



LIFE CYCLE OF SPOTTED POD BORER, *MARUCA VITRATA* (FABRICIUS) (CRAMBIDAE, LEPIDOPTERA) ON GREENGRAM UNDER LABORATORY CONDITIONS

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ABSTRACT: A study on biology of spotted pod borer, *Maruca vitrata* was studied on greengram under laboratory conditions during *rabi* 2014-2015 at the Regional Agricultural Research Station, Lam, Guntur. The female moth laid eggs on the flower buds, flower petals, tender pods and on inner surface of glass jar. The egg period lasted for 3.25 days. Mean fecundity was 52.16 eggs. There were five larval instars with mean larval duration of 14.85 days. The measurements (length x breadth) of first, second, third, fourth and fifth instar larvae were 3.02 mm x 0.61 mm, 4.43 mm x 0.87 mm, 8.80 mm x 1.69 mm, 11.10 mm x 2.68 mm and 15.68 mm x 3.07 mm, respectively. The average head capsule width of first, second, third, fourth and fifth instar larvae were 26.80 μ m, 65.20 μ m, 88.70 μ m, 121.60 μ m and 139.60 μ m, respectively. The fully grown larvae stopped their feeding and spun silken thread around it to transform into pupa on dry leaves, flowers and debris. The pre pupal and pupal period lasted for 1.85 and 7.35 days respectively. The longevity of male and female moths was 5.80 and 7.95 days respectively. The total developmental period of *M. vitrata* ranged from 32.95 to 35.10 days with 76.00% of adult emergence.

Key words: Biology, spotted pod borer, *Maruca vitrata*, greengram

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INTRODUCTION

Green gram [*Vigna radiata* (L.) Wilczek] is one of the important pulse crops due to its nutritional and industrial values. Around the world, the crop is cultivated in 5.0 M. ha with a production of 2.5 m. t. While in India it is grown in an area of about 26.06 lakh ha with production and productivity of 16.10 lakh tonne and 619 kg ha⁻¹, respectively [1]. Andhra Pradesh is the fourth major state of India contributing 15.5 % of the national production with 351 kg ha⁻¹ average productivity of green gram. A large number of insects have been recorded feeding on this crop from sowing till harvesting. The spotted pod borer, *Maruca vitrata* (Fabricius) is predominant species in South India and is a serious pest because of its extensive host range, destructiveness and distribution [2]. It belongs to the family Crambidae and order Lepidoptera. It is widely distributed in Asia, Africa, Australia and the Americas [3] infesting 40 host plants including cowpea, pigeonpea and common bean. It attacks the crop right from pre-flowering to pod maturing stage by feeding on flower buds, flowers and pods through webbing. Economic loss of 25 - 50% in green gram was reported by Sandhyarani and Eswari [4]. Differences in agro-climatic conditions and crop phenology may influence the biology and life cycle of *M. vitrata*. Therefore, understanding the biology of the pest in the crop is most important for formulating IPM strategies for effective management of the pest and hence the present investigation was carried out.

MATERIAL AND METHODS

The initial culture of *M. vitrata* was developed by collecting larvae from unsprayed green gram crop grown at Regional Agricultural Research Station, Lam, Guntur. Around fifty larvae were reared in laboratory by providing fresh flowers and pods of green gram as food daily up to the adult emergence. Ten pairs of freshly emerged female and male moths were paired and confined in big glass jar (30 x 30 x 20 cm) containing tender shoots, flowers and pods of green gram raised in earthen pots for ovi position and a cotton swab soaked in five per cent honey solution was provided as their food. Number of eggs laid on the flower buds and pods were counted using magnifying glass daily till death of female and the average number of eggs laid by a female was calculated.

The freshly hatched larvae were taken individually in plastic specimen tubes. They were provided with fresh flowers and pods of green gram as food. The number of larval instars was confirmed through measuring the width of head capsule. The total larval period was calculated on the basis of days from egg hatching to pupation. When fully grown larvae stopped feeding, contract and become dark, they were kept undisturbed for pupation. Pupal period was calculated based on number of days for adult emergence from pupa.

RESULTS AND DISCUSSION

Egg: The freshly laid eggs were pale yellowish white, scale like with reticulated markings on the chorion and were laid singly and in small groups. The eggs were laid on the flower buds, flower petals, tender pods and on inner surface of glass jar. The eggs were dorso-ventrally flat and were not visible to naked eye. The incubation period under laboratory conditions varied between 2.5 and 4 days with a mean of 3.25 days in green gram (Table 1). The present findings are in agreement with Chandrayudu *et al.* [5], Bindu *et al.* [6], Haritha [7] and Naveen *et al.* [8].

Larva: The larvae had passed through the five larval instars. The duration of each instar (Table 1), the length and breadth of each instar was recorded along with the width of the head capsule (Table 2). Earlier studies by Ghorpade *et al.* [9] and Haritha [7] revealed that there were five larval instars during the larval period of spotted pod borer and are in agreement with present findings.

The newly hatched first instar larvae were minute, active and white and devoid of spots on their body. The head capsule was slightly red in colour. The newly hatched larvae bore into the unopened flowers. The second instar larva was creamy white in colour similar to first instar larvae but with greater size and slightly red coloured head capsule. The third instar larva was distinguished from the second instar larva by the presence of prominent black spots on its each body segment. The head and prothoracic shield became still darker. The fourth instar larva was creamy white in colour and black spots were observed on its body similar to that of third instar except in size and the colour of head capsule was slightly black. The fifth instar larva was deep creamy white in colour along with creamy white head capsule. The body slightly tapers towards both ends with maximum width in the middle. The duration of first, second, third, fourth and fifth instar larvae on an average were 2.15 days, 2.70 days, 2.95 days, 3.05 days and 4.00 days, respectively. The total larval period of *M. vitrata* was 14.85 days on green gram. The measurements (length x breadth) of first, second, third, fourth and fifth instar larvae were 3.02 mm x 0.61 mm, 4.43 mm x 0.87 mm, 8.80 mm x 1.69 mm, 11.10 mm x 2.68 mm and 15.68 mm x 3.07 mm, respectively. The average head capsule width of first, second, third, fourth and fifth instar larvae were 26.80 µm, 65.20 µm, 88.70 µm, 121.60 µm and 139.60 µm, respectively. The fully grown larvae stopped their feeding and spun silken thread around it, which is completely concealed and pupation occurs on dry leaves, flowers and debris. Similar observations were also reported by Ganapathy [10] on green gram, Bindu *et al.* [6] and Haritha [7] on red gram, Naveen *et al.* [8] on cowpea and Sonune *et al.* [11] on black gram.

Pupa: Pupation was observed in inner side of damaged pods and sometimes in rearing containers under the laboratory conditions. The pupa was brown in colour and gradually turned dark before the adult emergence. The pre pupal and pupal period lasted for 1.85 and 7.35 days respectively (Table 1). Pupal period was 7.76 days green gram [5] and 7.13 to 7.6 days on red gram [9, 6, 12].

Adult: The moth had medium brown wings and creamy white to brown body with long legs. Forewings were small with semitransparent bands and the hind wings were silver white with brown spots at the apical margin across the wings. Male and female moths could be clearly distinguished by the abdominal shape. In male, abdomen tapered towards the end and the tip of female abdomen was long, slightly bulged and provided with two openings. The longevity of male moth varied from 4.0 to 7.5 days with an average of 5.80 days, while that of female varied from 6.0 to 9.0 days with an average of 7.95 days (Table 1). The present findings are in concurrence with Sonune *et al.* [11] who reported that the longevity of male adult was 6.24 days, while that of female adult was 8.06 days on black gram.

Total development Period: The total development period of *M. vitrata* ranges between 32.95 to 35.10 days on green gram under laboratory conditions (Table 1) which was in concurrence with the findings of Ganapathy [10] on green gram and Sonune *et al.* [11] on black gram.

Mating Period: The mating took place during night within two to three days after moth emergence and the maximum number of mating pairs were observed between 20.00 to 1.00 h. The sex ratio was 1: 0.754 on green gram which is in agreement with findings of Chandrayudu *et al.* [5]. After mating, the moths laid eggs on under surface of leaves, terminal shoots, flower buds and tender pods.

Table 1: Details of life cycle of *M. vitrata* on green gram under laboratory conditions

Particulars	Duration (DAYS)		
	Minimum	Maximum	Average \pm S.D.
Egg	2.5	4.0	3.25 \pm 0.51
Larval instar			
I instar	1.0	3.0	2.15 \pm 0.67
II instar	2.0	3.5	2.70 \pm 0.54
III instar	2.0	4.0	2.95 \pm 0.60
IV instar	2.0	4.0	3.05 \pm 0.69
V instar	3.0	5.0	4.00 \pm 0.75
Total larval period	12.0	16.0	14.85 \pm 0.08
Pre Pupal period	1.0	2.0	1.85 \pm 0.47
Pupal period	6.0	8.0	7.20 \pm 0.71
Adult emergence (%): 76.00 No. of pupae observed: 50 No. of adult emergence: 38			
Adult longevity			
Male	4.0	7.5	5.80 \pm 1.30
Female	6.0	9.0	7.95 \pm 0.98
Fecundity No. of eggs laid per female:			52.16 \pm 3.85
Total developmental period			32.95 – 35.10

Table 2: Biometrics of *M. vitrata* larval instars under laboratory conditions on green gram

Instar	Number studied	Length Range (mm) (Average \pm S.D.)	Breadth range (mm) (Average \pm S.D.)	Head capsule width range (μ m)	Average (μ m)	Ratio (Dyar's law)
1 st	10	3.02 \pm 0.24	0.61 \pm 0.18	18-26	26.80	
2 nd	10	4.43 \pm 0.44	0.87 \pm 0.13	52-74	65.20	2.4
3 rd	10	8.80 \pm 0.42	1.69 \pm 0.19	82-94	88.70	1.4
4 th	10	11.10 \pm 0.70	2.68 \pm 0.15	108-128	121.60	1.4
5 th	10	15.68 \pm 0.71	3.07 \pm 0.18	130-152	139.60	1.15

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