



SHORT NOTE

Biology of *Helicoverpa armigera* Hub. on rose in laboratory condition

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Rose plant is attacked by number of insect pests like bud borer, thrips, scale, aphids, weevils, chafer beetles leaf eating caterpillars and non insect pest like red mite. Amongst them, *Helicoverpa armigera* is the major coconut pest on rose. Due to the presence of sweet fragrance, absence of bitter principles, *Helicoverpa* moths are attracted for oviposition on tender rose buds. Infestation of the bud borer is seen on open cultivated roses in severe form from January to March. Female moth lays cream colored eggs singly on young buds. Newly hatched larva bore into buds by making holes and feeds on growing petals. Caterpillars also damage flowers by eating petals and leaving excreta. In south Gujarat, it is considered to be a major limiting factor in production of good quality rose flowers. Its attack coincides with bud and flower stage and in absence of this it also feed on leaves and reduces the market value of flowers.

The study on biology of *H. armigera* was carried out in the laboratory, Department of Entomology, N.M. College of Agriculture, Navsari Agricultural University, Navsari at 24.03 ± 1.75 °C temperature and average relative humidity was 53.9 ± 3.04 per cent during November December 2006.

Maintenance of *Helicoverpa* culture

Ten gravid females obtained from mass culture were released in a glass jar of 23cm diameter and 10cm height. Cuttings of tender shoot of rose having buds and leaves were dipped in fresh water filled conical flask to maintain turgidity of leaves and buds. These shoots were provided to females for resting and oviposition. These females were kept under observation for the number of eggs laid on leaves from the following day. The adult females were removed immediately after the egg laying was over.

Rearing technique

In the laboratory, larvae were reared separately on the respective host in transparent plastic tubes of 2.5cm diameter and 7.5cm length. The open end of plastic tubes

was covered with the perforated lids to facilitate aeration. In case of rose variety Gladiator rose bud were provided as food daily till pre-pupal stage. At the time of pre pupal stage, 1/3 part of each plastic tube was filled with moist soil to facilitate pupation. The pupae formed were transferred to jars for emergence of the adults.

Newly emerged male and female moths were transferred in a glass jar (23cm diameter x 10cm height). Cutting of tender shoots of respective host plant having buds and leaves were dipped in fresh water filled in conical flask (4.5cm diameter at bottom and 8.0cm height) to maintain turgidity of bud and leaves. The shoots thus prepared, were provided to the moths inside the rearing jars for resting and oviposition. The open end of glass jar was covered with fine muslin cloth, secured in a position with the help of rubber band. Cotton swabs dipped in five per cent honey solution were placed in rearing jar for food to the moths. The shoots were substituted daily with fresh one. The eggs were collected from the shoots and used for further study.

The results of the investigation of *H. armigera* carried out in the laboratory are presented in Table 1 and discussed below.

Egg: The eggs were laid singly on buds as well as on tender leaves. The female mostly preferred egg lying on buds. The freshly laid egg was yellowish white in colour which changed to deep yellow after one day and became dark brown prior to hatching. Eggs were hemispherical with flat base and prominently sculptured with numerous ridges running from one polar end to another. These ridges persisted until hatching. After emergence of the larvae, the egg shell became transparent with a tiny emergence hole made by the larva. The eggs were larger, measuring from 0.45 to 0.51mm with an average 0.49 ± 0.04 mm in length and from 0.50 to 0.58 mm with an average of 0.54 ± 0.2 mm in width (Table -1).

Table 1 : Measurement of various stages of *H. armigera*

Stage		Number observed	Measurement in mm		
			Min.	Max.	Av. ± S.D.
Egg	Length	25	0.45	0.51	0.49±0.04
	Width	25	0.50	0.58	0.54±0.02
Larva 1 st instar	Length	25	1.42	1.50	1.47±0.02
	Width	25	0.49	0.55	0.51±0.02
2 nd instar	Length	25	3.50	3.55	3.52±1.08
	Width	25	0.78	0.84	0.82±0.01
3 rd instar	Length	25	8.71	11.00	9.74±0.66
	Width	25	2.78	2.84	2.81±0.02
4 th instar	Length	25	21.80	25.90	23.02±1.36
	Width	25	3.23	3.26	3.24±0.01
5 th instar	Length	25	31.60	36.50	34.50±1.29
	Width	25	4.95	5.20	5.11±0.07
6 th instar	Length	25	40.80	46.90	43.89±1.24
	Width	25	5.95	8.40	6.59±0.56
Pre-pupa	Length	25	22.42	28.38	25.01±1.56
	Width	25	4.92	4.98	4.96±0.02
Pupa	Length	25	19.95	23.10	20.93±1.09
	Width	25	5.90	6.15	6.09±0.08
Adult (Male)	Length	25	15.40	18.75	17.09±0.77
	Width	25	33.40	39.15	36.20±1.55
Adult (Female)	Length	25	18.40	22.20	20.57±1.22
	Width	25	38.39	49.90	41.61±2.86

Min. = Minimum, Max. = Maximum, Av. = Average, S.D. = Standard deviation

Incubation period of egg varied from 3 to 5 days with an average 3.72 ± 0.79 days. Earlier, the incubation period of eggs was found to be 4 days on pigeon pea, groundnut and cotton and 5 days on tomato, gram, cabbage and potato (Anon., 1990).

The hatching percentage of eggs of *H. armigera* on rose was varied from 66.00 to 96.00 per cent with an average 83.67 ± 9.21 per cent.

First instar larva: The freshly emerged larvae were semi-translucent, yellowish white in colour with yellowish orange longitudinal lines on the dorsal surface of the body. The head, thoracic and anal shields and legs were brown in colour and newly emerged larvae were sluggish which became active after 2-3 hours on buds.

The body length of first instar larva varied from 1.42 to 1.50 with an average 1.47 ± 0.02 mm while, the width varied from 0.49 to 0.54mm with an average 0.51 ± 0.02 mm. The duration of first instar larva varied from 2 to 3 days with an average of 2.16 ± 0.37 days (Table- 1&2).

Second instar larva: Second instar larva was morphologically closely resembled that of first instar larva. In this instar, the larva was yellowish brown in colour with some what darker head than the general body colour. The second instar larvae measured 3.50 to 3.55 mm with an average of 3.52 ± 1.08 mm in length and 0.78 to 0.84mm with an average of 0.82 ± 0.01 mm The duration of second instar larva varied from 2-3 days with an average of 2.84 ± 0.37 days (Table- 1&2).

Table 2 : Duration of various stages of *H. armigera*

Stage	Number observed	Duration in days		
		Min.	Max.	Av. ± S.D.
Incubation (egg period)	25	3.00	5.00	3.72±0.79
Larva 1 st instar	25	2.00	3.00	2.16±0.37
2 nd instar	25	2.00	3.00	2.84±0.37
3 rd instar	25	2.00	6.00	3.80±1.00
4 th instar	25	3.00	6.00	4.60±0.76
5 th instar	25	3.00	6.00	4.16±0.69
6 th instar	25	4.00	8.00	6.60±1.22
Total larval period	25	19.00	28.00	24.16±2.25
Pre-pupa	25	1.00	3.00	2.28±0.61
Pupa	25	9.00	14.00	10.44±1.36
Adult (Male)	25	4.00	8.00	5.40±1.04
Adult (Female)	25	5.00	11.00	8.84±1.91
Pre-oviposition	25	2.00	4.00	2.76±0.83
Oviposition	25	4.00	7.00	5.36±0.99
Post-oviposition	25	0.00	2.00	0.84±0.85
Total life cycle (Male)	25	35.00	45.00	39.40±2.33
Total life cycle (Female)	25	37.00	48.00	42.96±2.47
Hatching percent	25	66.00	96.00	83.67±9.21
Fecundity	25	290.00	910.00	631.84±208.34
Sex Ratio	25	29.00	21.00	1:0.72

Min. = Minimum, Max. = Maximum, Av. = Average, S.D. = Standard deviation

Third instar: Third instar larvae were longer than second instar larvae. The body colour turned to yellowish brown. Many scattered black spots were observed on the body. The data presented in Table- 1 revealed that the body length of the third instar larvae varied from 8.71 to 11.00mm with an average of 9.74 ± 0.66 mm while, the width of body varied from 2.78 to 2.84mm with an average of 2.81 ± 0.02 mm.

The duration of third instars larva varied from 2 to 6 days with an average of 3.80 ± 1.00 mm (Table-2).

Fourth instar larvae: In fourth instar larva, there was variation in colour and number of longitudinal stripes of the larvae. Generally the lateral stripes on all the fourth

instar larvae were yellowish brown but dorsal stripes were variable in colour. The stripes were continuous in some larva while in other they were broken. The fourth instar larva measured 21.80 to 25.90mm with an average of 23.02 ± 1.36 mm in body length while width varied from 3.23 to 3.26mm with an average of 3.24 ± 0.01 mm. Duration of fourth instar larva ranged from 3 to 6 days with average of 4.60 ± 0.76 days (Table- 1&2).

Fifth instar larvae: The fifth instar larva was pale brown with broken larval stripes and continuous dorsal stripes. Head was reddish brown and the body length of fifth instar larva was varied from 31.60 to 36.50mm with an average of 34.50 ± 1.29 mm while, the width of body varied from 4.95 to 5.20mm with an average of

5.11 ± 0.07mm. Duration of fifth instar larva ranged from 3 to 6 days with an average 4.16 ± 0.69 days (Table- 1&2).

Sixth instar larvae: The sixth instar larva was flattened ventrally but convex dorsally. The body was pale brown in colour with scattered short hairs on it. The head of the larva was reddish whereas thoracic and anal shields and thoracic legs were brown in colour. The larva measured 40.80 to 46.90mm with an average of 43.89 ± 1.24mm in body length while, width varied from 5.95 to 8.40mm with an average of 6.59 ± 0.56mm Duration of larva ranged from 4 to 8 days with an average of 6.60 ± 1.22 days (Table- 1&2).

Total larval period: The data on total larval period indicated that the larval period varied from 19 to 28 days with an average of 24.16 ± 2.25 days. In past, the larval period were 24.18, 31.50, 24.94 and 30.00 days recorded on potato, tomato, cabbage and gram, respectively (Anon., 1990).

Pre-pupa: When the larva completed its development, it stopped feeding and searched for a suitable site for pupation. In the prepupal stage, the full grown larva of sixth instar becomes sluggish and suspended feeding and movement. The colour of the full grown larva became brownish and later on turned lighter with less prominent stripes before formation of pupa. The larva contracted its length and appendages and became quiescent and then the pupa formation took place. The length of pre-pupa varied from 22.42 to 28.38mm with an average of 25.01 ± 1.56mm while the width of the body varied from 4.92 to 4.98mm with an average of 4.96 ± 0.02mm. The duration of pre-pupa ranged between 1 to 3 days with an average of 2.28 ± 0.61 days (Table- 1&2). In past Singh and Singh (1975) reported that prepupal period was ranging from 1 to 2 days on tomato. Thus, the present finding is more or less in conformity with the observations reported by above workers.

Pupa : The pupae were broadly rounded anteriorly but tapering posteriorly. The newly formed yellowish green pupa became light brown within 24 hours and further darkened prior to emergence of moth. Abdomen was distinctly marked into ten segments and well defined dark brown spiracles were visible on 4th to 9th abdominal segments. Similar description of pupa was given by Singh and Singh (1975)

The length of pupa ranged between 19.95 to 23.10 mm with an average of 20.93 ± 1.09mm while, the width

of pupa varied from 5.90 to 6.15mm with an average of 6.09 ± 0.8mm and the duration of pupal stage varied from 9 to 14 days with an average 10.44 ± 1.36 days (Table- 1&2). In past, the pupal period was recorded 9.50 days on cotton and 22.64 days on tomato (Anon., 1990). The present findings are more or less similar with above results.

Adult : The adults were medium in size, possessing yellowish brown fore wings with series of the dots on margin. There was black kidney shaped mark on underside of each fore wing. Hind wings were light in colour and each possessed a dark colour patch at the apical end. Morphologically, both male and female were closely resembled to each other except female had tuft of hairs on the tip of the abdomen. Body length of male moths ranged from 15.40 to 18.75mm with an average of 17.09 ± 0.77mm. whereas the width varied from 33.40 to 39.15mm with an average of 36.20 ± 1.55mm. In case of female, the body length ranged from 18.40 to 22.20mm with an average 20.57 ± 1.22 mm and width from 38.39 to 49.90mm with an average of 41.61 ± 2.86 mm (Table- 1). Almost similar measurement was observed by Singh and Singh (1975).

Pre - oviposition, oviposition and post – oviposition: Pre-oviposition period varied from 2 to 4 days with an average of 2.76 ± 0.83 days. The oviposition period was found to be ranging from 4 to 7 days with an average 5.36 ± 0.99 days. The post-oviposition period was observed to varying between 0 to 2 days with an average 0.84 ± 0.85 days (Table- 2).

Fecundity of female : The results on fecundity revealed that the egg laying capacity of the female varied from 290 to 910 eggs with an average 631.84 ± 208.34 eggs.

Longevity of adult *H. armigera*: The average longevity of male was varied from 4 to 8 days with an average of 5.40 ± 1.04 days, whereas in case of female, it was varied from 5 to 11 days with an average of 8.84 ± 1.91 days. Thus, the females lived longer than the males (Table- 2). In past Singh and Singh (1975) reported that the longevity of male and female varied from 3.13 ± 0.78 and 6.63 ± 0.85 days, respectively on rose. Thus present finding are more or less in agreement with the results reported by above workers.

Total life cycle: The total life period of *H. armigera* (egg to death of adult) recorded on rose in laboratory are presented in table-2. The Total life cycle of male ranged from 35 to 45 days with an average of 39.40 ±

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2.33 days and in case of female it was 37 to 48 days with an average of 42.96 ± 2.47 days. Thus, the duration of life cycle of female was longer than male. In past, the life span of male were 33.16, 57.71 and 66.50 days and female 35.36, 59.48 and 70.71 days in cotton, potato and tomato, respectively (Anon.1990). Thus, the present finding on total life cycle are more or less in agreement with past report.

Sex ratio: The sex ratio of male: female recorded in laboratory was 1: 0.72 (Table- 2). In past Singh and Singh reported that the sex ratio (male: female) was 1: 0.67 for laboratory reared adults on tomato which is in agreement with present findings.

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