

## ORIGINAL ARTICLE

### Effects of Radiation on Sexual Attraction in *Ephestia calidella* (Guen.) (Lepidoptera:pyralidae)

<sup>1</sup>B. Sh. Hamad, <sup>2</sup>T.R. Ahmad and <sup>1</sup>A.A. AL-Taweel

<sup>1</sup>IPCR center, Directorate of Agric. Res., Ministry of Science and Technology, P. O. Box 765, Baghdad, Iraq.

<sup>2</sup>Seed Technology center, Directorate of Agric. Res., Ministry of Science and Technology, P. O. Box 765. Baghdad, Iraq.

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#### ABSTRACT

Field trials showed that the responses of released males of carob moth, *Ephestia calidella* to live- female traps were not significant even when they were irradiated up to 400 Gray of gamma rays. Likewise, there were no significant differences between the irradiated and unirradiated males in their dispersal. Meanwhile, there were no significant differences between the abilities of the irradiated and normal females to attract males. Finally the results showed that the synthetic lure was as effective as the females in attracting males.

**Key words:** *Ephestia calidella*, carob moth, Iraq

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#### Introduction

Carob moth, *Ephestia calidella* (Guen.) is considered as one of the most destructive pest in Iraq. It attacks date fruits in the field and warehouse (Cox 1975, Ahmad 1985). In Iraq, a research program was initiated to investigate the possibility of using sterilized insect for controlling *Ephestia* species population (Ahmad *et al.* 1971; Al-rubeai *et al.* 1989; AL-Taweel, 2000; AL-Taweel *et al.*, 2001 ). The response of sterilized male to their mates is considered as one of the important general activities of sterilized insect, that should be inspected in sterile-male release program (Proverbs 1968; AL- Taweel *et al.* 1990, 1993). Also, dispersal behavior of the irradiated male is very critical in any release program. However, the response of irradiated male to their mates and the ability of irradiated females to attract males were not investigated. Therefore, the present investigation was undertaken to determine the responses of males irradiated as pupae and unirradiate males of *Ephestia calidella* to live-female traps and their dispersal and to inspect whether irradiated females pupae were as attractive as normal females to males in a natural infestation. As a supplementary part of the tests the attractiveness of synthetic lure was tested in comparison with the attractiveness of normal and irradiated female as pupae.

#### Materials and Methods

The trials were conducted during 1992-1993 in an old date palm orchard located in Madain district, southern Baghdad province Iraq. Experimental insects were from a laboratory stock seeded with eggs and reared on an artificial diet composed of 81% crushed whole wheat, 1% yeast, 6% syrup (dibis) and 12% glycerol. Stock culture were maintained at  $29 \pm 1^\circ\text{C}$  and  $65 \pm 5\%$  r.h. with a 16 hr photo phase and a 8-hr Scot phase. Pupae were obtained by placing roll of cotton into ca. 21 day old stock culture for 48 hr, then they were removed and unrolled. The mature larvae within the cotton were separated according to the sex and the males identified by the dark testes visible through the 5<sup>th</sup> abdominal dorsum, were placed singly in a diet

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**Corresponding Author:** Dr. Bassim Shehab, IPCR Center, Directorate of Agric. Res., Ministry of Science and Technology. P. O. Box 765, Baghdad, Iraq.  
E-mail: bassim.shehab@yahoo.com

vial (7 × 2.5 cm). The vials were observed daily until the larvae pupate. The female larvae were treated in the same way. To test the response of irradiated males to virgin female traps were accomplished by treating the male pupae 2- day before eclosion with 0, 100, 200, 300, and 400 Gray in Cobalt-60 irradiator at a dose of about 105.50 Gray/ min. Within 24hr after eclosion, male were marked with different colures of Day GLO fluorescent powder (Day – GLO, Switzer, brothers, Inc. Cleveland, Ohio, U.S.A) by dropping the powder pigment in the container with the moths. The container was gently shaken and rolled until the moths were thoroughly covered, they were then allowed to recover. After marking, moths were released in the central of the orchard surrounding by fifteen live -female traps, each containing 10 ♀♀, distributed randomly in the orchard. The distance between the releasing site and traps was about 0 – 300 m. Trapped males were examined under UV light to determine number of dyed (released) and undyed (wild) males in each collection. To investigate the effects of gamma radiation on the ability of the females to attract males were done by treating the female pupae 2-day before eclosion with 0, 100, 200, 300, and 400 Gray in Cobalt-60 irradiator at a dose of about 92.40 Gray / min. The females that emerged after 12 -24 hr from irradiation were used to bait Delta traps in two testing. The females were confined within the traps in small separate cages (glass vial 6×3.5 cm diameter) which permitted limited freedom of movement, but prevented mating with any male entering. The prevention of mating was essential, as the female ceases to be attractive to male after mating (Ahmad, personal communication). Adult male moth were ensnared inside the traps by sticky surface. Traps were placed in the area at the same time to permit the attraction of moths during flight. A 72 hr exposure period was used in the two testing. These tests were replicated three times in a randomized complete block design and conducted from 26 September to 29 September and from 19 October to 22 October. Furthermore the attractiveness of synthetic lure in a comparison with the attractiveness of normal and irradiated females with 400 Gray was evaluated as described previously. At the end of the 72 hr exposure period the traps were removed and counts were completed. Data for release / recovery of males were transformed to arcsine  $\sqrt{\%}$  transformation, while other tests were transformed using  $\sqrt{x+0.5}$  transformation. The data then were subjected to analysis with a two – way analysis of variance; means were separated using Duncans (1955) multiple range test.

## Result and Discussion

Data in table (1) revealed that there was not significant differences ( $F = 6.01$ ;  $df = 4, 4$ ;  $P > 0.05$  and  $F = 0.73$ ;  $df = 4, 4$ ;  $P < 0.05$ ). In recovery of normal marked males and those irradiated with 100, 200, 300, and 400 Gray and released in the date palm orchard during the period of seasonal flight activity of *E. calidella* in 1992 and 1993 respectively. Moreover, the males irradiated with 200 and 400 Gray and released in the orchard in 1992 had suffered no impairment of copulation response as was reflected by high percentage of recoveries (27.2% of 58 ♂♂ and 34.6 % of 52 ♂♂) of released males, respectively. Wong (1972) also stated that the males of lesser Peachtree borer *Synanthedon pectipes* (Grote and Robinson) irradiated with 200 Gray did not alter the copulation response. Meanwhile, the data exhibit that the trap catches of marked irradiated and non irradiated males were highest at traps nearest the release site and decrease linearly with distance [recapture of irradiated ♂:  $y = - 0.027x + 13.43$  ( $r = 0.986$ ); recapture of non irradiated ♂:  $y = - 0.0188x + 13.69$  ( $r = 0.999$ )] in which (y) is the number of males at distance (x) (fig. 1). Over all, there is no significant differences between irradiated and non irradiated males in their dispersal. Our results accurately reflect the ability of irradiated male as pupae up to 400 Gray, to locate females under natural condition.

**Table 1:** Trap recovery of *Ephestia calidella* irradiated, marked and released in the date palm orchard, 1992-1993

Dose (Gray)	No. males released		% males recaptured		Combined $\bar{X}$
	1992	1993	1992	1993	
0	61.0	58.0	1.09 a*	13.36 a	7.23
100	70.0	76.0	10.83 a	5.77 a	8.30
200	58.0	55.0	27.23 a	12.15 a	19.69
300	45.0	62.0	1.32 a	13.41 a	7.37
400	52.0	61.0	34.58 a	4.24 a	19.41

Means within a column followed by the same letter are not significant different ( $p < 0.05$ ; Duncan's multiple test).

In test 1, the number of males caught during the 72 hr exposure period by the traps baited with irradiated females and normal females were not significantly different ( $F = 0.483$ ;  $df = 4, 8$ ;  $P < 0.05$ ) (table 2). A similar result was encountered in test 2, as there were no significant differences ( $F = 3.57$ ,  $df = 4, 8$ ;  $P < 0.05$ ) among the traps baited with normal and irradiated females. In comparison of the attractiveness of males to synthetic lure, irradiated females and normal females in table (3), there were no significant differences ( $F = 4.01$ ;  $df = 2, 4$ ;  $p > 0.05$  and  $F = 0.16$ ;  $df = 2, 4$ ;  $p < 0.05$ ) between the synthetic lure and irradiated

**Table 2:** Number of male *Ephestia calidella* captured during 72 hr in traps baited with females irradiated with different doses of gamma radiation.

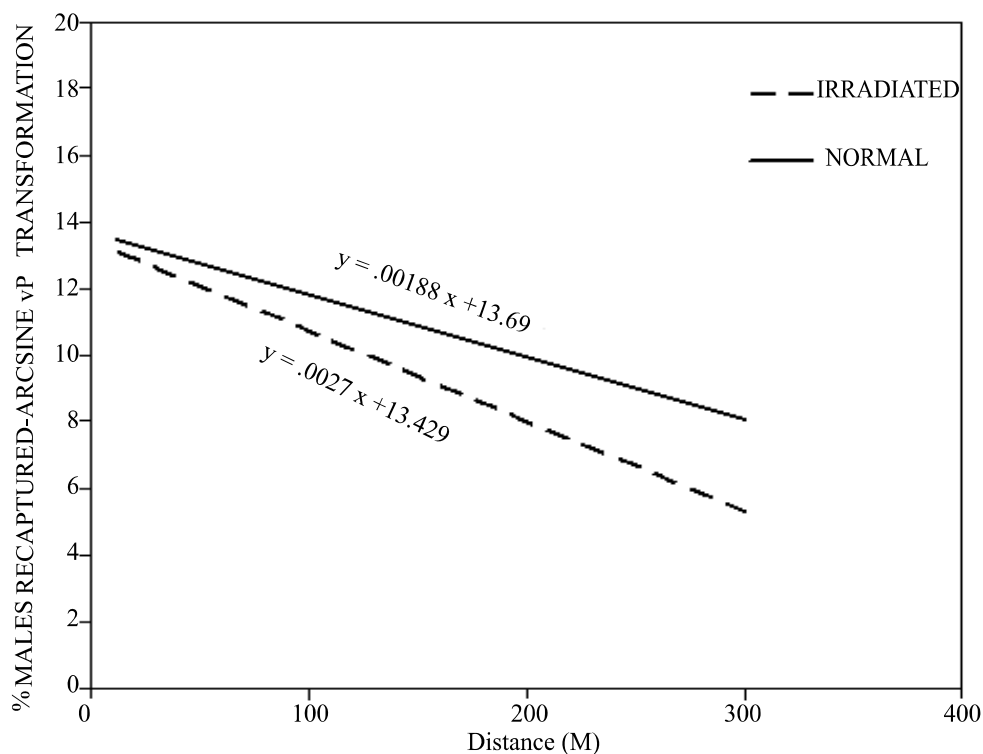
Dose (Gray)	$\bar{X}$ No. males caught in each test		Combined $\bar{X}$
	Test 1	Test 2	
	Sept. 26 -29	Oct. 19-22	
0	3.3	8.0	5.7
100	8.0	9.7	8.9
200	5.0	5.0	5.0
300	5.0	4.0	4.5
400	2.0	5.3	3.7

No significant differences were found among the doses (p < 0.05; Duncan's multiple range test).

**Table 3:** Numbers of male *Ephestia calidella* captured during 72 hr., in traps baited with synthetic pheromone and irradiated and normal females.

Attractant	$\bar{X}$ No. males caught each year		Combined $\bar{X}$
	1992	1993	
	(Sept. 26-29)	(Oct.19-22)	
Synthetic lure	15.6	4.2	9.9
Irradiated ♀♀	35.0	3.5	19.3
Normal ♀♀	56.0	5.7	30.9

No significant different were found among the attractant (p< 0.05 ;Duncan'smultiple range test)



**Fig. 1:** Percentage recovery of irradiated and normal male of *E. calidella* recaptured at different trapping distance from release site.

females as well as the normal females in both seasons of 1992 and 1993. The same situation was reported in a related species of almond moth by Brower, (1979) where the irradiation of adults of *Ephestia cautella* (Walker) did not significantly decrease the mating ability of males or females at doses up to 450 Gray. Likewise, Godwin *et al.* (1964) reported no significant in the relative attractiveness of irradiated and non irradiated female of gypsy moth *Lymontria dispar* (L.). Therefore, the irradiation up to 400 Gray did not diminish the mating ability of either sexes. Also, the results indicate that the synthetic lure was as effective as the females in attracting males.

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