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Short Communication

Growth, development and fecundity of *Helicoverpa armigera* Hubner on two varieties of chickpea

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Chickpea (*Cicer arietinum* L.) is major pulse crop in the semi-arid tropics (SAT). Insect pests are among the various causes that bring down chickpea production drastically. Gram pod borer, *Helicoverpa armigera* (Hubner) (Lep., Necthdae), is the most important insect pest of this crop. The caterpillar of *H. armigea* feeds on tender leaves, defoliates plants, makes hole in the pods and feeds upon the developing grains. The pod damage ranged from 0 to 84.4% with an overall average of 7% (5). The avoidable losses due to *H. armigera* in chickpea across locations in India ranged between 9 and 60% (5). The principal means of controlling *H. armigera* has been the use of conventional insecticides. However, the indiscriminate use of insecticides has led to development of resistance against some commonly used insecticides in *H. armigera*. Several lines with exploitable level of resistance to *H. armigera* have been identified in chickpea (1, 4, 8). Non-preference and antibiosis seem to be operative in chickpea against *H. armigera* (6, 7). Presently, there is no variety in chickpea which can be called as resistant to *H. armigera*. Keeping in view the above facts, the present investigation was carried out to study growth and development, ovipositional preference and larval retention of *H. armigera* in susceptible and comparatively less susceptible varieties of chickpea.

Two varieties of chickpea, BG 256 (susceptible) and C 235 (less susceptible) were grown in plots of 6 rows of 5 m length. Row to row and plant to plant distances were maintained as 40 and 10 cm. The experiments were laid in a factorial randomized block design with three replications and 12 treatments. The sowing was done on 15 November 1997 and 17 November 1998, and harvesting on 24 April 1998 and 28 April 1999. The experiment was conducted under controlled condition with 26±1°C temperature and 80±5% relative humidity with 12 hours each of photophase and scotophase. Development study was conducted on 65 individual larvae grouped into 13 replications of 5 larvae each. The 65 freshly emerged larvae, 0-12 hours old, were released in separate vials (5 x 2.5 cm) containing fresh leaves of BG 256 and C 235 with the help of a hair brush. The lid of the vial had one cm^2 opening covered with 60 mesh copper-wire gauge for proper aeration. The base and inner side of each vial were lined with moist filter paper to prevent desiccation of leaves. Fresh leaves of both varieties after having washed properly with tap water and surface dried were provided to each test larvae every 24 hours up to 5 days. From the 6th to 10th days, fresh buds and flowers of test varieties were given to each test larvae every 24 hours. From the 11th day to the period till the larvae attained prepupal stage, fresh pods from the susceptible and less susceptible varieties were provided. The leftover food and faeces were cleaned daily. Body weight of five 10-day old larvae and 5-day old pupae reared on susceptible and less susceptible varieties were recorded.

Data on various growth and developmental parameters of *H. armigera* like larval and pupal periods, larval and pupal survival, larval and pupal weight, adult emergence, adult longevity, oviposition period, fecundity of emerging adults, incubation period and per cent egg hatch were recorded from each replication. For larval and pupal weight, five 10-day old larvae and five 5-day old pupae were taken from each replication. For fecundity, two pairs of newly emerged adults, collected at random from each replication were confined in the ovipositional jar separately for each pair and each replicate. To assess the overall suitability of susceptible and less susceptible varieties, the Howe's growth index was also calculated.

To study the ovipositional preference and larval retention, trials were laid down at Research Farm of Banaras Hindu University, Varanasi during 1997-98 and 1998-99. Both chickpea varieties were grown in a randomized block design with 13 replications. The experimental plot had 6 row of 5 m length. Five plants from each row from central four rows (20 plants in each replication) were selected randomly and weekly counts of eggs and larvae present on them were made during full flowering and podding stages. Data were recorded on number of eggs and larvae of *H. armigera* from all the 13 replications. The data collected were subjected to appropriate statistical analysis.

The average larval and pupal durations differed significantly on susceptible and less susceptible varieties during both the years of investigation (Table 1). The average larval duration on BG 256 was 17.12 days whereas it was 20.72 days on C 235 in 1997. The pupal period was 9.82 days on BG

Table 1. Growth and development of larvae and pupae of *H. armigera* on two varieties of chickpea during 1997-98 and 1998-99

Variety	Average larval period (days)		Average pupal period (days)		Weight of 10-day old larvae (mg)		Weight of 5-day old pupae (mg)	
	1998	1999	1998	1999	1998	1999	1998	1999
BG 256	17.12	17.56	9.82	10.49	424.85	424.08	280.84	288.80
C 235	20.72	19.91	12.1	12.82	383.89	390.49	265.93	267.50
S.Em ±	0.26	0.28	0.24	0.20	1.27	2.13	1.90	1.95
C.D. at 5%	1.02	1.1	0.96	0.8	5.00	8.4	7.90	7.7

256 and 12.1 days on C 235. Similar trend was observed in 1998-99. The larval duration in C 235 was more than in BG 256 indicating antibiosis in chickpea variety C 235. The average larval weight also differed significantly on susceptible and less susceptible varieties during 1997-98. The average larval weight of 10-day old larvae was 424.85 mg on BG 256 and 383.89 mg on C 235. The average pupal weight of 5-day old pupae was 280.84 mg on BG 256 and 265.93 mg on C 235. The similar trend was observed during 1998-99. This showed that BG 256 suited well to the larval and pupal growth as compared to C 235. Longer larval and pupal period with lighter larvae and pupae in less susceptible variety C 235 indicated antibiosis in C 235. Dubey *et al.* (2) and Srivastava and Srivastava (7) also recorded significantly lower weight of the larvae fed on resistant than on susceptible varieties.

The larval survival on BG 256 was significantly higher than C 235 during both the years (Table 2) indicating that C 235 was relatively less palatable and less suited to support growth and development of *H. armigera*. Similar results were also reported earlier (2, 7). Since all the larvae which had survived in the course of this investigation had pupated successfully and no pupal mortality was observed, the pupal survival and adult emergence were same as the larval survival. The average adult longevity of male and female moths reared on BG 256 and C 235 did not differ significantly in the year 1997-98 but all these parameters differed significantly in 1998-99 (Table 2). The females lived longer as compared to males in both the varieties.

Table 2. Larval-pupal survival, adult emergence and adult longevity of *H. armigera* on two varieties of chickpea during 1997-98 and 1998-99

Variety	Larval survival (%)		Pupal survival (%)		Adult emergence (%)		Adult longevity (days)	
	1998	1999	1998	1999	1998	1999	1998	1999
BG 256	93.6 (75.39)*	92.6 (74.22)	93.6 (75.39)	92.6 (74.22)	93.6 (75.39)	92.6 (74.22)	11.33	11.00
C 235	83.5 (66.05)	82.0 (63.93)	83.5 (66.05)	82.0 (63.93)	83.5 (66.05)	82.0 (63.93)	10.66	9.61
S.Em ±	(1.45)	(1.05)	(1.45)	(1.05)	(1.45)	(1.05)	0.25	0.18
C.D. at 5%	(5.73)	(4.16)	(5.73	(4.16)	(5.73)	(4.16)	NS	0.71

Figures in parentheses indicate angular transformed values

The fecundity of adults developed on two varieties differed significantly (Table 3). The average fecundity of female reared on BG 256 was higher than C 235, indicating that the former variety was better for multiplication of *H. armigera* as compared to the later. The average per cent egg hatch on both the varieties differed significantly only in 1998-1999 where egg hatch average was 80.1% in BG 256 and 64.6% in C 235. The Howe's growth index on BG 256 (0.115, 0.112) was higher than that on C 235 (0.093, 0.096) during both the years indicating that BG 256 was preferred by *H. armigera* than C

Table 3. Reproductive potential of *H. armigera* on two varieties of chickpea during 1997-98 and 1998-99

Variety	Fecundity/female		Per cent egg hatch	
	1998	1999	1998	1999
BG 256	518.9	511.5	68.8 (56.01)*	80.1 (63.52)
C 235	427.2	417.2	64.7 (53.51)	64.6 (53.48)
S.Em ±	14.2	5.36	(0.76)	(0.84)
C.D. at 5%	56.3	21.2	NS	(3.30)

Figures in parentheses indicate angular transformed values

Table 4. Ovipositional preference and larval retention of *H. armigera* on two varieties of chickpea during 1997-98 and 1998-99

Variety	Days to 50% flowering		Full flowering stage				Podding stage				Pod damage by pod borer (%)	
			Total eggs (20 plants)		Total larvae (20 plants)		Total eggs (20 plants		Total larvae (20 plants)			
	1998	1999	1998	1999	1998	1999	1998	1999	1998	1999	1998	1999
BG 256	76.5	77.0	48.7 (7.05)*	49.1 (7.08)	43.1 (6.65)	42.8 (6.62)	68.7 (8.35)	64.1 (8.07)	64.9 (8.12)	63.2 (8.01)	35.04 (36.22)	36.04 (36.89)
C 235	84.5	83.0	35.2 (6.02)	36.6 (6.13)	28.5 (5.43)	28.2 (5.40)	53.8 (7.40)	52.0 (7.28)	49.7 (7.12)	52.1 (7.29)	25.57 (30.37)	26.45 (30.93)
S.Em ±	1.25	1.18	(0.24)	(0.09)	(0.05)	(0.09)	(0.19)	(0.12)	(0.10)	(0.16)	(0.22)	(0.31)
CD at 5%	4.9	4.7	(0.93,	(0.36)	(0.21)	(0.37)	(0.76)	(0.47)	(0.38)	(0.63)	(0.68)	(0.96)

* Figures in parenthesis indicate vn+1 transformed values

235. These results are in conformity to earlier report (7).

Ovipositional preference and consequent build-up of larval population and then its retention on a particular variety was a contributing factor in determining reaction of a variety against *H. armigera* (3). In 1997-98, the total number of eggs and larvae were higher on BG 256 as compared to C 235 (Table 4). BG 256 exhibited higher pod damage (35.05%) as compared to C 235 (25.57%). During 1998-99, the egg counts and the subsequent population build up of larvae and pod damage projected more or less a similar picture as was found in 1997-98. It was evident that there was a direct relationship between the egg counts followed by larval population and pod damage.

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