LABORATORY AND FIELD STUDIES FOR EVALUATION OF SOME FRESH AND USED PLANT OILS ON THE GLASSY CLOVER SNAIL, *MONACHA CARTUSIANA* (MÜLLER)

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Abstract

Recycling waste especially used frying oils is considered healthy and ecofriendly procedure. Considering as novel technique, molluscicidal activities were evaluated for two waste frying oils of sunflower and soybean baits against the glassy clover snail, *Monacha cartusiana* (Müller) under laboratory and field conditions. Fresh oils of both were also tested. A promising result indicated that used frying oils of both sunflower and soybean exhibited potent mortality percentages after three weeks with 35 % concentration under laboratory conditions, where juvenile mortality for both used oils was 100 %, while adult mortality were 66.67, and 73.33 %, respectively. The lowest hatching % of *M. cartusiana* was 41.98 for used sunflower oil followed by 52.33, 57.48 and 60.78 % for fresh sunflower oil and used & fresh soybean oils, respectively. Similarly, field investigations estimated the residual effect of used frying sunflower and soybean oils on reduction percentages after three weeks were 55.32 & 57.39%, respectively with concentration 35 %. Compared to control, reductions in activities of amylase, invertase and trehalase enzymes in adults of *M. cartusiana* treated with used frying soybean oil were recorded. In addition, physicochemical parameters (free fatty acids, acidity % and peroxide value) of fresh and used frying oil were measured.

INTRODUCTION

Land gastropods cause costly damage to field crops, vegetables and fruit trees as well as ornamental plants (Nakhla *et al.* 1993 and Godan 1983). In recent years, searching for environmentally safe methods to substitute agrochemicals became a priority of most agricultural scientists to avoid acute and chronic hazards to human, non-target organisms and the environmental pollution (El-shafiey *et al.* 2010). Unfortunately, about 25 million agricultural workers in developing countries are poisoned every year by pesticides (Jeyaratnam 1990). Attention is increasingly being paid to the use of natural compounds as essential oils. In this concern, comate 500 pesticide (85% cotton seed oil) was used as a molluscicide against *M. cartusiana*. (Shahawy 2005). While, molluscicidal activities of nine plant powders were evaluated against *M. cartusiana* (Arafa 2006). The reuse of waste materials has gained great interest in terms of minimizing cost and elimination of environmental disposals. Used

frying oils are generated during food preparation in large amounts and contribute to environmental pollution. A variety of waste oils from food and agro-based raw materials have been used as alternative and cheap substrates (Lan *et al.* 2015). A finding by Farag *et al.* (2010) indicated that long term used frying oils displayed more deformations in rat organs than that used for shorter period, may support the reuse of waste frying oils in baits controlling snails.

MATERIALS AND METHODS

Tested animals: land snail, glassy clover snail, *M. cartusiana* (juveniles and adults) were collected from fields cultivated with Egyptian clover at Banayous locality, Zagazig district, Sharkia Governorate, Egypt. The collected snails were immediately transferred in white cloth bags to the laboratory. Healthy and similar individuals were chosen and kept in glass terrarium filled with moist clay soil adjusted at 75 % of water field capacity. Snails were fed daily with fresh green leaves of cabbbage for two weeks before treatment for acclimatization.

Tested fresh oils: The fresh oils used were oil of soybean, *Glycine max* L. purchased from Toyor El- Gana company, Diarb Negm district at Sharkia governorate and oil of sunflower, *Helianthus annuus* L. purchased from Sindbad company, Fakous district at Sharkia governorate, Egypt.

Frying process: Fresh potatoes pieces were purchased from the local market. The batches of potatoes were fried at 20 min intervals for 1 h in soybean and sunflower oils. The oils were dried over anhydrous sodium sulfate, filtered and stored at 5°C until analysis.

Parameters studied: The fatty acid composition was determined according to ISO 12966-2 (2011) and other chemical parameters: acid value and peroxide value applied to A.O.A.C. (2005) were determined for oil samples (fresh & used). Analyzes were performed at Food Technology Research Institute, Giza governorate, Egypt.

Toxicity studies:

Laboratory tests: were evaluated by two different techniques:

1-Dipping technique: Eggs of *M. cartusiana* were put in Petri-dish, washed with distilled water and then prepared for the following test. Four concentrations: 2, 4, 8 and 16% from tested oils were prepared by adding 16 ml of oil + 83.75 ml distilled water with 0.25 ml tween 80 then diluted to reach 8, 4 and 2%. Tested eggs were dipping for one minute in all concentrations. Sieved clay soil were put in plastic boxes (3/4 kg. capacity) and irrigated to reach the field capacity. Small holes were made by glassy needle and ten eggs were placed in it. Four replicates were used for each

concentration and check control were prepared using distilled water with 0.25 ml tween 80. The boxes were tightly covered with cloth netting secured with rubber band to prevent hatchlings of the snail from escaping, Boxes were examined daily and incubation period, hatching period and hatching percentages were recorded as Ismail *et al.* (2010).

2-Poisonous baits technique: Three concentrations 8.75, 17.50, and 35 % for tested oils were prepared by incorporating the appropriate amount of each compound with bran bait. Three plastic boxes (3/4 kg capacity) were used for each concentration. Five grams of baits were spread into each box. Control treatment was prepared using bran bait. Five juveniles & five adult individuals of *M. cartusiana* were introduced into each plastic box, then covered with muslin cloth and secured with rubber band. Mortality were observed using stainless steel needle according to El-Okda 1980. Mortality percentages were calculated after 1, 3, 7, 14 and 21 days and corrected by Abbott's formula (1925).

Field application: The field trial was conducted in about one feddan in a field cultivated with Egyptian clover, heavily infested with *M. cartusiana* snails at Banayous locality, Zagazig district, Sharkia Governorate during April, 2017. The field area was divided into five plots, each including control, each plot was divided into three replicates for each treatment. Area of about 50 m^2 was left as buffer between each plot. Baits were offered on blue plastic pieces each provided with 100 gm. Reduction percentages were calculated according to the formula of Henderson and Tilton (1955) as follows:

$$\% \text{ Reduction} = [1 - (t_2 \times r_1) / (t_1 \times r_2)] \times 100$$

Whereas:

r_1 = Number of alive snails before treatment in untreated plots.

r_2 = Number of alive snails after treatment in untreated plots.

t_1 = Number of alive snails before treatment in treated plots.

t_2 = Number of alive snails after treatment in treated plots.

Biochemical studies:

Preparation of samples for biochemical assay: The adult mollusca shells of *M. cartusiana* snails were removed and the soft tissues were weighed, pooled, and homogenized as 1:10 (w/v) in distilled water. The homogenates were centrifuged at 5000 r.p.m for 20 minutes at 5 °C according to Abd El-Haleim *et al.* (2006). The supernatants were immediately assayed to determine the activities of amylase, invertase and trehalase enzymes by the method of Ishaaya and Swiriski (1976).

Statistical analysis: Statistical analysis was conducted according to Snedecor (1951).

RESULTS AND DISCUSSION

Acidity % and peroxide value of fresh & used sunflower and soybean frying oils:

Acidity % and peroxide value determinations are one of the best indicators of oil damage. Data in Table (1) showed that both waste frying oils had higher acidity % and peroxide value than fresh ones. Where acidities and peroxide values of sunflower oils were 0.04 %, 0.13 %, 9.68 Meq.O_2/Kg and 33.15 Meq.O_2/Kg for fresh and used, respectively. While, acidities and peroxide values of soybean oils were 0.08 %, 0.13 %, 2.56 Meq.O_2/Kg and 14.74 Meq.O_2/Kg for fresh and used, respectively. Data also indicated that soybean oil is resistant to oxidation at frying temperature when compared to sunflower oil. Kaleem *et al.* (2015) found that rancidity of oils can produce potentially toxic compounds associated with long-term health effects such as neurological disorders, heart and cancer.

Fatty acids composition of fresh & used sunflower and soybean frying oils (fresh & used):

Analysis of fatty acids components of sunflower and soybean frying oils (fresh & used) in Table (2) and Figures (1, 2, 3 & 4) indicated the presence of unsaturated fatty acids such as palmitoleic acid (0.09, 0.10, 0.11 & 0.07 %), oleic acid (24.01, 25.83, 24.25 & 24.61%), linoleic acid (52.85, 52.04, 53.53 & 52.17%), linolenic acid (0.84, 0.72, 5.64 & 5.56%), for sunflower and soybean oils (fresh & used), respectively. Also, the saturated fatty acids like palmitic acid (5.42, 4.49, 9.76 & 10.30 %) and stearic acid (4.58, 5.38, 4.57, 4.66%), for sunflower and soybean oils (fresh & used), respectively were presented in high percentages. While, linoleic acid (trans) $C_{18:2T}$ was detected in both frying used sunflower and soybean oils. Trans fatty acids being hazardous to human health; are generated by frying. Similar observations were obtained by Tyagi and Vasishtha (1996) whom found that soybean oil showed 1.68% of trans acids after frying of potato chips. Marinova *et al.* (2012) detected palmitic acid $C_{16:0}$ (7.4 & 9.8 %), stearic acid $C_{18:0}$ (4.1 & 3.4 %), Oleic $C_{18:1}$ (25.6 & 25.1 %), Linoleic $C_{18:2}$ (62.7 & 55.6 %) linolenic $C_{18:3}$ (0.0 & 5.6%) acids in sunflower and soybean oils, respectively. Linoleic acid content is frequently used as an indicator of the degree of oil degradation, since the polyunsaturated linoleyl chain is highly susceptible to oxidation. Kleber *et al.* (2015) indicated that trans fatty acids have been linked to increase risks for number of diseases such as cardiovascular disease, stroke, diabetes, infertility or certain cancers.

Table 1. Chemical properties of fresh & used sunflower and soybean oils.

Samples	Chemical properties	
	Acidity % (as oleic acid)	Peroxide value ($Meq.O_2/Kg$)
Fresh sunflower oil	0.04	9.68
Used sunflower oil	0.13	33.15
Fresh soybean oil	0.08	2.56
Used soybean oil	0.13	14.74

Table 2. Fatty acids composition percentage of fresh & used sunflower and soybean oils.

Fatty acids	Structural Formula	Oils			
		Fresh sunflower	Used sunflower	Fresh soybean	Used soybean
Myristic acid $C_{14:0}$	$CH_3(CH_2)_{12}COOH$	0.07	0.06	0.07	0.07
Palmitic acid $C_{16:0}$	$CH_3(CH_2)_{14}COOH$	5.42	4.49	9.76	10.30
Palmitoleic acid $C_{16:1}$	$CH_3(CH_2)_5CH=CH(CH_2)_7COOH$	0.09	0.10	0.11	0.07
Margaric acid $C_{17:0}$	$CH_3(CH_2)_{15}COOH$	0.09	0.09	0.09	0.09
Myristoleic acid $C_{17:1}$	$CH_3(CH_2)_{10}CH=CH\text{-}COOH$	0.04	0.04	0.04	0.04
Stearic acid $C_{18:0}$	$CH_3(CH_2)_{16}COOH$	4.58	5.38	4.57	4.66
Oleic acid $C_{18:1}$	$CH_3(CH_2)_7CH=CH(CH_2)_7COOH$	24.01	25.83	24.25	24.61
Linoleic acid (trans) $C_{18:2T}$	$CH_3(CH_2)_4CH=CHCH_2CH=CH(CH_2)_7COOH$	–	0.46	–	0.49
Linoleic acid $C_{18:2}$	$CH_3(CH_2)_4CH=CHCH_2CH=CH(CH_2)_7COOH$	52.85	52.04	53.53	52.17
Linolenic acid $C_{18:3}$	$CH_3(CH_2)_4CH=CHCH_2CH=CHCH_2CH=CH(CH_2)_4COOH$	0.84	0.72	5.64	5.56
Arachidic acid $C_{20:0}$	$CH_3(CH_2)_{18}COOH$	0.38	0.42	0.36	0.41
Eicosenic acid $C_{20:1}$	$CH_3(CH_2)_7CH=CH(CH_2)_9COOH$	0.22	0.22	0.18	0.25
Behenic acid $C_{22:0}$	$CH_3(CH_2)_{20}COOH$	0.43	0.53	0.43	0.51

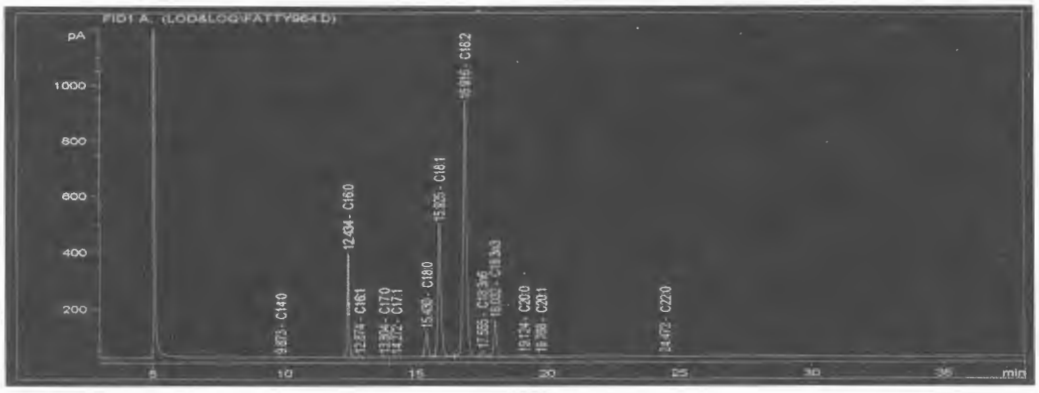

Fig. 1. Fatty acids composition of fresh sunflower oil.

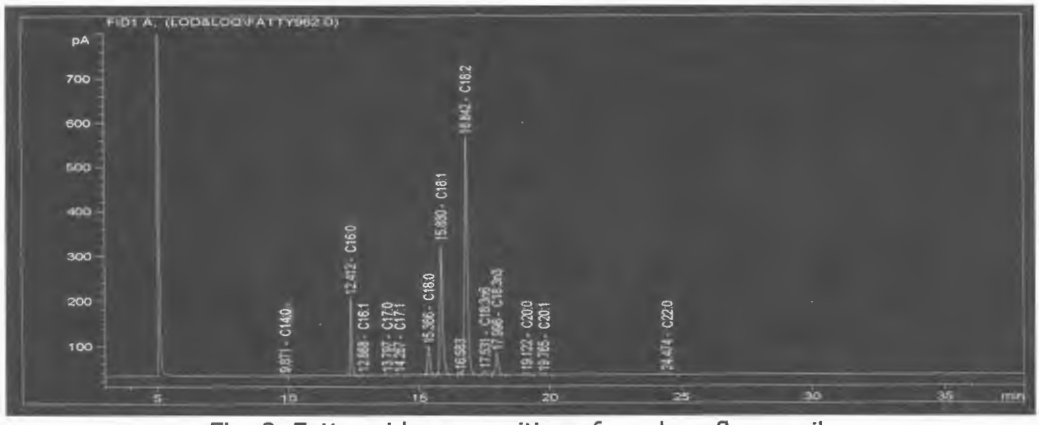

Fig. 2. Fatty acids composition of used sunflower oil.

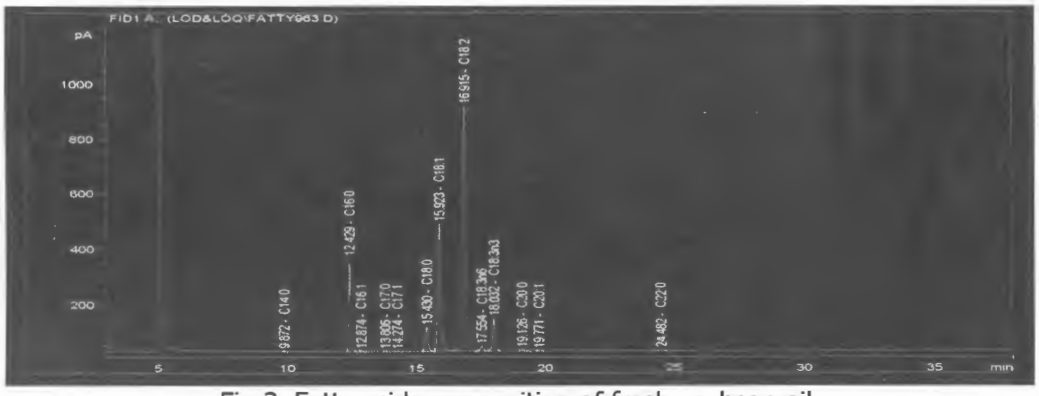

Fig.3. Fatty acids composition of fresh soybean oil.

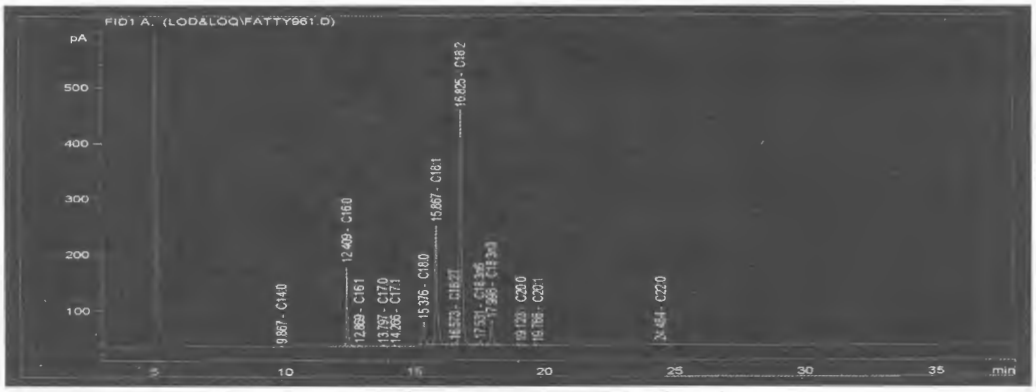

Fig. 4. Fatty acids composition of used soybean oil.

Effect of fresh & used sunflower and soybean oils on eggs of *Monacha cartusiana* snail under laboratory conditions:

Using dipping technique, data in Table (3) revealed significance between the two concentrations (8 & 16%) of sunflower oil and (16%) for soybean oils (fresh & used) than control in incubation periods. Moreover, there were none significance in all treatments with control in hatching periods (days). Finally, hatching % for the highest concentration (16%) reached 52.33, 41.98, 60.78 and 57.48% for sunflower and soybean oils (fresh & used), respectively compared with control which was 91.30 %. Sabry (2004) found that treatment with ginger oil, *Zingiber officinale* against the blowfly, *Chrysomyia albiceps* gave significant reduction in hatchability. Marcic *et al.* (2009) showed the efficacy of rapeseed oil against eggs of spider mites, green peach aphid and pear psylla in Serbia. Ismail *et al.* (2010) showed that the hatchability of the two tested snails *M. cartusiana* and *Eobania vermiculata* eggs decreased to reach 50, 42.5% on the highest concentration (400 ppm.) of neem extract (Neemazal T.S.)

The effect of fresh & used tested oils on juveniles and adults of *Monacha cartusiana* snail by baits technique:

The results in Tables (4 & 5) showed that after three weeks, mortalities of juveniles and adults of *M. cartusiana* snail were (26.67, 20.00 %), (33.33, 26.67 %) and (53.33, 46.67 %) with fresh sunflower oil at concentrations 8.75, 17.50 and 35 %, respectively. In the case of used sunflower oil, the mortality was (40.00, 26.67 %), (73.33, 46.67 %) and (100, 66.67 %) at the same concentrations, respectively. On the other hand, mortality percentages of fresh soybean oil was (33.33, 20.00 %), (53.33, 33.33 %) and (93.33, 60.00 %) at concentrations 8.75, 17.50 and 35.00 % respectively. In the case of used soybean oil the mortality was (46.67, 33.33 %), (73.33, 53.33 %) and (100, 73.33 %) at the same concentrations, respectively. For instances, Shahawy (2005) showed that the pesticide comate 500 (85% cotton seed oil) was the lowest effective compound with 2.5 % mortality percentage against *M. cantiana* snail after 12 days. Ismail *et al.* (2010) regarded the effect of neem extract (Neemazal T.S.) against adult snail *M. cartusiana* mortality percentages which reached 20, 40 and 55% for the three tested concentrations 0.625, 1.250 and 2.5 %, respectively.

Table 3. Effect of fresh & used sunflower and soybean oils on eggs of *Monacha cartusiana* snail by dipping technique under laboratory conditions.

Oils		Concentration	No. of egg	Incubation period (days)	Hatching period (days)	No. of Juveniles	Hatching %
Sunflower oil	Fresh	2%	40.00	17.00^{de}	7.00^{b}	35.89^{ab}	89.73^{bc}
		4%	40.00	17.67^{cd}	7.33^{ab}	30.38^{e}	75.95^{g}
		8%	40.00	18.33^{ab}	7.67^{ab}	27.65^{f}	69.13^{j}
		16%	40.00	18.67^{a}	8.67^{a}	20.93^{i}	52.33^{n}
	Used	2%	40.00	17.67^{cd}	7.67^{ab}	35.07^{bc}	87.68^{d}
		4%	40.00	18.33^{ab}	8.00^{ab}	29.48^{e}	73.70^{h}
		8%	40.00	18.67^{a}	8.33^{ab}	25.91^{g}	64.78^{k}
		16%	40.00	18.67^{a}	8.67^{a}	16.79^{j}	41.98^{o}
Soybean oil	Fresh	2%	40.00	16.33^{de}	7.67^{ab}	37.04^{a}	92.60^{a}
		4%	40.00	17.00^{de}	7.67^{ab}	33.85^{cd}	84.63^{e}
		8%	40.00	17.33^{de}	8.00^{ab}	30.14^{e}	75.35^{gh}
		16%	40.00	18.00^{bc}	8.33^{ab}	24.31^{gh}	60.78^{l}
	Used	2%	40.00	16.67^{de}	7.67^{ab}	35.63^{ab}	89.08^{cd}
		4%	40.00	17.00^{de}	8.00^{ab}	33.18^{d}	82.95^{f}
		8%	40.00	17.67^{cd}	8.33^{ab}	28.73^{ef}	71.83^{i}
		16%	40.00	18.33^{ab}	8.67^{a}	22.99^{h}	57.48^{m}
Control			40.00	16.00^{e}	7.00^{b}	36.52^{ab}	91.30^{ab}
$LSD_{0.05}$				1.60*	1.62^{ns}	1.65***	1.69***

Field experiment:

Data in Table (6) summarized the effectiveness of tested poisonous baits of used sunflower and soybean oils with concentrations (17.5&35%), *against M. cartusiana* snails under field conditions. Data showed that the initial effect after one day were (4.95 & 7.69 %) and (6.76 & 9.38 %) for used sunflower and soybean oils at concentrations (17.5&35%), respectively. The residual effect on reduction percentages after three weeks were (44.33& 55.32 %) and (47.83 & 57.39 %) for the tested used sunflower and soybean oils at the same concentrations, respectively. The reduction percentages were increased by increasing concentration and time elapsing.

Table 4. Effect of fresh & used sunflower and soybean oils on juveniles of *Monacha cartusiana* snail by baits technique under laboratory conditions.

Oils		Concentration	Mortality percentages				
			One day	Three days	One week	Two weeks	Three weeks
Sunflower oil	Fresh	8.75 %	0.00^{e}	6.67^{ef}	13.33^{e}	13.33^{g}	26.67^{f}
		17.50 %	6.67^{de}	20.00^{cd}	26.67^{cd}	33.33^{ef}	33.33^{ef}
		35.00 %	13.33^{cd}	26.67^{bc}	33.33^{c}	46.67^{cd}	53.33^{c}
	Used	8.75 %	6.67^{de}	13.33^{de}	26.67^{cd}	26.67^{f}	40.00^{de}
		17.50 %	13.33^{cd}	26.67^{bc}	33.33^{c}	40.00^{de}	73.33^{b}
		35.00 %	26.67^{ab}	33.33^{b}	46.67^{b}	53.33^{c}	100^{a}
Soybean oil	Fresh	8.75 %	6.67^{de}	13.33^{de}	13.33^{e}	26.67^{f}	33.33^{ef}
		17.50 %	13.33^{cd}	20.00^{cd}	20.00^{de}	46.67^{cd}	53.33^{c}
		35.00 %	20.00^{bc}	33.33^{b}	53.33^{b}	93.33^{a}	93.33^{a}
	Used	8.75 %	13.33^{cd}	26.67^{bc}	33.33^{c}	40.00^{de}	46.67^{cd}
		17.50 %	26.67^{ab}	33.33^{b}	46.67^{b}	53.33^{c}	73.33^{b}
		35.00 %	33.33^{a}	46.67^{a}	66.67^{a}	73.33^{b}	100^{a}
Control		0.00	0.00^{e}	0.00^{f}	0.00^{f}	0.00^{g}	0.00^{g}
$LSD_{0.05}$			10.29***	10.75***	10.46***	10.34***	9.82 ***

Similar results were recorded by Ismail and Abdel Kader (2011) where reduction percentages for *M. cartusiana* adult snails were 39.6,57.2 and 62.4 % for (1, 2 and 4 %), respectively concentrations of essential oil of *Syzygium aromaticum* using baiting technique under field conditions after 21 days. Farag (2012) tested castor oil at concentration (40%) against *M. cartusiana*, and found that the initial effect gave (6.54%) reduction while the residual effect recorded (53.12%) reduction at three weeks.

Biochemical studies: The obtained data in Table (7) showed remarked decrease in the activity of amylase, invertase and trehalase enzymes in adults of *M. cartusiana* treated with used soybean oil compared to control. The decreasing percentage reached its maximum level after one week of treatment with used soybean oil where activity of amylase, invertase and trehalase enzymes recorded (-6.07, -24.15 & -47.84), (-25.54, -30.16 & -33.48) and (-63.54, -70.23 & -80.30) at concentrations 8.75, 17.50 and 35 respectively. similar results were obtained by Ali (2008) where the changes in the activity of amylase and invertase of the Greasy cut worm *Agrotis*

ipsilon were decreased when treated with botanical oils (canola, sunflower and sesame) as compared with the control. Farag (2012) reported that the activity amylase, and invertase were decreased as a result of all treatments of *M. cartusiana* with castor oil compared to control.

Table 5. Effect of fresh & used sunflower and soybean oils on adults of *Monacha cartusiana* snail by baits technique under laboratory conditions.

Oils		Concentration	Mortality percentages				
			One day	Three days	One week	Two weeks	Three weeks
Sunflower oil	Fresh	8.75 %	0.00^{c}	0.00^{c}	6.67^{ef}	20.00^{e}	20.00^{f}
		17.50 %	0.00^{c}	6.67^{bc}	13.33^{de}	26.67^{de}	26.67^{ef}
		35.00 %	6.67^{bc}	13.33^{b}	26.67^{bc}	33.33^{cd}	46.67^{d}
	Used	8.75 %	0.00^{c}	6.67^{bc}	13.33^{de}	20.00^{e}	26.67^{ef}
		17.50 %	6.67^{bc}	13.33^{b}	20.00^{cd}	26.67^{de}	46.67^{d}
		35.00 %	13.33^{ab}	26.67^{a}	33.33^{b}	40.00^{c}	66.67^{ab}
Soybean oil	Fresh	8.75 %	0.00^{c}	0.00^{c}	20.00^{cd}	20.00^{e}	20.00^{f}
		17.50 %	6.67^{bc}	13.33^{b}	26.67^{bc}	33.33^{cd}	33.33^{e}
		35.00 %	13.33^{ab}	26.67^{a}	46.67^{a}	53.33^{b}	60.00^{bc}
	Used	8.75 %	6.67^{bc}	13.33^{b}	26.67^{bc}	26.67^{de}	33.33^{e}
		17.50 %	13.33^{ab}	26.67^{a}	33.33^{b}	33.33^{cd}	53.33^{cd}
		35.00 %	20.00^{a}	33.33^{a}	46.67^{a}	66.67^{a}	73.33^{a}
Control		0.00^{c}	0.00^{c}	0.00^{c}	0.00^{f}	0.00^{f}	0.00^{g}

CONCLUSION

The study investigated the probability of using waste frying oils baits as a save and inexpensive manner to control *M. cartusiana* to thrift the fresh oils for human use. The results exhibited that the used frying oils are more toxic than fresh oils where it induce the increase in reduction percentage in field. Where, the connection between trans fatty acid (TFA) and mortality of *M. cartusiana* snail was investigated. Trans fatty acids (TFAs) are unsaturated fatty acids containing double bonds in trans configuration that the molluscicidal activity may attributed to presence of TFA.

Table 6. Effect of used sunflower and soybean oils against *Monacha cartusiana* snails by baits technique under field conditions.

Frying oils	Concentration. (%)	Number of snails before treatment	Initial effect		Residual effect								
			One day		Three days		One week		Two weeks		Three weeks		Mean for red.
			No.	% Red.	No.	% Red.	No.	% Red.	No.	% Red.	No.	% Red.	
sunflower oil	17.50	57.33	56.33	4.95^{c}	53.33	14.42^{c}	51.33	30.59^{c}	47.00	38.73^{c}	45.33	44.33^{b}	26.60^{a}
	35	65.67	62.67	7.69^{ab}	58.67	17.81^{b}	56.00	33.89^{b}	48.67	44.61^{b}	41.67	55.32^{a}	31.86^{b}
soybean oil	17.50	55.33	53.33	6.76^{bc}	49.33	17.98^{b}	47.00	34.14^{b}	43.33	41.48^{bc}	41.00	47.83^{b}	29.64^{a}
	35	63.33	59.33	9.38^{a}	53.00	23.01^{a}	48.33	40.83^{a}	43.33	48.87^{a}	38.33	57.39^{a}	35.90^{b}
Control		69.00	71.33		75.00		89.00		92.33		98.00		
$LSD_{0.05}$				6.62*		6.32**		5.42***		5.72***		5.55***	4.99**

Table 7. Changes in (amylase , invertase and trehalase) enzymes activities in adults of *Monacha cartusiana* snail treated with used soybean oil using baits technique.

Treatments	Concentration (%)		Amylase			Invertase			Trehalase		
			One day	Three days	One week	One day	Three days	One week	One day	Three days	One week
Used soybean oil	8.75	SA	15.33^{a}	13.77^{a}	12.37^{ab}	15.99^{ab}	14.49^{ab}	12.10^{b}	8.72^{b}	7.05^{b}	5.83^{b}
		RA%	-1.22	-4.90	-6.07	-12.05	-18.00	-25.54	-38.55	-53.71	-63.54
	17.50	SA	14.47^{a}	11.08^{a}	9.99^{b}	14.09^{b}	12.34^{b}	11.44^{b}	7.95^{b}	6.70^{b}	4.76^{b}
		RA%	-6.77	-23.48	-24.15	-22.50	-29.60	-30.16	-43.97	-56.01	-70.23
	35	SA	10.33^{a}	8.96^{ab}	6.87^{bc}	13.10^{b}	11.99^{b}	10.81^{b}	6.74^{b}	4.91^{b}	3.15^{bc}
		RA%	-33.44	-38.12	-47.84	-27.94	-32.14	-33.48	-52.50	-67.76	-80.30
Control		SA	15.52^{a}	14.48^{a}	13.17^{a}	18.18^{a}	17.67^{a}	16.25^{a}	14.19^{a}	15.23^{a}	15.99^{a}
$LSD_{0.05}$			8.98^{ns}	7.11^{ns}	6.32*	3.76^{ns}	3.69*	3.65*	3.54**	3.26***	3.14***

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دراسات معملية وحقلية لتقييم بعض الزيوت النباتية الطازجة والمستعملة على قوقع البرسيم الزجاجى *Monacha cartusiana* (Müller)

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تعتبر إعادة تدوير النفايات خاصة زيوت القلي المستخدمة طريقة صحية وآمنه للبيئة، حيث استهدفت الدراسة تقنية جديدة للاستفادة من تلك الزيوت كبديل فعال ورخيص الثمن للمبيدات، تم تقييم زيتى عباد الشمس وفول الصويا محل الدراسة؛ كطعوم سامة ضد قوقع البرسيم الزجاجي *Monacha cartusiana* تحت الظروف المعملية والحقلية ، حيث تم اختباركلا الزيتين الطازج والمستعمل ، وأظهرت نتيجة واعدة أن زيوت القلي المستعملة في كل من عباد الشمس وفول الصويا سجلت نسب موت عالية بعد ثلاثة أسابيع عند تركيز ٣٥٪ تحت الظروف المعملية، حيث كان معدل موت الافراد الصغيرة لكل من الزيوت المستعملة ١٠٠٪، في حين بلغت موت البالغين ٦٦,٦٧ و ٧٣,٣٣٪ على التوالي ، وأظهرت النتائج أن أقل نسبة فقس للقوقع كانت ٤١,٩٨ ٪ عند استخدام زيت عباد الشمس المستعمل تليها ٥٢,٣٣ و ٥٧,٤٨ و ٦٠,٧٨ ٪ لزيت عباد الشمس الطازج، وزيت فول الصويا المستعمل و الطازج على التوالي. وبالمثل، قدر البحث الحقلي أن التأثير المتبقي لزيت عباد الشمس وزيت فول الصويا المستعمل يعمل علي زيادة نسب خفض التعداد بعد ثلاثة أسابيع حيث كانت ٥٥,٣٢ و ٥٧,٣٩٪ عند التركيز ٣٥٪ على التوالي مقارنة بالكنترول، وباجراء الدراسات البيوكميائية تم تسجيل نقص في نشاط انزيمات الأميليز والأنفرتييز وتريهالاز لدى الأفراد البالغين الذين تم معاملتهم بزيت فول الصويا المستعمل. وبالإضافة إلى ذلك، تم قياس الخصائص الفيزيائية والكيميائية مثل الأحماض الدهنية الحرة، نسبة الحموضة وقيمة البيروكسيد لكل من زيت القلي الطازج والمستعمل.