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Efficacy of Some Plant Seeds Against the Glassy Clover Snail, *Monacha cartusiana* (Müller)

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ABSTRACT

The present study was conducted on rapeseeds, castor seeds and apricot kernels against the glassy clover snail, *Monacha cartusiana* (Müller). The study used a new technique to obtain an effective, safe and cheap alternative method to pesticides, molluscicidal activities were evaluated for rapeseeds, castor seeds and apricot kernels baits against the glassy clover snail under laboratory conditions (26 ± 2°C). The results showed that the highest mortality of the apricot kernels as compared to rapeseeds and castor seeds, due to the presence of the amygdalin in apricot kernels and its absence within rapeseeds and castor seeds. Results indicated that amygdalin separated from apricot kernels recorded mortality percentages after three weeks for treatment with 2 % concentration under laboratory conditions, where, juveniles of *M. cartusiana* mortality were 100 %, while, adults of *M. cartusiana* mortality were 86.67 %, compared to apricot kernels powder without amygdalin recorded 13.33 % of juveniles and 6.67 % of adults with 10 % concentration .Similarly, field investigations estimated the residual effect of amygdalin separated from apricot kernels and apricot kernels powder on reduction percentages after three weeks were 71.62 % and 76.46 %, at concentration 2 % and 10 % respectively. Biochemical studies were recorded an increase in the activity of aspartate aminotransferase and alanine aminotransferase enzymes in juveniles and adults of *M. cartusiana* treated with amygdalin separated from apricot kernels. In addition, analysis of amygdalin separated from apricot kernels, where it was confirmed.

INTRODUCTION

Land gastropods cause costly damage to field crops, vegetables and fruit trees as well as ornamental plants (Godan 1983 and Nakhla *et al.* 1993).Recently, Molluscs are considered as a group of the most important pests attacking horticultural, field and fodder crops around the world (Barker, 2002). Unfortunately, about 25 million workers of agricultural in developing countries are poisoned every year by pesticides (Jeyaratnam 1990). Attention is increasingly being paid to the use of natural baits as plant seeds against land snails. In this concern, natural products from plant origin have received much attention as potentially useful bio-active compounds in an effort to develop alternatives to the conventional pesticides (Singh and Singh 2004 and Gabr *et al.* 2006). Also, Zhong *et al.* (2011) showed that three botanical products against snail of *Oncomlania hupensis*. In addition to (Arafa 2006) who mentioned that molluscicidal activity of nine plant powders were evaluated against *M. cartusiana* snail. A finding by Ismail and Abd El-Kader (2011) evaluated the potential of the flower-bud power and commercially available eugenol of clove; *Syzygium aromaticum* against juveniles and adults of *M. cartusiana* using baiting technique. Finally, Abd El-Haleim (2007) showed that extracts of fennel, black pepper, santonica, red pepper, pomegranate and neem against *M. obstructa* snail.

The current study is planned to evaluate some plant products as an alternative powder to harmful chemical pesticides against *M. cartusiana* snail; using available cheap and safe source presented in rapeseed, castor seed and apricot kernels as which the main pest of Egyptian clover under laboratory and field conditions.

MATERIALS AND METHODS

Tested animals: land snails, the glassy clover snail, *M. cartusiana* (juveniles and adults) were collected from fields cultivated with Egyptian clover at Sheeba locality, Zagazig district, Sharkia Governorate, Egypt and identified according to the keys given by Godan (1983). 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 bran for two weeks before treatment for acclimatization El-Okda (1981).

Tested seeds: Seeds used were rapeseeds; *Brassica napus* L., castor seeds; *Ricinus communis* L. and apricot kernels; *Prunus armeniaca* L. Rapeseed were obtained from Department of Oil Crops, Field Crops Research Institute, Agriculture Research Center at Giza governorate and (castor seeds & apricot fruits) were purchased from the local market.

Sampling and extraction procedure for apricot fruits: Kernels are pulled out fruits, and then dried at room temperature for 6 days to achieve standard drying and subsequently kept in electrical oven at 30 °C for 24 h. After the outer shells of the apricot kernel have been cracked out, the extracted kernels dried previously are pulverized by means of a blender. 5 gram of each sample is extracted three times with 100 mL iso-propanol using soxhlet technique for 3 h at 90 °C. The contents are passed through a filter paper (Wattmann 42), and then the extract is set aside for 72 h until amygdaline precipitate settle down. The product is washed out three times with ethylic ether to obtain a dry powder of amygdalin Muhammad *et al*. (2013).

High performance liquid chromatography (HPLC) analysis of amygdalin separated from apricot kernels using an amygdalin standard was purchased from sigma-Aldrich (USA): Amygdalin separated from apricot kernels analyzed by HPLC Chromatograph YL-9100 system with LC-18 (250 mm × 4.6 mm × 5µm). The mobile phase used was methanol : acetonitrile : Water 30 : 30 : 40 (v/v), at a 1 ml / min. The detection was made at wave length of 220 nm. Analyzes were performed at Micro Analytical Center, Cairo University, Giza Governorate, Egypt.

Toxicity studies:

Laboratory tests:

Poisonous baits technique: Rapeseeds, castor seeds and apricot kernels pulled out fruit, and then dried at room temperature for 6 days. After the outer shells of kernel have been cracked out. Seeds and kernels dried previously are pulverized by means of a blender. Four concentrations 1.25, 2.50, 5.00 and 10 % for powder seeds and kernels were prepared by incorporating the appropriate amount of each compound with bran bait and four concentrations 0.25, 0.50, 1.00 and 2 % for amygdalin separated from apricot kernels and apricot kernels powder without amygdalin at concentrations 1.25, 2.50, 5.00 and 10.0 %. 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 Sheeba locality, Zagazig district, Sharkia Governorate during April, 2017. The field area was divided into five plots, 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: **% 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: Juveniles and adults 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 used as enzyme source for aspartate aminotransferase (AST) and alanine aminotransferase (ALT). Activities of enzymes were measured according to the method described by Reitman and Frankel (1957).

Statistical analysis: The statistical analysis was determined by using one way test, (ANOVA), COHORT SOFTWARE (2005).

RESULTS AND DISCUSSION

Efficacy of rapeseeds, castor seeds and apricot kernels on juveniles and adults of *Monacha cartusiana* snail by baits technique under laboratory conditions: The results in Tables (1 & 2) found that after three weeks, mortalities of juveniles and adults of *M. cartusiana* snail were (0.00 %, 0.00 %), (0.00 %, 0.00 %), (6.67 %, 0.00 %) and (13.00 %, 6.67 %) with rapeseeds at concentrations 1.25 %, 2.50 %, 5.0 % and 10 %, respectively. In the case of castor seeds, the mortality was (0.00 %, 0.00 %), (6.67 %, 6.67 %), (26.67 %, 13.33 %) and (33.33 %, 20.00 %) at the same concentrations, respectively. On the other hand, mortality percentages of apricot kernels were (26.67 %, 13.33 %), (40.00 %, 26.67 %), (66.67 %, 46.67 %) and (100 %, 73.33 %) at concentrations 1.25 %, 2.50 %, 5.0 % and 10 % respectively. Moreover, there were significance in all treatments for juveniles and adults of *M. cartusiana* snail. This is due to the presence of the amygdalin in apricot kernels and its absence within rapeseeds and castor seeds. For instances, Vickery *et al.* (1987) found that amygdalin is considered a main component of apricot kernel. However, it toxic cyanogenic glycosides. Silem *et al.* (2006) mentioned that amygdalin contain high amount of cyanogenetic glycoside might cause acute or chronic toxicity in human beings and animals. Halenar *et al.* (2013) indicated that amygdalin is a major component of the seeds of prunasin family plants such as apricots, almonds, peaches, apples and other rosaceous plants.

Table 1. Efficacy of rapeseeds, castor seeds and apricot kernels on juveniles of *Monacha cartusiana* snail by baits technique under laboratory conditions.

Seeds & kernels	Concentration	Mortality percentages				
		One day	Three days	One week	Two weeks	Three weeks
Rapeseeds	1.25 %	0.00^{e}	0.00^{e}	0.00^{e}	0.00^{e}	0.00^{e}
	2.50 %	0.00^{e}	0.00^{e}	0.00^{e}	0.00^{e}	0.00^{e}
	5.0 %	0.00^{e}	0.00^{e}	0.00^{e}	0.00^{e}	6.67^{e}
	10.0 %	0.00^{e}	0.00^{e}	0.00^{e}	6.67^{de}	13.33^{de}
Castor seeds	1.25 %	0.00^{e}	0.00^{e}	0.00^{e}	0.00^{e}	0.00^{e}
	2.50 %	0.00^{e}	0.00^{e}	0.00^{e}	6.67^{de}	6.67^{e}
	5.0 %	0.00^{e}	0.00^{e}	13.33^{d}	20.00^{cd}	26.67^{cd}
	10.0 %	0.00^{e}	6.67^{d}	26.67^{bc}	33.33^{c}	33.33^{c}
Apricot kernels	1.25 %	0.00^{e}	6.67^{d}	13.33^{d}	20.00^{cd}	26.67^{cd}
	2.50 %	0.00^{e}	13.33^{c}	20.00^{cd}	33.33^{c}	40.00^{c}
	5.0 %	6.67^{b}	26.67^{b}	33.33^{b}	53.33^{b}	66.67^{b}
	10.0 %	13.33^{a}	33.33^{a}	53.33^{a}	93.33^{a}	100^{a}
Control	0.00	0.00^{e}	0.00^{e}	0.00^{e}	0.00^{e}	0.00^{e}
$LSD_{0.05}$		1.32***	2.94***	11.14***	18.81***	13.52 ***

High performance liquid chromatography (HPLC) Study: HPLC is used for verification the efficiency of amygdalin separated from apricot kernels via the comparison the retention time of the standard amygdalin with those amygdalin separated from apricot kernels under conditions that specified in method at 2.02 min (Figures 1, 2). Similar observations were obtained by Viorica- Mirela *et al.* (2006) reported that amygdalin quantity analyses by HPLC method. Yan *et al*. (2006) whom found that amygdalin was successfully separated from the crude extract of *Prunus armeniaca* L. using high-speed countercurrent chromatography. Muhammad *et al.* (2013) studied that amygdaline in Iraqi plant seeds was extracted and determined by high performance liquid chromatography.

Efficacy of amygdalin separated from apricot kernels and apricot kernels powder without amygdalin on juveniles and adults of *Monacha cartusiana* snail.

Using baits technique, data in Tables (3, 4) found that after three weeks of treatment, mortalities of juveniles and adults of *M. cartusiana* snail were (26.67 %, 20.00 %), (40.00 %, 33.33 %), (73.33 %, 46.67 %) and (100 %, 86.67 %) with amygdalin separated from apricot kernels at concentrations 0.25 %,0.50 %, 1.0 % and 2.0 %, respectively. On the other hand, mortality percentages of apricot kernels powder without amygdalin, were (0.0 %, 0.0 %), (0.0 %, 0.0 %), (6.67 %, 0.0 %) and (13.33 %, 6.67 %) at concentrations 1.25 %, 2.50 %, 5.0 % and 10.0 %, respectively. Moreover, there were significance in all treatments for juveniles and adults. Barceloux (2009) and Zhao (2012) explained that amygdalin the cyanogenic diglucoside D-mandelonitrile- β-D- gentiobioside, is usually present in apricot kernels, bitter almonds and the seeds of other members of the genus *Prunus*. It is potentially dangerous because it can undergo hydrolysis to produce hydrogen cyanide (HCN). The ingestion of apricot kernels can thus cause cyanide poisoning Suchard *et al.* (1998). Chwalek and Ple. (2004) found that amygdalin is a cyanogenic glucoside initially isolated from the seeds of bitter almonds (*Prunus dulcis*). Viorica-Mirela *et al.* (2006) reported that apricot kernels have considerable quantity of amygdalin is a toxic substance for human organism.

Table 2. Efficacy of rapeseeds, castor seeds and apricot kernels on adults of *Monacha cartusiana* snail by baits technique under laboratory conditions.

Seeds & kernels	Concentration	Mortality percentages				
		One day	Three days	One week	Two weeks	Three weeks
Rapeseeds	1.25 %	0.00^{b}	0.00^{c}	0.00^{c}	0.00^{c}	0.00^{e}
	2.50 %	0.00^{b}	0.00^{c}	0.00^{c}	0.00^{c}	0.00^{e}
	5.0 %	0.00^{b}	0.00^{c}	0.00^{c}	0.00^{c}	0.00^{e}
	10.0 %	0.00^{b}	0.00^{c}	0.00^{c}	6.67^{c}	6.67^{de}
Castor seeds	1.25 %	0.00^{b}	0.00^{c}	0.00^{c}	0.00^{c}	0.00^{e}
	2.50 %	0.00^{b}	0.00^{c}	0.00^{c}	0.00^{c}	6.67^{de}
	5.0 %	0.00^{b}	0.00^{c}	0.00^{c}	6.67^{c}	13.33^{d}
	10.0 %	0.00^{b}	6.67^{bc}	6.67^{c}	13.33^{bc}	20.00^{cd}
Apricot kernels	1.25 %	0.00^{b}	0.00^{c}	6.67^{c}	6.67^{c}	13.33^{d}
	2.50 %	0.00^{b}	6.67^{bc}	13.33^{bc}	20.00^{bc}	26.67^{c}
	5.0 %	0.00^{b}	13.33^{b}	26.67^{ab}	33.33^{b}	46.67^{b}
	10.0 %	6.67^{a}	26.67^{a}	33.33^{a}	66.67^{a}	73.33^{a}
Control	0.00	0.00^{b}	0.00^{c}	0.00^{c}	0.00^{c}	0.00^{e}
$LSD_{0.05}$		1.40***	6.79***	14.03***	20.05***	17.52 ***

Table 3. Efficacy of amygdalin separated from apricot kernels and apricot kernels powder without amygdalin on juveniles of *Monacha cartusiana* snail by baits technique under laboratory conditions.

Powders	Concentration	Mortality percentages				
		One day	Three days	One week	Two weeks	Three weeks
Amygdalin	0.25 %	0.00^{b}	0.00^{c}	6.67^{c}	20.00^{cd}	26.67^{cd}
	0.50 %	0.00^{b}	6.67^{bc}	20.00^{bc}	33.33^{bc}	40.00^{c}
	1.00 %	6.67^{b}	13.33^{b}	33.33^{ab}	53.33^{b}	73.33^{b}
	2.00 %	20.00^{a}	40.00^{a}	53.33^{a}	93.33^{a}	100^{a}
Apricot kernels powder without amygdalin	1.25 %	0.00^{b}	0.00^{c}	0.00^{c}	0.00^{d}	0.00^{e}
	2.50 %	0.00^{b}	0.00^{c}	0.00^{c}	0.00^{d}	0.00^{e}
	5.0 %	0.00^{b}	0.00^{c}	0.00^{c}	0.00^{d}	6.67^{e}
	10.0 %	0.00^{b}	0.00^{c}	6.67^{c}	6.67^{d}	13.33^{de}
Control	0.00	0.00^{b}	0.00^{c}	0.00^{c}	0.00^{d}	0.00^{e}
$LSD_{0.05}$		11.49*	11.55***	20.20***	20.37***	15.01 ***

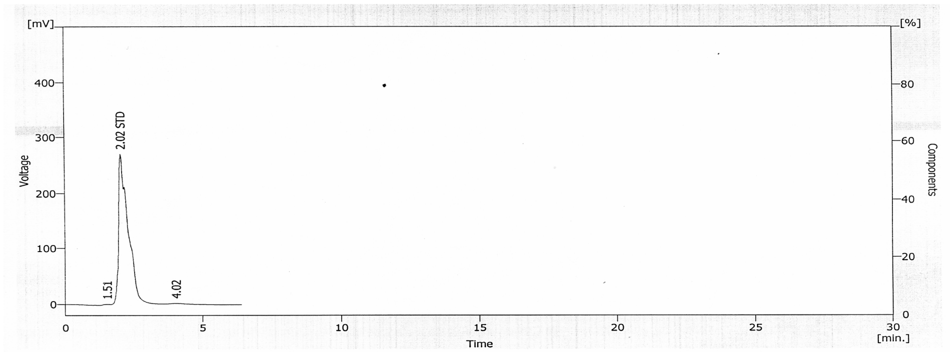

Figure 1. Chromatogram of the standard amygdaline.

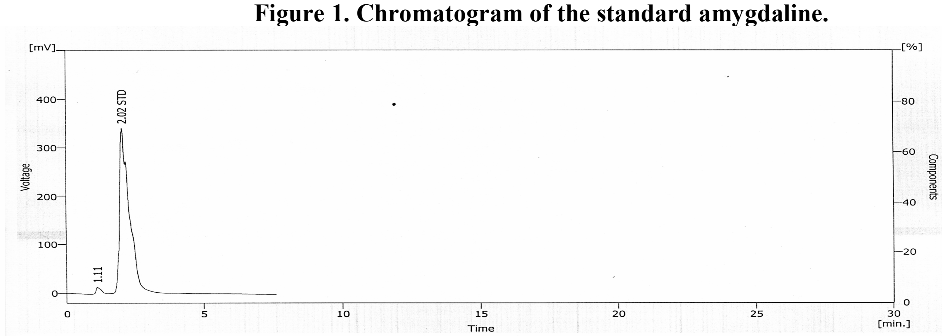

Figure 2. Chromatogram of amygdalin separated from apricot kernels.

Table 4. Efficacy of amygdalin separated from apricot kernels and apricot kernels powder without amygdalin on adults of *Monacha cartusiana* snail by baits technique under laboratory conditions.

Powders	Concentration	Mortality percentages				
		One day	Three days	One week	Two weeks	Three weeks
Amygdalin	0.25 %	0.00^{b}	0.00^{c}	0.00^{c}	13.33^{cd}	20.00^{cd}
	0.50 %	0.00^{b}	0.00^{c}	6.67^{bc}	26.67^{bc}	33.33^{bc}
	1.00 %	0.00^{b}	6.67^{b}	13.33^{ab}	40.00^{b}	46.67^{b}
	2.00 %	6.67^{a}	13.33^{a}	20.00^{a}	73.33^{a}	86.67^{a}
Apricot kernels powder without amygdalin	1.25 %	0.00^{b}	0.00^{c}	0.00^{c}	0.00^{d}	0.00^{e}
	2.50 %	0.00^{b}	0.00^{c}	0.00^{c}	0.00^{d}	0.00^{e}
	5.00 %	0.00^{b}	0.00^{c}	0.00^{c}	0.00^{d}	0.00^{e}
	10.00 %	0.00^{b}	0.00^{c}	0.00^{c}	6.67^{d}	6.67^{de}
Control	0.00	0.00^{b}	0.00^{c}	0.00^{c}	0.00^{d}	0.00^{e}
$LSD_{0.05}$		1.14***	1.62***	12.84*	15.60***	18.48 ***

Field experiment: Data in Table (5) showed the effectiveness of tested poisonous baits of apricot kernels powder and amygdalin separated from apricot kernels *against M. cartusiana* snails under field conditions. Data found that the initial effect after one day were (5.29 & 8.14 %) at concentrations(5 % and10 %) for apricot kernels powder, respectively, and (4.99 & 7.79 %) for amygdalin separated from apricot kernels at concentrations (1% and 2%), respectively. The residual effect on reduction percentages after three weeks were (58.92 & 76.46 %) and (54.33 & 71.62 %) for apricot kernels powder and amygdalin separated from apricot kernels at the same concentrations, respectively. The reduction percentages were increased by increasing concentration and time elapsing. Moreover, there were none significance in all treatments. Similar results were recorded by Walker and Krieble (1990) reported that amygdalin is a toxic cyanogenic glycoside. It is hydrolyzed by β- glucosidase into d-glucose, benzaldehyde and prussic acid (hydrogen cyanide). Ismail and Abdel Kader (2011) found that the reduction percentages for *M. cartusiana* adult snails were 39.6, 57.2 and 62.4 % for (1, 2 and 4 %) concentrations, respectively, 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 Tables (6,7) found remarked increase in the activity of aspartate aminotransferase (AST) and alanine aminotransferase (ALT) enzymes in juvenile and adults of *M. cartusiana* treated with amygdalin separated from apricot kernels compared to control. The increasing percentage reached its maximum level for juveniles and adults of *M. cartusiana* after one week of AST and ALT enzymes recorded (-45.21**,** -36.97**,** -32.57 & -7.66) and (-34.84**,** -35.44**,** -12.87 & -0.62) for juveniles, respectively, (-

19.41, -29.73, - 49.45 & -51.80) and (-41.76, -27.13, -15.65 & - 10.85) for adults, respectively, at concentrations 0.25, 0.50, 1.0 and 2.0 % respectively. The activity of AST and ALT were decreased as a result of all treatments compared to control. Generally, alteration in the activity of AST and ALT are known to be helpful in the diagnosis of hepatic infarcts or damage. Results are in agreement with those reported by Lebsack *et al.* (1980) who mentioned that the possible mechanism involved in the elevation of AST and ALT levels may be due to tissue damage. Tilkian *et al.* (1983) studied the pathogenesis effects which response enzymes activation, and stated that the amount of AST was directly proportional to the number of cell damaged and the intervals after administration. Amer *et al.* (1994) found that the increase of AST and ALT activity may be referred to the diffusion of these enzymes from its intracellular sites due to damage caused by the insecticide on the subcellular level. El-Deeb *et al.* (1999) tested the effects of khella fruits ethanolic extract and santonica hexanic extract on AST activity of *Monacha contiana* snail. El-Shafiey (2010) reported that the activity of both enzymes AST and ALT was decreased as a result of treatment with both hexane and petroleum ether extracts of *Jatropha curcas* plant.

Table 5. Effect of apricot kernels powder and amygdalin separated from apricot kernels against *Monacha cartusiana* snails by baits technique under field conditions.

Powders	Conc. (%)	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.	
Apricot kernels powder	5	62.33	60.67	5.29^{a}	57.67	13.48^{a}	52.00	27.92^{a}	48.00	37.70^{a}	33.67	58.92^{ab}	28.66^{a}
	10	65.67	62.00	8.14^{a}	54.67	22.16^{a}	43.33	42.99^{a}	36.33	55.25^{a}	20.33	76.46^{a}	41.00^{a}
Amygdalin separated from apricot kernels	1	63.83	62.33	4.99^{a}	60.67	11.12^{a}	54.00	26.90^{a}	50.67	35.78^{a}	38.33	54.33^{b}	26.62^{a}
	2	67.00	63.50	7.79^{a}	58.00	19.05^{a}	47.67	38.52^{a}	40.33	51.30^{a}	25.00	71.62^{ab}	37.66^{a}
Control		72.00	74.00		77.00		83.33		89.00		94.67		
$LSD_{0.05}$				4.31^{ns}		16.41^{ns}		24.91^{ns}		23.90^{ns}		18.83^{ns}	29.77^{ns}

Table 6. Changes in (AST and ALT) enzymes activities in juvenile of *Monacha cartusiana* snail treated with amygdalin separated from apricot kernels using baits technique.

Treatment	Conc.(%)		AST			ALT		
			One day	Three days	One week	One day	Three days	One week
Amygdalin separated from apricot kernels	0.25	SA	2.48^{b}	2.57^{b}	2.86^{c}	21.94^{b}	26.34^{b}	33.61^{b}
		RA%	-53.21	-52.32	-45.21	-57.04	-47.79	-34.84
	0.50	SA	2.63^{b}	2.76^{b}	3.29^{bc}	25.18^{b}	30.28^{b}	33.30^{b}
		RA%	-50.38	-48.79	-36.97	-50.70	-39.98	-35.44
	1	SA	2.80^{b}	3.26^{b}	3.52^{bc}	33.99^{b}	37.57^{ab}	44.94^{ab}
		RA%	-47.17	-39.52	-32.57	-33.44	-25.53	-12.87
	2	SA	3.31^{b}	4.05^{ab}	4.82^{ab}	36.82^{ab}	46.05^{a}	51.26^{a}
		RA%	-37.55	-24.86	-7.66	-27.90	-8.72	-0.62
Control		SA	5.30^{a}	5.39^{a}	5.22^{a}	51.07^{a}	50.45^{a}	51.58^{a}
$LSD_{0.05}$			1.82*	1.31*	1.92^{ns}	15.03*	19.07^{ns}	16.23^{ns}

SA = Specific activity as (µg pyruvate /ml) RA% = (Relative activity %) = [(Treatment – Control) / Control] × 100

Table 7. Changes in (AST and ALT) enzymes activities in adults of *Monacha cartusiana* snail treated with amygdalin separated from apricot kernels using baits technique.

Treatment	Conc.(%)		AST			ALT		
			One day	Three days	One week	One day	Three days	One week
Amygdalin separated from apricot kernels	0.25	SA	2.82^{b}	3.58^{b}	5.15^{ab}	10.57^{b}	16.99^{b}	21.14^{b}
		RA%	-53.62	-37.41	-19.41	-68.56	-51.95	-41.76
	0.50	SA	2.64^{b}	3.35^{b}	4.49^{bc}	11.32^{b}	17.41^{ab}	26.45^{ab}
		RA%	-56.58	-41.43	-29.73	-66.33	-50.76	-27.13
	1	SA	2.34^{b}	2.46^{b}	3.23^{c}	15.83^{b}	21.77^{ab}	30.62^{a}
		RA%	-61.51	-56.99	-49.45	-52.91	-38.43	-15.65
	2	SA	2.24^{b}	2.27^{b}	3.08^{c}	23.77^{ab}	27.15^{ab}	32.36^{a}
		RA%	-63.16	-60.31	-51.80	-29.30	-23.22	-10.85
Control		SA	6.08^{a}	5.72^{a}	6.39^{a}	33.62^{a}	35.36^{a}	36.30^{a}
$LSD_{0.05}$			1.91**	1.89*	1.39*	16.29*	18.19^{ns}	17.67^{ns}

SA = Specific activity as (µg pyruvate /ml) RA% = (Relative activity %) = [(Treatment – Control) / Control] × 100

CONCLUSION

The study investigated the probability of apricot kernels powder and amygdalin separated from apricot kernels at baits as a safe and inexpensive manner to control *M. cartusiana*. Besides amygdalin separated from apricot kernels were more toxic than apricot kernels powder, amygdalin recorded an increase in reduction percentage in field. Where, the connection between amygdalin and mortality of *M. cartusiana* snail was investigated.

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تأثير بعض البذور النباتية ضد قوقع البرسيم الزجاجى(Müller) *Monacha cartusiana*

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أجريت هذه الدراسة على بذور الشلجم والخروع والمشمش ضد قوقع البرسيم الزجاجى, حيث استهدفت الدراسة تقنية جديدة للاستفادة من تلك البذور كبديل فعال ورخيص الثمن للمبيدات، حيث تم تقييم بذور الشلجم والخروع والمشمش كطعوم سامة ضد قوقع البرسيم الزجاجى تحت الظروف المعملية (٢٦±٢مْ) , وأوضحت النتائج أن أعلى تأثير مميت كان لبذور المشمش مقارنة ببذور الشلجم والخروع وذلك راجع الى وجود مركب الأميجدالين السام ببذور المشمش وعدم وجوده ببذور الشلجم والخروع,وأظهرت النتائج أن مركب الأميجدالين المفصول من بذور المشمش سجل نسب موت بعد ثلاثة أسابيع من المعاملة عند تركيز ٢٪ تحت الظروف المعملية، حيث كان معدل موت الافراد الصغيرة ١٠٠٪ ، في حين بلغ موت الأفراد البالغين ٨٦,٦٧٪ مقارنة لمسحوق بذور المشمش الخالى من مركب الأميجدالين حيث سجل نسبة موت ١٣,٣٣ ٪ للأفراد الصغيرة ، في حين بلغت نسبة الموت ٦,٦٧ ٪ للأفراد البالغة وذلك عند تركيز ١٠ ٪ وبالمثل، أوضحت التجربة الحقلية أن تأثير مركب الأميجدالين المفصول من بذور المشمش و مسحوق بذور المشمش أدى الى زيادة نسب خفض التعداد بعد ثلاثة أسابيع حيث كانت ٧١,٦٢ و ٧٦,٤٦ ٪ على التوالى عند التركيز ٢ ٪ و ١٠ ٪ على التوالي ، وباجراء الدراسات البيوكيميائية تم تسجيل زيادة في نشاط انزيمات أسبارتات أمينو ترانسفيراز و ألانين أمينو ترانسفيراز لدى الأفراد الصغيرة والبالغة الذين تمت معاملتهم بمركب الأميجدالين المفصول من بذور المشمش. هذاوبالإضافة إلى ذلك، تم تحليل مركب الأميجدالين المفصول من بذور المشمش حيث تم التأكد من وجوده.