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Development of white butterfly, *Pieris brassicae* L. in cabbage ecosystem

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Abstract

The eggs of butterfly, *Pieris brassicae* were collected from cabbage field during February- March 2018. The collected individuals were transferred into insect collection paper packs and were brought to the laboratory for further study. The caterpillars feed fresh leaves of cabbage. The pupal stage on host plants, adults emerge in mid-spring and eggs lying in bunch on the undersides of outer of leaves. The incubation period of eggs was 4.80 ± 0.45 days while 26-27 days were taken by larvae. The last instar larvae were found to change into pupae by spinning cocoon. The total period of pupae was 7.91 ± 0.80 days. The newly emerged adult were separated and identified. The wing span of male and female were 60 mm and 70mm, respectively. These finding could be used in management of *P. brassicae*.

Keywords: Life cycle, cabbage, white butterfly (*Pieris brassicae* L.)

Introduction

Cabbage is one of the most widely cultivated vegetables of the temperate zone. This cold climate vegetable is known for its ball-shaped "head" which is eaten in both the raw and cooked form. *Brassica* spp is an important and highly diversified group of crops grown worldwide [1]. Cabbage or headed cabbage (*Brassica oleracea*) is a leafy green or purple biennial, grown as an annual vegetable crop for its dense-leaved heads. Closely related to other Cole crops, such as a broccoli and cauliflower, it descends from *B. oleracea* var. *oleracea*, a wild field cabbage (Cabbage Wikipedia). Their leaves can range from smooth to crinkled, green to red. Butterflies are the most beautiful and attractive than most other insects and have fascinated human imagination and creativity. They are valuable pollinators when they move from plant to plant, gathering nectar and are the one of the important food chain components of the birds, spiders and predatory insects. Approximately 17,200 species of butterfly are found throughout the world, of which 1,501 species of butterfly are known from India [2]. In India, rapeseed mustard, *Brassica* spp. is attacked by more than 40 insect pests. *Pieris brassicae* (Lepidoptera: Pieridae) is commonly known as the large white butterfly. It is a destructive cosmopolitan and the most widely distributed lepidopteran pest of crucifers [3]. The largest Indian butterfly is Common Bird wing, *Troideshelena* (Linn.) with a maximum expanse of 190mm and the smallest is Grass Jewel, *Freyeriatro chilusputli* (Kollar) with a minimum expanse of 15mm [4]. Cabbage butterfly, *Pieris brassicae* (L.) has emerged as one of the major insect pest of cabbage vegetable crop. A 92 percent yield loss in *Brassica* spp. and a 19.76 per cent yield loss exclusively on *Brassica carinata* PC-5 were due to this pest infestation [5]. Past studies on biology revealed that *P. brassicae* lays eggs in clusters and those first instar larvae feed gregariously [6-8] manage the population of butter fly before feeding time by different insecticides under natural field condition and increase quality and quantity of the crop yield

Materials and methods

Experimental site

Dashmesh Khalsa College Zirakpur, near Nabha Sahib Gurudwara, S.A.S Nagar (Mohali) district is located in the eastern part of the Punjab state and lies between North latitudes of $30^{\circ}21'00''$ and $30^{\circ}56'00''$ and East longitudes of $76^{\circ}30'00''$ and $76^{\circ}55'00''$ covering a geographic ambience of 1189 sq.km. The district Zirakpur is bounded by Patiala and Fatehgrah Sahib Districts in the south-west, Ropar district in the northwest, Chandigarh and

Panchkula in the east and Ambala district of Haryana state in the south. The major soil type of the district is weakly colonized tropical arid brown soils.

Collection of eggs

The eggs of butterfly, *Pieris brassicae* were collected from cabbage field during 20 February, 2018. They were very small in size, rounded and yellowish in colour (Figure 1). The collected eggs with cabbage leaves were transferred into a jar (20×10 cm) and were kept in the rearing room. The temperature of rearing room was maintained at 27±2 °C with 65±5% RH. The actual size of eggs was about 1-3 mm in diameter (like a pinhead or smaller). The incubation period of eggs was 4.80±0.45 days (Figure 2).

Maintenance of larvae of *P. brassicae*

The jars with butter fly eggs were left undisturbed till the emergence of the larvae. The newly emerged larvae feed on leaves by scraping the chlorophyll of leaves. The instar neonate larvae were found to feed on cabbage leaves in gregarious form (Figure 1). After second instar, the larvae were noticed to disperse into neighbouring leaves or plant. The leaves were defoliated by later instar larvae. The quantity of food as leaves was maintained throughout the development of butter fly. The jar was cleaned after every moult in later stage and the larvae were carefully transferred into another clean jar. The larvae were noticed to transform into pupae in 26-28 days (Figure 2).

Rearing of pupae

The final instar larvae were separated from jar. They can be easily noticed from the larvae of different ages. Fully grown caterpillars were 45mm long, olive green with a yellow line along the top of the body (Figure 1). The mature caterpillars were the body is covered in splotchy black dots and patches with short black hair over the whole body. The head is bluish-grey with black patches. The final stage larvae were sluggish and stop feeding. These larvae were transferred into another jar and left the larvae till the pupation. The pupa was anchored to leaves by a silken thread. The total cycle of pupae were completed in 7.91±0.62 days (Figure 2).

Maintenance of adults

The newly emerged adults were collected from the jar. The wing span of adult male and female was 60 mm and 70mm, respectively (Figure 3). The upper sides of wings were whitish in colour. Forewing had a black tip, and two black dots with a black smear were noticed on the forewings of female butterfly. The undersides of the wings were pale yellow, dusted with grey. Total life span of both male and female of *P. brassicae* were 7.65±0.56 and 7.82±0.62 days, respectively (Figure 2). We have observed some activities like as hibernation, basking, puddings or migrating need to be at the proper place at the proper time.

Feeding and basking of *P. brassicae*

The caterpillar and adult stage butterfly have very different food preferences due to differences in their mouth parts. Caterpillars have chewing mouth parts as mandibles which are able to eat leaves in "U" shape and other plant parts. Caterpillars do not need to drink additional water because they get all need from the plants through a tube-like tongue is proboscis. The adult butterflies are able to feed only on various liquids. Most butterflies prefer flower nectar but

others may feed on the liquids found in rotting fruit, in ooze from trees and animal dung. Butterflies are preferred to feed in sunny areas protected from wind. Butterflies are cold-blooded meaning they cannot regulate their own body temperature. As a result, their body temperature changes with the temperature of their surroundings. Butterflies survive temperatures between 82-100 °F are best.

Results and Discussion

After mating with a male, the female butterfly must go in search of a plant on which to lay her eggs. Because the caterpillars that will hatch from her eggs were very particular choosing a leaves of plant. We can recognize the right plant species by its leaf color and shape. This scratches the leaf surface, causing a characteristic plant odor to be released on the plants leave. Some butterflies lay a single egg, while others may be lay their eggs in clusters form. A sticky substance produced by the female enables the eggs to stick where ever she lays them, either on the underside of a leaf or on a stem. The present study is similarly with reported 17–35 eggs per plant [7] and 36-40 eggs per plant [9]. Our experiments demonstrated that the *P. brassicae* which caused a longer development period. The *P. brassicae* were with highest total number of eggs laid per plant and eggs per cluster form same suggesting [10].

The incubation period was shortest on *P. brassicae* during generations in this study. On the other hand higher hatching percentage of eggs, faster growth of insect during different larval instars, pre-pupal, pupal and adult stages were observed in this species. The development period during generations were shortest also reported that *P. brassicae* [11]. Batches of eggs which were laid within an hour of each other may begin to hatch several hours apart, and the time taken for all the eggs in one batch to hatch was found to range from two hours to about seven. A fertilised female lays scarcely any infertile eggs. The fertility after one mating falls below 100 per cent, after about 14 days, but normally the female mates again before this time. Temperature naturally affects the time taken by the eggs to hatch. The shortest time was about ¾ days at 28 °C the longest observed was 17 days at 12.5 °C. Hatching percentage was significantly higher in all generations.

In this present work each cluster contains about 50-80 eggs. Eggs laying period lasted about 2 days, freshly laid eggs are yellowish in colour. As the larvae develop inside the ova, the colour is gradually changed usually darkening one day before hatching. The growth period of the 1st larval instar was significantly on *P. brassicae*. The growth period of the second instar of *P. brassicae*, the second instar growth period was superb. Our study was in agreement with the reports for 2.3–4.7 days [12]. The third instar revealed that the maximum third instars growth period on *P. brassicae* was during the generation. Our study confirms the findings of who reported 2.2–4.9 days [12]. Development of the fourth instar was significantly is maximum growth. The maximum growth period of the fifth instar is on *P. brassicae* during the generation respectively. Adult period of *P. Brassicae* with 4–5 days, which may be due to different host and environmental conditions [13]. The total development period was significantly on *P. brassicae*. Our result is similarly with who reported the total development period ranging from 32–64 days in three generations [12]. Based on the results from this study and the above conclusions, damage caused by *P. brassicae* could be reduced by growing resistant *Brassica* sp to reduce the yield loss of crop.

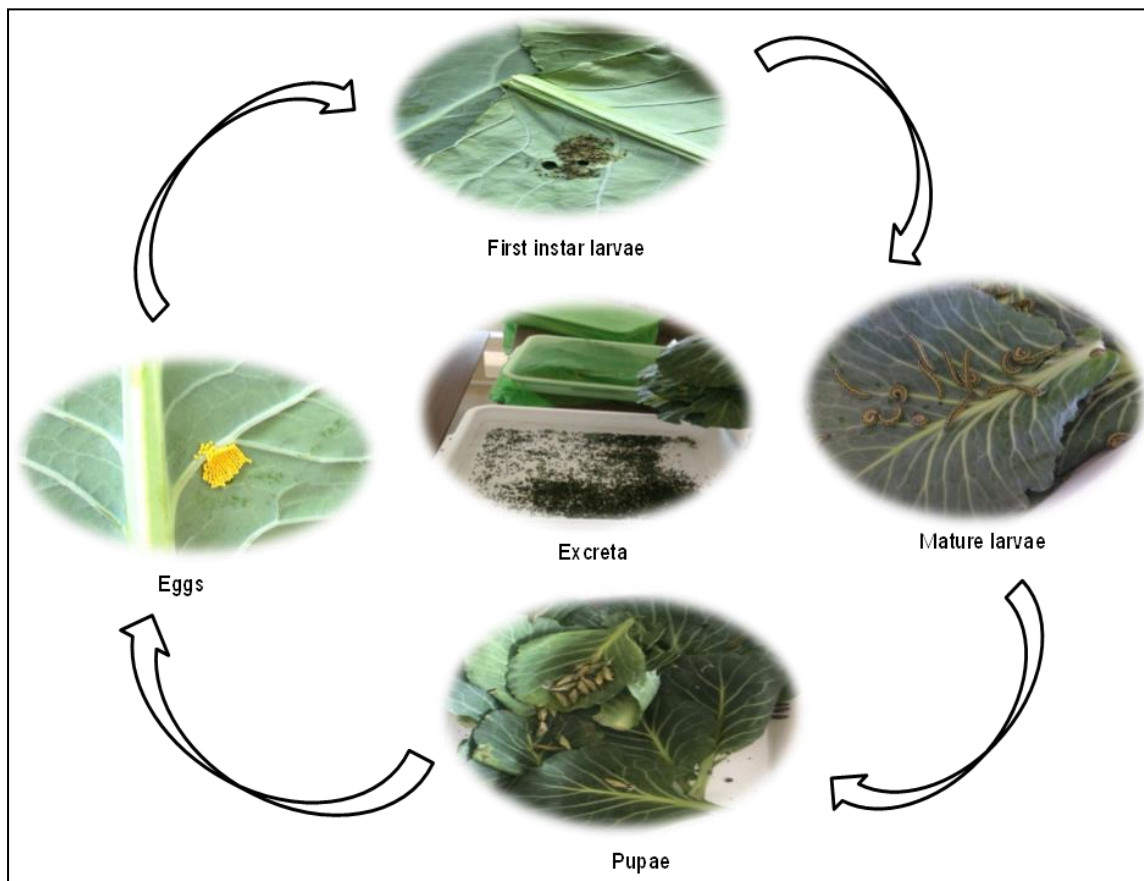


Fig 1: Biology of *P. brassicae* on cabbage

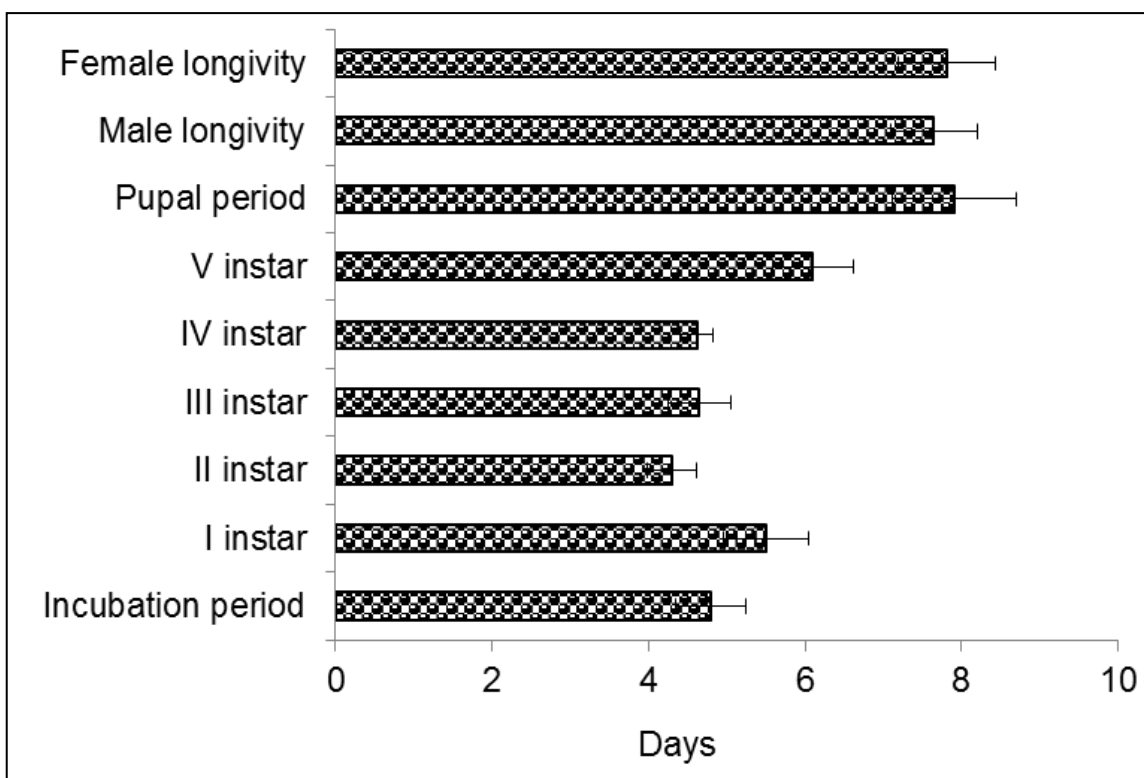


Fig 2: Duration of different stages of *P. brassicae* on host plant

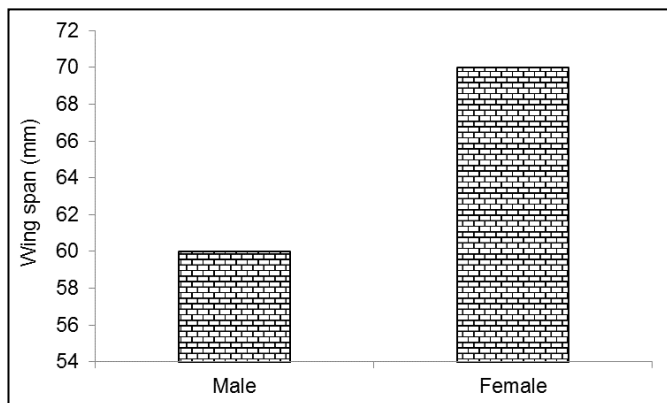


Fig 3: Wing span of both male and female of *P. brassicae*

Conclusion

Eggs collected with using a sweep net from Experiment field of college during *kharif*-2018. Butterfly eggs are very small, eggs are really small round, and pinhead or smaller varies. Caterpillars have chewing mouth are mandibles, which enable them to eat leaves in “U” shape and other plant parts. The female butterfly attaches the eggs to leaves or stems of plants that will also serve as a suitable food source for the larvae when they hatch. The larva, or caterpillar, that hatches from the egg is the second stage in the life cycle. Egg lying of butterfly insects on cabbage leaves and increase the population of butterfly which damages the cabbage crop. Overall results obtained showed the *in-vitro* manage the *P. brassicae* before instars forming of butterfly and managing the *P. brassicae* under in the field condition by various insecticides after that increase the quality and quantity yield of cabbage.

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