Study the biology of common castor butterfly, *Ariadne merione merione* Cramer

Abstract

A laboratory experiment was conducted at the PC Unit Sesame & Niger, Department of Entomology, JNKVV, Jabalpur on biology of spiny castor caterpillar, *Ariadne merione merione* (Cramer) on castor. Considerable variation in larval period on castor plants was observed, with the shortest of 27.41(max.) and 25.80 (min.) days being when reared on castor leaves. Generally, females length longer than males on all the castor plants. The average developmental period of 1^{st}, 2^{nd}, 3^{rd}, 4^{th} and 5^{th} larvae were 70.92±4.89, 109.22±1.81, 134.37±1.87, 147.87±4.12 and 176.82±5.67 hours, respectively. The pupa length and width ranged from 18.79±0.74 mm and 5.62±0.11 mm, respectively. The periods of pre-oviposition, oviposition and post-oviposition in hours sequencely, 59.62±6.17, 121.42±2.42 and 61.69±3.20, respectively.

Keywords: Eclosion, revealed, leaves, developmental, departure and imitation.

1. Introduction

The spurge (Euphorbiaceae) family non-edible oilseed crop castor (*Ricinus communis* L.) is thought to have originated in Abyssinia. Due to its minimal demand on soil fertility, moderate rainfall requirements and lack of competition with food crops and food grade oils, it is extensively dispersed throughout the tropics and sub-tropics. Castor is farmed on an industrial scale in around 30 nations, with India leading the pack in terms of both acreage and production. Its fruits are appealing, but they are frequently removed before they ripen because the poison ricin concentrates in their beanlike seeds. It also serves as a host plant for Eri-silkmoth (*Samia cynthia ricini*). The common castor butterfly is a pest of castor plants, *Ricinus communis* (Nayar *et al*., 1976) and the larvae consume the venomous nettles as well, *Tragia involucrate* and *T. plukenetti* (Kunte, 2000).

The common castor butterflies are brownish orange with black curved patterns. Females have larger curved lines that form distinct bands. The larvae of this butterfly only eat castor plant leaves. They prefer to rest on top canopy leaves, maintaining the wings slowly moving horizontally and always closer to host plants.

2. Material and Methods

After pupation, pupae were collected and placed in another cages. The male and female adults emerging were collected in plastic bottles and released in separate rearing cage for mating and egg laying. Fresh castor leaves were supplied daily as food to larvae. The adults were fed with 10% honey soaked in cotton swabs. Longevity of life stages were observed with the larval instars, formation of pupa and adult emergence and until death. After death, adults were stretched and preserved for measuring their wing expanse and length. Colour, shape and incubation period observations were made. To evaluate the duration of each instar, newly hatched larvae were released singly in glass containers. By maintaining the paired adult moths in glass jars, the researchers were able to document the pre-oviposition, oviposition and post-oviposition periods, as well as fecundity and longevity. Different life stages examined under lab condition of stages were done with digital vernier caliper.

3. Results and Discussions

The female moths lay their eggs singly on the lower surface of the leaves between the midrib and veins, between the floral buds, inside the flowers and in the stems and capsules. Females spread their wings during egg laying, either singly, in pairs and in clusters (12-15/ cluster). Similar egg laying pattern of *Ariadne merione merione (*Cramer) was observed by Bala *et al.,* (2014). The first instar began eating on empty egg shells and subsequently the skin of leaflets shortly after emerging. The leaf epidermis, delicate and apical portion of the shoots were also consumed by 2^{nd} instar larvae. The 3^{rd} instar larvae, after initial feeding on the epidermis of leaves and tender parts of the plants. The 2^{nd} instar larvae also ate the leaf epidermis as well as the sensitive and apical region of the shoots. By scrapping, 4^{th} instar larvae feed on the leaf epidermis and delicate sections of the branches. Scrapping allowed 5th instar larvae to feed mostly on castor plant leaves and delicate portions. More or less similar damage pattern was observed by Bala *et al.,* (2014).

The newly born larva was cream coloured at first, then turned brownish green with three brown horizontal bands on the dorsal side. The body was roughly rectangular in shape, although narrowing slightly posteriorly. The head is very small and brown. Second instar larvae were covered in yellowish green spines with branching tips. The head was brown, with two brown horns. Dorsally, third instar larvae possessed a yellowish green broad stripe with a brown margin longitudinal to the body. The three brown horizontal bands body spines were similarly brown.

The 1mm head was blackish brown with white patterns. The larval body of the fourth instar turned green. The dorsal stripe darkened and became brown with yellowish white borders. The three black horizontal bars started to fade away. The head was square and blackish brown in colour. On the head, there were three triangular white marks. The head horns were reddish brown in colour and 2 mm long. The division was obvious. The spines on the body were green and were placed in four lines on each side of the body on all segments. When completely mature, the fifth instars were green with obvious segmentations and the dorsal stripe orange with black margins and numerous little white to cream coloured dots. Two above and one below the dorsal three horizontal stripes and white triangular marks with black edges are visible. The horns turned orange, with black tips and pale and dark green crossing lines on the body lateral sides. The colour of the spines altered from brown to black with yellow to orange dots at the base. Before approaching the pupal stage, the larva got sluggish and shrank significantly. This is known as the prepupal stage. The larva body tightened and it adhered itself to the substrate, its rear end dangling downwards. With pupal maturation, the brown colour shifted to black till adult eclosion. The male and female adults were essentially identical, with brownish orange wings with black wavy lines. It was discovered in the field. Mating lasted 80 minutes from beginning to conclusion. Butterfly mating was seen to occur predominantly during the late morning hours (11:00 am to 2:00 pm).

The length and breadth of first instar caterpillar varied from 2.90 to 2.33 mm with an average of 2.52 mm and 0.057 to 0.054 mm with an average of 0.05 mm, respectively. Developmental period of first instar caterpillar varied from 75.10 to 65.70 hours with an average of 70.92 hours. Bala *et al.*, (2014) reported average length of the larva measured between 2-4 mm. The first instar lasted 2 to 3 days during the Pre Monsoon (May-June) and 3 to 4 days during the Post Monsoon (October-November).

The length of the second instar ranged from 6.50 to 7.11 mm with an average of 6.93 mm, while breadth varied from 0.087 to 0.083 mm with an average of 0.085 mm. Bala *et al.*, (2014) reported average length of the larva measured 6-8 mm and the duration of instar period was 2 to 3 days during Pre Monsoon (May-June) and 3 to 4 days during Post Monsoon (Oct-Nov).

There were no changes in other characters from previous instar. The length of the third instar caterpillar ranged from 15.49 to 11.78 mm with an average of 12.94 mm, while breadth

varied from 0.15 to 0.16 mm with an average of 0.16 mm. Developmental period of third instar caterpillar varied from 136.90 to 132.60 hours with an average of 034.37 hours. Bala *et al.,* (2014) reported the average length of the larva was 8-16 mm. The third instar lasted 3 to 4 days during the Pre Monsoon (May-June) and 2 to 4 days during the Post Monsoon (October-November).

Legs were green. Length of the fourth instar caterpillar varied from 19.99 to 19.20 mm with an average of 19.59 mm and breadth 0.21 to 0.22 mm with an average of 0.21 mm. Bala *et al.,* (2014) reported average length of larva measured between 17 to 26 mm. Duration of larval period was 2 to 4 days during Pre Monsoon (May-June) to 2 to 3 days during Post Monsoon (Oct-Nov).

Length of the caterpillar varied from 34.40 to 30.76 mm with an average of 3.08 mm. Breadth ranged from 0.50 to 0.46 mm with an average of 0.48 mm. The duration of fifth instar caterpillar was 181.60 to 169.10 hours with an average of 176.82 hours. Bala *et al.,* (2014) reported larvae ranged in length from 27 to 40 mm on average. The larval phase lasted 2 to 3 days during the Pre Monsoon (May-June) and 3 to 5 days during the Post Monsoon (October-November).

The length of the pre-pupa ranged from 19.03 to 18.13 mm with an average of 18.54 mm. Breadth varied from 5.03 to 4.20 mm with an average of 4.57 mm. When completely developed, the fifth instar ceased feeding, turned brown, and its lateral crossing lines changed to brown and white. Before approaching the pupal stage, the larva got sluggish and shrank significantly. This stage, known as the prepupal stage, lasted 8 to 10 hours before forming the pupa. Bala *et al.,* (2014) reported average the pupa length ranged from 28 to 29 mm and its breadth was 3 mm. The pupal stage lasted 6 to 7 days during the Pre Monsoon (May-June) and 7 to 11 days during the Post Monsoon (October-November).

The length and breadth of pupa varied from 19.66 to 18.03 mm with an average of 18.79 mm and 5.75 to 5.50 mm with an average of 5.62 mm, respectively. The front end was narrow. At the widest point, both lateral sides curved inwards, revealing two pointed projections on the dorsal side. Throughout the year, the three early stages and adults can be found in their native habitat. Rainfall appears to be the most important factor promoting higher reproduction rates in *A. merione merione* Cramer as is the case for both *Catopsilia crocale* (Chirstopher and Mathavan, 1986) and *Catopsilia pyranthe* (Atluri *et al.,* 2004). The host plants reproduction was

most likely influenced by precipitation during the North-West monsoon. The host plant saw the most fresh growth during this season, a resource required by the larvae for greater performance due to the likely increased amounts of nitrogen and water content. Although the host plant was available throughout the year, leaf quality in terms of nitrogen and water content might have varied through the year. For most of India, Wynter - Blyth (1957)[8] rated spring as the most favorable period, followed by post monsoon and South – West monsoon. In the Northern Western Ghats, Kunte (1997) observed peak flight activity occurs during the late monsoon (August-September) and early winter (October-November). These variances in butterfly phenology show that various species respond differently to environmental seasonality and have diverse life history patterns. Even different species of a genus may behave differently as observed by Jones and Rienks (1987) in the three species of the tropical *Eurema* they studied.

Adult females lay eggs on the underside of leaves alone or in tiny clusters of 2 to 5 at a time. Adults were discovered feeding on rotten *Lantana camara* flowers, overripe, fallen and damaged *Annona squamosa, Syzygium cumini* and *Artocarpus heterophyllus* fruits and *Citrus aurantifolia* sap pouring from incisions in tree trunks (Bala *et al.,* 2014).

Length of the males varied from 61.52 to 56.89 mm with an average of 59.70 mm, while the breadth with wing expanded form varied from 5.52 to 4.75 mm with an average of 5.08 mm. Length of the female moths varied from 14.23 to 13.68 mm with an average of 13.97 mm and breadth with wing expanded form varied from 6.15 to 5.90 mm with an average of 6.03 mm.

The pre-oviposition period of female moth varied from 67.69 to 54.29 hours with an average of 59.62 hours. The oviposition period of females ranged from 123.00 to 117.82 hours with an average of 121.42 hours.

The lifespan of *Ariadne merione merione* Cramer ranged from 70 to 66 days. The overall development time from egg laying to adult eclosion was determined to be 22-32 days, allowing for up to 9 overlapping broods every year (Bala *et al.,* 2014).

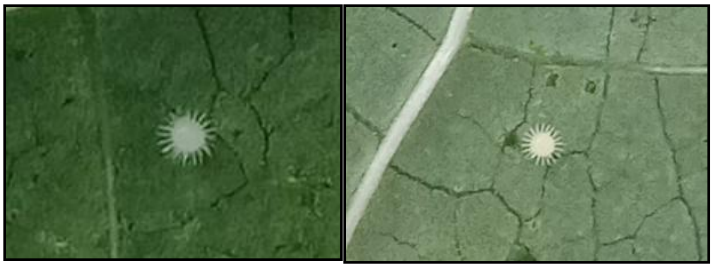
Table 1. The duration of several life phases of spiny castor caterpillar on castor.

S. No.	Life phases	Period		
		Maximum	**Minimum**	**Mean±SD**
1.	**Eggs (days)**	3.30	2.80	3.05±0.24
2.	**Larvae**			

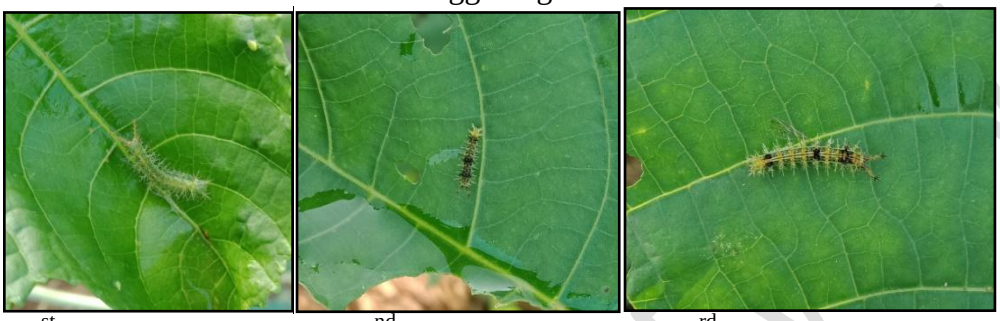
	1st instar (Hrs.)	75.10	65.70	70.92±4.89
	2nd instar (Hrs.)	111.80	107.90	109.22±1.81
	3rd instar (Hrs.)	136.90	132.60	134.37±1.87
	4th instar (Hrs.)	152.50	144.10	147.87±4.12
	5th instar (Hrs.)	181.60	169.10	176.82±5.67
	Total larval period (Days)	27.41	25.80	-
3.	Pre-pupa (Hrs.)	141.01	123.30	133.05±7.68
4.	Pupa (Hrs.)	85.99	78.15	83.31±3.67
5.	**Adults**			
	Pre-oviposition (Hrs.)	67.69	54.29	59.62±6.17
	Oviposition (Hrs.)	123.00	117.82	121.42±2.42
	Post oviposition (Hrs.)	64.45	57.11	61.69±3.20
6.	**Longevity**			
	Female (Days)	39.46	38.17	38.77±0.53

Table 2. Biometric parameters of various stages of spiny castor caterpillar on castor.

S. No.	Stage	Particulars	Measurement (mm)		
			Maximum	Minimum	Mean±SD
1.	**Larvae**				
	1st instar	Length	2.90	2.33	2.52±0.25
		Width	0.057	0.054	0.05±0.01
	2nd instar	Length	7.11	6.50	6.93±0.29
		Width	0.087	0.083	0.085±0.01
	3rd instar	Length	15.49	11.78	12.94±1.73
		Width	0.16	0.15	0.16±0.02
	4th instar	Length	19.99	19.20	19.59±0.32
		Width	0.22	0.21	0.21±0.05
	5th instar	Length	34.40	30.76	32.08±1.62
		Width	0.50	0.46	0.48±0.01
2.	Pre-pupa	Length	19.03	18.13	18.54±0.37
		Width	5.03	4.20	4.57±0.34
3.	Pupa	Length	19.66	18.03	18.79±0.74
		Width	5.75	5.50	5.62±0.11
4.	**Adults**				
	Male	Length(mm)	61.57	56.89	59.70±2.05
		Wing expanded(cm)	5.52	4.75	5.08±0.33
	Female	Length(mm)	14.23	13.68	13.97±0.23
		Wing expanded (cm)	6.15	5.90	6.03±0.13



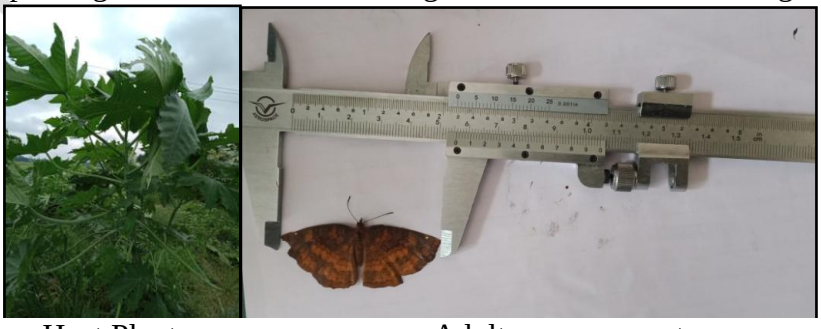
Eggs stage



1st instar larva 2nd instar larva 3rd instar larva

4th instar larva 5th instar larva Pre-pupal stage

Pupal stage Adult stage Damaged leaf



Host Plant Adult measurement

4. Conclusion

The incubation period of eggs with an average of 3.05 days. The length and breadth of 1st, 2nd, 3rd, 4th and 5th instars caterpillar varied from 2.52, 6.93, 12.94, 19.59, 3.08 mm and 0.05, 0.085, 0.16, 0.21, 0.48 mm, respectively. The length of pre-pupa and pupa with an average of 18.54 and 5.62 mm, respectively. The male length and breadth and female moth with an average of 59.70, 13.97 mm and 5.08 and 6.03 mm, respectively. The average pre-oviposition and oviposition period of a female moth of 59.62 and 121.42 hours, respectively. The total life cycle of *Ariadne merione merione* Cramer varied from 70-66 days.

6. References

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