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EFFECT OF SOME ENVIRONMENTAL CONDITIONS ON THE MOLLUSCICIDAL ACTIVITY OF *YUCCA FILAMENTOSA* "MARGINATA" AND *CESTRUM PURPUREUM*

Hamed, M.[1*]; El-Amin, S.[1]; Abdel-Fattah, A.S.[2]

[1]Medicinal Chemistry Department, Theodor Bilharz Research Institute, Giza, Egypt.
[2]Organic Chemistry department, Faculty of Science, Cairo University, Giza, Egypt.

[*]manalayman90@yahoo.com

Abstract

The molluscicidal activities for the dry powder of *Yucca filamentosa* "*marginata*" and *Cestrum purpureum* were evaluated under certain environmental factors (eg. mud, sun, pH, storage and temperature) throughout one week exposure to *Biomphalaria alexandrina* snails the intermediate host of *Schistosoma mansoni*. Both of the two plants showed effective molluscicidal activity against the snails under different conditions. The molluscicidal activity of different solvent extracts, e.g. methanol, ethyl acetate, acetone, petroleum ether, benzene, and ether of the two plants against *B. alexandrina* snails were tested; the most active one was methanol extract after exposure period 24 hours with LC_{90} values for *Y. filamentosa* "*marginata*" and *C. purpureum* of 85 ppm and 78 ppm respectively.

Keywords: *Yucca filamentosa "marginata", Cestrum purpureum,* molluscicides, extracts, environmental factors

Introduction

Schistosomiasis (Bilharziasis), is still considered as the world's most. Wide spread parasitic disease and they are only members of the digenetic trematodes whose larvae penetrate directly into the final host (humans) after release from snails, the intermediate hosts. One way to attack the problem of schistosomiasis is to damaged the vector snails and thus remove a vital connection in its life cycle. This may be achieved by means of synthetic products such as Bayluscide or alternatively with molluscicides from plant sources [1,2].

Currently chemotherapy is the favoured control measure; however interrupting the life cycle of the parasite by control or destruction of the snail hosts by various methods [environmental, chemical or biological] is an important alternative to be considered [3]. In general, the control of schistosomiasis by the application of molluscicides, several aspects have to be taken into consideration. These include the chemicals used, the preparation of the molluscicide suspension or emulsion, the rate, season and methods of application, factors affecting the efficiency of the molluscicide used, costs of the molluscicidal operations, tests for evaluating results of treatment and determination of prevalence of the disease before and after snail control [4]. The rising costs of synthetic molluscicides, the concern about the development of resistance to them, and their toxicity to non-target organisms have led to an increasing interest in plants and plant-derived compounds for the control of schistosomiasis [5-12].

The water suspension of the dry powder of *C. purpureum* has a higher molluscicidal activity than that of *Y. filamentosa* "*marginata*" against *B. alexandrina* snails with values of LC_{90} 120 ppm for *C. purpureum* compared to 130 ppm of *Y. filamentosa "marginata"* after 24 hours exposure [13,14]. The author was prompted by these findings to examine in this paper the molluscicidal activity of *Y. filamentosa* "*marginata*" and *C. purpureum* against *B. alexandrina* snails under certain environmental factors such as; mud, sun, pH, storage and temperature within the molluscicidal activity of their different solvent extracts.

Materials and Methods

The leaves of the plant *Yucca filamentosa* "*marginata*" (fam. Agavaceae) were collected from Orman garden in Giza during October. *Cestrum purpureum* (fam. Solanaceae) plant samples were collected from Elzohreia garden in Cairo during July. Both plant samples were shade dried at room temperature, then powderd by electric mill. **Snails**

From Giza governorate irrigation canals which had not been treated with molluscicides, *Biomphalaria alexandrina* snails, the intermediate hosts of *Schistosoma mansoni* (shell diameter 6-8 mm) were collected. The snails were left to acclimatize in the laboratory, dechlorinated tap water with pH 7 (temperature 25±2 °C) for three weeks before being used.

Extraction

The dry powder of each plant was soaked successively in ether, petroleum ether (60-80), benzene, chloroform, ethyl acetate, acetone, and methanol for seven days at room temperature for each solvent. Each extract was filtered and evaporated to dryness under vacuum, and then its biological effect was evaluated against the snails.

Molluscicidal activity tests

The dry powder of the two plants was used as an aqueous suspension to prepare different concentrations on the basis of weight / volume (ppm) in dechlorinated tap water. The same technique was followed with the solvent extracts of each plant. For each experimental concentration, 3 replicate each of ten snails / litres were used, as well as in control group. The exposure period was 24 hours followed by another 24 hours of recovery, and then the snails' mortalities were recorded. The molluscicidal activities of the two plants were expressed in terms of LC_{50} & LC_{90} values according to Litchfield and Wilcoxon's method, (1949) [15].

Effect of some environmental conditions on the molluscicicdal activity

Effect of storage

Different concentrations of each plant dry powder were stored for seven days at room temperature (25±2°C), then the snails were exposed to the stored concentrations for 24 hours, followed by 24 hours recovery.

Effect of sun radiation

After preparing different concentrations of each plant dry powder, the aqueous suspensions were exposed to direct sun light for 6 hours, then ten snails per liter were added to each concentration for 24 hours followed by another 24 hours of recovery.

Effect of pH values

Different dilutions of each dry powdered plant were prepared using dechlorinated water previously adjusted to pH 4, 7 and 9 by dilute HCl or NaOH

solution. Snails' exposure period was 24 hours followed by 24 hours of recovery.

Effect of temperature

Three series of different concentrations from the dry powder of each plant were prepared and ten snails per liter were added to each concentration. The concentrations of each series were maintained at 15°C, 25°C and 35°C for 24 hours followed by another 24 hours of recovery.

Effect of mud particles

For each plant dry powder different concentrations were prepared as aqueous suspension using dechlorinated water containing 5000 ppm of mud particles per each concentration. The jars were provided with gentle air stream to maintain continuous and thoroughly mixing. Tests involved 24 hours exposure time, followed by 24 hours as recovery period.

Result and discussion

Effect of some simulated field conditions

Effect of temperature

Results in tables (**1**&**2**) show that the molluscicidal activity of *Y. filamentosa "marginata"* and *C. purpureum* against *B. alexandrina* snails after 24 hours exposure was increased with raising temperature to 35ºC, while the activity decreased at low temperature (15ºC). The higher activity at high temperature may be attributed to increasing the release and solubility of the active constituents of the dry powder suspension in hot medium, this causes easy penetration of the active ingradients to the snails membrane.

Effect of mud particles

Data in table (**3**) show a considerable suppression in the molluscicidal activity of *Y. filamentosa "marginata"* water suspension by adding 5000 ppm of mud particles. Moreover, from table (**5**) it was found that the molluscicidal activity of *C. purpureum* dry powder suspension was diminished up to 150 ppm, this may be due to adsorption of active ingredient (s) of the powder on the mud particles.

Effect of sun radiation

Sun radiation decreased the molluscicidal activity of both *Y. filamentosa "marginata*" and *C. purpureum* plants (tables **3**&**5**). The observed reduction in molluscicidal activity of the present plants after 6 hours of exposure to sun light or in the presence of 5000 ppm river bed mud is in parallel with the suppressive effect of sun light on the toxicity of *Euphorbia* species, *Endod*, *A. lophantha* and *B. muricata* by the presence of river bed mud [16-19].

Effect of pH changes

Acidic and alkaline media cause a slight depression in the molluscicidal activity of *Y. filamentosa* "*marginata"* up to 150 ppm, while it was stable for *C. purpureum* in comparison with the neutral medium (tables **3**&5), this may be due to slow hydrolysis of the active compounds in both acidic and alkaline media for the plant *Y. filamentosa* "*marginata"*. Also, a slight reduction in the molluscicidal activity of *G. glabra* at the alkaline media (pH 8-10) was recorded by El-Deeb (1986) [20].

Effect of storage

A highly suppressive effect on the molluscicidal activity of water suspension of *C. purpureum* powder was shown by storing it for seven days (table **6**), while there is a slight reduction in the toxic effect of *Y. filamentosa* "*marginata"* (table **4**). This may be due to biodegradation of the active components of both plants. These findings agree with those on the plants *A. arvensis, A. lophantha, B. muricata* and *E. lactea* that their molluscicidal activities have been highly suppressed by storage for seven days as aqueous suspensions under normal conditions (without boiling or keeping in refrigerator) [21,22].

The susceptibility of *B. alexandrina* snails to the different solvent extracts of *Yucca filamentosa* "*marginata*" was carried out. Data in table (**7**) showed the molluscicidal activity of different solvent extracts, e.g. methanol, ethyl acetate, acetone, petroleum ether, benzene, and ether of *Y. filamentosa* "*marginata*" against *B. alexandrina* snails. The most active one was methanol extract, its LC_{90} value was 85 ppm after exposure period 24 hours, while the values for acetone, ethyl acetate, benzene, ether, and petroleum ether extracts were 325, 300, 500, 275 and 280 ppm respectively. This means that the activity of methanol extract of *Y. filamentosa* "*marginata*" was 3.8, 3.5, 5.8, 3.2, and 3.3 times as that of acetone, ethyl acetate, benzene, ether and petroleum ether extracts respectively.

The toxicity of different solvent extracts of *C. purpureum* against *B. alexandrina* snails was evaluated (table **8**). The LC_{90} value of methanol was 78 ppm, while LC_{90} values for acetone, ether, petroleum ether, benzene, and ethyl acetate extracts were 150, 220, 270, 240, and 460 ppm respectively, which indicates that these activities were 48.0, 64.5, 71.1, 67.5, 83.0 % less than that of methanol extract.

The above results revealed that the methanol extract of *C. purpureum* was 8.2 % more active than that of *Y. filamentosa* "*marginata*", this indicates that the most active components were present in this extract, these results are in accordance with those of Sedki (1994) on methanol extract from the plants *A. arvensis* and *A. lophantha* that was highly toxic to *B. alexandrina* snails in comparison with acetone, chloroform, petroleum ether and ether extracts [21]. Furthermore confirmation that the susceptibility of *B. alexandrina* snails to the dry powder of both *Y. filamentosa* "*marginata*" and *C. purpureum* revealed a higher molluscicidal activity of *C. purpureum* than that of *Y. filamentosa* "*marginata*" so, the values of LC_{90} for *B. alexandrina* snails after 24 hours was 120 ppm for *C. purpureum* compared to 130 ppm of *Y. filamentosa "marginata"*, thus the toxicity of *C. purpureum* against *" B. alexandrina* was 1.08 times that of *Y. filamentosa* " *marginata*" [23]. Also, the results claimed that extending the snails exposure period to 48 hours decreased the LC_{90} value of the tested plants to be 52 ppm for *C. purpureum* and 118 ppm for *Y. filamentosa* "*marginata*"; these observations indicate that the molluscicidal activity of the two plants increased by increasing the exposure time from 24 to 48 hours [23].

This observation was also recorded by El-Assal et al (1993) on the pesticides Hostaquick and Kelthane against *B. alexandrina* snails [24].

So, the chromatographic separation for the two plants was carried out on the methanol extract [13,14].

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Table 1. Effect of temperature on the molluscicidal activity of *Yucca filamentosa* "*marginata*" dry powdered leaves against *Biomphalaria alexandrina* snails after 24 hours exposure.

Concentration (ppm)	Mortality % at :		
	15°C	25°C	35°C
210	100	100	100
200	90	100	100
170	80	100	100
150	50	100	100
140	30	80	100
130	20	50	100
120	10	20	80
110	0	10	60
100	0	0	50
90	0	0	20
80	0	0	0

Table 2. Effect of temperature on the molluscicidal activity of dry powder water suspension of *Cestrum purpureum* against *Biomphalaria alexandrina* after 24 hours.

Concentration (ppm)	Mortality % at :		
	15°C	25°C	35°C
200	100	100	100
190	90	100	100
150	80	100	100
130	70	100	100
120	60	100	100
100	50	90	100
90	40	70	100
80	30	60	100
70	20	50	100
50	10	20	100
40	0	0	100
20	0	0	80
10	0	0	30
5	0	0	10
4	0	0	0
Control	0	0	0

Table 3. Effect of mud particles, sun radiation, and pH values on the molluscicidal activity of the dry powderd leaves of *Yucca filamentosa* "*marginata*" against *Biomphalaria alexandrina* snails at 25 °C after 24 hours.

Concentration (ppm)	Mortality % at :				
	Mud (5000 ppm)	Sun light	pH		
			4	7	9
200	100	100	100	100	100
180	90	80	90	100	100
150	80	50	70	100	80
140	50	30	60	80	70
130	20	20	40	50	50
120	10	0	10	20	40
110	0	0	0	10	30
100	0	0	0	0	10
90	0	0	0	0	0
Control	100 (x)	100 (xx)	-	-	-

(x) 145 ppm without mud.
(xx) 145 ppm without exposure to sun light.

Table 4. Effect of 7 days storage on the molluscicidal activity of the dry powdered leaves of *Yucca filamentosa* " *marginata*" against *Biomphalaria alexandrina* snails at 25 °C .

Concentration (ppm)	Mortality %
200	100
150	90
120	70
100	50
80	40
60	20
40	10
20	0
Control	100 (x)

(x) 145 ppm freshly prepared water suspension.

Table 5. Effect of mud particles, sun radiation, and pH values on the molluscicidal activity of the dry powdered water suspension of *Cestrum purpureum*" against *Biomphalaria alexandrina* snails at 25 °C after 24 hours.

Concentration (ppm)	Mortality % at :				
	Mud (5000 ppm)	Sun light	pH		
			4	7	9
500	100	100	100	100	100
400	80	100	100	100	100
300	50	100	100	100	100
200	20	100	100	100	100
150	0	90	100	100	100
130	0	80	90	100	100
120	0	60	60	100	90
100	0	50	50	90	50
80	0	30	30	60	40
60	0	20	10	30	20
40	0	10	0	0	0
20	0	0	0	0	0
Control	100 (x)	100 (xx)	-	-	-

(x) 130 ppm without mud.
(xx) 130 ppm without exposure to sun light.

Table 6. Effect of 7 days storage on the molluscicidal activity of the dry powder of *Cestrum purpureum* against *Biomphalaria alexandrina* snails for 24 hours.

Concentration (ppm)	Mortality %
400	100
300	80
250	60
200	50
250	30
100	20
50	0
Control	100 (x)

(x) 130 ppm freshly prepared water suspension.

Table 7. Comparative susceptibility of *Biomphalaria alexandrina* snails to different extracts of leaves of *Yucca filamentosa* "*marginata*" at 25 °C, after 24 hours.

Extract	LC_{50} (ppm)	LC_{90} (ppm)	Slope
Methanol	38 (29.2-49.7)	85	1.71
Ethyl acetate	180 (146.3-221.4)	300	1.42
Acetone	170 (133.8-215.9)	325	1.62
Petroleum ether	63 (21.4-185.2)	280	3.45
Benzene	255 (196.1-331.5)	500	1.69
Ether	150 (110.2-204.8)	275	1.66

Table 8. Comparative susceptibility of *Biomphalaria alexandrina* snails to different extracts of *Cestrum purpureum* after 24 hours at 25 °C.

Extract	LC_{50} (ppm)	LC_{90} (ppm)	Slope
Methanol	39 (30.4-50.2)	78	1.66
Ethyl acetate	310 (258.3-372.0)	460	1.35
Acetone	84 (68.8-102.4)	150	1.51
Petroleum ether	125 (96.8-161.2)	270	1.81
Benzene	175 (154.8-197.7)	240	1.28
Ether	90 (66.1-122.4)	220	2.07