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Biology of diamond back moth *Plutella xylostella* (Linn.) on cabbage variety pride of India under Manipur agroclimatic conditions

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Abstract

Diamond back moth (*Plutella xylostella* (Linn.)) (Lepidoptera: Plutellidae) is one of the major constraints for profitable cultivation of cabbage (*Brassica oleracea* var. *capitata* Linn.). Since the biology of an insect pest differs in different regions based on the weather factors of the particular area, the sufficient knowledge about the biology of an insect pest is necessary for adopting suitable control measures in a particular region. Almost no systematic works have been done on this aspect in Manipur. Therefore, the investigation of biology of diamond back moth is carried out on cabbage var. 'Pride of India' under Imphal agro-ecological situations during *Rabi* season of 2014-15. Based on the laboratory study conducted different biological aspects of DBM is discussed briefly in this paper.

Keywords: *Plutella xylostella*, *Brassica oleracea*, biology

Introduction

In Manipur, cabbage (*Brassica oleracea* var. *capitata* Linn.) is widely cultivated as a winter crop which plays an important role in the people daily diet. The productivity of the crop is only 10.1 M.T/ha in Manipur as compared to the national productivity of 22.89 M.T/ha (FAO, 2018 and Anon., 2018) [3]. The reason for this low yield can be attributed to the attack of the cabbage crops by insect pests coupled with a lack of proper and scientific study on the nature and control of such pests. One among these pests of greater importance is diamond back moth which is the first insect to create resistance against *Bt* spray and most of the commercial insecticides used to control them. Since the biology of an insect pest differs in different regions so, the sufficient knowledge about the biology of an insect pest is necessary for adopting suitable control measures in a particular region. However, biology of the pest was studied by various workers but with contradictory records. Almost no systematic works have been done on this aspect in Manipur. Therefore, it was considered imperative to initiate investigation on this aspect on diamond back moth the major pest of cabbage which is most popularly cultivated in Manipur.

Materials and methods

The biology of *P. xylostella* is studied on cabbage var "Pride of India" under room temperature ($20^{\circ}\text{C} \pm 3^{\circ}\text{C}$) and relative humidity (83 ± 5 per cent). The larvae collected from the pesticides unsprayed field were kept in petridishes measuring 150 cm in diameter and 7 cm in depth. A piece of moist blotting paper was kept at the bottom of the petridishes to provide suitable moist conditions. The fresh leaves collected from the pesticides free field were provided daily till pupation. Pupae were removed and kept in cages measuring 30 cm x 30 cm x 30 cm for adult emergence. After their emergence a pair of male and female moth was separated and released on a cabbage seedling keeping inside the oviposition cage (45 cm^3) for egg laying. Ten such pairs were maintained for this study. Moths were provided with water and 50% honey solution on cotton swabs. Observations on numbers of eggs laid were made daily until the adult die. Eggs laid on the leaf were kept separately in plastic container ($15\text{ cm} \times 10\text{ cm}$) covered with black muslin cloth. On hatching the larvae reared separately providing daily fresh cabbage leaf in each container. On completion of the development, pupae were collected and kept in rearing cage (3 cm^3) to allow adult emergence providing two swabs of cotton wool, one containing water and the other 50 % honey solutions. Detailed observations on incubation, larval and pupal period as well as adult were recorded.

Results and discussions

The mean data of biological study of *P. xylostella* presented in Table 1. Adults started to lay eggs after the one day of emergence. Most of the eggs were laid in the first five days of their life time. Eggs were laid all over the plant and few eggs were also laid on the cotton which was use for the feeding purpose. Anyhow most of the eggs were found on the leaves (both upper and lower surfaces). In which majority of the eggs were laid on the above surface of the leaves. Egg laying lasted for 5 days. Average eggs laid per female were 190.36 ± 36.84 . The incubation period was ranged from 1 to 4 days with mean duration of 2.41 ± 0.031 days. First instar was not feeding on the upper side of the leaves where there is most waxy layer present. They fed in the below surface of the leave causing the window like symptom which was like leaf mining. The later instars were feeding on the upper part of the leaf and they don't create any windows like symptom, they

simply skeletonise the leaf leaving only the veins intact. Total larval period ranged from 15 to 18 days with the mean of 16.7 ± 1.05 days. Larval size was 6.63 ± 0.35 mm and the width was 1.43 ± 0.09 mm during the final instar. After the last instar period is completed larva stopped feeding and searched for the perfect pupation area spinning the web around the body which is a prepupal period and it lasts for 2.1 ± 0.57 with the range of 2 to 3 days. Then the larva enters into the pupal stage. It was obctect pupae had light green colour initially further turned into yellow and finally became dark brown. The mean pupal period was 7.27 ± 0.147 and its period ranged from 5 to 9 days. Pupal length was 6.83 ± 0.11 and width was 1.53 ± 0.10 mm. Mean adult emergence percentage was around 88.40 ± 1.20 . The mean adult longevity was 10.54 ± 1.29 with the range from 9-14 days. The result further showed that the duration of life cycle varied from 33 to 41 days.

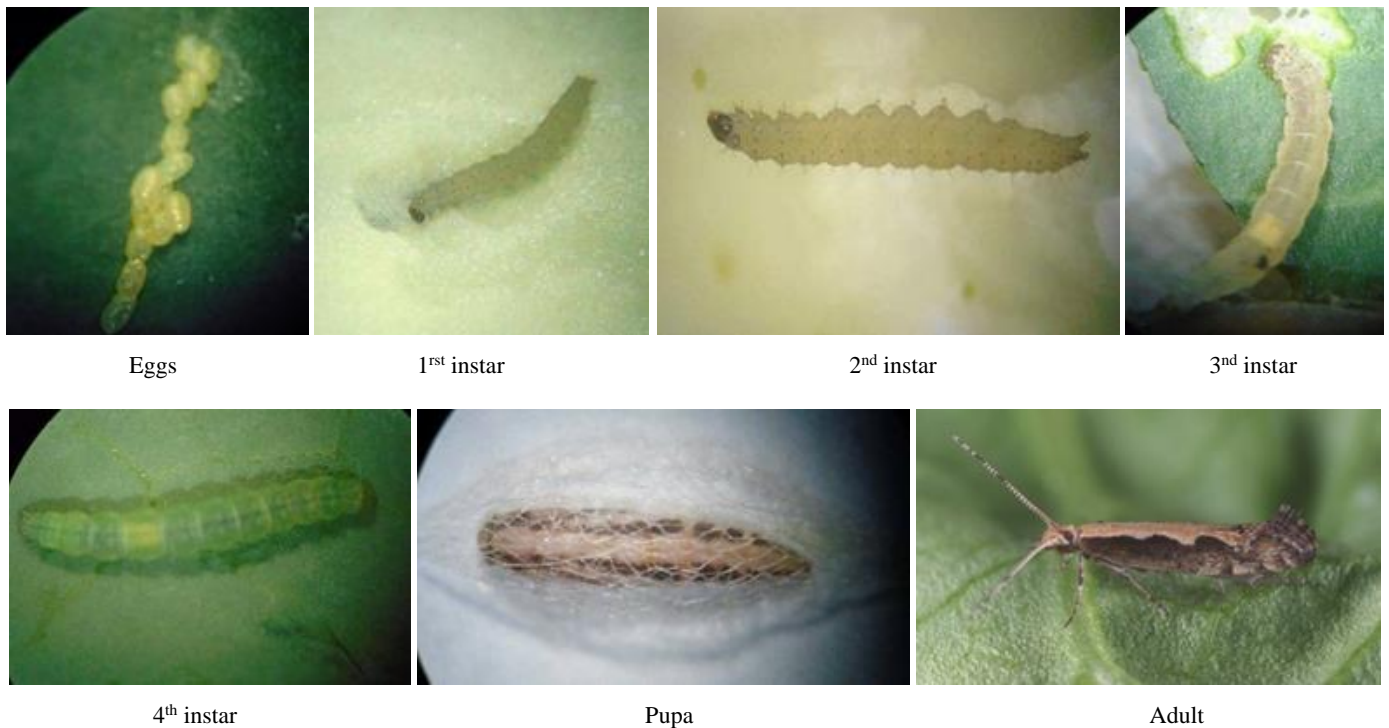


Fig 1: Different life stages of diamond back moth

Table 1: Biology of *P. xylostella* on cabbage variety 'Pride of India'

Biological events	Mean ± SD	Range
Fecundity (Eggs/Female)	190.36±36.84	93 – 261
Incubation period (days)	2.41±0.031	1 – 4
Larval period (days)	16.7±1.05	15-18
1st instar	3.6±0.4	3-4
2nd instar	3.7±0.45	3-4
3rd instar	4.4±0.52	4-5
4th instar	5.1±0.57	4-6
Prepupal period	2.1±0.57	2-3
Pupal period(days)	7.27±0.147	5 – 9
Pupal size (mm)	6.83±0.11	6.1-6.9
Length (mm)	1.53±0.10	1.4-1.6
Width (mm)		
Adult longevity(days)	10.54±1.29	09– 12
Adult emergence percentage	88.40±2.20	79-90
Total life cycle (days)	36.61±1.31	33 - 41

Conclusion

Diamond back moth *Plutella xylostella* (Linn.) the most serious pest of cabbage which could complete its life cycle within a period of 36.61 ± 1.31 days with a fecundity of 190.36 ± 36.84 eggs/female on the variety "Pride of India" under agro-climatic conditions of Manipur. Thus, the results observed through this study revealed that the biology of DBM remains same as the other regions but as the temperature was reported to play major role in the biology of most of the lepidopteron pests variation in the biology is also expected in the upcoming years as it is already a prediction of 1 °C increase in the temperature due to the global warming. So the closer look into the biology of diamondback in the upcoming years also needed to pin point the variation in the biology to take timely action.

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Current study is in line with the studies conducted by Abraham and Padmanabhan (1968)^[1], Jayarathnam (1977)^[4], Hasan and Singh (2008)^[6] and Meena and Singh (2012)^[5].

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