

Original Research Article

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Biology of Tur Pod Bug, *Clavigralla gibbosa* Spinola on Pigeonpea Variety Manak

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ABSTRACT

Keywords

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Biology of tur pod bug, *C. gibbosa* was studied under laboratory conditions on pigeonpea variety viz., Manak *in vitro* at prevailing room temperature $26\pm 1^\circ\text{C}$ and relative humidity 75 per cent from mid October 2013 to January 2014. Eggs were laid in clusters in the batches of 2 to 33 eggs. The incubation period was 5.7 days. There were five nymphal instars with a mean of 1.7, 1.9, 2.4, 3.8 and 5.1 days for 1st, 2nd, 3rd, 4th and 5th nymphal instars respectively and the total nymphal duration recorded was 14.9 days. Total adult life of male was 15.6 and that of a female 23.7 days. Total life cycle was completed in 24.11 days on an average. The results revealed that the pre-oviposition, oviposition and post-oviposition period averaged 7.5, 12.8 and 8.6 days, respectively. The fecundity was 100.6 eggs/female from which 83.56 per cent eggs hatched.

Introduction

Pigeonpea (*Cajanus cajan*) is an important crop in semi-arid tropical and subtropical farming systems, providing high quality vegetable protein, animal feed, and firewood. After Chickpea, Pigeonpea is the second most important pulse crop grown in the country. Pigeonpea ranks sixth in area and production in comparison to other legumes such as beans, peas and chickpea. Insect pests feeding on flowers, pods, and seeds are the most important biotic constraint affecting pigeonpea yields. Gram pod borer (*Helicoverpa armigera*), arhar plume moth (*Exelastis atomosa*), arhar pod fly (*Melanagromyza obtusa*), spotted pod borer (*Maruca vitrata*), tur pod bug (*Clavigralla*

gibbosa) and blister beetle (*Mylabris spp.*) are one of the most important constraints for low productivity of pigeonpea in India. Among the sucking bugs, tur pod bug is the most important in India (Basu and Mitra, 1978). It was once considered to be a minor pest of pigeonpea but, has assumed the status of a major pest (Singh and Singh 1978). The pod bug damage in pigeonpea was recorded from 25 to 40% (Adati *et al.*, 2007). Both the nymphs and adults of the pest suck the cell sap from the developing grains of the green pods. In case of heavy infestations of the tender pods, they get shriveled. The bug also sucks sap from leaves, flowers and tender shoots, but pods are most preferred. Damaged

seeds are dark, shriveled, do not germinate and are not acceptable as human food. On an average it causes 25.20% pod and 28.38% grain damage (Veda, 1993).

Materials and Methods

The studies on the biology of tur pod bug were carried on pigeonpea cultivar Manak under laboratory at prevailing room temperature $26\pm 1^{\circ}\text{C}$ and relative humidity 75 per cent at the Department of Entomology, CCS Haryana Agricultural University from mid October 2013 to January 2014. Ten pairs of adults of *C. gibbosa* were collected from cultivar Manak and caged separately in pairs in glass jars measuring (20 x 15 cm) covered with muslin cloth on the top and tied with rubber bands. Fresh twigs with pods of pigeonpea cultivar Manak were provided daily to the caged pairs of *C. gibbosa*. The twigs were placed into moistened cotton at the bottom of the glass jar. The nymphs were reared in petri-dishes lined with a blotting-paper to absorb liquid excreta on immature pods with leaves. The petri-dishes were changed after 2 to 3 days and cleaned with soap water to maintain hygienic conditions. The pods were changed daily in order to supply fresh food to the nymphs. Observations on the moulting and other remarkable external changes in developing nymphs were recorded daily during nymphal period.

The observation on number of eggs per female, incubation period, egg hatchability (%), number of nymphal instars, nymphal period, pre-oviposition, oviposition and post oviposition period, sex ratio and life cycle of adult (egg to adult) were recorded.

Results and Discussion

The results on the biology of tur pod bug studied under laboratory conditions from mid

October 2013 to January 2014 have been summarized in table 1.

Eggs

The freshly laid eggs glued to the surface of pods or leaves were creamy white in colour. After few hours colour changed to light brown and ultimately brownish in colour. Freshly laid fertile and unfertile eggs were oval in shape but after 24 hours, unfertile eggs become boat like in appearance, whereas, such type of shape was not found in case of fertile eggs. Similar results were given by Rana and Patel (2001) and Ombir (1981) who reported that colour of eggs and changed to dark brown before hatching on pigeonpea, after 24 hours. While Singh and Patel (1968) reported that eggs were mostly brown and sometimes brownish white or dirty brown in colour. The result showed that on an average a single female laid 100.6 eggs ranging from a minimum of 13 eggs to a maximum of 186 eggs/female. Eggs were laid in clusters in the batches of 2 to 33 eggs. Sometimes overlapping of the eggs was also noticed. Whereas earlier workers (Singh *et al.*, (2005 and Rana and Patel 2001) reported that the fecundity was ranged from 80 to 153 and 78 to 290 eggs per female. Egg hatchability of test insect was also recorded and it ranged from 74.2 to 91.4 per cent with an average of 85.56 ± 6.06 per cent. Similar results were given by (Misra *et al.*, 2000; Rana and Patel, 2001) who reported that hatching percentage was varied from 77.7 to 91.4 and 88 to 94 in different pigeonpea cultivars, respectively.

Incubation period

The Incubation period of eggs was ranged from 4.3 to 7.4 days with an average of 5.7 ± 1.39 days. Previous workers also reported variation in incubation period (Kumar and Dhurairaj, 2006; Misra *et al.*, 2000) is rather higher in comparison to present findings.

Chhabra *et al.*, (1993) reported the incubation period to be 8 days.

Nymphal instars

There were no much differences among the different nymphal instars. The newly emerged nymph was delicate and creamy yellowish in colour. Numerous setae were scattered on the whole body surface and readily visible on antenna, head, thorax and legs. The antenna and some parts of leg were of pink colour. The pink colour changed to dark pink and finally brown within 3-4 hours of hatching. A “Y” shaped ecdysial line is prominent on the vertex. The rostrum was four segmented having four stylets and the first basal segment is shorter and thicker than remaining ones. Metathorax is smaller than the prothorax and mesothorax. All parts of leg covered with fine hairs. The tarsus had two tarsomere which were more or less of equal size. Pretarsus had a pair of claws, In between the claws, a pair of knob shaped pulvilli was distinctly visible.

Dorsolateral outgrowths *i.e.* scoli were present on the 2nd, 3rd, 4th, 5th, 6th and 7th abdominal segments. Two round shaped scent glands were present on the dorsal side of abdomen. The colour of scent gland was pink in beginning but later changed to dark brown. The upper one was placed between the 4th and 5th and lower between the 5th and 6th segments. The body length of 1st instar nymph varied from 1.3 to 1.8 mm with an average of 1.55 ± 0.25 mm. The breadth of head, thorax and abdomen varied from 0.41 to 0.54, 0.49 to 0.58 and 0.67 to 0.85 mm with the average of 0.47 ± 0.06 , 0.53 ± 0.04 and 0.76 ± 0.09 mm, respectively.

The second instar nymph resembles the first instar nymphs except in a pair of black robust spines on the either side of prothorax which become obvious in this instar. These spines were referred as thoracic spines. The body and antenna length was measured 2.6 to 2.8

mm and 1.9 to 2.4 mm with the averages of 2.7 ± 0.1 and 2.15 ± 0.25 mm, respectively. The breadth of head, thorax and abdomen varied from 0.54 to 0.65, 0.67 to 0.83 and 1.18 to 1.46 mm with the averages of 0.59 ± 0.05 , 0.75 ± 0.08 and 1.32 ± 0.01 mm, respectively.

No other striking change except the appearance of a pair of wing pads on the thoracic region. The thoracic spines become quite prominent in this instar. The body and antenna length varied from 3.9 to 4.2 mm and 2.8 to 3.3 mm with the averages of 4.05 ± 0.15 and 3.05 ± 0.25 mm, respectively. The breadth of head, thorax and abdomen varied from 0.68 to 0.80, 1.02 to 1.16 and 2.07 to 2.36 mm with the averages of 0.74 ± 0.06 , 1.09 ± 0.07 and 2.21 ± 0.14 mm, respectively.

The newly moulted fourth instar nymph was quite similar to the preceding instars except the wing pads become prominent and grew up to the second abdominal segment. Each scoli turned into black colour and a whitish line also occur with scoli. The body & antenna length was measured from 5.6 to 6.1 mm and 4.52 to 4.71 mm with the averages of 5.85 ± 0.25 and 4.61 ± 0.09 mm, respectively. The breadth of head, thorax and abdomen varied from 0.98 to 1.07, 1.62 to 1.87 and 2.97 to 3.31 mm with the averages of 1.02 ± 0.04 , 1.74 ± 0.09 and 3.14 ± 0.17 mm, respectively.

Fifth instar nymph was as big as adult. Wing pads become prolong up to fourth abdominal segments. The body and antenna length was measured 7.3 to 9.5 mm and 5.5 to 6.6 mm with the averages of 8.4 ± 1.1 and 6.05 ± 0.55 mm, respectively. The breadth of head, thorax and abdomen varied from 1.19 to 1.28, 2.62 to 3.65 and 3.47 to 4.13 mm with the averages of 1.23 ± 0.04 , 3.13 ± 0.51 and 3.8 ± 0.33 mm, respectively. Similar findings were reported by Rana and Patel (2001) who observed that newly hatched nymphs were delicate and pale yellowish in colour.

Table.1 Biological parameters of *C. gibbosa* on pigeonpea variety Manak

Biological parameters	Manak	
	Range	Mean±S.D
Fecundity	13-186	100.6±56.04
Egg hatchability (%)	74.2-91.4	83.56±6.06
Incubation period	4.3-7.4	5.7±1.39
Nymphal period (days)		
1 st instar	1.4-2.1	1.7±0.24
2 nd instar	1.2-2.3	1.9±0.38
3 rd instar	1.9-2.8	2.4±0.32
4 th instar	3.1-4.7	3.8±0.55
5 th instar	4.2-5.9	5.1±0.61
Total nymphal duration	11.8-17.9	14.9±1.97
Total life cycle (days)	16.1-30.1	24.11±4.72
Pre-oviposition period (days)	1-12	7.5±3.65
Oviposition period (days)	3-19	12.8±5.37
Post-oviposition period (days)	1-16	8.6±4.66
Total adult life (days)		
Male	2-29	15.6±8.60
Female	4-32	23.7±9.15

Abdomen was wedge shaped and light yellowish in colour. The second instar was more or less similar to first instar except black stout spine on each side of prothorax. The third instar nymphs were yellowish to reddish brown in colour. Numerous setae were observed on the whole body surface. The fourth instar nymphs resembled the third instar nymphs in colour and shape. The fifth instar nymphs have patches appeared on abdominal areas which were very light to dark in colour. These descriptions are in accordance with Singh and Patel (1968) and they noted that newly hatched nymphs were delicate, pale clay yellowish to pinkish in colour and measured 1.58 mm in length. It has numerous setae on its body surface. The 4th, 5th and 6th abdominal segments had a darker patch covering most of the central part of the dorsum. Two granular structures were seen on the two extremities of this patch. Scoli came out from 2, 3, 4, 5, 6 and 7th abdominal segments. The second instar nymphs resembled with first instar nymphs except a pair of black stout spine on either sides of the thorax. In third instar, a pair of wing pads on thoracic region was present.

These wing pads become quite prominent in the fourth instar. The length of scoli measured maximum in this stage. Fifth instar nymph resembles with adult. The size of the scoli decreased in this stage. The data presented in table 1 reveals that the mean duration of nymphal instars were 1.7, 1.9, 2.4, 3.8 and 5.1 days ranging from 1.4-2.1, 1.2-2.3, 1.9-2.8, 3.1-4.7 and 4.2-5.9 days for the 1st, 2nd, 3rd, 4th and 5th instars, respectively. The total nymphal duration was found to be 14.9 days ranging from 11.8-17.9 days. The nymphs passing through five instars had been reported by various workers (Lefroy, 1909; Bindra, 1965; Kapoor, 1966; Ombir *et al.*, 1992).

Adult

The newly emerged adult was yellow to light salmon coloured but after 2-3 hours changed to brown. The antenna was four segmented and out of which flagellum was thicker and darker than the preceding two segments of pedicel.

The distal portion of femur of hind legs was much swollen and bears two stout big spine in

addition to some other spines. The tarsus which in earlier instar was described to bear only two tarsomeres had now three segments. The last tarsomere had a pair of single shaped claws. Five pair of spiracles was present on the dorsolateral side of abdomen. The fore wings almost covered the entire abdominal length. The hind wings were dirty white and membranous with yellowish brown costal margin. Scoli reduced completely in this stage. The female was bigger than male. In case of female, the tip of abdomen when viewed dorsally appears straight, whereas, it appears with a "V" shaped notch when viewed ventrally. The body and antenna varied from 8.1 to 8.9 and 5.9 to 6.56 mm with the averages of 8.5 ± 0.04 and 6.23 ± 0.33 mm in male and 9.6 to 10.9 and 6.5 to 7.4 mm with an average of 10.25 ± 0.65 and 6.96 ± 0.45 mm in female. The breadth of abdomen varied from 3.3 to 3.81 mm with an average of 3.7 ± 0.25 mm in female and 2.38 to 2.93 mm with an average of 2.65 ± 0.27 mm in male. The breadth of head and thorax varied from 1.3 to 1.6 and 3.9 to 4.59 mm with an average of 1.45 ± 0.15 and 4.24 ± 0.34 mm in female and 1.19 to 1.38 and 3.48 to 4.29 mm with an average of 1.28 ± 0.09 and 3.8 ± 0.4 in male. Similar results also reported by Rana and Patel (2001) that the newly emerged adult was yellow to light salmon in colour and changed to brown within a few hours. Head was small in size and dark brown in colour. The thorax was numerously covered with golden coloured hairs. Abdomen was wedge shaped and pale brown in colour with blackish edges. The female bug was larger with swollen abdomen than male. The results are in confirmation with the findings of Ombir (1981) and Singh and Patel (1968). The total life cycle of *C. gibbosa*, was ranged from 16.1 to 30.1 days with an average of 24.11 ± 4.72 days. Earlier much variation in longevity *i.e.* from few days to 155 days has also been reported by Bindra (1965), Choudhary and Dhamdhare (1981) and

Dhudhasia *et al.*, (1986). Out of 255 adults observed, 129 were female and 126 were males and female to male sex ratio was 1.02:1. Adult longevity of male was found to be shorter than the female. Total adult life of male was recorded 15.6 days with a range of 3-36 days. Earlier workers Misra *et al.*, (2000) and Singh *et al.*, (2005) recorded 33.70 days on UPAS 120 and 13.6 days of male adult life on Manak. Total adult life of female was recorded 23.7 days with a range of 4-32. Earlier workers Misra *et al.*, 2000 and Singh *et al.*, (2005) recorded 44.80 days of total adult life of female on UPAS 120 and 15.0 days of female adult life on Manak

Pre-oviposition, oviposition and post-oviposition period

The pre-oviposition period averaged 7.5 days with a range of 1-12 days. Previous workers recorded pre oviposition period from 1 to 10 days (Bindra, 1965; Choudhary and Dhamdhare, 1981; Dhudhasia *et al.*, 1986) which is quite similar to present findings. The oviposition period was observed to be 12.8 days with a range of 3-19 days. Previous workers also reported oviposition period from 1 to 80 days (Bindra, 1965; Choudhary and Dhamdhare, 1981; Dhudhasia *et al.*, 1986) is rather higher in comparison to the present finding. The post-oviposition period was 8.6 days ranging from 1-16 days? However Singh *et al.*, (2005) recorded 4.2 days of post oviposition period on Manak. Misra *et al.*, (2000) recorded 10.70 days of post oviposition period on UPAS 120.

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