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The Stimulatory Effect of Mixtures Milk Thistle and Wild Safflower Oil with some Insecticides on the Adults and Larvae of Flour Beetles

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A B S T R A C T

The aim of the current study is testing the mortality effect of mixtures of *Milk thistle* and *Carthamus tinctorius* oils with some insecticides on the whole and larvae of flour beetles using three different pesticides: Aktara, Indoxacarb and Alfacypermethrin, using the four different concentrations 50, 100, 200, 500 ppm for each mixing ratio (oil: pesticide) in the general rate mortality of the concentrations of oil mixture with pesticides in the adults and larvae of flour beetles. The results of the statistical analysis showed a clear significant difference between the general averages of the mortality ratios of the four concentrations. The results also indicated the values of propensity, LC50, and the total activation ratios of the mixtures of *Milk thistle* oils and Sob with the pesticides Aktara, Indoxacarb, and Alfacypermethrin. A variation in the LC50 values for the mixtures of oils with pesticides was noticed, but there is an increase in the toxicity of the mixture of oil and Indoxacarb pesticide compared with the mixtures of oil, Aktara pesticide and alfacypermethrin. The LC50 values for mixtures of *Milk thistle* and *Carthamus tinctorius* oils with Indoxacarb pesticide reached 34.5 and 17.9 ppm on caterpillars and 46.4 and 23.5 ppm on adults, while it reached 46.4 and 23.5 ppm for mixtures The oils themselves with the Aktara pesticide were 858.5 and 715.3 ppm on caterpillars and 190.3 and 538.7 ppm on adults. As for the mixtures of oils with Alfacypermethrin, they were 3194.4 and 248.5 ppm on caterpillars and 307.8 and 1410.5 ppm on adults.

Introduction

The process of mixing pesticides has become a common process in the field of pest control. Today, chemical pesticides are widely used in the world to control insects, and there are more than (1000) types of pesticides spread all over the world. Each type of these types has its advantages and disadvantages on the system. Environmental, where 5.6 billion pounds of pesticides are annually used in the world, and the percentage of up to pests and organisms targeted for the purpose of control is estimated at only 0.1% of those pesticides. The rest cannot be counted and remains within the agricultural area; thus, posing a threat to the environment, irrigation water, surface and groundwater to cause pesticides Chemical losses are too great for the ecosystem (Ahuja,2021). Despite the great role of pesticides in pest control because of their ease of application, quick results and low costs. On the other hand, pesticides are often highly toxic and poorly decomposed, i.e. they remain in the environment for a long period without degradation. Another damage caused by these broad-spectrum pesticides is the reduction of natural enemies in environment (Koss et al., 2005). The most realistic alternative to reduce the use of pesticides is to rationalize their use and follow the correct methods in their use in order to reduce their collateral damage (Al-Hasani, 2003). The addition of stimulants to pesticides to increase their effectiveness when used at low concentrations and other methods and strategies that all go in this direction. The combination of chemical pesticides with plant extracts gives a double effect against insects, known as synergism; so, it is harmless to stored food (Khalequzzaman and Khanom, 2002).

In this field, many researchers studied the activation of pyrethroids by using plant extracts (leaves, seeds, and roots) as activators for pesticides against storehouse insects, including flour beetles (Al-Jubouri et al., 2011, Batoul and Nizar, 2012). The results were statistically analyzed using the complete random design and the significant differences between the means tested using Duncan's test based on the SAS statistical package Anter (2010).

Materials and Methods

The study was conducted in the Department of Plant Protection / College of Agriculture and Forestry during 2022 under laboratory conditions, at a temperature of 28 o C and a relative humidity of 65%.There are some factors affecting the disease; viz. determining the LC50 value of the oils and the LC50 values for the mixture of oils with pesticides at a mixing ratio of 1: 1 (oil: pesticide) separately. The lethal half values for both the mixture and the pesticide were extracted by processing and square, by processing each mixture, which were to 50, 100, 200 and 500 per million, and by dissolving them Palacetone. Then after that, the larvae and adults of the flour beetle raised on wheat were treated. As for the treatment, it was treated with acetone only. The treated insects were placed in Petri dishes with a diameter of 9 cm in an incubator at a temperature of 30 °C and a relative humidity of 65-70%. The mortality ratios were calculated after 24 hours of treatment, and the mortality ratios were corrected using the Abbott equation mentioned in Shaaban and Al-Mallah (1993). The toxicity lines were drawn to calculate the LC50 values of the mixture, and then the proportion of activation by synergism and potentiation was calculated for each of the oils used in the study in some insecticides and as Come. Calculating the activation rate using the Metcalf (1972) equation when the activated substance does not have a lethal or synergistic effect at the same time, by the following:

First: Calculating synergy ratios:

In this step, the percentage of potentiation was excluded, which represents the percentage of mortality caused by the activated substance in the whole and larvae of the flour beetle. This method can be summarized in the following steps:

- Finding the corrected mortality rate for the concentrations used for each of the used oils and pesticides both individually in the study.
- Finding the corrected mortality percentage for the used concentrations of the mixture; viz. oil + pesticide.
- Correction of the mortality ratio of the mixture using the modified Abbott equation mentioned in Al-Mallah and Al-Jubouri (2012) in order to get rid of the fatal effect of the stimulant substance, which represents the proportion of potentiation, and thus only its synergistic effect is preserved as in the equation: -

% cor. Mortality for mixture = (% mortality of mixture – % mortality of stimulant con. For mixture /100- % mortality activated substance con. For mixture) X 100

- Toxicity lines are drawn for the mixture and the herbicide separately from the corrected mortality percentages to calculate the 50 LC values for each of the corrected herbicide and mixture (the synergist).

- Calculating the ratio of the synergistic effect using the modified Metcalf (1972) equation which stipulates that the synergistic substance has a toxic effect:

Synergistic effect ratio = 50LC value for the pesticide / 50LC value for the synergist (corrected mixture)

Second: Calculating the total activation ratio = 50LC value for the pesticide / 50LC value for the mixture

Third: Calculating the percentage of strengthening in oils after the percentage of total activation and the percentage of synergy have been calculated, the percentage of strengthening can be calculated using the following equation:

Reinforcement ratio = activation ratio - synergy ratio.

Results & Discussion

The results of Table (1) showed the effect of the concentrations of the mixture of *Milk thistle* seed and *Carthamus tinctorius* oil with the Aktara pesticide on the percentage of mortality larvae and adults of flour beetles. General average for mortality adults and larvae. This can be explained by the higher response of adults than the response of larvae to the oil-pesticide mixture, and may be due to the ionization of the mixture and its excretion with food outside the body (Karso, 2012). The results of the same table showed that the general average of mortality adults and larvae of flour beetles for the mixture of *Milk thistle* oil with the Aktara pesticide was 40.00%, while the general average for killing insect stages for the mixture of *Carthamus tinctorius* oil with the Aktara pesticide was 30.00%. mortality between *Carthamus tinctorius* oil and kelp oil mixed with Aktara pesticide, and this can be explained by the fact that *Milk thistle* oil contains a higher content of unsaturated fatty acids compared with kelp oil, which may contain saturated fatty acids. As saturated compounds are polar and cannot penetrate through the waxy layer of ice, while unsaturated fatty acids are non-polar, so they have the ability to interact and penetrate through the waxy layer and are lipophilic and thus lead to their toxic effect on insects (Al-Jubouri and Nizar, 2011). Table (1) shows that the general mortality rates of the concentrations of the oil mixture with Aktara pesticide in whole and larvae of flour beetles increased with increasing concentrations of 50, 100, 200 and 500 ppm, reaching 21.67, 24.17, 42.50 and 51.67%, respectively. Statistical analysis: There is a clear significant difference between the general averages of the mortality rates for the four concentrations. The effect of the same table showed that the values of the half-lethal concentration of the mixture of *Milk thistle* oil with Aktara pesticide in the insects decreased from the rest of the values of the half-lethal concentrations, which amounted to 190.3. These results were consistent with what was confirmed by Karso (2012) that sesame oil has a better effect when mixed with pesticides, as the average mortality of the hairy grain beetle was 88.8% when treated with a mixture of oil with the pesticide Indoxacarb.

Table (2) shows the effect of the concentrations of the mixture of *Milk thistle* seed oil and *Carthamus tinctorius* with the pesticide Indoxacarb on the percentage of mortality larvae and adults of flour beetles. General average for mortality adults and larvae. It is explained that the response of adults was higher than the response of larvae to the mixture of oil with the pesticide, and may be due to the ionization of the mixture and its excretion with food outside the body (Karso, 2012). This may be attributed to the variation in the level of the enzyme (M.F.O) according to the insect species, which is considered a catalyst for the removal of toxicity from the insect's body (Hsu Yu, 1993). It is clear from the results of the same table that the general average of mortality whole and larvae of flour beetles from a mixture of the type of oil mixed with the pesticide showed the superiority of *Carthamus tinctorius* oil in the general average of mortality and reached 37.08%, while the general average of mortality of *Milk thistle* oil was 26.00%. The results of the statistical analysis showed a clear significant difference between the general average of the mortality rates between *Milk thistle* oil and *Carthamus tinctorius* oil mixed with the pesticide Indoxacarb. This can be explained by the fact that *Milk thistle* oil contains a higher content of unsaturated fatty acids compared with Carthamus tinctorius oil, which may contain saturated fatty acids. As saturated compounds are polar and cannot penetrate through the waxy layer of ice, while unsaturated fatty acids are non-polar; so, they have the ability to interact and penetrate through the waxy layer and are lipophilic and thus they lead to their toxic effect on insects (Al-Jubouri and Nizar, 2011). Table (2) shows that the general mortality rates of the concentrations of the oil mixture with the pesticide Indoxacarb in whole and larvae of flour beetles increased with increasing concentrations of 50, 100, 200 and 500 ppm, reaching 18.33, 22.50, 33.33 and 52.50%, respectively. The results of the statistical analysis showed that there is a clear significant difference between the general averages of the mortality rates for the four concentrations. The results of the same table also indicated that the effect of the semi-lethal concentration values of the mixture of oil and Indoxacarb pesticide on the insect larvae decreased from the rest of the semi-lethal concentration values, which amounted to 248.5. From the same table, it is noted that the LC50 values of the mixture of *Milk thistle* oil and *Carthamus tinctorius* with the pesticide Indoxacarb showed a clear decrease with the whole insect than the LC50 values of the mixture of oils with the pesticide with the larvae, and this confirms that the pesticide is more active with the whole insect. These results were consistent with what was mentioned by (Shaaban and Al-Mallah, 1993) that sesame oil has a good revitalizing effect with many pesticides, including Indoxacarb, where its effect is attributed to increasing the permeability of the pesticide through the insect's cuticle, or it works to inhibit pesticide-destroying enzymes as well as its mortality effect on if used alone. This is consistent with what Karso (2012) mentioned that the mixture of sesame oil with the pesticide Indoxacarb gave the highest average mortality rates for the hairy grain beetle, amounting to 88.8%.

Table 1. Effects of concentrations of Aktara pesticide mixture, Milk thistle seed oil and *Carthamus tinctorius* on flour beetle larvae and adults.

Insect type	Oil mixture type + Aktara pesticide	Con. ppm	average murder rate	The general average of the phases	LC_{50}	Tilt	Trust limits	
							Lowest	the above
Larvae	Milk thistle	50	26.67g h i	32.92b	743.9	0.55	356.9	10932.4
		100	30.00h i					
		200	36.67d e					
		500	46.67c d					
	Carthamus tinctorius	50	20.00h i		203.1	0.73	136.7	354.4
		100	20.00h i					
		200	40.00d e					
		500	43.333c d e					
Adults	Milk thistle	50	20.00h i	37.08a	190.3	1.35	152.7	244.9
		100	33.33e –h					
		200	60.00a b					
		500	66.67a					
	Carthamus tinctorius	50	16.67i		529.1	1.1	361.7	1036.6
		100	16.67i					
		200	33.33e –h					
		500	50.00b c					
The general average of the concentrations		50	21.67c					
		100	24.17c					
		200	42.50b					
		500	51.67a					
The general average for the type of oil		Milk thistle	40.00a					
		Carthamus tinctorius	30.00b					

* means with different letters in the same sectors showed a significant difference at p= 5%.

Table (3) shows the effect of a mixture of *Milk thistle* seed oil and *Carthamus tinctorius* with the pesticide Alfacypermethrin on the percentage of mortality larvae and adults of flour beetles, and that the average year of mortality adults and larvae gave the same value as it reached 82.92%, respectively. The results of the statistical analysis showed that there is no significant difference between the general average of mortality wholes and larvae. This result may be explained by the fact that it may be attributed to the high density of *Milk thistle* oil and its high content, which may prevent the respiration process causing the insects to die of suffocation (Abu Shanab, 2011). It is clear from the results of the same table that the general average of the mixture of *Milk thistle* oil with the pesticide Alfacypermethrin in mortality the stages of the insect was 73.33%, while the general average for mortality the stages of the insect from the mixture of *Carthamus tinctorius* oil with the pesticide Alfacypermethrin was 87.50%, and the results of the statistical analysis showed that there is a clear significant difference between the general average for mortality rates between *Milk thistle* oil and *Carthamus tinctorius* oil mixed with the pesticide Alfacypermethrin. These results agree with what was reached by (Al-Rubaie, 2004) that the activation effect of some pyrethroid pesticides increases when mixed with vegetable oils against the hairy grain beetle, such as sunflower oil. They also agreed with what was confirmed by him (Shaaban, 1991) that soybean oil, date kernel oil, mineral oils, and Thanite compound when mixed with the deltameterin pesticide have a stimulatory effect against adults of the southern cowpea beetle *C. Maculatus.*

Table (3) shows that the general mortality rates of the concentrations of the oil mixture with the pesticide Alfacypermethrin in whole and larvae of flour beetles increased with increasing concentrations of 50, 100, 200 and 500 parts per million reaching 65.83, 80.00, 86.67, and 99.17%, respectively. The results of the statistical analysis indicated that there is a clear significant difference between the general averages of the mortality rates of the four concentrations. The results of the same table also indicated that the effect of the half-lethal concentration values of the mixture of *Carthamus tinctorius* oil with the pesticide vacypermethrin on insect larvae decreased from the rest of the half-lethal concentration values, which amounted to 21.1. These results were consistent with what was mentioned by Karsu (2012) that the larvae reared on sunflower were superior in their response to mixtures of sunflower with the pesticides Alfacypermethrin, Indoxacarb, Lufenuron and acetamberd, as the average mortality rate was 63.98% compared with the control treatment of 48.2%.

Table 2. Effects of concentrations of Indoxcarb mixture with Milk thistle and Carthamus tinctorius seed oil on mortality adults and larvae of flour beetles.

Insect type	Oil mixture type + Aktara pesticide	Con. ppm	average murder rate	The general average of the phases	LC_{50}	Tilt	Trust limits	
							Lowest	the above
Larvae	Milk thistle	50	h 10	b 28.33	3194.4	0.70	1049.4	140004.0
		100	g h 13.33					
		200	e f g 23.33					
		500	e f 26.67					
	Carthamus tinctorius	50	g h 13.33		248.5	1.59	213.4	323.5
		100	d e 33.33					
		200	d e 33.33					
		500	a 73.33					
Adults	Milk thistle	50	h 10	a 35.00	307.8	1.52	246.5	414.7
		100	e f g 23.33					
		200	c d 43.33					
		500	b 60					
	Carthamus tinctorius	50	f g h 20		447.9	0.79	286.3	1135.8
		100	d e 33.33					
		200	c d 40					
		500	b c 50					
The general average of the concentrations		50	c 18.33					
		100	c 22.50					
		200	b 33.33					
		500	a 52.50					
The general average for the type of oil		Milk thistle	b 26.25					
		Carthamus tinctorius	a 37.08					

* means with different letters in the same sectors showed a significant difference at p= 5%.

Table 3. Effects of concentrations of a mixture of alfa cypermethrin with Milk thistle seed oil and Carthamus tinctorius on the mortality of adults and larvae of flour beetles.

Insect type	Oil mixture type + Aktara pesticide	Con. ppm	average murder rate	The general average of the phases	LC_{50}	Tilt	Trust limits	
							Lowest	the above
Larvae	Milk thistle	50	d e 63.33	a 82.92	34.5	1.39	18.7	49.2
		100	b c 70					
		200	c 83.33					
		500	a b 96.67					
	Carthamus tinctorius	50	d 73.33		21.1	1.57	8.6	33.2
		100	b c 86.67					
		200	a b c 90					
		500	a 100					
Adults	Milk thistle	50	e 56.67	a 82.92	46.4	1.97	33.2	58.2
		100	d 70					
		200	b c 86.67					
		500	a 100					
	Carthamus tinctorius	50	d 70		23.5	1.70	5.3	37.1
		100	a b c 90					
		200	a b c 90					
		500	a 100					
The general average of the concentrations		50	d 65.83					
		100	c 80.00					
		200	b 86.67					
		500	a 99.17					
The general average for the type of oil		Milk thistle	b 73.33					
		Carthamus tinctorius	a 87.50					

* means with different letters in the same sectors showed a significant difference at p= 5%.

Table (4) showed the values of inclination, LC50, and total activation ratios for mixtures of *Milk thistle* and *Carthamus tinctorius* oils with the pesticides Aktara, Indoxacarb and Alfacypermethrin. For the mixture of *Milk thistle* and *Carthamus tinctorius* oils with Indoxacarb pesticide, it erached 34.5 and 17.9 ppm on caterpillars and 46.4 and 23.5 ppm on adults, while for the mixtures of the same oils with Aktara pesticide, it reached 858.5 and 715.3 ppm on caterpillars and 190.3 and 538.7 ppm on adults and reached for the mixture of oils with the pesticide Alfacypermethrin 3194.4 and 248.5 ppm on larvae and 307.8 and 1410.5 ppm on adults. This is consistent with what was confirmed by the study of Al-Mallah and Rana (2005) that the values of LC_{50} .Insect growth inhibitors (Match%50EC, Dimilin%10EC, and Trigard%75WP) varied according to the type of food and the type of insect, the fig moth *Ephestia cautella* Walk and the raisin moth *Ephestia calidella* Guenee. Moth figs bred on dates. This was confirmed by the results of the values of the total activation percentage of the mixtures of *Milk thistle* and *Carthamus tinctorius* oils with the pesticides Aktara, Indoxacarb and Alfacypermethrin. We note from the same table that the values of the total activation percentages of the mixtures of *Milk thistle* and *Carthamus tinctorius* oils with the pesticide Indoxacarb on the larvae and adults of flour beetles gave the highest activation rates than the mixtures of oils with the rest of the pesticides. 14.57, 28.09, 12.04, and 23.77%, respectively, while it was 0.42, 0.50, 0.49, and 0.17% for the mixtures of *Milk thistle* and chloroplast oils with aktara pesticide, and 0.04, 0.50, 0.53, and 0.11%, respectively. The reason for the difference in the activation rates between the mixtures of oil and pesticides is attributed to a variation in the levels of (M.F.O) enzymes depending on the type of insect. These results were consistent with what was confirmed by Karso (2012) that the highest activation ratio was obtained when mixing sesame oil with an Inoxacarb pesticide and a ratio of 1:1 when treating the larvae of the hairy grain beetle.

Table 4. Values of propensity, LC50, and total activation ratios of mixtures of Milk thistle and Carthamus tinctorius oils with some insecticides in flour beetle larvae and adults in a mixing ratio of (1:1).

Insect type	Blended oil type	Alpha Cypermethrin			Indoxacarb			Actara		
		The total activation rate	LC50	Slop	The total activation rate	LC50	tilt	The total activation rate	LC50	Slop
Larvae	Milk thistle	0.04	3194.4	0.70	14.57	34.5	1.39	0.42	858.5	0.51
	Carthamus tinctorius	0.50	248.5	1.59	28.09	17.9	1.42	0.50	715.3	0.77
Adults	Milk thistle	0.53	307.8	1.52	12.04	46.4	1.97	0.49	190.3	1.35
	Carthamus tinctorius	0.11	1410.5	0.37	23.77	23.5	1.70	0.17	538.7	1.05

References

[1] Ahuja, S. (2021). Overview: modern water purity and quality. Handbook of Water Purity and Quality, Chapter 10-Pesticides in water, Pages 231- 253.

[2] Al-Hasani, A. and H. Muhammad (2003). The effect of some plant extracts and powders on the productivity and destruction of adults of the saw-breasted beetle, Oryzaephilus surinamenesis. Master's thesis \ College of Education \ University of Tikrit.

[3] Al-Mallah, N. M. and Abdul-Razzaq Y. A. (2011). A new method for calculating the ratio of synergy and potentiation in the active materials of pesticides. Journal of Agriculture Al-Rafidain. 39(4:)24–249.

[4] Al-Mallah, N. M. and Rana R. A. (2005). The effect of the type of food host and some insect growth inhibitors on the rate of food loss and the rate of increase of the fig moth and the raisin moth. Tikrit Journal of Pure Sciences 10 (1): 25-29.

[5] Al-Mallah, N. M., Al-Jubouri, A. Y. (2012). Chemical pesticides, their groups, methods of their effect and their metabolism on organisms and the environment. Deposit number in the House of Books and Documents in Baghdad 1055 for the year 2012. 355 pages.

[6] Al-Rubaie, A. and A. Karim, (2004). The stimulatory effect of some vegetable oils on the pyrethroid insecticide Karateagainst the hairy grain beetle (Khabra).

[7] Antar, Salem Hamadi (2010). Statistical analysis in scientific research and SAS program. University of Mosul Faculty of Agriculture and Forestry. Book House for Printing and Publishing, 192 pages.

[8] Daoud, A. S. (1991). The stimulatory effect of some vegetable and mineral oils on deltamethrin against adults of the southern cowpea beetle. Al-Rafidain Agriculture Journal, 23 (1): 245-250.

[9] Karso, B. A. (2012). The effect of some vegetable oils and using methods on responding of Khapra larvae to some pesticides, PhD thesis, University of Mosul, Iraq. pp 131.

[10] Koss, A.S. M., Jensen, A. S., Schreiber, A., Pike, K. S., and Snyder, W. E. (2005). Comparison of predator and pest communities in Washington potato fields treated with broadspectrum, selective, or organic insecticides.Environ. Entomol.34,87–95.

[11] Shaaban, A. and N. M. Al-Mallah (1993). pesticides Ministry of Higher Education and Scientific Research / University of Mosul. Dar Al-Kutub Press for Printing and Publishing, Mosul, pg. 520.

[12] Yu , S., J., and E. L. Hsu (1993). Induction of detoxification enzymes in phytophagous insects : roles of insecticide synergists larval age and species . Arch . Insect Biochemistry Physiological . 24 : 21- 32.