



## TOXIC EFFECTS OF SOME PLANT OILS AGAINST ADULTS OF SITOPHILUS GRANARIES (COLEOPTERA: CURCULIONIDAE) AND RHIZOPERTHA DOMINICA (COLEOPTERA: BOSTRICHIDAE)

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**ABSTRACT:** Background: The infestation of seeds by insects and their negative effects on food production, is a challenge due to the reduction on seedling performance and the quality of the final product. Damage caused by insect feeding on seeds may reduce nutrients, viability, weight and expose them to pathogens. Methods: seven plant oils used in this experiment to find out the extent of their use as alternatives to pesticides against *S. granarius*, *R. dominica*, the oils used in the experiment are basil oil (*Ocimum basilicum*), anise oil (*Pimpinella anisum*), flaxseed oil (*Linum usitatissimum*), cumin oil (*Cuminum cyminum*), Clove oil (*Syzygium aromaticum*), Peppermint oil (*Mentha piperita*), Cinnamon oil (*Cinnamomum verum*). three concentrations (0.5, 1, 2 ml / 50 gm of Wheat) were examined of every oil. the effective of these oils in reducing the insect population was studied. three replicates were used for each concentration and each replicate contained ten insects, in addition to the control treatment (no oil application). Results :Seven essential plant oils were evaluated: Basil oil, star anise oil, flaxseed oil, cumin oil, clove oil, peppermint oil, and cinnamon oil, against the coleopteran *S. granarius* and *R. dominica*. Results showed that, death rate increases by the concentration and the exposure duration increase, As the fatal toxicity of cinnamon oil in the rate of 100% against *R. dominica*, and *S. granarius* at Concentration 2 ml, death rate 100% after 48 hours against *R. dominica*, and after 72 hours against *S. granarius*, . Clove oil death rate recorded 100% against *R. dominica* at the Concentration 1, 2 mL after 72 hours of treatment, while Clove oil recorded death rate 100% at Concentration 2 ml against *S. granarius* after 72 hours of treatment, flax seed oil death rate recorded 100% against *R. dominica* after 72 hours of exposure at Concentration 2 mL, while death rate recorded %83.3 against *S. granarius* at the same Concentration and same exposure time. Conclusion: and find that insect *R. dominica* She was more sensitive of insect *S. granarius* when treated All plant oils tested Except for cumin oil and basil oil.

**Key words:** Plant oil, *Rhyzopertha dominica*, *Sitophilus granarius*, Stored insect.

### INTRODUCTION

Wan and Lu (2010) found that, the extracts of *Ailanthus altissima* has a lethal effect against four major insects that infect stored grains by touching and fumigation. Denloye (2010) reported that, the bio-activity of a powder and some of the aromatic oil extracts of the garlic and onion plant. They act to protect the grains

and reduce the damage of *C. maculatus*. Ashouri and shayesteh (2010) found that, Black pepper powder and red pepper have a significant effect on reducing insect populations of *S. oryzae* and *R. dominica*, Powders reduced the numbers of offspring produced after 50 days of treatment. Ahmed (2010) studied Seven Essential Oil toxicity against *C. maculatus* and *S. oryzae* and found that, the tested oils play a significant role

in reducing the number of tested insects. The death rate increases as the concentration of oil increases and the exposure period increases for all tested oils. **Cruz *et al.* (2019)** reported that, the leaf extract of *Porophyllum linaria* is effective in reducing the number of maize insects. **Yang *et al.* (2020)** studied 28 Essential oils and concluded that, all studied oils were effective in against the maize weevil. he also showed that, the essential oil extracts of *Lantana camara* is effective in reducing the activity and abundance of *S. oryzae*.

**Wei *et al.* (2018)** reported that, the extract of *Bupleurum bicaule* is effective against two stored grain insects, And that the greater the concentration and the greater the exposure time, the greater the death rate in the treated insects.

Several studies have demonstrated the use of Essential oil and plant extracts Their high efficiency in reducing the number of insects infecting stored grain (**Salim *et al.*, 2019; Luke 2018; Russo *et al.*, 2015; Jide-Ojo *et al.*, 2013 and Trivedi *et al.*, 2018).**

The aim of the study was to find alternative pesticide substances of plant origin capable of killing an insect insects stored, To be used on stored grains without any harm or damage to human beings or animal or environment.

## MATERIAL AND METHODS

### Essential oil

seven plant oils used in this experiment to find out the extent of their use as alternatives to pesticides against *S. granarius*, *R. dominica*, the oils used in the experiment are basil oil (*Ocimum basilicum*), anise oil) *Pimpinella anisum* , flaxseed oil (*Linum usitatissimum*) cumin oil (*Cuminum cyminum*), Clove oil (*Syzygium aromaticum*), Peppermint oil (*Mentha piperita*), Cinnamon oil (*Cinnamomum verum*). three concentrations were studied of every oil. the effective of these oils in reducing the insect population was studied. Concentration of 0.5, 1,2 ml / 50 gm of Wheat, three replicates were used for each concentration and each replicate contained ten insects, in addition to the control treatment (no oil application).

### Insect cultures

*R. dominica* and, *S. granarius*, were collected from infected wheat grains in a grocery store in Bani Walid, city Libya, where insects were bred and the experiment was conducted on healthy wheat grains, at a temperature  $28 \pm 2$ , and relative humidity  $75 \pm 5\%$ .

### Bioassay

The tested plant oils were used in the experiment against *R. dominica* and *S. granarius* using concentrations 0.5, 1, 2 ml/ 50gm Wheat grains, large capacity glassware 200 ml is used. After exposing, the insects used in the experiment, data were recorded for all concentrations against adults. the efficiency of these oils on reducing the number of the insects was recorded, the results were recorded in specific intervals for all concentrations 24, 48, 72 hours, the recording of dead adult's numbers was completed 72 hours after the start of the experiment for all oils and compared to the control.

## RESULTS AND DISCUSSION

All vegetable oils showed an efficiency in reducing the number of warehouse insects exposed to aromatic plant oils in this experiment.

Results shown in Table (1), cleared that, treatment of plant oils against an insects *S. granarius*, and *R. dominica*.

Whereas, cinnamon oil was more efficient than other tested vegetable oils, where he gave a death rate 100% against insect *R. dominica* Within 48 hours of the treatment, it gave a death rate 100% against insect *S. granarius* after 72 hours of the treatment at concentration 2ml/50gm, and this is consistent with many previous results that showed that vegetable oils have a high ability to reduce the number of warehouse insects, (**Kareem *et al.*, 2012, Nadi, 2021**).

Cinnamon oil is followed by clove oil, which gives a death rate 100 against *R. dominica*, and *S. granarius* at concentration 2 ml after 72 horse of exposer , and gave death rate 100% at concentration 1 ml after 72 horse of treatment against insect *R. dominica*, while gave

death rate 80% against *S. granarius* at the same concentration after 72 hours of exposure, the death rate was 73.3% at concentration 0.5 ml against insect *R. dominica*, while the effect of oil was 60% against *S. granarius* at concentration 0.5 ml.

The effect of flax seed oil was 100% at a concentration of 2 ml after 72 hours of exposure against *R. dominica* and its effect on *S. granarius*

was 83.3% after 72 hours of exposure at the same concentration, while its effect was 60% at the lowest concentration of 0.5 ml after 72 hours of exposure against the *R. dominica* and *S. granarius* was more tolerant the death rate recorded 23.3% at the same concentration, It recorded death rate 86.6% at a concentration of 1 ml against *R. dominica* and 60% against *S. granarius* at the concentration of 1 ml after 72 hours of treatment.

**Table (1). The efficiency of seven plant oils on the death rate of *R. dominica* and *S. granarius* using three concentrations and three periods of exposure**

Plant oil	Dose (ml/50gm grain)	Mortality (%) of <i>Rhyzopertha dominica</i>			Mortality (%) of <i>Sitophilus granarius</i>		
		Exposure periods (hour)					
		24h	48h	72h	24h	48h	72h
Basil	0.5	0	10	16.6	0	0	10
	1	0	23.3	33.3	0	16.6	40
	2	0	40	50	3.3	30	63.3
Anise	0.5	0	30	43.3	0	16.6	23.3
	1	0	50	60	3.3	10	40
	2	16.6	40	73.3	20	33.3	66.6
Flax seed	0.5	10	33.3	60	0	16.6	23.3
	1	26.6	73.3	86.6	6.6	33.3	60
	2	40	90	100	26.6	70	83.3
Cumin	0.5	6.6	26.6	43.3	0	30	50
	1	16.6	36.6	56	6.6	40	60
	2	23.3	73.3	80	23.3	70	86.6
Clove	0.5	20	63.3	73.3	20	36.6	60
	1	33.3	83.3	100	6.6	60	80
	2	46.6	80	100	50	83.3	100
Peppermint	0.5	0	40	56.6	0	0	46.6
	1	16.6	50	66.6	0	20	50
	2	33.3	66.6	83.3	16.6	50	80
Cinnamon	0.5	33.3	63.3	76.6	6.6	26.6	56
	1	40	70	93.3	33.3	56	76.6
	2	46.6	100	-	40	70	100
Control	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Then comes peppermint oil in efficiency, where the death rate was 83.3% against insect *R. dominica* after 72 hours of treatment at concentration 2 ml, Its effect was 80% against an insect *S. granarius* at the same concentration at the same exposure time, It also gave a death rate of 66.6% at a concentration of 1 ml against an insect *R. dominica* after 72 hours of treatment, It also gave a 50% death rate against an insect *S. granarius* at the same focus and the same

exposure time, The death rate at the lowest concentration used was 0.5 ml against an insect *R. dominica* in the rate of 56.6% after 72 hours of treatment, It gave a death rate of 46.6% against *S. granarius* at the same concentration and exposure time.

Cumin oil recorded a death rate 80% at a concentration of 2 ml and after a 72-hours of exposure against *R. dominica*, and 86.6% against *S. granarius* at the same concentration and

exposure time, and 56% death rate against *R. dominica* at a concentration of 1 ml after 72 hours. It recorded 60% death rate against *S. granarius* at a concentration of 1 ml after 72 hours of treatment. It recorded a death rate of 43.3% at the concentration of 0.5 against *R. dominica* after 72 hours, with a death rate of 50% against *S. granarius* at a concentration of 0.5 ml after 72 hours of exposure, these results are in agreement with, (Dipak, 2021 and sebastien, 2021).

Anise oil recorded a death rate of 73.3% against *R. dominica* at concentration of 2 ml after 72 hours of treatment, it recorded a death rate of 66.6% against *S. granarius* after 72 hours of exposure at the same concentration, and it recorded a death rate of 60% after 72 hours of exposure at a concentration of 1 ml against *R. dominica*, while it recorded a death rate of 40% against *S. granarius* at the same concentration and the same exposure period. Anise oil at the lowest concentration of 0.5 recorded a death rate of 43.3% against *R. dominica* after 72 hours of exposure and gave a death rate against *S. granarius* 23.3% at the lowest concentration and the same exposure period.

The least effective oil tested in this experiment was basil oil, which recorded a death rate of 50% of the treated individuals at a concentration of 2 ml after 72 hours of exposure against *R. dominica*, it recorded a death rate of 63.3% against *S. granarius* after 72 hours at a concentration of 2 ml, It also recorded a death rate of 33.3% at a concentration of 1 ml against *R. dominica* after 72 hours of exposure and recorded a death rate of 40% against *S. granarius* at the same concentration and the same exposure period, it recorded a death rate of 16.6% against *R. dominica* after 72 hours of treatment at the concentration of 0.5 ml, It recorded a death rate of 10% against *S. granarius* at a concentration of 0.5 ml and after 72 hours of exposure. These results are in agreement with those of (Goler, 2019).

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