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Biology and morphometrics of spotted pod borer, *M. vitrata* (geyer) on pigeonpea variety bdn-711 under laboratory condition

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Abstract
A biological and morphometrical study on spotted pod borer, *Maruca vitrata* (Geyer) was studied on pigeonpea early variety BDN-711 during *Kharif*-2017 at Entomological Research Laboratory VNMKV, Parbhani. The egg period counted 2.63 ± 0.42 days. There were five larval instars with mean larval duration of 9.61 ± 1.80 days. The measurements (length x breadth) of first, second, third, fourth and fifth instar larvae were 1.32 ± 0.01 x 0.18 ± 0.006, 2.50 ± 0.04 x 0.40 ± 0.01, 5.60 ± 0.07 x 0.90 ± 0.02, 11.12 ± 0.11 x 1.80 ± 0.10 and 15.95 ± 0.13 x 2.82 ± 0.09 mm, respectively. However length x breadth of pupa, male and female were 13.01 ± 0.12 x 2.75 ± 0.05, 12.62 ± 0.20 x 0.90 ± 0.04 and 13.02 ± 0.20 x 0.93 ± 0.05 mm respectively. Mean fecundity was 144.5 ± 100.2 eggs. The pre-pupal and pupal period lasted for 2.01 ± 0.28 and 7.64 ± 1.92 days respectively. Longevity of male and female moths was 10.25 ± 3.05 and 12.67 ± 3.55 days, respectively. Whereas mean total developmental period 22.88 ± 1.25 days.

Keywords: biology, morphometrics, *M. vitrata*, pigeonpea, BDN-711

Introduction
Maruca vitrata (Geyer) is an important pest of grain legumes, which feeds on plant species belonging to 20 genera and six families, the majority of which belong to Papilionaceae. India has virtual monopoly in pigeonpea production accounting to 90 per cent of world's total production and occupies an area of 3.88 million ha with a production of 3.29 million tonnes (Anonymous, 2014) [1]. Pigeonpea damaged by large number of insect pests but the damage caused by *M. vitrata* results major reduction of grain yield (Srivastava and Joshi, 2011) [9]. Due to introduction of short duration pigeonpea cultivars, the incidence of *M. vitrata* has been aggravated by early flowering of these varieties during periods of high humidity and moderate temperature. (Sharma *et al*. 1999) [6]. Larvae web the leaves and inflorescence, and feed inside on flowers, flower buds, and pods, young larvae bore into the flower, buds and cause flower shedding enclosed in the sepals. Karel (1993) [3] observed more larvae on flowers 52.3 per cent than pods 37.8 per cent followed by leaves 9.9 per cent. In pigeon pea, first-instar larvae prefer flowers, pods and leaves while third instar larvae prefer pods compared to flowers and leaves (Sharma, 1998) [5]. Due to concealed larval feeding habit, protects the larvae from the adverse factors and insecticides showed varied levels of effectiveness**.** Therefore, keeping this idea the research was carried out with this objective.

Material and methods
The field collected larvae of *M. vitrata* were reared on fresh flowers and pods in insect rearing cages of size 35x45x20 cm. After pupation, pupae were transferred to another rearing cage for adult emergence which was used for further studies. Freshly emerged ten pairs of male and female adults were released in cage for mating and oviposition containing shoots of pigeonpea plant. Cotton swab soaked in 50 per cent honey solution served as food for the adults. Freshly laid eggs were transferred to petri dishes for hatching. Then emerged larvae were reared on fresh pigeonpea flowers or pods in plastic specimen cages separately and fresh flowers or pods replaced daily. Observations were recorded on different parameters as listed in Table 1. Daily observations were made at every six hourly intervals. The casting of head capsule of larvae indicated the moults which helped to record number of larval instars. Total larval and pupal duration were also recorded to know the longevity and fecundity details five pairs of moths which emerged on the same day were enclosed in wire mesh cage containing pigeonpea shoot or flowers and the eggs laid on different parts of the plants were counted and recorded daily until the death of female moth.

Biology and morphometrics of *M.* vitrata
Duration of different developmental stages and data pertaining to morphometrics are presented in Table 1.

Table 1: Duration of different stages (days) and morphometrical dimension of M. vitrata on pigeonpea variety BDN-711

Parameters	Mean ± SE
Incubation period	2.63 ± 0.42
Larval period	
1st Instar	1.70 ± 0.28
2nd Instar	1.42 ± 0.11
3 rd Instar	1.99 ± 0.38
4th Instar	2.10 ± 0.22
5th Instar	2.40 ± 0.32
Total Larval Period	9.61 ± 1.80
Pre-pupal period	2.01 ± 0.28
Pupal period	7.64 ± 1.92
Preovipostion period	1.25 + 0.30
Ovipostion period	4.34 ± 2.45
Fecundity	144.5 ± 100.2
Male adult longevity	10.25 ± 3.05
Female adult longevity	12.67 ± 3.55
Total Life Cycle	22.88 ± 1.25

Morphometrical dimension (Mean ± S.E.)		
Stages of pest	Dimensions	
	Length (mm)	Breadth (mm)
Egg	0.70 ± 0.01	0.48 ± 0.008
Larval stages		
1st	1.32 ± 0.01	0.18 ± 0.006
2nd	2.50 ± 0.04	0.40 ± 0.01
3rd	5.60 ± 0.07	0.90 ± 0.02
4th	11.12 ± 0.11	1.80 ± 0.10
5th	15.95 ± 0.13	2.82 ± 0.09
Pupa	13.01 ± 0.12	2.75 ± 0.05
Male	12.62 ± 0.20	0.90 ± 0.04
Female	13.02 ± 0.20	0.93 ± 0.05

Egg

Incubation period with an average of 2.63 ± 0.42 days. Freshly laid eggs were yellowish white in colour with scale like markings outer side and laid singly in small groups. The average length and breadth of eggs were 0.70 ± 0.01 and 0.48 ± 0.008 mm, respectively. The present findings are in conformity with Chandrayudu (2003) [2]. More or less similar observations were made by Veeranna *et al* (1999) [10] and Sravani (2015)

Larval stages

Throughout larval development, five instars were observed.

The newly hatched larva was light brown in colour. The duration of first instar larva with a mean of 1.70 ± 0.28 days. The length and breadth were 1.32 ± 0.016 and 0.18 ± 0.006 mm, respectively. Second instar larva with a mean of 1.42 ± 0.11 days. The length and breadth were 2.50 ± 0.04 and 0.40 ± 0.01 mm, respectively. The duration of the third instar with a mean of 1.99 ± 0.38 days. The length and breadth were 5.60 ± 0.07 and 0.90 ± 0.02 mm, respectively. The present results are in slight agreement with the findings of Veeranna *et al.* (1999) [10] and Sravani (2015). However fourth instar larva with a mean of 2.10 ± 0.22 days. The length and breadth were 11.12 ± 0.11 and 1.80 ± 0.10 mm, respectively. These observations are in conformity with Veeranna *et al.* (1999) [10] and Sravani (2015). Fifth instar larva with a mean of 2.40 ± 0.32 days. The length and breadth were 15.95 ± 0.13 and 2.82 ± 0.09 mm, respectively. However the total larval period was ranged from 9.10-10.11days with an average of 9.61 ± 1.80 days.

Pre-pupal stage and pupal stage

The larvae after reaching the last instar lost its body spots and become greenish in colour and entered into a pre-pupal stage. The duration of pre-pupa with an average of 2.01 ± 0.28 days. Pupation took place underside of plant parts. It was brownish in colour and slowly turned darker prior to adult emergence. The duration of pupa with an average of 7.64 ± 1.92 days. Pupal length and breadth were 13.01 ± 0.12 and 2.75 ± 0.05 mm, respectively. The present findings are in close agreement with the findings of Shukla *et al* (2008) [7] and Shravani (2016) [8].

Oviposition and fecundity

The mean duration of pre-oviposition, oviposition 1.25 + 0.30, 4.34 ± 2.45 days with a range of 1.25-1.80, 3.20-5.95 and fecundity 144.5 ± 100.2 with a range 95-200.

Adult longevity and total life cycle

Adult were creamy white to brown body with long legs. 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. The longevity of adult male with an average 10.25 ± 3.05 days. However adult female 12.67 ± 3.55 days. The body length and width of adult male and female were 12.62 ± 0.20, 0.90 ± 0.04 and 13.02 ± 0.20, 0.93 ± 0.05 mm, respectively. The total life cycle from egg to adult with an average of 22.88 ± 1.25 days. These results are in close agreement with the observations made by Naveen *et al* (2009) [4].

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