

Two Molluscicides from Saudi Arabian Euphorbiales against *Bulinus wrighti*

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ABSTRACT. The mortality caused to the snail *Bulinus wrighti* (The snail vector of urinary schistosomiasis) by different extracts of two species of plants belonging to the family Euphorbiaceae has been investigated. It was found that very low concentrations of fresh leaf extracts were effective in killing the snail. The LC₅₀ of methanol and acetone extracts for *Euphorbia schimperiana* and *Euphorbia helioscopia* were 2.3 ppm and 8.9 ppm respectively.

KEYWORDS: *Bulinus wrighti*, urinary schistosomiasis, Euphorbiaceae, *Euphorbia schimperiana*, *Euphorbia helioscopia*.

Introduction

Urinary schistosomiasis has been reported in Saudi Arabia since 1887^[1,2,3]. *Schistosoma haematobium* is transmitted in Saudi Arabia exclusively by certain members of the genus *Bulinus* (Muller, 1781). The importance of *Bulinus wrighti*^[4] as a natural intermediate host seems to be limited by its restricted distribution^[5].

Selective mollusciciding and chemotherapy should spearhead schistosomiasis control, the main objectives of mollusciciding are to eliminate infected snails, depress snail host population density and thus reduce snail/human infection potential, where agriculture potential is high, or in periurban areas, molluscicides can provide the cheapest and most effective means of control^[6].

Many plants have been screened for their intrinsic molluscicidal properties in an attempt to find an affordable alternative to niclosamide and which is suited for use in self-help schistosomiasis control programme^[7]. From the family Eu-

phorbiaceae, molluscicidal activity has been reported in *Bridella adroviridia* and *Cryptogonone argents*^[8], *Euphorbia cotonifolia*^[9], *Croton macrostachys*^[10], *Croton tiglium*^[11], *Jatropha curcas*^[12] and *Euphorbia lactea*^[13].

Molluscicidal properties of some Saudi Arabian Euphorbiales against the snail *Biomphalaria pfeifferi* were discussed and reported^[14,15,16,17]. Among the tested species of the genus *Euphorbia* was *Euphorbia schimperiana* and *Euphorbia helioscopia* which have been studied as molluscicides by using different solvents^[14,15].

The aim of this study is to investigate the effect of fresh leaf extracts of *Euphorbia schimperiana* and *Euphorbia helioscopia* as a plant molluscicides on the snail *Bulinus wrighti*.

Materials and Methods

Snails

The snails used in this study were *Bulinus wrighti* which were laboratory breeding. Snails kept in dechlorinated tap water, pH 6.7 in plastic tanks (10 liters). The tanks were continuously aerated by air pump. Fresh lettuce was used for feeding three times a week. The aquaria were maintained at a constant temperature of 25-28°C and were illuminated by using a warm lamp (40 W) for 12 hour a day. The water was changed twice monthly. Identification was made according to^[5,18], and was confirmed by the natural history museum, London.

Extraction of Euphorbiales

Fresh leaves of *Euphorbia schimperiana* and *Euphorbia helioscopia* were collected in Saudi Arabia. Their identification were made with reference to the herbarium of the Faculty of Science, King Abdulaziz University, Jeddah. Known weights of fresh leaves for each plant were ground and extracted with different solvents following the procedure used by^[14].

Preparation of Molluscicide Solutions

Stock solutions of 1000 ppm were freshly prepared on a basis of weight/volume in distilled water. Series of concentrations that would permit the computation of LC₅₀ values were prepared. Recovery periods were followed the exposure periods which were both of 24 hours. The snails were not fed or disturbed during these periods. The snails were probed and considered dead if they did not move inside the shell. LC₅₀ and LC₉₀ values were estimated by the method of^[19].

Results

From data presented in Table 1 the following facts are pointed out :

1 – *Euphorbia schimperiana* extracts in general are highly more active than *Euphorbia helioscopia* extracts.

TABLE 1. LC₅₀ and LC₉₀ (ppm, 24-hours exposure) of extracts from fresh leaves of *E. helioscopia* and *E. schimperiana* for *Bulinus wrighti*.

	<i>E. helioscopia</i>		<i>E. schimperiana</i>	
	LC ₅₀	LC ₉₀	LC ₅₀	LC ₉₀
Cold water	80 (66.6-96) [1387]	109.6 (84-142.5) [1900]	81.8 (74-90) [1191]	106 (81.7-138) [1543]
Hot water	96.6 (87.8-106) [1267]	117.7 (90.6-153) [1555]	72.8 (56-94.6) [674]	140.6 (100-196.8) [1301]
Methanol	11.3 (8.7-14.5) [289]	18.3 (11.3-29.7) [469]	2.3 (1.3-4.1) [39.2]	6.9 (1.4-33.1) [117]
Chloroform	80.5 (53.7-120.8) [1829]	173.4 (61.9-485.5) [3940]	3 (1.8-5) [60.6]	7.7 (2.8-20.7) [83.9]
Acetone	8.9 (6.2-12.9) [289]	17.5 (10-30.6) [569]	10.1 (8.5-11.9) [60.6]	13.99 (11.2-17.5) [83.9]
Hexane	99 (90-109) [2475]	127.7 (94-159.6) [3192]	18 (12-27) [385]	38.6 (14.8-100.4) [827]

Values are LC with 5% confidence limits in parentheses, and in brackets, the fresh weight equivalent of the LC value in mg/l (LC × weight of fresh leaves/weight of extracted fresh leaves).

2 – Out of *Euphorbia schimperiana* extracts, methanol extract possessed the highest molluscicidal activity against the snails *Bulinus wrighti* with LC₉₀ of 2.3 ppm (Fig. 1).

3 – Out of *Euphorbia helioscopia* extracts, the acetone extract was the most toxic one against the same snails with LC₉₀ of 8.9 ppm (Fig. 2).

4 – The snails were slightly affected by the cold water and hot water extracts of the two tested plants.

5 – The fresh weight equivalent of the LC₉₀ value in mg/l for *Euphorbia schimperiana* methanol extract was 39.2 and that for *Euphorbia helioscopia* acetone extract was 289 (Table 1).

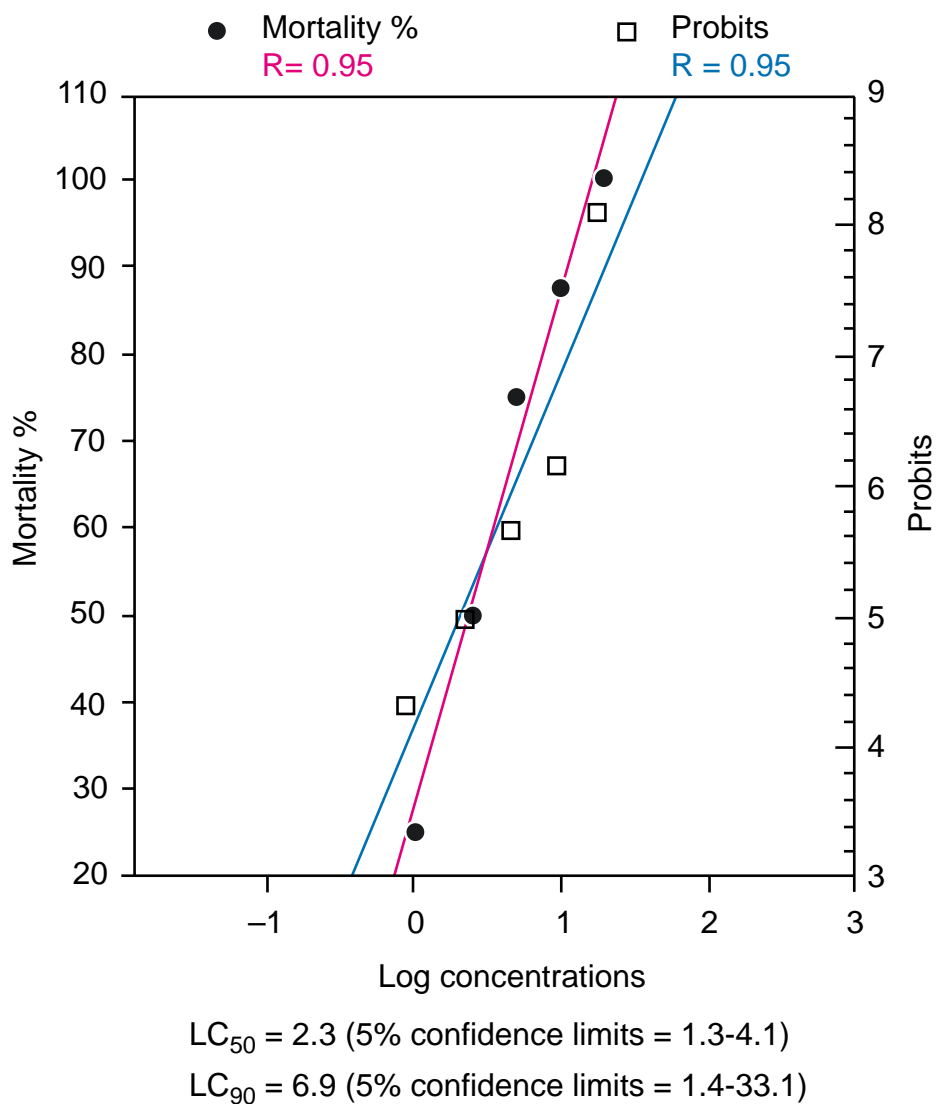


FIG. 1. LC₅₀ and LC₉₀ (for 24 hours exposure) of the methanol extract of fresh leaves of *Euphorbia schimperiana* for *Bulinus wrighti*.

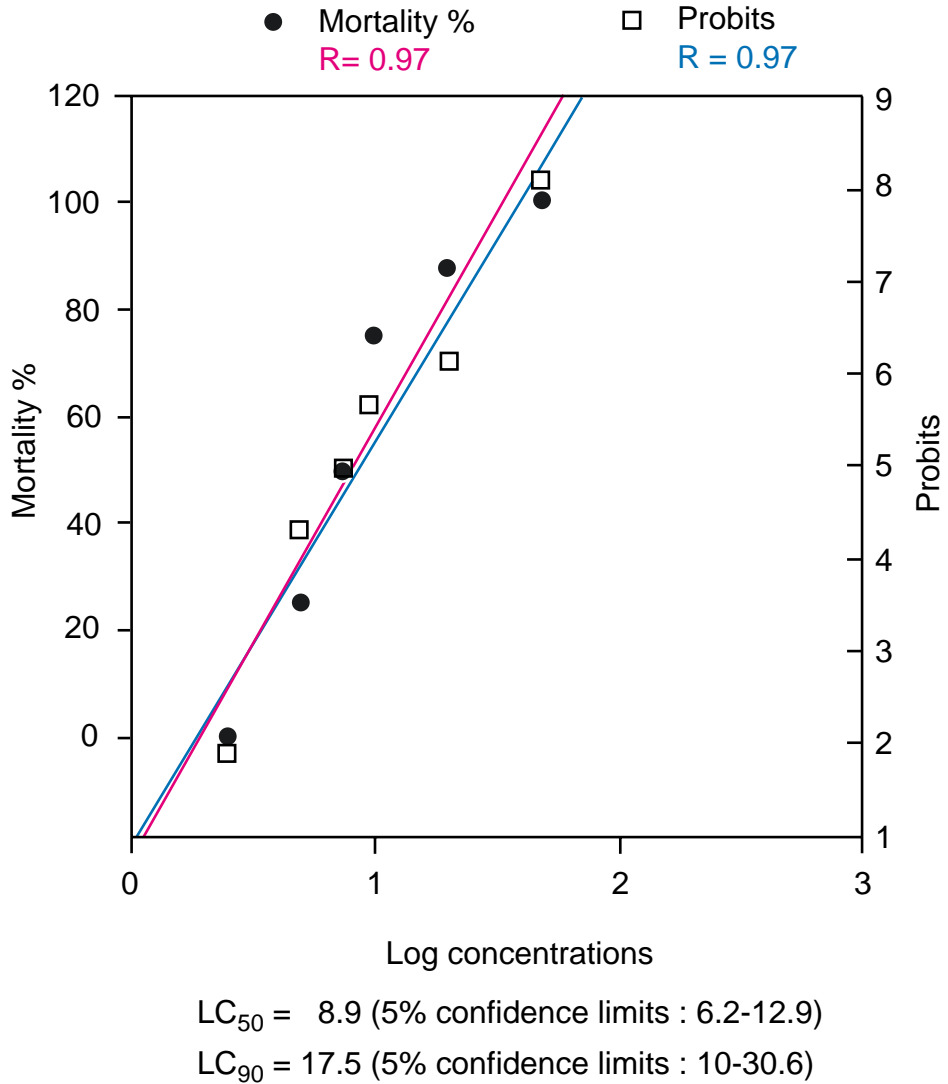


FIG. 2. LC₅₀ and LC₉₀ (for 24 hours exposure) of the acetone extract of fresh leaves *Euphorbia helioscopia* for *Bulinus wrighti*.

Discussion

The molluscicidal activity of *Euphorbia schimperiana* extracts against the snails *Bulinus wrighti* was compared with the following :

1 – *Euphorbia schimperiana* cold water extract and *Euphorbia schimperiana* hot water extract gave LC₅₀s of 81.8 ppm and 72.8 ppm respectively against *Bulinus wrighti* while there were no mortality up to 100 ppm by using the same extracts against the snail *Biomphalaria pfeifferi*^[14,15].

2 – The methanol and acetone extracts were better in their molluscicidal activity against *Bulinus wrighti* than those recorded for the snail *Biomphalaria pfeifferi*^[14,15]. The methanol extract of *Euphorbia schimperiana* gave an LC₅₀ of 2.3 ppm against the snail *Biomphalaria pfeifferi* as that recorded for the methanol stem extracts of *Euphorbia pseudocacatus* against *Bulinus truncatus* with an LC₅₀ of 2.05 ppm^[20], while the LC₅₀s recorded from using the acetone extracts of *Euphorbia peplus*^[20] and *Euphorbia lactea*^[13] against the snails *Bulinus truncatus* were better than those reported in this study.

3 – The chloroform and hexane extracts have higher molluscicidal activity against the snails *Biomphalaria pfeifferi*^[14,15] than those reported in this study by using the snails *Bulinus wrighti*. Also, the chloroform extract of *Euphorbia peplus* gave good results against the snail *Bulinus truncatus*^[20] and that of *Euphorbia lactea*^[13], while those reported from *Euphorbia nubica* and *Euphorbia nerifolia* have less molluscicidal activity^[20].

The results of the susceptibility of *Bulinus wrighti* to the action of *Euphorbia helioscopia* extracts was compared with some other results recorded here :

1 – As *Euphorbia schimperiana*, cold water and hot water extracts of *Euphorbia helioscopia* gave good results (LC₅₀ of 80 ppm and 96.6 ppm respectively) against the snails *Bulinus wrighti* while they gave negative results against the snails *Biomphalaria pfeifferi*^[14,15].

2 – The methanol, acetone and hexane extracts gave a big difference results against the snail *Bulinus wrighti* rather than reported for *Biomphalaria pfeifferi*^[14,15].

3 – The chloroform extract has less molluscicidal activity against *Bulinus wrighti* in comparison with those of *Biomphalaria pfeifferi*^[14,15] and those of^[20] which studied the same extracts.

The analysis of variance procedure tests whether there are any significant differences between the two plant species, the six extraction solvents, the 10 concentrations, or their interactions has been made. In case of a significant difference, Tukey's pair-wise comparison procedure^[21] has been followed.

From The ANOVA table (Table 2), it shows that the first four effects are highly significant (p value < 0.0001), also the interaction between the plant species and the concentrations is significant (p value = .0133). The effect of inter-

action between solvents and concentrations turned out to be not significant. Therefore one can say that plant species 1 and 2 are significantly different from each other ($\alpha = .05$).

TABLE 2. Analysis of variance of the data in Table 1.

Source of variation	Degree of freedom	Sum of squares	Mean of squares	F	P-value
S	1	1.35	1.355	135.5**	<.0001
E	5	10.57	2.113	211.3**	<.0001
C	9	2.69	0.299	29.9**	<.0001
S x E	5	2.89	0.578	57.8**	<.0001
S x C	9	0.24	0.027	2.7*	.0133
E x C	45	0.57	0.013	1.3	.1911
Residuals	45	0.45	0.010		
Total	119				

S : Plant species, E : Extraction solvent, C : Concentration (mg / litre), ** : Highly significant (p value < .0001).

The follow up procedures using Tukey's method^[21] and confidence level of 95% show that the following extraction solvents are not significantly different at ($\alpha = .05$) : (cold water, hot water), (methanol, acetone), (chloroform, hexane). Only concentration 10 and 20 are significantly different from 100. All others are not significantly different.

As in general, the results of *Euphorbia schimperiana* extracts and *Euphorbia helioscopia* extracts indicates that both plants share in possessing a high molluscicidal activity against the snail *Bulinus wrighti*. In conclusion, it appears that the methanol extract of *Euphorbia schimperiana* has a strong molluscicidal activity and it is the most suitable for a biological application which offers a simple and cheap molluscicidal agent of plant origin.

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نباتات من عائلة الإيوفوربيا (Euphorbia) لقتل القواقع الوسيطة الناقلة لمرض البلهارسيا البولية (*Bulinus wrighti*)

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جدة - المملكة العربية السعودية

المستخلص . تسبب استخدام المستخلصات المختلفة لنباتين يتبعان عائلة الإيوفوربيا في موت القواقع الوسيطة الناقلة لمرض البلهارسيا البولية ، ولقد لوحظ أن استخدام مستخلصات الورق الأخضر لهذه النباتات وبتراكيز منخفضة جداً أدى بصورة فعالة في قتل هذه القواقع ، ولقد كان التركيز المميت بنسبة ٥٠٪ لمستخلص الميثانول لنبات الإيوفوربيا شامبريانا بمقدار ٣, ٢ جزء من المليون ، في حين كان التركيز المميت بنسبة ٥٠٪ لمستخلص الأستون لنبات إيوفوربيا هيلوسكوبيا بمقدار ٩, ٨ جزء من المليون .