UNIVERSITY OF BENGHAZI

FACULTY OF SCIENCE

DEPARTMENT OF ZOOLOGY

Ecological Study on Olive fruit fly *Bactrocera* (*Dacus) oleae* on Olive Orchard In Benghazi region.

By

FATMA AKRAIM OMAR MUSSA

SUPERVISOR

DR. ABDULLAH FADEL

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Dedicate

To who miss him at every moment of my life my Beloved father

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1. INTRODUCTION

The dominance of the insects in the world founa and their general biological success can be shown in several ways. The three usual ways are to consider the number of species concerned, the number of individuals, and the range of habitats colonized and niches occupied.

The number of animal species named, and thus validated, is about one million, in total of these, some 800,000 are insects, which made about 80% of all pest known animal species. The reproductive potential of insects and especially species can be very great, which correlated to chances of survival of the off spring, unfortunately most of the pest species have a great reproductive potential, in addition to wide range of tolerance.

It should be stressed that although a great deal of the time the majority of entomologists are concerned with the damage caused by insects to humans, crops, livestock and possessions, in point of fact in several major ways insects are of vital beneficial importance to human society.

The monetary value of insects is quite incalculable, but clearly enormous, since we are still losing an estimated 30-40% of crop produce worldwide a proximately valued at $300,000 million despite an annual expenditure of $20,000 million on insecticides (Hill, 1997).

Olive tree is considered as one of the most valuable fruit tree in the world, take in consideration the market value of olive oil and table olive which highly consumed worldwide.

The olive tree was native to Asia Minor and spread from Iran, Syria and Palestine to the rest of the Mediterranean basin 6,000 years ago. It is among the oldest known cultivated tress in the world. It has been grown on Crete by 3,000 BC. The Phoenicians spread the olive to Mediterranean shores of Africa and southern Europe. Olive have been found in Egyptian tombs from 2,000 years BC. 1400 years ago the Prophet of Islam, Mohammad (peace be upon him), advised his followers to apply olive oil to their bodies, and himself used oil on his head. The use of oil is found in many religions and cultures. It has been used during special ceremonies and also as a general health measure. (http://www.oliveoilsource.com/, 2008).

Olive tree, *Olea europea L.*, is one of the most ancient successful cultivation in Libya, it has been grown between 26^0 , 30' and 32^0, 45' N. However, the native olive varieties, mostly for oil production constituted the main cultivated ones. In Benghazi area about 370337 olive trees used to produce olive oil and table olive (The secretariat of agriculture in Benghazi).

The losses caused to this crop by insect pests, fungi, and weeds, are reasonable to estimate in which the damage cause to harvested fruits by insect pests made at least 15 % losses of production, which mainly caused by the larval stage (Mazomenos *et al.*, 2002). The most important insect pest of the olive tree *O. European L.* is the olive fruit fly *Bacterocera oleae* Gmelin, 1788.Formerly (*Dacus oleae*) (Diptera: Tephritidea) which represents the greatest damaging pest to the olive production and olive oil quality worldwide (Athar, 2005).

In as for crop intended for oil extraction the olive fly can cause 4 different kinds of damages, a) premature drop of attacked fruits; b) direct pulp destruction caused by larvae developing in the fruits; c) acidity increase and development of pulp infections and oviposition resulting from holes in the skin; d) infections resulting from predation of other insects on *Bactrocera oleae* eggs. For crop intended for table olives: rejection of fruits with a simple oviposition mark.

In Greece, economic losses brought about by *B. oleae* are annually estimated at 30% of total production and the cost of chemical control in 1994 was estimated at U.S. $20 million, involving almost 75% of the olive orchards in the country(Vontas *et al*., 2001).

However, the reproductive potential of this fly was reflected in the number of spring produced in the Mediterranean regions, where two to five generations of flies occur yearly. The fly overwinter in the pupal stage several cm below the soil surface and adult flies emerge from March to May, depending upon the latitude and temperature.

In early June females actively seek and oviposit on early maturing olive fruits, where, 10 to 12 eggs may be laid daily, usually one per olive fruit, that make up about 200 to 250 are laid in a lifetime. The female punctures the fruit with the ovipositor and deposits an egg beneath the skin. The legless larva (maggot) feeds upon the fruit tissue, causing the fruit to drop off the tree. The egg, larval, and pupal stages last 2 to 4, 10 to 14, and about 10 days, respectively(Weems and Nation, 2008).

The olive tree is regarded as being of significant economic importance in the Mediterranean basin which has 98% of the world′s cultivated olive trees. It consist of about 800 million trees and occupy a surface area of approximately 10 million hectares (Mazomenos *et al*.,2002).

Olive tree subject to infestation with several pests, however, the olive fruit fly is considered the most serious insect pest of olive fruit world-wide . Historically, it infested Mediterranean areas of southern Europe, North Africa and the Middle East, where, olives have been cultivated for thousands of years. It is also found on the Indian subcontinent, Mexico, South Africa and other regions where wild olives are grown (Rice., *et al* 2003). It is generally agreed among olive fly researchers that this insect can survive and develop in any area, wherever, olive trees are grown. Al-though olive grower in Libya are experience the damage caused by this pest only few economic damages were documented and published.

The aims of this study is to determine:

1- The seasonal incidence of the fly in Benghazi area.

2- The olive varieties susceptibility.

2. R EVIEW OF LITERATURE

The olive fruit fly *Bactrocera oleae* (formerly *Dacus oleae*) considered as a serious pest of Olive in most of the countries around the Mediterranean sea, in southern Europe, Asia, and Africa (Weems and Nation, 2008; Vontas *et al*.,2001). *B. oleae*[1] has been a serious economic threat to the olive, *Olea europaeae* L., industry in California since its discovery in Los Angeles in 1998(Yokoyama *et al*., 2006). Therefore it is considered the most destructive pest of olive worldwide (Koukidou *et al*., 2006).

The species *B. oleae* Gmelin,1788 is believed to have originated olive in the Mediterranean regions, where, there was records of infestations in fruit back to the third century. It was also found in eastern and southern Africa, California, Los Angeles (Vossen *et al.,* 2006). However it was recorded In southern Europe, where olives have been cultivated for thousands of years and from which distributed to Canary islands, India, western Asia (Rice *et al.,* 2003; Zalom *et al.*,2003).

Olive flies survive best in cooler coastal climates, but also found in hot, dry regions as Greece, Italy, Spain, Mexico, and California.

Taxonomically *B.oleae* has an unusual combination of features, which makes it difficult to relate to other species, although its closest relatives are probably the few other *Bactrocera* species native in Africa.

B. oleae= Bactrocera oleae.

The adults fly measure approximately 3/16 inch in length (4-5mm), reddish- brown in color with large reddish eyes and small(aristate) antennae.

The top of the thorax (trunk) is dark brown with 2 to 4 grey or black longitudinal stripes and a white crescent-shapped spots on the scutellum located to the rear of wings, in addition to several yellow- white patches . The abdomen is brown with darker variable areas on the sides of each segment. The wings are clear membranous with a small dark spot near the tip and can be distinguished from those patterns. The females have a pointed tip of the abdomen (ovipositor) Plate (1) (Rice, 2000; Collier and Van, 2003; Vossen *et al.*, 2006).

In study by (Genç and Nation, 2008) on survival and development of *Bactrocera oleae* immature stages at different levels of temperatures in laboratory where they indicated that embryonic development was fastest at 35c^{o} but there was no pupal development therefore, no adult at that level of temperature . The slowest development of immature stages were at 16^{o}c, while the highest percentage of adults obtained from an initial set of 100 eggs was 74% at 27^{o}c. The lower development threshold for the egg, larval and pupal stages were 9.19, 13.94 and 12.36^{o}c,respectively. While optimum temperature for development and survival of immature stages was 27^{o}c.

However, since the flies are very mobile they have the ability to seek out cooler area of orchard and urban trees. Fly movement range from 200 m in the presence of an olive host to as much as 4 km searching for hosts (Rice, 2000; and Vossen *et al.*, 2006).

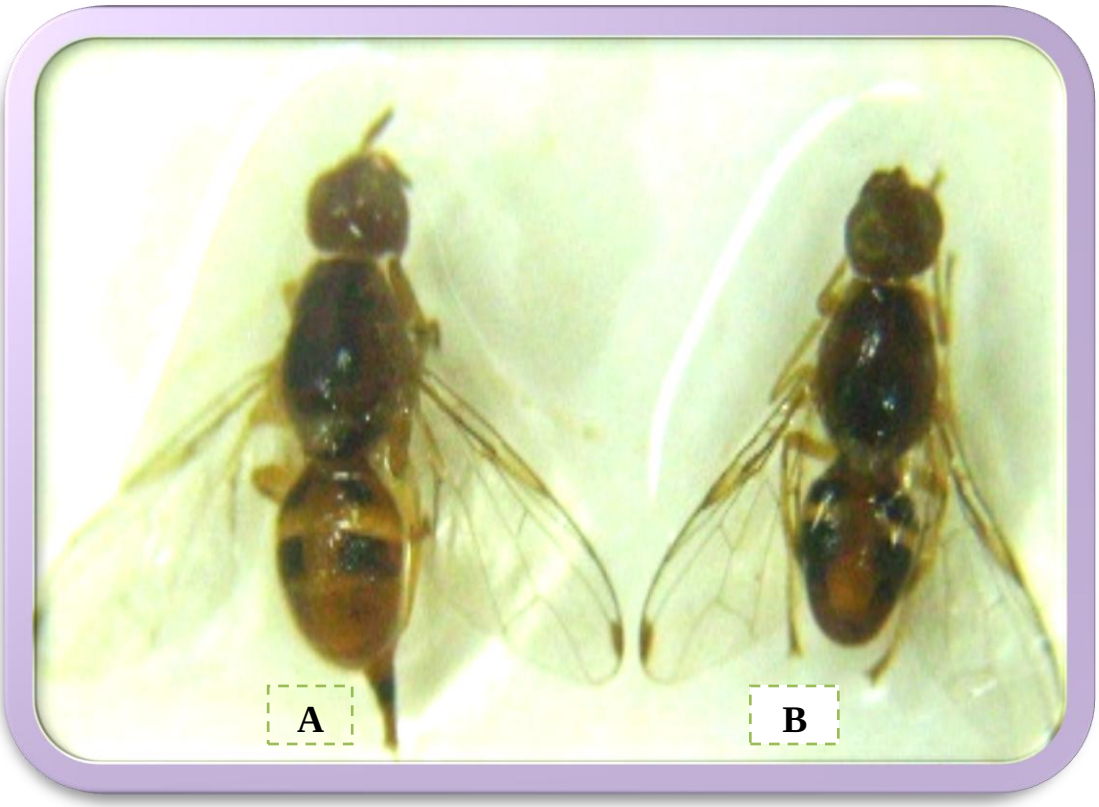


Plate (1) Female (A) and Male (B) Olive fruit fly *B. oleae*.

The life cycle is closely linked to the seasonal development of its main host, the cultivated olive *O. europea,* and to the local climate (Zalom *et al.,* 2003). Adults feed on nectar, honey dew, and other opportunistic source of liquid or semi-liquid food sources, the eggs laid inside the olive fruit which hatch to larvae.

The larvae are monophagous, and feed exclusively on olive fruit (Yokoyama *et al.,*2006).The olive fruit fly has three, and perhaps as many as five, generations per year depending upon local conditions (Vossen *et al.,*2006).

The first generation adults appear in the spring and in some conditions case leading to production of several generations, adult emergence throughout the whole year, high populations can develop very rapidly at ideal temperature. The second generation appears in midsummer. In summer the olive fly can complete a generation in as little as 30 to 35 days at optimum temperatures (Vossen *et al.,*2006; and Zalom *et al.,* 2009). In the Mediterranean region, two to five generations of flies occur yearly (Weems and Nation, 2008).

Adult emerges from march to may depending upon the latitude and temperature under summer conditions, a pre-oviposition period of six to ten days elapses before mating, with longer time required earlier when temperature are not high enough. During the pre-oviposition period the ovary mature and the first egg developed. (Weems and Nation, 2008).

Male produce an auditory stridulatory sound or signal during courtship, which occur at dusk, near the end of the day light period. Female produce a multicomponent pheromone, the major component of the pheromone is 1,2 dioxyaspiro[5.5] undecane and it is relatively long- range attractant for male.

While females are not attracted to the compound from either sex, feral females likely mate several times during their life time (Weems and Nation, 2008).

In early June females actively seek males and oviposit sites early female lay from 10 to 12 eggs daily, usually one egg per olive fruit, and about 200 to 250 are laid throughout its life spane. Under laboratory conditions, an individual female may lay 10 to 40 eggs per day and from 200 to 500 eggs in its life time (Collier and Van , 2003; Zalom *et al.,* 2003).

The eggs are white and oblong shape, it is approximately 0.8 mm Figure(1) (Yokoyama *et al.,* 2006). Egg are laid just under the fruits skin of the ripening fruit when the pits of the olives begin to harden (Martinez *et al*., 2007) .

The larvae are white-yellow legless maggots with a pointed end towards the head (Yokoyama *et al.*,2006) Figure (2). The legless larvae (maggot) feeds on the fruit tissue, causing the fruit to drop off. The fly overwinter in the pupal stage several cm below the soil surface and leaf litter (Weems and Nation, 2008; Martinez *et al*., 2007) .

The pupa exists in envelope brownish- yellow, barrel- like, 4 mm long, and 2 mm wide Figure (3). For 8-10 days during summer but may take as long as 6 months in winter (Zalom *et al.,* 2003; Collier and Van, 2003; Weems and Nation, 2008).

Adult can live from 2-6 months depending on the temperature and food availability (honeydew, fruit juices, bird feces etc..) (Rice, 2000).

The damage caused to crops by fruit flies can be either direct, through oviposition in fruit and tissues of vegetative parts of plants and feeding by

Plate (2) Egg.

Plate (3) Larva.

Plate (4) Pupa

larvae, or indirect, through decomposition of plant tissues which make it valarnable to be invading by different microorganisms (Hasyim *et al.*, 2007). Oviposition stings alone, without egg or larval feeding, will lower the value of table fruit (Rice, 2000).

The olive fruit fly *B. oleae* is a key pest of olive orchards causing damages of major economic importance throughout the Mediterranean regions and requires annul management. Both qualitative and quantitative crop losses due to this pest , can reach up to 50% if control measures are not taken(Tsitsipis. 2007).

European damage threshold level due to this fly for oil production is about 10%. research in Spain showed that damage level would not exceed this level even with fruit show 100% of stings symptoms (Vossen *et al.*, 2006).

The losses, caused in this crop by insect pest, fungi and weeds, have been quoted by some authors to be as high as 30% of production (Bueno and Jones, 2002).

The losses of the olive crop due to damage inflicted mainly by *D. oleae* range from 10 to 70% (Karamanlidou *et al.*, 1991). Economic losses due to this pest have been estimated up to 15% of the olive crop (Mazomenos *et al.*, 2002). Therefore it is reasonable to estimate the damage caused to harvested fruit by insect pest to be at least 15% of production, which equivalents to $ 800 million per year. This comes, despite the fact that olive growers spend annually more than $ 100 million in combating these pests and of which 50% corresponds to pesticides (Bueno and Jones, 2002). European authors have indicated economic losses of table olive crops as high as 100% from infestation that are not controlled. Oil losses can reach as high as 80%.

From combined fruit drop, pulp destruction, and increased acidity of oil if fruit is not harvested in a timely fashion. The impact of the damage on table olive and oil production varieties were variables between Mediterranean countries which reach in Spain 1962 5% , in Italy 1962 25% , and in Libya 1980 27-72% , 1981 7-14% which related to pest management followed in these areas (Rice, 2000).

The larger table olive varieties are preferred for oviposition by female flies since these fruits tend to allow better survival and produce greater numbers of olive fly larvae (Rice, 2000). On the other hand , even the smaller oil cultivars are excellent hosts for olive fly, wherever these cultivated olives are grown (Vossen *et al*., 2006; Rice, 2000). In addition to cultivated olives, olive fly is known to attack several species of wild olives (Vossen *et al*., 2006; Rice 2000).

As indicated earlier, olive cultivars in Mediterranean countries show varying susceptibility to infestation by olive fly. In general, large sizes of olives and olives with higher water content (table cultivars) are more susceptible than small olives with lower water content (oil cultivars). The damage has been responsible for losses of up to 80% of oil value because of lower quantity and quality. In some varieties of table olives, this pest is capable of destroying 100% of the crop (Zalom *et al*., 2009). The large , earlier-maturing olive varieties, such as those grown in California, are preferred for egg laying (Athar, 2005).In study by (حمد،1998) indicated a close positive relation between fruit infestation by flies and weight, diameter and length of the fruit. The first generation of olive fly females preferred oviposition in Manna olive fruits, which are characterized by large size and lower hardness(Delrio *et al*., 2010).

The olive fruit fly is not difficult to control, but without such efforts, 100% of the fruit may be damaged. Most of the visible damage occurs in the autumn from September to October, prior to that infested fruit appears only to have small spots or stings. When the fruit is cut open, however, brown lines (tunnels) and maggots are visible (Vossen *et al*., 2006).

The control of the olive fly *B. oleae* (Gmelin) is based today on the use of organophosphorus insecticiteds either as bait or cover ground sprays ,the use of which has ecological and toxicological consequences for the olive agroecosystem. In Europe, the olive fruit fly is largely controlled using full cover sprays containing organophosphate insecticides, either dimethoate or fenthion (Collier And Van , 2003; Alexandrakis *et al*., 2005).

Olive oil production has a major contribution in the economies of several Mediterranean countries, the control of the olive fruit fly *Dacus oleae*, is considered vital (Karamanlidou *et al*., 1991).

Olive fly has very specific and restrictive nutritional requirement. It has been shown that *Pseudomonas savastanoi*, the bacterial causal agent of olive knot disease, is a symbiont required in the gut of olive fly larvae and adults. The bacteria help flies break down chemicals in olive fruit into essential amino acids and proteins required for growth and reproduction (Rice, 2000).

Although the level of crop protection in olive growers varied depending on a number of parameters including the degree of isolated density of pest population, fruit load the trees, irrigation, etc.. the application of mass trapping as a preventative method solves many problems when it is applied early in summer and for many years.

Since the olive fly can only lay their eggs in olive fruit, therefore methods, that lead to remove the fruits may result to low effect.

- Old fruit removal: olives can be sprayed at bloom to remove all or most of the fruit. Two products are available floral and fruit stop. These products may not result in complete fruit removal in which case it will be necessary to remove the remaining fruit by hand.

- Also spray with spinosad pinosed GF-120 (Alexandrakis *et al.*, 2005 ; and Krueger, 2005).

- Attract and kill traps: Cardboard trap with a food and sex attractant impregnated with an insecticide. The flies are attracted to the traps and then killed by the insecticide. These traps can be unless used in early June and should be effective for about 6 months they will probably will not provides stand alone control under heavy populations density unless used at least one trap per two trees. Bueno and Jones, (2002) suggested the semiochemicals as substances which transmit massage between living organisms, both plant and animal.

- Pheromones can be classified in terms of the response which they produce e.g., aggregation pheromones, alarm pheromones, recognition pheromones and sex pheromones. A sex pheromone released by virgin females attracts male *B. oleae.* The principal component of this sex pheromone was identified in late 1979 as 1.7- dioxaspiro [5.5] undecane (Weems and Nation ,2008).

- Mass trapping: works simply by catching the flies before they are able to lay eggs. It requires consistent trap maintenance to insure that the traps are in good working order. It is probably less effective than some other methods.

In study by Broumas *et al.*, (2002) on the efficacy of an improved form the mass- trapping method for the control of the olive fruit fly *B. oleae* and suggested that the mass- trapping method reduces the amount of insecticide used for olive protection by 99.5 % (15 mg a.i. per tree per year as

opposed to 3 g in the case of bait sprays). A considerable reduction in the cost of the mass- trapping method is expected with the extension of its use and the mass production of material used, especially in when three types of traps can be used:

1- Mcphail trap; uses torula yeast dissolved in a water reservoir from which the flies cannot escape. A pheromone attractant can also be added. It is still in use today and give very useful information especially about female *B. oleae* activity, although in some quarters they may be considered as old fashion (Bueno and Jones, 2002).

2- Yellow sticky trap with a pheromone and a food attractant bait. It has long been known that yellow colors are attractive to tephritid Diptera. This has lead to the development of trapping devices consisting of plastic strips of approximately 17×23 cm which have the appropriate shade of yellow for maximum attraction and is covered in a non- drying adhesive.

3-The OLIPE trap which is made from 1.5 to 2 liter plastic soda bottles with torula yeast dissolved in water with 11/64 to 13/ 64 inch holes melted into the shoulder of bottle. Traps are hanged in the upper half of the tree in a shady location.

Brumas and Haniotakis(1994) conducted comparative field studies of various attractants of the olive fruit fly *B. oleae* and used a combination of semiochemical for the control using four trap designs, three trap colors, six different food attractants and two pheromone formulations were compared under field conditions; which showed no difference between the trap designs and the food attractants tested, trap color had a signification effect in preference test only, traps combining food attractants and pheromones attracted higher numbers of both male and female flies but the differences became statistically significant only in case of low trap densities.

(1998) حمد in his study documented that one parasite specie was that reported on the larvae olive fruit fly belongs to hymenoptera: figitidae and sub- family figitinae. Omar El-mokhtar University site showed more parasitic incidence than the other two sites.

In study by (1986 ،لياس) indicated that percentage of infestation of *D. oleae* by *O.concolor* parasitism were varied significantly with geographical region, location and olive varieties.

Hallak *et al.,* (2007) in his preliminary study of the efficiency of *Eu pelmus urozonus* (dalm) (Hym: Eupemidae) on olive fruit fly revealed that the parasitoid is effective in all generation of olive fly.

The higher parasitism efficiency was in second and third generation of pest. While lesser parasitism efficiency was in the fourth generation of pest because of the competition with other parasitoids.

Another study was conducted to survey the parasites of *B. oleae* (Gemel) in El-Beda region by (2006 ،المبروك و أمين) who recorded four species of parasites, *Phigalio sp.*, *Eupelmus sp* ., *Macroneura sp*., And *Eurytoma sp*., and these represented a new record for El-Gebel Al-Akhder region and *Eurytoma sp*. Was recorded for the first time in Libya .

3. MATERIALS AND METHODS

Materials:

3.1. Traps and attractants used :

Macphail traps (IAEA,2003) Plate (5) were used extensively in Europe, primarily for monitoring , but in some cases for mass trapping (control) as will. They are made of plastic with a reservoir for liquid bait, therefore flies enter from the lower opening and drown in the solution .

Diammonium hydrogen phosphate solution (3%) used as attractant (1998، حمد; and Caleca *et al* ., 2007).

- Glass containers.
- plastic containers.
- Binocular Olympus type made of Japan (VMT 1x, 4x).

70% ethanol.

- Petri dish, Plate(6).

3.2. Study sites:

The experiment was conduct in olive orchard on different parts of Benghazi area.

3.2.1. Site I: Al-magzha, 40 km south of Benghazi city. Plate(7).

The orchard consisted of 2 hectares field with 400 olive trees of table varieties and oil varieties was used also during the trials conducted in 2009,distance were about 6 and 6.5 m between trees and rows respectively.

Plate (5) Macphail Trap.

Plate (6) Material used in experiments.

(ex: Binocular, Petri dish, and Ethanol).

Plate (7): General view of Al-magzha site.

3.2.2. Site II: Al-kwaifia I, 18 km east of Benghazi .Plate(8)

The orchard consisted of 5616 m^2 field with 132 trees of the table olive variety. Distance between trees and rows were 6 m.

3.2.3. Site III: Al-kwaifia II, 18 km east of Benghazi .Plate (9)

The orchard consisted of 6581 m^2 field with 78 trees of table and oil olive varieties . Distance between trees and rows were about 7.50 m.

3.2.4. Site Iv : Boatni, 10 km south of Benghazi. Plate (10)

The orchard consisted of 3168 m^2 field with 66 trees of table olive varieties. No chemical control was used in these sites against olive fruit fly. The trial started on the 17th,May ,2009 and ended by the 2nd,Jan, 2010.

Methods :

3.3. Experiment I : Determination of seasonal activity of adults was conducted using Mcphail trap.

A total of 72 traps were used for sampling throughout the study period. Traps were hung on the trees at a hight of 1.5 m. at north side of the tree in spring /summer, and at south side of the tree in fall / winter. Traps were placed in the upper one third of the tree. and allowed clear space around trap (Johnson.2006; and Gonçalves and Torres, 2010). The distance between traps were at least 15 meter (Katsoyannos *et al*.,2007 ;and Bueno and Jones, 2002).

Plate (8): General view of Al-kwaifia I site.

Plate (9): General view of Al-kwaifia II site.

Plate (10): General view of Boatni site.

Traps were distributed as the following :

Site I : 25 traps

Site II : 20 traps

Site III: 15 traps

Site Iv: 12 traps

Samples were collected weekly, at each check, numbers and sex of olive fruit flies captured documented. Plate(11)

3.4. Experiment II: Determination of infestation level**.**

Infestation level were categorized as:

a- active infestation (eggs, alive first and second instar larvae).

b- Harmful infestation (3rd larvae, pupae, exit holes and the empty tunnel).

Assessment of infestation level were conducted using 100 olive fruits which collected from trees and from dropped fruits weekly. From Al-magzha, Al-kwaifia II, and Boatni. From 25th,July, 2009 to 28th,Nov,2009. Fruits were examined in the lab under binocular where, life cycle stages documented.

3.5. Experiment III: Monitoring development stages.

Monitoring developmental stages of the fly under laboratory condition. In order to determine the different stages (larvae, pupae) samples of 100 Olive fruits were used in experiment II these were brought to the laboratory and placed in plastic containers, covered with fine net and inspected daily until emergence of adults (Plate. 12)**.**

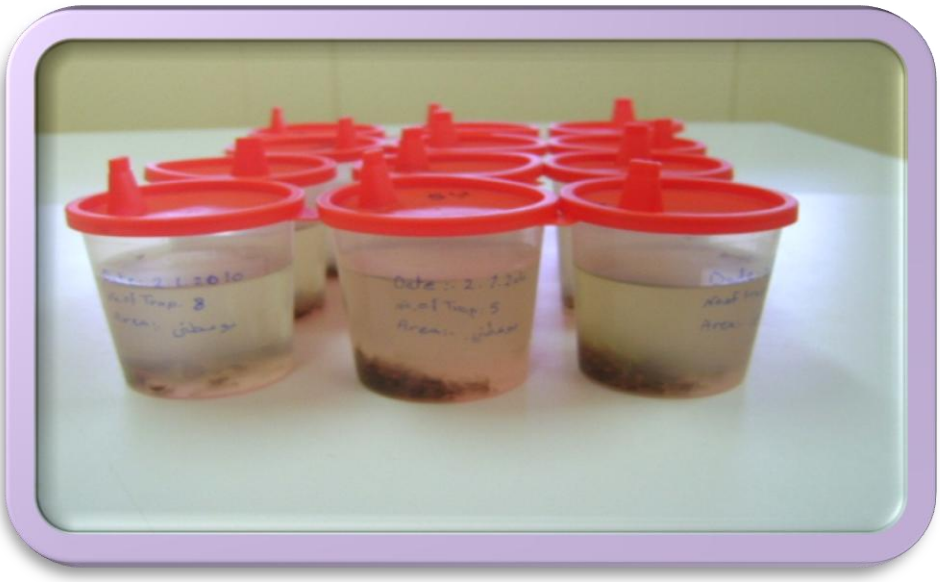
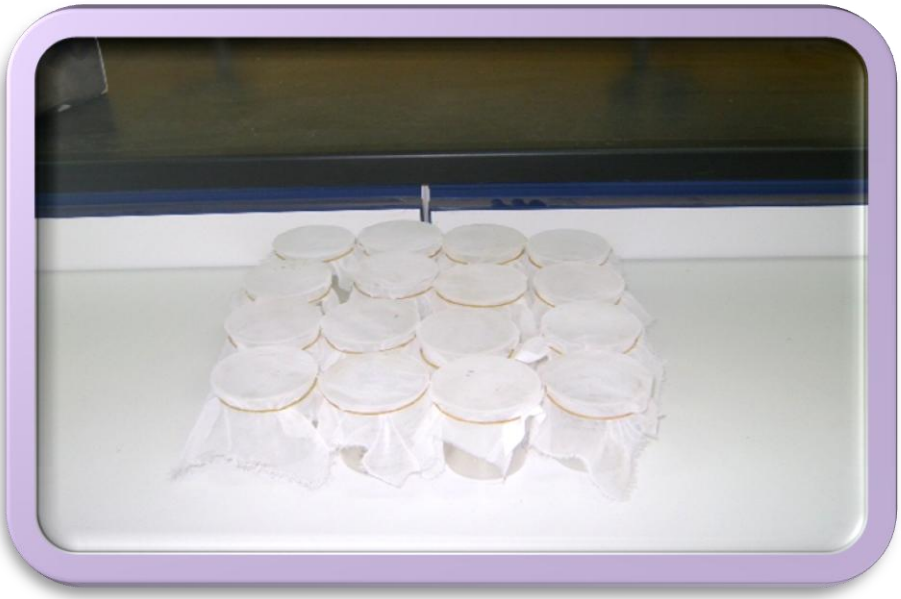


Plate (11) container for collection flies.



Plate(12) plastic containers for monitoring life cycle.

3.6. Identification of specimens:

The preliminary identification was made by specimens examination under Binocular and using the keys for identification of Dipetra to genus level. The species name have been confirmed by experts in plant protection research institute, Aldogi, Cairo, Egypt.

3.7. The statistical analysis:

The obtained data were presented as (Mean ± SE) of the adults incidences during Months, and Sites. The means were subjected to one way ANOVA, and the differences between mean were subjected to 0.05 of significant level. All calculation was performed using SPSS statistical packages.

In overall mean percentage of infection level were compared between table and oil varieties by T-test at P= 0.05.

4. RESULTS

4.1. Adult Seasonal incidences :

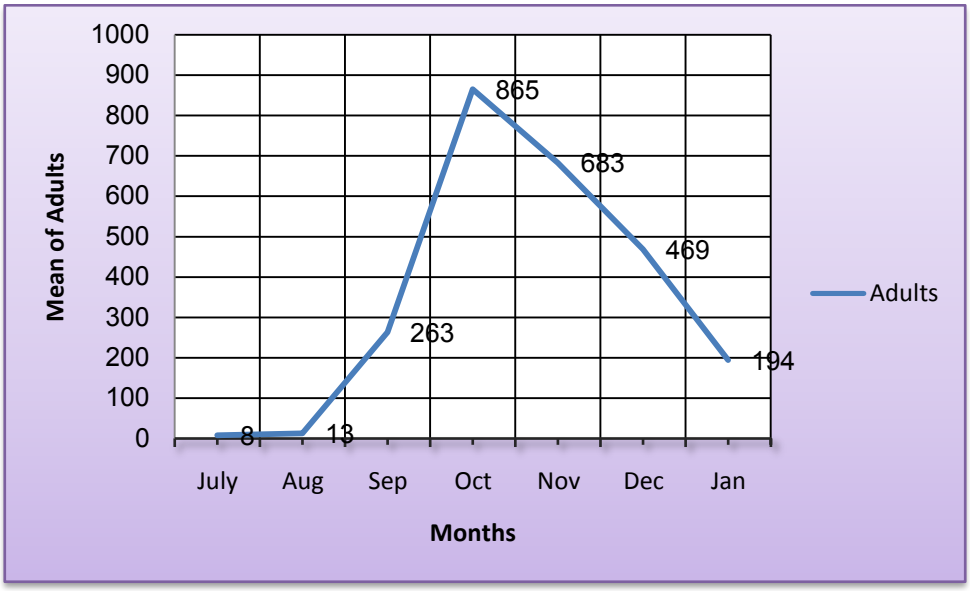
Number of flies collected using Mcphail traps provided with solution of diammonium phosphate at 3% concentration were counted . Adult number collected from Al-magzha site indicated that flies activity started by the second week of July in small numbers up to the third week of August, by last week of August and the first week of September the numbers show slight increase.

Fly numbers continued to increase to reach the peak by the fourth week of October, followed by decline in numbers again in the second week of December and continued to decreased until the first week of January 2010. Figure (1), Table (1).

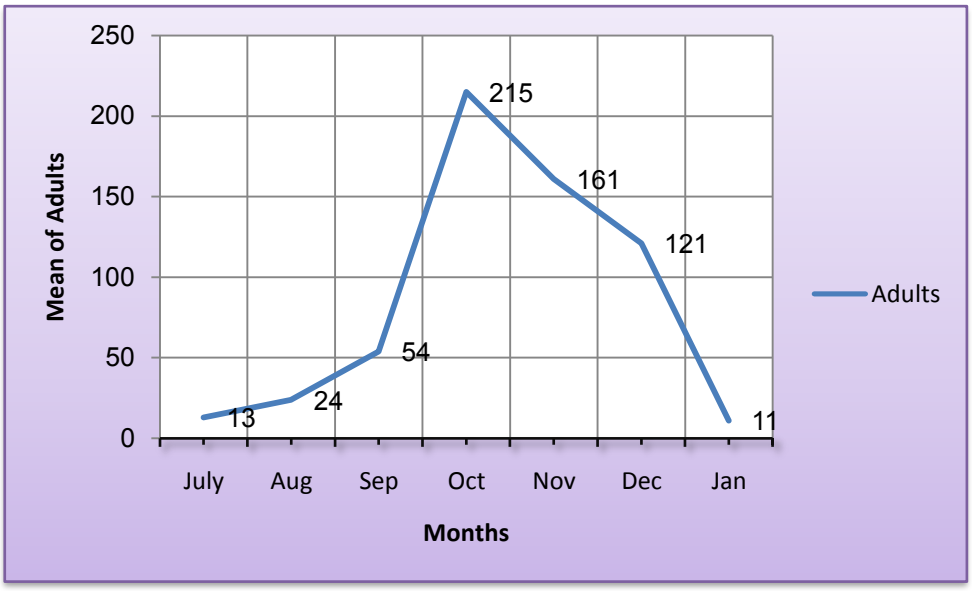
In Al-kwaifia I sampling data indicated that the beginning of adult incidence were in the second week of July. However, absence of flies in traps recorded in the fourth week, and slight increase in number were documented at the third week of September. Followed by decline again which continued up to the second week of October.

Fly numbers resume increasing to reach the highest peak by the fourth week of October. Incidence had also dropped in the first week of November. Second peak of activity were documented by the second week of November. However, adult incidence were fluctuated until the end of December, before clearly went down by the first week of January (figure 2), Table (1).

In Al-kwaifia II, Adult incidence in traps began in the second week of July, Numbers were steadily increased up to the third week of August to



Figure(1) Olive fruit fly captured per month at Al-magzha Orchard. May/ January, 2009/2010.



Figure(2) Olive fruit fly captured per month at Al-kwaifia I orchard. May/ January, 2009/2010.

Table (1) Olive fruit fly captured per month at four study sites.

Months	Sites			
	Al-magzaha	Al-kwaifia I	Al-kwaifia II	Boatni
July	8	13	15	0
August	13	24	29	18
September	263	54	249	199
October	865	215	721	932
November	683	161	429	1071
December	469	121	385	808
January	194	11	162	477

reach the first peak, before went down again for another two weeks. Numbers increased by mid of September, to show the second peak by late October.

In early November numbers declined, however it climb up again in last week of November, to drop again by the first week of December followed by increase later on in December, which end up by clear decline early in January figure(3), Table(1).

In Boatni results indicate the first appearance of adult catches in the first week of August, this case continued up to early September.

Incidence increase by late September, which continued to give its highest peak by the first week of November, to drop down again in the first week of December.

Numbers rise up again in the third and fourth weeks of December, that continued up to the first week of January. Figure (4),Table(1).

The (ANOVA) analysis indicated significant differences in mean numbers of flies between the study areas(F= 7.263, P.002) Table (2). The multiple comparisons between areas presented in Table (3).

However ANOVA results indicate high significant differences in mean numbers of adults between months (F= 9.989, P= .000) Table (4), as well as the multiple comparisons are presented in Table (5).

Highest numbers of flies catch recorded in Al-magzha , Al-kwaifia I, and Al-kwaifia II in October were 865,215,721, respectively. While in Boatni area highest number catches made in November were 1071, while the lowest number of flies recorded during July and August. Figure(5), Table (1).

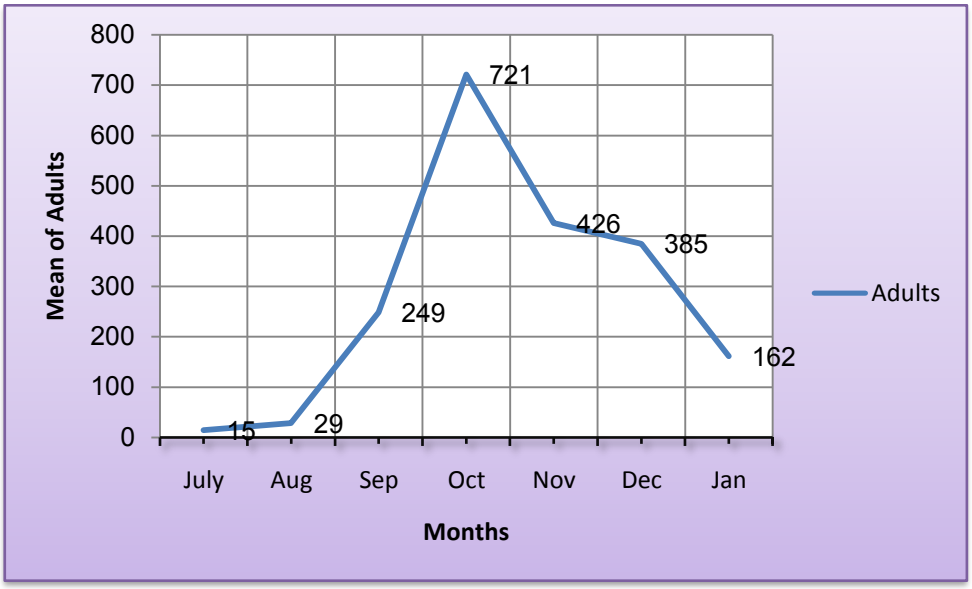


Figure (3) Olive fruit fly captured per month at Al-kwaifia II Orchard. May/ January, 2009/ 2010.

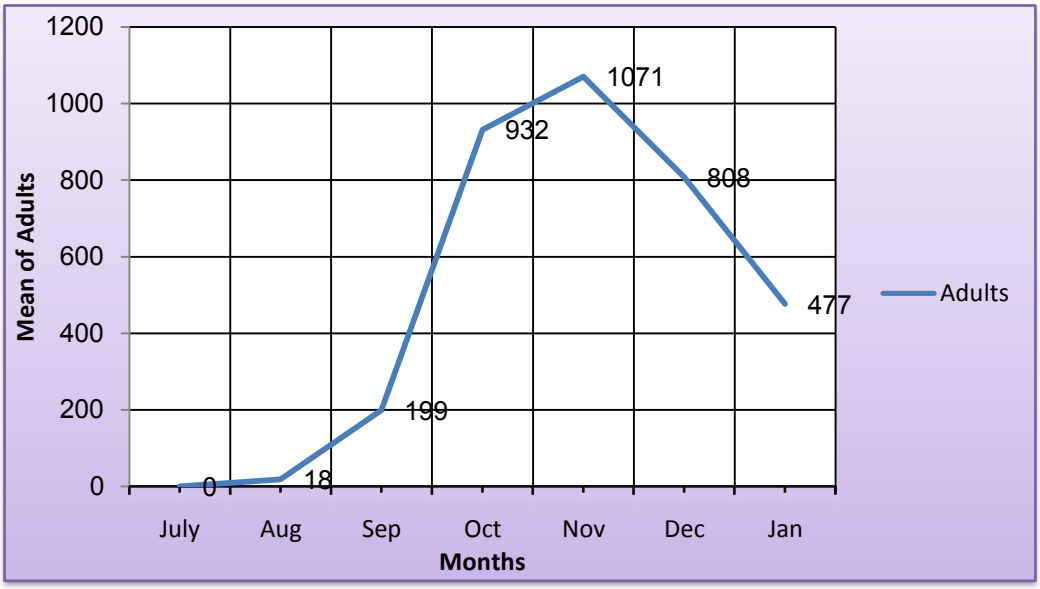


Figure (4) Olive fruit fly captured per month at Boatni Orchard. May/ January,2009/2010.

Table (2) Analysis of variance (ANOVA) of Adult in sites.

Sites	Sum of squares	Df	F	P
Contrast	628233.82	3	7.263	.002
Error	519019.43	18		

"showing sum of squares df = degree of freedom, F = table value, P=significant values at 0.05 level."

Table (3) Mean and standard error of Adults in area.

Sites	Mean± Std. Error
Almagzha	356.429± 64.181 [a]
Alkwaifia I	85.429± 64.181[b]
Alkwaifia II	280.714± 64.181[ac]
Boatani	500.714± 64.181[ad]

Means followed by the same letters in column are not significantly different at 0.05.

Table (4) Analysis of variance (ANOVA) of Adult across months.

Months	Sum of squares	Df	F	P
Contrast	1728246.9	6	9.989	.000
Error	519019.43	18		

"showing sum of squares df = degree of freedom, F = table value, P=significant values at 0.05 level."

Table (5) Mean and standard error of Adults across months.

Months	Mean ± Std. Error
July	9.00± 48.903[a]
August	21.000± 84.903[ab]
September	186.250± 84.903[abc]
October	682.500± 84.903[d]
November	585.250± 84.903[de]
December	445.750± 84.903[def]
January	211.000± 84.903[abcg]

Means followed by the same letters in column are not significantly different at 0.05.

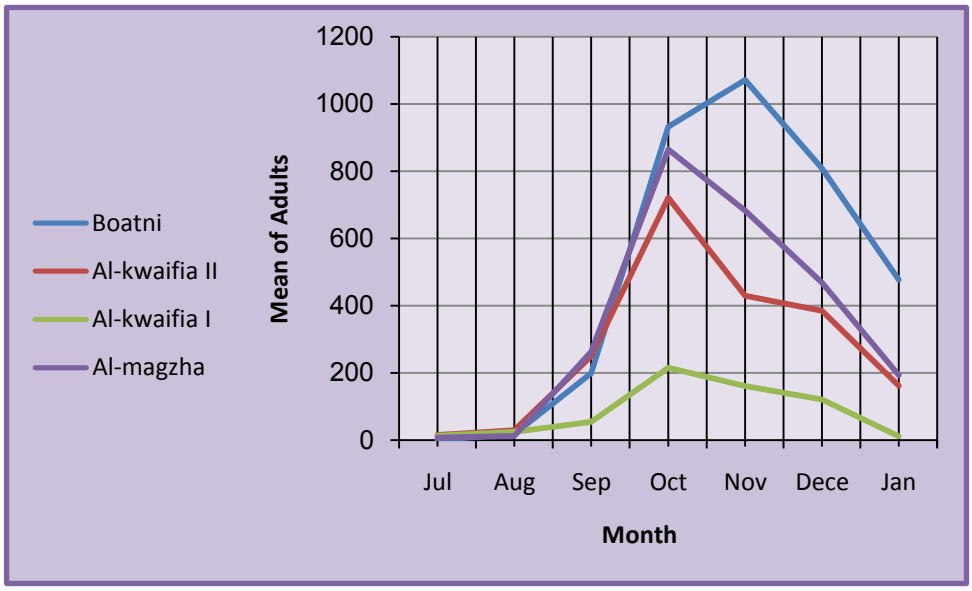


Figure (5) Olive fruit fly captured per month at four study sites.

4.2. Assessment of infection level :

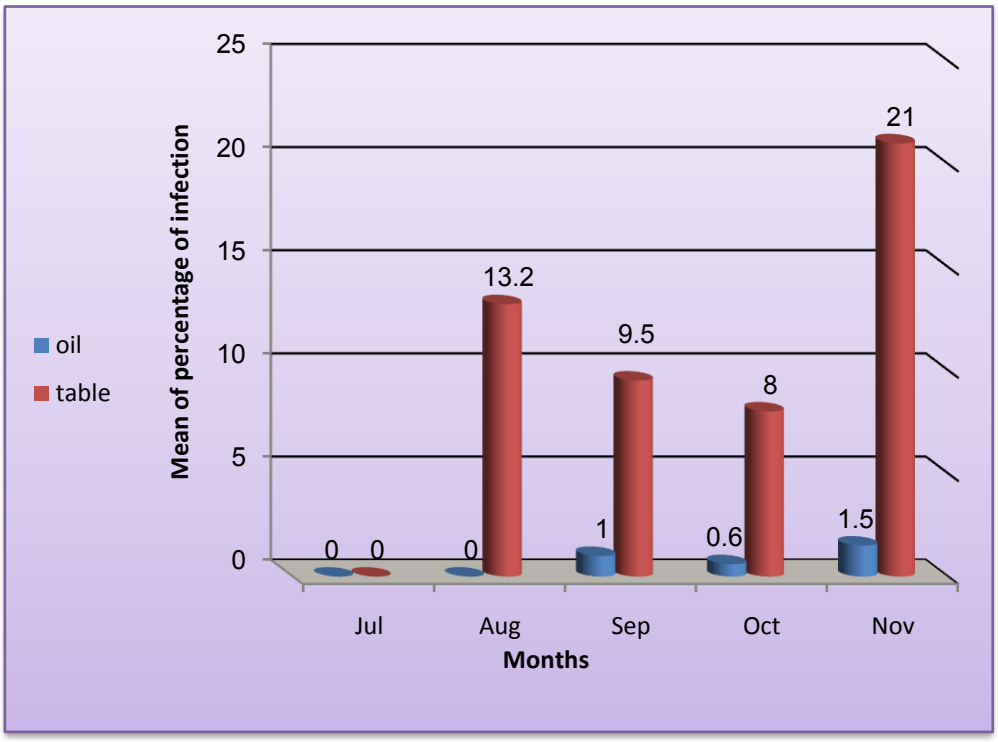
Infection caused by olive fruit fly are exclusive to the fruits, therefore symptoms noticed included fruit sting, holes, pulp distortion.

Infection symptoms on table variety in Al-magzha were noticed in late July. at 1% level, which continued to 24% by the third week of August, followed by decline to only7% by the second week of September. However, infection level made another peak in the first week of October at 24 % , followed by drop to10% by the end of October, increased thereafter during November until reached the highest peak at 29% by the end of November.

In oil variety infection symptoms were noticed at later time by the first week of September at 2%. Infection level were decreased to 0% by the first week of October. Slight increase was documented by mid of October when reached 1%. However infection level reached another peak in the first week of November at 3%, followed by decline again until reached 0% by the last of November, then decreased to 0% by the end week of November Figure(6),Table(6,7).

In Al-kwaifia II, symptoms appeared on table variety in the first week of August, where, infection percentage was about 3%, and increased in the fourth week of August to reach 16%, followed by decline in the first week of September. Relatively high infestation level were in the second week of October at 25% , which decreased slightly to 20% by the last week of the same month.

Infection symptoms on oil variety documented by the end of August was 2%. Relative infection level , reaching its highest peak of 5% in the first week of September. However, infection level fluctuated by



Figure(6) Mean of percentage of infection by Olive fruit fly on Table, Oil varieties in Al-magzha

Table(6) Percentage of infection on Table, Oil varieties in three sites.

Date	Sites				
	Al-magzha		Al-kwaifia II		Boatni
	Table Olive	Olive Oil	Table Olive	Olive Oil	Table olive
25.7.09	1%	0	0	0	0
1.8.09	2%	0	3%	0	10%
8.8.09	4%	0	4%	0	5%
15.8.09	16%	0	9%	0	8%
22.8.09	24%	0	16%	0	8%
29.8.09	20%	0	8%	2%	3%
5.9.09	3%	2%	5%	5%	4%
12.9.09	7%	1%	20%	2%	17%
19.9.09	15%	0	13%	3%	16%
26.9.09	14%	1%	11%	2%	15%
3.10.09	24%	0	12%	0	7%
10.10.09	16%	1%	25%	2%	15%
17.10.09	15%	1%	17%	3%	13%
24.10.09	14%	0	21%	1%	20%
31.10.09	10%	1%	20%	0	19%
7.11.09	12%	3%	0	0	82%
14.11.09	20%	2%	0	0	96%
21.11.09	23%	1%	0	0	73%
28.11.09	29%	0	0	0	80%

Table(7) Mean of percentage of infection by olive fruit fly on Table, oil varieties in three sites.

Months	Sites				
	Al-magzha		Al-kwaifia II		Boatni
	Table Olive	Olive Oil	Table Olive	Olive Oil	Table Olive
July	0	0	0	0	0
August	13.2	0	8	0.4	6.8
September	9.5	1	12.25	3	13
October	15.8	0.6	19	1.2	14.8
November	21	1.5	0	0	82.75

the mid of October where it was around 3%,this level continue to decline to 0% by the end of October. Figure(7), Table(6,7).

In Boatni the percentage of infection symptoms on the table variety document by the first week of August at 10%, which declined to 3% by the

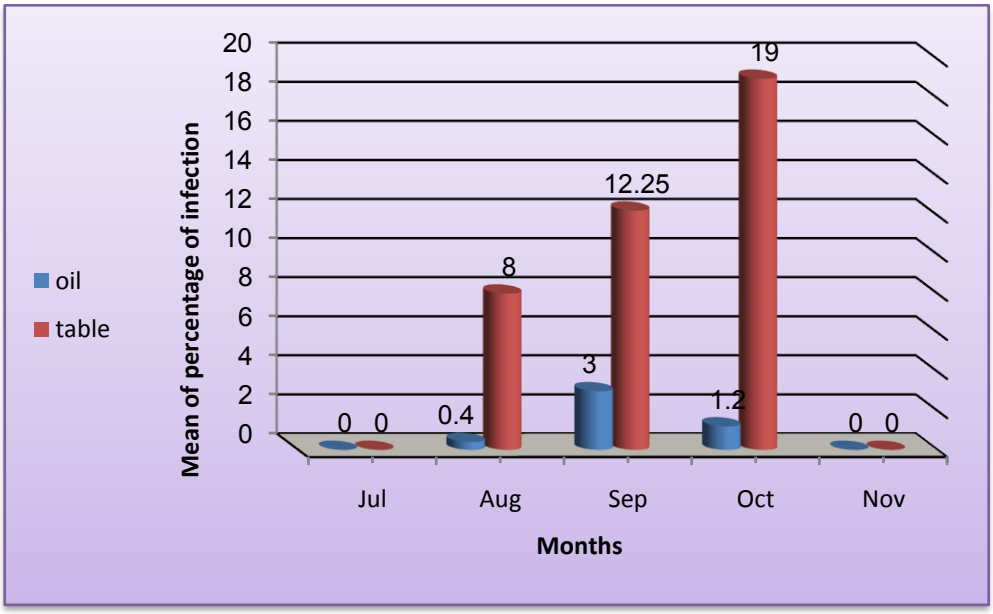
end of August.

A peak of infection level was reached by the second week of September where the percentage of infection at17%. with drop slightly in late September, followed by increased level by late October at 19%. This level continue to increase to reach the highest peak 96% by the mid of November. Followed by drop in late November to 80%. Figure (8), Table(6,7).

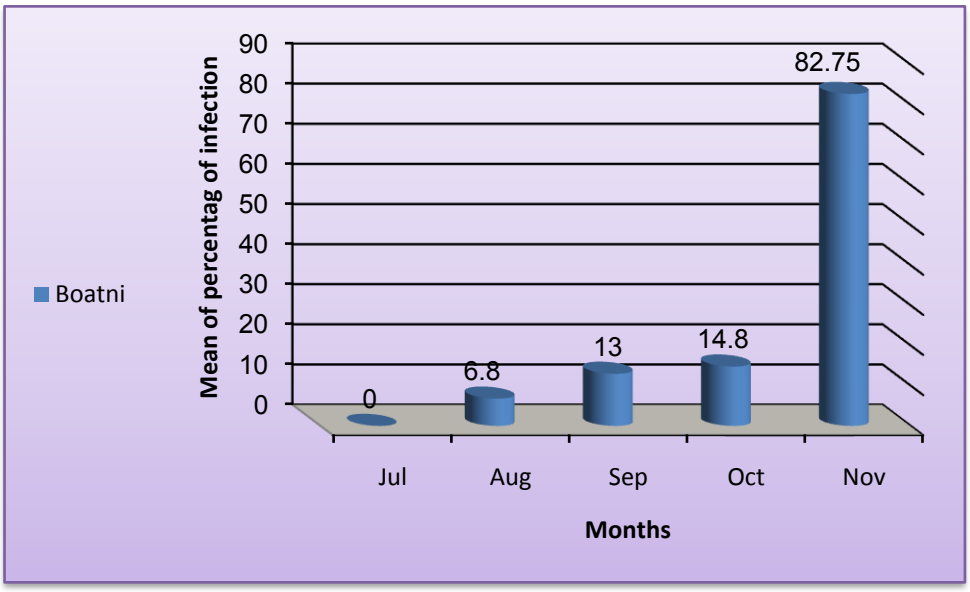
T- test analysis indicated a significant differences between infection symptoms level on table variety and oil variety. Figure (9) table (8,9,10).

4.3. Monitoring of immature stages development:

Different immature stages were monitored under room condition from 26th Sep to 28th of Nov. Result indicated no differences in time taken for development. Table(11).



Figure(7) Mean of percentage of infection by olive fruit fly on Table, Oil varieties in Alkwaifia II.



Figure(8) Mean of percentage of infection by olive fruit fly on Table varieties in Boatni.

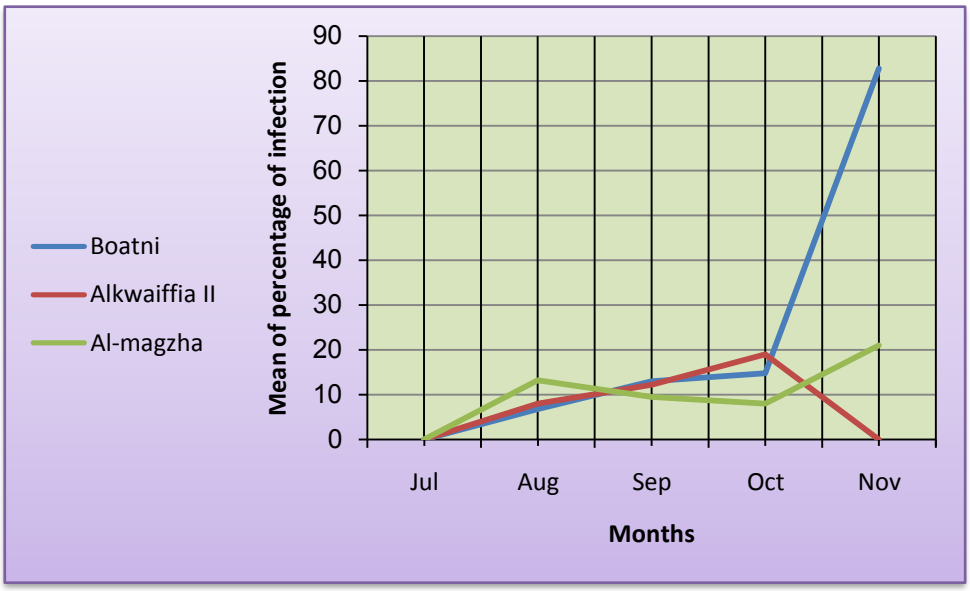


Figure (9) Mean of percentage of infection by olive fruit fly on Table varieties In (Al-magzha, Al-kwaifia II, and Boatni).

Table(8) Paired samples statistic (T. Test) of Table and Oil varieties in Al-magzha site

Al-magzha olive tree	N	Mean	Std. Deviation	T	df	P-value	Mean Difference
Table	5	11.900	7.8594	3.389	4	.028	11.2800
Oil	5	.6200	.6496				

" showing Mean, df = degree of freedom, T = table value, P = significant values at 0.05 level."

Table(9) Paired samples statistic (T. Test) of Table and Oil varieties in Al-kwaifia II site

Al-kwaifia II. olive tree	N	Mean	Std. Deviation	T	df	P-value	Mean Difference
Table	5	7.8500	8.1693	2.089	4	.105	6.9300
Oil	5	. 9200	1.2617				

" showing Mean, df = degree of freedom, T = table value, P = significant values at 0.05 level."

Table(10) Paired samples statistic (T. Test) of Table and Oil varieties in three sites

Three sites olive tree	N	Mean	Std. Deviation	T	df	P-value	Mean Difference
Table	15	14.4067	20.1756	2.717	14	.018	13. 8933
Oil	15	.5133	.8560				

" showing Mean, df = degree of freedom, T = table value, P = significant values at 0.05 level."

Table(11) Numbers of larvae and pupae stage developed to the next stage.

Life stage	Numbers	Time (d)	Temp. (^{o}c)	% RH	Mortality rate	Notes
Larvae	12	2 – 3	18.1	60.6	50%	
	33	4 – 5	19.3	64.9	57.5%	
	9	6 – 8	16.5	65.7	33.3%	
Pupae*	8	9 – 14	16.7	66.5	25%	1p[1]/ 2m[2]/ 3f [3]
	14	16- 20	17.2	64.8	42.8%	2p/ 4m/ 2f
	4	22- 29	21.4	64.2	0	4p
Pupae	23	10-13	19.5	61	65.2%	1p/ 3m/4f
	19	14-17	19	59.1	26.3	3p/ 7m/ 4f
	13	18-20	16.6	66	76.9%	3p

*pupated in the lab

P[1] = Parasite, m[2] = male, f[3] = female.

5. DISCUSSION

5.1. Adult Seasonal incidences:

Results indicated that flies activity started by the second week of July up to mid September at all study sites, Which normally coincide with maturation of the olive fruit fly which depends on weather conditions and fruit ripeness. These results were in accordance with the results from Greece by Mazomenos *et al*.,(2002) in study conducted to attract and kill adults as part of an integrated control system.

However by the fourth week of October, fly population began to increase and reached a peak in Al-magzha , Al-kwaifia (I), and Al-kwaifia (II) Which might be due to the local conditions where the average temperature was around 18.5^{o} c, and relative humidity at 63%. Since cool and humid coastal conditions of Benghazi were favorable for olive fruit fly development, that in accordance with result indicated by Yokoyama *et al*., (2006). Who indicated the maximum number of adult captured were in October.

Statistical analysis indicate significant differences in mean numbers of flies between months Table(4,5); while in the second week of December the numbers decline again and continued until the first week of January which might be due to the inappropriate environmental conditions since average temperature was around 14.7^{o}c and relative humidity at 76%, which agree with (1998) حمد. who indicated that the decline in numbers of fly in Qernada area where the average temperature is very low since this area is very high above the sea level.

However in Al-kwaifia (I) flies number dropped in the first week of November, then increased again in the second week of November which

might be caused by fluctuation in temperature; where it was 21.8^{o} c in the first week and 14.6^{o} c in the second week of November. In studies on the developmental time of each life stage indicate significant decrease with increasing temperature from 16^{o}c up to 27^{o} c. Temperature was the major factor comprehensively influencing the population fluctuation. Genç and Nation (2008); and Soroosh *et al*., (2007).

In the first week of January numbers went down again ; which might be due to absence of olive fruit. Similar results were also observed by لياس (1986), who indicated that activity started in late February at Ijlilia site.

However in Al-kwaifia (I) and Al-kwaifia (II) the data showed high numbers of fly in October and decline in November, December, and January.

The statistical analysis indicated significant differences in the number catches of flies between areas, while no significant differences were observed between Al-magzha and Al-kwaifia(II) Table(2,3) .

In Boatni, the results obtained show little difference from other sites where, flies activity started by the first week of August which might be due to late maturation of olive varieties planted in this area. Followed by decline by mid-August. Incidences increased again by late August, coincide with climatic conditions of summer and fall which might influence the presence of olive fruit fly population as documented by Cristofara *et al*., (2007) and Collier and Van Steenwyk (2003). Our results were in accordance to study by Mazomenos *et al*.,(2002). In which they indicated that the fly population remained low in the trap until late August.

Statistical analysis showed significant differences in numbers of flies between months, while there were no significant differences between July, August, September, and January between sites.

Fly increase continued until reached its highest peak by the first week of November which contradicted with result by Yokoyama *et al*.,(2006) who reported that the highest numbers of adults were captured in October followed by decline again in the first week of December. These investigations supported the study conducted by (1998) حمد in which he suggested that the decline of flies number in December might caused by fruits harvest.

Fly numbers increased again in the third and fourth week of December and continued up to the first week of January 2010.Thess results confirmed by the results of (1986) لياس who suggest that could have been attributed to flies that coming from surrounding areas.

5.2. Assessment of infection level:

Infection symptoms on table olive variety in Al-magzha were noticed in late July. The infection symptoms level was 1%. Fruit susceptibility begins at the time of pit hardening, usually in July in the Mediterranean areas(Rice 2000). Our results confirmed by (1998) حمد who documented the beginning of infection by the early August which continued to increase until the third week of August , followed by decline in the second week of September, which reflected by the reduction in adult activity level. Infection level made another peak in October when the average temperature was around 24.1^{o}c, and the humidity was at 74%. Our finding were in accordance with Yokoyama *et al*., (2006). Who, documented that the maximum number at ovipositional sites per fruit occurred in October, which might be due to the fruit suitability to female fly since the fruits were at maturing stage.(1998 حمد).

The highest peak of infection level in the mid and last week of November coincide with the average temperature 15.9^{o}c and relative humidi

ty at 71%. which might be due to fruit maximum size in November(Yo koyama *et al*., 2006). Furthermore, results of Burrack and Zalom(2008) indicated that higher infestation levels occurred later in the season.

Infection symptoms on oil varieties were noticed later in the season compared with table varieties symptoms were first recorded at 2% level early in September, which coincide with the ripping time which in fact more susceptible to infection at that stage. In addition to the fact that olive fruit fly prefer to lay eggs in large size fruits which usually table varieties compared with small fruits i.e. oil varieties . Rice (2000), and Delrio *et al*., (2010)

The statistical analysis of the present study indicated significant differences between infection level of table variety and oil variety and that was in accordance to the study by (1986)لياس who noticed that oil varieties were less susceptible to infection.

Infection level declined to reach 0% by the first week of October, and slightly increased towards mid of October and continued to rise up until the first week of November which coincide with maturing of the table varieties selected by olive fruit fly. These results confirmed by Burrack and Zalom (2008) who documented that the heavy infection of Sevillano and Manzanillo olives (large size) may have stimulated flies to oviposit in the next most preferred variety for oviposition.

Although, in Al-kwaifia (II) infection symptoms appeared on table variety in the first week of August at level of 3 %. However, the statistical analysis showed no significant differences between study areas.

Infection symptoms continued to increase to reach the highest level in October, which supported by (1998) حمد who obtained the highest peak in October which might be due to fruit suitability.

The degree of infestation of olive fruits by *Bactrocera oleae* was affected by the type of cultivar and the degree of olive fruit maturation Salah *et al*., (1998).

However infection symptoms on oil variety documented by the end of August were at 2%, similar results obtained in Al-magzha site, which reached its highest peak in the first week of September which was about 5%. Our results agree with result documented by Yokoyama *et al*.,(2006) who observed that the number of ovipositional sites were directly related to an increase in fruit volume from September through October.

Infection level fluctuated during October then dropped to 0%.which might be due to the presence of table olive in the same site. Which is more preferred for oviposition by female flies, in addition to the positive correlation between infestation and fruit sizes. (Rice, 2000; Rizzo and Caleca, 2006; and Athar, 2005).

In Boatni the percentage of infection symptoms on table variety observed in the first week of August .

Infection level continued to increase until reached another peak around 19% by the end of October; when the average temperature was around 18.5c˚ and humidity at 69% , this can be due to fruit maturing. Our results were in accordance to results by (1998) حمد who documented that the highest peak of infection in Qernada site, was during October.

The highest peak in this study was by the mid of November when the average temperature around 14.6^{o}c and the relative humidity at 65%, which coincide with the high population of fly at these period. These results confirmed by (1986)لياس who indicated that the highest level of infection was at the end the season. The greatest damage occurs as the fruit begins to soften and turn in color (September to November) (Vossen, 2004).

The statistical analysis of the total infection levels indicated significant differences between infection symptoms on table and oil varieties.

5.3. Monitoring of immature stages development:

The results in table(11) indicated no differences in temperatures and humidity under room temperature which might be due to all samples were taken at autumn season. Our results were in accordance to the study of Yokoyama and Miller (2007). They indicated that no significant differences were found in the response of each life stage between 15^{o} c and 25^{o} c.

The least of mortality was at 6 – 8 d-old larvae. Similar results were also observed by Yokoyama and Miller (2007), who indicated that mortality decreased with an increase in age for larvae exposed to 15^{o} c and 65 % RH.

The results showed that the larvae of the olive fruit fly exposed to endoparasite *Opius concolor* (Hymenoptera: Barconidae) completed the development in the cocoon of the pupa allowing the adult parasite to emerge. Our results confirmed by (1986)لياس , who documented that a percentage of pupa ranged between 28% and 50% gave rise to *Opius concolor*. Plate(13), Table(11).

Plate (10) Female of the Barconidae (*Opius concol*or) from *B. oleae* larva.

6. CONCLUSION

The olive fruit fly (*Bactrocera oleae* (Gmelin), 1788) (formerly *Dacus oleae*) is a serious pest of olive in most of the countries around the Mediterranean sea.

The adults feed on nectar, honeydew, and other available sources of liquid or semi-liquid food. The larvae are monophagous, and feed exclusively on olive fruits. The damage caused by tunneling of larvae in the fruits results in about 30 percent loss of the olive in Mediterranean countries.

The results of this study indicated that adult seasonal incidence started from July through December and declined at January; in (Al-magzha, Al-kwaifia I, and Al-kwaifia II). While in Boatni started by the first week of August and dropped in January. The catch numbers of adult reached to the highest peak at October in (Al-magzha, Al-kwaifia I, and Al-kwaifia II) while in Boatni at November.

Statistical analysis indicated significant differences in mean catch numbers of flies between months as well as between areas of study.

However, assessment of infection level results indicated that infection symptoms on table varieties appeared by the first week of August at all studied areas. While infection symptoms on oil varieties appeared at the first week of September in Al-magzha and by the last week of August in Al-kwaifia II.

Statistical analysis indicated significant differences in infection level between varieties. Table varieties were more preferable by flies which shown significant infection level compared with oil varieties.

Monitoring of immature stage development:

Different immature stages were monitored under room conditions. Results indicated that no temperature effect on the time of the change from larvae to pupae; but had effect the mortality rate. In contrast temperature show effect on larvae hibernate in the laboratory and pupa which brought to the laboratory from the field.

Therefore, from the result we conclude some advices which may help the farmers to reduces olive fruit infections and increase olive fruit production:

1- Deep land plowing under olive trees after crop harvesting to expose larva and pupa stages to the sun light for dissection .
2- Clean land from grass and stacks of dirts.
3- Collecting falling green olive and getting rid of them by burning.
4- Collecting near-mature olive and squeezing them as soon as possible.
5- Putting a net made of wire on windows of olive mangles to prevent olive fruit fly of entering to or from the mangle.
6- Cleaning mangles of all garbage, cleaning basins and wire all holes that larva of olive fly may use to get in the mangles.
7- At last, don't put the good fruit with infected ones(corrupt with olive fruit fly), when percent of infection is between 20% and 25% or more.
8- More studies about the role of parasites of olive fruit fly in the biological control are needed.

7. SUMMARY

The olive tree(*Olea europea*) is one of the sustainable green trees belong to (family: Oleaceae), honored the olive tree and their productions in the Qur'an is a great benefit to the people .The olive tree is subject to infection with a number of pests. Olive fruit fly considered as the most serious one infest the olive fruits which results in significant losses of oil production.

Bactrocera oleae Gmelin, (Diptera: Tephritidae) infests fruit, lay eggs give rise to a small brown spots on the fruit after hatching the larvae burrow into the core of the fruit and feed on the inner contents result in rot and injury caused falling fruit before maturity , decrease the proportion of oil in the fruits and increases the acidity.

The methods and obtained results in the present study can be summarized as follows:

1 –Monitoring the adult of flies used plastic McPhail traps with diammonium Hydrogen phosphate solution at concentration of 3% from mid-May 2009 until the beginning of January 2010 at four sites. Showed a significant differences between the study areas. Trap catches which reflect adult activity started in July in both Al-magzha, Al-kwifia I, and Al-kwaifia II; while occurred by the first week of August in Boatni.

Results also indicate significant differences between months where the highest peak of catches in October at Al-magzha, Al-kwaifia I, and Al-kwaifia II; while the highest peak of catch ability in November in Boatni which might be due to weather factors and the maturation of olive fruit.

2 - For determination of olive varieties susceptibility:

Were collected 100 fruit of oil olive at random each week from the beginning of the last week of July until the end November results showed a significant differences between varieties; where the table olives were more susceptible compared with olive oil due to the large size of the fruit and the water content.

3- Monitoring of development time taken by different stages of olive fruit fly under laboratory conditions.

Larvae developed in infected fruits which placed in plastic containers, covered with fine net, were monitored up to adult stage time taken for each stage were recorded.

Results indicated that no relationship between temperature and time taken to change to the next stage. Although temperature change show clear effect on larvae mortality rate. While show vice versa effect on pupation time. Since pupation time increased when temperature decreased, in addition to high mortality rate.

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APPINDEX (1)

Mean of Temperature and Humidity recorded in Benghazi during April 2009/ January 2010**.**

Months	T˚c	RH %
April	18.8	51
May	21.6	50
June	25.8	48
July	26.8	59
August	26.7	62
September	26.3	55
October	21.9	60
November	17.3	65
December	15.6	63
January	13.8	65

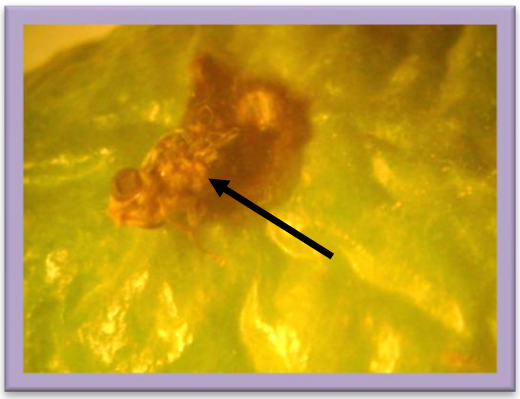
APPINDEX (2)

The numbers of Olive fruit fly captured per month at four study sites.

Months	Al-magzha		Al-kwaifiaI		Al-kwaifiaII		Boatni	
	male	female	Male	female	male	female	male	Female
May	0	0	0	0	0	0	0	0
June	0	0	0	0	0	0	0	0
July	5	3	8	5	6	9	0	0
August	6	7	8	16	14	15	8	10
September	156	107	27	27	90	159	125	74
October	454	411	107	108	302	419	511	421
November	340	343	95	66	246	180	649	422
December	233	236	65	56	138	202	433	375
January	113	81	3	8	76	86	245	232

APPINDEX (3)

Photos show the distorted Flies.



دراسة بيئية لذبابة ثمار الزيتون *Bactrocera(Dacus) oleae* في منطقة بنغازي

الخلاصة

شجرة الزيتون *Olea europaea L.* من الأشجار المستديمة الخضرة تنتمي إلى العائلة الزيتونية Oleaceae و التي تضم الجنس *Olea* . كُرمت شجرة الزيتون و منتجاتها في الكريم القرآن لعظيم منافعها الغذائية و الطبية للإنسان فقال الله تعالى «اللَّهُ نُورُ السَّمَاوَاتِ وَالْأَرْضِ مَثَلُ نُورِهِ كَمِشْكَاةٍ فِيهَا مِصْبَاحٌ الْمِصْبَاحُ فِي زُجَاجَةٍ الزُّجَاجَةُ كَأَنَّهَا كَوْكَبٌ دُرِّيٌّ يُوقَدُ مِنْ شَجَرَةٍ مُبَارَكَةٍ زَيْتُونَةٍ لَا شَرْقِيَّةٍ وَلَا غَرْبِيَّةٍ يَكَادُ زَيْتُهَا يُضِيءُ وَلَوْ لَمْ تَمْسَسْهُ نَارٌ نُورٌ عَلَى نُورٍ يَهْدِي اللَّهُ لِنُورِهِ مَنْ يَشَاءُ وَيَضْرِبُ اللَّهُ الْأَمْثَالَ لِلنَّاسِ وَاللَّهُ بِكُلِّ شَيْءٍ عَلِيمٌ » 35 سورة النور.

تتعرض شجرة الزيتون للإصابة بالعديد من الآفات من أهمها ذبابة ثمار الزيتون و ينتج عن هذه الإصابة خسائر كبيرة لهذا المحصول.

ذبابة ثمار الزيتون *Bactrocera oleae* من عائلة *ذباب الفاكهة* Tephritidae ، رتبة ثنائية الأجنحة Diptera ، تصيب الثمار من خلال آلة وضع البيض و ينشأ عنها بقع صغيرة سمراء على الثمار، بعد فقس البيض تحفر اليرقات داخل لب الثمرة و تتعفن. و ينشأ عن الإصابة تساقط الثمار قبل النضج كما تقل نسبة الزيت في الثمار المصابة و تزداد نسبة الحموضة. كما تقل قيمة ثمار المائدة.

هذا و يمكن إيجاز الطرق و النتائج التي تم التوصل لها في هذا البحث على النحو التالي:

1- تم مراقبة الأطوار البالغة للذبابة باستخدام مصائد مكفيل البلاستيكية مزودة بجاذب غذائي (محلول ثنائي امونيوم هيدروجين الفوسفات) بتركيز 3% من منتصف شهر مايو 2009 حتى يناير 2010. في المواقع الأربعة (المقزحة، الكويفية 1، الكويفية 2، و بوعطني)

أظهرت النتائج وجود فروق معنوية بين مناطق الدراسة لنشاط الذبابة حيث كان بداية

نشاط الذبابة خلال شهر يوليو في كلاً من المقزحة، الكويفية1، و الكويفية2؛ بينما كان في الأسبوع الأول من شهر أغسطس بالنسبة لموقع بوعطني. و لصنف الزيتون علاقة بذلك.

كما أظهرت النتائج وجود فروق معنوية بين الشهور حيث كانت أعلى نشاط للذبابة في شهر أكتوبرفي(المقزحة، الكويفية1، و الكويفية2) بينما كانت أعلى نشاط للذبابة في شهر نوفمبر في موقع بوعطني و ذلك بسبب فترة نضوج ثمار الزيتون.

2- و لتحديد حساسية الأصناف للإصابة تم تجميع 100ثمرة من زيتون المائدة و 100ثمرة من زيتون الزيت بطريقة عشوائية لكل أسبوع بدايةٍ من الأسبوع الأخير من شهر يوليو و حتى نهاية شهر نوفمبر. و أظهرت النتائج وجود فروق معنوية بين الأصناف حيث كان زيتون المائدة هو الأكثر إصابة من زيتون الزيت و ذلك بسبب كبر حجم الثمار و لمحتواها المائي.

3- و لمراقبة أطوار الذبابة تحت ظروف المعمل وضعت اليرقات التي تم الحصول عليها من الثمار المصابة في علب بلاستيكية و تغطيتها بشاش، ثم تسجيل الفترات الزمنية المستغرقة للتحول إلى الأطوار المختلفة (العذراء، الحشرة الكاملة) .

حيث أظهرت النتائج عدم وجود أي علاقة بين درجات الحرارة و المدة المستغرقة في تحول اليرقات إلى العذاري ، و بينما كان لدرجات الحرارة تأثير على نسبة الوفيات حيث كلما زادت درجات الحرارة زادت نسبة الوفيات. و العكس بالنسبة للعذاري التي تم تعذرها داخل المعمل .

أما بالنسبة للعذاري التي تم العثور عليه في الثمار كلما قلت درجات الحرارة زادت المدة المستغرقة في التحول إلى الطور البالغ، وكذلك زيادة نسبة الوفيات

جامعة بنغازي

كلية العلوم

قسم علم الحيوان

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أطروحة مقدمة استكمالاً لمتطلبات درجة الإجازة العليا(الماجستير) في علم الحيوان

من قبل

فاطمة اكريم عمر موسى

بإشراف

الدكتور عبد الله فضل

بنغازي – ليبيا

2012