



ISSN (E): 2277-7695  
ISSN (P): 2349-8242  
NAAS Rating: 5.23  
TPI 2023; SP-12(7): 1574-1576  
© 2023 TPI  
[www.thepharmajournal.com](http://www.thepharmajournal.com)  
Received: 17-04-2023  
Accepted: 14-05-2023

**Swati Sharma**  
Department of Entomology,  
IGKV, Raipur, Chhattisgarh,  
India

**Neelkamal Patel**  
Department of Entomology,  
IGKV, Raipur, Chhattisgarh,  
India

**Ashish Kumar Sharma**  
Department of Entomology,  
IGKV, Raipur, Chhattisgarh,  
India

## Study on *in vitro* biology of diamondback moth, *Plutella xylostella*, (Linn.) on Cabbage

Swati Sharma, Neelkamal Patel and Ashish Kumar Sharma

### Abstract

From 2022 to 2023, a study under laboratory conditions was conducted at BTCCARS in Bilaspur to determine the life cycle of the diamondback moth *Plutellae xylostella* (Lepidoptera: Plutellidae) under laboratory conditions. As a result, the egg period was  $2.90 \pm 0.26$  days, the larval period was  $10.55 \pm 0.47$  days, the prepupal period was  $1.5 \pm 0.11$  days, and the pupal period was  $4.80 \pm 0.17$  days. Total lifespan under laboratory conditions varied between 17 and 28 days, averaging  $21.35 \pm 0.82$  days. The study also found that larval instars differed in length, with the 1st instar being the shortest and the 4th instar being the longest. The length of the pupal period also varies, with some pupae hatching in 4 days and others in 6 days. The results of this study provide valuable information on the diamondback moth life cycle that can be used to develop more effective pest management strategies.

**Keywords:** Diamondback moth, *Plutellae xylostella*, life cycle, laboratory conditions, egg period, larval period, pre-pupal period, pupal period, entire life span

### Introduction

Cabbage (*Brassica oleracea* var. capitata) is a cruciferous vegetable native to Cyprus and the Mediterranean. It belongs to the cruciferous family and also includes broccoli, cauliflower and Brussels sprouts. Khor was called "Caputo" by the Greeks, meaning "head", because of its resemblance to a human head. Cabbage is a versatile vegetable that can be eaten raw, boiled, or fermented. A good source of vitamins C, K and fiber. Cabbage can be eaten cooked or raw and is a versatile vegetable that can be used in salads and many other dishes. As vegetarians become more popular around the world, the demand for vegetables is increasing. India is the second largest vegetable producer in the world and cabbage is one of the country's most important crops. From 2019 to 2020, the planted area of cabbage in India was 4.03 million hectares and the annual production was 93.69 million tons. This indicates a good opportunity to increase cabbage production in India to meet both domestic and export demand. (Anonymous, 2022) [2]. Cabbage yields are affected by many bottlenecks, the most important of which are pests, which cause severe economic damage to the cabbage crop. Among all pests, the diamondback moth, long considered a relatively minor pest, has now emerged as a major pest, overshadowed by serious foliar pests such as the cabbage worm, *Pieris rapae* (L.) and the cabbage grinder, *Trichoplusia Ni* (H.). DBM is believed to be of Mediterranean origin and is distributed internationally, affecting cabbage, cauliflower, radishes, turnips, mustard, amaranth, etc. Among these, cauliflower and cabbage are the most preferred host plants because their fleshy, fleshy leaves provide the olfactory and gustatory stimuli necessary for successful selection and colonization. The ecology of the diamondback moth has been studied by various researchers of the diamondback moth in India. H. (Harcourt, 1957; Bhalla and Dubey, 1986; Chelliah and Srinivasan, 1986) [8, 3, 4] and found variations in different parameters with environmental conditions and damage at different locations. Considering the above issues, the present study was conducted to investigate the ecology of his *P. xylostella* (lin) in the diamondback moth. Under controlled laboratory conditions.

### Materials and Methods

Biology of *P. xylostella* (Lin) rearing techniques to study the biology of *P. xylostella*, an initial culture of diamondback moth was developed by collecting large numbers of larvae from a cabbage patch near Bilaspur District. Larvae were reared on fresh cabbage leaves in plastic containers and maintained at  $25 \pm 2$  °C in a BOD incubator. Cabbage was cultivated at the experimental field of the Agricultural College Horticulture Farm in Bilaspur to provide fresh food for the mass culture of diamondback moth.

**Corresponding Author:**  
**Swati Sharma**  
Department of Entomology,  
IGKV, Raipur, Chhattisgarh,  
India

Pupae were sorted and transferred to another rearing cage covered with muslin cloth for adult emergence. Emerged adults were separated and provided with a 10% honey solution + multivitamin soaked in an absorbent cotton swab for feeding and cauliflower leaves for oviposition. Female moths lay creamy-white eggs on both sides of the leaves. Leaves bearing eggs were removed and kept in another plastic jar for hatching. The first, second, third, and fourth stars were provided with fresh cabbage leaves, and the process was continued until pupation. Thus, the culture of *P. xylostella* was multiplied and maintained during the experimental period.

### Results and Discussion

Freshly laid eggs of the diamondback moth are oval in shape and pale yellowish in color. The females of this moth typically lay their eggs singly or in small groups on the lower surface of the leaves near the midrib of the petiole of cabbage. They may also lay eggs on the walls of the container. Table 1 indicates the incubation period of the eggs of the diamondback moth varies from 4 to 6 days, with an average of  $2.90 \pm 0.26$  days. This means that it takes about 3 days for the eggs to hatch.

#### I instar

Immediately after hatching, the first instar larvae were small, white in colour, and had dark brown heads. First instars take an average of 2.85 days to complete development (Table 1). The length and width of the larval head capsule are 1.4 mm x 1.64 mm (Table 2). Larval size increased towards moulting.

#### II instar

Freshly moulted 2nd instar larvae differed in size from earlier larvae. The colour of the larvae was yellowish green, and the color of the head capsule was light brown to reddish brown. Larval head capsule length and width are 3.18 mm x 2.81 mm (Table 2). Stage II takes an average of 2-3 days to complete

development (Table 1). The results, summarized in Table 1, showed a mean survival time of 2.4 days for 2nd instar larvae. The survival period of the 2nd instar larvae was 2-3 days.

#### III instar

Immediately after moulting, the larvae were pale yellow with a light brown head. Larval head capsule length and width are 4.24 mm x 4.01 mm (Table 2). Larval duration is 2-3 days with an average of  $2.45 \pm 0.11$  days (Table 1).

#### IV instar

Fourth instar larvae were dark green with light brown heads. The entire body was covered with sparse, short, upright hairs. Larval head capsule length and width are 5.80 mm x 5.20 mm (Table 2). The results summarized in Table 2 showed that the duration of stage 4 he varied between 2 and 4 days, with an average of  $2.90 \pm 0.18$  days.

#### Total larval period

The total larval period (Table 1) varied from 8 to 14 days with an average of 10.55 days. The total larval period of the diamondback moth was recorded as 8 to 14 days.

#### Pre-pupal and pupal period

The pre-pupal stage of the diamondback moth is a period of transition between the larval and pupal stages. During this stage, the larva ceases to feed and its movements become sluggish. The larva also becomes more contracted, and its body colour may change. The pre-pupal stage typically lasts for 1 to 2 days, with an average of  $1.5 \pm 0.11$  days. (Table 1). Finally, The larvae of the diamondback moth entered the pupal stage after the pre-pupal stage. The pupae are enclosed in a thin, silken cocoon that is pale green in color. The cocoon gradually becomes light yellow with brownish markings as the pupa matures. Table 1 indicates the duration of the pupal stage varies from 4 to 6 days, with an average of  $4.80 \pm 0.17$  days.

**Table 1:** *In vitro* biology of diamond back moth, *P. xylostella* L. on cabbage during rabi 2022-23

S. No.	Particulars/Stage	Duration(Days)		
		Minimum	Maximum	Mean $\pm$ S.Em*
1.	Egg period	4	6	$2.90 \pm 0.26$
2.	<b>Larval period</b>			
	I instar	2	4	$2.85 \pm 0.18$
	II instar	2	3	$2.40 \pm 0.11$
	III instar	2	3	$2.45 \pm 0.11$
	IV instar	2	4	$2.90 \pm 0.18$
	Total Larval period	8	14	$10.55 \pm 0.47$
3.	Pre-pupal period	1	2	$1.50 \pm 0.11$
4.	Pupal period	4	6	$4.80 \pm 0.17$
5.	Total (Pre-pupal + pupal period)	5	8	$6.15 \pm 0.25$
6.	Egg to adult emergence period	17	28	$21.35 \pm 0.82$
7.	<b>Total duration of life cycle (Egg to adult longevity)</b>			
	Male	23	34	$29.40 \pm 0.80$
	Female	26	40	$33.10 \pm 1.04$
9.	<b>Adult emergence (%)</b>			
	Male		39%	
	Female		61%	
	Sex ratio		1:1.56	

**Table 2:** Length and breadth of different stages of larval head capsule of diamondback moth, *P. xylostella* L. during 2022-23

Stage	Head capsule	
	Length (mm)	Breadth (mm)
I instar	1.4	1.64
II instar	3.18	2.81
III instar	4.24	4.01
IV instar	5.80	5.20

### Description

The adult diamondback moth is a small, slender insect with a brownish-grey body and ochreous white head. The forewings have a brown band that is constricted to form light-coloured diamonds on the back. The hind wings are narrow and light gray in color. The adult longevity of the diamondback moth ranges from 17 to 28 days, with an average of  $21.35 \pm 0.82$  days. The duration from the date of emergence to death of adults was considered as adult longevity.

Overall developmental period The period from the date of oviposition to the date of adult death was considered the length of the overall life cycle. The data presented in Table 1 showed that the total lifespan of *P. xylostella* on cabbage under laboratory conditions varied between 17 and 28 days, with an average of  $21.35 \pm 0.82$  days.

### Discussion

Previously, egg incubation periods were found to be 1–4 days (Murasing *et al.* 2019)<sup>[10]</sup>, 2–4 days (Harika *et al.*, 2019)<sup>[7]</sup>, and 3.10 days (Bhalla and Dubey, 1986)<sup>[3]</sup>. 2, 18 days (Devjani and Singh, 1999)<sup>[5]</sup>, 3-8 days (Varela *et al.*, 2003)<sup>[11]</sup>, 3-4 days (Kumar *et al.*, 1999)<sup>[9]</sup>, total development time 27-32 days (Ahmed *et al.*, 1999). 2004), with a total life cycle of 13–22 days (Goyal *et al.*, 2022)<sup>[6]</sup>. Findings from former employees corroborate the investigation. However, some errors may occur depending on the type of food, experiment period, climatic conditions, etc. The larva *P. xylostella* reached the 4th instar during the larval period he underwent three molts. The time spent by each step was recorded (Table 1).

### In conclusion

*Plutella xylostella* poses a serious threat to the successful forecasting of cruciferous plants. Knowledge of the diamondback moth's ecology influences the quality of the host plant and aids in the control of this insect.

### References

- Ahmad H, Kumar M, Sharma D, Jamwal VVS, Khan RB, Gupta S. Bionomics of diamondback moth, *Plutella xylostella* (L.) on cabbage. Ann. Pl. Protec. Sci. 2011;19(1):80-83.
- Anonymous. Statistics: Area and production statistics National Horticulture Board, 2022. [www.http://nhb.gov.in/database2021-22](http://nhb.gov.in/database2021-22).
- Bhalla OP, Dubey JK. Bionomics of the diamondback moth in the North Western Himalaya. 1986, 55-61.
- Chelliah S, Srinivasan K. In Diamondback moth management. (Talekar, N.S and Griggs, T.D., eds.): Proceedings of the First International Workshop, 1985, AVRDC, Taiwan. 1986, 63-76.
- Devjani P, Singh TK. Field density and biology of diamondback moth, *Plutella xylostella* L. (Lepidoptera: Plutellidae) on cauliflower. Journal of Advanced Zoology. 1999;20(1):53-55.

- Goyal R, Kumar V, Kumar A, Kumar A, Sati K, Prakash O, *et al.* Biology of diamondback moth (*Plutella xylostella* Linn.) on cauliflower under laboratory conditions. The Pharma Innovation Journal. 2022;11(9):1611-1615.
- Harika G, Dhurua S, Sreesandhya N, Suresh M, Rao SG. Biology of diamondback Moth, *Plutellae xylostella* (Lepidoptera: Plutellidae) of Cauliflower under Laboratory Condition. International Journal of Current Microbiology and Applied Sciences. 2019;8(1):866-873.
- Harcourt DG. Biology of diamondback moth, *Plutella maculipennis* (Curt.) (Lepidoptera: Plutellidae) in Eastern Ontario. II. Life history, behaviour and host relationship. Can. Entomol. 1957;89:554-64.
- Kumar SS, Nirmala D, Desh R. Bionomics and parasitization of diamondback moth, *Plutella xylostella* L., (Lepidoptera: Plutellidae). Journal of Entomological Research. 199;23(4):309-314.
- Murasing J, Vignesh M, Singh I. Biology of diamondback moth *Plutella xylostella* (Linn.) on cabbage variety pride of India under Manipur agroclimatic conditions. The Pharma Innovation Journal. 2019;8(9):75-77.
- Varela AM, Seif A, Lohr B. Aguide to IPM in Brassicas as production in Eastern and Southern Africa. The International Centre of Insect Physiology and Ecology (ICIPE), Nairobi, Kenya. 2003, 95.