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Functional Ultrastructure of Antennae, Wings and Their Associated Sensory Receptors of Peach Fruit Fly, *Bactrocera zonata* (Saunders) as Influenced By The Sterilizing Dose of Gamma Irradiation

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ABSTRACT

In view of the fact that, any undesirable effects of gamma irradiation with the sterilizing dose (90 Gy) on the peach fruitfly *Bactrocera zonata* (Saunders), will lead indirectly to failure of irradiated males to disperse strongly, to seek out appropriate niches or to behave synchrony with wild males to success in the courtship with females and/or to mate during the application of the sterile insect technique (SIT). Using the scanning electron microscopy, the changes which occurred to the antennae, wings and their associated sensilla due to the sterilizing dose were investigated. The ultrastructure of antennae in this fly showed no sexual dimorphism, but they differed significantly ($P<0.05$) in their lengths. Seven distinct morphological types of sensilla were observed among the microtrachia. These were trichoid (type sharp 1,2 and blunt), chaetica (type 1, 2), basiconica (type non-socket) and styloconica. The distribution of these sensilla were described. One pair of wings was found to have similar typical structures in both sexes. Six different types of located sensilla were observed on each wing namely; trichoid (type sharp and blunt), chaetica (type 1, 2 and curved) and basiconica type (non-socket). Pupal irradiation with the sterilizing dose produced adults with different malformations in the antennae (funiculus and arista) and wings (intraveins) and their associated sensilla of both sexes. There were non-significant ($P>0.05$) differences in the morphometric traits: head length, head width, thorax length and wing length that may result in the male mating success of the peach fruit fly. However, the significant decreases ($P<0.05$) in the wing width and the significant changes in the apical, anal and humural angles of the wing may affect the circadian rythum and the role of the wings for location host plant fruit for feeding, courtship and mating behaviour.

Key words: *Antennae, Wings, Peach Fruit Fly, Bactrocera Zanata (Saunders), Fruit Flies, Diptera, Gamma Irradiation.*

INTRODUCTION

Native to tropical Asia, the peach fruit fly, *Bactrocera zonata* (Saunders) is spreeding to other regions of the world including the Middle East. This pest was officially identified and recorded for the first time from Egypt [1] where it attacks over 50 known host plants, (e.g. mangos, peaches, apricots and citrus)[2]. Numerous infestations by *Bactrocera* species have been eradicated using a combination of methods including male annihilation technique (MAT)[3,4], foliar and soil pesticide treatment and fruit removal. MAT is based on the attractiveness of the males to methyl-eugenol, a component of the female pheromone on which they feed usually once only in their life time [5,6]. MAT aims at distributing an absorbent substrate impregnated with a mixture of pesticide and methyl-eugenol (also called lure and skill stations) in the target area, after 40 consecutive weeks the male population disappears, leaving the wild females without mates [7]. Since, the sterile insect technique (SIT) protect the environment from insecticides and the promising field trials in many fruit flies by releasing sterile males for controlling these pests encouraged studying the effect of gamma irradiation dose that developing sterility in flies but otherwise remain healthy and vigorous in their mating behaviour [8,9].

In nature, Tephritids males form leks to attract the females using acoustic signals [10] and sex pheromones [11]. It has become evident that the antenna is a major channel of sensory input, including receptors for volatile odors and pheromones, contact chemorecption, water vapor, carbon dioxide, sound perception and touch [12-14].

On the other hand, the peach fruit fly have one pair of wing articulating with the thorax and consisting of flattened lobes supported by hollow viens. The hind wing becomes wholly modified to form the halters, which concerned with the maintenance of stability in flight. The sensilla at the base of the wings and on halteres of Diptera are of particular importance [15]. Some authors discussed this point and found that wings have a main role in courtship and mating of several species of tephritid [16,17,18].

So, sensilla are considered the main communication system in insects between the individuals and their external environment. According to their functions, it may be divided into chemoreceptors, mechanoreceptors and thermohygroreceptors [19,20]. Moreover, sensilla can play an important role in the insect control (biological or chemical control). Therefore, the studying of

chemoreceptor sensilla can be used in control of these flies by using recent insecticides which block the function of these sensilla [21].

The aim of the present study was to investigate the effects of the sterilizing dose (90 Gy) of gamma irradiation [22], restrictly on the morphology of antennae and wings and their associated sensilla in both male and female, peach fruit flies, when irradiated as full grown pupae by the aid electron microscopy (SEM). This become very important before the implementation of SIT against the peach fruit fly, *B. zonata* to known whether gamma-irradiation affects the main role of both antennae and wings of the released flies for location of the host fruit plant for feeding, oviposition, courtship, mating activity and mating behavior.

MATERIALS AND METHODS

The Fly Colony and Irradiation Technique

Permanent laboratory colony of the peach fruit fly, *B. zonata* was held and reared at 25±2°C and 60-65% R.H. at the Plant Protection Research Institute (PPRI), Egypt [23]. Pupae were irradiated 2 days before adult emergence with 90 Gy using the cobalt-60 gamma-irradiation unit (model 220) installed in the Regional Radioisotope Centre for the Arab Countries, Cairo, with the dose rate of 1.05 Gy/sec.

Examination With The Scanning Electron Microscopy (SEM)

Fresh specimens of males and females from a colony maintained in the laboratory (non-irradiated) and adult males and females resulted from irradiated fully grown pupae (90 Gy) were used. They were freezed by liquid nitrogen then dried in the chamber of the scanning electron-microscope, SEM (Jeol – JSM – 5600 LV in SEM Unit, Central Laboratory for Elemental Analysis, Inshas, Egypt) in the low vacuum mode. Then the micrographs were taken, this technique called low vacuum scanning electron microscope freeze drying (LV-SEM) [24]. This technique resulted in the presence of few small particles in white color represents ice during freeze drying technique of the specimens in low vacuum SEM on the micrographs.

Identification of Antennal and Wing Sensilla

Identification of sensilla was carried out according to Zacharuk [19]and Snodgrass [25]. The mean dimensions of antennae and wings were obtained from

20 males and females using the micrometric lens of binocular microscope. Also, the angles of the wing were measured.

Statistical Analysis

The obtained data were analyzed for significance using normal statistics[26].

RESULTS AND DISCUSSION

Normal Structure of Head

The head of the peach fruit fly, *B.zonata* is strongly sclerotised capsule jointed to the thorax by a flexible membranous neck. It bears the mouth parts and also the sense organs. The main sense organs on the head are a pair of compound eyes, three ocelli and a pair of antennae (Plate 1). There are two types of sensilla associated with the head; Trichoid sharp (Ts) and Chaetica (Ch2).

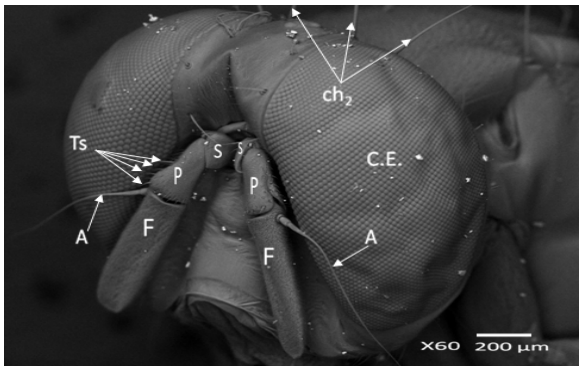

Plate 1. Scanning electron micrograph of head in normal male of *Bactrocera zonata.* Note the ommatida and compound eyes (C.E.) also antennal segments {scape(s), peticel (P), funiculus (F) and Arista (A)}. Sensilla chaetica (ch_2), Trichoid sharp (Ts).

Effect of Gamma Irradiation on Some Measurements of Adult Male

Data in Table 1 revealed the effect of the sterilizing dose (90 Gy) on five morphometric traits: head length, head width, thorax length, wing length and wing width. There were non-significant (P>0.05) differences in the mean head length head width, thorax length and wing length between the irradiated and non-irradiated males. However, the wing width of the irradiated males was

significantly (P<0.05) decreased than that for the non-irradiated males. The non-significant differences in head, thorax and wing lengths may result in a good competition of the irradiated males of peach fruit fly with unirradiated males to mate with the normal females in the field during the application of SIT program. However, the significant decrease (P<0.05) in the wing width may affect the flight ability of the irradiated males for location the host plant fruit for feeding, courtship and mating behaviours. The male size and other morphometric traits (eye length, head width, face width, thorax length and wing length) as determinates of male mating success in the Mediterranean fruit fly; were measured [27].

Table 1. Effect of gamma-irradiation on measurements of head length and width, thorax length and wing length and width in male peach fruit fly, *Bactrocera zonata* (Saunders) treated as a full grown pupae.

Male measurements	Non-irradiated male	Irradiated male	LSD 0.05
Range **Mean head length (mm)**	(6.4 – 7.5) 6.90 [a]	(6.0 – 7.4) 6.58 [a]	0.74
Range **Mean head width (mm)**	(2.0 – 4.2) 3.46 [a]	(3.5 – 4.2) 3.92 [a]	1.01
Range **Mean thorax length (mm)**	(7.9 – 8.7) 8.50 [a]	(8.6 – 9.1) 8.80 [a]	0.46
Range **Mean wing length (mm)**	(5.4 – 5.9) 5.63 [a]	(5.3 – 5.6) 5.44 [a]	0.26
Range **Mean wing width (mm)**	(2.0 – 2.3) 2.18 [a]	(1.8 – 2.1) 1.94 [b]	0.17

*** Similar letters in the horizontal lines means non-significant differences (P> 0.05).**

Normal structure of the fly antennae

The antennae of peach fruit fly, *B.zonata* are situated in a frontal depression between compound eyes (the antennal fossa). Antenna is composed of 3 parts, the scape (semicircle shape) that attached to the pedicel which is movable with it to allow the movement of antenna. The funiculus (3rd antennal segment) is unsegmented flagellum, broadly triangular in cross section, with an

inner and outer surface. A large protruding arista extends from the superior edge of the outer surface of the funiculus (Plate 1). The antennae of this fly show no sexual dimorphism.

Effect of Gamma Irradiation on the Antennal Structure and Length of Both Sexes

The sterilizing dose of gamma-irradiation (90Gy) resulted in abnormalities or malformation and disorientation in the arista (Plate 2 C, D, 3 C, D and 4 C, D). Meanwhile the funiculus of female antennae showed swelling shape (Plate 2, D). Moreover, the results in Table 2 indicated that there were significant decrease ($P< 0.05$) in the mean length of the antennae of the irradiated males and females than that of the non-irradiated flies, in addition the mean length of the non-irradiated females decreased significantly ($P<0.05$) than that for non-irradiated males. However, there were non-significant differences ($P>0.05$) between both sexes of the irradiated flies.

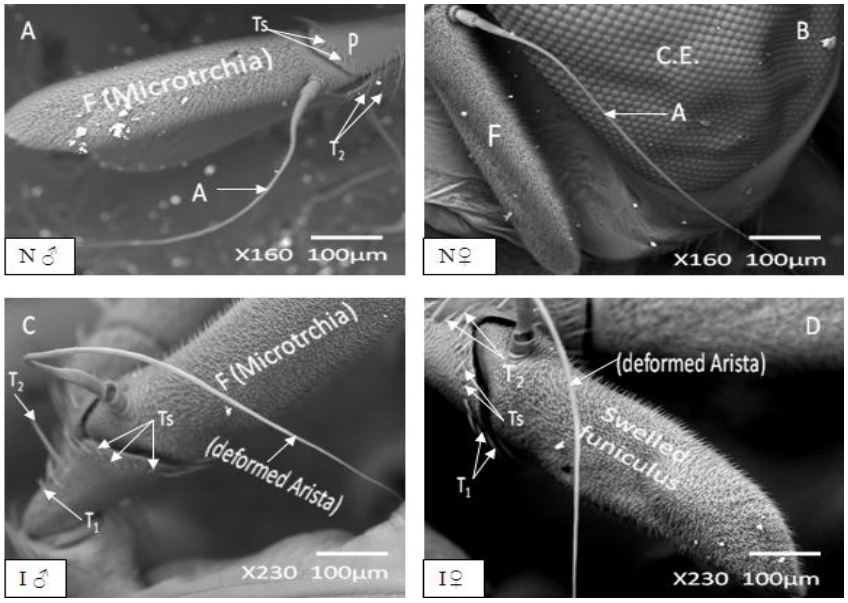

Plate 2. Scanning electron micrographs of non irradiated and irradiated male and female antenna of Bactrcera zonata showing no sexual dimorphism. Note deformation in the arista of the irradiated flies (C, D). Also the swelled funiculus in the irradiated females. Sensilla trichoid (1, 2 and Sharp) are present.

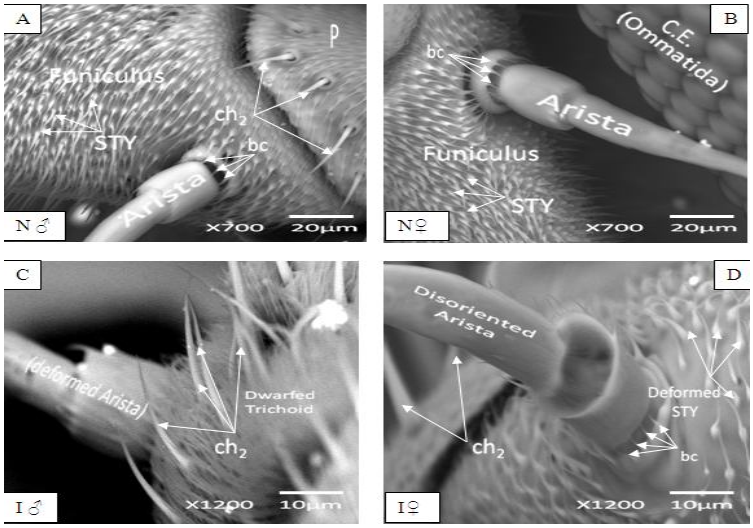

Plate 3. Scanning electron micrographs of non irradiated and irradiated male and female antenna of bactrocera zonata showing dense micotrachia on pedicel and funiculus, chaetica (ch2) and basiconica (bc) on the base of arista. Also note the deformation and disorientation of the arista of both sexes (C, D). Sensilla basiconica and styloconica (STY) showed deformation and dwarfing as affected by gamma radiation.

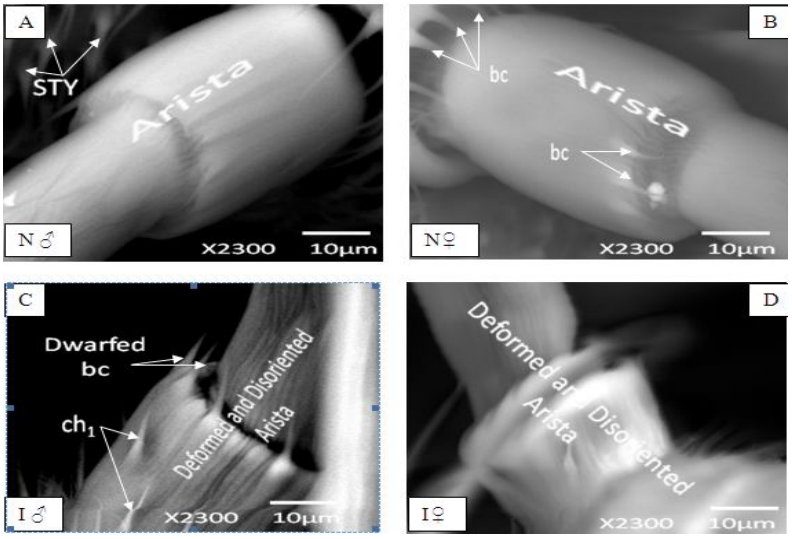

Plate 4. Scanning electron micrographs of non irradiated and irradiated male and female antenna of Bactrocera zonata. Note deformation and disorientation of the aristal segments, also sensilla chaetica (ch1) and basiconica (bc) showed deforming and dwarfing shape.

Table 2. Effect of gamma-irradiation on the mean length of antennae in the adult male and female peach fruit fly, *Bactrocera zonata,* treated as a full grown pupae (8 – 9 days old).

Antennae dimensions	Non-irradiated		Irradiated	
	Male	Female	Male	Female
Range **Mean length (mm)**	(3.6 – 4.2) 3.90 [a]	(2.8 – 3.7) 3.32 [b]	(2.2 – 3.5) 2.94 [c]	(2.0 – 4.0) 2.86 [c]
LSD 0.05	0.26			

*** Similar letters in the horizontal lines means non-significant differences (P> 0.05).**

The sensilla associated with male and female antennae are shown in plates (2,3,4,5,6,7). The scape and pedicel have dense microtrichia and chaetica. Seven distinct morphological types of sensilla were observed in 4 groups on the antennae, among the microtrichia. These sensilla are: Trichoid sensilla sharp (type I and II and blunt), chaetica sensilla (type 1, 2), basiconic sensilla types and styloconic sensilla.

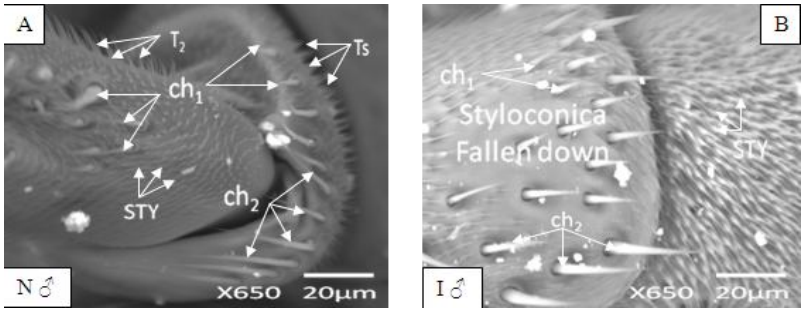

Plate 5. Scanning electron micrographs of non irradiated and irradiated male and female pedicel segment of bactrocera zonata showing sensilla trichoid (T2 and Ts), chaetica (ch1 and ch2) and styloconica (STY). Note the falling of styloconica (STY) from the pedicel.

The significant reduction (P< 0.05) in the antennal length may be resulted in the reduction of the site receptors and neurotransmitters of the volatile odour and sex pheromones. Also, the abnormalities and disorientation in the antennal structures and their associated sensilla, may affect the important role in the flies host-plant location behaviour for feeding, courtship, mating and oviposition. Also, these may explain the expected failure of the irradiated males of peach fruit fly to compete with non- irradiated males to reach and mate with non-irradiated females, which may be resulted in low male competitiveness in the promising SIT program as previously recorded for the Mediterranean fruit fly, *Ceratitis capitata* (Wiedemann) [(28)].

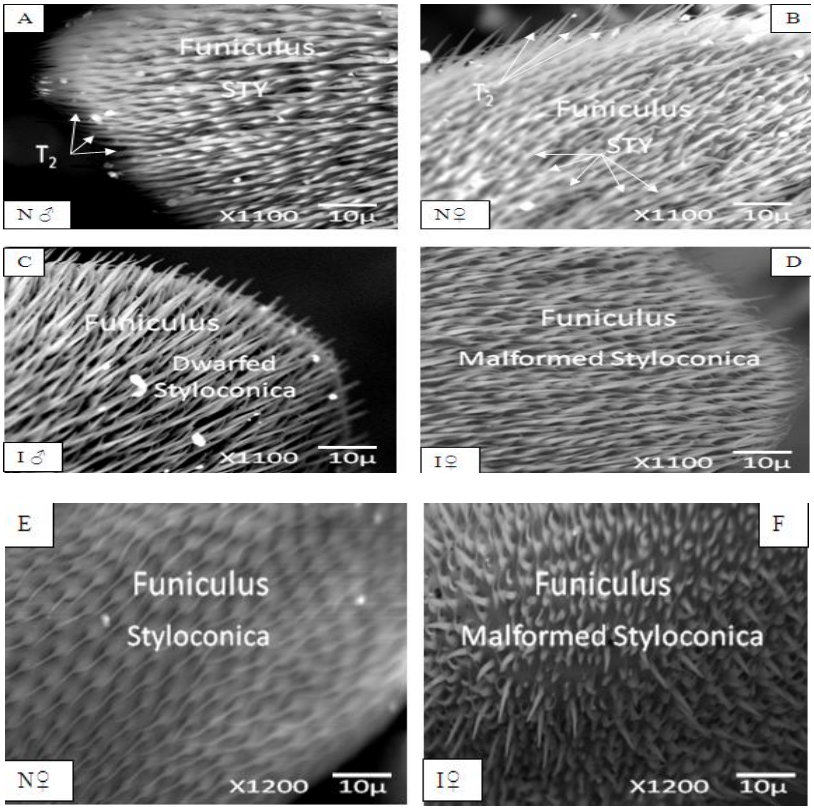

Plate 6. Scanning electron micrographs of non irradiated and irradiated male and female funiculus segment of *Bactrocera zonata* showing malformation of sensilla styloconica (STY).

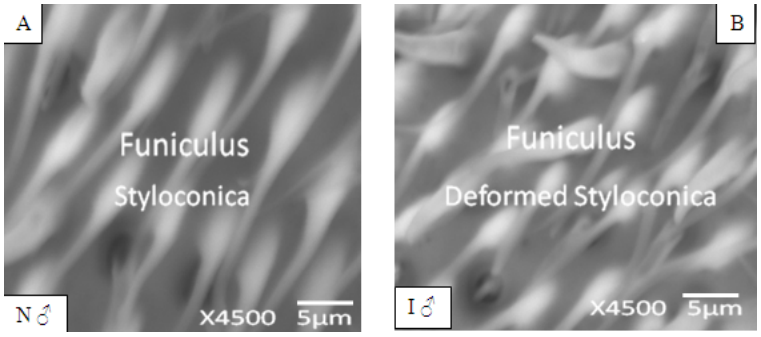

Plate 7. Scanning electron micrographs of non irradiated and irradiated male and female of funiculus segment of *Bactrocera zonata* showing deformation of sensilla styloconica (STY).

Normal structures of the fly wings

As in all fruit flies and dipterous insects, the peach fruit fly, *B.zonata* (Saunders) have only one pair of wings. Plate 8 illustrated the feature of the whole normal wing. The wing margins and angles are named. The leading edge of the wing is called the costal margin, the trailing edge is the anal margin and the outer edge is the apical margin. The angle between the costal and apical margins is the apical angle, that between the apical and anal margins is the anal angle, while the angle at the base of the wing is called the humeral angle. The veins divide the area of the wing into a series of cells.

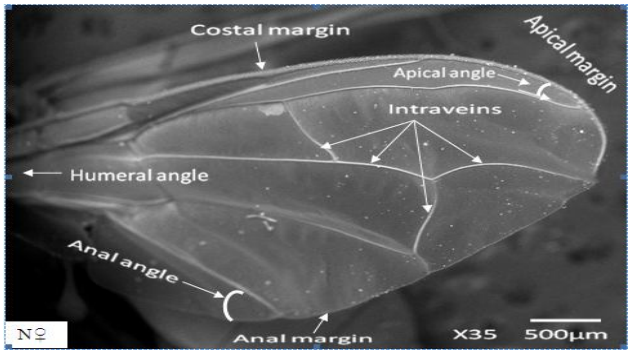

Plate 8. Scanning electron micrographs of non irradiated female wing of *Bactrocera zonata* showing margins and angles of the wing.

Effect of gamma irradiation on the wing structure and angles

Although, the normal structure of the wing shape of both males and females peach fruit fly did not affected by the sterilizing dose of the gamma irradiation (90 Gy), the intraveins showed abnormalities or malformations of some parts of the irradiated flies wing (intravein swelling) (Plate 11). Moreover, the apical and humeral angles of the irradiated males were significant ($P<0.05$) increased than that of the non-irradiated males while the anal angle was decreased significantly ($P<0.05$) than that of the non-irradiated males, (Table 3).

The sensilla associated with male and female wings of peach fruit flies, *B. zonata* are shown in plates (8, 9, 10, 11, 12).

The abnormalities and malformation of some parts of wing structure (intraveins swelling) of the irradiated males and females and the significant ($P<0.05$) differences in the wing angles of the irradiated males of peach fruit fly may be resulted in some changes in the circadian rhythm or another biological

functions that depend on the role of the wings and their associated sensilla in the courtship behaviour, mating behaviour.

Table 3. Effect of gamma-irradiation on the angles of the wing of the adult male of peach fruit fly *Bactrocera zonata.*

Wing Angles	N♂	I♂	LSD 0.05
Apical angle	(b) 27.67°	(a) 40.67°	1.31
Anal angle	(a) 156.00°	(b) 144.33°	1.85
Humeral angle	(b) 60.33°	(a) 68.67°	1.31

*** Similar letters in the horizontal lines means non-significant differences (P> 0.05).**

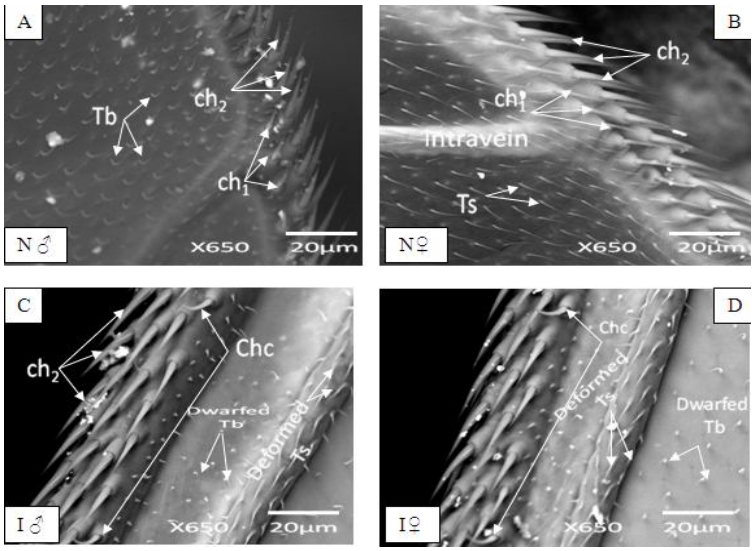

Plate 9. Scanning electron micrographs of non irradiated and irradiated male and female wing of *Bactrocera zonata* showing chaetica sensilla (ch1, ch2 and chc), trichoid sensilla (Ts, Tb). Also note the dwarfing and deforming of trichoid sensilla (Ts and Tb).

The examination of the associated sensilla on the antennae and wings of the peach fruit fly with scanning electron microscope showed the following types:

- ***Trichoid sensilla***

They are setiform hairs, usually freely movable on the basal membrane. They vary greatly in length, their diameter was generally directly related to length and the thickness of their side walls and porosity varies with function. They are mechanosensitive, chemosensitive and olfactory (they could be dually mechano-chemoreceptors). Trichodea was occurred on most parts of the body and appendages (Plates 1 – 11). On the antenna of both sexes, trichoid sharp (type I and type II) were scattered all over the pedicel (Plate 2). The trichoid sharp (Ts, type II) were condensed on the outer margin of the funiculus and on the base of arista, Plates (3, 4). Meanwhile, on the wing of both sexes, trichoid blunt (Tb), trichoid sharp (Ts) sensilla were scattered all over the wing, plates (8-11). The trichoid sharp (Ts) were condensed on the intravein of both non-irradiated and irradiated males more than that for females, trichoid blunt (Tb) are olfactory sensilla for detection of volatile odour and pheromones cues.

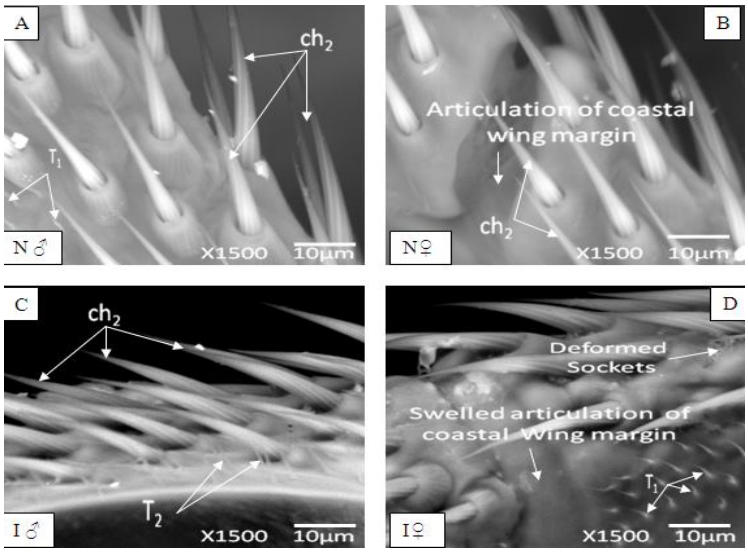

Plate 10. Scanning electron micrographs of non irradiated and irradiated male and female wing of *Bactrocera zonata* showing trichoids (T1 and T2) and chaeticas (ch2). Note the deformed sockets (Ts) and the swelled articulation of costal wing margin.

- ***Chaetica sensilla***

They are bristles or spines generally set in a socket and are much like the trichoid hair type but they are much heavier and have thicker wall. They are

innervated by one or more neurons. Only two types of sensilla chaetica were observed on the outer margins of both male and female antennae and wings of peach fruit fly, *Bactrocera zonata.* Chaetica Type 1 (Ch 1) were observed on plates (1, 5, 9, 10, 11), sensilla chaetica type 2 and curved were observed on plates (9, 10, 11).

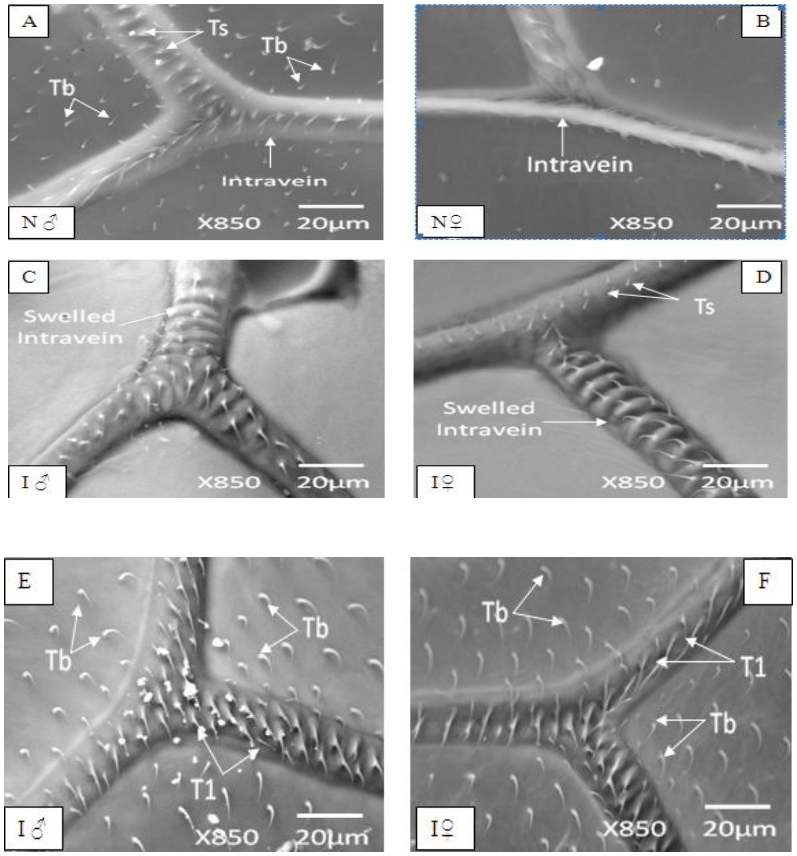

Plate 11. Scanning electron micrographs of non irradiated and irradiated male and female wing of *Bactrocera zonata* showing the intraveins of the wing and trichoid sensilla (T1, Tb and Ts). Note the swelled intravein (C,D).

- ***Styloconica (grooved) sensilla***

They are pegs, cones or squat hairs inserted at the tip of a conical or cylindrical projection of insensitive cuticle. The terminal cuticular projections are innervated by one or few neurons and are assumed or proven to be mechano

or chemosensitive. Styloconica was occurred on most parts of pedicel and funiculus, plates (3, 5, 6, 7).

- ***Basiconic sensilla***

They are basically trichoid hairs that are much reduced in length and changed in form to be peg or cone-like, Plates (3,4,6,7). They are of chemoreceptive variety and they are innervated by one or several neurons.

Effect of Gamma-Irradiation on the Associated sensilla

It is obvious that irradiation had a slight effect on the different types of the located sensilla as compared with control, sensilla trichoidea showed slight warping and dwarfing (Plates 6,9,11,12) and fell down leaving their positions Plate (5).

Moreover, some sensilla chaetica (Ch), basiconica (bc) and styloconica showed malformations and disorientation in some regions of the antennae and wings as affected by gamma irradiation plates (3-12).

Since, the sensilla are mechanosensitive, chemosensitive, olfactory, auditory and gustatory in function, irradiation seemed to make the peach fruit fly failed in their communication to seek their favourate hosts for feeding, courtship and mating behavior with non-irradiated females in the field during the application of SIT program.

However, the role of insect antennae and wings in the location of the host plant for feeding, courtship and mating behavior had been discussed by many authors. In Diptera, the wind is perceived by movements of the third antennal segment relative to the second, probably involving Johnston's organ. Also, they hold their legs in the flight position when their antennae are stimulated in flight[29]. The odours of host fruit play an important role in the female host plant location behavior, the response varied depending on fruit species [30]. Moreover, the olfactory receptors on the antennae bind to odour molecules including pheromones, the neurons that possess these receptors signal this binding by sending action potentials down their axons to the antennal lobe in the brain, prevention of female perception to sex pheromone may disturb the intra specific communication between male and female[15]. Also, the pattern of sexual behaviour and involvement of signals produced during *Bactrocera correcta* courtship, in some experiments, female sensory receptors were modified [31]. Moreover, the arista is implicated as an acoustic receptor in *Anastrepha*

suspensa (Loew)[32]. In addition, in *Bactrocera oleae* sensilla on the third antennal segment respond to sex pheromones and other volatiles. Therefore, aristae and antennae were chosen as putative sound and pheromone receptors, respectively [33, 34].

The use of the sensory plate on the antennae of *Apis mellifera* to have key role in the perception of mechanostimuli and gustatory information [35, 36]. Moreover, these behaviors had been discussed by many authors; the Mediterranean fruit fly, *Ceratitis capitata* courtship behavior revealed unreported details. Moreover, the droplet of pheromone at the tip of the male's abdomen during wing vibration was partially or completely retracted during wing buzzing and head rocking [17]. The wing movements of courting male medflies *C. capitata* include previously non-described twisting movements during continuous wing vibration that may cause the sexually dimorphic rear portions of the male's wings to waft pheromone toward the female [37]. Moreover, the principle function of courtship is to facilitate copulation with an appropriate partner, but courtship does not always lead to successful copulation[15]. The courtship signaling via wing vibration was accompanied by sound production and has been reported in several species of Tephritids. In this large family of flies, sound communication as well as complex courtship displays appeared to be restricted to species with leaking mating systems (i.e. Mediterranean fruitfly, *Anastrpha* and *Dacus* species) [18]. Meanwhile, the male calling sounds (made during wing vibration) and courtship sounds (made during wing flapping and sounds made during the jump and prior to copulation) were recorded in pairing with fast-mating selected females [16]. In addition, in *Drosophila* and as in most insects, gustation is mediated by sensory hairs located on the external and internal parts of the proboscis and on the legs and wings [38]. Moreover, concerning the active maintenance of stability, deviations from a steady path perceived by various sensilla and the nervous input from these exerts a controlling influence on the wing beat so that the deviation is corrected. Of primary importance in this respect is Johnston's organ in the antenna, the hair beds on the front of the head and the sensilla at the base of the wings. The hallters of Diptera are of fundamental importance in this order and they are considered separately [15]. However, the role of the associated sensilla had been discussed by many authors [39-43]. The antennal basiconic sensilla showed to detect carbon dioxide, fatty acid, estars ammonia and amines [39], meat odour [40], also short chain n-alcohols [41]. Meanwhile, the long chaetica

responded to sugar, fatty acids and alcohols [42]. However, chaetica sensilla act as mechanical function, during the molt, it was connected between sensory cells and the old apparatus [43].

While, the chaetica with medium length were stimulated by fruit juice and surface [44]. The antennae of *Bactrocera dorsalis* shows no sexual dimorphism and consists of three segments (basal scape, pedicel and elongated funiculus). The scape and pedicel have dense microtrachia and chaetica. Seven distinct morphological types of sensilla were observed in 4 groups on the funiculus, among the microtrichia. These sensilla are trichoid sensilla types I and II, clavate sensilla types I and II, basiconic sensilla types I and II and styloconic sensilla [45]. The insect pheromones in *Drosophila* elicit stereotypic behaviors that are critical for survival and reproduction. They identified the nectar-feeding and oviposition sites [46]. Odours are detected by olfactory receptor neurons (ORNS) housed in hair-shaped structures trichoid sensilla, on the antennae and maxillary palps. Finally, the insect such as *Aedes aegypti* use trichoid sensilla to respond to odour compounds as in oviposition attachment and sweet borne compounds and methyl alcohol [47].

CONCLUSION

The present authors hope that this study could contribute to the success of the application of sterile insect technique (SIT) against the peach fruit fly, *Bactrocera zonata* in the field. However, the undesirable effects of the gamma-irradiation on the structure of antennae, wings and their associated sensilla may cause failure of irradiated males to disperse strongly to seek out the host plant fruit or to behave synchrony with wild males. Moreover, it is recommended that more electrophysiological and behavioural studies must be carried out to elucidate the precise function of the antennae and wing receptors.

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مجلة البحوث الإشعاعية
والعلوم التطبيقية

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التركيب الدقيق الوظيفى لقرون استشعار واجنحة وأعضاء الحس المصاحبة لها فى ذبابة ثمارالخوخ باكيتروسيرا زوناتا المتأثرة بالجرعة المعقمة لاشعة جاما

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قد تؤدى التأثيرات غير المرغوب فيها لاشعة جاما بالجرعة المعقمة (90 جراى) على ذبابة فاكهة الخوخ باكيتروسيرا زوناتا بطريقة غير مباشرة إلى فشل الذكور المشععة فى البحث أو الوصول إلى العائل الاساسى والتنافسى مع ذكور الحقل فى غزل الاناث والتزاوج معها أثناء تطبيق برنامج تعقيم الحشرات (SIT). وقد استخدم الميكروسكوب الالكترونى الماسح لدراسة التغيرات التى طرأت على قرون الاستشعار والاجنحة والشعيرات المصاحبة لهما باستخدام الجرعة المعقمة للاشعاع.

أثبتت الدراسة أنه لا يوجد هناك فروق مورفولوجية فى قرون الاستشعار بين الجنسين لهذه الذبابة ولكنها تختلف معنوياً ($P<0.05$) فى أطوالها. وقد شوهدت سبع أنواع مورفولوجية مختلفة من أعضاء الحس وهى الشعريه نوع الحاد والمنثنى (trichoid) والشوكية نوع 1، 2 (chaetica) والقاعدية المخروطية (basiconica) والمجوفة (styloconica) وتم وصف توزيع هذه الشعيرات. كذلك يوجد زوج واحد من الاجنحة له نفس التركيب المورفولوجى فى كل من الجنسين. توجد هناك ستة أنواع مختلفة من الشعيرات الحسية على كل جناح وهى الشعريه نوع الحاد والمنثنى (Trichoid) والشوكية نوع 1، 2 والمنحنى (chaetica) والقاعدية المخروطية (basiconica).

وقد نتج عن تشعيع العذارى بالجرعة المعقمة وجود تشوهات مختلفة فى قرون الاستشعار (الفينكيولاس والاريستا) والاجنحة (العروق الداخلية) والشعيرات الحسية المصاحبة لهما فى كل من الذكور والاناث المشععة.

سجلت الدراسة أيضاً وجود فروق غير معنوية ($P>0.05$) فى قياسات كل من طول الرأس وعرضها وطول الصدر وطول الاجنحة مما قد يؤدى إلى نجاح عملية التزاوج لذكور ذبابة الخوخ. بينما وجد هناك نقص معنوى ($P<0.05$) فى عرض الاجنحة وتغيرات معنوية فى الزوايا الرأسية والزيلية والعضدية للاجنحة مما قد يؤثر عل معدل الطيران ودور الاجنحة فى الوصول إلى العائل الاساسى للغذاء والغزل والتزاوج.