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Effect of different host plants on the development and reproduction of *Helicoverpa armigera* (Hub.) (Lepidoptera; Noctuidae) in Golestan province, Northern Iran

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Abstract
Objectives: American bollworm *Helicoverpa armigera* (Hub.) is one of the important and key pests in cotton fields of Golestan province in the northern part of Iran. The effect of different food plants on the development and reproduction of the pest was investigated in 2001-2002.
Methodology and results: The experiments were done using chickpea, tomato, cotton and velvet leaf weed. One hundred larvae were collected and reared on each host under laboratory conditions (25 ± 1 °C; 65 ± 5 % RH; 12/12 h light/darkness cycles). The moths were fed on distilled 10 % honey solution and eggs from individual females were counted each morning. The number of eggs laid per female increased gradually between day 3 - 7 and declined steadily thereafter until death. The mean number of eggs deposited on different crops varied with 789.58 eggs on cotton in 18 days (mean of 43.92 day^{-1}), for tomato 338.17 eggs in 17.5 days (mean of 19.34 day) and garbanzo bean 829.83 eggs in 18. days (mean of 44.9 day^{-1}). The duration of adult's life was 16-19 days.
Conclusion and application of findings: These findings demonstrate that host plant has an effect on reproduction of *H. armigera*. This knowledge can be utilized to manipulate reproduction of the pest so as to suppress its populations.

Keywords: *Helicoverpa armigera,* bollworm, host plants, oviposition, Iran

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Introduction
The American bollworm is one of the important insect pests of cotton in Golestan province in northern Iran. This pest also attacks many other crops including vegetables, weeds and food crops, feeding mainly on the flower buds, flowers and bolls. The *Helicoverpa* caterpillar seems to prefer certain crops, e.g. cotton, grain sorghum, maize and sweet corn, garbanzo bean, tobacco, tomato and velvetleaf weed (Salavatian 1960 & 1991; Bayat-Assadi & Abaei, 1983). Host plant specificity and ovipositor motivation may vary among individual females in response to changes in internal physiological state caused by increasing egg load ((Singer *et al..,* 1992; Prokopy *et al.,* 1994).

It has been shown that for *Euphydrays editha,* an oligophagous insect species, variation among individual females in acceptance of a second-ranked host species could be caused either by variation in strength of preference for the top-ranked host over the second-ranked host, and/or variation in the general readiness to oviposit (Singer *et al..,* 1992). Polyphagous species such as *Helicoveroa armigera* (Hub) also display a hierarchy of host plant preference (Firempong & Zalucki 1990a,b & 1991; Jallow & Zalucki,

1998 & 1996), and the pattern of host utilization by individual females may vary in response to changes in their physiological state. The choice of host plants by *H. armigera* is influenced by genetic differences among females (Jallow & Zalucki, 1991), and plant factors. The objective of this study was to study the effect of feeding on different plants on the development and reproduction on *H. armigera* as assessed based on fecundity and rate of oviposition.

Materials and Methods

The effect of feeding on different host plants on egg laying by *H. armigera* female moths was studied. One hundred *H. armigera* larva of medium to large sizes were collected from garbanzo bean (*Cicer arietinum* (L.), tomato, cotton and velvetleaf (*Abutilon theophrasti* (Medik) and transferred to the laboratory. These larvae were reared on the individual host plants inside special jars up to formation of pupae.

Newly emerged females (n = 20) were paired individually with newly emerged males in clear plastic containers (17cm diameter × 25 cm height) with perforated lids. Moths were provided with 10 % honey solution. Each morning, till the females died, eggs from individual females were collected, counted, and kept in temperature-controlled cabinets for 1-2 days to check their fertility. The experiments were conducted under controlled environment of 25 ± 1 °C, 65 ± 5 % RH and 12/12h light/ darkness cycle. The eggs laid in different treatments were counted daily and the data analyzed statistically.

Results

The mean number of eggs laid per female increased gradually from day 3 to 7 and declined steadily thereafter until death (fig.1-4). On garbanzo bean the mean number of eggs laid by each female was 829.8 in 18.5 days with a mean of 44.9 per day. The longevity of these moths was between 18-19 days. The maximum and minimum number of eggs laid by one female moth per day was 93 and 18, respectively. Most eggs were laid 3 – 10 days after female moth emergence (table 1).

On tomato the mean number of eggs laid by each female over the study period was 338.17 with a mean of 19.34 eggs per day. The longevity of these moths was between 16-18 days. The maximum and minimum eggs laid by one female were 40 and 8, respectively. On tomato most eggs were laid 3-7 days after emergence of female moths (table 1). On cotton the mean number of eggs laid increased to 789.58 in 17.92 days with a mean of 44.92 eggs per day. The longevity of these moths ranged between 16-19 days. The maximum and minimum eggs laid were per day 87 and 19, respectively. Most eggs were laid from 2 - 8 days after the emergence of moths (table 1).

On velvetleaf, the mean number of eggs laid by each moth was 669.92 in 19.58 days with a mean of 18.92 eggs per day. The longevity of these moths ranged between 17 - 20 days. The maximum and minimum eggs laid by each female moth per day were 73 and 12, respectively. On this host most eggs were laid between 2-10 days after the emergence of female moths (table 1).

Table 1: Number of eggs deposited by *H. armigera* females on different host plants under laboratory conditions.

Host	Mean of eggs	Eggs deposited				Number of days eggs deposited			
		Max.	Min	Ave.	S.D.	Max.	Min.	Ave.	S.D.
Garbanzo bean	829.83	93	18	44.9	24.780	19	18	18.67	0.492
Tomato	338.17	40	8	19.34	10.754	18	16	17.5	0.674
Cotton	789.58	87	19	44.92	25.527	19	16	17.92	0.514
Velvetleaf	669.92	73	12	18.92	17.858	20	17	19.58	0.668

Discussion

The age-specific oviposition pattern of mated *H. armigera* females indicates that maximum oviposition occurs early in life with 90% of eggs being laid within 10 days of female emergence. This finding is consistent with that reported by Singh and Rembold (1989) on the same insect pest. Field observation of oviposition patterns of *H. armigera* on cotton suggest that the first eggs were usually deposited on the third or fourth night after emergence; the mean nightly numbers of eggs deposited then increased to peaks on the ninth day.

Egg load had a significant effect on the host plant specificity of *H. armigera*. The moths that emerged from feeding on garbanzo bean and cotton had a longer life time and larger egg load than those that emerged from tomato. (Singer, 1982; Prokopy *et al.,* 1994). Increasing egg load is positively associated with increasing search intensity for, and alighting upon, hosts in many insect species (Singer *et al.,* 1992). In our study oviposition was significantly influenced by egg load. Velvetleaf is one of the important weed hosts of *H. armigera* in late season (late September to late November) and the last generation of *H. armigera* activates on this host as well as late planted cotton. This host is the most potent pool and source of carry over population of the pest for the following season.

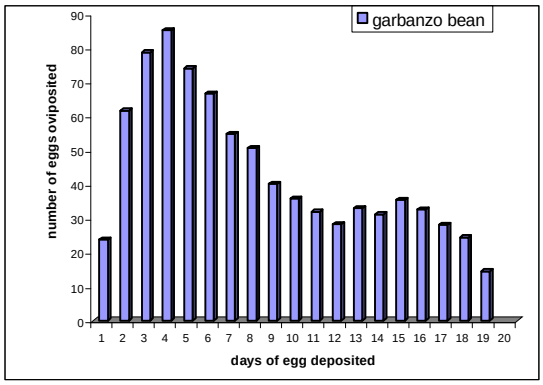

Fig 1: Mean number of eggs deposited per day by mated *H. armigera* females on garbanzo bean host

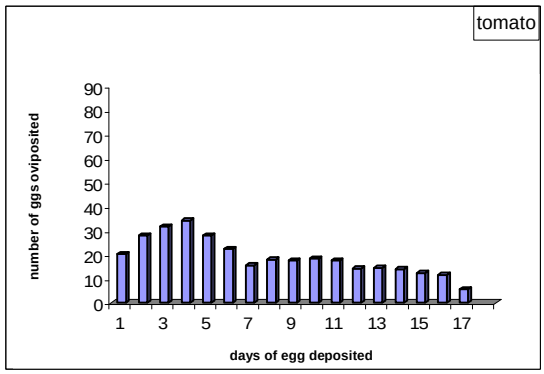

Fig 2: Mean number of eggs deposited per day by mated *H. armigera* females on tomato host during their lifetime under laboratorv conditions.

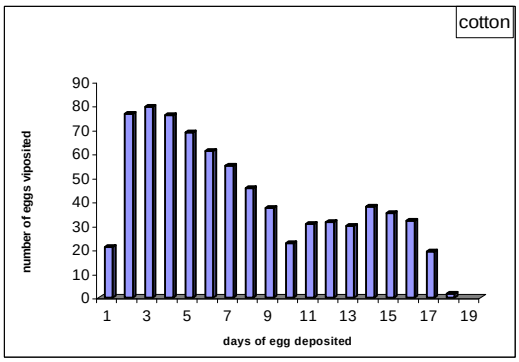

Fig 3: Mean number of eggs deposited per day by mated *H. armigera* females on cotton host during their lifetime under laboratorv conditions.

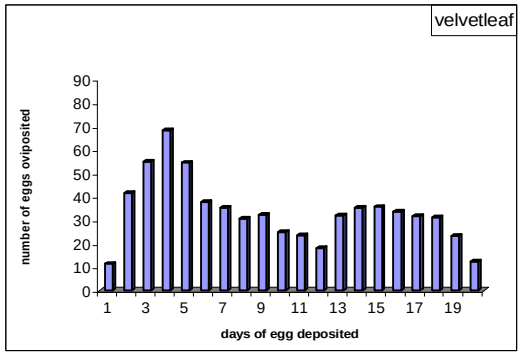

Fig 4: Mean number of eggs deposited per day by mated *H. armigera* females on velvetleaf host during their lifetime under laboratorv conditions.

Although the egg load of females fed with 10 % honey solution was not different during the adult stage there was a difference in their propensity to accept garbanzo bean, cotton, tomato and velvetleaf. The maximum egg-laying period in *H. armigera* is short, being 3-8 days (Singh & Rembold, 1989; Mustapha *et al.,* 1998), and as confirmed in this study.

This is the first study that has investigated host acceptance by *H. armigera* as affected by egg load in Iran. The data suggests that the variation in egg load may play a role in determining the variation in host plant preference by individual female moths. It is concluded that different hosts have different effects on egg laying behaviour of *H. armigera*. The highest number of eggs was laid on garbanzo bean while the least eggs were laid on tomato. Formulations of future pest management strategies for control of *H. armigera* should take into account the host-seeking behavioral changes that could arise due to variation in the physiological state of females.

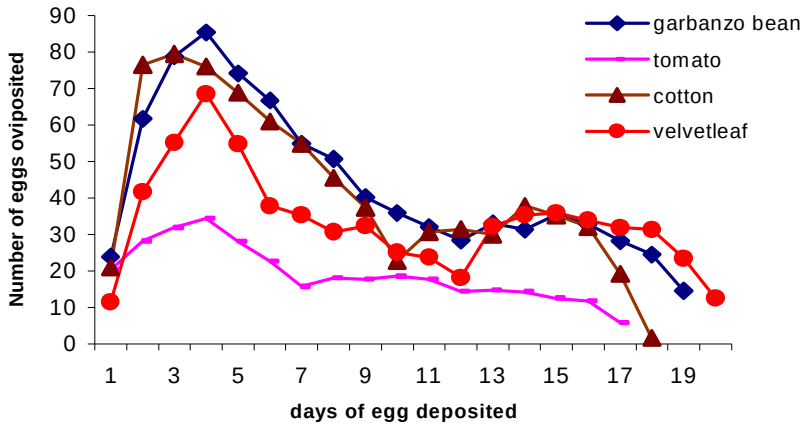

Fig 5: Mean number of eggs deposited per day by mated *H. armigera* females on important hosts during their lifetime under laboratory conditions.

References

Bayat Assadi H. and Abaei M, 1983. Report of cotton bollworm in Gorgan and Gonbad. Agriculture Research Center of Gorgan. 47p. (In Farsi)

Courtney SP, Chen GK, Gardner A, 1989. A general model for individual host selection. Oikos 55: 55-65.

Firempong S. and Zalucki MP, 1990a. Host plant selection by *Helicoverpa armigera* (Hub.) (Lepidoptera: Noctuidae) role of certain plant attributes. Aust. J. Zool. 37: 675-683.

Firempong S. and Zalucki MP, 1990b. Host plant preferences of populations of *Helicoverpa armigera* (Hub.) (Lepidoptera: Noctuidae) from different geographic, locations. Aust. J. Zool. 37: 665-673.

Firempong S. and Zalucki MP, 1991. Host plant selection by *Helicoverpa armigera* (Hub.) (Lepidoptera: Noctuidae) the role of some herbivore attributes. Aust. J. Zool. 39: 343-350.

Jallow MFA. and Zalucki MP, 1995. A technique for measuring intra-specific variation in oviposition preference of *Helicoverpa armigera* (Hub.) (Lepidoptera: Noctuidae) J. of the Aust. Entom. Soc. 34: 281- 288.

Jallow MFA. and Zalucki MP, 1996. Within and between-population variation in host-plant preference and specificity in Australian *Helicoverpa armigera* (Hub.) (Lepidoptera: Noctuidae). Aust. J. Zool. 44: 503-519.

Jallow MFA. and Zalucki MP, 1998a. Host-plant selection and use by *Helicoverpa armigera* (Hub.) (Lepidoptera: Noctuidae) individual variation within and among population. The Aust. J. of Eco. 23: 187- 188.

Jallow MFA. and Zalucki MP, 1998b. Effect of egg load on the host selection behavior of *Helicoverpa armigera* (Hub.) (Lepidoptera: Noctuidae). Aust. J. Zool. 46: 261-299.

Minkenberg OPJM, Tatar M, Rosenheim JA, 1992. Egg load as major source of variability in insect foraging and oviposition behaviour. Oikos 65: 134 – 142.

Mustapha FA, Jallow MFA, Myron P, Zalucki MP, 1998. Effects of egg load on the host-selection behaviour of *Helicoverpa armigera* (Hub.) (Lepidoptera: Noctuidae).). Aust. J. Zool. 46: 291- 299.

Prokopy RJ, Roitberg RD, Vargas RA, 1994. Effects of egg load on finding and acceptance of host fruit in *Ceratitis capitata.* Physio. Entom. 19, P: 124 – 132.

Salavatian M, 1960. Cotton bollwrom and its control. J. Agric. Ext. Org. Iran. 11p. (in farsi).

Salavatian M, 1991. The necessity of studying ecological and biological effective factors in controlling field crop pests. Agric. Ext. Org. Iran. P: 21- 53. (In farsi).

Singer MC, Vasco D, Parmesan C, Thomas CD, Ng D, 1992. Distinguishing between preference and motivation in food choice: an example from insect oviposition. Animal Behaviour 44: 463- 471.

Singh AK and Rembold H, 1989. Oviposition behaviour of *Helicoverpa armigera* (Lepidoptera: Noctuidae) in relation to the day-night cycle. Insect Science and its Application 10: 393-400.