*Int.J.Curr.Microbiol.App.Sci* (2019) *8*(1): 866-873

*International Journal of Current Microbiology and Applied Sciences*
***ISSN: 2319-7706*** **Volume 8 Number 01 (2019)**
Journal homepage: http://www.ijcmas.com

**Original Research Article** https://doi.org/10.20546/ijcmas.2019.801.094

# Biology of Diamondback Moth, *Plutellae xylostella* (Lepidoptera: Plutellidae) of Cauliflower under Laboratory Condition

**G. Harika[1*], S. Dhurua[2], N. Sreesandhya[2], M. Suresh[2] and S. Govinda Rao[2]**

*[1]DAATTC, Vizianagaram, AP, India*
*[2]ANGRAU, Agricultural College, Naira, A.P, India*

**Corresponding author*

**Keywords**

Biology, *Plutellae xylostella*, Cauliflower

**Article Info**

***Accepted:***
07 December 2018
***Available Online:***
10 January 2019

**A B S T R A C T**

Biological studies conducted during 2017-18 at the Post Graduation Research laboratory, Department of Entomology, Agricultural College, Naira on Diamondback moth, *Plutellae xylostella* (L.) (Lepidoptera: Plutellidae) revealed that the egg period (incubation period) varies from 2 to 4 days (Av. 3 ± 0.5 days). The larva passed through four different instars. The first, second, third and fourth instar larva lived for 2 to 3 days (Av. 2.5 days), 2 days (Av. 1.5 days), 1 to 3 days (Av. 1.75 ± 0.25 days) and 2 to 4 days (Av. 2.75 ± 0.25 days), respectively with a total larval period of 7 to 12 days (Av. 9 days). The pre-pupal and pupal stage lasted for 1 - 2 days (Av. 1.5 ± 0.5 days) and 3 to 5 days (Av. 4.25 ± 0.25 days), respectively. The adults lived for 3 to 7 days (Av. 4.5 ± 1 days) and the entire life span under laboratory conditions varied from 13 to 22 days (Av. 17.75 ± 0.25 days).

## Introduction

Cauliflower (*Brassica oleracea* var. *botrytis* Linn.) is an economically important winter vegetable of the several vegetables in the species *Brassica oleracea.* In India, it is cultivated in an area of 4.26 lakh ha. With an average annual production of 8199 Mt and productivity of 19.2 Mt $ha^{-1}$ (*www.indiastat.com*). The yield of cauliflower is adversely affected by many bottlenecks of which insect pests are of prime importance as they cause serious economic damage to cauliflower crop. Among all the pests, diamondback moth, which was long considered a relatively insignificant pest is now becoming a major pest even though its impact was overshadowed by serious defoliators such as cabbage worm, *Pieris rapae* (L.) and cabbage looper, *Trichoplusia ni* (H.) *etc*.

DBM is believed to have originated in the Mediterranean area and is cosmopolitan in distribution infesting cabbage, cauliflower, radish, turnip, mustard and amaranthus *etc*. Among these, cauliflower and cabbage are the most preferred host plants as their fleshy and succulent leaves provide necessary olfactory and gustatory stimuli for successful selection

and colonization. The biology of diamondback moth was studied by different diamondback moth researcher in India *i.e.* (Harcourt, 1957, Bhalla and Dubey, 1986, Chelliah and Srinivasan, 1986) revealed a variation in various parameters due to damage in environmental condition and different location. In view of the above problem, the present study was undertaken to study the biology of diamondback moth, *P. xylostella* (L.).

## Materials and Methods

### Biology of *P. xylostella* (L.)

### Rearing technique

With a view to study the biology of *P. xylostella*, initial culture of diamondback moth was developed by collecting large number of larvae from nearby cabbage and cauliflower cultivated fields of Srikakulam district. The larvae were reared on fresh cauliflower leaves in plastic jars, maintained at 25 ± 2°C and 70-75 per cent relative humidity in BOD incubator. Cauliflower was also cultivated at experimental field, Agricultural College Farm, Naira for fresh supply of food to the mass culture of diamondback moth.

Pupae were sorted and transferred to another rearing cage covered with muslin cloth for adult emergence. Emerged adults were separated and provided 10 per cent honey solution + multivitamin soaked in an absorbent cotton swab for feeding and cauliflower leaves for oviposition. Female moth lays creamy-white eggs on both the sides of the leaves. Leaves bearing eggs were removed and kept in another plastic jar for hatching. I, II, III and IV instars and were provided with fresh, cauliflower leaves and the process continued upto their pupation. Thus, the culture of *P. xylostella* was multiplied and maintained during the experimental period.

## Results and Discussion

### Egg

Freshly laid eggs were oval in shape, pale yellowish in colour and study on the site of egg laying indicated that the females of diamondback moth laid their eggs mostly singly or in small groups on the lower surface of the leaves near the midrib of petiole of cauliflower and also on the walls of the container. Similar observations on egg shape appearance were reported by Abraham and Padmanaban (1968), Vora *et al.*, (1985), Ramegowda *et al.*, (2006), Dhaduk (2007), Gowri and Manimegalai (2016). The results presented in Table 1 indicated that the incubation period of eggs varied from 2 to 4 days with an average of 3 ± 0.5 days (Plate 1). Earlier, the incubation period of eggs was found to be 4 days (Stapathi, 1990), 3.3 days (Chauhan *et al.*, 1997), 2.18 ± 0.12 days (Devjani and Singh,1999), 2 to 3 days (Kapadia and Koshiya, 1999), 3 to 4 days (Kumar *et al.*, 1999), 3 to 4 days (Sharma *et al.*, 1999), 3.0 to 5.25 days (Ramegowda *et al.*, 2006), 3.33 ± 0.42 days (Dhaduk, 2007), 3 to 4 days (Gangurde and Wankhede, 2010), 2 days (Gowri and Manimegalai, 2016). The results of the earlier workers support the investigation. Though, some variations might be due to type of food, duration of the experiment or climatic condition.

### Larva

During the larval period, *P. xylostella* has under gone three moultings and had four instars. The period occupied by each instar were recorded (Table 2).

### I instar

The first instar larvae soon after emergence were minute, white colour with a dark brown head. The I instar occupies 2 to 3 days on an

average of 2.5 days to complete its development (Table 2). Head capsule of the larva measures 1.48 mm X 1.66 mm in length and breadth (Table 6) (Figure 1). The size of larvae increased towards moulting (Plate 2). Earlier, Sharma *et al.,* (1999), Kumar *et al.,* (1999) and Dhaduk (2007) recorded the duration of first instar larva was found to be 2 to 3 days, 2 to 3 and 2.50 ± 0.50 days, respectively and supports the present study.

## II instar

The freshly moulted II instar larva differed from the previous instar with greater size. The larva was yellowish green in colour and head capsule was light brown to reddish brown in colour. Head capsule of the larvae measures 3.21 mm X 2.86 mm in length and breadth (Table 6) (Figure 2). The II instar occupies an average of 2 days to complete its development (Table 2), (Plate 3). The results summarized in the Table 2 indicated that the duration of the second instar larva on an average was 1.5 days. The duration of the second instar larva was recorded 1 to 1.5 days by Sharma *et al.,* (1999), 1 to 1.5 days by Kumar *et al.,* (1999) and 1.20 ± 0.25 days by Dhaduk (2007). Thus, the results of the earlier workers are in agreement with the present findings.

## III instar

Immediately after moulting, the larvae were light yellow in colour with light brown head. Head capsule of the larvae measures 4.26 mm X 4.07 mm in length and breadth (Table 6) (Figure 3).

The larval period ranges from 1 to 3 days with an average of 1.75 ± 0.25 days (Table 2), (Plate 4). Earlier, Sharma *et al.,* (1999), Kumar *et al.,* (1999) and Dhaduk (2007) recorded the duration of third instar larva was found to be 1 to 2, 1 to 2 and 1.84 ± 0.34 days, respectively and supports the present study.

## IV instar

The IV instar larva were dark green with light brown head. Body was covered with sparse short erect hairs all over its body. Head capsule of the larvae measures 5.88 mm X 5.24 mm in length and breadth (Table 6) (Figure 4). The results summarized in the Table 2 indicated that the duration of the fourth instar varied from 2 to 4 days with an average of 2.75 ± 0.25 days (Plate 5). The duration of the fourth instar larva was reported as 1.5 to 2.5 days (Sharma *et al.,* 1999), 1.5 to 2.5 days (Kumar *et al.,* 1999) and 2.04 ± 0.24 days (Dhaduk, 2007). Thus, the results of the earlier workers are in agreement with the present findings.

## Total larval period

The total larval period (Table 2) varied from 7 to 12 days with an average of 9 days. The total larval period of the diamondback moth was recorded as 8 to 11 days by Patil and Porkharkar (1971), 8 to 20 days by Vora *et al.,* (1985), 10 days in the hot and rainy seasons and 12 to 15 days in the cold season by Chelliah and Srinivasan, 1986, 11 days by Chauhan *et al.,* (1997), 10.5 ± 0.32 days by Devjani and Singh (1999), 9 to 10 days by Kapadia and Koshiya (1999), 7.58 ± 0.51 days by Dhaduk (2007) and 7 to 11 days by Gangurde and Wankhede (2010). The results of the earlier workers are in conformity with the present study.

## Pre-pupal and pupal period

The pre-pupal stage was recognized by the sluggish movement, absence of feeding and more contract form of larva. It was observed that the larvae underwent a pre-pupal stage which lasted for 1 to 2 days with an average of 1.5 ± 0.5 days (Table 3 and Plate 6). Finally, the larvae entered in pupal stage. Earlier, the pre-pupal period was recorded as 1 day

(Stapathi, 1990), 0.7 to 2.4 days (Kandoria *et al.*, 1994), 1 day (Kapadia and Koshiya, 1999), 1.20 ± 0.13 days and 2 days (Gowri and Manimegalai, 2016). The results of the earlier workers are in agreement with the present study.

The pupae had thin silken flimsy cocoon, pale green in colour but it gradually became light yellow with brownish markings. The results summarized in the Table 3 indicated that the duration of the pupal period varied from 3 to 5 days with an average of 4.25 ± 0.25 days (Plate 4.6). Earlier, the pupal period of *P. xylostella* was recorded as 3 to 7 days (Patil and Porkharkar, 1971), 4 to 5 days (Vora *et al.*, 1985), 4 days in the hot rainy season and 4 to 5 days in the cold season (Chelliah and Srinivasan, 1986), 5 days (Stapathi,1990), 3.3 to 11.4 days (Kandoria *et al.*, 1994), 5.9 days (Chauhan *et al.*, 1997), 6 to 7 days (Kapadia and Koshiya, 1999), 3 to 5 days (Sharma *et al.*, 1999), 3.50 to 4.75 days (Ramegowda *et al.*, 2006), 3 to 5 days (Dhaduk, 2007), 4.50 ± 1.11 days (Ahmad *et al.*, 2008), 3 to 5 days (Gangurde and Wankhede, 2010), 4.6 ± 0.37 days (Ahmad *et al.*, 2011) and 3 to 4 days (Gowri and Manimegalai, 2016).

**Table.1** Incubation period of eggs of *P. xylostella*

| No. of eggs observed | Incubation period (Days) | | |
|---|---|---|---|
| | Min. | Max. | Av. ± S.D. |
| **10** | 2 | 4 | 3 ± 0.5 |

**Table.2** Duration of different larval instars of *P. xylostella*

| Larval instar | No. of larvae observed | Duration (Days) | | |
|---|---|---|---|---|
| | | Min. | Max. | Av. ± S.D. |
| **First** | 20 | 2 | 3 | 2.5 |
| **Second** | 20 | 1 | 2 | 1.5 |
| **Third** | 20 | 1 | 3 | 1.75 ± 0.25 |
| **Fourth** | 20 | 2 | 4 | 2.75 ± 0.25 |
| **Total larval period** | 20 | 7 | 12 | 9 |

**Table.3** Pre-pupal and pupal period of *P. xylostella*

| No. of larvae | Duration (Days) | | | | | |
|---|---|---|---|---|---|---|
| | Pre-pupal period | | | Pupal period | | |
| | Min. | Max. | Av. ± S.D. | Min. | Max. | Av. ± S.D. |
| **20** | 1 | 2 | 1.5 ± 0.5 | 3 | 5 | 4.25 ± 0.25 |

**Table.4** Longevity of the adults of *P. xylostella*

| No. of adults | Duration (Days) | | |
|---|---|---|---|
| | Min. | Max. | Av. ± S.D. |
| **20** | 3 | 7 | 4.5 ± 1 |

**Table.5** Duration of life cycle of *P. xylostella* (egg to adult)

| No. of adults | Duration (Days) | | |
|---|---|---|---|
| | Min. | Max. | Av. ± S.D. |
| **20** | 13 | 22 | 17.75 ± 0.25 |

**Table.6** Length and breadth of head capsules of different larval instars

| Stage | Head capsule | |
|---|---|---|
| | Length (mm) | Breadth (mm) |
| **I instar** | 1.48 mm | 1.66 mm |
| **II instar** | 3.21 mm | 2.86 mm |
| **III instar** | 4.26 mm | 4.07 mm |
| **IV instar** | 5.88 mm | 5.24 mm |

**Fig.1** Length and breadth of head capsules of I larval instar

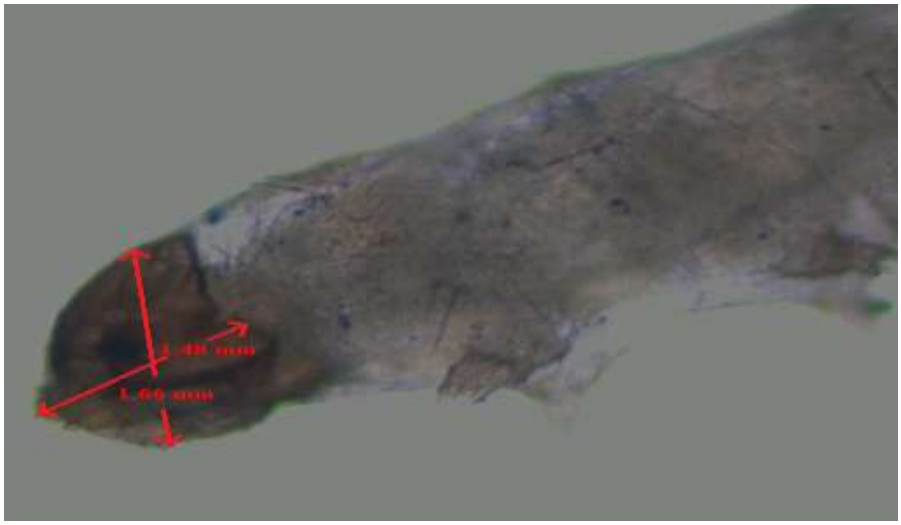
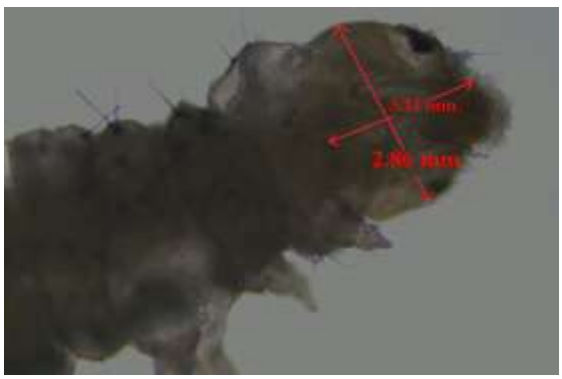


**Fig.2&3** Length and breadth of head and Length and breadth of head capsule of capsule II larval instar of III larval instar



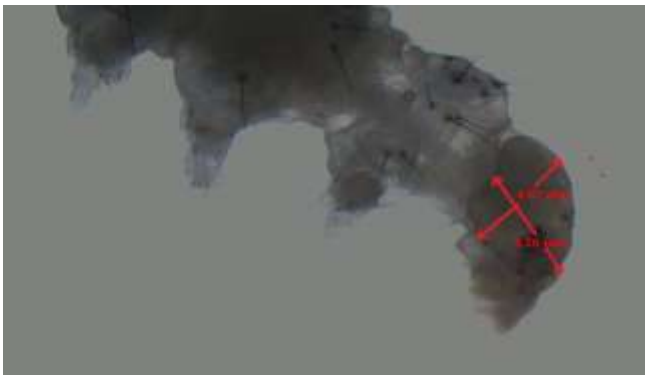


**Fig.4** Length and breadth of head capsules of IV larval instar

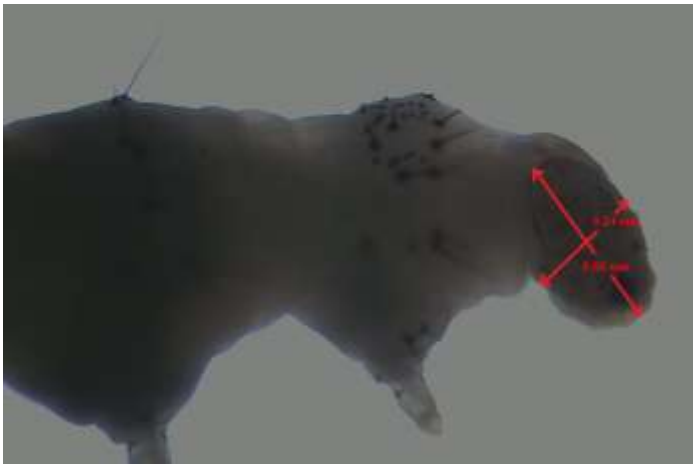


**Plate.1,2&3** Eggs & I instar & II instar

**late.4,5&6** III instar & IV instar & Pre-pupae and Pupae

## Description

Moths were small, slender and brownish grey in colour with ochreous white head. The moths had brown band on the fore wings which is constricted to form light coloured diamonds on the back and hind wings are narrow, light grey in colour. The adult longevity ranges between 3 days to 7 days on an average of 4.5 ± 1 days to complete the development.

## Longevity

The duration from the date of emergence to death of adults was considered as the adult

longevity. The results presented in Table 4 indicated that the adults lived for 3 to 7 days with an average of 4.5 ± 1 days. Earlier, the longevity of the adults was reported as 6 to 13 days by Chelliah and Srinivasan, 1986 and 3 to 4.27 days by Ramegowda *et al.*, 2006.

## Total development period

The duration of total life cycle was considered as the period between the date of egg laying to the date of death of adults. Data presented in Table 5 revealed that the entire life span of *P. xylostella* on cauliflower under laboratory conditions varied from 13 to 22 days with an average of 17.75 ± 0.25 days. Earlier, the total life cycle has been reported as 11.93 to 21.2 days (Abro *et al.*, 1992) and 14 to 22 days as reported by Gangurde and Wankhede (2010). The results of the earlier workers are in conformity with the present study.

In conclusion, *Plutella xylostella* is a serious threat to successful prediction of cruciferous vegetables. Knowledge of the biology of diamondback moth influences the host plant quality and helps in the management of this insect.

## Acknowledgements

The study is a Part of M.Sc. (Ag.) thesis submitted by the senior author to Acharya N G Ranga Agricultural University, Lam, Guntur, Andhra Pradesh. The senior author is highly thankful to Acharya N.G. Ranga Agricultural University, Lam, Guntur, Andhra Pradesh for the financial assistance in the form of stipend and providing the facilities for conducting the research work.

## References

Abraham EV and Padmanaban MD. Binomics and control of the diamondback moth, *Plutella maculipennis curtis*. Indian Journal of Agricultural Science. 1968; 38(3): 513-19.

Abro GM, Soomro RA and Syed TS. Biology and behavior of diamondback moth, *Plutella xylostella* (L.). Pakistan Journal of Zoology. 1992; 24: 7-10.

Ahmad H, Kumar M, Sharma D, Jamwal VVS, Khan RB and Gupta S. Binomics of the diamondback moth, *Plutella xylostella* (L.) on cabbage. Annals of Plant Protection Science. 2011; 19(1): 80-83.

Ahmad T, Ali H and Ansari MS. Biology of diamondback moth *Plutella xylostella* (Linn.) on *Brassica juncea* cv. PUSA BOLD. Asian Journal of Bio Science. 2008; 3(2): 260-262.

Bhalla OP and Dubey JK. Bionomics of the diamondback moth in the North Western Himalaya. 1986; 55-61.

Chauhan U, Bhalla OP and Sharma KC. Biology and seasonality of the diamondback moth, *Plutella xylostella* L. (Lepidoptera: Yponomeutidae) and its parasitoids on cabbage and cauliflower. Pest Management in Horticultural Ecosystems. 1997; 3(1): 7-12.

Chelliah S and 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 Pp.

Devjani P and 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.

Dhaduk AK. Biology, population dynamics and chemical control of diamondback moth, *Plutella xylostella* (Linnaeus) on cabbage (*Brassica oleracea*). M.Sc. (Ag.) Thesis submitted to Junagadh Agricultural University. Junagadh.

2007.

Gangurde SM and Wankhede SM. Biology of diamondback moth, *Plutella xylostella* Linn. International Journal of Plant Protection. 2010; 2(2): 165-166.

Gowri G and Manimegalai K. Biology of diamondback moth, *Plutella xylostella* (Lepidoptera: Plutellidae) of cauliflower under laboratory condition. International Journal of Fauna and Biological Studies. 2016; 3(5): 29-31.

Harcourt DG. Biology of diamondback moth, *Plutella maculipennis* (Curt.) (Lepidoptera: Plutellidae) in Eastern Ontario. II. Life-history, behavior and host relationship. Can. Entomol. 1957; 89:554-64.

http://www.indiastat.com. Ministry of agriculture, Government of India, 2014-15. Accessed on 16-09-2017.

Kandoria JL, Lal A and Singh L. Biology of diamondback moth, *Plutella xylostella* (L.) on cauliflower. Journal of Insect Science. 1994; 7(1): 76-80.

Kapadia MN and Koshiya DJ. Biology and natural enemies of *Plutella xylostella* (L.) on its new host food plant. GAU Research Journal. 1999; 24(2): 106-107.

Kumar SS, Nirmala D and Desh R. Bionomics and parasitization of diamondback moth, *Plutella xylostella* L. (Lepidoptera: Plutellidae). Journal of Entomological Research. 1999; 23(4): 309-314.

Patil SP and Pokharkhar RN. Diamondback moth, a serious pest of cruciferous. Research Journal of Mahatma Phule Agriculture University. 1971; 2(2): 134-139.

Ramegowda GK, Patil RS, Guruprasa GS and Naik LK. Biology of diamondback moth, *Plutella xylostella* (L.) on mustard in laboratory. Journal of Entomological Research. 2006; 30(3): 241-243.

Sharma SK, Devi N and Deshraj. Binomics and parasitization of diamondback moth, *Plutella xylostella* L. (Lepidoptera: Plutellidae). Journal of Entomological Research. 1999; 23(4): 309-314.

Stapathi CR. Biology of diamondback moth, *Plutella xylostella* (L.). Environment and Ecology. 1990; 8(2): 784-785.

Vora VJ, Bharodia RK and Kapadia MN. Pests of oilseed crops and their control: Rape and mustard. Pesticides. 1985; 19(1): 38-40.

**How to cite this article:**

Harika, G., S. Dhurua, N. Sreesandhya, M. Suresh, Govinda Rao, S. 2019. Biology of Diamondback Moth, *Plutellae xylostella* (Lepidoptera: Plutellidae) of Cauliflower under Laboratory Condition. *Int.J.Curr.Microbiol.App.Sci.* 8(01): 866-873.
doi: https://doi.org/10.20546/ijcmas.2019.801.094