EGYPTIAN ACADEMIC JOURNAL OF
BIOLOGICAL SCIENCES
ENTOMOLOGY

A

ISSN
1687-8809

WWW.EAJBS.EG.NET

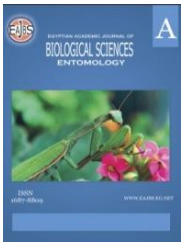
Vol. 14 No. 3 (2021)

Citation: *Egypt. Acad. J. Biolog. Sci. (A. Entomology) Vol. 14(3) pp.115-127 (2021)*
DOI: 10.21608/EAJBSA.2021.215617

Egypt. Acad. J. Biolog. Sci., 14(3):115-127(2021)

Egyptian Academic Journal of Biological Sciences
A. Entomology

ISSN 1687- 8809
http://eajbsa.journals.ekb.eg/



Evaluating the Attractable Efficiency of Certain Fruit Extracts and Some Oils for different Plant Materials for Mediterranean Fruit fly, *Ceratitis capitata*.

Mahenaz A.A. GabAlla
Fruit Fly Research Section, Plant Protection Research Institute, Agriculture Research Center, Ministry of Agriculture - Sabahia, Alexandria
E-mail* : saadasmaa245@gmail.com

ARTICLE INFO
Article History
Received:16/8/2021
Accepted:30/9/2021
Keywords:
Ceratitzs capitata, olfactometer, Imidacloprid, methyl eugenol

ABSTRACT

Commercial lures and traps have recently become available for monitoring fruit fly, *Ceratitis capitata*. Experiments were made in the laboratory to evaluating the attractiveness of some plant extracts and plant oils (Natural odour materials) against medfly *Ceratitis capitate* (Wied) using a simple Olfactometer.

The Guava, Melon, Mango, Banana, Apricot and Orange extracts (5, 10 and 25% concentrations) were used. Guava, Mango and Banana extracts were the highest attracted to adults of medfly at (5, 10 and 25%) concentrations of extracts. The best day for attracted flies was the fifth day when the flies were highly attracted

Anise, Cinnamon, Cloves, Camphor and Flaxseed oils were used. Cloves, Cinnamon and Anise oils (10.25%, 8.13% and 7.61%) were good to attracted medfly at the concentrations (5%), while Cloves, Anise and Cinnamon oils (13.45%, 5.78% and 3.93 %) were good to attracted at the concentrations (10%). The (25%) concentration was the least efficient lures, lowest to attract medfly (2.67%, 2.43%, 1.51%) for Anise, Cloves and Cinnamon oils, respectively. Camphor and Flaxseed oils had a repellent effect and the fifth day was good in attracted medfly.

Three good attracted fruit extracts (Guava, Mango and Banana) for medfly were also evaluated with added Piyrothroid or Imidacloprid insecticides both separately to the fruit extracts and calculated the percentage of attracted and mortality of medfly. The results of this study clarifies that the Guava extract was the best to attracted medfly (21.62%) while the percentage of mortality was (19.08%) with added Piyrothroid. Whilst, when added Imidacloprid insecticide the percentage of attracted medfly decreased, it was (7.93%) with Guava extract. A good percentage of mortality medfly was with Mango and Imidacloprid insecticide (8.07%). Results of the present study suggest that the plant extracts with insecticides can be an effective tool in integrated pest management programs for the control of fruit flies.

INTRODUCTION

Fruits are considered as one of the most important crops in the whole world because of their nutritional and economical importance as well as for local consumption or exportation. The medfly, *Ceratitzs capitata* (Wied), is a notorious and highly invasive insect species with a major economic impact because of its broad host range, cause massive

losses of crop production, decreased export trade, attacking over 250 different types of fruit including apple, citrus, stone fruits and vegetables and ornamental plants and its importance to international quarantine (Hagen *et a1*., 1981; Liquido *et al*., 1991).

Many options are available for fruit fly control such as fruit fly trapping, collecting infested fruits, releasing sterile males, physical control, biological control and finally application of synthetic insecticides (Shahabuddin 2011; Ndlela, *et al*., 2016). When the continuous use of synthetic insecticides provides potential risks for the environment, human health, non-target organisms, which can cause pest resistance and secondary pest outbreaks (Adjrah *et al*., 2013). The control of fruit flies mostly is still done by using synthetic Pesticides. For reducing the use of pesticides, one of the more environmentally friendly alternative controls and monitoring of medfly that is safe for consumers specifically, the use of traps, the most widely used lure in trapping programs for *C. capitata* detection is a synthetic compound, a trimed lure (Beroza *et a1*., 1961). Methyl eugenol (4-allyl-1,2-dimethoxy benzene carboxylate) was used for trapping fruit flies (Metcalf, 1990). The use of methyl eugenol can reduce the use of pesticides (Vargas *et al.*, 2008). But the use of methyl eugenol can only attract male *C. capitata*. One way to increase the effectiveness of using methyl eugenol is by combining it with fruit juice. The combination of methyl eugenol and fruit extract is effective in trapping *C. capitata* (Wati, 2013). Attractive baits are developed to increase the effectiveness of monitoring and pest control. In bait preparation, fermenting proteins and sugars were used for attracting pests, because it needs in egg development (Epsky *et al*., 1999). Also, several attempts have been made to improve trapping efficiency using plant odours (Frey *et al*., 1994).

Farmers lack the knowledge of synthetic attractants and it is not easily available and with high cost. For the ecofriendly management of fruit flies, the locally available low-cost natural sources of inputs were evaluated to assist the maximum trapping of fruit flies with a high yield and cost-benefit ratio.

The present work focuses to evaluate the efficacy of some fruit extracts and plant oil against the attraction of adults of medfly *C. capitata* also determined their effectiveness by observing the duration of their effectiveness as well as the number of fruit flies trapped. The attractiveness of volatiles responses of *C. capitata* to volatiles in laboratory assays has been reported using a Simple olfactometer (Pow *et aI.*, 1998).

MATERIALS AND METHODS

Tested Insect:

The Mediterranean fruit fly *Ceratitis capitata* (Wied.), (Diptera: *Tephritidae*). Pupae were obtained from the Department of Lesions Horticultural Crops Plant Protection Institute, Research Agricultural Research Center. Emerged adults were introduced to cages of 30 cm- 30 cm - 30 cm size. *C.capitata* was located with adult media (Hydrolyzed yeast and granulated sugar) 1:3 concentration (Khan *et al*., 2016).

Simple Olfactometer Design:

Olfactometer has been used to allow quick screening of volatiles for attractiveness or repellency to adults *C.capitata* with producible results. The attractive effect of some fruit extracts and plants oil at different concentrations. Fifty pairs of adults *C.capitata* (males and females) 5 days old were placed in a plastic container (9cm X 18cm X23cm) then monitoring displacement, as a result, was measured after fruit extracts and plants oil exposure. This container contained six arms in order to allow the odour to reach, arms with equal lengths (50cm), placed equidistantly from a central area where the insects are released, arms connected with six transparent cylindrical plastic containers, all parts of the set-up were cleaned with acetone (Hanafy, 2000). The tested attractants were placed in six cylindrical plastic containers. The insect is placed in the remaining point and then allowed

to make a choice. One individual is deployed at a time, and the path of its election is recorded, Averages are based on the cumulative number of fruit flies captured. This operation is repeated three times to achieve statistically significant data and this is used for assessing both attractive and repulsive acts of fruit extracts and plants oil on insects.

a. Six fruit extracts at three concentrations 5, 10 and 25% (Guava, Mango, Banana, Apricot, Orange and Melon) compared with control (nothing).

b. Five natural odour plants oil at three concentrations 5, 10 and 25% (Anise, Camphor, Cinnamon, Cloves and Flaxseed oils) compared with odorless (nothing) control in cylindrical plastic containers.

Fruit Extraction:

The six fruits (Guava, banana, mango, melon, apricot and orange) were pulverized into a fine powder using a grinding mill. The extraction of the investigated fruits was carried out according to the method of (Mbatchou *et. al*. 2011). Powder of each fruit (200gm) was soaked in (700ml of 98% ethanol) for two weeks with intermittent shaking. The extract was separately evaporated to dryness at room temperature to obtain the crude extracts. The resulting crude extracts were stored in a glass vials pack closed at (2-4^{o}C) until used for bioassay assessment experiments.

a. Percentage of attracted flies of each transparent container was accumulation counted and calculated percentage of attracted flies for five days respectively. The experiments were laid out with extracts and replicated three times; results recorded every 24 hours until five days. The experiment planned a completely randomized design.

b. Natural odor plant materials oil (Anise, Camphor, Cinnamon, Cloves and Flaxseed oils) were evaluated against fruit flies in smile olfactometer also at three concentrations by the previous way.

c. Evaluated the best fruits extracts against attraction and mortality medfly. Three fruits extracts (Banana, Mango and Guava) at a concentration (10%) against medfly by mixed with two commercial synthetic insecticides:

i. Synthetic Pyrithroied, Fas Tac [Cyano-3-phenoxybenzyl-3-(2,2-dichlorovinyl)-2,2-dimethylcyclopropane carboxylate] 5% EC in 4ml/L water with each extract.

ii. Neonicotinoid insecticide, Imidacloprid [1-(6-chloro-3-pyridylmethyl)-N-nitroimidazolidin-2-ylideneamine] 20% OD 100ml/100L in water with each extract.

The two insecticides were tested with the best three fruit extracts and evaluated the attracted flies and the mortality of adult accumulation for 7 days respectively. Dead flies in each treatment were counted daily. Toxicity was evaluated by calculating the percent mortality.

Statistical Analysis:

The data on the number of fruit flies attracted and also the mortality in the individual attractants were recorded every 24 hours until the fifth day. The collected data were statistically analysed according to the split-plot design recommended by (Steel and Torrie, 1980). Compared between Mean Percentage of attracted adult of medfly to extracts in presence insecticide or absent after 5 days respectively from treatment employment T-test.

RESULTS AND DISCUSSION

The design of an experiment in order to test the responses of *C. capitata* towards plant odors involves the consideration of the stimuli generally involved in locomotion. The effectiveness of six different fruit extracts and five plant oil were bioassayed as attractants in three concentrations (5, 10 and 25%) and at period 5 days. Each attractant was used in three replicate traps for adult *C. capitata* under laboratory conditions. The obtained data of these experiments were recorded in eleven tables.

1- Performance of Adult Fruit Flies to Attractants:

a- Fruit Extracts:

Preliminary assays at 5% concentration shown in Table (1) obviously the fruit flies are having the tendency of high attraction towards the Guava extract (26.15%) than the others while the Apricot extract (0.67%) was the lowest attracted flies. The highest day in attraction flies was the fifth day (17.57%) followed by the fourth day (14.61%), the third day (11.44%), the second day (6.98%) and the lowest was the first day (1.83%). The statistical analyses define significance among the general mean percentage of fruit extractions in 5 days. The attractiveness power of extracts increased gradually till the end of the experiment.

Table 1. Attraction adults of fruit fly *Ceratitis capitate* to different fruit extracts at (5%) conc. under laboratory conditions.

Fruit extracts	Mean of periods (%) ± SD After					General Mean
	1day	2days	3days	4days	5days	
Guava	6.67±4.41	13.89±5.36	24.97±7.64	37.22±8.31	48±7.26	26.15^{A}
Mango	1.11±0.92	15.55±2.54	22.20±5.13	26.11±6.74	32.78±7.88	19.55^{B}
Banana	4.45±0.96	10.55±2.51	18.34±6.01	22.78±7.57	24.45±6.31	16.11^{C}
Melon	0±0	3.89±2.24	7.22±3.61	7.69±1.92	8.89±0.96	5.54^{D}
Orange	0.56±0.96	4.45±2.35	5.11±2.82	6.23±1.85	6.68±2.79	4.61^{D}
Apricot	0±0	0±0	1.11±0.92	1.11±0.92	1.11±0.92	0.67^{E}
Control	0±0	0.56±0.96	1.11±0.92	1.11±0.92	1.11±0.92	0.78^{EF}
General Mean	1.83^{e}	6.98^{d}	11.44^{c}	14.61^{b}	17.57^{a}	10.49

Mean followed by the same letter in column and row are not significantly different according to L.S.D. test at 0.05 level of probability.

The data of the preferred the odor of medfly to fruit extract at (10%) concentration in Table (2) shows that Guava was superior to the other fruit extracts. The mean of attracted flies was as follows, Guava (33.46%), Mango (23.71%), Banana (10.34%), Melon (8.89%), Apricot (3.22 %) and Orange reduced the attraction efficiency by (1.32%). The fifth day was the best to attract flies of medfly (19.17%). The statistical analyses define significance between extracts and control in 5 days.

Table 2. Attraction adults of fruit fly *Ceratitis capitate* to different fruit extracts at (10%) conc. under laboratory conditions.

Fruit extracts	Mean of periods (%) ± SD After					General Mean
	1day	2days	3days	4days	5days	
Guava	9.44±3.47	21.67±6.46	33.89±9.18	46.11±6.73	56.21±9.76	33.46^{A}
Mango	0 ±0	11.11±3.47	29.99±3.32	37.78±10.72	39.67±10.93	23.71^{B}
Banana	3.33±1.67	6.69±1.66	10.57±2.54	15±3.33	16.11±3.85	10.34^{C}
Melon	1.67±.1.54	4.46±1.93	11.65±4.51	13.33±4.34	13.33±4.34	8.89^{D}
Orange	0±0	0.56±0.96	1.11±0.92	2.13±2.54	2.78±2.86	1.32^{F}
Apricot	0 ±0	2.23±0.88	3.89±1.51	5±1.67	5±1.67	3.22^{E}
Control	0 ±0	0.56±0.96	1.11±0.92	1.11±0.92	1.11±0.92	0.78^{FG}
General Mean	2.06^{e}	6.75^{d}	13.17^{c}	17.21^{b}	19.17^{a}	11.67

Mean followed by the same letter in column and row are not significantly different according to L.S.D. test at 0.05 level of probability

Furthermore, the results of the attractant efficiency of certain fruit extracts recorded in Table (3) indicated that the mean percentage of six fruit extracts (Mango, Banana, Guava, Apricot, Melon and Orange) at (25%) concentration were (8.00, 5.92, 5.78, 4.71, 0.96 and 0.89%) respectively, compared with control (0.78%). The highest attraction influence occurred after the fifth day (6.88%) and the lowest period was (0.32%) on the first day.

Table 3. Attraction adults of fruit fly *Ceratitis capitata* to different fruit extracts at (25%) conc. under laboratory conditions.

Fruit extracts	Mean of periods (%) ± SD					General Mean
	After					
	1day	2days	3days	4days	5days	
Guava	1.11±0.92	1.67±1.54	5.56±0.96	10±4.41	10.56±3.72	5.78^{B}
Mango	0±0	3.33±2.89	7.78±3.47	14.45±2.55	14.45±2.55	8.00^{A}
Banana	1.11±1.92	2.12±2.58	4.35±3.85	11±3.46	11±3.46	5.92^{B}
Melon	0±0	0±0	1.11±0.92	1.67±1.54	2.01±1.61	0.96^{C}
Orange	0±0	1.11±0.92	1.11±0.92	1.11±0.92	1.11±0.92	0.89^{C}
Apricot	0±0	2.78±1.75	5.57±2.53	7.34±2.89	7.85±2.53	4.71^{B}
Control	0 ±0	0.56±0.96	1.11±0.92	1.11±0.92	1.11±0.92	0.78^{C}
General Mean	0.32^{d}	1.64^{c}	3.80^{b}	6.67^{a}	6.88^{a}	3.86

Mean followed by the same letter in column and row are not significantly different according to L.S.D. test at 0.05 level of probability

In general, Guava is the best at (5%) and (10%) concentrations while Mango was the highest attracted in (25%) concentrations. The fifth day was the best in attracting the adult medfly in the three concentrations (5%, 10% and 25%).

These results agree with the results of research by (Cornelius, Duan & Messing 2000) which reported that the *Bactrocera dorsalis* females were found to be more attracted to the aroma of mango, guava, or citrus fruit than that of carambola or papaya fruit. In another study, by (Wati, 2013) found that the combination of star fruit extract plus methyl eugenol was effective in trapping medfly fruit flies. In addition, the Female of medfly was not interested in the treatment with attractants of methyl eugenol without fruit juice, indicated by no female of medfly coming and being trapped. Also (Sodiq, *et al.*, 2015) showed that the female fruit flies were most attracted to guava juice.

Furthermore, the result is endorsed by the reports of (Satpathy and Rai, 2002) that the attraction of melon fruit fly was good in the bait combinations of overripe banana + acetic acid + carbofuran. Also, the fruit pulps of banana captured a greater number of *Bactrocera dorsalis* followed by guava was registered by (Rajpal, 2008). The fruit extracts of Grapefruit pulp + acetic acid + yeast + black jaggery is the second preferred attractant for medfly, the attractant nature of grape pulp was also strengthened by the experimental results (Bharathi, *et al*., 2004). In addition, the previous studies by (Sowmiya, *et al*., 2021) found that the attractant efficiency of natural extracts indicated that the fruit flies were attracted and trapped maximum in the food baits of banana fruit pulp + acetic acid + yeast + black jaggery.

2-Plant Oils:

These experiments evaluate the attractability of five plant oils included (Anise, Cloves, Cinnamon, Camphor and Flaxseed) at three concentrations (5, 10 and 25%) and period 5 days**,** for trapping fruit flies under laboratory conditions.

a.Plant Oil at (5%):

The percentage results in Table (4) revealed that plant oil can be arranged in descending according to attracted medfly as follows Cloves (10.25%), Cinnamon (8.13%) and Anise (7.61%). The fifth day was the best in attracted Medfly (6.96%). The statistical analyses define no Significant between Anise and Cinnamon oil. And no Significant between the fifth and fourth day to attracted adults.

Table 4. Attraction of fruit fly *Ceratitis capitata* to different plant oils at (5%) conc. under laboratory conditions.

plant oils	Mean of periods (%) ± SD					General Mean
	After					
	1day	2days	3days	4days	5days	
Anise	2.78 ±0.71	5.63±2.52	7.59 ±2.14	10.67±3.34	11.36±2.44	7.61^{B}
Cloves	1.67 ±1.54	7.58 ±0.96	11.11 ±1.92	14.36±2.75	16.54±1.72	10.25^{A}
Cinnamon	2.01±1.62	5.23 ±3.46	9.45 ±2.51	11.14±1.67	12.83±1.04	8.13^{B}
Camphor	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0.0^{C}
Flaxseed	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0.0^{C}
Control	0 ±0	0.56±0.96	1.11±0.92	1.11±0.92	1.11±0.92	0.78^{C}
General Mean	1.08^{d}	3.17^{c}	4.88^{b}	6.38^{a}	6.96^{a}	4.49

Mean followed by the same letter in column and row are not significantly different according to L.S.D. test at 0.05 level of probability.

b.Plant Oil at (10%):

The laboratory test revealed in Table (5) Mediterranean fruit flies have been shown to respond positively to Plant oil Cloves with (13.45%) followed by Anise (5.78%) and Cinnamon (4.58%). In contrast, there was no preference for Camphor and Flaxseed. The fifth day was highly in attracted the adults' Medfly. There was a significant between Cloves and both Anise and Cinnamon oil.

Table 5. Attraction of fruit fly *Ceratitis capitata* to different plant oils at (10%) conc. under laboratory conditions.

plant oils	Mean of periods (%) ± SD					General Mean
	After					
	1day	2days	3days	4days	5days	
Anise	0.56±0.97	2.78±2.55	7.23±1.92	8.89±2.56	9.45±4.81	5.78^{B}
Cloves	1.11± 0.92	9.45±2.71	16.13±5.86	19.43±5.09	21.11±4.19	13.45^{A}
Cinnamon	0 ±0	0.56±0.96	6.10±0.96	6.10±0.96	6.91±1.21	3.93^{B}
Camphor	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0.0^{C}
Flaxseed	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0.0^{C}
Control	0 ±0	0.56±0.96	1.11±0.92	1.11±0.92	1.11±0.92	0.78^{C}
General Mean	0.28^{c}	2.23^{b}	5.10^{a}	5.92^{a}	6.43^{a}	3.99

Mean followed by the same letter in column and row are not significantly different according to L.S.D. test at 0.05 level of probability

c-Plant Oil at (25%):

On the other hand, results presented in Table (6) showed that Anise oil application was found to be effective in the capturing of fruit flies with (2.67%) followed by Cloves (2.43 %) and reduced the catch efficiency of fruit flies with Cinnamon (1.51%). Also, there

was not any attractive effect for both Camphor and Flaxseed oil. The highest number of catches of fruit flies was recorded on the fifth day (6.60%). The statistical analyses define significance between Anise, Cloves and Cinnamon oil.

Table 6. Attraction of fruit fly *Ceratitis capitata* to different plant oils at (25%) conc. under laboratory conditions.

plant oils	Mean of periods (%) ± SD					General Mean
	After					
	1day	2days	3days	4days	5days	
Anise	0 ±0	0.56±0.97^{ab}	3.89±0.73^{a}	4.44±1.69^{a}	4.44±1.69^{a}	2.67 ^{A}
Cloves	0 ±0	2.23±2.54^{a}	2.77±2.81^{ab}	3.25±1.35^{ab}	3.89±1.92^{ab}	2.43 ^{A}
Cinnamon	0 ±0	0 ±0	2.01±1.63^{abc}	2.78±1.51^{bc}	2.78±1.51^{bc}	1.51 ^{B}
Camphor	0±0	0 ±0	0 ±0	0 ±0	0 ±0	0.0 ^{C}
Flaxseed	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0.0 ^{C}
Control	0 ±0	0.56±0.97^{ab}	1.11±0.92^{bc}	1.11±0.92^{c}	1.11±0.92^{c}	0.78^{C}
General Mean	0 ±0 ^{d}	2.23^{c}	5.28^{b}	6.11^{a}	6.60^{a}	4.10

Mean followed by the same letter in column and row are not significantly different according to L.S.D. test at 0.05 level of probability.

Generally, Cloves is the best at (5%) and (10%) concentrations while Anise was the highest attracted in (25%) concentration. The fifth day was the best in attracting the adult medfly in the three concentrations (5%, 10% and 25%).

These results agree with the results of (Tan, 2009) who found that flowers of many orchid species "*bactrocerophilous orchids*", selectively strongly attract *Bactrocera carambolae, Bactrocera dorsalis* and *Bactrocera umbrosa* fruit fly males by emitting fragrant chemicals consisting of either methyl eugenol (ME) or raspberry ketone (RK), for pollination.

Furthermore, the guava and star fruit orchards showed that the essential oils of *Melaleuca bracteata* and *Ocimum* sp. have good potential as fruit fly attractants for controlling, trapped a significantly greater number of medfly than did the distillation water and mash extracts of both plants (Agri and Hidayat, 2013)

Also, previous studies suggested that safflower oil, another edible vegetable oil, is active against fruit fly, (*Bactrocera tryoni* and *Queensl*) mainly by preventing the landing and creation of oviposition punctures (Hidayat, *et al.*, 2013, 2014). In addition, rapeseed oil application was also reported to protect cherry fruits from the creation of oviposition punctures by the European cherry fruit fly, (*Rhagoletis cerasi*) for up to 3 days (Daniel, 2014).

In addition, the laboratory study of (Hidayat, *et al.*, 2018**)** shows that the combination of artificial fruit and coconut oil significantly reduced the total of medfly attractant, eggs laid and fruit fly infestation to chilli fruits. The same results were also found in the treatments of artificial fruit by the application of synthetic insecticide deltamethrin.

Further study, found that significant effects for application of neem oil and coconut oil treatment to large red chili fruits on the average number of fruit flies *Bactrocera dorsalis* and *C. capitata* landings, infested fruits, and eggs laid. Their findings suggested that these particular oils may be effective for control of fruit flies' infestation, where the number of fruit flies landings on fruit in these two treatment groups averaged just 1: 4 landings in the control group. No significant difference in landings was observed on large red chili fruits that were treated with the other vegetable oil (candlenut oil, corn oil, soybean oil, and palm oil) formulations, compared to the control group (Hidayat, *et al*., 2018). Also, (coconut oil)

may be a viable alternative to non-edible neem oil. This is important because locally available oils are less expensive than neem oil. Reduced infestation in treated fruits could be the repellent effect of chemical compounds in the treatment (Yusup, *et al.*, 2018).

3-Evaluation Efficiency of Some Insecticides with Some Plant Extracts and Plant Oils for Attracted Medfly and Calculated the Mortality of Flies:

I-With Pyrithroied Fas Tac (5%) EC 4ml/L water.

a.The attraction of Medfly.

Fruit fly was caught by the extracts is presented in Table (7) were the three best fruit extracts were evaluating with synthetic insecticide pyrethroid (Fas. Tac. 5%) for attraction Medfly. The laboratory study revealed that the attractiveness power of Guava was (21.62%), Mango (13.32%) and Banana (4.46%). The highest reduction in fruit fly visits on fruit extracts was on the seventh day. The statistical analysis defines significance between fruit extracts Guava, Mango and Banana.

Table 7. Three fruit extracts (10%) + pyrothroied Fas Tac 5% EC 4ml/L water for attraction and Control fruit fly *Ceratitis capitata*.

Fruit extracts	Mean of periods (%) ± SD After							General Mean
	1day	2days	3days	4days	5days	6days	7days	
Guava	2.78±2.55	16.89±5.07	24.67±7.26^{a}	33.14±9.83	36.10±9.83	37.78±6.18	0±0	21.62^{A}
Mango	2.21±1.53	12.33±1.67	20.45±4.19	28.12±4.74	30.16±5.23	0±0	0±0	13.32^{B}
Banana	0.56±0.97	5.16±1.27	9.56±2.93	15.97±2.86	0±0	0±0	0±0	4.46^{C}
Control	1.11±0.92	3.22±0.94	3.84±1.69	4.68±1.85	0±0	0±0	0±0	1.84^{D}
General Mean	1.67^{e}	9.4^{d}	14.63^{c}	20.48^{a}	16.57^{b}	9.45^{d}	0^{e}	10.31

Mean followed by the same letter in column and row are not significantly different according to L.S.D. test at 0.05 level of probability

b.Mortality of Medfly.

On the other hand, the percentage of adults mortality of Medfly caused by the mixing fruit extracts with synthetic Fas Tac was (19.08%), (14.91%) and (4.95%) for Guava, Mango and Banana respectively. The highest mortality of adults Medfly was (16.99%) on the seventh day (Table 8).

Table 8. Three fruit extracts (10%) + pyrothroied Fas Tac 5% EC 4ml/L water for evaluated the mortality of fruit fly *Ceratitis capitata*.

Fruit extracts	Mean of periods (%) ± SD After							General Mean%
	1day	2days	3days	4days	5days	6days	7days	
Guava	1.11±1.92	7.33±1.64	11.79±2.58	18.86±4.92	25.59±5.08	31.11±5.52	37.78±6.18	19.08^{A}
Mango	0.56±0.97	5.14±1.86	8 ±3.33	13.05±2.63	21.44±4.67	26 ±4.40	30.16±5.23	14.91^{B}
Banana	0±0	2.53±1.96	5.67±1.66	10.48±2.54	15.97±2.86	0±0	0±0	4.95^{C}
Control	0.56±0.97	1.11±1.92	2.75±0.81	4.68±1.85	0±0	0±0	0±0	1.3^{D}
General Mean	0.56^{e}	4.03^{d}	7.05^{c}	11.77^{b}	15.75^{a}	14.28^{a}	16.99^{a}	10.06

Mean followed by the same letter in column and row are not significantly different according to L.S.D. test at 0.05 level of probability.

II-with adding the Second insecticide Imidacloprid 20% OD 100ml/100L water.

a.The attraction of Medfly.

Further study revealed in Table (9) shows that the general mean percentage of attracted flies could be arranged in descending order as follows: Guava (7.93%), Mango (7.20%) and Banana extracts (3.90%). The highest attracted medfly was (9. 87%) on the fourth day. However, there was no significant difference between Guava and Mango. But there was a significant between Mango and Banana.

Table 9. Attracatability percentage of medfly adult to fruit extracts + Imidacloprid 20% OD 100ml/100Lwater.

Fruit extracts	Mean of periods (%) ± SD After					General Mean
	1day	2days	3days	4days	5days	
Guava	1.11±1.92	4.44±1.86	8.31±4.52	12.23±4.19	13.58±3.72	7.93^{A}
Mango	1.68±1.52	5±1.73	11.45±2.58	17.86±5.09	0±0	7.20^{A}
Banana	0.56±0.97	2.71±1.92	6.80±4.41	9.43±5.12	0±0	3.90^{B}
Control	0±0	0±0	0.56±0.97	0±0	0±0	0.11^{C}
General Mean	0.84^{d}	3.08^{c}	6.79^{b}	9.87^{a}	3.40^{c}	4.79

Mean followed by the same letter in column and row are not significantly different according to L.S.D. test at 0.05 level of probability

b.Mortality of Medfly.

The statistical analysis is shown in Table (10) it is clear that the highest mortality of adults was with Mango extract (8.07%) and the lowest mortality was in the Banana (3%). With respect to time of exposure, the maximum rise of mortality was observed on the fifth day (7.86%). There was a significant difference between Mango and Guava. Also, there was a significant between Guava and Banana.

Table 10. Mortality of medfly resulted from exposure to fruit extracts + Imidacloprid 20% OD 100ml/100L water.

Fruit extracts	Mean of periods (%) ± SD After					General Mean
	1day	2days	3days	4days	5days	
Guava	0.56±0.97	1.68±1.53	5.56±2.38	9.25±2.43	13.58±3.72	6.13^{B}
Mango	0.56±0.97	2.57±1.48	7.44±0.96	11.94±2.56	17.86±5.09	8.07^{A}
Banana	0±0	0.56±0.97	4.98±2.79	9.46±5.12	0±0	3^{C}
Control	0±0	0±0	0.56±0.97	0±0	0±0	0.11^{D}
General Mean	0.28^{c}	1.20^{c}	4.64^{b}	7.66^{a}	7.86^{a}	4.33

Mean followed by the same letter are not significantly different according to L.S.D. test at 0.05 level of probability.

Furthermore, results in Table (11) found that the use of fruit extracts Guava, Mango and Banana extracts (10%) Without and with the presence of pesticides (Fas Tac and Imidacloprid) to attract and control adults of *C. capitata.* The statistical analyses by T-test distinct different significant between attract ability of Guava and Mango extract Without and with Presence of Imidacloprid pesticides. No significant difference between Without and with the presence of pesticides in bananas.

Table 11. comparative between General Mean% attracted of adult *C. capitata* to different fruit extracts after 5 days respectively, With and Without pesticides under laboratory conditions.

Extracts	General Mean%± SD attracted adults after 5 days		
	Without pesticide	With pesticide	
		Fas Tac	Imidacloprid
Guava	33.46^{A}	22. 72^{A}	7.93^{B}
Mango	23.71^{A}	18.65 ^{A}	7.20^{B}
Banana	10.34^{A}	6. 25^{A}	3.90^{A}

Mean followed by the same letter in row are not significantly different according to T- test at 0.05 level of probability

These results agree with the results of (Raga and Sato, 2011) they studied that the effects of imidacloprid against *Anastrepha fraterculus* (Wied) and *Ceratitis capitata* (Wied) were evaluated under broadcast spray in the laboratory. In general, they found when *A. fraterculus* and *C. capitata* were sprayed with insecticides, the time required for killing them was inversely proportional to the neonicotinoid concentrations. By cover spray, *A. fraterculus* were more susceptible to imidacloprid than *C. capitata*, In general, *A. fraterculus* and *C. capitata* adults died up to 7 days after application.

In addition, (Raga, *et al.*, 2018) were evaluated some insecticides under laboratory conditions. Five pairs of Fruit flies (Diptera: Tephritidae) *Anastrepha fraterculus* (Wied.) and *Anastrepha grandis* (Wied.) were placed into Petri dishes and exposed to insecticides (deltamethrin1.00 ppm, zeta-cypermethrin 0.35ppm, imidacloprid 2.10 ppm, and thiamethoxam 0.50 ppm) using a Potter spray tower. The number of insect deaths was monitored until 21 hours after spraying. In general, Different fruit fly mortalities were observed among the insecticide treatments beginning 30 minutes after exposure**,** insecticides caused similar mortalities 21 hours after treatment for both fruit fly species.

Conclusions

From the previously mentioned results, it could be concluded that fruit flies are preferred the odour and are more attracted to Guava extract which was the most effective lure attracted followed by Mango (5% and 10%), Mango extracts (25%) with renewing them every one week. But with respect to oils, Cloves oil (5% and 10%) which have good potential as fruit fly attractants for controlling it, which are major pests on fruit orchards, so diverted them away from fruit orchards, reduced fruit fly visits, eggs laid and infested fruits so fruits to be protected. Melon, Orange, Apricot extracts and Anise, Cinnamon, Camphor oils have low potential as fruit fly attractants. In contrast, Camphor and Flaxseed oils had a repellent effect on the fruit fly. So these results demonstrate the extracts which have good potential as fruit fly attractants can be used as "lure" for fruit fly and safe and cheaper alternatives to insecticide in monitoring *C. capitata* population. Also, it's clearer that the use of mixed fruit extracts with pesticide Fas Tac 5% increase in mortalities %, however, decrease in % of attracted adult of *C. capitata.* In addition, mix fruit extracts with the pesticide, Imidacloprid decreased the attracted effect of the fruit fly.

REFERENCES

Adjrah, Y. A., Dovlo , S.D. , Karou, K. , Eklu-Gadegbeku, A. , Agbonon, C. , de Souza, and Gbeassor, M. (2013). Survey of pesticide application on vegetables in the Littoral area of Togo. *The Annals of Agricultural and Environmental Medicine,* (20):715–720.

Agri, K. K. and Hidayat, P., (2013). Potency of *Melaleuca bracteata* and *Ocimum* sp. Leaf

Extracts as Fruit Fly (Bactrocera dorsalis complex) Attractants in Guava and Star Fruit Orchards in Bogor,West Java, Indonesia. *Journal of Developments in Sustainable Agriculture,* 8: 79-84

Beroza, M., Green,N. , Gertlfr,S .I., Steiner, L.F. and Miyashita, D.H., (1961) . Insect attractants new attractants for the Mediterranean fruit fly. *Journal of Agricultural and Food Chemistry,* 9:361-365.

Bharathi, T.E., Sathiyanandam, V.K., and David, P.M. (2004). Attractiveness of some food baits to the melon fruit fly, *Bactrocera cucurbitae* (Coquillett) (Diptera: *Tephritidae*). *International Journal of Tropical Insect Science,* 24(2):125-134.

Cornelius, M. L., Duan, J. J., & Messing, R. H. (2000). Volatile host fruit odors as attractants for the oriental fruit fly (Diptera:*Tephritidae*). Journal of Economic Entomology, 93, 93–100.

Daniel, C. (2014). Rhagoletis cerasi: Oviposition reduction effects of oil products. *Insects,* 5(2), 319–331.

Epsky, N.D., Hendrichs, J., Katsoyannos, B.I., Vasquez, L.A., Ros, J.P., Zümreoglu, A. *et al*. (1999). Field evaluation of female-targeted trapping systems for *Ceratitis capitata* (Diptera: Tephritidae) in seven countries. *Journal of Economic Entomology*,92(1):156-164.

Frey, J. E., Cortada, R. V. & Helbling, H., (1994). The potential of flower odours for use in population monitoring of western flower thrips Frankliniella occidentalis Pergande (Thysanoptera: *Thripidae*). *Biocontrol Science and Technology,* 4: 177-186.

Hagen, K. S., Allen,W. W. and Tasson, R. L. (1981). Mediterranean fruit fly: The worst is yet to come. *California Agriculture,* 55:5-7

Hanafy, A.H.A. (2000). Laboratory evaluation of some local food attractants and natural odour Mediterranean fruit fly *Ceratitis capitate* (Wied.). *Annals of* ***Agricultural*** *Sciences*,38(4):2517-2527

Hidayat, Y., Fauziaty, M. R. and Dono, D. (2018). The effectiveness of vegetable oil formulations in reducing oviposition of *Bactrocera dorsalis* Hendel (Diptera: *Tephritidae*) in large red chili fruits. *Indonesian Journal of Entomology,* Vol. 15 No. 2, 93–100

Hidayat, Y., Ferera, R. F., Ramadhan, A. F., Kurniawan, W., Yulia , E. and Rasiska, S. (2018). Combination of edible vegetable oil and artificial fruit to reduce *Bactrocera dorsalis* oviposition in chilli fruits. *Journal of Applied Entomology,* 143:69–76.

Hidayat, Y., Heather, N., & Hassan, E. (2013). Repellency and oviposition deterrence effects of plant essential and vegetable oils against female Queensland fruit fly *Bactrocera tryoni* (Froggatt) (Diptera:*Tephritidae*). *Australian Journal of Entomology,* 52(4), 379–386.

Hidayat, Y., Heather, N., & Hassan, E. (2014). Mechanism and effectiveness of safflower oil against female *Queensl*and fruit fly *Bactrocera tryoni*. *Entomologia Experimentalis Et Applicata,* 152(3), 175–181.

Khan, S., Shah, M. M., Ahmad, R. and Haq, I. U. (2016). The insecticidal potential of botanical extracts for management of Peach fruit fly, *Bactrocera zonata* Saunders, 1842 (Diptera: *Tephritidae*). *Turkish Journal of Entomology*,40 (4): 445-453.

Liquido, N.J., Shinoda, L.A. and Cunningham, R.T. (1991). Host plant of the Mediterranean fruit fly (Diptera: *Tephretidae*). *Entomological Society of America,* 77:1-52.

Mbatchou, V.C., Ayebila, A. J. and Apea, O.B. (2011). Antibacterial activity of phytochemicals from *Acacia nilotica*, *Entadaafricana* and *Mimosa pigra* L. on Salmonella typhi. *Journal of Animal & Plant Sciences,* 10(1): 1248-1258.

Metcalf, R.L., (1990). Chemical ecology of Dacinae fruit flies (Diptera: Tephritidae). *Annals of the Entomological Society of America*;83(6):1017-1030.

Ndlela, S., Mohamed, S., Ndegwa, P.N., OngAmo, G.O. and Ekesi, S.(2016). Male annihilation technique using methyl eugenol for field suppression of *Bactrocera dorsalis* (Hendel) (Diptera: *Tephritidae*) on mango in Kenya. *African Entomology,* 24(2), 437–447.

Nikpay, A. (2007). Insecticidal efficacy of three vegetable oils as postharvest grain protectants of stored wheat against *Rhyzopertha dominica* (F.) (Coleoptera: Bostrychidae). *Insect Science,* 14(2), 145–150.

Pow, E. M., Bennison, J. A., Birkett, M. A., Lesniak, M. 1., Manjunata, M., Pickett, P.A., Segers, L.S., Wadhams, L.J., Wardlow, L.R., & Woodcock, c. M., (1998). Behavioural responses of western flower thrips (Frankliniella occidentalis) to host plant volatiles. *Proceedings ofthe 6'h International Symposium on Thysanoptera, Akdeniz University, Antalya, Turkey* (in press).

Raga, A. and Sato, M.E., (2011). Toxicity of neonicotinoids to *ceratitis capitata* and *anastrepha* fraterculus (diptera: tephritidae). *journal of plant protection research,* Vol. 51, No. 4

Raga, A., Tambones, L., Galdino, Braga, S., Silva, Berton, F., Baldo and Sato, M.E., (2018). Comparison of Insecticide Toxicity in Adults of the Fruit Flies *Anastrepha fraterculus* (Wied.) and *Anastrepha grandis* (Macquart) (Tephritidae). *Journal of Experimental Agriculture International,* 25(2): 1-8,

Rajpal, S. (2008). Studies on varietal susceptibility of oriental fruit fly, *Bactrocera dorsalis* (Hendel) on guava and its attraction to different poison baits. *Asian Journal of Bio Science,*3(2):330-332.

Satpathy, S. and Rai, S. (2002). Luring ability of indigenous food baits for fruit fly, *Bactrocera cucurbitae* (Coq.). *Journal of Entomological Research*, 26(3):249-252.

Shahabuddin (2011). Efektivitas ekstrak daun selasih (*Ocimum* sp.) dan daun wangi (*Melaleuca bracteata* L.) sebagai atraktan lalat buah pada tanaman cabai. *Jurnal Agroland*, (18): 201-206.

Sodiq, M., Sudarmadji and Sutoyo, (2015). Efektifitas atraktan terhadap lalat buah belimbing di Jawa Timur *Agrotop, 5* 71-79.

Sowmiya, L., Chandrasekaran, M. and Soundararajan, R.P. (2021). Evaluation of cost-effective natural attractants for fruit fly in snake gourd ecosystem. *Journal of Pharmacognosy and Phytochemistry*, Sp 10(2): 151-156

Steel, R.G.D. and Torrie, J.H. (1980). Principles and procedures of statistics. Auckland Hill Book Co., Inc., London.N.Y.

Tan, K.H. (2009). Fruit fly pests as pollinators of wild orchids. Orchid Digest 73: 180-187.

Vargas, R. I., Mau, R. F. L., Jang, E.B., Faust, R.M., and Wong, L., (2008). The Hawaii Fruit Fly Area wide Pest Management Programme (US Department of Agricultural Research Service-University of Nebraska, Lincoln).

Wati, R. (2013). Pengaruh Kombinasi Petrogenol dan Ekstrak Belimbing (*Averrhoa carambola* L.) terhadap Perilaku Makan Lalat Buah (*Bactrocera dorsalis* Hend.) (Undergraduate Thesis) Universitas Negeri Padang-Padang.

Yusup, H. Muthia, R. F. Danar, D. (2018). The effectiveness of vegetable oil formulations in reducing oviposition of Bactrocera dorsalis Hendel (Diptera:*Tephritidae*) in large red chili fruits. *Jurnal Entomologi Indonesia,*Vol. 15 No. 2, 93–100.

ARABIC SUMMARY

تقيم بعض مستخلصات الفاكهة والزيوت لجذب ذبابة ثمار الفاكهة بواسطة التصميم البسيط لجهاز قياس الرائحة تحت الظروف المعملية

ماهيناز عبد العزيز احمد جاب الله

قسم بحوث ذبابة الفاكهة، معهد بحوث وقاية النبات، مركز البحوث الزراعية، وزارة الزراعة - الصباحية، الإسكندرية

ذبابة ثمار الفاكهة متعددة العوائل تسبب اضرارلمدى واسع من الفواكة والخضروات. أصبحت الجاذبات والمصائد متاحة مؤخرًا لرصد ذبابة الفاكهة و قد تم فى هذة الدراسة تقييم ستة مستخلصات فاكهة (جوافة– مانجو – موز – شمام – برتقال – مشمش) و خمسة زيوت نباتية (ينسون – قرنفل – قرفة –كافور –زيت بذرة الكتان) بتركيز (5 – 10 – 25%) قيمت تجاه الحشرة الكاملة للذبابة بأستخدام التصميم البسيط لجهاز قياس الرائحة تحت الظروف المعملية.

كانت مستخلصات الجوافة والمانجو والموز الأعلى جذبًا للحشرة الكاملة للذبابة عند تركيزات (5 و10 و 25٪) كان أفضل يوم لجذب الذباب هو اليوم الخامس. اما بالنسبة للزيوت النباتية، كانت زيوت القرنفل والقرفة واليانسون (10.25٪ ، 8.13٪ ، 7.61٪) هى الافضل لجذب الذبابة عند تركيز (5٪) ، بينما كانت زيوت القرنفل واليانسون والقرفة (13.45٪ ، 5.78٪ ، 3.93٪) هى الاعلى فى الجذب للذبابة عند تركيز (10٪). اما تركيز (25٪) كان أقل كفاءة فى جذب ذبابة الفاكهه (2.67٪، 2.43٪، 1.51٪) وذلك لزيوت اليانسون والقرنفل والقرفة على التوالي. زيوت الكافور وبذور الكتان كان لها تأثير طارد. اليوم الخامس كان ايضا الاكثر لجذب ذبابة الفاكهه.

كذلك تم تقييم مستخلصات (الجوافة والمانجو والموز) الاكثر جذب لذبابة الفاكهه بعد اضافة اثنين من المبيدات الحشرية (بيروثرويد أو إيميداكلوبريد) بشكل منفصل إلى مستخلصات الفاكهة ثم حساب النسبة المئوية للجذب والموت للذبابة. أظهرت نتائج هذه الدراسة أن مستخلص الجوافة كان الأفضل لجذب الذبابة (21.62٪) بينما كانت نسبة الموت (19.08٪) مع إضافة البيروثرويد (Fas Tac 5% EC). بينما عند إضافة إميداكلوبريد انخفضت نسبة جذب الذبابة، كانت (7.93٪) بالنسبة لمستخلص الجوافة. النسبة الاعلى لمتوسط موت الذبابة كانت مع مستخلص المانجو واميداكلوبريد (8.07٪). كما تشير نتائج الدراسة إلى أن مستخلصات الفاكهة يمكن أن تكون أداة فعالة في برامج المكافحة المتكاملة لذباب الفاكهة.