

## **The effect of some insecticides on fat bodies of house fly *Musca domestica* L.**

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**Abstract:** This study was conducted at Zoology Research Laboratory, Department of Biology, College of Science, University of Sulaimania to investigate the oral effect of toxicity thiamethoxam, deltaethrin and lambda-cyhalothrin in different concentration on the biological aspects and visceral fat body cells of house fly house fly *Musca domestica* L.in laboratory. First generation of adult house flies tested in this work was the progeny of flies obtained during the summer.

The highest mortality among treated house flies was (96.66 %) that occurred by 3.12 thiamethoxam after 24 hour from administration, followed by (90.00 %) 60 ppm lambda- cyhalothrin, (83.33 %) 300 ppm of malathion and by deltamethrin. There were significant differences between control and each treatment.

The results indicated that the structure of fat bodies was changed due to the effect of various concentrations, the low concentrations of each insecticides caused the occurrence of vacuolations and cytoplasmic granulations as the first sign of poisoning, the medium doses causes the cell exhibited different stages of inclusion deformation, degeneration, necrosis and finally the cell lost its integrity while, high doses caused a series damage to fat cells which finally exploded.

**Keywords:** House fly, insecticides, mortality, fat bodies.

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### **I. 1.Introduction:**

The house fly, *Musca domestica* L. is an important pest of human and domesticated animals and is also a vector of both human and animal disease. [1]lists more than 100 pathogen species harbored and of these, 65 are known to be have transmitted by the flies. More recently, house flies have shown to vector enterhemorrhage colitis caused by *Esherishia coli* 0157:h7 and *Yersinia pseudotuberculosis* [2]. The fly breeds in filth of all kinds, and it is often the primary cause of lawsuits in areas in which urban growth infringes upon agriculture areas, a fact that has greatly increased the pressure on live stock operators of effectively control house fly population [3]. Historically, house fly management has been directed at adult populations and relied heavily on chemical control [4]. However, the use of insecticides in house flies management program less effective because of the resistance problems [5].

Normally, chemical larvicide's and adulticides are the primary means of nuisance fly control. Improper use of those products combined with the housefly's short life cycle and high biotic potential, produce conditions conducive to the development of resistance to insecticide. Insecticides are chemical agents or from biological origin that control insects. Control may result from killing the insects or otherwise preventing it from engaging in behaviours deemed destructive. Insecticides may be natural or man- made and are applied to target pests in a myriad of formulations and delivery systems (spray, baits, slow release diffusion,...etc.) [6]. Most insecticides affect one of the following five biological system in insects according to [7], these include:

- 1- Nerves system
- 2- The production of energy.
- 3- The production of cuticle.
- 4- The endocrine system.
- 5- Water balance.

The fat bodies of the house fly occupy a considerable portion of the coelom and richly supplied with tracheae. Besides serving as a reservoir of food energy, they presumably function for the temporary storage of nitrogenous wastes. Scattered throughout the mass are large cells of the oenocytes type arranged in clusters [8]. Fat bodies usually present in all insects and derived from mesoderm of the wall of embryonic coelomic cavities. Some-times show a segmental disposition and occurs as loose strands, sheet and lobes of tissue. Generally there is a visceral layer around the gut and a peripheral layer beneath the integument [9]. The fat body is a tissue composed by cells arranged forming laminas or ropes dispersed in the heamocoele and filling all the cavities of the head, thorax and abdomen. The fat body is divided in to parietal (adhered to the cuticle) and visceral (located

among the organs) [10]. The trophocyte is the main cell type of the insect fat body. The shape, appearance and volume of the trophocytes vary and are widely depending on the development stage and nutritional state of the insect, however, a marked characteristic of this type of the cell is a cytoplasm filled with lipidic deposits except for a thin portion at the cell's periphery, a ring surrounding the nucleus, and dispersed islands between the lipid droplets. Few inclusions are present at these regions of the cytoplasm. The trophocytes increase in size and probably also in number during the post-embryonic feeding period. When they become the largest cells of the insect's body [11],[ 12].

## **II. Material and Methods:**

The experimental flies were obtained from environment, during the summer 2004. The collection was performed by the applied of boxes measured (30 x 30 x 30 cm), a petri-dish include a fresh sheep manure placed inside the cage and after awhile the adult flies attract to the cages by inducing the odor from manure, then the cage was closed. This work was repeated several times until obtained ( 150 - 200) flies [13]. The flies brought to the laboratory and raised therein. All flies were housed in a sleeve cage, it is a 5 gallon bucket in size (high 40 cm & diameter 42 cm), front side had a hole (10 cm in diameter) with long sleeve shirt 20 cm long for the purpose of cleaning and feeding, while the rearing container was provided by a pair of holes (window) in both sides (15 x 20 cm), for the ventilation purposes [14]. Adults flies were reared in plastic cages and supplied by two kind of foods; (I) mixture of 10% sugar solution, plus 5 drops/liter of Vitamin B12 and (II) powder milk [15]. A plastic container (5 x 7 cm) contains a sheep dung placed inside the container for oviposition, subsequently the oviposition sites were observed daily for the presence of eggs, they were transferred to rearing larvae container, the lid and windows which closed by muslin cloth for ventilation, observation, as well as prevented the larvae to escape also the other insects to pass through in container. Two days after egg hatching, a 5 cm thick layer of sand was added to the bottom of the container to form a cooler and drier place for larvae to pupate [16]. The container included pupae still tightly sealed until the adults emergency, these the newly emerged flies( first generation) provided by sugar solution 10% plus vitamin B12 and powder milk, then the next generation of flies were reared in the same manner as previously described. Rearing took place in a temperature controlled cabinet at 22 -27 C° and a constant illumination of 12: 12 LD [17].

### **2-1 Ingestion (oral) :**

Adults were picked up randomly from the cage, then they were transferred to standardized cages (28, 22 cm) modified by the researcher at this project. Prior the experiment, flies were starved two hours. Bioassay experiment were performed on progeny of adults produced by the field-collected flies [18]. A bait (oral) method was used for all insecticide bioassay in order to evaluate the toxicity of insecticide, ten adult flies 7-days old were used for each dose in the three replication, to be 30 insects in each dose while the control take the same trend and each insecticide used in three doses plus control. Total of 120 adult flies were applied in determination the toxicity of each insecticide. Flies were transferred to the cages, the starved adults provided by 2-cm pieces of cotton dental wick that had been soaked in the 10 % sugar solution containing different concentration of the insecticides according to each case while the control group was provided by sugar solution 10% [19]. All bioassay experiments carried out at 25 - 27 C° and RH 40 -50 %, under laboratory condition with a 12: 12 hours L: D photoperiod. [20].

### **2-2 Insecticidess:**

Four insecticides representing thiamexomam, malathion, deltamethrin and lambda-cyhalothrin were tested; three different concentration were prepared from insecticides. These concentrations were chosen by arbitrary preliminary range-finding tests [21],[22],[ 23]. Thiamexomam was used as the formulated product Actara<sup>R</sup> from (syngenta) 3.12 ppm, 1.56 ppm and 0.78 ppm for thiamexomam active ingredient. Malathion the formulated product Vapmalathion<sup>R</sup> 50 WP, from (VAPCO) 300 ppm, 150 ppm and 75 ppm for malathion active ingredient, was used deltamethrin as formulated product of Deltamac<sup>R</sup> (2.5% w/v), from (VAPCO) 19ppm and 4.75 ppm for deltamethrine active ingredient. lambda-cyhalothrin formulated product Icon<sup>R</sup> 100 WG, from (syngenta) 60 ppm, 30 ppm and 15 ppm for Lambda-cyhalothrin.

For ingestion experiment, sucrose solution (10% w/v) was used as a carrier for feeding [21], [24]. Each concentration was administered as ad libitum. The results were analyzed by using factorial test according to the Complete Randomized Design. The averages were compared by employing Dunnet' test [25]. Mortality was recorded 1, 2, 4, 6, 12 and 24h after treatment. Flies unable to stand upright and move less were recorded as a dead. When needed control mortality was corrected by Abbot's formula.

### **2-3 Dissection:**

Dissecting done to study the effect of insecticide on the fat bodies, after 24 hours ingestion trial of insecticides; five adult flies were taken from each treatment of different insecticides plus control group. The

adult fly dorsally fixed on slide, and then the body was covered by physiological saline 0.9% (NaCl 0.9 gm per 100ml of distilled water). Then insects were cut longitudinally at abdominal region by using a sharp scalpel [26]. The fixed insect was dissected under 2X and 4X objective lenses. After cutting the cuticle the fat bodies picked up by using a spear-shaped head needle firmly from insect abdomen. The fat body was stained by dilute methylene blue (0.01%). The fat bodies were examined by light microscope (Hamilton BLP 1400, Taiwan) under the magnification of 40X. Photographs were taken by computerized microscopic-camera GKB CCD color digital camera, Taiwan). System with magnification power 1680.

### **III. Result and Discussion:**

The insecticide toxicities against adult *M. domestica*, are present in table (1) shows that, there are no significant differences between control and all treatments at the first and second recording hours. At the fourth hour, treatments with 1.56 and 3.12 ppm thiamethoxam are significantly higher than the control and the other treatments. At the sixth hour, the treatments 1.56 and 3.12 ppm thiamethoxam, 19 ppm deltamethrin are significantly higher than control and other different treatments. At the twelfth hour, the treatments 1.56 and 3.12 ppm thiamethoxam, 300 ppm malathion, 9.5 and 19 ppm Deltamethrin, 30 and 60 ppm lambda-cyhalothrin are significantly higher than control and other treatments. At twenty four hours, the treatments 0.78 ppm, 1.56 and 3.12 thiamethoxam, 75, 150 and 300 ppm malathion, 9.5 and 19 ppm Deltamethrin, 30 and 60 ppm lambda-cyhalothrin are significantly higher than control and other treatments. The highest mortality correlated with treatment 3.12 ppm thiamethoxam which was (96.66%) at the twenty fourth hour recording, followed by (90.00%) in treatments 60 ppm lambda-cyhalothrin, (83.33%) in treatment 300 ppm malathion and (76.66%) by 19 ppm of Deltamethrin. These results were represented by (table 2).

Ultra structural examination of untreated fat body of house fly (orally administrated by 10% sugar solution) revealed, that the normal fat body was oval or rounded in shape, which is surrounding by thick intact membrane, filled with large and homogenous inclusions while the lipid droplets in mature cells become so large that they occupy most of the cells, (Plates-1a, 2a, 3a, 4a). These results agreed with [12], [9], [27], [28].

The fat body of treated adult by low concentrations of different insecticides seems to be highly vacuolated, and the cells appeared to be slightly affected under the action of these insecticides as observed in (Plates-1b, 2b, 3b, 4b). The cytoplasm of treated cells exhibited fine granulation as observed (plates-1b, 2b, 3b). The first sign is cytoplasmic vacuolation and appearance granulated cytoplasm especially clearly observed under the action 75 ppm malathion and 15 ppm Lambda-cyhalothrin (Plate- 2b, 4b). While under the effect medium concentrations of those insecticides the treated fat cells exhibited different stages of the inclusion degeneration and deformation cases, which are the cytoplasmic inclusions (lipidic droplets), become minors and decreased in amount as observed (Plates-1c, 2c, 3c, and 4c), which were clearly observed under the action of malathion 150 ppm and Deltamethrin 9.5 ppm (Plates-2c, 3c) which was the most cytoplasm of the cell became transparent. The fat cells of adult house fly that treated by 60 ppm Lambda-cyhalothrin showed the undulating irregular cell membrane as observed in (plate-4 d). The insecticide also caused the clumping of chromatin as observed clearly in the nuclei of the fat cells (plate-3 b), treated by 4,75 ppm which were the nuclei filled with widespread clumping chromatin. The fat cells of the house fly that were treated by 3.125 ppm thiamethoxam, 300 ppm malathion, 19 ppm Deltamethrin and 60 ppm Lambda-cyhalothrin respectively characterized by partially or completely decayed cell membrane and exploding of the cells as observed (Plates-1d, 2d, 3d, 4d). The results showed that insecticides were toxic to fat body cells and because of its role in detoxifying the insects from poison substances. It could be concluded that the fat body cells which are affected by low concentrations of different insecticides caused physiological changes induced by insecticides, the fat body cells of adult house fly could be seen with visible vacuolization which was the first signs of poisoning as shown very obviously observed (plates-1b, 2b, 3b and 4b). This results agreement with [29] who stated that the fat body cells of treated larvae (*Culex pipiens*) could be seen with visible vacuolization due to lipophilic nature of insecticide and damage should especially occur at the level of the membrane systems owing to the lipophilic nature of insecticide. Treated fat body cells of adult house fly appeared with cytoplasmic vacuoles. Vacuole formation is a cellular defense mechanism against insecticides which segregates toxin substances in vacuoles and prevent them disrupting cellular metabolism. The appearance of vacuoles in the pathological conditions have been reported by [30] who found that poisons caused the appearance of vacuoles in locusts; in these vacuoles various substances accumulated, and this represented the initial stage of disintegration.

Medium doses of insecticides were caused greater changes in fat body, the cell body transparent as the result decreased in a amount of inclusions, the cytoplasm with big vacuoles, lipid droplets depleted, inclusions slightly granulated and the cell transparent from peripheral region or in one pole of the cell while the boundary of the cell appear slightly as observed (plates- 1c, 2c, 3c and 4c). This in agreement with [28] who stated that insecticides may be acting in the hyperpolarization of the fat body cell membranes inhibiting lipid, carbohydrate and/ or protein uptake making with that these cytoplasmic inclusion became minors. The appearance of these small inclusions in the fat body cells may be due to, also, for insect stress when exposed to the insecticide,

showing a signal of the mobilization of these reserves for the energy production in a possible process of insecticide detoxification. The fat body cells exhibited different stages of cell inclusion degeneration and deformation, coalescence and with necrosis as observed in mentioned above pictures, this in agreement with [31] who stated that treated fat body by JH pyriproxfen, the cells exhibited different stages of organelles degenerations. This is the second sign of poisoning go through disturbance. This also in agreement with [32] showed that the rapid loss of cellular integrity mid-gut cells in *C. pipiens* having ingested poison. The outer cells wall layer and cytoplasmic ground substance disappeared rapidly. Before complete breakdown a cellular hypertrophy is observed.

Microscopic examination revealed that Deltametrin which was belong to Pyrethrin group insecticide causing chromatin clumping in nuclei of treated fat cells of adult house fly, as shown obviously in (Plate-3b). This in a agreement with [33], recorded that pyrethrum was described as causing a widespread clumping of chromatin of nerve cells nuclei in house fly, and this also agree with [34] who stated that ultra structural examination of fat body cells of *Culex pipiens* that treated by insecticides showed that the nucleus contains heavily dense chromatin condensation.

The damage in fat body cells were observed under high concentrations of the insecticides, as observed (plates-1d, 2d, 3d and 4d). Which the cell lost its control on the permeability, subsequently the cell filled by unknown fluid leading to increase of internal pressure which results in cell wall destroying and finally the cell exploded. This in a agreement with [35] who stated that exposure cell to poison caused increase in cell membrane permeability, which is the cause of the cell damage, and in agreement with [36] stated that Fenitrothion (organphosphors), insecticide are easily soluble in fatty acids; they react with the lipid membranes of the cell and increase the permeability of membranes and may decrease the amount of fatty acids, and Fenitrothion was possibly responsible for the damage to the cell membrane. The damage was proportional to the concentration of the insecticide, and also agrees with [37] stated that several pesticides have the ability to damage cell membranes.

**Table (1) Mean numbers of house fly knockdown treated by different concentrations of insecticides, at six recording intervals.**

Insecticide	Concentration	Knockdown No.					
		after 1 hr.	after 2 hr.	after 4 hr.	after 6 hr.	after 12 hr.	after 24 hr.
Thiamethoxam	0.00 ppm	0.00	0.00	0.00	0.00	0.00	0.00
	0.78 ppm	0.00 <sup>NS</sup>	0.33 <sup>NS</sup>	0.33 <sup>NS</sup>	1.67 <sup>NS</sup>	5.33 *	8.00*
	1.56 ppm	1.00 <sup>NS</sup>	1.33 <sup>NS</sup>	4.33 *	7.00 *	8.67 *	10.00*
	3.12 ppm	1.67 <sup>NS</sup>	3.33 *	4.33*	7.33*	8.67 *	9.67*
Malathion	0.00 ppm	0.00	0.00	0.00	0.00	0.00	0.00
	75 ppm	0.00 <sup>NS</sup>	0.00 <sup>NS</sup>	2.67 <sup>NS</sup>	3.67*	5.33 *	6.33 *
	150 ppm	0.00 <sup>NS</sup>	0.67 <sup>NS</sup>	2.33 <sup>NS</sup>	3.33 <sup>NS</sup>	5.33 *	7.67 *
	300 ppm	0.00 <sup>NS</sup>	0.00 <sup>NS</sup>	1.67 <sup>NS</sup>	3.67*	8.00 *	9.00 *
Deltamethrin	0.00 ppm	0.00	0.00	0.00	0.00	0.00	0.00
	4.75 ppm	0.00 <sup>NS</sup>	0.67 <sup>NS</sup>	0.00 <sup>NS</sup>	1.67 <sup>NS</sup>	3.33 <sup>NS</sup>	4.00 <sup>NS</sup>
	9.50 ppm	0.67 <sup>NS</sup>	1.67 <sup>NS</sup>	2.33 <sup>NS</sup>	5.67 *	6.67 *	8.33 *
	19.0 ppm	1.00 <sup>NS</sup>	2.00 <sup>NS</sup>	2.33 <sup>NS</sup>	4.67 *	8.33 *	10.00 *
Lambda-cyhalothrin	0.00ppm	0.00	0.00	0.00	0.00	0.00	0.00
	15.0 ppm	1.00 <sup>NS</sup>	1.00 <sup>NS</sup>	0.33 <sup>NS</sup>	1.00 <sup>NS</sup>	2.00 <sup>NS</sup>	3.00 <sup>NS</sup>
	30.0 ppm	5.00*	6.33*	5.00 *	6.67*	7.67 *	9.00 *
	60.0 ppm	3.67*	4.33 *	5.00 *	6.67 *	8.00 *	9.33 *
D value 0.05		1.91	2.66	3.05	3.51	3.86	4.26

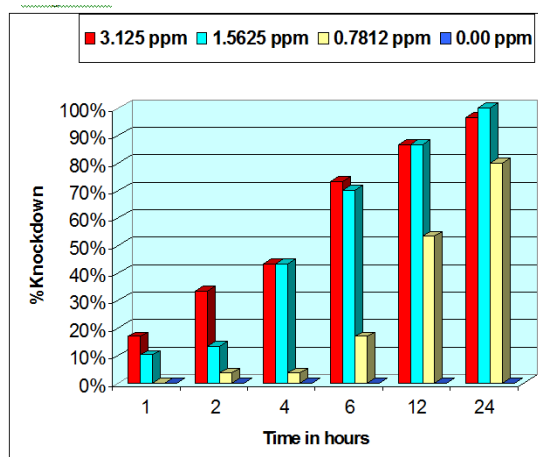
NS : No significant

\* Significant

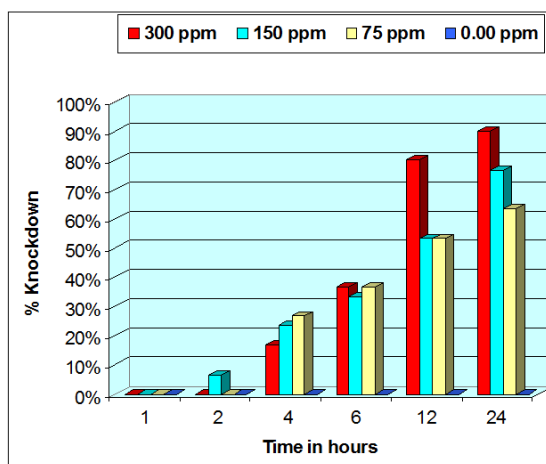
**Table (2) Mean numbers of house fly knockdown with movement subsequent treated with various concentrations of insecticides, at six recording intervals.**

Insecticide	Concentration	Knockdown with movement No.					
		after 1 hr.	after 2 hr.	after 4 hr.	after 6 hr.	after 12 hr.	after 24 hr.
Thiamethoxam	0.00 ppm	0.00	0.00	0.00	0.00	0.00	0.00
	0.78 ppm	0.00 <sup>NS</sup>	0.33 <sup>NS</sup>	0.33 <sup>NS</sup>	0.67 <sup>NS</sup>	1.67 <sup>*</sup>	0.00 <sup>NS</sup>
	1.56 ppm	0.67 <sup>NS</sup>	1.33 <sup>NS</sup>	2.67 <sup>*</sup>	2.33 <sup>*</sup>	0.33 <sup>NS</sup>	0.00 <sup>NS</sup>
	3.12 ppm	1.67 <sup>*</sup>	3.33 <sup>*</sup>	2.67 <sup>*</sup>	4.67 <sup>*</sup>	0.33 <sup>NS</sup>	0.00 <sup>NS</sup>
Malathion	0.00 ppm	0.00	0.00	0.00	0.00	0.00	0.00
	75 ppm	0.00 <sup>NS</sup>	0.00 <sup>NS</sup>	2.33 <sup>NS</sup>	2.33 <sup>NS</sup>	1.00 <sup>NS</sup>	1.00 <sup>*</sup>
	150 ppm	0.00 <sup>NS</sup>	0.33 <sup>NS</sup>	1.33 <sup>NS</sup>	1.67 <sup>NS</sup>	1.33 <sup>NS</sup>	1.00 <sup>*</sup>
	300 ppm	0.00 <sup>NS</sup>	0.00 <sup>NS</sup>	1.00 <sup>NS</sup>	2.00 <sup>NS</sup>	1.33 <sup>NS</sup>	0.00 <sup>NS</sup>
Deltamethrin	0.00 ppm	0.00	0.00	0.00	0.00	0.00	0.00
	4.75 ppm	0.00 <sup>NS</sup>	0.6 <sup>NS</sup>	0.00 <sup>NS</sup>	1.67 <sup>NS</sup>	1.33 <sup>NS</sup>	0.33 <sup>NS</sup>
	9.50 ppm	0.33 <sup>NS</sup>	1.33 <sup>NS</sup>	2.00 <sup>NS</sup>	2.33 <sup>NS</sup>	1.67 <sup>*</sup>	0.00 <sup>NS</sup>
	19.0 ppm	1.00 <sup>*</sup>	2.00 <sup>NS</sup>	0.67 <sup>NS</sup>	1.33 <sup>NS</sup>	0.00 <sup>NS</sup>	0.00 <sup>NS</sup>
Lambda-cyhalothrin	0.00ppm	0.00	0.00	0.00	0.00	0.00	0.00
	15.0 ppm	0.33 <sup>NS</sup>	0.00 <sup>NS</sup>	0.33 <sup>NS</sup>	0.33 <sup>NS</sup>	1.33 <sup>NS</sup>	0.00 <sup>NS</sup>
	30.0 ppm	1.33 <sup>*</sup>	3.00 <sup>*</sup>	2.33 <sup>NS</sup>	2.67 <sup>*</sup>	1.33 <sup>NS</sup>	0.00 <sup>NS</sup>
	60.0 ppm	3.67 <sup>*</sup>	3.67 <sup>*</sup>	4.00 <sup>*</sup>	3.33 <sup>*</sup>	1.67 <sup>*</sup>	0.00 <sup>NS</sup>
D value 0.05		0.91	2.31	2.34	2.36	1.65	0.51

NS : No significant  
\* Significant



**Figure10:** Mean percentage of house fly knockdown treated by 3.12, 1.56, and 0.78 ppm thiamethoxam, at six various recording intervals.



**Figure 11:** Mean percentage of house fly knockdown treated by 300, 150, 75 ppm Malathion, at six various records intervals.

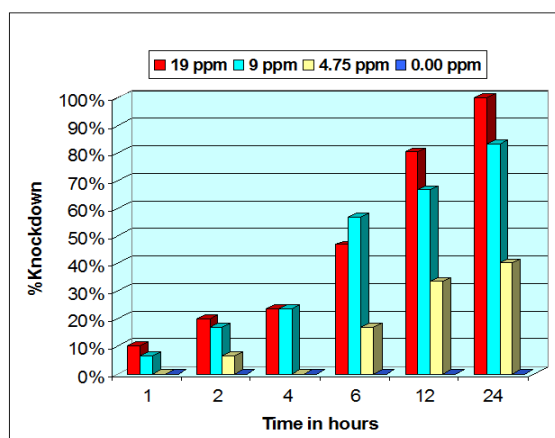
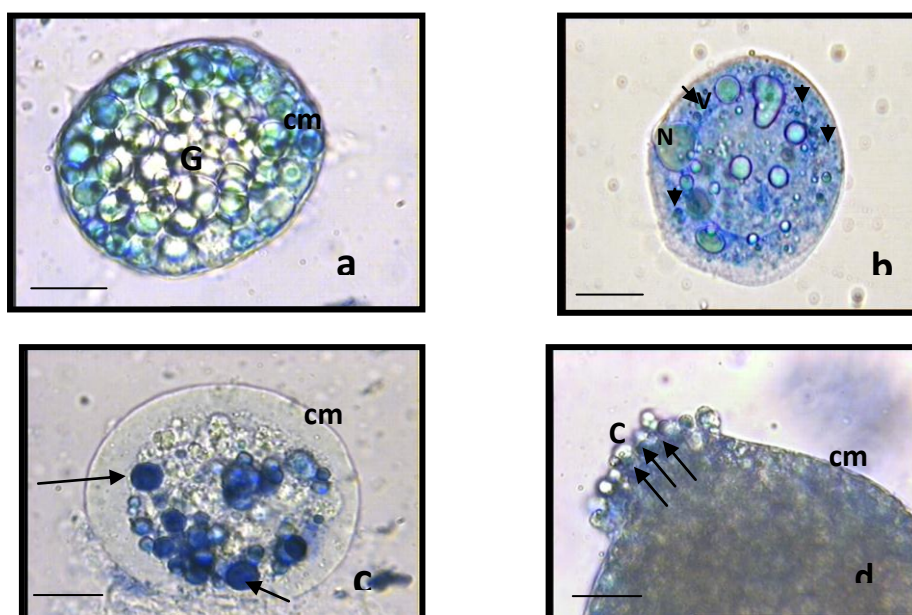


Figure 12: Mean percentage of house fly knockdown treated by 19, 9.5, 4.75 ppm deltamethrin, at six various recording intervals.



**Explanation figures plate 1:**

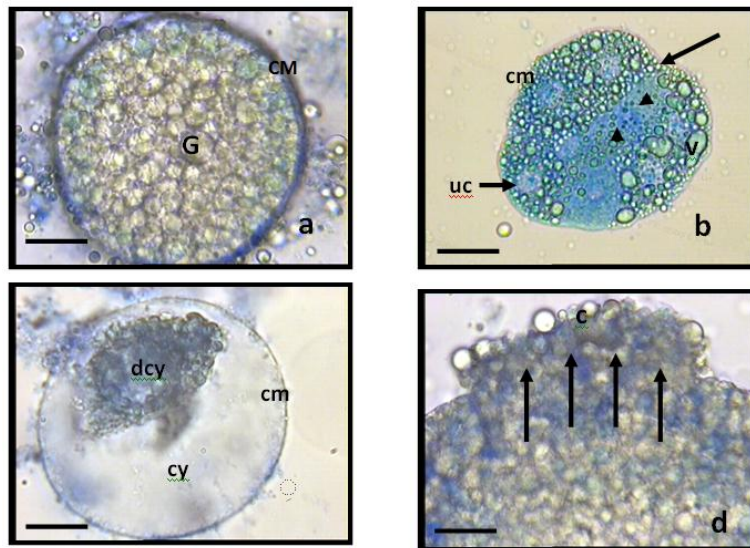
**a)** Control fat body cell of adult house fly (orally administrated with sugar solution 10%); shows the cell filled with a large number homogenous inclusions (G) which are obscure the nuclei, the cell spherical in shape and covered by thick intact cell membrane (cm).

**b)** Treated fat body by 0.7812 ppm thiamethoxam showed little number of inclusions with few unknown vacuoles(v) ( probably include Insecticide after penetrated the cell membrane) by phagocytes. This is the first sign of the poisoning. Slightly granulation (arrowheads) and appearance of big nucleus (N) due to decrease the amount of cell inclusions.

**c)** Fat body poisoned by 1.562 ppm thiamethoxam, the cell boundary slightly (cm) appears with transparent cytoplasm with deformation of inclusions (arrowheads) which accumulated around the nucleus with obvious large vacuoles (arrows) strongly stainable. This is the second sign of poisoning go through disturbance.

**d)** Fat body poisoned by 3.125 ppm thiamethoxam showed a big alternation to be plumping as a result of nucleus destroyed which lost the control on the cell membrane accordingly there were no permeability control, finally the cell exploded under the effect of the high dose of the insecticide and thrown their content (c) to the hemolymph.

Cm-cell membrane; cy- cytoplasm; v- vacuole; N- nucleus; C- content; G- lipid droplets Bar = 25 μm



**Explanation figures plate 2:**

**a-** Control fat body of adult house fly (administrated by sugar solution), the cell circular in shape and covered by thick intact cell membrane (cm) a large homogenous oil droplets filled the whole body (G).

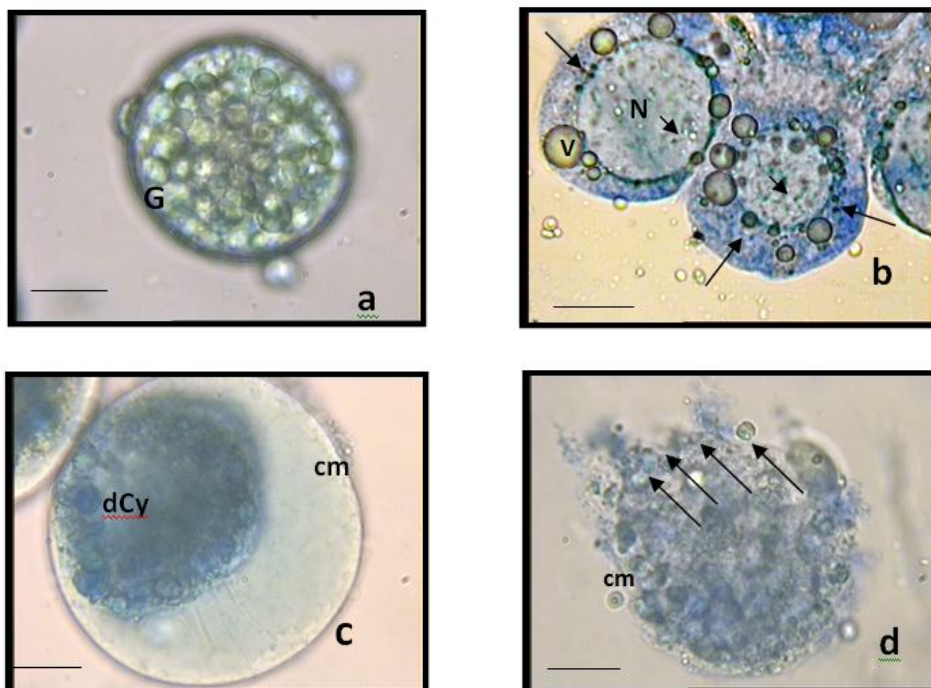
**b-** The poisoned cell by 75 ppm malathion appeared as the first sign of poisoning with visible a large number vacuoles (v) inside the cytoplasm in different sizes and the occurrence of fine granulation (arrowheads), and appearance of urate cells (uc) inside the poisoned cell, the nucleus appeared slightly while the cell membrane (cm) invaginated to inside (arrow) which finally the cell became irregular in shape.

**c-** The poisoned cell by 150 ppm malathion cause the plumping of the cell to be spherical, due to decrease the amount cell inclusions the cytoplasm became transparent (cy), the particles accumulated a round the nucleus to the one pole of the cell, while the cell membrane intact (cm).

**d-** Fat body poisoned by 300 ppm malathion produced a large changes in the cell structure there are a large number of vacuoles and the cell plumped more to be like a balloon to reach more than 150 microns in diameter which lead to explode the cell ( arrows) through the inclusions to the haemocoel, finally the cell died.

Cm- cell membrane; v- vacuole; cy- cytoplasm; dcy- dark cytoplasm; G-granules;

C-content; uc- urate cell. Bar = 25  $\mu$ m



**Explanation figures plate 3 :**

**a-** Control fat body cell of adult house fly (administrated with sugar solution), the cell appeared rounded in shape in association of a large homogenous oil droplets (G) with sharp intact outline cell membrane (cm).

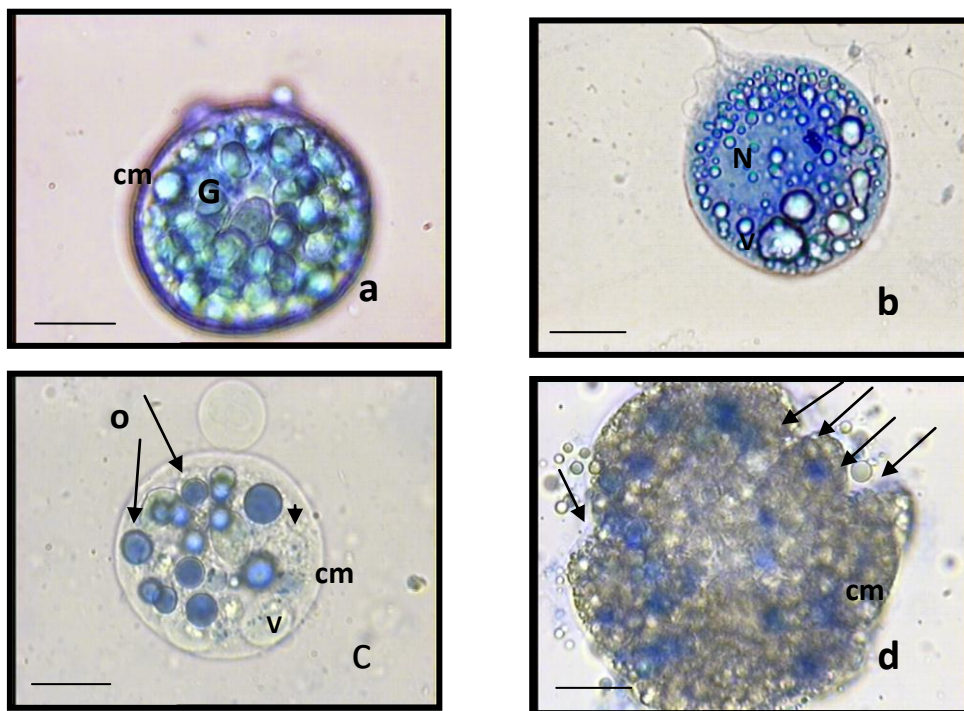
**b-** 4.75 ppm deltamethrin gave the first sign of poisoning such as ; vacuolization (v) of the cytoplasm in different sizes filled with unknown fluid, with coarse inclusions and obvious large circular nucleus (N) with visible clumping of the chromatin network inside the nucleus (arrow ahead) and cytoplasmic fine granulation occurred (arrows).

**c-** 9.5 ppm of the deltamethrin gave the second dangerous alternation where the cell body appear spherical and big in size and the cell content dissolved with smooth-darking colour and accumulated in one pole of the cell exactly look like the effect of malathion in 150 ppm.

**d-** 19 ppm of the deltamethrine caused completely damage to the cell left the inclusions scattered inside the cytoplasm and the cell membrane decay on one side under the effect of high dose of the insecticide ( arrows), then the content exploded as shown in view 4.

Cm-cell membrane; CY- cytoplasm; N-nucleus; v-vacuole; dcy- dark cytoplasm.

Bar = 25  $\mu$ m



**Explanation figures plate 4 :**

**a-** Obvious normal fat body of adult house fly ( administrated with sugar solution ), show the cell circular in shape, the nucleus centrally found with large number of inclusions(G) and sharp intact out line cell membrane (cm).

**b-** 15 ppm of lambda-cyhalothrin gave the first sign of poisoning where a various sizes of unknown vacuoles (v) in different sizes distributed in all body cell, the inclusions appear fine, the nucleus (N) slightly appear , the cell became oval in shape this alteration exactly as that in cause of 0.7812 ppm thiamethoxam.

**c-** 30 ppm of tambda-cyhalothrin caused the cell body transparent as the result decreased in a mount of inclusions, the cytoplasm with big vacuoles (v), lipid droplets depleted( arrows), inclusions slightly granulated ( arrow ahead) and the cell transparent from peripheral region while the boundary of the cell (cm) appear slightly.

**d-** Fat body poisoned by 60 ppm of the lambda-cyhalothrin caused highly damage to the cell membrane (cm) particularly from two poles (arrowheads), where the inclusions scattered, irregular, granulated while the poisoned cell plumped abnormally, with irregular shape and the inclusions slightly started to throw out.

G- Inclusion; N- nucleus; O- lipid droplet; v-vacuole, cm-cell membrane.

Bar = 25 $\mu$ m.



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