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LIFE HISTORY OF *APION CLAVIPES* GERST

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ABSTRACT

***Apion clavipes* Gerst is economically important pest of mung bean in the low land of North Shewa, Ethiopia. The biology of *A. clavipes* which commonly feed on mung bean was studied under laboratory condition. Adults and larvae were reared on potted plants in cages under ambient condition (18-25°C). 6.2±0.23 days of pre-oviposition and 4.17±0.17 days of oviposition were observed. A female laid 12.4±0.69 eggs, which required 4.46±0.20 days to hatch. The freshly laid egg is oval and pale white. Larva passed through 15.23±0.47 days. It is apodous, 'C' shaped, wrinkled and creamy white with pale brown head. Pupation was completed in 7.96±0.17 days. Pupa is exarate, and pale creamy. Female adults lived longer than male for 37.47±0.63 and 28.45±0.44 days, respectively. The weevil had a total developmental period of 27.64±0.57 and total generation period of 38.02±0.54 days, showing that it can complete up to nine generations per annum under ideal conditions.**

Key words: *Apion clavipes*, developmental period, generation period, oviposition, fecundity, egg, larva, pupa, duration, longevity

Mungbean, *Vigna radiata* (L.) R. Wilczek (Fabaceae) is a short duration legume crop cultivated throughout the arid and semi-arid tropics (Pandey et al., 1988; Heuze et al., 2013). It is recent introduction to Ethiopia (not more than three decades) with an area of about one lakh ha with productivity being 965 kg ha^{-1} (CSA, 2016). Mung bean production is expanding in Ethiopia particularly in the lowland areas of Amhara, SNNPR and Oromia regional states (CSA, 2016). Lack of improved varieties, poor management practices, and damage by insect pests and diseases are among the factors contributing to its low productivity. The damage by insect pests is of paramount importance among which pod boring insects cause a significant yield loss. *Apion clavipes* Gerst is one of the most important pod boring insect pests of mung bean in Ethiopia. This insect was first observed in 2012 cropping season at Debre Birhan Agricultural Research Center (DBARC), Shewa Robit research site on variety N-26 'Rassa'.

Studies on mung bean pests in Ethiopia even in East Africa are few (Reed et al., 1989). Studies on the biology and nature of attack of these pests which are essential for making decisions are lacking. Hence, the present study on the biology of *A. clavipes*.

MATERIALS AND METHODS

The study was conducted at the Crop Protection Laboratory of Debre Birhan Agricultural Research Center, Debre Birhan, Ethiopia. 9°.29'.57'', 39°.36'.14'', 2819 masl in North Shewa Zone of the Amhara National Regional State, Ethiopia. The Adults and larvae of *A. clavipes* were collected from mungbean fields in Shewa Robit research site. Samples were sent to Center for Agriculture and Biosciences International (CABI), England for confirmation. The fecundity was studied on mung bean variety N-26 'Rassa'. Pods containing *A. clavipes* larvae were collected from field in Shewa Robit research site and kept in cylindrical rearing cages (29.5 x 14.5 cm) covered with mesh lids. Emerged adults were maintained in the cage by providing potted plants (18-25°C).

A couple of newly emerged adult weevils, within 24 hr of emergence, were released in each cage having plant(s) with young pods. Data were collected on preoviposition and oviposition period and number of eggs laid/ female. Punctures and gummy secretion produced by adult female was used as an indicator to locate the oviposition point on each pod (n=30). Mungbean plants grown on pots and having young

Table 1. Life stages and life cycle of *A. clavipes*

S.N.	Life stages	Ranges (days)	Mean (days) ± SEM	Stage	Body length (mm) Mean ± SEM	GR	Body width (mm) Mean ± SEM	GR
1.	Incubation period	3-6	4.46±0.2	Egg (n=12)	0.40 ± 0.02	-	0.24 ± 0.01	-
2.	Larval period	11-18	15.23±0.47	Instar I (n=28)	1.80 ± 0.03	-	0.84 ± 0.02	-
3.	Pupal period	6-9	7.96±0.17	Instar II (n=34)	2.96 ± 0.06	1.64	1.39 ± 0.03	1.65
4.	Pre-oviposition period	4-7	6.20±0.23	Instar III (n=40)	3.87 ± 0.03	1.31	2.04 ± 0.02	1.47
5.	Oviposition period	3-5	4.17±0.17	Pupa (n=21)	3.18 ± 0.03	-0.82	1.88 ± 0.01	-0.92
6.	Male adult longevity (after adult emergence)	24-31	28.45±0.44	Adult Female (n=26)	5.31 ± 0.04	-	2.51 ± 0.01	-
7.	Female adult longevity (after adult emergence)	30-42	37.47±0.63	Adult Male (n=24)	3.80 ± 0.04	-	1.72 ± 0.04	-
8.	Total developmental period (egg to adult)	23-34	27.64±0.57					
9.	Total generation time (egg to egg)	33-42	38.02±0.54					
10.	Fecundity (number of eggs/ female)	6–18	12.40±0.69					

±SEM = standard error of the mean; n=number sampled; GR=growth rate

tender pods were artificially infested with newly emerged adults and kept in cylindrical rearing cage. Newly laid eggs were daily observed and 20 pods containing eggs were partly opened and each kept in petri plate (9 cm dia). The bottom of the petri plate was lined with moistened tissue paper to protect pods from drying. The eggs were checked under a stereozoom microscope for hatching.

Larvae obtained were reared on pods kept in petri plate by replacing fresh and young pods every two to three days (n=56). Change in larval instar stage and period lasted for each stage was observed based on ecdysis. For observations on pupa, pods containing larvae were kept in petri plate (9 cm dia) and the pods were examined daily until emergence of adults (n=48). Newly emerged adults (males and females) within 24 hr were collected by hand and placed in rearing cages with potted plants. The sexes were identified while mating; males are smaller and have shorter snout. Observations were made on 42 males and 45 females for longevity (Devis and Van Lenteren, 2002). Measurements of body size of the life stages were made in a stereozoom microscope fitted with micrometer.

RESULTS AND DISCUSSION

The freshly laid egg was oval and pale white or creamish, and measured 0.40 ± 0.02 x 0.24 ± 0.01 mm (Table 1). Thakur and Firake (2013) found that it is was between 0.3 to 0.8 mm on pigeonpea. Similar variation in size had been known in *A. amplum* (Sharanabasappa and Basavanagoud, 2005). Eggs required 4.46 ± 0.2 days with a range of three to six days for hatching. This agrees with the three to four days on pigeonpea (Thakur and Firake, 2013). A similar incubation period of three to five days was also reported for *A. amplum* on pigeonpea (Sharanabasappa and Basavanagoud, 2005).

The larva passed through three instars in which the first two instars were found to be Vovacious feeders while the last instar was sluggish (Mintesnot et al., 2018). Larva was apodous. It started feeding on developing seeds and slowly bore into young green seeds. The full grown larva was 'C' shaped, wrinkled and creamy white with pale brown head. The total larval period was 15.23± 0.47 days. The present findings are in contrary with the findings of Thakur and Firake (2013).

Sharanabasappa and Basavanagoud (2005) reported 14.1 days larval period of *A. amplum*, on green grama. The first instar larva was 1.80 ± 0.03 mm long and of 0.84 ± 0.02 mm wide; the second 2.96 ± 0.06 mm long and 1.39 ± 0.03 mm wide; and the third 3.87 ± 0.03 mm long and 2.04 ± 0.02 mm wide. The last instar larva gradually changed into inactive stage within matured pod and eventually moulted into pupa. The pupa was exarate, appeared pale creamy with brownish black eyes and measured 3.18±0.03 mm x 1.88 ± 0.01 mm. During transition, body span reduction on both length and width was observed with rates of 0.82 and 0.92, which indicated reduction in length and width by 17.82 and 7.84%, respectively when compared to last larvae stages. It took an average of 7.96 ± 0.17 days for the pupa to reach to the adult stage (Table 1).

Adults were black with distinct snout. Both sexes look alike but females were 5.31 ± 0.04 mm x 2.51 ± 0.01 mm in size while it was 3.8 ± 0.04 mm x 1.72 mm in male. The male lived for 28.5 ± 0.4 days while the female lived 37.5 ± 0.6. On the average, it took 27.6 ± 0.57 days from egg to adult emergence while the total generation period from egg to egg was about 38.02 ± 0.54 days under laboratory condition. The adult female started laying eggs 6.2 ± 0.2 days after emergence. The oviposition period varied from 4.17 ± 0.17 days. Total number of eggs/ female was about 12.4 ± 0.69 (Table 1). Thakur and Firake (2013) reported five to eight days preoviposition period of *A. clavipes* on pigeonpea in the North Eastern Hill region of India. Similarly, Sharanabasappa and Basavanagoud (2005) reported comparable pre oviposition period for *A. amplum* on green gram.

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