

## Short communication

## Comparative biological parameters of the cotton bollworm, *Helicoverpa armigera* (Lep.: Noctuidae) on various corn hybrids

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## چکیده

برخی پارامترهای زیستی کرم غوزه پنبه، *Helicoverpa armigera* (Hübner) روی هیبریدهای مختلف ذرت (SC700، SC704، SC500، DC370 و SC260) در قالب رژیم غذای مصنوعی تحت شرایط آزمایشگاهی (دمای  $25 \pm 1$  درجه سلسیوس، رطوبت نسبی  $65 \pm 5$  درصد و دوره نوری ۱۶ ساعت روشنایی و ۸ ساعت تاریکی) بررسی شد. لاروهای پرورش یافته روی هیبرید SC700 طولانی ترین دوره رشدی قبل از بلوغ ( $41/21$  روز)، کمترین باروری روزانه ( $100/90$  روز) و کمترین شاخص زیستی ( $0/69$ ) گرم در روز) را نشان دادند. براساس نتایج به دست آمده، هیبرید SC700 میزبان نامناسبی برای رشد و نمو کرم غوزه پنبه بود.

The cotton bollworm, *Helicoverpa armigera* (Hübner) is a destructive polyphagous pest causing serious damage to many economically important crops in Iran. The objective of this study was to determine some biological parameters of *H. armigera* in response to various corn hybrids to evaluate the resistance of each corn hybrid in order to use them in integrated pest management (IPM) program. The susceptible corn hybrids can be used for available mass rearing of the natural enemies of *H. armigera*.

Seeds of various corn hybrids were obtained from Seed and Plant Improvement Institute (Karaj, Iran) and the neonate larvae of *H. armigera* were from a laboratory colony maintained on a cowpea-based artificial diet in Tabriz University, Iran. The stock culture was established on artificial diets prepared by powdered seeds of various corn hybrids, as described by Twine (1971). All experimental insects were kept inside a growth chamber ( $25 \pm 1^\circ\text{C}$ ,  $65 \pm 5\%$  RH, and a photoperiod of 16: 8 (L: D) hours). To ensure that the eggs have the same age, 10-15 pairs of *H. armigera* were reared on related hybrids inside an oviposition container (11.5 cm in diameter by 9.5 cm in height) topped with a fine mesh net for ventilation. After 12 hours, a total of fifty eggs were removed from the container to be used for the experiment. Later, the newly hatched larvae were transferred into plastic Petri dishes (8 cm in diameter by 2 cm in height), with a hole covered with a fine mesh net, containing the

artificial diets of corn hybrids. Food material refreshed daily and the larval mortality and changes through their developmental stages were recorded. The sixth-instar larvae were kept in plastic containers (3 cm in diameter by 5 cm high). The larval, pre-pupal and pupal periods and their mortality were recorded on various corn hybrids. The weights of pre-pupae and pupae were measured within 12 and 24 hours respectively. Larval growth index (LGI), standardized insect-growth index (SII) and fitness index (FI) of *H. armigera* was calculated on the corn hybrids according to Pretorius (1976) and Itoyama *et al.* (1999). After the emergence of adults, a pair of female and male moths was placed into oviposition container. To provide a source of carbohydrate for adult feeding, a small cotton wick soaked in 10% honey solution was placed in the oviposition container. Pre-oviposition period, oviposition period, daily fecundity (eggs per reproduction day), total fecundity (eggs during the reproductive period) and adult longevity of females and males were recorded.

In this study, the incubation period of *H. armigera* was not significantly different on corn hybrids. The longest larval period ( $F = 4.29$ ;  $df = 4, 91$ ;  $P < 0.01$ ) was found on SC700 ( $24.90 \pm 1.48$  days), while the shortest larval period was recorded on SC500 ( $19.43 \pm 0.70$  days). The mean larval period was  $21.80 \pm 0.97$  days, which was similar to the results reported by Naseri *et al.* (2009) for *H. armigera* on different

soybean varieties. The development time ( $F = 3.17$ ;  $df = 4, 90$ ;  $P < 0.01$ ) showed a significant difference among the corn hybrids, with values ranging from  $37.62 \pm 0.60$  days on SC500 to  $41.21 \pm 0.95$  days on SC700 (table 1). The larval feed had no significant impact on the pre-pupal and pupal period of *H. armigera*. The mean value of pre-pupal period was  $1.46 \pm 0.17$  days on all corn hybrids that was shorter than the values reported for *H. armigera* reared on soybean (2.59 days) (Naseri *et al.*, 2009). The pupal period ranged from  $12.95 \pm 0.33$  days on SC700 to  $13.35 \pm 0.23$  days on DC370 (table 1). The adult longevity for *H. armigera* varied from  $12.60 \pm 1.45$  to  $16.00 \pm 1.32$  days for males and  $11.78 \pm 1.48$  to  $14.09 \pm 0.91$  days for females (table 2), although Liu *et al.* (2004) found that the longevity values were 1.65 days for the male and 10.61 days for the female reared on corn. However, corn hybrids showed significant impact on oviposition period ( $F = 2.84$ ;  $df = 4, 40$ ;  $P < 0.05$ )

with the longest on SC500 ( $7.11 \pm 0.42$  days) and the shortest on SC700 ( $3.10 \pm 0.64$  days) (table 2). There was a significant difference in daily fecundity ( $F = 2.89$ ;  $df = 4, 186$ ;  $P < 0.01$ ) of *H. armigera* on five corn hybrids. The highest number of eggs laid per reproduction day was on SC500 ( $162.10 \pm 18.70$ ) and the lowest number was on SC704 ( $100.90 \pm 10.20$ ) (table 2). The highest value of larval growth index of *H. armigera* was 2.80 on SC500 (fig. 1). The standardized insect-growth index of *H. armigera* showed no significant difference among the corn hybrids (fig. 2, A), while the highest value of fitness index ( $F = 6.77$ ;  $df = 4, 86$ ;  $P < 0.01$ ) was on SC704 and SC500 (0.80 gr/day), and the lowest value was on SC700 (0.69 gr/day) (fig. 2, B). Our results indicate that SC700 is a resistant hybrid against *H. armigera* and SC500 is a suitable corn hybrid for the development of this pest.

**Table 1.** The mean ( $\pm$  SE) duration of immature stages (days), pre-pupal and pupal weight (mg) of *Helicoverpa armigera* fed on diets containing various corn hybrids at laboratory conditions.

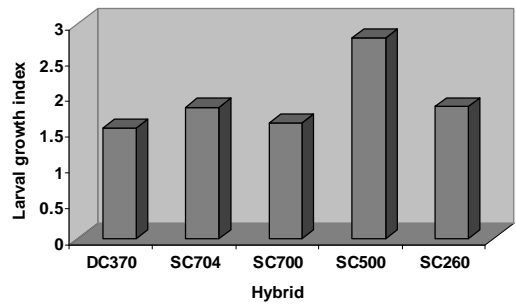
Hybrid	Incubation	Larval period	Pre-pupal period	Pre-pupal weight	Pupal period	Pupal weight	Development time
DC370	3.00	$22.12 \pm 0.92b$	$1.35 \pm 0.17b$	$273.10 \pm 13.50a$	$13.35 \pm 0.23a$	$248.10 \pm 10.50a$	$39.63 \pm 0.81ab^*$
SC704	3.00	$20.79 \pm 0.98b$	$1.32 \pm 0.17b$	$299.50 \pm 14.50a$	$13.05 \pm 0.31a$	$269.30 \pm 13.00a$	$38.16 \pm 0.89b$
SC700	3.00	$24.90 \pm 1.48a$	$1.30 \pm 0.13b$	$255.80 \pm 12.50a$	$12.95 \pm 0.33a$	$255.80 \pm 12.50a$	$41.21 \pm 0.95a$
SC500	3.00	$19.43 \pm 0.70b$	$2.05 \pm 0.23a$	$305.30 \pm 15.20a$	$13.10 \pm 0.28a$	$264.60 \pm 12.60a$	$37.62 \pm 0.60b$
SC260	3.00	$21.75 \pm 0.70b$	$1.30 \pm 0.15b$	$294.20 \pm 12.50a$	$13.25 \pm 0.23a$	$266.10 \pm 11.10a$	$39.30 \pm 0.71ab$

The means followed by different letters in the same column are significantly different ( $P < 0.01$ ,  $P < 0.05^*$ , LSD).

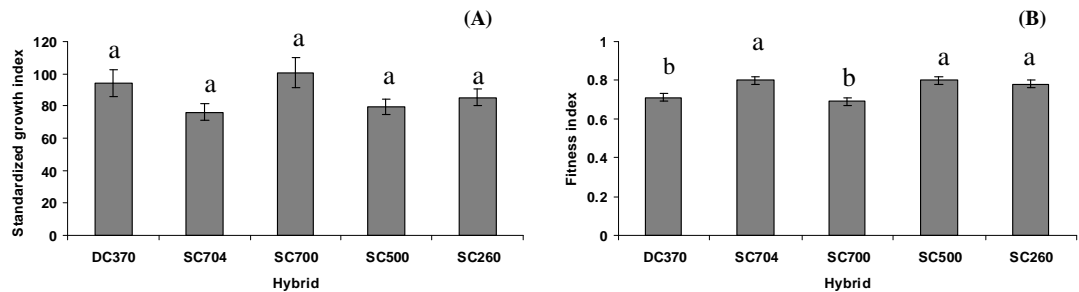
**Table 2.** The mean ( $\pm$  SE) adult longevity, life span, oviposition period (days), and fecundity of *Helicoverpa armigera* fed on diets containing various corn hybrids at laboratory conditions.

Hybrid	Longevity		Life span				Fecundity/female	
	Male	Female	Male	Female	Pre-oviposition period	Oviposition period	Daily	Total
DC370	$12.60 \pm 1.45a$	$12.00 \pm 2.17a$	$51.90 \pm 1.41a$	$52.57 \pm 2.16a$	$6.14 \pm 0.96a$	$6.43 \pm 1.73a$	$111.80 \pm 14.10b$	$738.00 \pm 154.00a$
SC704	$14.13 \pm 2.38a$	$14.09 \pm 0.91a$	$53.00 \pm 2.05a$	$51.73 \pm 1.46a$	$8.18 \pm 1.03a$	$5.27 \pm 0.84ab$	$100.90 \pm 10.20b$	$464.20 \pm 98.60a$
SC700	$16.00 \pm 1.32a$	$11.78 \pm 1.48a$	$55.36 \pm 1.45a$	$56.89 \pm 1.98a$	$7.11 \pm 0.90a$	$3.10 \pm 0.64b$	$108.20 \pm 13.40b$	$440.00 \pm 167.00a$
SC500	$15.46 \pm 1.19a$	$12.88 \pm 0.77a$	$56.69 \pm 1.36a$	$52.63 \pm 1.73a$	$6.50 \pm 1.15a$	$7.11 \pm 0.42a$	$162.10 \pm 18.70a$	$787.00 \pm 152.00a$
SC260	$14.67 \pm 1.94a$	$12.25 \pm 1.33a$	$58.00 \pm 2.12a$	$53.00 \pm 1.75a$	$7.00 \pm 1.52a$	$5.25 \pm 0.96ab$	$136.90 \pm 19.90ab$	$582.00 \pm 141.00a$

The means followed by different letters in the same column are significantly different ( $P < 0.05$ , LSD).



**Fig. 1.** The larval growth index of *Helicoverpa armigera* fed on diets containing different corn hybrids at laboratory conditions.



**Fig. 2.** The mean standardized insect-growth index (A) and fitness index (B) of *Helicoverpa armigera* fed on diets containing different corn hybrids at laboratory conditions. Bars represent standard error of the means.

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