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population density and food preference of the land snail, *monacha cantiana* (montagu) to cucurbit vegetable crops and using plant extracts for its control

Shahawy, Wafaa A.

Harmful Animals Department, Plant Protection Research Institute, Agricultural Research Center

ABSTRACT

An experiment was carried out at Farag El-Shamy, El-Riad region, Kafr El-Sheikh Governorate during two successive seasons; 2012 and 2013 to study the population density, food preference and evaluation of some plant extracts on *Monacha cantiana* on some cucurbit vegetables. Data showed that the most attractive vegetable crop to snail was water melon (120.36 and 122.27 snails) while the cucumber was the least preferred with (63.64 and 64.55) snails during two seasons, respectively. The highest population density of *M.cantaina* were 51.75, 47.5, 43.25, 41.5 and 40.25 snail /m² while the least number were 15.75, 9.5, 10.0, 8.75 and 7.0 snail /m² on water melon, squash, snake melon melon and cucumber in two seasons respectively. Geranium extract exhibits the highest toxic effect (84.5%) reduction while the lowest was neem oil (56.0 %) reduction on water melon.

INTRODUCTION

Land snails are considered one of the most destructive agricultural pests causing economic damage to a wide variety of plants including horticulture and field crops. In Egypt, land snails have been located mostly in the northern Governorates of Delta region, attacking various crops causing great damage to the soft vegetative parts of the plants. Land snails are dangerous agricultural pests causing great damage to field and vegetable crops in addition to horticultural vegetation such as citrus, guava, pear and date palm as well as ornamental plants, as the plant parts (Shahawy, 2005). The land snail, *Monacha cantiana* (Montagu) became an important agriculture pest causing a great damage to crops in deferent localities in Egypt as previously mentioned. It was recorded with relatively high population density on major economic crops at Kafr El-Sheikh Governorate.

Using mollusicides in high concentration has a toxic effect on man and livestock and cause environmental pollution, El-Wakil and Radwan (1991). In recent years, many researchers tried to find new mechanical, ecological and biological control methods that are safer, cheaper, and more readily available.

An experiment was carried out at Farag El-Shamy, El-Riad region, Kafr El-Sheikh Governorate during two successive seasons; 2012 and 2013. Aim of the work to study the population density, food preference and non-preference and evaluation of some plant extracts on the most common snail, *Monacha canaiana* (Montagu) at this region infesting the following five plant species: melon, *Cucumis melo* L.; cucumber, *Cucumis sativum* L.; snake melon, *Cucumis sativaus* L.; water melon, *Citrullus lanatus* (Thunb) and squash, *Cucurbita pepo* (pumpkin).

MATERIALS AND METHODS

1. Preference and non-preference of snail, *Monacha cantiana* (Montagu) to five cucurbite species:

An experiment was carried out at Farag El-Shamy, El-Riad region, Kafr El-Sheikh Governorate under field conditions during the two successive seasons; 2012 and 2013 to study the preference and non-preference of the snail, *M. cantiana* infesting branches and leaves of melon, *Cucumis melo* L.; cucumber, *Cucumis sativum* L.; snake melon, *Cucumis sativaus* L.; water melon, *Citrullus lanatus* (Thunb) and squash, *Cucurbita pepo* (pumpkin). An area of half feddan (2100 m^2) was prepared, and then seedlings of the plant species were transplanted in alternative rows at 35cm spaces between them and width of 175 cm between rows in the plots from April 1st during the two seasons. Weekly samples were taken randomly from each plant species on April 15th to Jun. 26th. Each sample was obtained from one m^2 and replicated four times.

2. Evaluation of some aqueous and oil plant extracts on the infestation with *Monacha cantiana* (Montagu) snail on water melon:

2.1. Collection and preparation of the plant extracts:

Five aromatic plant species (sweet basil, geranium, spearmint peppermint and clove) were collected from the Farm of Sakha Agricultural Research Station, Kafr El-Sheikh. The plants were dried naturally on laboratory benches at room temperature for 7 days, to become crisp dry. Further drying was practiced in the oven at 40 °C for 24 hrs, and then the plant parts were crushed to fine powder using a laboratory grinder.

Table (1): Aromatic plant species used to control *Monacha cantiana*.

Arabic name	English name	Scientific name	Part used	Family
الريحان	Sweet basil	*Ocimum basilicum* L.	Leaves	Lamiaceae
العتر	Geranium	*Pelargonium graveolens* L.	Leaves	Geraniaceae
النعناع البلدى	Spearmint	*Mentha viridis* L.	Leaves	Lamiaceae
النعناع الفلفلي	Peppermint	*Mentha piperita* L.	Leaves	Lamiaceae
القرنفل	Clove	*Eugenia aromatic* (E.a)	Flower buds	Myrtaceae

2. 2. Preparation of crude extracts:

Dried plant powders were extracted according to **Freedman *et al.* (1979)**, 250 g of each plant sample were soaked in 750 ml of polar solvent (ethyl alcohol) and non- polar solvent (n-hexane) in a large conical flask for 72 hrs. with shaking for 3 hrs. The contents of the flask were filtered through anhydrous sodium sulphate. The extracts were concentrated by removing the solvent on water bath at 40 °C to obtain the crude extract. The obtained extracts were weighed and dissolved in an appropriate volume of pure acetone, and kept in the refrigerator for assaying.

2. 3. Preparation of plant aqueous extracts:

Plant parts used were soaked in three volumes of water for 72 hrs. and then screened through muslin cloth **(El-Samahy, 2002)**.

3. Preparing the field experiment:

A field experiment was conducted at Farag El-Shamy, El-Riad. An area of one feddan (4200 m^2) was divided into 48 plots (each plot about 87.5 m^2 / replicate) in a randomized complete block design. Seedlings of melon, cucumber, snake melon, water melon and squash were transplanted at a space of 35 cm between plants and a width of 175 cm between rows in the plots on April 1st in 2012 and second season 2013. Extracts and oils aromatic plant species were applied with concentration of 0.5 %. while Metaldehyed 5 % molluscicide were applied 2 kgm /feddan on April 29th using atomizer of 2 liters to complete coverage of treated water melon plants. Snails were directly counted before treatment on leaves, branches and on soil surface from each plant in one meter. Also these samples were taken 1,3,5,7 and 10 days post treatment. The reduction in snail population due to treatments was calculated according to Henderson and Telton (1955).

Duncan's multiple range test (1955) at 5% level was used to reveal the significance among the means of larvae on the evaluated plant species.

RESULTS AND DISCUSSION

1. Population density of *Monacha cantiana* (Montagu) on cucurbit crops:

The population density of snail, *M. cantiana* was counted on the leaves, branches and soil surface of five cucurbit crops Table (2). The first observation was carried out on April 15th in 2012 and 2013 seasons. The snail, *M. cantiana* was recorded on all vegetable crops. The level of infestation varied from one crop to another.

1.1. Water melon:

During 2012 season, population density of the snail appeared in two peaks, on April 29th and May 20th Table (2). The highest mean number of snail was 51.75 snails/m^2 on April 29th. However, the lowest mean number was 15.75 snails/m^2 on the last season.

Population density of snails during 2013 season, showed approximately a similar trend as that in 2012 season.

1.2. Squash:

During 2012 season, population fluctuation of snail, *M. cantiana* numbers displayed into two peaks, April 29th and May 20th. The highest mean number of the snail stages were 47.50 snail/m^2 on April 29th, however, the lowest mean number of snail stages was 9.50 snail/m^2 on June 25th. Population fluctuation of snail, *M. cantiana* during 2013 season, showed a similar trend to that of 2012 season Table (2).

Table (2): Population density of snail, *Monacha cantiana* on five plant species during 2012 and 2013seasons.

Sampling Date	No. of snail/m^2				
	Water melon	Squash	Snake melon	Melon	Cucumber

		2012	2013	2012	2013	2012	2013	2012	2013	2012	2013
April	15	20.25	20.75	15.75	16.25	12.75	13.00	10.00	10.25	8.75	8.75
	22	23.25	24.75	19.25	19.75	16.50	17.00	13.25	13.75	11.00	11.25
	29	51.75	52.50	47.50	47.50	42.75	43.25	41.50	41.50	40.00	40.25
May	6	32.50	32.75	27.25	27.75	21.75	22.50	17.50	17.75	16.25	16.75
	13	45.00	45.50	37.50	38.00	28.75	29.25	22.75	23.00	22.00	22.25
	20	48.25	48.75	42.50	43.25	40.75	41.25	28.75	29.25	25.00	25.25
	27	40.75	40.75	35.75	36.25	31.25	31.25	25.25	25.75	23.25	23.00
Jun	4	36.25	36.50	25.00	25.25	23.25	23.75	20.00	20.50	18.25	18.25
e	11	24.75	25.25	17.50	18.00	20.00	20.50	17.75	18.25	16.25	15.50
	18	17.50	17.75	13.25	13.75	17.50	18.00	15.50	15.75	13.25	13.75
	25	15.75	16.00	9.50	10.25	10.00	10.75	8.75	9.25	7.00	7.50

1.3. Snake melon:

Data presented in Table (2) display the population density of snail, *M. cantiana* stages during 2012 and 2013 seasons. Results showed two peaks; on April 29th and on May 20th. The highest mean number of snail stages was 42.75 snail/m^2 on April 29th, while the lowest mean number was 10.00 snail/m^2 on the last sample. Population density of snail stages during 2013 season, showed approximately a similar trend to that of 2012 season Table (2).

1.4. Melon:

During 2012 season, population density of snail, *M. cantiana* stages recorded two peaks, on April 29th and May 20th. The highest mean number of snail stages was 41.50 snail/m^2 on April 29th however, on the lowest mean number 8.75 snail/m^2 on the last season Table (2). Population density of snail stages during 2013 season showed a similar trend to that of 2012 season.

1.5. Cucumber:

The highest mean number of snail stages was 40.00 snail/m^2 during first season while in the second season; the mean number of snail stages was 40.25 snails/m^2 on April 29th. However, the lowest mean number of snail stages was 7.00 snails/m^2 on last season Tables (2).

El-Okda *et al.* (1989) showed that the infestation of most of land snails occurred during May till November on fences, while it was present through the year on the inner plantations. The authors added also that the highest population density was noticed in the neglected and weedy orchards.

Also, **Shahawy (1998)** recorded the highest snail numbers on lettuce and clover in April. The population of the snail was greatly reduced on lettuce and clover during December and January.

2. Food preference of *Monacha cantiana* to five vegetable plant species:

The results in Fig. (1) show the preference of snail stages to five vegetable crops during the two seasons. Statistical analysis showed that the highest mean number of snail stages during the two seasons were 120.36 and 122.27 snails, on water melon, respectively followed by squash plant. However, the lowest mean numbers of snail stages were recorded on cucumber and melon with (63.64 - 64.55) and (71.72 - 72.72) snails during two seasons, respectively.

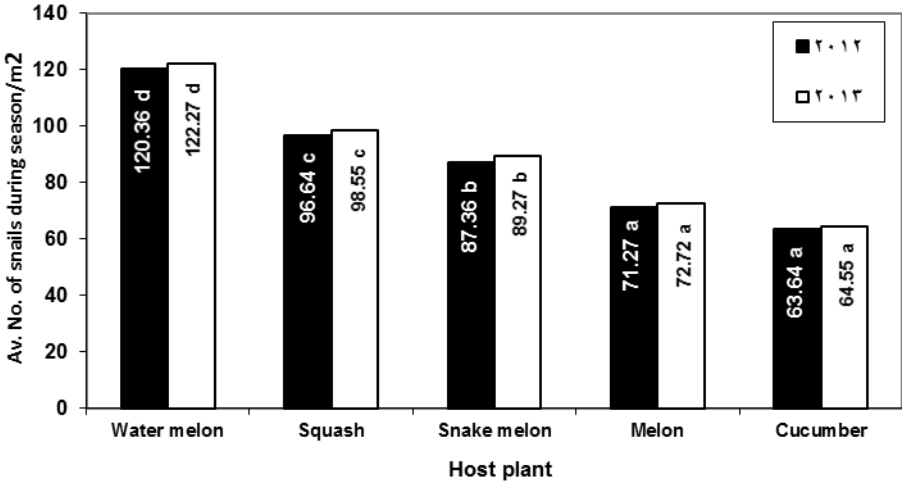

Fig. (1): Preference and non-preference of snail, *Monacha cantiana* to five vegetable plant species during 2012 and 2013 seasons.

3. Effect of some plant extracts on *Monacha cantiana* stages on water melon:

Data presented in Tables (3 and 4) showed that the initial and residual effect of plant extracts, clove oil, spearmint oil, peppermint oil, sweet basil oil, geranium oil, jojoba oil, neem oil, and aqueous extracts (ae) of sweet basil, geranium, peppermint, spearmint and clove against snails infesting water melon during 2012 season.

Data showed that the initial activity of geranium extract was higher than the other tested compounds. While, the initial and toxicities of neem oil was the least. Residual activities of the tested substances were estimated as shown in Table (3). Geranium extract, sweet basil, metaldehyed and clove extract were the most potent compounds, while, neem oil and jojoba oils were less active.

Sharshir *et al.* (1996) used ground seeds of eight plants, black pepper, caraway, coriander, anise, cumin, tooth pick, capsicum and damsissa in order to evaluate their toxicity against the land snail, *M. catniana* under

laboratory conditions. Results indicated that pure ethanolic extract of caraway and coriander gave high mortality to *M. catniana*, while cumin and tooth pick were the least effective.

Shahawy (1998) examined 14 plant extracts against *M. cantiana*. The plants were belonging to six families; Umbelliferae, Composite, Solanaceae, Lamiaceae, Piperaceae and Geraniaceae. Results showed that caraway extract was the most effective against snail, followed by parsley, damsissa and yarrow.

Table (3): Initial and residual effect of extracts and oils of aromatic plants against *Monacha cantiana* on Water melon during 2012 season.

Treatment	No. of snails before treatment	Period after treated by day										General	
		1		3		5		7		10			
		No.	R%.	No.	R%	No.	R%	No.	R%	No.	R%	No.	R.%
Control	203	208	00.0	218	00.0	223	00.0	234	00.0	244	00.0	**1127**	**00.0 a**
Metaldehyed molluscicid	206	73	65.4	55	75.1	41	81.9	37	84.4	57	77.0	**263**	**77.0 d**
Clove oil	202	99	52.2	77	64.5	69	68.9	61	73.8	35	85.6	**341**	**69.6 c**
Spearmint oil	204	107	48.8	98	55.7	85	62.1	77	67.3	66	73.1	**433**	**61.8 b**
Peppermint oil	201	100	51.4	95	56.0	82	62.9	75	67.6	60	75.2	**412**	**63.1 c**
Sweet basil oil	200	97	52.7	75	65.1	62	71.8	55	76.1	31	87.1	**320**	**71.2 c**
Geranium oil	203	91	56.3	65	70.2	52	76.7	37	84.2	33	86.5	**278**	**75.3 d**
Jojoba oil	206	117	44.6	101	54.3	95	58.0	85	64.2	72	70.9	**470**	**58.9 b**
Neem oil	203	125	39.9	105	51.8	96	57.0	92	60.7	78	68.0	**496**	**56.0 b**
Sweet basil (ae)	205	86	59.1	48	78.2	42	81.4	32	86.5	18	92.7	**226**	**80.1de**
Geranium (ae)	200	74	63.9	40	81.4	32	85.4	15	93.5	11	95.4	**172**	**84.5 e**
Peppermint (ae)	206	92	56.41	64	71.1	50	77.9	44	81.5	26	89.5	**276**	**75.9 d**
Spearmint (ae)	203	98	52.9	73	66.5	59	73.5	52	77.8	33	86.5	**315**	**72.1cd**
Clove (ae)	200	98	52.2	53	75.3	46	79.1	39	83.1	23	90.4	**259**	**76.7 d**

(ae) aqueous extract

Means followed by a common letter are not significantly different at the 5% level by DMRT

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الكثافة العددية والتفضيل الغذائى للقوقع الأرضى *Monacha cantiana* (Montagu) لمحاصيل الخضر القرعية ومكافحته باستخدام بعض المستخلصات النباتية

وفاء عبد المجيد شهاوى

قسم بحوث الحيوانات الضارة معهد بحوث وقاية النباتات – مركز البحوث الزراعية – الدقى – الجيزة – مصر

أجريت هذه التجربة بقرية فرج الشامى بمدينة الرياض التابعة لمحافظة كفر الشيخ فى موسمى ٢٠١٢ و٢٠١٣م وأمكن تلخيص النتائج فى الأتى :

١- الكثافة العددية لقوقع *Monacha cantiana* على خمسة محاصيل خضر قرعية (الأناناس، الخيار، القثاء، بطيخ اللب، والكوسة). وجد أن أعلى ذروتين للقوقع كانت على محصول بطيخ اللب فى ٢٩ أبريل و٢٠ مايو مقارنة بباقى المحاصيل الأخرى.

٢- بطيخ اللب هوالأكثر تفضيلا للقوقع (بمتوسط ١٢٢,٣٦ و١٢٢,٢٧ قوقع) وأقلها الخيار (بمتوسط ٦٣,٦٤ و ٦٤,٥٥ قوقع) فى كلا الموسمين على التوالى.

٣- تأثير خمسة مستخلصات نباتية (الريحان – العتر – النعناع البلدى – النعناع الفلفلى – القرنفل) على نسبة الإصابة بالقوقع محل الدراسة حيث كان مستخلص العتر هو الأكثر فعالية فى خفض الإصابة بقوقع *M. cantiana* (بنسبة ٨٤,٥٪ وأقلها زيت النيم (بنسبة ٥٦,٠٪ .

قام بتحكيم البحث

أ.د / على على عبد الهادى	**كلية الزراعة – جامعة المنصورة**
أ.د / محمد محمد مرتضى	**مركز البحوث الزراعية**