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ASSESSMENT OF BIOLOGY AND MORPHOMETRIC PARAMETERS OF JATROPHA LEAF WEBBER AND FRUIT BORER, *PEMPELIA MOROSALIS* FAB.

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ABSTRACT

Jatropha is an important bio-fuel crop. The plant suffers more from several insect pests damage. Of which, *Pempelia morosalis* Fab. caused serious damage. Studies on the assessment of biology and morphometric parameters of *P. morosalis* was carried out during 2011-12 at University of Agricultural Sciences, GKVK, Bangalore. The incubation period lasts for 5.9 ± 0.80 days. The duration of first, second, third, fourth and fifth instars were 2.3 ± 0.48, 4.2 ± 0.91, 5.8 ±0.78, 6.9 ± 0.87 and 8.1 ± 0.87 days, respectively; pupal period lasted for 6.9 ± 0.73 days. Male and female had longevity of 5.6 ± 0.5 and 7.5 ± 0.5 days, respectively, with fecundity of 66.5 ± 17.8 per female.

INTRODUCTION

Jatropha curcas L. (Euphorbiaceae), is a native of Mexico and tropical America but naturalized now throughout the world. It is also called as purging nut, barbados nut and physic nut. The seeds are very rich in oil (40%) which is mainly used as bio-fuel. The oil is used as an illuminant as it burns without emitting smoke. The demand for fossil fuel is expected to grow from the current 6.8 to 34.0 billion gallons by 2022 (DOR, 2011).

Jatropha oil contains approximately 24.60% of crude protein, 47.25% of crude fat, and 5.54% of moisture content (Akintayo, 2004). All parts of jatropha (seeds, leaves and bark) have been used in traditional medicine and for veterinary purposes for a long time (Dalziel, 1955 and ITCOT, 2004).

A global list of phytophagous insects constitutes 60 species in 21 families of four orders (Hampson, 1912). The pest complex includes *Nephopteryx* (Hampson, 1912), tailed mealy bugs *Ferrisaina (Ferrisia) virgata,* C., Jatropha Scale , *Hemilecanium imbricans* N. and neem Scale: *Pulvinaria maxima G.* (Ayyar, 1919, 1940), papaya mealy bug, *Paracoccus marginatus* Williams and Granara de Willink (Regupathy and Ayyasamy, 2009, 2010b), leaf and flower webber cum fruit borer, *Salebria (Pempelia) morosalis* (Saalm Uller), castor semilooper, *Achaea janata* L. (on *Euphorbia pilulifera*) (Beeson, 1941), tobacco cutworm, *Spodoptera litura* (Fabricius) (Meshram and Joshi, 1994 and Robinson *et al.*, 2004), scutellarid bug, *Scutellera nobilis* Fab. (Shankar and Dhyani, 2006), calotropis leaf hopper bug, *Eurybrachis tomentosa* F., grape-vine thrips, *Rhipiphorothrips cruentatus* H., chilli muranai mite, *Polyphagotarsonemus latus* Banks and *Chrysocoris purpureus, C.* (Regupathy and Ayyasamy, 2006; Manoharan *et al.,* 2006). Among these *P. moroaslis* larvae causes serious damage (Shankar and Dhyani, 2006; Beeson, 1941; Manoharan *et. al.,* 2006 and Robinson *et. al.*, 2004) and the incidence was to the extent of 60 to 70 per cent in Madhya Pradesh (Meshram and Joshi, 1994). Immediately after larva hatched from the eggs, the first and second instar larvae appear to be gregarious and caused skeletonization of leaves. The later instar caterpillars fed inside the leaves by webbing the 3 to 4 leaves together with the help of salivary secretion and excreta, which results in defoliation. Besides, larvae boring in to tender shoots, fed on the internal content by moving downward. Such infestated shoots resulting in drying and droping and no further growth was observed on such affected shoots. During later stages larvae web the inflorescence and tender capsules, fed on the contents of the inflorescence and capsules by remaining inside (Regupathy and Ayyasamy, 2006). The infested parts when opened reveal the presence of caterpillars with excretory pellets and silken galleries. Such affected parts dry and drop off. The pest caused both qualitative and quantitave loss by affecting new growth and inflorescence of the plant; thus reduced the fruit set; besides reduced the yield and oil content of jatropha. Several constraints in jatropha production have been identified, which include; non-availability of land, shortage of inputs, irrigation

facilities, *etc*. In addition, the plant suffers more from insect pest and disease. Among several insect pest, *P. moroaslis* causes serious damage (Shankar and Dhyani, 2006). Literature pertaining to biology and morphometry of *P. morosalis* is very megre. Hence, detailed investigations on the bio-ecology and weak links in its growth stages will pave the way for its effective suppression.

MATERIALS AND METHODS

A laboratory experiment was conducted at GKVK, Bangalore during 2011-12. Field collected larvae were placed in insect rearing cages (35 cm × 30 cm × 35 cm) having cut ends of terminal shoots of jatropha immersed in 250 ml conical flask containing water to maintain the turgidity. Fresh terminal shoots were provided for feeding as and when required. On completion of larval period, pupae were transferred to a petridish and kept inside the rearing cage. The males with cylindrical tapering abdomen and the female with broad abdomen having tubular aperture at the end were examined to separate the sex. A pair of male and female was released into the rearing cage provided with diluted honey solution in glass vials for feeding and tender shoots were provided as ovipositional substrate. The eggs of female moth laid on tender plant parts. As larva web the leaves and bore into the fruits, it is difficult to find the cast head capsule so Dyar's law was used to find out the moulting. In this manner number of larval instars was recorded. Larval duration, pre pupal period, pupal period, premating period, mating period, oviposition period, fecundity, viability of eggs, male adult longevity and female adult longevity were recorded (Ambika *et al*., 2007; Sharma and Srivastava, 2010). Biology was studied during August to October, 2011 with the mean maximum and minimum temperatures recorded were 29.5°C and 21.2°C respectively with relative humidity of 88.3 per cent.

RESULTS AND DISCUSSION

The morphometric measurements on egg, larval instars, pupae and adults (both male and female) of *P. morosalis* on jatropha were shown in Table 1. Dyar's law was used to find out the number of larval instars based on the head capsule width measurement were shown in Table 2. Similarly growth parameter on developmental periods of egg, nymphal instars, pupae, adult (both male and female), pre-oviposition, oviposition, fecundity, post-oviposition period were shown in Table 3 and 4.

Table 2: Head capsule width of life stages of *P. morosalis* larva

Instar	Head capsule width (mm)		Ratio
	Range	Mean ± SD.	
I instar	0.17-0.20	0.18 ± 0.04	-
II instar	0.18-0.42	0.28 ± 0.05	1.44
III instar	0.29-0.65	0.40 ± 0.07	1.42
IV instar	0.52-0.89	0.58 ± 0.10	1.45
V instar	0.73-1.16	0.83 ± 0.25	1.43

n = 10

Table 3: Life cycle stages of *P. morosalis* on jatropha

Sl. no.	Insect stages	Period in days	
		Range	Mean ± S.D
1.	Incubation period	5-7	5.9±0.80
2.	I instar	2-3	2.3±0.48
3.	II instar	3-5	4.2±0.91
4.	III instar	5-7	5.8±0.78
5.	IV instar	6-8	6.9±0.87
6.	V instar	7-9	8.1±0.87
7.	Total larval period	22-26	24.2±1.39
8.	Pre pupal period	2-3	2.4±0.51
9.	Pupal period	6-8	6.9±0.73
10.	Total developmental period (incubation to till adult emergence)	36-50	42.5±0.7

n = 20

Studies on the biology of *P. morosalis* revealed that the female moth laid flat to oval whitish coloured eggs which are firmly glued to the surface. The eggs were deposited singly or in small groups on terminal leaves along the leaf vein of the abaxial surface of leaves and young shoots. In the present study, the egg length varied from 0.53 to 0.59 mm with an average of 0.56 ± 0.02 mm and egg width ranged from 0.49 to 0.55 mm with an average of 0.51 ± 0.01. The incubation period under laboratory condition varied from 5 to 7 days with an average 5.9 ± 0.80 days, the present results are in close agreement with the observations made by Ambika *et al*. (2007) and Sharma and Srivastava (2010).

The caterpillar moulted four times and thus has five larval instars. The first instar larva was minute, pale white coloured body; second instar larva has light green coloured body with five thin indistinct light dark coloured longitudinal lines; third instar larva has light green coloured body with five distinct green coloured longitudinal stripes; fourth instar larval head is black in colour without black coloured prothoracic shield; fifth instar larval head is blackish brown coloured; body is dark reddish in colour with light reddish brown longitudinal

Table 1: Morphometric data of *P. morosalis* on jatropha

S. no.	Insect stages	Length(mm)		Width(mm)	
		Range	Mean ± S.D	Range	Mean ± S.D
1.	Egg	0.53-0.59	0.56±0.02	0.49-0.55	0.51±0.01
2.	I instar	2.52-2.72	2.64 ± 0.07	1.40-1.90	1.67±0.18
3.	II instar	5.38-5.67	5.52±0.09	2.90-3.40	3.21±0.17
4.	III instar	9.39-9.58	9.52±0.05	5.80-6.80	6.42±0.35
5.	IV instar	14.86-14.96	14.92±0.03	7.90-8.50	8.21±0.20
6.	V instar	20.52-22.9	21.24±0.7	9.90-11.9	11.21±0.74
7.	Pre-pupa	14.26-17.28	15.86±0.99	2.45-2.97	2.65±0.18
8.	Pupa	7.10-9.0	8.03±0.06	2.30-2.89	2.65±0.18
9.	Adult female	9.67-11.97	10.61±0.80	19.35-24.5	21.43±1.52
10.	Adult male	8.34-11.56	10.0±0.95	19.10-23.3	20.81±1.50

n = 20

Table 4: Adult longevity and fecundity of *P. morosalis* on jatropha

S. no.	Insect stage	Range	Mean ± S. D
1.	Premating period (hr)	12-23	17.4 ± 3.2
2.	Mating period (min)	12-19	15.6 ± 2.6
3.	Oviposition period (d)	3-5	3.9 ± 0.7
4.	Fecundity	38-96	66.5 ± 17.8
5.	Viability of eggs (%)	75.3-87.5	82.43 ± 3.9
6.	Male adult longevity(d)	5-6	5.6 ± 0.5
7.	Female adult longevity(d)	7-8	7.5 ± 0.5
8.	Total developmental period	48-64	55.6 ± 0.7

n = 20

patch on middorsum; duration of 1st, 2nd, 3rd, 4th and 5th instars were 2.3, 4.2, 5.8, 6.9 and 8.1 days respectively. The present findings are in accordance with the findings of Ambika *et al*. (2007) and Sharma and Srivastava (2010), who recorded five instars with same colour features on the body and also duration of instars. Total larval period ranged from 22 to 26 days with an average of 24.2 ± 1.39 days. Pre-pupal period lasted for 2 to 3 days with an average of 2.4 ± 0.51 days. Pupation occurred in webbed leaves inside the thin silken cocoon. Pupal period lasted for 6 to 8 days with an average of 6.9 ± 0.73 days. These results are in confirmation with the findings of Sharma and Srivastava (2010) who recorded the larval duration of 25 to 30 days and pupal period of 7 to 8 days.

Emergence of adult moth from the pupal case noticed mostly during morning and evening hours. The adult moth is medium sized, fore wings are light grayish brown in colour with white coloured band towards anterior margin, where as hind wings are pale white in colour. Female moths are slightly larger, having bulged abdomen and the male moths were smaller in size without bulged abdomen. These findings are in agreement with the reports of Ambika (2005), Beeson (1941) and Sharma and Srivastava (2010). Copulation took place 12 to 23 hours with an average of 17.4 ± 3.2 hours after emergence during evening and at night; mating period ranged from 12 to 19 hours with an average of 15.6 ± 2.6, ovipositional period ranged from 3 to 5 days with an average of 3.9 ± 0.7 hours.

Fecundity ranged from 38 to 96 eggs per female with a mean of 66.5 ± 17.8. Male adult longevity ranged from 5 to 6 days with an average of 5.6 ± 0.5 days. While, female adult longevity ranged from 7 to 8 days with an average of 7.5 ± 0.5 days. In all cases female lived longer than male. The present results are in accordance with the findings of Ambika (2005) and Sharma and Srivastava (2010) who observed adult longevity of male and female was 5 to 6 days and 7 to 8 days respectively.

The total life cycle from egg to adult emergence lasted longer (48 to 64 days with an average of 55.6 ± 0.7days). The longer period taken for completion of life cycle is attributable for the inter play of multifactors such as temperature, relative humidity, quality of the food and other interaction effects as reported by Mathur (1960) in case of teak defoliator.

Accurate knowledge of the insects present in an area is essential as a basis for development of integrated pest management. Thus, study on bio-ecology to determine the weak links in its growth stages thus paving the way for its effective suppression.

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