at Laboratory of Abhilashi University Mandi (Chail-chowk), during rabi season 2021-2022.

The nymph moulted four times to attain the maturity respectively on mustard. The duration of first instar nymph was 1 to 2 days with an average of 1.25 ± 0.10 days. The average duration of second instar nymph was 1 to 2 days with an average of 1.65 ± 0.09 days. The duration of third instar nymph was 0.5 to 4 days with an average of 1.86 ± 0.10 days. The average duration of fourth instar nymph was 1 to 4 days with an average of 2.96 ± 0.10 days. Total nymphal period was 6 to 9 days with an average of 7.25 ± 0.22 days. The longevity of adult was ranged from 2 to 9 days with an average of 7.15 ± 0.21 days and the total life cycle 8 to 17.5 days with an average of 16 ± 0.48 . The average pre-reproductive, Reproductive, and post Reproductive, periods were 0 to 2, 2 to 9 and 0 to 2 days, with an average of 0.85 ± 0.03 , 6.04 ± 0.18 , 0.96 ± 0.03 , respectively.

The mustard crop found severely damaged due to aphid, *L. erysimi* Kalt. The aphid passed through four distinct instars before attaining the adult stage. The instars were determined from the exuviated casted off at each moult. The freshly borne first instar nymph was elongated, wingless, delicate, transparent and pale yellowish or light greenish in colour having a pair of cornicles on the posterior region of abdomen.

Acknowledgement

Author is thankful to, Department of Entomology, School of Agriculture, Abhilashi University Mandi-175028, Himachal Pradesh (India), to provide necessary facility and valuable suggestion during investigation.

Reference

1. Ansari ZA, Lal MN. Development of *Lipaphis erysimi* on Brassica Genotypes. *Annals of Plant Protection Sciences*. 2010;18(2):489-556.

2. Dwivedi SA, Gharde SK, Singh RS. Biology of Mustard Aphid, *Lipaphis erysimi* (Kalt.) in Laboratory Condition. *Annals of Biology*. 2018;34(2):167-169.
3. Gautam MP, Singh SN, Kumar, Misra PK, Yadav SK, Singh DP, *et al.* Mustard aphid, *Lipaphis erysimi* (Kalt) (Homoptera: Aphididae): A review. *The Pharma Innovation Journal*. 2019;8(9):90-95.
4. Imran A, Singh SP. Effects of rape seed mustard genotypes on the biological parameters of *Lipaphis erysimi*. *Society for Sci. Dev. in Agric. and Tech*; c2014. p.370-373.
5. Jana K, Pal S. Biology of mustard aphid, *Lipaphis erysimi* Kalt. On certain brassica genotypes. *Journal of Applied Zoology*. 2008;19(2):145-146.
6. Koirala Saurabha. Mustard Aphid and Crop Production. *International Journal of Applied Sciences and Biotechnology (IJASBT)*. 2020;8(3):310-317.
7. Madhusoodanan, Hrideek KJ, Kuruvilla KM, Thomas J. Mustard-cultivation practices. *Indian Journal of Aracanut and Medical plants*. 2004;5(4):145-150.
8. Malviya JK, Lal MN. Biology of mustard aphid, *Lipaphis erysimi* (Kalt.) on selected Brassica germplasm. *Cruciferae Newsl*. 2000;22:55-56.
9. Sidhu HS, Singh S. Biology of mustard aphid, *Lipaphis erysimi* Kalt. In the Punjab. *J Indian Oilseed*. 1964;8:348-359.
10. Rana JS. Performance of *Lipaphis erysimi* (Homoptera: Aphididae) on different Brassica species in a tropical environment. *Journal of Pest Science*. 2005;78(3):155-160.
11. Singh AP, Singh PP, Singh YP. Biology of mustard aphid, *Lipaphis erysimi* (Kalt.). *Indian Journal of Entomology*. 2006;68(2):144-147.