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LABORATORY AND FIELD TRAILS IN CONTROL THE GLASSY CLOVER SNAIL *MONACHA CARTUSIANA* (MULLER) ATTACKING EGYPTIAN CLOVER IN SHEBIN EL-KOM DISTRICT AT MENOUFIA GOVERNORATE

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ABSTRACT: Nineteen plant extracts with four concentrations (2, 3, 5, and10%) and five pesticides with recommended, 0.5, and 2 recommended dose were used to test their toxicity effect against the glassy clover snail Monacha cartusiana (Muller) under laboratory conditions, this experiment was conducted for seven days. Mortality percentages were calculated as the end of the experiment, seven plant extracts were classified as high toxic material they caused 91 : 100% mean mortality at 10% concentration (Galls, Clove, Garlic, Rhubarb, Lavander, Nut meg, and Visnaga fruits) another seven plant extracts were classified as moderate toxic materials caused 60 : 89% mean mortality at 10% concentration (belladonna, mustard, thymus, cynen pepper, seena-p, camomile, and black cumin) the lowest plant extracts toxicity were calendula, pyrethrum, colophony, Seena-L and Bitter-wood, they were caused 0 : 59% as mean mortality at 10% concentration. The five pesticides were arranged in descending order as follows: Citrogard > High point > Dumper > Agriflex > Akarimyt. Another experiment was conducted under field condition, three high toxic plant extracts (Galls, Clove, Mustard) in addition to two pesticides (Citrogard and high point) were studied for their effect on Monacha cartusiana infested Egyptian clover plants for three weeks, the reduction percentages were calculated after 1, 3 , 5 , 7 , 14 and 21 days. Samples collected after 14 days of application showed remarkable decreasing in numbers reached 92.39, 88.08 and 86.18 % mortality for galls, clove and Mustard, while these plants caused 100% after 21 days and both pesticides treatments recorded 100% mortality after 14 days.

***Key words**: Mollusces, Monacha cartusiana, plant extracts, pesticides*

INTRODUCTION

Mollusces have been largely neglected in the pest control literature, and yet gastropod mollusc species currently constitute some of the most significant and intractable threats to sustainable agriculture. Insistences of crop losses from herbivorous gastropods have been reported throughout recorded history. However, the 20th century witnessed the emergency of gastropods as important crop pests in temperate and typical regions. The increased pest status has been associated with cultivation of new crops, intensification of agricultural production systems, and the spread through human trade and travel of species adapted to these modified environments. Furthermore, in some crops, the significance of gastropods is only now becoming apparent with the decline in the importance of other pest groups, such as insects, for which effective control strategies have been developed (Barker 2002). Now, in Egypt the land mollusca species are serious economic land pests attacking plants especially in northen coastal areas. According to the chewing mouth parts of these animals and their mucous excretion (Ryder and Bowen, 1977) they cause very noticeable holes in the leaves of the plant on which they fed and

in some cases these pests gather and stuck on other parts of the attached plant, (El-Okda, 1980 and Godan, 1983). Control of gastropods in vegetable crops has always been different, due on the one hand to low economic there sholds and on the other, to the variable life cycles of the main pest species and the introduction of many environmental factors, such as different crops, soil type, climate, and timing of application of the molluscicidal baits (Port and Port, 1986). The clover land snail, *Monacha cartusiana* is the most common and serious pest in Egypt, where it cause asubstantial damage to different agricultural crops at various governorates. It was recorded with a relatively high population density on the major economic crops such as Egyptian clover (Awad, 2000) A combination of agricultural and a chemical control methods is recommended to combat snails or slugs problem. For many years, land snails and slugs have been successfully controlled with metaldehyde or carbamates of ten formulations as bait pellets (Garthwaite and Thomas, 1996 and Hammond *et al*., 1996). However, environmental health problems and the toxic effects to non-target organisms and beneficial invertebrates that caused as result of extensive use of pesticides have enhanced scientists to search for another alternative snails management, in addition to look for new safe molluscicides with different mode of action.

The present study aims to throw light on the following points:

1. The effect of nineteen plant extracts with different concentrations on survival of *Monacha cartusiana* under laboratory conditions.
2. The effect of five chemical compounds with different concentrations on *M.cartusiana* under laboratory conditions.
3. The effect of the most toxic three plant extracts and the highest toxic two compounds on *M. cartusiana* population infested Egyptian clover under field conditions.

MATERIAS AND METHODS

1. Laboratory experiments:

1.1. Effect of plant extracts:

- Tested snail:

Adults of glassy clover snail. *Monacha cartusiana* were collected directly, from infested fields at Menoufia governorate. The collected snails were transferred to the laboratory, kept under room conditions at 20±3ºC and 80±5RH% healthy and similar individuals were chosen and kept in glass terrariums (70×40×40 cm) which was filled with moist soil adjusted at 75% of water field capacity and provided daily with fresh green lettuce leaves for two weeks before treatment for acclimatization (Godan, 1983).

All powder plants of this study were collected and identified English name, Arabic name, scientific name, family and used parts in table (1) powders of nineteen plant samples were used in this study. Dry powder of each plant material was added to distilled water and mixed thoroughly, then autoclaved with steam under pressure at 121ºC for 20 minutes. Four concentrations of each aqueous extract 2, 3, 5, and 10% were used. The aqueous extracts were kept in dark glass bottled in refrigerator for further testes (Mutwally *et al*., 2010). Ten adult healthy snails used in 3 replicates for each concentration provided with 5 cm lettuce disc sprayed with the plant extract another replicate for each concentration was left as control provided with clean lettuce disc sprayed with water.

1.2. Effect of pesticides:

Five pesticides with 3 concentrations of each compound were used to study their molluscicidal activity on *Monacha cartusiana* using the spraying leaf technique under laboratory conditions (common name, trade name, chemical structure and chemical name of these compounds are shown in table (2).

Table (1): Scientific name, Family, English name and Arabic name of used plant extracts:

Scientific name	Family	English name	Arabic name	Used part
Matricaria chamomilla	Asteraceae	Camomile	بابونج	Flowers
Nigella sativa	Ranunculaceae	Black cumin	حبة البركة	Seeds
Senna alexandrina	Fabaceae	Senna leaves	سنا مكي اوراق	Leaves
Thymus vulgaris	Lamiaceae	Thyme	زعتر	Flowers
Lavendula angustifolia	Lamiaceae	Lavender	خزامي	Flowers
Eugenia caryophyllus	Myrtaceae	Clove	قرنفل	Buds
Chrysanthemum cinerariifolium	Asteraceae	Pyrethrum	بيرثرم	Flowers
Thuja standishii	Cupressaceae	Oak gall	عفص	Buds
Atropa belladonna	Solanaceae	Belladonna	ست الحسن	Flowers
Rheum rhabarbarum	Polygonaceae	Rhubarb	راوند	Roots
Brassica hirta	Brassicaceae	Mustard	خردل	Seeds
Myristica fragrans	Myristicaceae	Nutmeg	جوزة الطيب	Fruits
Ammi visnaga	Apiaceae	Khella	خلة بلدي	Fruits
Senna alexandrina	Fabaceae	Senna pods	سنا مكي قرون	Fruits
Capsicum annum	Solanaceae	Cayenne pepper	فليفلة حمراء	Fruits
Calendula officinalis	Asteraceae	Calendula	اقحوان	Flowers
Pinus sp.	Pinaceae	Colphony	قلفونية	Fruits
Quassia amara	Simaroubaceae	Bitter wood	خشب المر	Steam
Allium sativum	Alliaceae	Garlic	الثوم	Steam

Table (2): Trade name, Active ingredient, Chemical name, Rate of application and Chemical family for used pesticides.

Trade name	Active ingredient	Chemical name	Rate of application	Chemical family
Dumper 55% SC	Fenbutatin oxide	Bis[Tris(2-methyl-2-phenyl propyl)tin] oxide.	1 CM^3/ 1 L water	Organotin
Akari 5%EC	Fenpyroximate	1,1-dimethyl(E)-4-[[[[(1,3-dimethyle-5-phenoxy-1H-pyrazol-4-yl)methylene]amino]oxy]methyle] benzoate	50 CM^3/ 100 L water	Pyrazol
Agri-flex 18.6% SC	Thiamethoxam + Abamectin	3-(2-Chloro-5-Thiazolylmethyl) Tetrahydro-5-methyl-N-Nitro-4H-1,3,5-Oxadiazin-4- imine+ Avermectin B1a	60 ml / 100 L water	Neonectinoid+ Biocides
Cittoguard 15% EC	Pyridaben	2- tert-butyl-5-(4-tert-butyl benzylithio)-4- chloropyridazin-3(2H)-one	200 ml/ 100 L water	Pyridazinone
High point10% EC	Abamectin+ Hexythiazox	Avermectin B1a+ trans-5-[4-chlorophenyl)-N-cyclohexyl-4-methyl-2-oxo-3-thiazolidine carboxamide.	25 CM^3/ 100 L water	Biocides+ Thiazolidine

- Tested snails:

Adult snails of *Monacha cartusiana* were collected from infested nurseries and field crops in Dakma village, El May district, Menoufia governorate. The obtained snails were transferred in plastic bags to the laboratory, then kept in plastic containers filled with moist soil and fed on fresh leaves of lettuce for 14 days to be laboratory acclimatizatized only healthy snails were used in the experiments leaf discs of lettuce (5 cm diameter were sprayed with tested concentration, then 3 replicates were used for each concentration, each replicate have 10 adult snails another replicate for each concentration was left as control provided with clean lettuce disc sprayed with water. The tested snails were examined daily for 7 days, where the dead individuals were counted and removed mortality percentages were calculated after 1, 2, 4, 5, 6, 7 days and corrected by Abbott's formula (Abbott, 1925). LC_{50} and slope values were calculated for each experiment.

2. Field experiment:

From nineteen plant extracts tested laboratory three of most toxic were chosen: galls, clove, and mustard, also high point, strogard was chosen as the most effected compound to spray under field condition.

This experiment was conducted in Egyptian clover field heavily infested with *M. cartusiana* in Dakma village, El May district, Menoufia governorate, during the growing

season April, 2015. Using three plant extracts (galls, clove and mustard), and two pesticides (high point and citrogard) to test their efficacy on *M. cartusiana*.

The area of study was divided into 6 plots each of about $1m^2$ and about the same area was lefted between each other in randomize block design system. The field was irrigated one day before treatment. The tested toxicants were applied in first day as spray solution at concentration of 10% for the three plant extracts and for the two pesticides.

RESULTS AND DISCUSSION

1. Laboratory experiments:

1.1. Toxicity effect of some plant extracts to *Monacha cartusiana*:

Nineteen plant extracts were used to test their toxicity effect against the clover snail *Monacha cartusiana* under laboratory conditions, temperature ranged from 25: 28ºC and 85 ± 5% relative humidity experiment was conducted for seven days with four concentrations for each plant extract 2, 3, 5, and 10%, mortality percentages were calculated and corrected. Plant extracts have different effect on *M. cartusiana*, therefore plant extracts were divided to three categories high, moderate and low toxic groups.

1.1.1. High toxic plant extracts:

Seven plant extracts were stored as high toxic materials, it caused from 91: 100% mean mortality at 10% concentration after seven days, these plants were galls, clove, garlic, rhubarb, lavender, nutmeg, and visnaga fruit. Data in table 3 proved that galls plant extract recorded from 60: 100%, mortality after 7 days of application at 2, 3, 5, and 10% concentration with mean mortality of 35.24 : 100% followed by clove which recorded 56.66% mortality at 2% concentration and 100% for 3, 5, or 10% with mean mortality ranged from 24.28: 100%. On the third rank garlic was less toxic at 2, 3, 5% concentrations record 10, 53.33, and 76.67% while 10% concentration gave 100% mortality, mean mortality ranged from 6.67 : 96.19%. Rhubarb resulted in 6.66, 40, 83.33 and 100% mortality with means ranged from 4.28: 97.62%. As for lavender 2% gave only 3.33% mortality while 10% gave 100% at the fourth day, mean mortality ranged from 1.9: 91.9%. nutmeg gave 3.33 and 33.33 after seven days at 2, 3% concentration while 5, 10% concentrations gave 83.33 and 100%, mean mortality ranged from 1.9: 100% mortality. The mortality percentages of 2% visnaga fruit were zero while 3% recorded only 23.33 after seven days increased to 73.33 and 100% for 5, 10% concentration with mean mortality ranged from 0 to 96.19% respectively.

Concentration mortality regression lines obtained for the seven plant extracts are given in fig 12, slope, LC_{50} and 95% fiducially limits of LC_{50} are shown in table (4). Clove gave the lowest LC_{50} 0.9715% followed by galls 1%, lavender LC_{50} was 2.401 while nutmeg LC_{50} was 2.7588 followed by garlic 2.9880, visnaga fruit 3.2664 and finally rhubarb 3.3272%. As for slope, it was 1.00 for galls and clove, 0.5104 and 0.5023for rhubarb and visnaga fruit by garlic 0.2966, then lavender and nutmeg LC_{50} were 0.0848 and 0.095.

Discussing the foregoing results cleared that the plant extracts of galls and clove were the most toxic materials, where 10% concentration resulted in 100% mortality one day after application followed by garlic and rhubarb gave 100% mortality after 4 or 2 days of application. Nutmeg 10% resulted in 100% mortality one day after application but LC_{50} was 2.7588%.

Table (3): Mortality percentages of *Monacha cartusiana* affected by high toxic plant extracts after seven days under laboratory conditions:

Plant extract	Mortality %								Mean
	Day & Conc.	1st	2nd	3rd	4th	5th	6th	7th	
Galls	2%	0	13.33	23.33	43.33	53.33	53.33	60	35.24
	3%	0	40	90	93.33	100	100	100	74.76
	5%	26.67	66.67	100	100	100	100	100	84.76
	10%	100	100	100	100	100	100	100	100
Clove	2%	0	0	13.33	20	30	50	56.66	24.28
	3%	0	16.67	56.67	80	90	93.33	100	62.38
	5%	0	26.67	56.67	80	100	100	100	66.19
	10%	100	100	100	100	100	100	100	100
Garlic	2%	0	3.33	3.33	10	10	10	10	6.67
	3%	0	13.33	16.67	26.67	43.33	43.33	53.33	28.1
	5%	10	23.33	40	53.33	60	76.67	76.67	48.57
	10%	83.33	93.33	96.67	100	100	100	100	96.19
Rhubarb	2%	0	0	3.33	6.66	6.66	6.66	6.66	4.28
	3%	0	6.67	13.33	16.67	23.33	40	40	20
	5%	23.33	40	60	73.33	80	83.33	83.33	63.33
	10%	83.33	100	100	100	100	100	100	97.62
Lavender	2%	0	0	0	3.33	3.33	3.33	3.33	1.9
	3%	0	0	3.33	13.33	16.67	26.67	36.67	13.81
	5%	10	20	23.33	46.67	66.67	73.33	76.67	45.24
	10%	76.67	76.67	90	100	100	100	100	91.9
Nutmeg	2%	0	0	0	3.33	3.33	3.33	3.33	1.9
	3%	0	0	3.33	3.33	13.33	16.67	33.33	10
	5%	0	13.33	33.33	46.67	66.67	76.67	83.33	45.71
	10%	100	100	100	100	100	100	100	100
Visnaga fruit	2%	0	0	0	0	0	0	0	0
	3%	0	6.67	10	10	20	23.33	23.33	13.33
	5%	16.67	26.67	36.67	56.67	66.67	70	73.33	49.52
	10%	83.33	90	100	100	100	100	100	96.19

Table (4): LC_{50}, Slope and 95% fiducially limits of LC_{50} for different plant extracts after seven days of spraying *Monacha cartusiana*:

Plant extracts	LC_{50}	Slope ± SE	Fiddciall limit of LC_{50}	
			L	U
Camomile	3.8863	0.0332 ± 1.2478	1.6451	2.2461
Black cumin	2.4626	0.0528 ± 0.2578	1.8816	3.0765
Seena- P	3.4249	0.0338 ± 0.6627	1.8210	3.1021
Thymus	2.887	0.0831 ± 0.6072	7.2118	9.2114
Lavander	2.4010	0.0848 ± 0.5436	2.8647	4.5120
Clove	0.9715	1.000 ± 0.2300		
Pyrethrum	7.3375	0.5624 ± 0.2827	5.1817	13.7452
Galls	1.000	1.000 ± 0.2288		
Belladonna	2.7324	0.2060 ± 0.2539	1.7009	2.7835
Rhubarb	3.3272	0.5104 ± 0.5165	1.3219	2.2479
Mustard	1.7854	0.6131 ± 0.4688	2.8131	4.1256
Nutmeg	2.7588	0.095 ± 0.6028	2.1211	3.0652
Visnaga fruit	3.2664	0.5023 ± 0.3019	4.1327	6.2412
Seena- L	8.8745	0.7285 ± 0.2808	5.4346	16.2426
Cayenn pepper	5.1341	0.8040 ± 1.2052	4.6093	9.8596
Calendula	4.8251	0.0102 ± 0.5513		
Colophony	7.2178	0.4492 ± 0.3229	5.3761	11.6853
Bitter wood	10.2522	0.6877 ± 0.3867	8.1358	34.5582
Garlic	2.9880	0.2966 ± 0.2597	1.9062	3.1039

1.1.2. Moderate toxic plant extracts:

Seven plant extracts among nineteen was classified as moderate toxic materials these are belladonna, mustard, thymus, cynen pepper, seena-p, camomile, and black cumin. These plant extracts caused from 60 to 89% at 10% concentration. Data in table (5) showed that belladonna 2% caused 16% while 3% and 5% gave 53.33 and 86.66%, after seven days while 10% gave 100% after 5 days. Mustard resulted in approximately the same mortality for different concentration recorded mean mortality of 73.81% for 10% concentration. Thymus and caynen pepper gave higher mortalities began with 6.66%, 0% for 2% concentration 30%, 3.33%, for 3%; 70%, 43.33% for 5% concentration, while 10% gave 100% after seven days for thymus and caynen pepper with mean mortality 81.45% for both at 10% concentration. The most toxic plant extract in this group was camomile followed by seena-p, both material recorded 100% mortality after three days

only at 10% concentration where the mean mortality was 0.95, 1.9%; 13.81, 6.19%; 38.57, 40.95% and 84.29, 87.14% for 2, 3, 5, 10% of seena-p and camomile plant extracts.

Table (5): Mortality percentages of *Monacha cartusiana* affected by moderate toxic plant extracts for seven days under laboratory conditions:

Plant extract	Mortality %								Mean
	Day&Conc	1st	2nd	3rd	4th	5th	6th	7th	
Belladonna	2%	0	0	0	6.66	10	16.66	16	7.05
	3%	0	0	13.33	30	36.67	46.67	53.33	25.71
	5%	3.3	13.3	36.66	46.66	60	76.66	86.66	46.18
	10%	10	26.66	60	76.66	93.33	100	100	66.66
Mustard	2%	0	0	3.33	10	13.33	13.33	13.33	7.62
	3%	0	0	16.67	26.67	36.67	40	50	24.29
	5%	3.33	16.67	40	63.33	76.67	86.67	90	53.81
	10%	26.67	43.33	76.67	83.33	90	96.67	100	73.81
Thymus	2%	0	0	0	0	6.66	6.66	6.66	2.85
	3%	0	3.33	3.33	6.67	13.33	20	30	10.95
	5%	10	23.33	30	46.67	56.67	60	70	42.38
	10%	36.67	60	83.33	93.33	96.67	100	100	81.43
Cayenn pepper	2%	0	0	0	0	0	0	0	0
	3%	0	0	0	3.33	3.33	3.33	3.33	1.9
	5%	3.33	13.33	23.33	23.33	33.33	36.67	43.33	25.24
	10%	46.67	63.33	73.33	86.67	100	100	100	81.43
Seena-P	2%	0	0	0	0	0	3.33	3.33	0.95
	3%	0	6.67	10	10	16.67	26.67	26.67	13.81
	5%	0	13.33	36.67	50	53.33	56.67	60	38.57
	10%	40	63.33	86.67	100	100	100	100	84.29
Camomile	2%	0	0	0	0	3.33	3.33	6.66	1.9
	3%	0	0	3.33	6.67	10	10	13.33	6.19
	5%	0	20	36.67	43.33	53.33	63.33	70	40.95
	10%	43.33	73.33	93.33	100	100	100	100	87.14
Black cumin	2%	0	0	0	0	6.66	13.33	20	5.71
	3%	0	0	3.33	10	26.67	33.33	43.33	16.67
	5%	0	0	13.33	36.67	60	76.67	83.33	38.57
	10%	30	86.67	100	100	100	100	100	88.1

Table (4) showed that LC_{50} differ from plant extract to another it was the lowest 1.7854% for mustard followed by black cumin 2.4626, belladonna 2.7324 and thymus 2.887% then increased to 3.4249 and 3.8863% for seena-p and camomile, the highest LC_{50} was 5.1341% for caynen pepper. Slope values were very low (less than 0.10) for camomile, black cumin, seena-p, and thymus while this values was 0.2060 for belladonna, and 0.6131 for mustard, and 0.840 for caynen pepper.

1.1.3. Low toxic plant extracts:

Material which caused 0: 59% as mean mortality were five materials. Only calendula gave 50.47% mean mortality for 10% concentration 2% concentration gave 10% mortality; 3% caused 26.67% while 5% resulted in 50% mortality, and 76.66% recorded for 10% concentration after 7days of application(table6) . Pyrethrum caused in 1.9, 6.19, 15.71, and 38.57% for 2, 3, 5, and 10% concentrations after 7 days where colophony used 3.33, 16.67, 33.33, and 66.66% mortalities after 7 days for 2, 3, 5, 10% concentrations; seena-p mortalities were 6.66, 13.33, 36.67, and 53.33% for the same concentrations after 7 days with mean mortality ranged from 8.57 to 30.48% at last bitter wood haven't any effect at 2% concentration; 10% mortality at 3%; 26.66% at 5% and caused 53.33% at 10% concentration the mean mortalities were 0, 3.33, 9.52, and 30.09% for 2, 3, 5, 10% concentrations respectively. This group hadn't sufficient effect on control *Monacha cartusiana.* Data tabulated in table (4) cleared that LC_{50} of calendula was the lowest in this group 4.8251%, while this value was high in others, record 7.3375 for pyrethrum; 7.2178 for colophony; 8.8745 for seena-L, and the highest was 10.2522% for bitter wood. Slope values were different it was 0.0102 for calendula; 0.4492, 0.5624, 0.7285, and 0.6877 for colophony, pyrethrum, seena-L and bitter wood. From obtained results we can concluded that the group of high toxic plant extracts are promising in control clover snail *Monacha cartusiana* at 10% concentration. Also black cumin and thymus can use where their LC_{50} were low and 10% concentration gave more than 80% as mean mortality.

These results are in agreement with that obtained by Abd El-Haleim 2007 mentioned that the values of LC_{50} for red pepper, pomegranate were 0.08, 0.42, 0.2, 1.55 and 0.7 respectively. The residual film technique against *Monacha obstructa*, finnel plant extracts was more toxic, while the santonica was the least toxic one. Values of LC_{50} for fennel, pomegranate, black pepper, red pepper, and neem were 0.02, 0.2, 0.5, 0.9 and 12.3 respectively. El-Sebaii (2006) evaluated that the molluscicidal effects of eight ethanotic.crude extracts: Piperaigrum (*Piper nigrum*), Colocyntb (*Citrullus colocynthis*). Datura (*Datkro tatuta*), Black mustard (*Brassica nigra*), Santonia (*Artemisa herba alba*), Eucalyptus (*Eucalyptus gfobutus*), Mint (*Mentha puleigirum*) Onion (*Allim cepa*) and methomyl as standard molluscicide were evaluated "Must three species of land snails: *Theba pisana*, *Monacba obstracta* and *Eobanla vermiculata* The results Indicated that the ethanol crude extract of onion (*Alliumn cepa*, LC50 = 40%) was found to be more active than the standard molluscicide, methomyl (LC50 = 45%) against *Theba pisana* The other tested crude ethanolic extracts were active to cause mortalities to all the tested land snails but less than methomyl.

Table (6): Mortality percentages of *Monacha cartusiana* affected by low toxic plant extracts for seven days under laboratory conditions:

Plant extract	Mortality %								Mean
	Day & Conc	1st	2nd	3rd	4th	5th	6th	7th	
Calendula	2%	0	0	3.33	6.66	10	10	10	5.71
	3%	0	6.67	13.33	20	20	26.67	26.67	16.19
	5%	0	10	20	30	36.66	43.33	50	27.14
	10%	3.33	16.66	40	63.33	76.66	76.66	76.66	50.47
Pyrethrum	2%	0	0	0	0	3.33	3.33	6.66	1.9
	3%	0	3.33	3.33	3.33	6.67	6.67	20	6.19
	5%	0	3.33	6.66	16.66	20	26.66	36.66	15.71
	10%	10	16.66	33.33	40	46.66	60	63.33	38.57
Colophony	2%	0	0	0	3.33	3.33	3.33	3.33	1.9
	3%	0	6.67	10	10	10	10	16.67	9.05
	5%	0	10	20	20	23.33	30	33.33	19.52
	10%	6.66	16.66	20	30	43.33	60	66.66	34.76
Seena-L	2%	0	0	0	0	3.33	6.66	6.66	2.38
	3%	0	3.33	10	6.67	13.33	13.33	13.33	8.57
	5%	0	6.67	20	23.33	33.33	36.67	36.67	22.38
	10%	10	13.33	23.33	33.33	33.33	46.67	53.33	30.48
Bitter wood	2%	0	0	0	0	0	0	0	0
	3%	0	0	0	0	3.33	10	10	3.33
	5%	0	0	3.33	6.66	13.33	16.66	26.66	9.52
	10%	3.33	13.33	18.33	30	42.33	50	53.33	30.09

1.2. Toxicity of some pesticides to Monacha cartusiana:

Five pesticides were experimented against *Monacha cartusiana* under laboratory conditions. Three concentrations were used for each compound. Data in table (7) revealed that the least toxic compound was Acharemyl which killed 10, 20, 43.33% from *M.cartusiana* at 0.25, 0.5, 1 C^3/1L water respectively, followed by Agri-flex where 0.3 C^3/1L water caused in 20% mortality while 0.6, 1.2 C^3/1L caused 33.33 and 53.33% mortality with mean mortality of 10.95, 14.29 and 25.71%. Dumber have moderate toxicity, caused in 35, 43.33, and 86.67% mortality for 0.5, 1, and 2 C^3 after 7 days, with mean mortality of 52.38% for 2 C^3/1L water concentration both high point and strogard proved to be sufficient for control *M. cartusiana* at the higher dose. High point recorded 26.67% mortality at 0.125 C^3 , while mortality increased to 83.33

with 0.25 C^3/1L water after 7 days. 0.5 C^3/1L water caused 100% mortality after five days of application. Citroguard gave 60, 95.33% mortality with 1, 2, C^3/1L water after 7 days while 4 C^3/1L water caused 100% after 3 days of application with mean mortality 87.61. Data in table (8) cleared $LC_{50,}$ slope, and fiduciall limits of LC_{50} was 0.9628, 0.5879 C^3/1L water for acharemyl and agre, while slope values were 0.4140 and 0.5568. Damber recorded 1.1828 C^3/1L water as LC_{50} with low slope value 0.2849 while high point and strogard LC_{50} were 0.1635 and 0.8795 C^3/1L water with slope values of 0.6962 and 0.7684. These results mean that high point 0.5 C^3/1L water and strogard 2 or 4 C^3/1L water are recommended for control *Monacha cartusiana*. Gabr *et al*., (2006) found that when the three tested compounds were used as bait, cekumeta was the most toxic one against the two snail species, followed by vertimic, while neemix was the lowest effective one. On the other hand, *Monacha obstructa was* more susceptible for neemix and vertimic than *Eobania vermiculata,* while vice-versa occurred in case of cekumeta bait compound.

Table (7): Mortality percentage of *Monacha cartusiana* affected by spraying some pesticides under laboratory conditions:

Pesticides	Day &Conc.	Mortality %							
		1st	2nd	3rd	4th	5th	6th	7th	Mean
Akarimyt	0.25 C^3/ 1L water	0	0	3.33	3.33	6.67	6.67	10	4.28
	0.5 C^3/ 1L water	0	6.67	6.67	6.67	13.33	16.67	20	10
	1 C^3/ 1L water	0	10	16.67	16.67	33.33	40	43.33	22.86
Agri-flex	0.3 C^3/ 1L water	0	3.33	3.33	16.67	16.67	16.67	20	10.95
	0.6 C^3/ 1L water	0	3.33	6.66	13.33	20	23.33	33.33	14.29
	1.2 C^3/ 1L water	0	16.67	20	23.33	30	36.67	53.33	25.71
Dumber	0.5 C^3/ 1L water	0	3.33	3.33	6.67	13.33	25	35	10.95
	1 C^3/ 1L water	0	6.67	13.33	16.67	23.33	33.33	43.33	19.52
	2 C^3/ 1L water	10	20	33.33	56.67	76.67	83.33	86.67	52.38
High Point	0.125 C^3/1L water	0	0	6.67	6.67	10	20	26.67	10
	0.25 C^3/ 1L water	10	20	33.33	46.67	60	76.67	83.33	47.14
	0.5 C^3/ 1L water	23.33	43.33	53.33	86.67	100	100	100	72.38
Citrogard	1 C^3/ 1L water	13.33	26.67	36.67	40	56.67	53.33	60	40.95
	2 C^3/ 1L water	10	20	40	63.33	73.33	93.33	95.33	56.47
	4 C^3/ 1L water	40	73.33	100	100	100	100	100	87.61

Table (8): LC_{50}, Slope and 95% fiducially limits of LC_{50} for some pesticides after seven days of spraying *Monacha cartusiana*:

Material	LC_{50}	Slope ± SE	Fiddciall limit of LC_{50}	
			L	U
Akarimyt	0.9628	0.4140 ± 0.2866	0.6791	4.5829
Agri-flex	0.5879	0.5568 ± 0.3347	0.4201	2.5005
Dumber	1.1828	0.2849 ± 0.1429	0.7906	1.2476
High Point	0.1635	0.6962 ± 0.83	0.1371	0.1902
Citrogard	0.8795	0.7684 ± 0.2284	0.5140	1.0904

2. Field experiments:

Three plant extracts of high toxic effect: galls, clove, and mustard in addition to two high point and citrogard as the most toxic pesticides were experimented under field condition to study their effect on *M. cartusiana* infested clove plants for three weeks. Data in Table (9) revealed that after one day of application numbers of *M. cartusiana* decreased sharply in pesticides treatment from 74, 46 as pretreatment samples for high point and strogard to 42, 22 individuals/1m2 cause 46.79 and 55.16% corrected mortality, while plant extracts decreased numbers from 84, 94, 128 indiv./1m^2 as pretreatment samples to 66, 72, and 120 indiv./1m^2, cause 26.34, 28.19, and 12.10% mortality for galls, clove, and mustard respectively after one day of application. After three days of application, numbers decreased in all treatments except in clove treatment where numbers increased slightly from 72 to 78 indivi./1m^2, increase in corrected mortalities was observed 34.06, 35.09, 60.25 and 66.13 for galls, mustard, high point, and strogard. After five days of application both numbers in all treatments were fixed with numbers in control was slightly decreased from 104 to 102 indiv./1m^2. Seven days of application showed high decrease in numbers and high increase in mortality recording 57.54, 54.83, and 48.26% for galls, clove, and mustard but 77.05 and 85.23 for high point and strogard respectively. Samples collected after fourteen days of application showed remarkable decrease in numbers reach 8, 14, 22 indiv./1m^2 for galls, clove, and mustard with 92.39, 88.08, and 86.18%, while no infestation was observed in both pesticide treatments record 100%mortality, on the other hand numbers in control was continuously increased three weeks after treatment no individuals was observed causing 100% mortality for both plant extracts and pesticides while control numbers increased from 112 to 118 indiv./1m^2. We can concluded that strogard and high point can impact *M. cartusiana* successfully after two weeks but there are many cautions of use pesticides on clove, while plant extracts especially galls, clove, and mustard are safe when was eaten by animal farms and causing excellent results in control *M. cartusiana* after 14 and 21 days of application. Ghamry, 1997 mentioned that under field conditions, powder bait of leaves caused 64 and 74% mortality for *M.* sp., after 25 days from the beginning of treatment during the growing seasons of (1996 and 1997), respectively.

Table (9): Reduction percentages in *Monach cartusiana* numbers after application with three plant extracts and two pesticides under field condition at Shebin El_Kom.

Materials		Reduction % after (day)					
		1	3	5	7	14	21
Galls	10%	26.34	34.06	32.77	57.54	92.39	100
Clove		28.19	28.19	26.78	54.83	88.03	100
Mustard		12.10	35.09	33.82	48.26	86.18	100
High point	0.5 cm/1 litre water	46.79	60.25	59.55	77.07	100	-
Citrogard	4 cm/1 litre water	55.16	66.13	65.47	85.23	100	-

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تجارب معملية وحقلية لمكافحة قوقع البرسيم الزجاجى التى تهاجم البرسيم المصرى فى مركز شبين الكوم –محافظة المنوفية *Monacha cartusiana*

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الملخص العربى

تم دراسة تاثير ١٩ مستخلص نباتي باستخدام ٤ تركيزات مختلفة ٢و٣و٥و ١٠ كنسبة مئوية بالاضافة الي خمس مبيدات حشرية باستخدام ٣ تركيزات مختلفة وذلك لاختبار تاثيرها السام علي قوقع البرسيم الزجاجى تحت الظروف المعملية لمدة ٧ ايام متتالية وتم حساب النسب المئوية للموت في نهاية التجربة . تم تقسيم المستخلصات الى ثلاث مجاميع.سبع منها كمواد عالية السمية حيث تسببت فى ٩١– ١٠٠ % موت عند تركيز.. ١٠%. لكل من العفص والقرنفل والثوم وجذور الراوندو اللافندر وجوزة الطيب والخلة البلدي وهناك سبع مستخلصات نباتية قسمت كمستخلصات متوسطة السمية تسببت فى % ٨٩–٦٠ عند تركيز ١٠% لكل من نباتات ست الحسن والخردل والزعتر والشطة الحمراء وسنامكي قرون والكاموميل وحبة البركة بينما كان الكالنديولا والبيرثرم والقلفونية وسنامكي الاوراق وخشب المر اقل المستخلصات سمية حيث كانت متوسط النسبة المئوية للموت ٠– ٥٩ % عند تركيز ١٠% كما تم ترتيب تاثير الخمس مبيدات حشرية تنازلي من الاعلي تركيز الى الاقل كالتالي الستروجارد – هاي بوينت – دامبر – اجري فليكس – ثم الاكاريميت.

تم اجراء تجربة حقلية باستخدام ٣ مستخلصات نباتية الاعلي سمية وهم العفص – القرنفل – الخردل بالاضافة الي مبيدي الستروجارد والهاي بوينت لدراسة تاثيرها علي قوقع البرسيم الزجاجي في الحقول المصابة لمدة ٣ اسابيع وتم حساب نسبة الموت بعد ١– ٣ –٥– ٧– ١٤– ٢١ يوم ووجد انه في العينات التي تم جمعها بعد ١٤ يوم من التطبيق تاثير ملحوظ في انخفاض الاعداد ووصلت نسبة الموت الي ٩٢.٣٩– ٨٨.٠٨– ٨٦.١٨ % لكل من العفص والقرنفل والخردل بينما سجلت ١٠٠ موت بعد ٢١ يوم وبالنسبة للمبيدات سجل كل من مبيدي الستروجارد والهاي بوينت ١٠٠ %موت بعد ١٤ يوم.

لقد أعطت مستخلصات العفص – القرنفل – الخردل نتائج جيدة لذا نوصى باستخدامها فى مكافحة هذا القوقع كونها آمنة على حيوانات المزرعة مع الحفاظ على البيئة من التلوث.