



**EFFECT OF *CYCLAMEN LIBANOTICUM* (MYRSINACEAE) EXTRACTS AGAINST THE MAGGOTS OF THE HOUSEFLY, *MUSCA DOMESTICA* (DIPTERA: MUSCIDAE) AND OF THE BLUEBOTTLE FLY, *CALLIPHORA VOMITORIA* (DIPTERA: CALLIPHORIDAE)**


Fadel Dani<sup>a\*</sup>, Hamze Mhammad<sup>a</sup>, Chahine Hala<sup>a</sup>, Rizk Helene<sup>a</sup>, Aoun George<sup>a</sup>

<sup>a</sup>Lebanese University, Faculty of Agriculture, Department of Plant Production. Dekwaneh–Lebanon

**ABSTRACT:** The objective of this study was to evaluate the larvicidal effect of the tuber extracts isolated from *Cyclamen libanoticum* against *Musca domestica* and *Calliphora Vomitoria*. For this reason, twenty young (second-third) instars of the *Musca domestica* and *Calliphora Vomitoria* were exposed separately to various concentrations (0.05 g/ml to 0.2 g/ml) of the extracts. Mortality was recorded after 10, 30, 60, 120, 180 and 240 min) of exposure. The results showed that the young larvae of *Musca domestica* were more susceptible to the extracts in comparison with *Calliphora Vomitoria*. A comparison of LC<sub>50</sub> and LC<sub>90</sub> values has shown that *Cyclamen libanoticum* was very active against both larval flies. Conclusions: This study is the first to report on the larvicidal activity of the extracts of *Cyclamen libanoticum* against *Musca domestica* and *Calliphora Vomitoria*. More studies are needed to isolate and identify the active components involved, their mode of action, and effects on other flies and pest species.

**Key words:** *Cyclamen libanoticum*, *Musca domestica*, *Calliphora Vomitoria*, larvicidal activity, maggots

\*Corresponding author: Fadel Dani, Lebanese University, Faculty of Agriculture, Department of Plant Production. Dekwaneh–Lebanon Email: dr.danifadel@gmail.com

Copyright: ©2016 Fadel Dani. This is an open-access article distributed under the terms of the Creative Commons Attribution License , which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited

## INTRODUCTION

*Cyclamen libanoticum* (Lebanon cyclamen) is a species of flowering plant in the family Primulaceae covering almost all of Lebanon especially in shaded places. It is native to a small area in the mountains of Lebanon northeast of Beirut at 750–1400 m elevation [1]. From winter to spring, Lebanese cyclamen bears peppery-smelling flowers with 5 oval petals opening white, then turn to pale pink with an irregular crimson-magenta mark at the base [2]. The number of flowers varies from 2 to 4 per tuber. Leaves are heart-shaped at the base, gray-green with a darker arrow head pattern. The tuber only produces roots from one side of the bottom. Some species belonging to *Cyclamen* genus were used for their biological activities in folk medicine. Anti-inflammatory and anti-nociceptive activities of *Cyclamen repandum* tubers in rats and mice were reported [3]. Antifungal activity of *Cyclamen mirabile* and *Cyclamen trochopteranthum* were also reported [4]. Despite their many biological activities, there is no available data about insecticidal activities of *Cyclamen libanoticum* on house flies or blue bottle flies species.

House flies (*Musca domestica*) and blue bottle flies (*Calliphora Vomitoria*) dwelling in Damour-Lebanon develop faster and live longer than their counterparts in the wild. Both of these flies may rest on plants, the ground, fence wires and decaying materials such as food of human or animal sources, carcasses, garbage and excrement. The life expectancy is generally 15 to 30 days and depends upon temperature and living conditions. Their life cycle begins in the egg stage as published by Keiding in 1986. A female house fly is capable of laying up to 150 eggs in a batch and over a period of a few days, she will produce five or six batches of eggs while the female bottle fly can lay in excess of 2000 eggs in a lifetime. Female flies favor damp, dark surfaces such as compost, manure and other decomposing organic material for egg laying. House fly eggs resemble individual grains of rice and within a day hatch into white larvae while blue bottle fly eggs are pale yellow or gray in color and their resulting larvae measure 9 to 22 mm in length with a thick black stripe on their back and may hatch within two to three days, depending on temperature.

Larvae also known as maggots are legless that feed from the egg-laying site for three to five days. During this time, maggots molt several times before they choose a dark place to pupate. Fly pupae are similar in function to butterfly cocoons: their hard, brown shells protect the inactive, developing flies. Over the course of three to six days, the pupae develop legs and wings, ultimately emerging as full-grown house flies. Within two to three days, female house flies are capable of reproduction. Houseflies pass through the egg, larval and pupal stages in approximately 10 days, after which adult flies emerge. House flies cease growth after emerging from their pupae. House flies found are covered with small hairs that serve as taste organs. House flies are major carriers of disease. They are known to transfer over 100 pathogens resulting in ailments, including typhoid, tuberculosis, cholera and dysentery. House flies collect these pathogens on their legs and mouths when feeding on feces, trash and other decaying material. The most common signs of bottle flies are either the adults themselves or their larvae. Bottle flies, also called blow flies, are common, large flies known for their metallic bluecolor. The adults may be seen resting on surfaces or buzzing around potential food or odor sources. The larvae may be observed when they crawl out of the breeding material to pupate. Within two to 10 days, larvae seek pupation sites, from which they eventually emerge as adult flies. Bottle flies breed in damp, organic matter such as dead animals. Bottle flies are also good pollinators. They often pollinate flowers with strong odors, such as pawpaws and goldenrod. When food sources are diminished, bottle flies feed upon the nectar of these flowers in order to produce healthy eggs. The aim of the present research was to determine the larvicidal activity of extracts of *Cyclamen libanoticum* growing naturally in Lebanon, under laboratory conditions against house flies and blue bottle flies.

## MATERIALS AND METHODS

### Description of plant material

The fresh tubers of *Cyclamen libanoticum* species used in the present study were collected from natural habitats in Lebanon. Taxonomic identification of *Cyclamen* species was performed by two associate professors of plants systematics in the department of plant production of the faculty of agriculture in the Lebanese university. The tubers (200 g) were first peeled, cut into 0.5 cm cubes. These cubes were then ground into a fine powder with the use of a blender. The powder extract was then stored at 4 °C until usage.

### Description and preparation of flies' culture

Larvae selected for this study were found on rotting dead animal materials from Garbagecontainers of Damour area during the period of ongoing garbage crisis that has left Lebanon's streets filled with rotting trash containing dead feeding on the corpse area and were at their second instar stage. All larvae were reared at 12:12 light/dark photoperiod in separated insectary cages in the Department of Animal Production, Faculty of Agriculture in the Lebanese university. Eggs, larvae of different growing stages (young and older) and pupae were found. Some of these larvae were left to enter the pupal stage and mature stage. Larvae are also known as maggots. Maggots growing in their second stage were selected and identified for these larvicidal assays. These maggots from *Musca domestica* were white in colour while the ones from *Calliphora Vomitoria* were white with a black stripe along their back. Young instars from *Musca domestica* and *Calliphora Vomitoria* were exposed to various concentrations of *Cyclamen libanoticum* extracts for larvicidal assays.

### Larvicidal assays

Larvicidal activity of the *Cyclamen libanoticum* extracts was assessed by using the method described by Cetin and Yanikoglu [5]. For experimental treatment, series of concentrations ranging from 50 to 200 ppm of dissolved extract were prepared. The extract-water solution was stirred for 30 s with a glass rod. After approximately 5 min, 20 larvae taken on a strainer with fine mesh were transferred gently to the test medium poured on petri-dishes by tapping. Three replicates of each concentration were run at a time. Mortality was recorded after 10-, 20-, 30-, 45-, 60-, 75-, 90-, 105-, 120-, 150- and 180 minutes of exposure and during which larvae were observed on petri dishes. All experiments were conducted at room temperature and replicated three times. Moribund larvae were those incapable of moving after probing with a needle in the siphon or cervical region or incapable of rising to the surface when the water was disturbed.

## RESULTS AND DISCUSSIONS

The larvicidal activity of the extracts of *Cyclamen libanoticum* against *Musca domestica* and *Calliphora Vomitoria* was presented in table 1 and 2 respectively (% Mortality  $\pm$  SE). Toxicities from Lebanon cyclamen to second instar *Musca domestica* and *Calliphora Vomitoria* larvae were noted and the LC<sub>50</sub>, LC<sub>90</sub> and 95% confidence limits were calculated (Table 3). Larvicidal activity using insecticides such as deltamethrin, methomyl, chlorpyrifos and flufenoxuron was also reported [6] and LC<sub>50</sub> was calculated and results showed high toxicity to the housefly larvae (LC<sub>50</sub> = 0.029, 0.03, 0.61 and 0.64 ppm respectively).

The lowest concentration of *C. libanoticum* extract (50 ppm) achieved 18.33 % mortality of maggots at 45 minutes post exposure but at 75 minutes mortality significantly increased to 66.66 %.The mortality was not typically concentration and time dependant in the young instar larvae. *Cyclamen libanoticum* extract caused 80.0% mortality on young larval stages of *Musca domestica* species at 105 minutes at the doses of 52.6 ppm and of *Calliphora Vomitoria* species at 120 minutes at the doses of 55.6 ppm (Figure 1, 2). Also, it was determined that the younglarval stages from house flies were more susceptible to Lebanon cyclamen extracts at 60 minutes limits incomparison with the young larval stages of blue flies (Figure 3). There are certain factors that can affect the growth and development of maggots making determining the postmortem more difficult [7].

The mean mortality was 3.46% in the control groups for young instars from *Musca domestica* and 4.27 % for young instars from *Calliphora Vomitoria*. The larvicidal activity of the tuber extracts isolated from two species of *Cyclamen* (*Cyclamen mirabile* Hildebr. and *Cyclamen alpinum* Dammann ex. Sprenger) against different stages of *Culexpipiens* maggots stages was evaluated and their mortality that was 3.3% in the control groups for young (first and second) instars and 2.6% for older (third and fourth) instars [6].

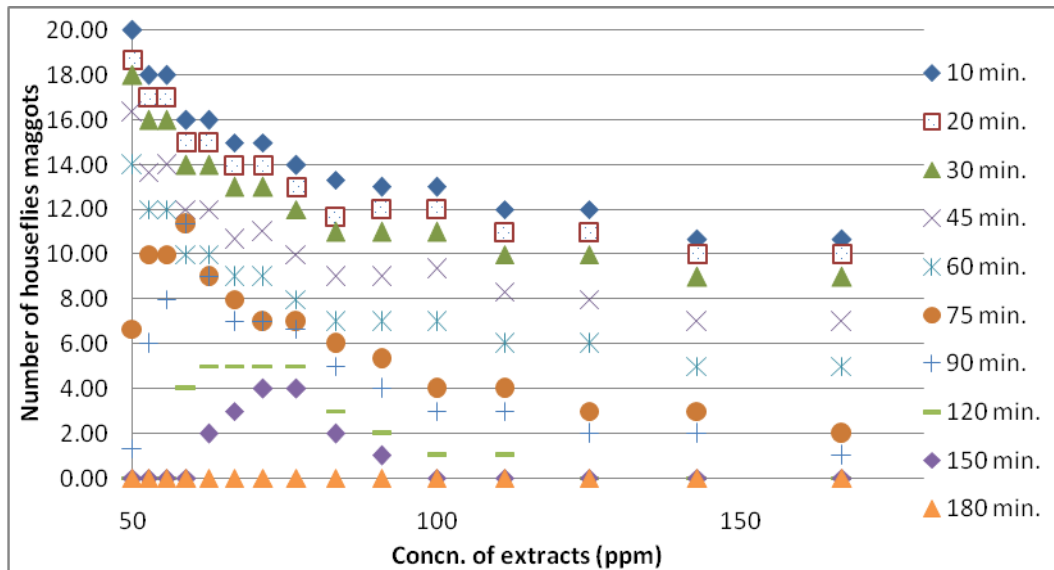


Fig. 1. Number of alive young houseflies maggots grown on different concentrations of *Cyclamen libanoticum* extracts at different timings.

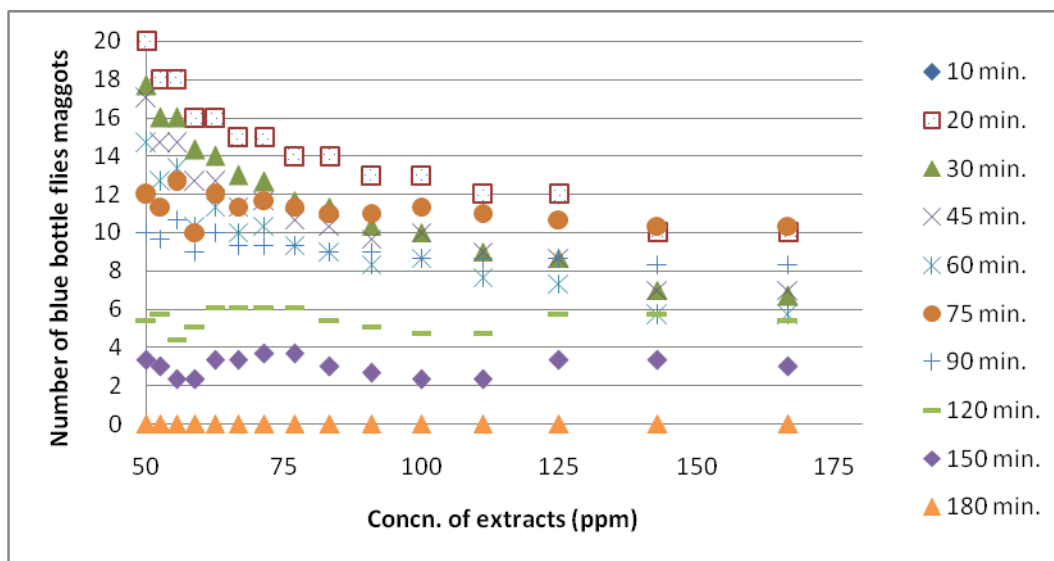


Fig.2. Number of alive young blue bottle flies maggots grown on different concentrations of *Cyclamen libanoticum* extracts at different timings.

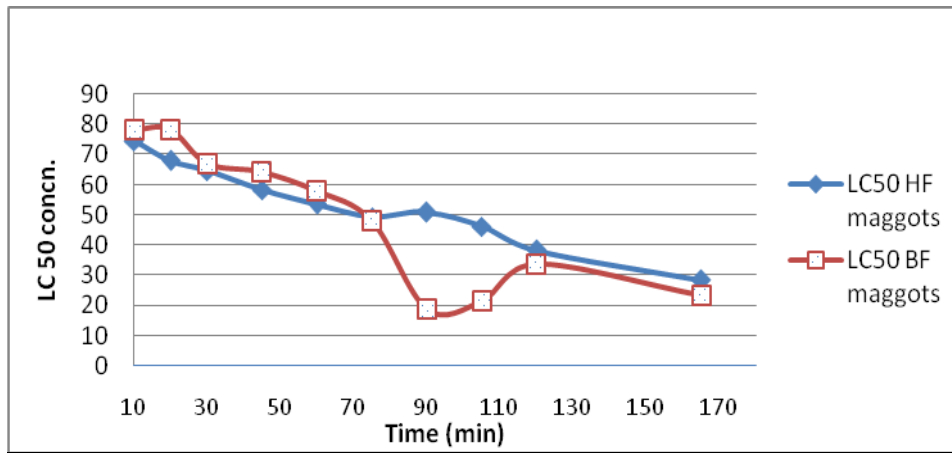


Fig. 3: Effect of time (min) on house flies [LC<sub>50</sub> HF] and blue bottle flies [LC<sub>50</sub> BF] maggots mortality.

Table 1: Larvicidal activity of the extracts of *Cyclamen libanoticum* against *Musca domestica* (% Mortality ± SE).

Concn. (ppm)	Time (min)										
	10	20	30	45	60	75	90	105	120	150	
0.00	0.00±0.5	0.00±0.5	0.00±0.3	0.00±0.5	0.00±0.3	0.00±0.5	0.00±0.5	0.00±0.5	0.00±0.5	0.00±0.5	5.00±0.5
50.00	0.00±0.5	6.67±0.5	10.00±0.5	18.33±0.5	30.00±0.3	66.67±0.3	93.33±0.5	96.67±0.0	100.00±0.7	100.00±0.5	100.00±0.5
62.50	20.00±0.5	25.00±0.5	30.00±0.5	40.00±0.0	50.00±0.3	55.00±0.3	55.00±0.0	65.00±0.5	75.00±0.0	90.00±0.5	90.00±0.5
76.92	30.00±0.5	35.00±0.0	40.00±0.0	50.00±0.0	60.00±0.5	65.00±0.3	66.67±0.7	75.00±0.5	75.00±0.5	80.00±0.5	80.00±0.5
90.91	35.00±0.5	40.00±0.3	45.00±0.5	55.00±0.0	65.00±0.5	73.33±0.5	80.00±0.0	85.00±0.0	90.00±0.5	95.00±0.5	95.00±0.5
100.00	35.00±0.5	40.00±0.5	45.00±0.5	53.33±0.0	65.00±0.0	80.00±0.0	85.00±0.5	90.00±0.7	95.00±0.0	100.00±0.5	100.00±0.5
125.00	40.00±0.4	45.00±0.0	50.00±0.0	60.00±0.0	70.00±0.0	85.00±0.0	90.00±0.0	95.00±0.0	100.00±0.5	100.00±0.0	100.00±0.0
142.86	46.67±0.3	50.00±0.0	55.00±0.5	65.00±0.0	75.00±0.0	85.00±0.5	90.00±0.0	95.00±0.5	100.00±0.5	100.00±0.0	100.00±0.0
166.67	46.67±0.1	50.00±0.5	55.00±0.0	65.00±0.5	75.00±0.0	90.00±0.3	95.00±0.5	100.00±0.0	100.00±0.5	100.00±0.0	100.00±0.0
200.00	51.67±0.5	55.00±0.0	60.00±0.0	70.00±0.3	80.00±0.0	95.00±0.5	100.00±0.3	100.00±0.0	100.00±0.0	100.00±0.0	100.00±0.0

Table 2: Larvicidal activity of the extracts of *Cyclamen libanoticum* against *Calliphora Vomitoria* (% Mortality ± SE).

Concn. (ppm)	Time (min)									
	10	20	30	45	60	75	90	105	120	150
0.00	0.0±0.5	0.0±0.5	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	5.0±0.0
50.00	0.0±0.0	0.0±0.0	11.7±0.5	15.0±0.0	26.7±0.5	40.0±0.0	50.0±0.5	60.0±0.0	73.3±0.5	83.3±0.0
62.50	20.0±0.5	20.0±0.5	30.0±0.3	36.7±0.0	43.3±0.0	40.0±0.5	50.0±0.5	58.3±0.0	70.0±0.0	83.3±0.3
76.92	30.0±0.0	30.0±0.3	41.7±0.5	46.7±0.3	53.3±0.5	43.3±0.5	53.3±0.5	61.7±1.0	70.0±0.5	81.7±0.5
90.91	35.0±0.5	35.0±0.0	48.3±0.0	51.7±0.0	58.3±0.0	45.0±0.6	55.0±0.0	65.0±0.3	75.0±0.0	86.7±0.7
100.00	35.0±0.5	35.0±0.5	50.0±0.7	50.0±0.0	56.7±0.0	43.3±0.0	56.7±0.5	66.7±0.7	76.7±0.5	88.3±0.0
125.00	40.0±0.0	40.0±0.0	56.7±0.5	56.7±0.5	63.3±0.5	46.7±0.5	56.7±0.0	63.3±0.0	71.7±0.7	83.3±0.5
142.86	50.0±0.0	50.0±0.0	65.0±0.0	65.0±0.5	71.7±0.0	48.3±0.5	58.3±0.5	63.3±0.4	71.7±0.0	83.3±0.0
166.67	50.0±0.5	50.0±0.0	66.7±0.0	65.0±0.7	71.7±0.0	48.3±0.0	58.3±0.0	65.0±0.3	73.3±0.6	85.0±0.0
200.00	55.0±0.5	55.0±0.0	63.3±0.0	70.0±0.0	78.3±0.5	53.3±0.5	63.3±0.7	65.0±0.3	75.0±0.0	86.7±0.5

**Table 3: LC<sub>50</sub> and LC<sub>90</sub> (time in minutes) values (ppm) of *Cyclamen libanoticum* extracts on against *Musca domestica* and *Calliphora Vomitoria*.**

Time (min)	<i>Musca domestica</i>		<i>Calliphora Vomitoria</i>	
	LC <sub>50</sub>	LC <sub>90</sub>	LC <sub>50</sub>	LC <sub>90</sub>
10	74.55±2.05	138.7±2.55	78.41±2.23	153.17±2.78
20	67.99±1.58	127.91±1.97	78.41±2.23	153.17±2.78
30	64.71±1.43	126.04±1.79	66.98±1.13	121.76±1.41
45	58.31±1.55	123.37±1.94	64.23±1.75	141.32±2.18
60	53.53±1.19	116.11±1.48	57.81±2.27	161.92±2.83
75	49.34±3.24	145.27±4.04	47.92±2.04	59.7±2.54
90	50.98±2.76	63.5±3.44	18.61±5.08	130.47±6.32
105	46.25±2.81	57.61±3.5	21.38±8.75	50.58±10.91
120	38.3±7.04	47.71±8.77	33.87±6.49	42.19±8.09

## CONCLUSIONS

Many plants have been reported about their potential insecticidal actions on different stages of *M. domestica* and *Calliphora Vomitoria* via crude extracts or extracted active compounds [8-9-10]. The larvicidal mortality of young instar larvae against *Cyclamen libanoticum* extracts was 100% at 180 minutes exposure regardless the amount of the powder extract used as treatment (50 to 200 ppm). Until now, biological activities of extracts isolated from *Cyclamen* species have been studied by different authors in the world but this study is the first to report on the larvicidal activity of the extracts of *Cyclamen libanoticum* against *M. domestica* and *Calliphora Vomitoria*. More studies are needed to isolate and identify the active components involved, their mode of action, and effects on other mosquito and pest species.

## ACKNOWLEDGMENTS

The authors would like to thank Mrs. Elissar Touma and Mrs. Salma Rammal for their help and guidance during the laboratory work. Mr. William Fadel is also greatly acknowledged for his field sampling.

## Conflict of interest statement

We declare that we have no conflict of interest.

## REFERENCES

- [1] Yesson, C, Toomey, N.H, Culham, A. 2009. Cyclamen: time, sea and speciation biogeography using a temporally calibrated phylogeny. *J Biogeography* 2009; 36(7): 1234-1252.
- [2] Compton, J.A, Clennett, J, Chris, B, Culham, A. 2004. Nomenclature in the dock. Over classification leads to instability: a case study in the horticulturally important genus *Cyclamen* (Myrsinaceae). *Botan J Linn Soc* 2004; 146(3): 339-349.
- [3] Speroni, E, Cervellati, R, Costa, S, Dall'Acqua, S, Guerra, M.C, Panizzolo, C. 2007. Analgesic and anti-inflammatory activity of *Cyclamen repandum* S. et S. *Phytother Res* 2007; 21(7): 684-689.
- [4] Gundogan, T, Mammadov, R, Ertem, H, Makasci, A. 2005. Phytochemical and microbiological investigations on endemic species of Turkey *Cyclamen mirabile* Hildebr and *Cyclamen trochopteranthum* O. Schwarz. *Xim Rastitel Sirya (Rusian)* 2005; 2: 55-59.
- [5] Cetin, H, Yanikoglu, A. 2006. A study of the larvicidal activity of *Origanum* (Labiatae) species from southwest Turkey. *J Vector Ecol* 2006; 31: 118-122.
- [6] Oz, E., Koc, S, Dusen, O.D, Mammadov, R., Cetin H. 2013. Larvicidal activity of *Cyclamen* (Myrsinaceae) extracts against the larvae of West Nile virus vector *Culex pipiens* L. (Diptera: Culicidae). *Asian Pacific Journal of Tropical Medicine* (2013)449-452.

- [7] Byrd, J, Castner, J. 2001. Forensic Entomology: the Utility of Arthropods in Legal Investigations (381-385). Boca Raton: CRC Press; 2001.
- [8] Abdel Halim, A.S., Morsy, T.A. 2006. Efficacy of *Trigonella foenum-graecum* (fenugreek) on third stage larvae and adult fecundity of *Musca domestica*. *J Egypt Soc Parasitol* 2006; 36: 329-34.
- [9] Mansour, S. A. Bakr, R. F.A, Mohamed,R. I, Hasaneen, N.M. 2011. Larvicidal Activity of Some Botanical Extracts, Commercial Insecticides and their Binary Mixtures Against the Housefly, *Musca domestica* L. *The Open Toxinology Journal* 5(1).
- [10] Shalaby, A.A, Allam, K.A, Mostafa, A.A, Fahmy, S.M. 1998. Insecticidal properties of citrus oils against *Culex pipiens* and *Musca domestica*. *J Egypt Soc Parasitol* 1998; 28; 595-606.

# International Journal of Plant, Animal and Environmental Sciences

