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Toxicity of certain plant oils on pupil stage of the peach fruit fly, *B. zonata* (sunders) (*tephritidae*: diptera)

Abstract

The Peach fruit fly, *Bactrocera zonata* (sunders) is known as the most serious fruit insect pest, this work carried out to test the toxicity of ten essential oils against one day old pupa of this pest by using 4 concentrations for each oil. Results revealed that eucalyptus oils was the most toxicity oil against *B. zonata* pupa with low LC_{50} value of 38.88ml/L followed by Basil oils followed by Onion, peppermint, ginger, garlic, water crass, clove, castor and mustard with LC_{50} value 39.704, 50.459, 69.205,78.418, 83.172, 98.0 ,101.293, 107.662 and 238.99ml/L, respectively. On the other hand mustard oils were the least toxic against *B. zonata* pupa with LC_{50} value of 238.99ml/L.

Keywords: peach fruit fly, *bactrocera zonata*, essential oils, flies control

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Introduction

The Peach fruit fly, *Bactrocera zonata* (sunders) is known as the most serious insect pest of tropical and subtropical fruits.[1] It is a polyphagous insect, where it has been recorded on over 50 cultivated and wild plant species.

Currently, *B. zonata* had wide spread in Egypt ,where it was recorded in different locations such as Alexandria,[2] Kalubia,[3] El-Beheira,[4] the whole Nile Delta region, Nile Valley and Kharga and Dakla oases, North Sinai Governorate (North-East) Governorates[5] and Qena governorate.[6] The world is heading now towards the use of materials and alternatives to safe and more environmentally friendly. Essential oils are one of the most promised materials in pest control where it is volatile, natural, complex compound mixtures characterized by a strong odor. it produced from several plant parts like leaves , stems and seeds. The oils are generally composed of complex mixtures of monoterpenes, biogenetically related phenols, and terpenes. Examples include 1, 8-cineole, the major constituent of oils from eucalyptus (*Eucalyptus globus*); eugenol from clove oil (*Syzygium aromaticum* and menthol from various species of mint (Mentha species). The aim of this work is determining the effect of ten natural plant oils against one day old pupae of *B. zonata*.

Materials and methods

The present study was carried out to determine the efficiency of 10 essential oils against the pupa of *B. zonata* (Table 1). Selected oils were mixed with water using Tween 80 and prepared in four concentrations (25, 50, 75 and100%). Four ml of each oil was added to 25gm of sandy soil in petri dishes, and then thirty 1st day old pupae were added to each petri dish. Three replicates (Petri dish) were used for each concentration. The pupal mortality was recorded and the LC_{50} was calculated using Ldp line program.[7]

Table 1 The tasted oils and their main components

No	English name	Scientific name	Main component	References
1.	Onion	*Allium cepa*	Quercetin-3-lucoside, isorhamnetin-4-glucoside, xylose.	Chauhan et al.,[16]
2.	Garlic	*Allium sativum*	Aliin, allicin, ajoene, allylpropl.	Niroumand et al.,[17]
3.	Clove	*Syzygium aromaticum*	Methyl amyl ketone, methyl salicylate.	Arancibia et al.,[18]
4.	Peppermint	*Mentha piperita*	Piperine, chavicine.	Choi et al.,[14]
5.	Basil	*Ocimum basilicum*	Estragole anetholelinalool	Deshpande & Tipnis[12]
6.	Castor	*Ricinus communis*	Ricinoleic acid, Oleic acid, Linoleic.	El-Defrawi et al.,[19]
7.	Eucalyptus	*Eucalyptus obliqua*	Alpha pinene, beta pinen - alpha Phellandrene.	Lucia et al.,[9]
8.	Watercress	*Nasturtium officinale*	Sulforaphane, Di Indolyl methane	Nakahara et al.,[20]
9.	Ginger	*Zingiber officinale*	Gingerols	White[21]
10.	Mustard	*Sinapis alba*	Erucic acid, oleic acid.	Sousa et al.,[15]

Results

Table 2 & Figure 1 represented the relative toxicity of the toxic selected oil against the one-day-old pupa of *B. zonata*. Results revealed that eucalyptus oils has the highest toxicity against *B. zonata* pupa with low LC_{50} value of 38.88ml/L. On the other hand mustard oils was the least toxic against *B. zonata* pupa with LC_{50} value of 238.99ml/Lathe toxicity of Basil oils come in the second rate followed by Onion, peppermint, ginger, garlic, water crass, clove, castor and mustard with LC_{50} value 39.704, 50.459, 69.205 ,78.418, 83.172, 98.0 ,101.293, 107.662 and 238.99ml/L, respectively. When comparing the fiducially limits and their overlapping with each other's, it was obvious that the confidence limits are overlapped among Eucalypts, Basil and Onion, also there are overlapped among Peppermint ,Ginger, Garlic

oils in addition to the over lapping among water crass and both Clove and Castor oils, but not overlapped with Mustard oils and others oils. Thus, we can say there is no significant difference among the LC_{50} values of Eucalypts, Basil and Onion oils, but they are significantly different between the LC_{50} of values Eucalypts, Basil and Onion from side and Mustard oil.

Table 2 LC_{50} and its confidence limits values of LCP line for 10 plant oils tested against 1-aday old pupa of *B. zonata* after 6days

No	Plant oils	LC_{50}ml/L	Fiducially limit		Slope
			Lower	Upper	
1	eucalyptus	38.88[a]	33.089	44.137	2.719
2	Basil	39.704[a]	33.633	45.229	2.598
3	Onion	50.459[a]	44.016	57.1	2.568
4	Peppermint	69.205[b]	62.376	77.745	3.153
5	Ginger	78.418[b]	69.901	90.557	2.931
6	Garlic	83.172[b]	72.29	100.847	2.430
7	Water crass	98.0[c]	85.158	120.708	2.820
8	Clove	101.293[c]	87.158	127.475	2.702
9	Castor	107.662[c]	90.094	144.21	2.358
10	Mustard	238.99[d]	146.523	969.196	1.493

Index compared with eucalyptus *=ml/L based on A.I
(a)= confidence limits that not overlapping means that there is a significant difference between the corresponding LC_{50} values

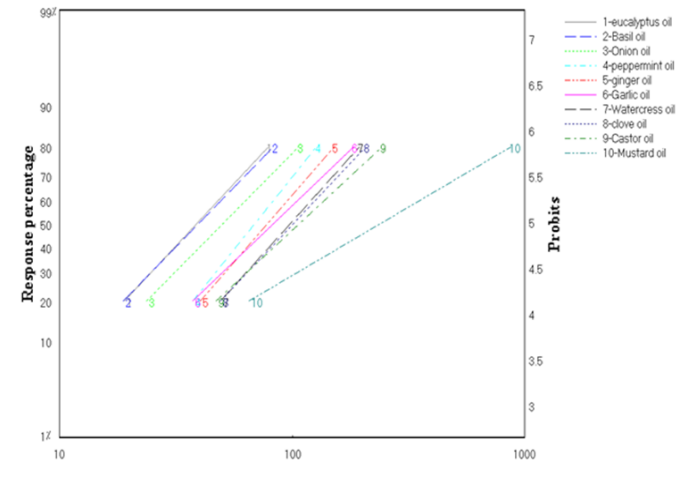

Figure 1 Toxicity of certain oils as surface contact against the one-day-old pupa of *B. zonata.*

Discussion

The present study revealed the current activity of essential oils where eucalyptus oils was the highest toxicity against *B. zonata* pupa followed by Basil, Onion, and peppermint oils, These results are in agreement with those reported by many investigators. Hummel et al.,[8] who reported that *Eucalyptus globule* is among the most active constituents against insects. Lucia et al.,[9] reported that essential oil from *E. globules* is toxic against *Aides aegypti* larvae and showed LC_{50} of 32.4ppm. Hidayat and Yusup[10] reported that *Eucalyptus dives* (Myrtales: *Myrtaceae*) oil showed a strong fumigant effect on the first and second instars of Queensland fruit fly *Bactrocera tryoni* (Froggatt). Palacios et al.,[11] evaluated 12 essential oils (EOs) insecticidal activity against the house fly *Musca domestica*. EO from *Eucalyptus cinerea* was the third most potent insecticide, with LC_{50} value (=5.5mg/dm^3). Deshpande and Tipnis[12] reported that *Ocimum basilicum* (Lamiaceae) essential oils showed insecticidal activity against *Sitophilus oryzae* (Coleoptera: Curculionidae), *Stegobium paniceum* (*Coleoptera*: Anobiidae), *Tribolium castaneum* (Coleoptera: Tenebrionidae) and *Bruchus chinensis* (*Coleoptera*: *Bruchidae*). Chang et al.,[13] reported that Basil oil and its three major active constituents (trans-anethole, estragole, and linalool) obtained from basil *(Oscimum basilicum L.)* were significantly toxicity against *C. capitata, B. cucurbitae and B. dorsalis.* Choi et al.,[14] tested for peppermint oils its insecticidal activities against eggs, nymphs, and adults of *Trialeurodes vaporariorum*, he reported that peppermint oils was highly effective against *T. vaporariorum* adults, nymphs, and eggs where it gave high mortality.

Sousa et al.,[15] evaluated the relative toxicity of the mustard essential oil (MEO) vapors of wild mustard (*Brassica rapa* L.) to young and old larvae, pupae and adults of *Sitophilus zeamais* Motschulsky and *Callosobruchus maculatus* (F). They reported that the different developmental stages of both species differed significantly in their response to MEO, but the adults being much more susceptible than the immature stages.

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None.

Conflict of interest

Author declares that there is no conflict of interest.

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