List of Contents

List of Tables

List of Figures

LIST OF ABREVIATIONS

Abbreviations	Title
MFF	**Mediterranean fruit fly**
PFF	**Peach fruit fly**
C. capitata	***Ceratitis capitata***
B. zonata	***Bactrocera zonata***
ME	**Methyl eugenol**
TML	**Trimedlure**
Att.	**attraction**
Rep.	**repellency**
Neu.	**neutral**
Conc.	**Concentration**
Red.	**Reduction**

SUMMARY

1- Calibration of Olfactometer

The glass units of innovated olfactometer were calibrated under laboratory conditions to test or screen several substances as attractants or repellents for the two species of fruit flies; the Mediterranean fruit fly (*Ceratitis capitata*), (Wied.) and the peach fruit fly, (*Bactrocera zonata*) (Saund.).

2- Laboratory Experiments

Evaluation response of fruit flies to some chemical and natural substances in the laboratory using the olfactometer,

The statistical analysis of the results showed the olfactory response of both males and females of the Mediterranean fruit fly *Cerititis capitata* and the *Bacterocera zonata* to attraction or repellency to the following substances:

- Some chemical compounds like Buminal, Agrinal, Ammonium sulfate, Diammonium phosphate, Ammonium acetate, Ammonium chloride, Ammonium carbonate, Ammonium hydrogen orthophosphate, Nu-lure, Amadine, Conserve, and Paraffin oil.

- ❖ Some natural compounds include either medicinal and ornamental plant oils, which are the garlic oil, camphor oil, cloves oil, red pepper extract, thyme oil, ginger oil, cinnamon oil, watercress oil, onion oil, parsley oil, basil oil, fennel oil, caraway oil, mint oil or fruit oils, it is peach oil, orange oil, citronella oil, roses oil, jojoba oil, lemon oil, lavender oil, apricot oil.

By using the olfactometers under laboratory conditions:

First, for the chemical compounds, the results showed significant differences between the mean numbers of males and females of the Mediterranean fruit fly and the peach fruit fly for attraction or repellency to the tested substances or different concentrations, and they recorded an attraction rate at 1% concentration for males or females. There were no significant differences between the average numbers of MFF with the different ammonium compounds. The Buminal showed the highest attraction rate 93.4% and followed by ammonium chloride, ammonium carbonate, ammonium hydrogen orthophosphate and amadin, each giving 80%, then di ammonium phosphate with an attraction of 73.4% and ammonium acetate by 66.6%.

Increase or decrease concentration of 1% caused relative decrease in the proportion of attraction. There was no recorded repellency rate at the same concentration of 1% except for Agrinal and ammonium sulphate, which recorded a repellency rate of 14.4% and 33.4%, respectively. The highest repellency rate recorded for ammonium acetate and ammonium phosphate was (66.6%) at a concentration of 4%. Females showed the same response rate for all tested compounds at a concentration of 1%, with the exception of Nu-lure and ammonium sulphate, which showed the highest response at 2% and 4% concentration, respectively.

- For peach fruit fly, the concentration showed 1% the highest attracting males without any significant differences between the tested compounds. The highest attraction % recorded by ammonium acetate and amadine was (80%). There was also no repellency effect for all tested substances of at a concentration of 1% except ammonium sulphate, which caused a repellency rate of 33.4%. The highest female attractiveness was also recorded at 1% concentration with the exception of ammonium sulphate and nu-lure which produced 20% repellency rates.

Second: Medicinal and ornamental Plant Oils:

For male Mediterranean fruit fly, garlic oil, camphor oil and cinnamon oil showed no effect on male attraction (0%). Garlic and camphor used at oils different concentrations showed repellent effects ranged from 40 to 73 and 27-60%, respectively. Cinnamon oil showed the least repellent effect at different concentrations ranging from 20-27%. The most attractive effect on males with clove oil (93%) was recorded at two concentrations 25 and 12.5%. The effect of attraction decreased due to decreased or increased concentration. Other tested oils were not sufficiently effective and showed no significant effect on males as attractant or repellent. As for females, the results also show that garlic, camphor and cinnamon oil had no effect on attracting females. Red pepper showed a moderate attraction effect of 33-47% between different tested concentrations. The remaining tested oils had no significant effect. Garlic oil showed a high repellent effect (93 and 80%) when used with concentrations of 100% and 25%, respectively. Other tested oils were not effective. Camphor oil has a repellent effect ranging from 27-67% without significant differences between test concentrations. Ginger oil showed a significant repellent effect (53%) when used

in two concentrations of 100% and 50%. Other tested oils were not effective enough and showed no significant effects on females.

As for the peach fly, the results also showed that garlic oil, camphor oil and cinnamon oil had no effect on attracting males. Clove oil showed an attractive effect (87 and 73%) when used in two concentrations 25 and 12.5%, respectively. Red pepper extract, thyme oil, ginger oil and watercress oil showed moderate attraction effects between different tested concentrations ranged from 13-47%. The rest of the tested oils had no significant effect. The results also showed that red pepper extract had an attractive effect of 53% when used in two concentrations of 100 and 25%, while other concentrations 50, 12.5.6.25 and 3% caused 40, 47, 33 and 27% attraction respectively. Repellency rates recorded by other tested oils did not exceed 27% in all tested concentrations. Garlic oil showed a repellent effect of 73% at 50% and 25% concentration, while other concentrations lower or higher caused less effect. In addition, non-significant repellency effects were observed among all tested concentrations of camphor oil, which ranged from 40-60%. The repellency effect of the other tested oils did not exceed all tested concentrations of 27%.

Third, some fruit oils:

Peach oil showed an attractive effect on fruit fly males. This effect was decrease by decrease of oil concentration, were the reduced the concentration of oil used and the highest effect of attraction (80%) were recorded at 6.25% concentration, while the oil did not show any repellency effect. The effect of attracting orange oil increased as the concentration increased and reached the highest attractiveness (67%) at a concentration of 12.25%. Citronella oil showed an effect of attraction of 6.26%, 33% at the two low concentrations 6.25% and 3%, respectively. Lavender oil also showed different attraction ratios when used at low concentrations. For fruit fly females, the tested oils showed no attractive effect. Citronella oil showed a repellency rate of 87% when used at 100% concentration. The effect decreased with the reduction concentration retching to 33% at 3% at concentration. Rose oil showed the highest effect of repellency of 67% when used at 100% concentration. Lavender oil has the most recent repellency effect of 60% at 100% concentration. Apricot oil also showed some repellent effects that vary with the concentration variation used.

For Peach fruit fly, peach oil and orange oil when used with a concentration of 6.25% for attraction for males by 73 and 60%, respectively. Lemon oil was attractive to males at concentrations of 50, 12.5%. Citronella oil produced the highest repellency rate of 80-100% when used at 100% and 50% respectively. Apricot oil and rose oil when used at 100% concentration resulted in a 53% repellency rate. Also lavender oil showed no attractive effect. High concentrations of apricot oil did not show attraction effects, whereas low concentrations showed varying repellency rates ranged between 13-27%. For females, vegetable oils tested at different concentrations showed no noticeable attraction effects. Citronella oil showed the highest repellency rate of 80% when used at 50% concentration. The rose oil induced 67% when used at 100% concentration, while lavender oil using the same concentration produced a 60% repellency rate.

3- Field Experiments

3.1- Attractability of certain substances for fruit flies

Buminal and Ammonium compounds showed the highest attracted average number of both species that significantly varied with those investigated for trimedlure

(in case of *C. capitata*) or methyl eugenol (in case of *B. zonata*). The average numbers of fruit flies (the two species of *C. capitata* and *B. zonata*) attracted to traps baited with garlic oil was nil. This means that garlic oil may be had a repellent action against fruit flies. *B. zonata* males and females as well as *C. capitata* females showed no response to all the tested oils. Irrespective of the used compounds, the average numbers of attracted individuals of the Med-fly gradually increased throughout the period of investigation (12 weeks). But, in case of the peach fruit fly a gradual increment was observed during the first 8 weeks. After that, a sharp decrement of attracted individuals was occurred throughout the latest four weeks. On the other hand, females of both the Mediterranean and peach fruit flies were more attracted to the tested compounds than males of the two species. Also, the highest concentration, the highest average numbers of attracted individuals.

3.2- Repellency of natural oils to fruit flies throughout premature fruiting period of Valencia orange

All used natural oils insignificantly attracted different average numbers of both the Mediterranean and peach fruit flies which significantly varied with those attracted to

Buminal. Garlic oil at 50% attracted the lowest average number of both *C. capitata* and *B. zonata*. Generally, the average number of captured flies of the two species of fruit flies gradually increased with the increase of time.

3.3- Efficiency of natural oils as repellents for fruit flies in mature fruiting period of Valencia orange

The two tested natural oils (Garlic at 50% and Citronella at 25%) significantly showed ahighy repellent action against the two species of fruit flies (*C. capitata* and *B. zonata*) where the average numbers of captured flies in traps surrounded by natural oils were much lower than that of control. Garlic oil at 50% was insignificantly much more effective as repellent compound for fruit flies than Citronella oil at 25%. The captured flies of the Med fly gradually increased with time during the first seven weeks, but in case of the peach fruit fly, sharply increment in attracted individuals took place throughout the first four weeks.

3.4- Effect of garlic and citronella oils on fruit infestation

The dropping and non-dropping fruits insignificantly varied according to treatment. Also, the same trend was observed

for both dropping and non-dropping fruits which was insignificantly differed during the three weeks of investigation. But, the infestation level of fruits was significantly differed showing low level of infestation in both dropping and non-dropping fruits. Both two tested compounds significantly reduced infestation level of fruits. The difference in infestation level between Garlic and Citronella oils was insignificant. On the other hand the infestation level of Valencia orange was insignificantly differed according to the three weeks of the investigation.