



Title	Biological Aspects of Cabbage White Butterfly Species <i>Pieris brassicae</i> (Linnaeus, 1758) in the Environs of Taunggyi District, Southern Shan
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## **Biological Aspects of Cabbage White Butterfly Species *Pieris brassicae* (Linnaeus, 1758) in the Environs of Taunggyi District, Southern Shan State**

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### **Abstract**

Biology of cabbage white butterfly species; *Pieris brassicae* (Linnaeus, 1758) was studied both in captivity and natural environs of Taunggyi District within the study period from September 2005 to September 2007. *Pieris brassicae* utilized the mustard, cauliflower and cabbage as host plant grown in the Shan State. The cabbage butterfly lay the eggs singly. The entire batch of eggs was laid compactly on the same area of the selected site on the host plant. A single batch of eggs consisted of 50-80. The duration of development from the egg to the emergence of adult from the pupa, varies with the seasons. The duration was longer in the cool season than in the hot and dry season.

**Key Words:** *Pieris brassicae*, biology, behaviour and ecology

### **Introduction**

Butterflies can be categorized into mountain butterflies, forest or woodland butterflies and grassland butterflies according to their preferable habitats. Lepidoptera inhabit arctic tundras, tropical forests and arid deserts. They play a major ecologic part in their relationships with plants and other animals in an ecosystem (Klots, 1976).

Southern Shan State is situated in the Eastern Hilly region. This area contains mountain ranges, valleys, forests and plains. Taunggyi District is included in these types comprising Inlay wetland in this area. Taunggyi District situated in hilly region with high altitude, the climatic condition is suitable for the cultivation of vegetables especially cabbage and mustards throughout the year. Butterfly species utilizing these vegetables frequent the cultivated fields of cabbage and mustard. Of the frequented butterflies, the majority are *Pieris sp.* of the family Pieridae.

The butterfly researchers in Myanmar have identified the *Pieris* species but the depth into the life of the species has not been reported. This enhances to work on the *Pieris* species. widely distributed in the cultivated fields of cabbage, cauliflower and mustard in Taunggyi District.

## Materials and Method

### Study period and study sites

Cultivated field of cabbage from Taungyi (20°1' N, 97°2'E), Kalaw (20°36 N, 96°33'E), Aungban ((20°39' N, 96°38'E) and Pindaya (20°43' N, 97°20'E) townships were chosen as study sites for this study. Weekly field surveys to the selected study sites were made throughout the study period from September 2005 to September 2007.

### Behavioural study

Behavioural patterns such as courting and mating were recorded in both nature and captivity. Three rearing houses each measured 1m x 1m x 1m supported by four wooden poles of 1.5m high was constructed in order to keep the captive butterflies similar to natural condition. Deltamethrin 0.09% mixed with diesel oil was applied to the bases of poles. In addition to the rearing houses, cabbage, cauliflower and mustards were grown in experimental plots of 30m x 45m to assess the severity of the larvae as pests of the cultivated vegetation



Fig.1 Study area in Myanmar.

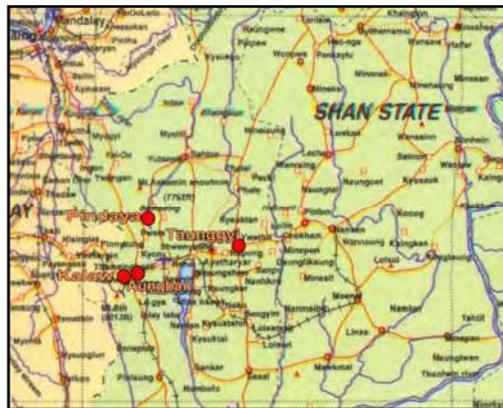


Fig. 2. Map showing study sites



Cabbage field in He'ho Cabbage field in Aungban Adult in nature

### Specimen collection and Rearing of the butterfly in captivity

The adult butterfly specimens were captured aided by a butterfly net from selected cultivated fields. The eggs, larvae and pupae from the host plants were also collected from the host plants and placed in rearing boxes.

The adult butterflies of both sexes caught from the selected cultivated field were released into respective butterfly rearing houses with flowering host plants. The eggs on the leaves of the host plant were kept separately in rearing boxes (10cm X 8cm) until the first larva hatched from the egg. The newly hatched larvae were individually placed in a cleaned rearing box with moistened leaves of the host plant. The rearing boxes were checked and cleaned daily. The developmental stages of larvae were recorded until the emergence of the adults from the pupae.



Parts of insect net



Insect net



Butterflies carrying cage



Potted host plants



Outside rearing cage



Rearing in air conditioned

## Results

### Breeding behaviours of the studied butterfly species

#### Courtship and Mating behaviors

In cabbage white butterfly species, prior to mating the male actively patrol for female. On confronting another male, he speeds away and continues his search. When the receptive female rested on a leaf blade the male rapidly followed and circled around the female and poked with its antennae.

Mating usually occur around the morning and late afternoon and mating period lasted for two to three hours. The female raise her wings slightly and exposing her abdomen so the time male mounted on the female's back and inserted its clasper into the bursa of female. The male and female mated in back-to-back or tail-to-tail position. The adults were sexually matured about two days after emergence from pupae. The male normally survived for 2-3 days after mating and the female 3-5 days after laying eggs.

#### Eggs laying and hatching in *Pieris spp.*

After mating, the female flied low over vegetation in a fluttering manner, and repeatedly touching down or landing on various plants. Once, a suitable host plant was sighted, the female curved the tip of the abdomen down to deposit the eggs on the underside of the leaf. Females deposit the eggs in clusters on both underside and upperside of the leaves of host plants. Most frequently, they are laid on the under surface of the leaf. 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. Newly hatched larvae can be found as a mass of small black spot on a leaf is one of the adaptive features to avoid from predation.



Courtship



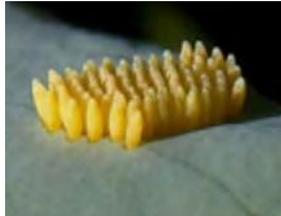
Mating



Eggs laying

### Developmental stages in *P.brassicae*

Eggs are spindle shaped, flat base lemon yellow in colour, translucent, tip turn brown just before hatching. The length of the egg is  $1.23\pm 0.07$  mm and  $0.61\pm 0.02$  mm in width with 14 to 16 longitudinal ribs, the fertilized eggs hatched out after  $5.5\pm 0.15$  days in hot and rainy seasons and  $10.5\pm 0.16$  days in cool season.



Newly laid eggs



Firstly hatched larva



various stages of larva



Prepupa



Pupa



Adult emergence

First larva is approximately  $2.85\pm 0.17$  mm in length and  $0.46\pm 0.01$  mm in breadth. The first larva molted to become the second larva after  $3.5\pm 0.08$  days in hot season,  $3.6\pm 0.08$  days in rainy season and  $7.00\pm 0.00$  in cool season. Second larva is approximately  $6.4\pm 0.79$  mm in length and  $0.86\pm 0.05$  mm width in size. Molting into third larva usually takes place within  $2.00\pm 0.00$  days in hot season,  $2.5\pm 0.11$  in rainy and  $3.00\pm 0.00$  days in cool season. Third larva is approximately  $13.15\pm 0.78$  mm and  $2.22\pm 0.06$  mm in width and shaped. It undergoes ecdysis after  $3.0\pm 0.00$  days in hot season and rainy season and  $4.00\pm 0.00$  days in cool season into the fourth larva stage. In Fourth larva the length and the width is approximately  $20.5\pm 1.15$  mm and  $7\pm 0.14$  mm. Ecdysis takes place after  $2.0\pm 0.00$  days in hot season and rainy season and  $3.00\pm 0.00$  days in cool season to become

the fifth larva. The length of the fifth larva about  $36.6\pm 2.46$  mm and  $3.26\pm 0.43$  mm in width. Numerous bristles and small black spots on all over the body. After  $5.0\pm 0.00$  days in hot season and rainy season and  $7.6\pm 0.17$  days in cool season the final larva transformed to pupa.

The length and width at the widest part of the pupa is approximately  $23.85 \pm 0.15$  mm. Pupa held with a belt-like girdle of silk. The pupal stage lasted for about  $11.1\pm 0.33$  days in hot season,  $11.1\pm 0.23$  days in rainy season and  $18.5\pm 0.11$  days in cool season. :

The adult lived for about  $5.0\pm 0.31$  days in hot season,  $7.4\pm 0.14$  days in rainy season and  $5.1\pm 0.31$  in cool season. The total life span for *P.brassicae* is about  $35.6\pm 0.62$  days in hot season,  $40.0\pm 0.66$  days in rainy season and  $55.71\pm 0.85$  days in cool season. Molting occurs in all stages of larvae including the pupal stage. A day before molting the larva stops feeding and remains motionless in every stage. The skin of the larva ready for molting ruptures just behind the head and the larva gradually wriggles out of the old skin. The molting process lasted about 3-30 minutes. The molted larva remains inactive for an hour or more. It then usually turns round and feeds on the old shed skin. This manners observed only in the first and second larva of studied butterfly species.

The emergence of the adult butterfly from the pupa usually takes place in the morning round about 8:00-9:00am. A night before the adult butterfly emerges; the patterns of the wing can often be seen through the pupal skin. The wing patterns and the colour of the abdomen become apparent as the emergence time approaches. The developed adult soon emerges through the split of the pupa at the anterior end by protruding the legs first and gradually pushes out till it is completely out of the pupa. The newly emerged adult then hang down and stay motionless holding onto the pupal skin. The emerged adult stays motionless till its wings harden and ready for flight. This takes about 2-3 hours for the butterfly to fly independently. During the study period the maximum temperature was  $31.5^{\circ}\text{C}$  in hot season,  $29.3^{\circ}$  in rainy season and  $26.2^{\circ}\text{C}$  in cool season (Fig.1). The prolific condition of the study species were recorded to be the highest in the cool season (Table. 1).

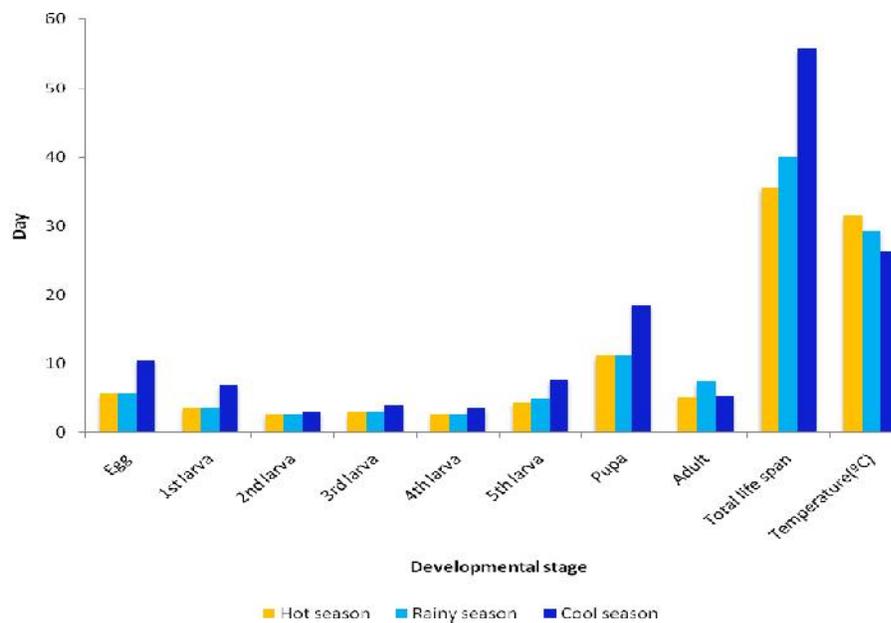


Fig 1. Developmental stages of *Pieris brassicae* in three different seasons

Table 1. Prolific condition of the studied butterfly species *P.brassicae* rare in captive condition

Season	Temp(°C) Max	RH (%)	Average egg	Hatched rate(%)	Alive rate of larva (%)	Alive rate of pupa (%)	Alive rate of adult (%)
Hot	31.5	54	54	90	80	63	89
Rainy	29.3	80	80	66	65	81	77
Cold	26.2	60	75	75	89	83	81

### Sexual dimorphism in *P.brassicae*

Apices of the fore wings are black while each hind wing consists of a black spot at the apex. Under surface of the hind wing is pale yellow. Female is similar to male except for the two additional spots on the upper surface of the forewing. The black markings and spots are more prominent in the female .



### Discussion

*Pieris brassicae* (Large White,) of the family Pieridae could be distinguished based on the pattern of black spots on both fore and hind wings. The common name collectively known as white cabbage butterflies are designated to these butterflies since the wing colour is white. The cabbage in the common name is specified as these butterfly species utilize cabbage as the main host plant. Distinctive sexual dimorphism is recorded in studied species. Two black spots on each of the fore wing of the female distinguish it from the male of this species where the black spots are lacking. The life span of the adult butterflies differs between virgin and mated butterflies.. The virgin male lived up to 10 days while the virgin female lived up to 18 days. Mated male lived only up to 3 to 5 days while the mated female 5 to 7 days after emergence from the pupa. This factor indicated that the adult butterflies live only long enough to produce the next generation. .

The female deposited the entire batch of eggs on the same area of the leaf of the host plant it has selected after the process of mating. The number of eggs in a batch could thus be recorded in the field . The number of eggs in a batch was also recorded by rearing the species in captivity. Each batch of eggs consisted of 50-80. More number of eggs in a batch could be related to assurance of survival since the eggs laid in the same area would be more vulnerable to predators than those laid sporadically.The under surfaces of the leaves of the host plants are usually the egg laying

sites for all the butterfly species of this study. This behaviour is also a mean of protection from the predators.

Mating of the adult butterflies occurs one or two days after the emergence from the pupae when fully matured. The mating period of *P. brassicae* recorded lasted for three hours in both nature and captivity. The mated adult females usually frequent the areas near cultivated fields of cabbages to lay the fertilized eggs.

Temperature greatly influences on developmental stages in the life cycle. This could be the reason why the *Pieris* butterfly species are distributed only in the cooler parts of Myanmar.

The larvae of *P. brassicae* could become a serious pest in the cultivated cabbage fields judged on the manner of laying eggs and preference of the leaves of the cabbage. The cultivators are still unaware of this fact as they are more concerned with outbreak of Diamond Back moth larvae. Therefore, it is concluded that attention should also be given towards the control of *P. brassicae* larvae before the actual outbreak.

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