



Biology and morphometry of common Mormon butterfly, *Papilio polytes* L. (Papilionidae: Lepidoptera) on acid lime

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ABSTRACT: The common Mormon, *Papilio polytes* L. is one of the important butterfly pests on citrus crops. The biology of *P. polytes* was studied under laboratory conditions at the Department of Agricultural Entomology, College of Agriculture, Vijayapura, Karnataka, India. The average fecundity was 21.70 eggs per female butterfly. The incubation, total larval and pupal period were observed to be of 3.83, 14.88 and 13.36 days, respectively. The total lifecycle of male and female butterfly was completed in 39.42 and 41.47 days, respectively. Pre-oviposition, oviposition and post-oviposition period were 1.18, 5.96 and 1.20 days, respectively.

Keywords: Acid lime, *Papilio polytes*, biology, morphometry, incubation period, larval period

INTRODUCTION

The common Mormon, *P. polytes* L. is one of the serious butterfly pests whose larval forms cause economic damage to crops by devouring large quantity of foliage during their development on citrus crops (Singh, 1993; Dileepkumar *et al.*, 2022). The caterpillars are voracious feeders of young seedlings and cause death of the seedling within no time (Resham *et al.*, 1986). The larvae of this butterfly are of regular occurrence in nurseries, young plantation and on newflush of grown up trees. Severe infestation of pest results in complete defoliation of the tree and decreased photosynthetic activity leading to reduction in vigour, plant growth and finally fruit yield (Butani and Jotwani, 1975). The pest is also known to feed on other hosts belong to family rutaceae (Corbet and Pendlebury, 1992; Haribal, 1992; Gunathigalraj *et al.*, 1998). In recent times, increase in area under cultivation of acid lime in northern parts of Karnataka attracted many insect pests to cause severe damage to crop (Dileepkumar *et al.*, 2022). Among them, *P. polytes* is one of the butterfly pests which have been limiting production under both nursery and field conditions along with *P. demoleus*. The morphological differentiation of immature stages of both the species of butterfly needs greater attention for correct identity of the pest. The literature on biology and morphometry of *P. polytes* is very meagre in India. So, the present study was undertaken to know developmental behaviour of pest on acid lime (*Citrus aurantifolia* Swingle) under laboratory conditions. This information may form valuable basis for correct identity and initiation of suitable control measures against this pest.

MATERIALS AND METHODS

The field culture of *P. polytes* was collected from the acid lime orchards near College of Agriculture, Vijayapura, Karnataka. The collected larvae were reared on acid lime leaves placed in petri plates and fresh leaves were renewed twice in a day till the end of larval stage in the laboratory (27±2°C, 65-70%RH). The pupae were collected and placed in an oviposition cage for adult emergence. The adult butterflies on emergence were provided with acid lime seedlings as substrate for the oviposition. The cotton soaked in 10% sugar solution was provided as food source. Ten pairs of adults were maintained separately in ovipositional cages to record the fecundity. Freshly laid eggs were collected every day and larval rearing was continued till pupation. The observations on life stages *viz.*, egg, larva, pupa and adults were recorded daily. The parameters like pre-oviposition period, oviposition period, post-oviposition period, incubation period, larval period (instars-wise), pre-pupal period, pupal period, adult longevity (Male and Female) and total length of life cycle in days were observed and mean duration for completion of each stage was computed. The morphometric observations on diameter, length and width of various life stages *viz.*, egg, larva, pupa and adults was measure with the help of stereo binocular microscope which was arranged with a camera at the apex of the eye piece. Later the mean values were computed with statistical analysis.

RESULTS AND DISCUSSION

Egg: The female *P. polytes* deposited egg singly on dorsal and ventral surface of leaves, young twigs and sometimes on stem portion of the plant. Freshly laid

Table 1. Biology of common Mormon butterfly, *Papilio polytes* L. reared on acid lime under laboratory conditions

Life stage parameter	Duration (days) Mean± SD
Fecundity	21.70±1.45
Incubation period	3.83± 0.24
Larval period	
I instar	2.39±0.25
II instar	2.21±0.25
III instar	2.56±0.36
IV instar	3.29±0.26
V instar	4.43±0.20
Total larval period	14.88±0.63
Pre-pupal period	1.00±0.00
Pupal period	13.36±0.59
Adult longevity	
Male	6.35±0.33
Female	8.39±0.35
Total life cycle	
Male	39.42±0.41
Female	41.47±0.39
Pre-oviposition	1.18±0.26
Oviposition	5.96±0.43
Post-oviposition	1.20±0.25

SD- Standard Deviation

eggs were small, spherical, greenish yellow and smooth in appearance. One day after, eggs were turn into pale yellow to cream colour with black taint on the surface of the egg and gave finely roughened appearance on surface (Fig. 1). Eggs become brownish black at one day before hatching. The fecundity was varied from 18 to 23 number of eggs per female and average fecundity was 21.70 ± 1.45 eggs per female. The average incubation period was 3.83 ± 0.24 days (Table 1). The diameter of egg was ranged from 1.13 to 1.35 mm with an average of 1.28 ± 0.06 mm (Table 2). The present observations on morphological descriptions of eggs of *P. polytes* were supported by Khan *et al.* (2019) and Islam *et al.* (2017). The similar incubation period were recorded in earlier reports (Suwarno *et al.*, 2007; Jaafar *et al.*, 2014; Islam *et al.*, 2017).

Larva: The larvae of *P. polytes* were moulted four times and passed through five larval instars during

the completion of larval stage. First instar larva was yellowish dark brown dorsally and dark brown laterally. Hypognathous head with mandibles and two conspicuous primary setae. White bands encircles first and last abdominal segment of the body (Fig. 2). The terminal abdominal segment bears whitish brown caudal horns. Larvae with small and large setae covering lateral sides of the body. The average length and width of first instar larva was 7.74 ± 0.13 and 1.22 ± 0.06 mm, respectively (Table 2). The second instar larva was looking like late first instar larva except in size and length of the body. The anterior parts of body heighten and widened than posterior part of the body. Larva with more extricates white marking on middle and posterior parts of the body (Fig. 3). As the age of larva was increased, white patches become more widened dorsally and laterally of the body. The average length and width of second instar larva was 8.72 ± 0.12 and 1.68 ± 0.04 mm, respectively. Third instar was dark brown with distinguishing white

furrow on lateral sides of thoracic and abdominal segments. Three pairs of white-bluish spots were present on dorsum of second to fourth abdominal segments (Fig. 4). Caudal horns were thicker, conspicuous, snow-white in colour and present on last abdominal segment. A pair of white spiky projection was visible on dorsum of fifth abdominal segment. The average length and width of third instar larva was 13.34 ± 0.28 and 2.42 ± 0.08 mm, respectively. Fourth instar larva more or less similar to third instar larva but has greasy appearance with greenish coloration of body. The lateral white streak completely enclosed the first and second abdominal segments (Fig.

5). Metathoracic segment bears four conspicuous white bluish spots dorsally. The average length and width of fourth instar larva was 31.19 ± 0.94 and 4.80 ± 0.09 mm, respectively. Unlike to early instars, fifth instar larva was drastically different in physical appearance. Newly moulted fifth instar larva was light green, later the colour was gradually changed to pure green. Dorsally there were two transverse sinus marking on the body, one is connected two eye spots present laterally on meta-thoracic segment and another one occurs between dorsum of meta-thorax and first abdominal segment. A pastel purplish bluish slit was existing in sinus marking.

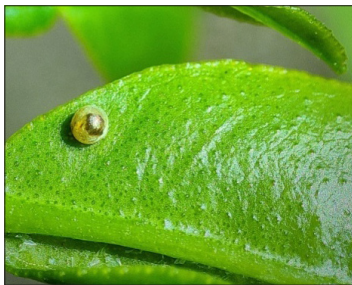


Fig 1. Egg



Fig 2. First instar



Fig 3. Second instar



Fig 4. Third instar



Fig 5. Fourth instar



Fig 6. Fifth instar

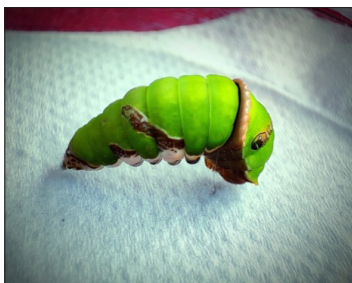


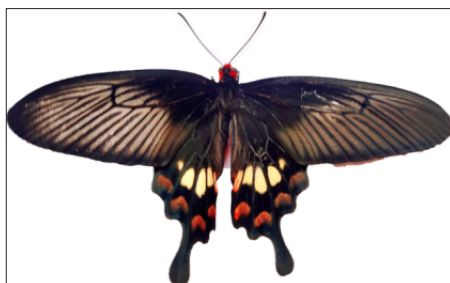
Fig. 7. Pre-pupa



Fig. 8. Green pupa



Fig. 9. Brown Pupa



Female adult



Male adult

Table 2. Morphometry of common Mormon butterfly, *Papilio polytes* reared on acid lime under laboratory conditions

Particulars	Width (mm)		Length (mm)	
	Mean± SD	Range	Mean± SD	Range
Egg (Diameter)	1.28±0.06	1.13-1.35	-	-
I instar	1.22±0.06	1.10-1.45	7.74±0.13	7.42-7.91
II instar	1.68±0.04	1.59-1.73	8.72±0.12	8.46-8.85
III instar	2.42±0.08	2.29-2.55	13.34±0.28	12.99-14.00
IV instar	4.80±0.09	4.71-5.12	31.19±0.94	29.14-31.90
V instar	8.02±0.07	7.93-8.13	36.48±0.42	35.79-37.15
Pupae	7.97±0.13	7.57-8.15	30.58±0.64	29.39-31.70
Male adult	57.66±0.78	55.97-58.92	29.60±0.18	29.15-29.87
Female adult	65.62±0.86	64.05-66.65	30.69±0.37	30.15-31.50

SD- Standard Deviation

Two pairs of bluish spots were present on dorsal side of third and fourth abdominal segments. Three pairs of oblique black to brownish bars were present on either side of the abdominal segments; first pair of oblique bar was arising from the base of lateral side of third abdominal segment and ended on dorsum of fourth abdominal segment. Second pair of bar was present on lateral sides of six abdominal segment and short third bar occurred on each sides of last abdominal segment (Fig. 6). The three pairs of thoracic and five pairs of abdominal pseudo legs were more conspicuous than earlier instars. Thoracic legs were whitish and spongy at the base and bears terminal hook like structure. Abdominal pseudo-legs were whitish, stumpy and spongy in appearance. Fleshy, pink, forked structure osmeterium was present on prothoracic region of larva, normally hidden but can be exerted outside when caterpillar was disturbed by external stimuli. The average length and width of fifth instar larva was 36.48 ± 0.42 and 8.02 ± 0.07 mm, respectively. The total larval period was 14.88 ± 0.63 days (Table 1). Similar morphological observations were recorded by Islam *et al.* (2017) and Khan *et al.* (2019) on different larval instars of *P. polytes*.

Pupa: Mature fifth instar larva was stopped feeding, becomes inactive, body shortened gradually in length and attached to substrate with frontal and posterior parts of the body by bending upward mid dorsally (Pre-pupa) (Fig. 7). The average pre-pupal period was 1.00 ± 0.00 days. The pupa was formed one day after pre-pupal stage.

The pupa of *P. polytes* is a chrysalis and was attached to substrate posteriorly with cremaster at the anal end and held in a position with help of silken griddles run dorsally on middle of the body. Two pupal forms were found, one being green morph which was predominantly green with two yellowish diamond patches on ventral side of abdominal segment. The brown morph was grayish to dark shades of brown (Fig. 8, 9). Pupae were having characteristic pair of cephalic horns, dorsal thoracic hum and a pair of caudal horn. Pupa turned black with appearance of black wings just before eclosion. The average pupal period was 13.36 ± 0.59 days (Table 1). The average length and width of pupa was 30.58 ± 0.64 and 7.97 ± 0.13 mm, respectively (Table 2). The pupal period of 9 to 15 days reported by Gaikwad and Bhawane (2013), Minh *et al.* (2015) and Islam *et al.* (2017) which corroborates the present study.

Adults: Adults of *P. polytes* were large, black colored with wide wing spread. The head, thorax and abdomen jet black colored with blackish scales all over the body. Head with hooked club shaped antenna and long curved proboscis. Thorax consists of three pair dusky black legs and two pairs of wing which are attractively colored on both the sides. Both female and male sexes were tailed giving the name swallowtails. Female was black with attractive red and white colored spots over the wings. Fore wing with pale streaks between the longitudinal veins. Hind wing with four elongated white spots and paler series of narrow red spots on outer margins of wing

(Fig. 10). The male was black, forewing with series of white spots decreasing in size towards the apex and hind wing with discal band of elongated white spots which were well separated from each other (Fig. 11). Similar morphological characters were observed in the earlier findings (Islam *et al.*, 2017; Suwarno *et al.*, 2007). The longevity of adult male and female butterfly was 6.35 ± 0.33 and 8.39 ± 0.35 days, respectively. The male sex of *P. polytes* was completed life cycle on an average of 39.42 ± 0.41 days, whereas life cycle of female butterfly was completed in 41.47 ± 0.39 days (Table 1). The average length and width of male adult butterfly was 29.60 ± 0.18 and 57.66 ± 0.78 mm, respectively whereas average length and width of female adult butterfly was 30.69 ± 0.37 and 65.62 ± 0.86 mm, respectively (Table 2). In accordance to present study Islam *et al.* (2017) recorded total developmental period of 32 to 64 days for *P. polytes* and opined that life cycle duration varies according to weather conditions. The pre-oviposition, oviposition and post-oviposition period was 1.18 ± 0.26 , 5.96 ± 0.43 and 1.20 ± 0.25 days respectively.

The common Mormon, *P. polytes* is occurring in serious proportions and causing significant damage to acid lime plants in northern parts of Karnataka. There is an ambiguity in morphological differentiation of immature stages of *P. polytes* with other closely related species of butterflies. The information generated during present study would be helpful for correct identity of pest by differentiating from other closely related species to initiate suitable control measures.

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MS Received: 03 January 2024

MS Accepted: 10 March 2024