

Studies on life history of the butterfly *Papilio memnon* (Linnaeus) Papilionidae: Lepidoptera on its host plant *Citrus medica* in Assam

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ABSTRACT

Papilio memnon (Linnaeus), the Great mormon butterfly belonging to the family Papilionidae: Lepidoptera is a common, strong flier butterfly, seen in forests, near human habitation areas. Females are often seen near flowers and larval host plants while males are found roaming restlessly or mudpuddling. Very limited works are available on biology of butterfly species in the world. Butterfly populations in India have declined (Grewal, 1996), and it is often suggested that captive rearing/breeding and releasing of butterflies in the wild will help restock at-risk populations and serve as a means of conservation. Life cycle of butterflies in North-east region have not been documented properly. Knowing the important aspect of butterflies for conservation of Biodiversity, it is important to know the interaction of butterflies with their host plant. Therefore an attempt was initiated to study the life cycle of *Papilio memnon* (Linnaeus), the Great mormon butterfly (Linnaeus) (Papilionidae; Lepidoptera) and its interaction with its host plant *Citrus medica* during the month of August, September 2012 and November, December 2012. It was seen that the female laid eggs singly on the underside the newly emerged leaves. The eggs were spherical in shape and yellow in colour. The incubation period were 2.75 ± 0.25 days (Summer season) and 6.0 ± 0.40 days (Winter season). The butterfly was reared in the laboratory condition after taking out the leaves twigs of the host plant laid with eggs for determining the life cycle parameters. The emerged Caterpillar is blackish brown in colour. The duration of each instar and stages were determined. The Butterfly has been reared for both summer and winter season.

Keywords: Butterflies, Biodiversity, conservation, host plant, biology, life cycle

INTRODUCTION

Among insects, butterflies provide economic and ecological benefits to the human society by virtue of their incontestable beauty and their ability to accomplish pollination, a key ecological process in natural sustainability throughout the world (Venkata Ramana *et al.*, 2003; Lomov *et al.*, 2006). As adults, they require a succession of adequate nectar resources and as larvae, they are typically host specific (Venkata Ramana *et al.*, 2003; Lomov *et al.*, 2006). However, due to large scale loss, fragmentation and degradation of natural habitats, many species are in the verge of extinction (Schultz & Chang, 1998) and urgent measures are required for conserving them from extinction. In the past few decades, butterfly populations in India have declined and it is often suggested that captive rearing/breeding and releasing of butterflies in the wild will help restock at-risk populations and serve as a means of conservation (Varshney, 1986; Nicholls & Pullin, 2000; Mathew, 2001; Crone *et al.*, 2007; Schultz *et al.*, 2008). Science museum situated at Khanapara currently engaged in captive rearing programs for protecting butterfly species.

Immature stages of butterflies are increasing importance as sources of systematic characters, and often give important clues as to the placement of species in major groups (DeVries, *et al.*, 1985; Freitas *et al.*, 2002). Haribal (1992)

noted that such information is lacking for 70% of the Indian butterflies. The present study furnished the necessary information about immature stages, larval performance on its host plant, *Citrus medica* and the length of life cycle from egg to adult eclosion for the Great Mormon butterfly, *Papilio memnon* (Linnaeus). The present work aimed to study the 'Life Cycle' with reference to the host-plant, '*Citrus medica*' specificity, oviposition, hatching, larval development, pupation and adult emergence for both summer and winter seasons.

Papilio memnon, the Great Mormon butterfly is a large butterfly with wingspan of 120 to 150 mm belonging to the Papilionidae family and commonly found in open, cultivated areas, scrub and deciduous forests. Status- Locally common and not threatened. Its distribution from India (West Bengal, Sikkim to Arunachal Pradesh, Andaman and Nicobar Islands), Nepal, Bhutan, Myanmar, Bangladesh (Kehimkar, 2008). This is closely related to Blue Mormon butterfly, *Papilio polymnestor* (Cramer). The females are more often seen near nectad plants and food plants and males are seen performing mud-puddling. Highly mimetic and polymorphic, with four male and nine female forms (Kehimkar, 2008). Out of four forms of male, only two forms described i.e, Typical form of **male agenor** – large, tailless, black, with blue dusting, and with or without a red basal streak in

FW cell. Bluish streak between veins, Undersidehindwing (UNH) usually has red crescents at tornus and male polymnestoroides is tailless with short blue discal stripes on UPH and UPF. Female agenor tailless. Uppersideforewing (UPF) ground colour sepia, streaked with greyish white. The basal third part of the cell is red and is touched outwardly with white. Upper hindwing (UPH) is blue-black with 5 to 7 white or discal patches. Female form butlerianus tailless, resembles male agenor form with both wings dark sepia. The forewing has white area on inner margin. The hind wing is scaled with blue. Female form alcanor tailed. UPF is greyish brown with veins and streaks between them black. Cell is red at base. Velvety black patch at base of spaces 1 and 2. UPH is black, cell partly white with broad white streaks around it. The tornus is red with a large black spot. A row of terminal spots between veins. Sides of the abdomen are yellow. Female form of Polymnestoroides is tailless with pale grey vein streaks on sepia UPF. UPH is velvety brown with discal area and black spots as in Blue Mormon. Out of 9 forms, only 4 female forms described (Kehimkar 2008). The males are much commoner than females. Larval food plants are *citrus spp.*, *Paramigyna scandens* (Rutaceae).

The larval host plant *Citrus medica* or citron given by Linnaeus is derived from its ancient name, "Median or Persian apple". The citron used to combat

seasickness, pulmonary troubles, intestinal ailments. The butterfly is often seen laying eggs on the fresh leaves or newly emerged leaves. Earlier, the life cycle of this butterfly on its host plant, *citrus medica* is not known from Assam. Therefore, an attempt was taken to conduct experiments in the laboratory to determine the duration and other morphological parameters of different life stages of the butterfly on one of its larval host plants *Citrus medica*.

METHODOLOGY

The life cycle of Great Mormon, butterfly was studied for both summer and winter season. The host plant, *Citrus medica* was surveyed and planted in 3 numbers of earthen pots outside the Gauhati University Entomological laboratory. The adult butterfly *Papilio memnon* (form alcanor) was seen laying singly eggs on the underside of the fresh leaves of its host plant *Citrus medica*. The egg diameter was measured using slide calipers. After hatching, the larval length, morphological characters and moulting behaviours from 1st to 5th instars were recorded after every 24 hours. For measuring the length, breadth and duration of larval instars, 4 numbers of larvae of the butterfly, were isolated & kept enclosed within a covered box individually as one set. Five such sets were considered. During the experiment period, duration was recorded.

Table 1. Measurements of length, breadth, headcapsule (in mm) in life cycle stages of Great mormonbutterfly studied during 2010-2012

Measurement in mm	Egg	Length of larva(mm)					Pupa(mm)
		1 instar	2 nd instar	3 rd instar	4 th instar	5 th instar	
Mean	1.775	6.375	9.458	17.916	25.416	39.125	41.5
./- Standard Error	0.086	0.523	0.8058	1.239	1.422	1.886	2.723
Standard Deviation	0.171	1.81	2.791	4.294	4.925	7.544	5.447
Range	2-1.6	10-- 4	15--7	25--10	34--18	55--30	48-37
Head capsule		1.125	1.425	2.25	3.375	5	
N	4	4	4	4	4	4	
		Width of larva(mm)					Pupa(mm)
		1 instar	2 nd instar	3 rd instar	4 th instar	5 th instar	
Mean		2.191	3.63	5.358	7.016	9.71	13.500
./- Standard Error		0.201	0.209	0.36	0.27	0.39	1.323
Standard Deviation		0.697	0.724	1.248	0.935	1.591	2.646
Range		3--1	5--2.8	7-3.5	9--6	13--7	17-25

Table 2. Duration (in days) for different developmental stages of Great Mormon Butterfly in two seasons (Monsoon & Winter)

Stages	Durations in Days (Monsoon)	Durations in Days (Winter)
Egg	2.75±0.25	6.0±0.40
1st Instar	2.0±0.0	6.0±0.0
2nd Instar	2.0±0.0	5.75±0.47
3rd Instar	3.0±0.0	5.0±0.0
4th instar	3.0±0.0	5.0±0.0
5th instar	3.75±0.25	6.5±0.28
Total larval	13.75±0.25	28.25±0.75
pupal	13.25±0.47	28.75±0.47
Total days from hatching to adult	29.75±0.47	62.5±1.5

RESULTS

Life cycle stages from egg hatching to adult were completed within 29.75±0.47 days (Summer season) and 62.5±1.5 days (Winter season). Measurements of length, breadth, head capsule of the Great Mormon butterfly is presented in Table 1 and duration of different stages of the butterfly for both summer and winter season is given in Table 2.

Life cycle stages:

Oviposition: The Gravid female searched

many plant species to find out the proper host plant. After heavy and light showers of rain, the female laid eggs on the tender leaves. The presence of water droplets in the tender & young leaves was observed during regular ovipositing time. During searching the host plant, female repeatedly moved around the plants by showing circling flight. The eggs were found laid singly on the tip of the leaves or underside of the leaves of the host plant. Egg laying occurs in between morning and afternoon. The host plants for egg laying were *Citrus medica*,

Citrus aurantifolia and *Ageles marmelos*. During oviposition half eaten leaves were found to be rejected.

Eggs: The eggs measured 1.6-2 mm in diameter. The eggs were laid singly on the underside of leaves of the host plant. The eggs were spherical in shape and yellow in colour. The incubation period were 2.75 ± 0.25 days (Summer season) and 6.0 ± 0.40 days (Winter season).

Larva: The freshly emerged larvae were transparent pale red in colour with faint blackish markings on the body. It took 4-7 minutes to come out from the shell. After hatching, the length, breadth and head capsule of each larva of each instars were measured and presented in Table 1. Duration of each larva of each instars (Summer as well as winter) was presented in Table 2. The 1st Instar larvae were blackish brown in colour measuring 4-10 mm in length and breadth 1-3 mm. The 2nd Instar looked like a fresh bird dropping measuring 7-15 mm in length and breadth 2.8-5 mm. In 3rd Instar larvae, the colour was changed to olive green and pale white bands are present on the abdominal region. The dorsal tubercles become quite distinct. The larvae measures 10-25 mm in length and 3.5-7 mm in breadth. The 4th Instar larval colour changed to green. Two black eye spots appeared on the dorsal surface in the thoracic region & connected with a helical black line, which gives them a snake like

appearance. The head becomes light brown in colour. The 4th instar measures 18-34 mm in length and 6-9 mm in breadth. The 5th Instar larvae was larger in size and looked similar with that of 4th instar larvae. From behind the head of the larva, a bright orange forked organ i.e., 'osmetrium' which emits a strong odour emerged out. It is more prominently green in colour with a prominent whitish band on its abdominal segments and slow in movements measuring 30-55 mm in length and 7-13 mm in breadth. Larval periods were lasts for $13.25.0 \pm 0.25$ days in Summer and 28.25 ± 0.75 days in Winter.

Moulting Behaviour: The moulting time required by each instar larvae was more than 15 mins. After completion of casting or moulting of the original skin, the larva took rest for 30-40 minutes and fed upon its own casted skin except the head case.

Pupa: Before the formation of pupa (chrysalis), the larvae stopped eating, excreted heavily, trying to find a suitable place for pupation. The larvae first fixes cremaster (abdominal tip) then hanged itself. It was grass green when in the lush settings and grey-brown with darker grey, brown and black streaks when situated in dried vegetation. The pupa was brownish and held at an angle to the support (stick) by means of a body band. The pupa measured 37-48 mm in length and 17-25 mm in breadth. The pupal duration were

13.25±0.47 days (Summer) and 28.75±0.47 days (Winter).

Adults: The adults were observed to emerge from the pupa by splitting open the case vertically on the dorsal side. Though they are highly mimetic and polymorphic, with four male and nine females forms, in the observations only two sexes of form

agenor (male) and form alcanor (female) were found. Male form agenor large, tailless, black, with blue dusting and with or without a red basal streak in forewing cell. Bluish streaks between veins, underside usually has red crescents at tornus. Female form alcanor tailed with upperside of forewings is greyish brown with veins and streaks between them black. Cell is red at

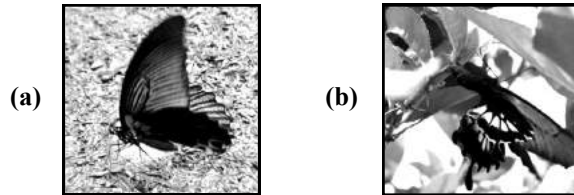


Figure 1. (a) Mudpuddling process of Great Mormon male butterfly and (b) female butterfly form alcanor egg laying

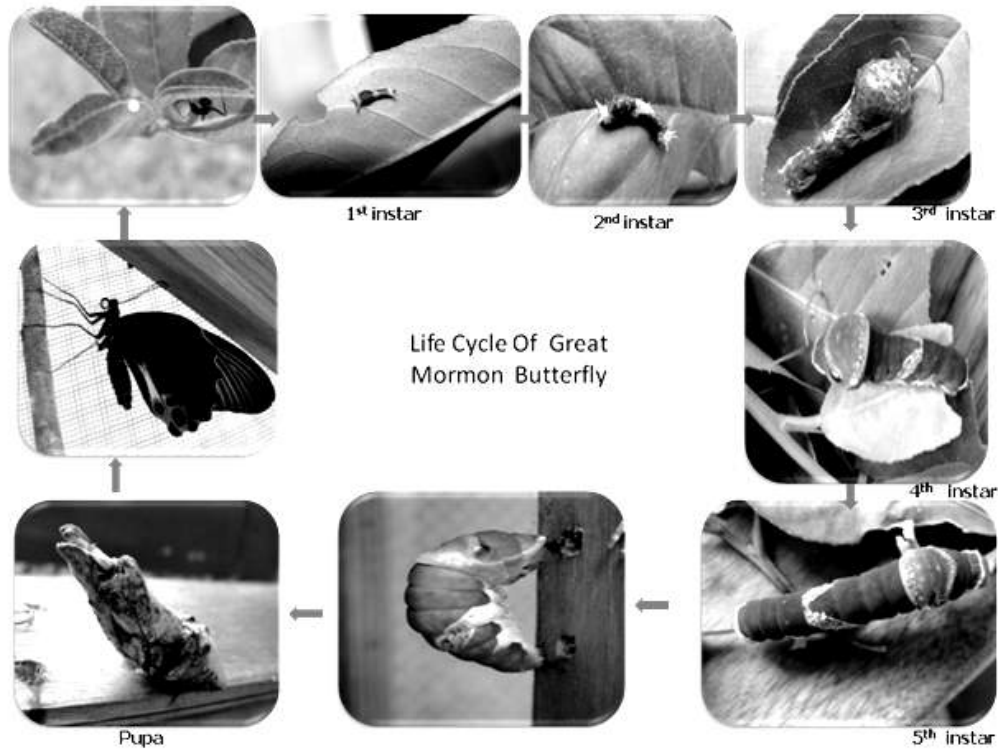


Figure 2. Life Cycle of Great Mormon Butterfly

base. Velvety black patch at base of spaces 1 and 2. Upperside of hindwings is black, cell partly white with broad white streaks around it.

DISCUSSION

Butterflies are an important group for the study of natural history than any other groups of insects (Ackery, 1984). The study of natural history of butterfly is very essential to know the host plant relationship, habitat preference and life history information. According to Ackery (1984), the study of the biology of butterfly is necessary for fulfillment of the part of systematic and faunistic studies. The Great Mormon butterfly as a wide range species move long distance within a day, hence it flies away after laying egg. Baker (1984) also supported this view that, the butterfly species that is common in surrounding habitats will never be seen to fly away, but the real travelers are frequently crosses the sites and not found anywhere nearby. The gravid female searched many plant species to find out the proper host plant. After heavy or light showers of rain, the females are seen to lay eggs on the tender leaves. The presence of water droplets in the tender & young leaves was observed during regular ovipositing time. Watanabe (1976) and Kakati (2002) suggested that, the egg laying females of some swallowtail butterfly also select the leaves of food plants considering the water content of

leaves. The Great Mormon eggs are hatched after average of 2.75 ± 0.25 days in Monsoon season and 6.0 ± 0.40 days in Winter season. After hatching, young 1st instar larvae consume the eggshell and take rest for few minutes then move for feeding. Kakati (2002) also observed consumption of eggshell by *Graphium doson axion* & *Chilasa clytia dissimilis*. The species completed their life cycle through 5 different larval stages. The total duration of life cycle from egg laying to adult emergence was also varies significantly during monsoon & winter season. During monsoon season the mean total duration of life cycle was 29.75 ± 0.47 days, whereas it was 62.5 ± 1.5 days in winter. During winter season, due to ceasation of sprouting of tender leaves the larvae have to depend on the leaves available on the host plants. Due to the less availability of the food during winter season, the larvae consumed inadequate amount of food, which may be the cause of lengthening the duration of life cycle stages, but maintain the adult butterfly size. Singer (1984) in his study also suggested that, the host plant quality may also effect the length of the life cycle duration and suggested that the larvae which finds itself on a poor host may either lengthen its generation time to become a normal sized adult or conserve its larval duration and become a smaller adult or one with few reserves.

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