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EFFECT OF GAMMA RADIATION ON MORPHOLOGY OF SENSORY STRUCTURES FOR THE ANTENNAE OF *Trogoderma granarium* (Everts.) ADULTS

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ABSTRACT

External morphology of antennal sensilla of both sexes of irradiated and non-irradiated *Trogoderma granarium* were studied with scanning electron microscopy. The number and distribution of antennal sensilla were also determined. Five types of sensilla could be distinguished on the flagella of both sexes : sensilla chaetica, long trichoid sensilla, short trichoid sensilla, basiconic sensilla I and II. The sensilla chaetica are probable tactile mechanosensila, where as both types of sensilla trichoid and basiconic sensilla type I liekly function in olfaction. Suggested function for basiconic sensilla type II include hygro/ thermoreception and chemoreception.

The male antenna is considerably larger than that of the female; in both sexes, sensilla on the antennal segments were most abundant on the apical segments, where sensilla trichoid were particularly concentrated.

External structure, general distribution and relative number of sensilla in irradiated specimens were affected. One-Day old pupae were more affected by gamma radiation more than 4 – day old. Essential difference were indicating clear sexual dimorphism. In male morphological features were regarded as modification for sex pheromone reception. The effect of sterile dose of gamma radiation on olfactory receptors may reduce the biological activity of insects.

INTRODUCTION

The Khapra beetle, *Trogoderma granarium*, is the most important pest of stored cereals and many other food materials. It is one of the very few storage insects that can breed in a hot dry environment, in addition, it can survive the normal winter of cool countries. (Burque, 1962).

The insects, communication between sexes is often mediated through pheromones and constitutes an important basis for reproductive success as well as inter specific reproductive isolation (Inscoe, 1977). The Khapra beetle female releases a pheromone which is accompained by characteristic posteral activity, so it can be termed sex pheromone, releasing or calling behaviour (Hammack and Burkholder, 1976).

The antennal sensilla play a crucial role by receiving stimuli for mating (Matthews, 1975). It is probable that the location of the sensilla on the antenna also has adaptive value and is, therefore, closely correlated with the corresponding behavioural peculiarities (flying, Walking, vibration of antennae, etc.) in different insect species (Zacharuk, 1985). Chemorception in insects is a specialized function related to the innate behaviour of the particular species, sex or individual (Chapman, 1982).

Several researches have provided extensive disscussion on the general morphology and function of the sensory receptors of adult stored product insects. (Peter and Parrbara, 1986, Pushpinder, 1988, El-Degwi, 1990 and George *et al.* 1997). No previous investigation have been made into the sensory apparatus of *T. granarium*.

Therefore the present work was undertaken to investigate the variations in the antennal morphology of irradiated and non irradiated adult in both sexes of *Trogoderma granarium* using information from scanning microscopy (SEM), also to determine the number and the distribution of antennal sensilla.

MATERIALS AND METHODS

The khapra beetles were obtained from stock cultures reared in Insect and pest Control laboratory. (NCRRT). Larvae were reared in half pound glass jars half filled with a mixture of whole and crushed wheat. The jars were tightly covered with muslin held by rubber bands and kept at 34 ± 1c° and 60 ± 5% R.H (Rajendran, 1982). Insects were removed as pupae then sexed and held in Petri dishes (9 cm diameter) lined with filter paper. The collected male and Female pupae 1 and 4 day old were treated with previously established sterile dose of gamma radiation from Co – 60 Source located in the (NCRRT). The dose was 60 Gy for female pupae and 200 Gy for male pupae (Gharieb, 1989) and were left until adult emergence. The heads with antenna intact were separated from the adults and dipped for 5 min in glacial acetic acid (for cuticle relaxation), 15 min in 14% tween (cleaning), and 5 min in absolute xylene. The ántenna were removed from the heads, monuted in xylene and studied under the light microscope (Pushpinder, 1988). The length and diameter of antennal segments, the number, distribution and size of sensilla were examined for ten irradiated and non- irradiated male and female antennae.

For examination with the scanning electron microscope (SEM) the whole antenna of freshly killed specimens were removed from the head, cleaned by gentle sonification in distilled water and 70% ethanol for 1 min, attached vertically to aluminium stubs and air-dried before being coated with gold in a vacuum evaporator (Merivee, 1997). Observation and description of sense sensilla were made with (Joel JSM. 5400) scanning electron microscope with an accelerating Votage of 10 Kv.

RESULTS AND DISCUSSION

T. granarium have 11 antennal segments, consisting of a scape, pedical and 9 segmented flagellum. The male distal antennal segment is oblong and narrow with apical segment tapering evenly to an acute tip (Fig. 1A), cylindrical and closely joined in female (Fig. 1B). The male antenna is considerably longer than that of the female. (Table 1). The longer antenna in males accommodate more sensilla which may be involved in detecting behaviorally important stimuli (Rup, 1988; Pajni and Gupta, 1990; El-Degwi, 1990; and George *et al.*, 1997). (Table 1) shows the changes in the length of unterated and treated antennae of male and female pupae. These measures were (508.7 and 429.3 μ m) in untreated adults, compared with (452.6 and

Table (1): Mean diameter and length of selected flagellar segments, pedical, scape and total length of both antennae of each sex of untreated and treated. *T. granarium*

No. of Segments	Diameter in (μ) ± S.E						Length in (μ) ± S.E					
	Male			Female			Male			Female		
	Untreated	Treated 1	Treated 2	Untreated	Treated 1	Treated 2	Untreated	Treated 1	Treated 2	Untreated	Treated 1	Treated 2
1	74.7 ± 2.86	53.7± 2.83	67.7±2.34	60.6 ± 2.34	65.3 ±2.86	70.0 ± 3.69	114.3 ± 4.35	93.3 ±3.68	109.7±4.67	74.7 ±5.94	60.7 ±4.35	86.3±8.72
2	53.7 ± 2.83	65.3±2.86	77.0±2.86	79.3 ±2.34	79.4 ±2.34	79.4±2.34	93.3 ±3.68	67.7 ±4.37	67.7±4.37	58.3 ±7.35	49.0 ±4.35	51.4±4.65
3	70.0 ± 3.69	58.3± 3.68	72.3±4.37	60.6 ±2.34	74.7 ±4.67	67.7±4.37	55.9 ±2.32	55.9 ±2.32	53.7±2.83	55.9 ±4.63	46.7 ±3.68	49.0±2.32
4	53.7 ± 2.83	44.4±2.34	55.9±2.32	49.0 ± 2.32	56.0 ±4.35	46.7±3.68	49.0 ±2.32	51.3 ±2.83	42.0±2.86	39.7±2.86	39.7±2.86	37.3±2.34
6	23.3 ± 0.0	23.3± 0.0	23.3±0.0	23.3 ± 0.0	23.3 ±0.0	23.3±0.0	23.3 ±0.0	23.3 ±0.0	23.3±0.0	23.3±0.0	23.3 ±0.0	23.3±0.0
8	23.3 ± 0.0	23.3± 0.0	23.3±0.0	23.3 ± 0.0	23.3 ±0.0	23.3±0.0	23.3 ±0.0	23.3 ±0.0	23.3±0.0	23.3 ±0.0	23.3 ±0.0	23.3±0.0
Pedical	53.7 ± 2.83	46.7± 0.0	53.7±2.83	58.3 ± 0.0	55.9 ±2.32	51.3±2.83	51.3 ±2.83	42.0 ±2.86	53.7±2.83	51.3 ±2.83	44.4 ±2.34	46.7±0.0
Scape	62.9 ± 2.86	51.3± 2.83	53.7 ±2.83	60.6 ± 2.34	58.0 ± 0.0	55.9±2.32	62.9 ±2.86	49.0 ±2.32	55.9±2.32	55.9 ±4.63	53.7 ±2.83	55.9±2.32
Total. length. of Antenna							508.7±8.72	452.6±5.72	476.0±9.32	429.3±11.93	387.4±15.79	406.0±11.87

Treated 1: treated pupae as one – day old .
Treated 2: treated pupae as four – day old .
Mean of five antennae in both sexes
Measurements from terminal flagellar segment.

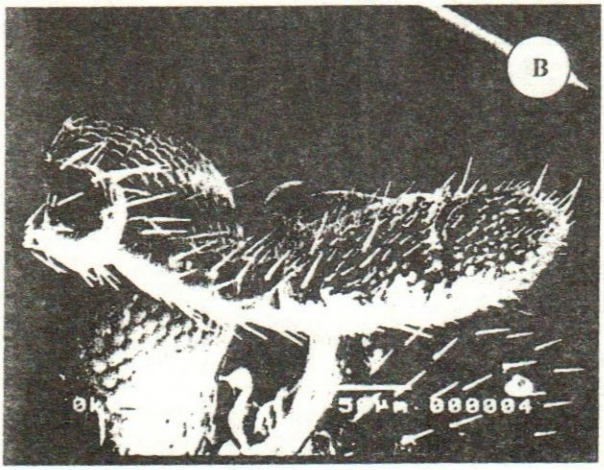

Fig. (1) SEM of untreated *T. granarium* male and female (A). flagellum of male is considerably larger than of female narrow , oblong with more sensilla (B).female antennal segments clindrical and closely jointed with relatively fewer sensilla .

387.4 μ m) in 1-day old treated pupae, where as the measures were (476.0 and 406.0 μ m) in 4- day old pupae, respectively. It is very important to note that the length of both antennae of each sex of treated 1-day old pupae is shorter than that of treated 4-day old.

The positions of the antennae and those of the sensilar fields located on the flagellar segments are correlated with the behaviour of the beetle (Enno *et al.*, 1997). The movement of the antennae depend only on the movement of the scape and pedical. The joint at the scape and head allows the scape to move only forward and backward, and to a slight degree also up and down. The joint at the scape and pedical (Fig. 3 D allows the pedical to move strictly up and down in one plane. The joint between the pedical and the first flagellar segment is rigid (Fig. 2D), joints between the other flagellar segments are elastic, which enable them to move in relation to one another (Fig. 2 C, 3 C). The movement of the flagellar segments are passive in relation to one another.

Male antenna particularly the distal flagellar segments, have more sensilla compared with those of the female (Table 4), only a small number of sensilla were observed on the scape, pedical and penultimate segments of flagellum. Abundant of olfactory receptors, pheromone receptors included, are located without exception on the anterior face of the antennal club (Hallberge, 1982; Faucheux, 1989- 1994).

Scanning of the antenna in both sexes revealed the presence of five types of sensilla. Chaetica, long trichoid, short trichoid, basiconica type I and II.

Sensilla chaetica are blunt and most striking spines of antennal sense organs (Fig. 2D, 3D, 4C). They are situated mainly in the central region of the segment and spaced fairly evenly around it. Their average length is (21.1 and 21.7 μ) in untreated male and female as shown in (Table 2). They are about (3.4 μ) in diameter at the base and set in membranous socket (Fig. 2D). They are found on ends of terminal segments and occur dorsally on scape and pedical, dorsolerally on all segments. They are (24.5 and 26.5 μ) long (Table 2) with a basal diameter of (2.3 and 2.8 μ) in treated male and female 1- day old pupae (Table 3), on the contrary with this, sensilla are short (18.4 and 18.2 μ) in length (Table 2) and (2.7 and 3.4 μ) diameter at the base of treated male and female 4-day old pupae (Table 3). Sensilla chaetica are few in number, It were about (22.4 and 18.4) in untrated male and female (Table 4). The number of this sensilla decreased in treated 1 and 4- day old pupae in both sexes (Table 4). The similar morphology and location are described by (Bland 1986 and El-Degwi 1990). Location of sensilla cheatica are more specifically probable to the position of the scape to the head and the pedical to the scape (Jany and McNeil, 1987), whereas Van der Pers *et al.*, (1980) suggested that the reduced of olfactive sensilla may serve as tactile mechanoreceptors.

Table (2): length of different sensilla for both antennae of each sex in untreated and treated *T. granarium* adults.

Type of sensilla	Untreated		Treated pupae as 1- day old		Treated pupae as 4-day old	
	Male	Female	Male	Female	Male	Female
Chaetica	21.1 ± 0.625	21.7 ±0.643	24.5 ± 1.259	26.5 ± 1.284	18.4 ± 1.808	18.2 ± 1.278
Long trichoid	18.8 ± 1.338	16.3 ± 0.923	16.6 ± 0.397	20.7 ± 0.087	17.1 ± 1.049	16.4 ± 2.212
Short trichoid	13.7 ± 0.586	8.8 ± 0.317	12.4 ± 0.385	12.1 ± 0.912	13.6 ±1.257	8.9 ± 0.922
Basiconica I	5.2 ± 0.698	4.7 ± 0.382	6.3 ± 0.193	5.5 ± 0.387	5.0 ± 1.061	4.9 ± 1.280
Basiconica II	4.8 ± 0.194	3.2 ± 0.211	5.0 ± 0.286	4.0 ± 0.203	4.5 ± 0.305	3.6 ± 0.189

Mean of five antennae in both sexes

Table (3) : Diameter at the base of different sensilla for both antennae of each sex in untreated and treated *T. granarium* adults

Type of sensilla	Untreated		Treated pupae as 1-day old		Trated pupae a 4-day old	
	Male	Female	Male	Female	Male	Female
Chaetica	3.4 ± 0.124	3.4 ± 0.142	2.3 ± 0.516	2.8 ± 0.122	2.7 ± 0.172	3.4 ± 0.249
Long trichoid	3.0 ± 0.142	3.0 ± 0.096	2.2 ± 0.077	2.1 ± 0.145	2.9 ± 0.249	2.3 ± 0.163
Short trichoid	2.3 ± 0.144	2.0 ± 0.208	2.1 ± 0.096	1.6 ± 0.164	2.3 ± 0.152	1.7 ± 0.084
Basiconica I	2.9 ± 0.154	1.5 ± 0.077	2.2 ± 0.095	1.2 ± 0.057	2.5 ± 0.084	1.5 ± 0.369
Basiconica II	2.8 ± 0. 154	2.2 ± 0.095	1.6 ± 0.142	1.7 ± 0.016	1.8 ± 0.057	1.9 ± 0.057

Mean of five antennae in both sexes

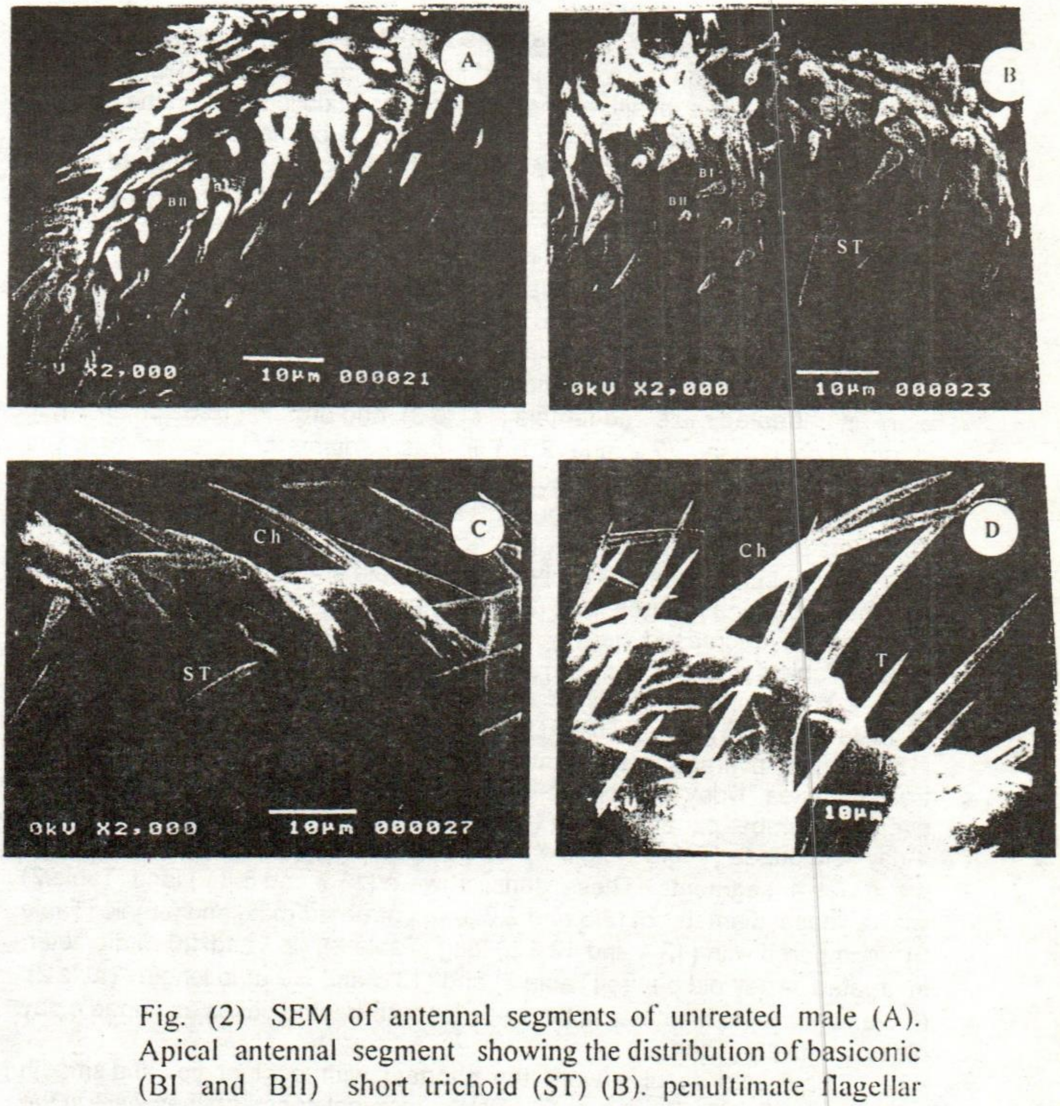

Fig. (2) SEM of antennal segments of untreated male (A). Apical antennal segment showing the distribution of basiconic (BI and BII) short trichoid (ST) (B). penultimate flagellar segments shows different size of basiconic sensilla (C) external surface structure of flagellar antennal segments, the base of long trichoid (T) (D). joint between pedical and 1st flagellar segment, long trichoid grooves (Gr) , trichoid (T) and curved chaetica (Ch) .

Sensilla trichodea or sensory hairs are the most numerous of the sensilla on the antenna. The location of trichoid sensilla is not strictly connected with the dorsal and ventral extensions flagellar segment, they are often situated outside the extension of the flagellar segments. (Fig. 2A, 3A, 4 A, 5B), may be the position of the sensillar fields location on the flagellar segment are correlated with the behaviour of the beetle. Using the light and scanning electron microscope, the trichoid are recognized in silhouette of four distinct phases. Long trichoid sensilla, short trichoid sensilla, basiconic sensilla type I and basiconic sensilla type II. They are distinguished by their length, curvature and tips, according to Mayer *et al.*, (1981).

The long trichoid sensilla were found in both sexes (Fig. 2, 3 , 4, 5) they were relatively straight and grooved hair (fig. 2C, D, 3C – D, 5C) and they were thin walled. The mean length of long trichoid sensilla was (18.8 and 16.3 μ) (Table 2), the mean diameter of the sensilla at the base was (3-0 and 3 μ) in untreated male and female (Table 3), and around (16.6 and 20.7μ) in length (Table 2)and (2.2 and 2.1μ) in basal diameter in treated male and female pupae 1-day old, respectively (Table 3). While their length was (17.1 and 16.4 μ) (Table 2) and about (2.9 and 2.3 μ) in diameter of treated male and female 4 - day old pupae, respectively (Table 3). Long trichoid sensilla were most abundant sensilla in type on the male antennae. The total number per male antenna ranges from (247-276) and (120-157) per female antenna (Table 4). It decreased heavily in treated male and female 1 and 4 day old pupae (Table 4).

The short trichoid sensilla of female were little greater in number than of male (Table 4). It reached (164.6) in female, while, in male it reached (158.6). The average total number decreased heavily (101 and 115) in both treated sexes 1-day old pupae (Table 4, Fig 4-6). It was slight increase in average number per antennae (112) for male and (136) for female treated as 4-day old pupae (Table 4, fig 5-7). Short trichoid were the most numerous on the distal 4 segments. These sensilla were (13.7 and 8.8 μ) long (Table 2) with a basal diameter of (2.3 and 2.0 μ) in untreated male and female (Table 3), compared with (12.4 and 12.1 μ) long (Table 2), (2.1 and 1.6 μ) diameter, in treated 1- day old pupae (Table 3) and (13.6 and 8.9 μ) in length (Table 2), (2.3 and 1.7 μ) in diameter at the base for both treated sexes as pupae 4 day old respectively (Table 3).

Basiconic sensilla were the shortest with a blunt tip and smooth surface (Fig.2 A – B, 3 A – B) . On the terminal segment, they were in the depression and surrounded by sensilla trichoid, (Fig. 2A). There was great varition in size of this sensilla (Fig 2B, 3B). In male there were more basiconic sensilla than in female. Two morphological types of basiconic sensilla (I and II) observed on the apical 4 segments differ in length and location. The basiconic BI sensilla were (5.2 – 4.7 μ) long (Table 2) with basal diameter (2.9 – 1.5 μ) in untreated male and female, respectively (Table 3).In treated 1-day old pupae of both sexes (Table 2,3), there were little increase in length and decrease in diameter (6.3 – 5.5), (2.2-1.2), repectively. While in treated male and female 4 day old pupae, it were (5.0-4.9 μ) long and (2.5 – 1.5 μ) in diameter at the base (Table 2,3). The average number of basiconic BI sensilla per antenna on male (128.6) and (72.0) on female (Table 4), whereas the number decreased in treated male and female of 1 and 4-day old pupae (59.8 – 28.8), (75.0 – 63.4), respectively, (Table 4).

The basiconic BII sensilla were (4.8- 3.2 μ) long (Table 2) and (2.8 – 2.2 μ) in diameter at the base (Table 3) in untreated male and female, and around (5-0 – 4.0 μ) long with the basal diameter of (1.6 – 1.7 μ) in both treated male and female 1-day old pupae (Table 2,3).The average length of treated 4-day old pupae male and female was (4.5–3.6 μ) (Table 2), (1.5-1.9 μ) in diameter at the base (Table 3). The mean number of these sensilla in untreated male was (107.0) and (57.6) in female (Table 4).Their numbers become less in treated male and female 1 and 4 day old pupae (Table 4). It is very important to note that terminal segment bear no basiconic B II (Fig 4 A) in treated male 1-day old pupae. The cuticle around the base was raised to form round collar in treated 4 day old male pupae (Fig. 5 A). Apical segments of treated 1-day old female pupae bear few basiconic BI, BII sensilla with raised basal socket, the lateral surface is smooth and the apex is corrugated (Fig 6 A – B), while in treated 4 – day old female pupae apical segments showed abundance of BI and BII with cuticle collar at the base (Fig. 7 A. B).

The external morphology, general distribution and relatively large number of long and short trichoid sensilla and basiconic type I and II are suggestive of an alfactory function (Inouchi *et al.*, 1987; Mohamed, 1989; El-Degwi, 1990). Trichoid sensilla are often the longest, most abundant and occur all along the flagella in greater numbers on males than on females (Wall, 1978). The sensilla trichoid may be an important role in courtship for both sexes. The surface texture of those sensilla is distinctly multiporous for possible olfactory perception of an air–born chemical stimulus, such as pheromone (Ronaled and Michael, 1987). Sensilla basiconic type I are abundant enough to be considered to play a major role in pheromone perception. The sensilla basiconic type II, which are similar in appearance to short sensilla, are often thermo-or hygroreceptors (Fischer and kogan, 1986). The receptors in these sensilla usually have broad, sometimes overlapping reaction spectra, apparently involved in food and/or habitat and selection is observed (Zacharuk, 1985), therefore habitat and plant food selection may also be hypothesized for basiconic.

External structure, general distribution and relative number of sensilla in irradiated specimens examined were affected (Fig. 4,5,6,7), while 1-day old pupae were more affected by gamma radiation than 4-day old. This may be due to the effect of radiation which agree with the time of morephogensis of antenna.

Essential differences were found in relative length, size of antenna and the number of funicular sensilla between males and females indicating clear sexual dimorphism in terms of the number of sensilla. In contrast to this, there seems to be no different between males and females in terms of the

Table (4) : Number and the percentage of different sensilla for both antennae of each sex in untreated and treated *T. granarium* adults.

Type of sensilla	Untreated				Treated pupae as 1-day old				Treated pupae as 4-day old			
	Male		Female		Male		Female		Male		Female	
	No. (Range)	%	No. (Range)	%	No. (Range)	%	No. (Range)	%	No. (Range)	%	No. (Range)	%
Chaetica	22.4 (20-25)	3.30	18.4 (16-23)	4.06	20.8 (20-24)	5.60	15.2 (12-21)	5.77	13.4 (15-21)	3.30	17.6 (16-19)	4.52
Long trichoid	263.2 (247 –276)	38.72	140.6 (120-157)	31.02	118.6 (111-127)	32.02	85.2 (78-95)	32.32	150.2 (139-160)	36.04	123.8 (120-130)	31.76
Short trichoid	158.6 (144-169)	23.33	164.6 (160-169)	36.32	101.0 (97-115)	27.25	115.6 (107.125)	43.85	112.8 (109-130)	27.06	136.4(125-143)	34.99
Basiconica I	128.6 (113-140)	18.91	72.0 (68-76)	15.89	59.8 (57-63)	16.14	28.8(26-32)	10.93	75.0 (70 -78)	17.90	63.4(59-76)	16.26
Basiconica II	107.0 (97-118)	15.74	57.6 (54-62)	12.71	70.4 (66-74)	18.99	18.8 (17-21)	7.13	65.4 (59-73)	15.70	48.6 (45-54)	12.47

Mean of five antennae in both sexes

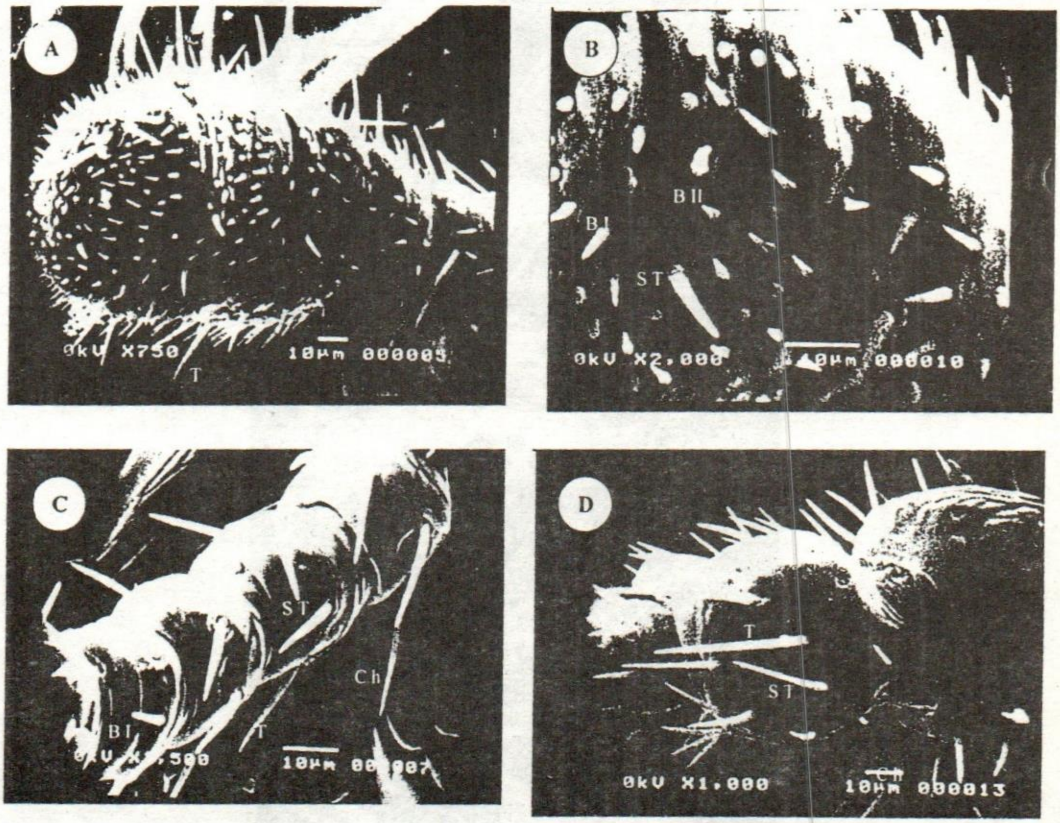

Fig. (3) SEM of antennal segments of untreated female (A). The club flagellar segments showing long trichoid (T) , the abundance of basiconic (B I , B II) (B). terminal three segments showing cuticule surface contain circular mammiform , short trichoid (ST) , basiconic (B I , B II) (C) . 2[nd] –5[th] antennal flagellar segments with smooth cuticular surface , long , short trichoid grooves (D). Junction between scape and pedical with pit field , short trichoid (ST) , chaetica (Ch) , long trichoid (T) .

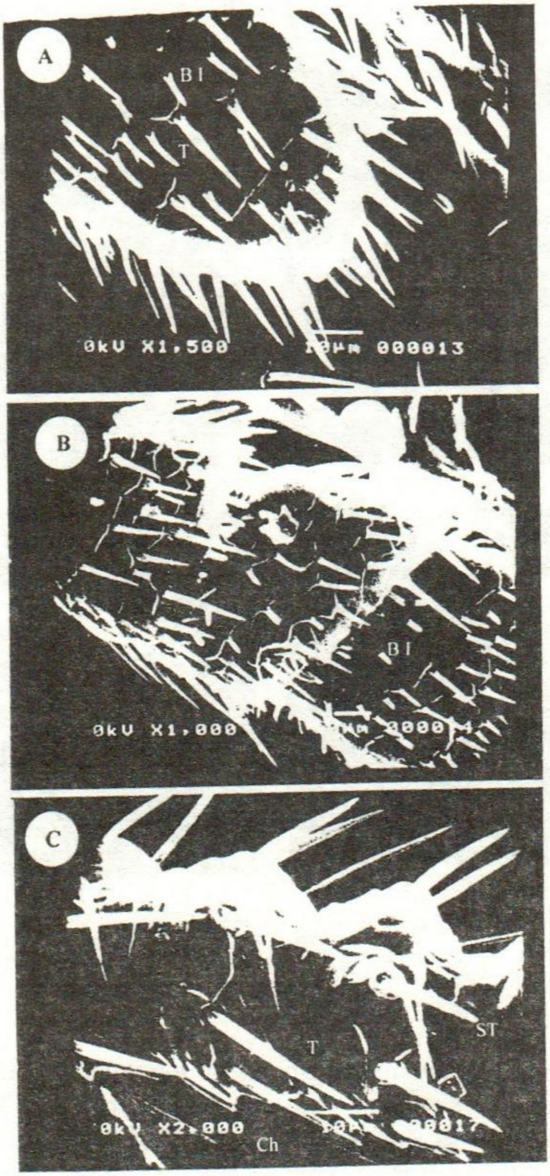

Fig. (4) SEM of antennal segments of treated male 1-day old pupae (A). Top view of apical segment bear no basiconic (B II), (B) . Terminal three segments with ridged cuticular surface and fewer sensilla (C) flagellar segments thick cuticular surface, raised basal socket long trichoid (T) , short trichoid (ST) and chaetica sensilla (Ch) .

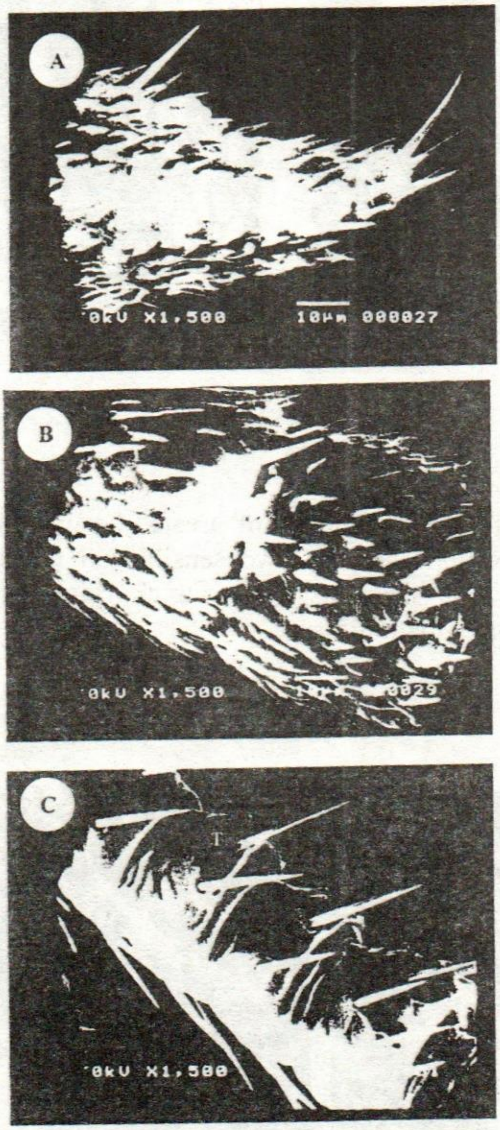

Fig. (5) SEM of antennal segments of treated male 4-days old pupae (A) . the clube showing position of basiconic (B I , B II) with cuticule collar at the base (B). distal segments shown distribution of basiconic type (I , II) (C). central portion of antennal flagellum showing cuticular smooth surface grooves of long and short trichoid .

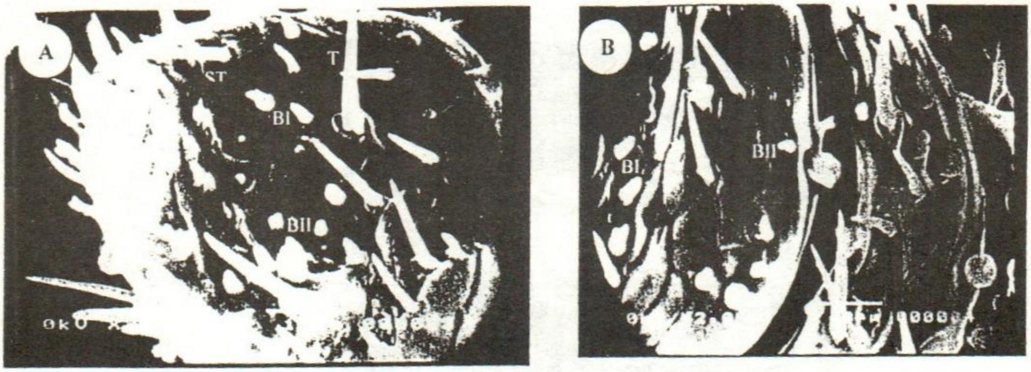

Fig. (6) SEM of apical segments of treated 1-day old female pupae (A) . The club showing fewer sensilla with raised basal socket (B) . terminal segments , show thick ridged cuticular surface with swelling mammiform .

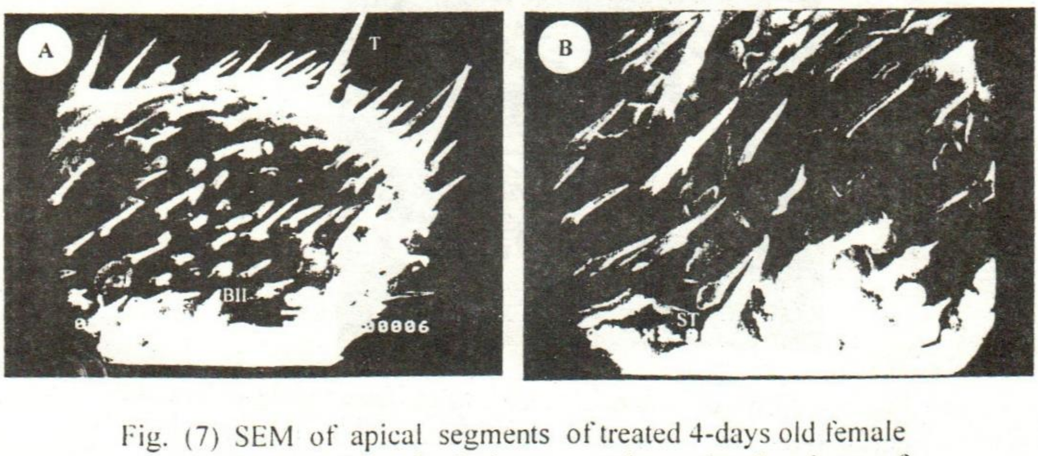

Fig. (7) SEM of apical segments of treated 4-days old female pupae (A) . Top view of apical segment shows the abundance of sensilla (B). distal segments showing the location of short trichoid sensilla with cuticule collar at the base .

types of sensilla found. The presence of sexual dimorphism in the length of sensilla and the number of sensilla on flagellum has been reported in number of insect orders (Liu and Liu; 1984; Mayo *et al.*, 1987; Pushpinder, 1988; Samuel *et al.*, 1993).

In this study, another example of sexual dimorphism has been discovered in the antennal morphology of *T. granarium.* This feature is in the form of cuticular mammiform found only on the 4 distal segments of the female antennae and becomes swelling in treated 1-day old pupae (Fig 3 B, 6 B), scape and pedical have numerous pits on the surface (Fig. 3D) and is referred to here in as the pit field on pedical. This region is proportionally short and frequently interrupted medially by the presence 1 or 2 trichoid sensilla within the smooth cuticle of the pit field. Non of the flagellar segments of the female antennae has pit fields, the male antenna present no inication of the pit field. The pits appear more as depression in the surface rather than openings. This description is in agreement with the finding of (Samuel *et al.*, 1993).

In conclusion, morphological features such as male specific increases in the size of the antenna, number of sensilla unique to mabs are regarded as modification for sex phermone reception detection.

Efficacy of gamma radiation on this morphological features may affect olfactory function which may offer cluse, how this receptors serve the insect and may be responsible to reduce the biological activity of the insects.

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تأثير الجرعة المعقمة من أشعة جاما على الوصف المورفولوجى لأعضاء الحس بقرون الاستشعار لحشرة خنفساء الصعيد

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باستخدام الميكرسكوب الضوئى العادى والميكروسكوب الإلكترونى الماسح تم وصف وحصر أعضاء الحس المختلفة على قرون الاستشعار لذكور وإناث خنفساء الصعيد المعاملة بالجرعة المعقمة من أشعة جاما وغير المعاملة.

أظهرت النتائج عن وجود خمسة أنواع لأعضاء الحس هى :

Sensilla chaetica
Long trichoid sensilla
Short trichoid sensilla
Basiconic sensilla type I
Basiconic sensilla type II

- وشعيرات Sensilla Chaetica غير حادة الطرف وذات شكل مميز وأكثر سمكاً وتعتبر مستقبلات لمس .
- أما شعيرات sensilla trichoid فهى ذات طرف مستدق وأقل سمكا وتعتبر مستقبلات كيماوية للشم.
- فى حين أن sensilla basiconic ذات طرف غليظ وسطح ناعم والأقصر طولاً وتعتبر مستقبلات للحرارة أو لاختيار الغذاء .

يتميز قرن الاستشعار فى الذكور بأنه أكثر طولاً منه فى الإناث وبوفرة عدد شعيرات sensilla trichoid والتى غالباً ما توجد بوفرة فى العقل الطرفية لكل من الذكور والإناث .

تأثرت الصفات المورفولوجية لقرون الاستشعار فى كل من الذكور والإناث من حيث الطول وعدد الشعيرات والتركيب الخارجى للشعيرات وطبقة الكيوتكل عند معاملة العذارى عمر يوم بالجرعة المعقمة أكثر منها فى حالة العذارى عمر ٤ يوم.

تشير التغيرات فى قرون الاستشعار لكل من الذكر والأنثى إلى وجود ظاهرة ثنائية الجنس بوضوح حيث لوحظ من الشكل المورفولوجى لقرون الاستشعار فى الذكور أنها مهيأة بصورة تلائم استقبال الفرمونات الجنسية.

وبصفة عامة قد يكون لتأثير أشعة جاما على أعضاء الحس الخاصة بالشم علاقة بالتأثير على الصفات الحيوية للحشرة.