

Full Length Research Paper

Molluscicidal activity of crude water leaf extracts of *Alternanthera sessilis* on *Bulinus* (phy) *globosus*

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Evaporated and unevaporated extracts were prepared from both dried and fresh leaves sample and subjected to a 24 h static bioassay. A reference molluscicide niclosamide (Bayluscide) was used as standard and rainwater as untreated control. Reaction of the snails on coming in contact with the test medium is either shock or distress. The distress reaction started with retraction of tentacles and ended in some cases with death. Shock reaction results when snails are immersed in a more concentrated crude water extract which usually resulted in the death of the snails. Statistical analysis of average mortality figures by the use of probit gave LC₅₀ of 40.42 (35.15 – 46.47) for the unevaporated crude water while the evaporated crude water extract had LC₅₀ of 48.07 (42.81 – 54.28) for the dried leaf extract. For the fresh leaves the unevaporated crude water extract had LC₅₀ of 32.57 (27.15 – 39.08) and evaporated crude water gave 45.00 (39.09 – 51.79). This results show that the molluscicidal properties of the leaf extract was dose dependent as mortality increases with the relative increase in concentration of the extract. Furthermore, the bioavailability of the active component is more in the fresh leaves sample when compared to the lethal concentration values of the dried leaves extract and the potential of the crude water extract in integrated schistosomiasis control is discussed.

Key words: *Alternanthera sessilis*, crude water extract, molluscicidal activity, bioavailability, schistosomiasis control.

INTRODUCTION

The snail intermediate host of *Schistosoma haematobium* is *Bulinus* (Phy) *globosus*. This snail host occurs throughout most parts of Africa and the adjacent regions (Brown, 1980). Although the snails do not play an active role in transmission of the parasite from one host to another, as do insect vectors; it is an indispensable intermediate host for the development of the parasite. The transmission of the infective stage of the parasite is accentuated through shedding of the cercariae by the snail host and the various human water contact activities (Dalton and Pole, 1978). Schistosomiasis can be controlled

by destroying the carrier snail and thus breaking the life cycles of the parasite (Amrita and Singh, 2001). Consideration of cost and environmental effect of most molluscicides in current use for the control of schistosomiasis has generated the search for cheaper and less polluting molluscicides, especially those of plant origin. Molgaard (1999) has expressed hope that plants showing molluscicidal properties could be used on self-help basis to control diseases in rural areas.

Alternanthera sessilis (Amaranthaceae), a plant indigenous to West Africa (Daziel, 1948) has many folkloric uses, some of which have been authenticated in the laboratory by many researchers worldwide. Many researchers have reported on the ethno medical and biological activity of the plant. For instance, in Sri Lanka, hot water extract of the entire plant when taken orally by

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Table 1. Expected effective lethal molluscicidal concentration of *A. sesselis* extract from dried leaves and Niclosamide on adult *Bulinus* (*Phy*) *globosus*.

Molluscicides	Lethal concentration values and limit (mg/l)	Slope function	Chi-Square (χ^2) at 0.05	
Unevaporated crude water extract	LC ₅₀ 40.42 (35.15 – 46.47)	1.29	6.54	NS
Evaporated crude water extract	LC ₅₀ 48.07 (42.81 – 54.28)	1.21	4.33	NS
Niclosamide (Bayluscide®)	LC ₅₀ 0.65 (0.54 – 0.77)		2.72	NS

Table 2. Expected effective lethal concentration of *A. sesselis* extracts from fresh leaves and Niclosamide on adult *Bulinus* (*Phy*) *globosus*.

Molluscicides	Lethal concentration values and limit (mg/l)	Slope function	Chi-Square (χ^2) at 0.05	
Unevaporated crude water extract	LC ₅₀ 32.57 (25.15 – 39.08)	1.60	7.71	NS
Evaporated crude water extract	LC ₅₀ 43.57 (38.38 – 49.46)	1.24	1.32	NS
Niclosamide (Bayluscide®)	LC ₅₀ 0.65 (0.54 – 0.77)		2.72	NS

NS – Computed χ^2 not significant statistically ($p > 0.05$).
Lower and upper limits of LC₅₀ values in parenthesis.

nursing mothers is known to increase the flow of milk (Quisimbing, 1951). Various workers (Lemma, 1970; Sherif and El-Sawy, 1969; Adewumi and Sofowora, 1980; Osuala and Okwuosa, 1993; Kela and Bowen, 1995; Ebele, 1998; Amrita and Singh, 2001) have reported on the molluscicidal properties of several plants, most of them shrubs, trees and perennial hydrophytes.

Our previous studies in small test volume indicated molluscicidal activity of *A. sesselis* against intermediate host of *S. haematobium* (Azare et al., 2002) which agrees with the report of (Ndifon and Ukoli, 1984). Therefore we decided to evaluate the effect of the extracts from *A. sesselis* on *Bulinus globosus* going by (WHO, 1983) guidelines.

MATERIALS AND METHOD

The leaves of the plant were air dried under shed in the laboratory for two weeks. Thereafter it was pulverised in a wooden mortar with a pestle. Total crude water extract was prepared according to the modified methods of Osuala and Okwuosa (1993) and Ebele (1998). 30 g of the dried leaf was soaked in 150 ml of distilled water and allowed to stand for 24 h at ambient temperature. The extract was obtained by filtering the soaked material through two thick layers of cheesecloth and finally through a sterile Whatman filter paper. The filtrate served as a stock solution, which was divided into two portions for the preparation of unevaporated crude water extract and evaporated water extract using the method of Kela et al. (1989). Fresh leaves crude water extract was obtained by slight modification of the procedure outlined by Ndifon and Ukoli (1984). 100 g of the fresh leaves was homogenised in a Maulinox blender for 10 min with addition of 400 ml of distilled water. The homogenate obtained was first filtered through two layers of cheesecloth and finally filtered through a sintered crucible in vacuo. Serial dilution of the stock solution was made ranging ten fold from 10 - 80 mg/l.

Adult samples of *B. globosus* were obtained from different parts of Northern Nigeria viz: Zaria, Kaduna State; Bauchi, Bauchi State, Izom, Dobi, Kuje and Gwagwalada in the Federal Capital Territory, Abuja, Nigeria. The collected snails were maintained in a 10 l

plastic aquarium that was filled to two-third with filtered rain water and aerated by means of a hyflow air pump.

WHO (1983) guideline for evaluation of molluscicides was adopted for evaluation of the potency of the extracts. Ten (10) batches of the laboratory-bred snails were used for each test concentration, which ranged from 10 – 80 mg/l. Each test concentration was replicated resulting to a total of 20 snails per nominal concentration. The set up was allowed to stand for 24 h and snails exposed to bioassay were not fed. Rainwater was used as the untreated control and Niclosamide (Bayluscide®) served as the reference molluscicide in accordance with Kela et al. (2000) and WHO (1983) guidelines. Snails suspected to be dead were transferred into aerated rainwater for a recovery period of 24 h.

RESULTS AND DISCUSSION

The evaporated and unevaporated crude water extracts were molluscicidal with 100% mortality recorded at concentrations less than 100 mg/l (Table 1 and 2). Snails in the test media were observed to move to the side of the container in an attempt to escape from the media. Mortality increased with the relative increase of concentration of the test media. The unevaporated crude water extract was more potent than the evaporated crude water extract. The reference molluscicide niclosamide (Bayluscide®) was active at less than 1 mg/l. Mortality was not recorded in the control experiment. The activity of the extract was dose dependent as shown in (Figure 1).

Our research results showed that the total crude water extract (evaporated and unevaporated) exhibit molluscicidal potency on *B. globosus* and agree with preliminary report (Azare et al., 2002) and the work of Ndifon and Ukoli (1988). Evaluation of the toxic effect of the plant extract on *B. globosus* showed that the unevaporated water extract exhibited higher molluscicidal potency than the evaporated crude water extract and that fresh leaf extract relatively exhibited higher molluscicidal activity than the dry leaf. The LC₅₀ values presented reveal that most of these extracts have good potential for future use

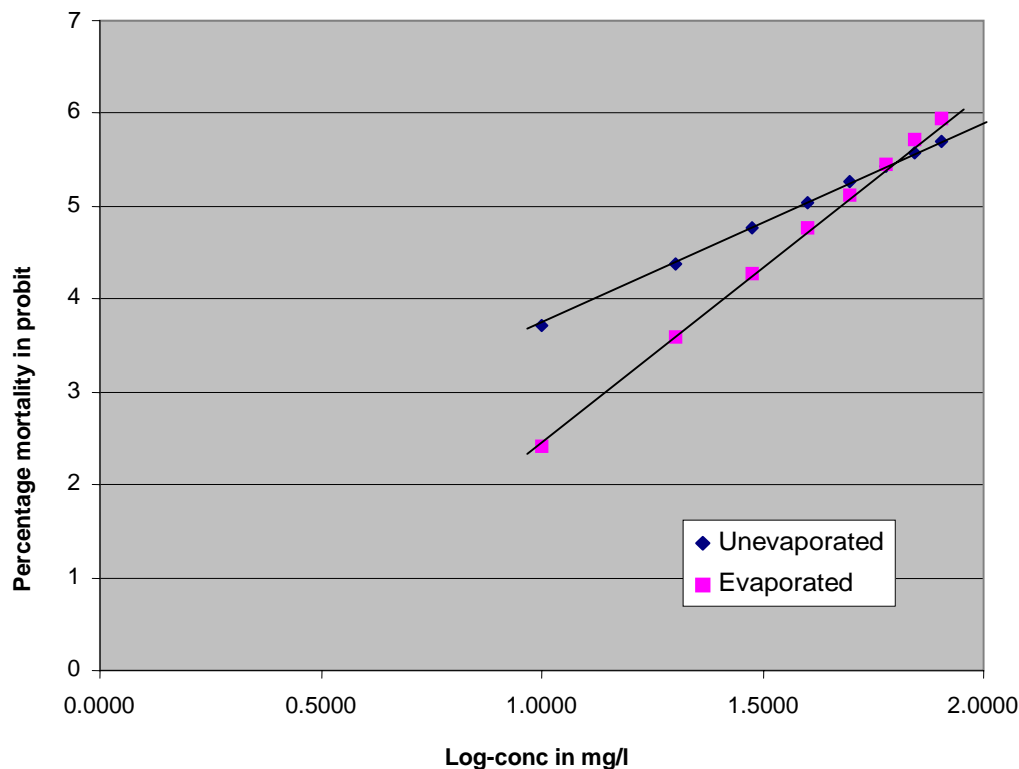


Figure 1. Log-dose, Mortality curve of evaporated and unevaporated crude water extract of *Alternanthera sesselis* on adult *Bulinus* (phy) *globosus*.

in integrated control of schistosomiasis. Difference in the slope functions of the extracts was noted in the analysed mortality data and it indicates the extent to which increase in concentration of the extract should be made, to secure an increase in mortality.

Sub lethal doses apparently irritate the snails as it was observed by the desire of the snails to crawl out of the test solution in order to avoid contact with the treated water. This is a protective behaviour of *B. globosus* to avoid contact with treated water.

One of the problems envisaged in the use of plant extracts, in the control of snails, is the choice of solvent for extracting the plant materials. From the results presented for both the dried and fresh leaves, the unevaporated crude water is more potent than the evaporated crude water extract.

In Africa, the deciding factor in schistosomiasis control programmes using molluscicides is the cost. Synthetic molluscicides are expensive and in addition, may lead to problems of toxicity to non-target organisms and deleterious long-term effects in the environment. The possible development of resistance in schistosomiasis-transmitting snail is another important factor. The use of plants with molluscicidal properties is a simple, inexpensive and appropriate technology for control of the snail intermediate host.

Conclusion

The screening of plants for molluscicidal activity started over 60 years ago and is continuing. *A. sesselis* is a hydrophilic plant that fringes some of the freshwater ponds in most of the schistosomiasis endemic areas in Nigeria. Casual observation indicated that this pond is hardly ever inhabited by freshwater snails. Our research findings would promote community self-help involvement in snail control.

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