



# A Comparative Study On The Biology Of *Pieris Brassicae* On Cruciferous Crops In Imphal Valley Of Manipur

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**Abstract:** This study investigates the biology and functional response of the Large White Butterfly, *Pieris brassicae*, on Cruciferous crops, which include economically significant plants like cabbage, mustard and cauliflower respectively. We explore aspects such as life cycle, feeding behavior, and population dynamics of *P. brassicae* to understand its impact on these crops and to develop potential management strategies. The effect of different host plants and rearing atmosphere on life cycle of cabbage butterfly, *Pieris brassicae* were studied during the year 2021-23. Insects were reared in the field (fluctuating weather) as well as in the laboratory (constant rearing conditions) on three host plants, viz. cabbage, cauliflower and mustard. Slightly differences were found in the incubation and pupal period of butterfly reared on different host plants. However, larval period was found to be significantly lower on cabbage followed by cauliflower and highest on mustard. Therefore, the developmental period (from eggs to adult) was reasonably lower on cabbage. Furthermore, inverse relationship was found in the body weight of butterfly and developmental period, where weight of full grown caterpillar and pupae was significantly higher on cabbage and lowest on mustard. Overall, the development of *P. brassicae* was much faster on cabbage than other hosts.

**Index Terms** - Manipur, butterfly, cabbage, mustard, temperature.

## I. INTRODUCTION

*Pieris brassicae*, commonly known as the Large White Butterfly, is a significant pest of Cruciferous crops. It lays eggs on the leaves of these plants, and the larvae feed voraciously, leading to substantial agricultural losses. Understanding the biology and functional response of this pest is crucial for developing effective pest management strategies.

Manipur which is located in the extreme north-eastern boarder of India, with its unique topography and climatic conditions (tropical monsoon type in central plain and cool temperate in the hills) has a rich diversity of flora and fauna and is suitable for almost all types of vegetables, both summer and winter crops. Approximately between 23.83°N to 25.68°N latitude and 93.03°E to 94.78°E longitude.

Cole crops belonging to the genus *Brassica* which comprises both vegetable species and oil yielding varieties. It occupies a pre-eminent in Indian agriculture and economy. Vegetables as such are essential for human diet and its necessity for the country requires considerable augmentation in production. Hence there arises a need to formulate cropping strategy as well as integrated management of pest and diseases as vegetables have great potential to contribute directly to the income. Employment and majority of rural as well as urban population of our country. In India about 11 species are found under the genus *Brassica Linneus (cruciferae)*. The genus includes two categories of plant of commercial importance. The Cole crops that are consumed as vegetables (cabbage, cauliflower, knoll kohl, turnip, etc) and oil yielding crops (rape seed, mustard oil etc). Generally, the leaves of all the species of vegetables Brassicas are edible but the strong flavour of some species is disagreeable or too strong for most people's taste and usually not favoured. Every effort is being made to raise yield of these crops to meet the growing demands in different part of the country by adopting modern agricultural practices such as use of high yielding varieties heavy

manuring and assured irrigation. Moreover, these efforts remain ineffective unless the crops are protected from ravages of the pests. Furthermore, 67% of the total geographical area of Manipur is hill covered by different type of forest and thus it has amazing varieties of flora and fauna with its rich and luxuriant vegetable the state can be considered as an ideal home for both beneficial and harmful insects. The strategy for control of insect pest on vegetable crop is necessarily to be different from other crops because of the nature of utilization of vegetables. This is especially true in case of chemical control by insecticides which are known to leave hazardous residue and thus cannot be recommended off hand. Thus, preference has to be given to other known effective methods of control and specially those by which population build up can be avoided. Due to growing awareness of harmful effects of indiscriminate use of chemical insecticides, plant product or bio pesticides are being explored extensively as an alternative to chemicals for protecting the crop (Sing et. al. 1995, Dhawan 1998, Gupta et.al. 1998 and Kumar 1999). Further different formulations of neem extract could be considered as universal bio insecticides as they are found effective against various insect pests. Among the winter vegetables, In Manipur cabbage, cauliflower and mustard, are widely cultivated and occupy an important status in the agricultural economy of the state. In the plains depending upon the time of curd availability these crops are cultivated as early (September to November), mid (November to January) and late (January to May) crops. These crops being a winter vegetable, its productivity reaches maximum during winter season. However, this vegetable is attacked and damaged by a large group of insect pests which not only hampers the yield of the crop but also reduces the market value. In Manipur 24 insect species belonging to 5 orders and 12 families are known to attack this vegetable. Among these, *Pieris brassicae* Linn (Lepidoptera: Pieridae) is the most serious one. This pest has been reported to cause 20-100% damage to important cruciferous crops including cauliflower in different parts of the country (Sachan & Gangwar, 1980,1990). A good amount of work on the life and seasonal history, nature and extent of damage of this pest associated with cole crops has been done by several workers (Rataul, 1976; Sachan & Srivastava 1972). Different aspects of population ecology of *P. brassicae* in different parts of the country were also studied by workers like Sachan & Gangwar (1980 & 1990); Sood & Bhalla (1996) and Sharma et al., 2005. Control of *P. brassicae* on vegetables is usually accomplished with the used of conventional insecticides application. Synthetic insecticides in spite of their hazardous nature continue to be the most effective weapons available for the control of this pest. Since these cruciferous crops are consumed as vegetable it would be ideal to use those plant derivatives which are more comparatively effective in checking the pest population as well as safe to the environment.

## II. MATERIAL AND METHOD

### a. Biology of *Pieris brassicae*

The life cycle of *P. brassicae* includes four stages: egg, larva, pupa, and adult. The duration of each stage can vary based on environmental conditions such as temperature and humidity.

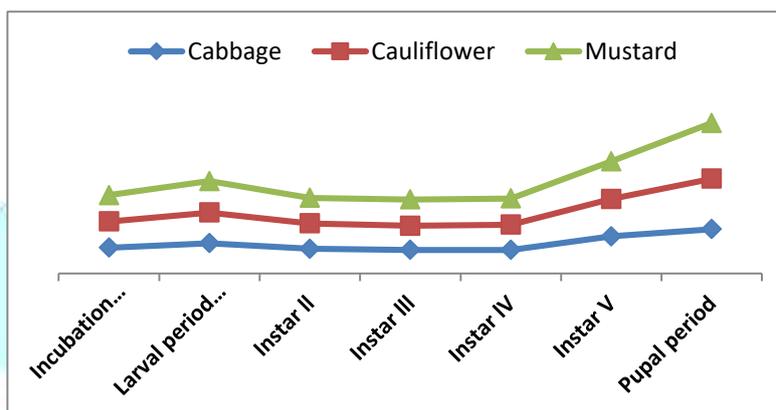
- **Egg Stage:** Eggs are laid on the underside of leaves and hatch into larvae within a few days.
- **Larval Stage:** The larvae, or caterpillars, are the primary damaging stage. They go through several instars before pupating. Feeding behavior varies with larval age and environmental conditions.
- **Pupal Stage:** The pupal stage occurs in a chrysalis. This stage can last from a few days to several weeks.
- **Adult Stage:** Adults are characterized by their white wings with black spots. They are primarily responsible for dispersing and laying eggs.

### b. Functional Response of *Pieris brassicae*

The functional response refers to how the feeding rate of *P. brassicae* larvae changes with the density of host plants. The experiment was set up in completely randomized design with three replications. Larvae of *Pieris brassicae* were collected from the field and reared on cabbage, cauliflower and mustard leaves in glass petriplates (21cm dia) in the laboratory for pupation and adult emergence. The moth emerged were released in rearing cages containing 4-5 leaf stage of the three plants grown in disposable plastic cups for oviposition. The plants containing the egg masses of *P. brassicae* were kept in petriplate over a moist filter paper for hatching. On hatching, 10 neonate larvae were transferred singly to the leaf pieces kept in petriplate over a moist filter paper for feeding. The larvae were supplied with fresh leaves daily till pupation. Observations were taken on incubation period based on eggs. The table below shows comparative study of *P. brassicae* on three different plants such as cabbage, cauliflower and mustard. The result is shown in the table below.

Table 1: Comparative study of *P. brassicae* on three different cruciferous crops

Parameters	Mean duration (in days ± s.d) <b>Cabbage</b>	Mean duration (in days ± s.d) <b>Cauliflower</b>	Mean duration (in days ± s.d) <b>Mustard</b>
Incubation period	4.60±0.55	4.65±0.55	4.68±0.55
Larval period Instar I	5.40±0.92	5.45±0.92	5.60±0.92
Instar II	4.40±0.52	4.50±0.52	4.55±0.52
Instar III	4.60±0.52	4.30±0.52	4.66±0.52
Instar IV	4.20±0.52	4.50±0.52	4.65±0.52
Instar V	6.60±0.52	6.66±0.52	6.70±0.52
Pupal period	7.90±0.74	8.97±0.74	9.90±0.74
Total life cycle	<b>38.10±4.29</b>	<b>39.48±4.29</b>	<b>40.61±4.29</b>

Figure 1: Comparative study of *P. brassicae* on three different cruciferous crops

### III. RESULT AND DISCUSSION

The pupal period and total life cycle duration from egg to adult emergence in the three host plants cabbage, cauliflower and mustard were 7.90, 8.97 and 9.90 days and 38.10, 39.48 and 40.61 days respectively (Table 1). In the present investigation, it is revealed that the total longevity of *P. brassicae* on the three cruciferous crops is shown shortest in cabbage (**38.10±4.29**) and longest in case of mustard (**40.61±4.29**) respectively which was similar to those obtained by (Chahil and Kular, 2013; Gupta, 1984; Chandel *et al.*, 1998; and Soud and Bhalla, 1996). Similarly the total developmental period obtained in the present finding was similar to those obtained by (Chahil and Kular, 2013).

Insect pest is the major problem in cultivation of vegetable crops. Vegetable growers make use of both recommended and un-recommended insecticides. When these insecticides were used indiscriminately, they show negative impact in the crop, soil, human health and the whole environment. During the past three decades efforts have been made to reduce the risk of human exposure to insecticides through the use of safe insecticides which could be safe to nature and non-target organisms. There is an utmost need to minimize the use of insecticides, educate the farmers about the recommended insecticides, dose of application of insecticides at proper time and to find out indigenous practices to control insect on vegetable crop.

The feeding behaviour and growth rate of *P. brassicae* larvae can lead to defoliation and reduced crop yield. Understanding the functional response helps in predicting the damage levels based on pest density.

### IV. CONCLUSION

In conclusion, the comparative study on the biology of *Pieris brassicae* (the cabbage butterfly) on cruciferous crops in the Imphal Valley of Manipur reveals important insights into its life cycle, host plant interactions, and ecological implications. The research indicates that variations in the growth and reproductive success of *P. brassicae* are significantly influenced by the specific cruciferous crop being studied. Factors such as plant physiology, nutrient composition, and pest resistance traits play crucial roles in determining the butterfly's preference and performance. The findings underscore the need for integrated pest management strategies tailored to local conditions, which can enhance crop resilience while mitigating the impact of *P. brassicae* infestations. Additionally, understanding the ecological dynamics of this pest in relation to its cruciferous hosts can inform sustainable agricultural practices and support biodiversity.

conservation in the region. Further research is recommended to explore the long-term effects of climate variability on *P. brassicae* populations and their interactions with different cruciferous crops, which will be vital for effective pest management and crop protection in Manipur's agricultural landscape.

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