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Biology of diamondback moth, *Plutellae xylostella*, (Linn.) (Lepidoptera: Plutellidae) on cabbage under laboratory condition

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Abstract

Biological studies conducted during 2021-22 under laboratory condition at BTCCARS, Bilaspur on diamondback moth, *Plutellae xylostella* (Linn.) (Lepidoptera: Plutellidae) revealed that the egg period (incubation period) varies from 3 to 5 days (Av. 3.90 ± 0.20 days). The larva passed through four different instars. The first, second, third and fourth instar larva lived for 2 to 3 days (Av. 2.40 ± 0.11), 2 to 3 days (Av. 2.75 ± 0.10), 2 to 3 days (Av. 2.65 ± 0.11) and 2 to 4 days (Av. 3.10 ± 0.14), respectively with a total larval period of 8 to 13 days (Av. 10 ± 0.41). The pre-pupal and pupal stage lasted for 1 - 2 days (Av. 1.5 ± 0.11) and 3 to 5 days (Av. 4.10 ± 0.16), respectively. The entire life span under laboratory conditions varied from 15 to 25 days (Av. 20.75 ± 0.73).

Keywords: Diamondback moth, *Plutellae xylostella* (Linn.), laboratory condition

Introduction

Cabbage (*Brassica oleracea* var. *Capitata*, Linn.) is an economically important winter vegetable of the several vegetables in the species *Brassica oleracea*. India is the second largest producer of vegetables in the world next only to china. In India, area under cultivation of cabbage is around 4.03 lakh hectares with annual production of 93.69 lakh metric tones during the year 2019-20. (Anonymous, 2022) [22]. The yield of cabbage is adversely affected by many bottlenecks of which insect pests are of prime importance as they cause serious economic damage to cabbage 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) [8, 3, 4] 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* (Linn.).

Materials and Methods

Biology of *P. xylostella* (Linn.) 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 cultivated fields of Bilaspur district. The larvae were reared on fresh cabbage leaves in plastic jars, maintained at 25 ± 2 °C in BOD incubator. Cabbage was also cultivated at experimental field, Agricultural College Horticulture Farm, Bilaspur 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, cabbage leaves and the process continued up to their pupation.

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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 cabbage and also on the walls of the container. Table 1 indicated that the incubation period of eggs varied from 3 to 5 days with an average of 3.90 ± 0.20 days.

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 2.4 days to complete its development (Table 1). Head capsule of the larva measures 1.50 mm X 1.68 mm in length and breadth (Table 2). The size of larvae increased towards moulting.

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 3.24 mm X 2.88 mm in length and breadth (Table 2). The II instar occupies an average of 2 -3 days to complete its development (Table 1). The results summarized in the Table 1 indicated that the duration of the second instar larva on an average was 2.75 days. The duration of the second instar larva was recorded 2 to 3 days.

III Instar

Immediately after moulting, the larvae were light yellow in colour with light brown head. Head capsule of the larvae measures 4.29 mm X 4.08 mm in length and breadth (Table 2). The larval period ranges from 2 to 3 days with an average of 2.65 ± 0.11 days (Table 1)

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 5.90 mm X 5.26 mm in length and breadth (Table 2). 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 3.10 ± 0.14 days.

Total larval period

The total larval period (Table 1) varied from 8 to 13 days with an average of 10 days. The total larval period of the diamondback moth was recorded as 8 to 13 days.

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 ± 0.11 days (Table 1). Finally, the larvae entered in pupal stage. 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 1 indicated that the duration of the pupal period varied from 3 to 5 days with an average of 4.10 ± 0.16 days.

Table 1: Biology of different life stages of diamond back moth, *P. xylostella* L. on cabbage during *rabi* 2021-22 under laboratory conditions.

S. No.	Particulars/Stage	Duration(Days)		
		Minimum	Maximum	Mean \pm SEM*
1.	Egg period	3	5	3.90 ± 0.20
2.	Larval period			
	I Instar	2	3	2.40 ± 0.11
	II Instar	2	3	2.75 ± 0.10
	III Instar	2	3	2.65 ± 0.11
	IV Instar	2	4	3.10 ± 0.14
	Total larval period	8	13	10 ± 0.41
3.	Pre-pupal period	1	2	1.50 ± 0.11
4.	Pupal period	3	5	4.10 ± 0.16
5.	Total (Pre-pupal + pupal period)	4	7	5.35 ± 0.22
6.	Egg to adult emergence period	15	25	20.75 ± 0.73
7.	Total duration of lifecycle (Egg to adult longevity)			
	Male	22	34	27.90 ± 0.90
	Female	26	40	33 ± 1.18
9.	Adult emergence (%)			
	Male		38%	
	Female		62%	
	Sex ratio		1:1.63	

Table 2: length and breadth of larval head capsule of diamondback moth, *P. xylostella* L. during 2021-22

Stage	Head capsule	
	Length (mm)	Breadth(mm)
I instar	1.50	1.68
II instar	3.24	2.88
III instar	4.29	4.08
IV instar	5.90	5.26

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 15 days to 25 days on an average of 20.75 ± 0.73 days to complete the development. Longevity The duration from the date of emergence to death of adults was considered as the adult longevity. 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 1 revealed that the entire life span of *P. xylostella* on cabbage under

laboratory conditions varied from 15 to 25 days with an average of $20.75.75 \pm 0.73$ days.

Discussion

Earlier, the incubation period of eggs was found to be 1 to 4 days (Murasing *et al.* 2019) ^[10], 2 to 4 days (Harika *et al.*, 2019) ^[7], 3.10 days (Bhalla and Dubey, 1986) ^[3], 2.18 days (Devjani and Singh, 1999) ^[5], 3 to 8 days (Varela *et al.*, 2003) ^[11], 3 to 4 days (Kumar *et al.*, 1999) ^[9], total development period 27-32 days (Ahmed *et al.*, 2004) ^[1], 13 -22 days total life cycle (Goyal *et al.*, 2022) ^[6]. 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 1).

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.

References

1. 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.
2. Anonymous. Statistics: Area and production statistics national Horticulture Board; c2022. [www.http://nhb.gov.in/database2021-22](http://nhb.gov.in/database2021-22).
3. Bhalla OP, Dubey JK. Bionomics of the diamondback moth in the North Western Himalaya; c1986. p. 55-61.
4. 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; c1986. p. 63-76.
5. 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.
6. 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 condition. The Pharma Innovation Journal. 2022;11(9):1611-1615.
7. 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.
8. Harcourt DG. Biology of the Diamondback Moth, *Plutella maculipennis* (Curt.) (Lepidoptera: Plutellidae), in Eastern Ontario. II. Life-History, Behaviour, and Host Relationships1. The Canadian Entomologist. 1957 Dec;89(12):554-564.
9. Kumar SS, Nirmala D, Desh R. Bionomics and parasitization of diamondback moth, *Plutella xylostella* L., (Lepidoptera: Plutellidae). Journal of Entomological Research. 1999;23(4):309-314.
10. Murasing J, Vignesh M, Singh I. Biology of diamond back moth *Plutella xylostella* (Linn.) on cabbage variety pride of India under Manipur agroclimatic conditions.

The Pharma Innovation Journal. 2019;8(9):75-77.

11. 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; c2003. p. 95.