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Molluscicidal Activity of Khaya Grandifoliola Extracts Against Freshwater Snails in Khartoum State- Sudan

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Abstract: *The treatment of freshwater snails with sub-lethal concentration of herbal molluscicides was effective in altering the amino acid profile of this snail species which contributed to the impairment of snails laying capacity. The herbal molluscicides were reported to contain diverse chemical profile; steroids and triterpenes, flavonoids, tannins and phenolic compounds in addition to the essential oils. The diversity of chemical constitution of different Callistemon species reflects diversity in its biological activities. The botanical molluscicides are of economic importance, especially in developing countries. Also, there is a continuous need to search for new plant species with ideal molluscicidal properities. Different plants have been reported as molluscicides. The present study was performed to study the molluscicidal activity of aqueous and ethanolic extracts of Khaya grandifoliola bark against freshwater snails. It is experimental study was carried out in Al-Keriab area in East Nile locality, Khartoum state/ Sudan, a total of 190 snail samples were randomly collected by using deep scoop from the main water canals supplying the irrigated schemes of the study area. The results showed that the aqueous extracts of Khaya grandifoliola barks possess100% molluscicidal property at concentration of 1 g/L.*

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Keywords— Molluscicidal Activity; Khaya grandifoliola; Schistosome; Snails; Al-Keriab Area

1. INTRODUCTION

Currently, there is an increased attention for the use of new molluscicides which are highly effective, rapidly biodegradable, less expensive, readily available and probably easily applicable with simple techniques than synthetic molluscicides. One of the new trends in the biological control of vectors of diseases is testing the toxicity of plant extracts, as alternatives to chemical molluscicides, which proved to be environmentally safe and have less residual activity [1]. There are many restrictions of using molluscicides with fresh water. Therefore, the safety of plant extracts to human being is an advantage for studying their effect against the snail vectors of schistosomiasis [2]. The treatment of snails with sub-lethal concentration of herbal molluscicides was effective in altering the amino acid profile of this snail species which could be contributed to the impairment of snail's egg laying capacity, snail-schistosome miracidiae finding mechanisms and immune response of the molluscan hosts but has no effect on the mammalian skin penetration rate by schistosome cercariae. The herbal molluscicides of *K. grandifoliola* were reported to contain diverse chemical profile; steroids and triterpenes, flavonoids, tannins and phenolic compounds, tetradecahydroxanthenediones, in addition to the essential oils. The diversity of chemical constitution of different Callistemon species reflects diversity in its biological activities; antibacterial and antifungal activities, molluscicidal activity. Reviewing the current literatures *Khaya grandifoliola* were not intensively investigated for mulloscicidal activity. So, the aim of the present study is to evaluate the efficacy of the aqueous and ethanolic extracts of *Khaya grandifoliola* barks as molluscicides against freshwater snails [4]. The intermediate snail host is an essential link in the schistosome life cycle. Knowledge of its ecology, bionomics and population dynamics are required for a proper understanding of the disease transmission, or as a basis for planning and evaluation of measures directed against snails in the control of the disease [5]. Despite the ability of schistosome species to develop in a variety of definitive mammalian hosts, the range of snail that serves as intermediate hosts is limited. Pulmonate snails of the family Planorbidae are the intermediate snail hosts for human schistosomes in Africa, the Middle East, the Caribbean Islands and South America. *Khaya grandifolio* plants are usually deciduous, monoecious, medium-sized to large tree up to 40 m tall; bole branchless for up to 23 m, often twisted or leaning near the top, up to (120-200) cm in diameter, usually with buttresses up to 3 m high; bark surface grayish brown, rough, exfoliating in small circular scales and becoming pitted, inner bark dark pink to reddish, with white streaks, exuding a clear gum; crown large, rounded; twigs glabrous. Leaves arranged spirally but clustered near ends of branches, paripinnately compound with 3-5 pairs of leaflets; stipules absent; petiole and rachis together up to 50 cm long; petiolules 0.5-1 cm long; leaflets opposite or nearly so, elliptical to ovate-elliptical or oblong-elliptical, (30) cm × 5-10 cm, cuneate to obtuse or rounded and slightly asymmetrical at base, shortly but distinctly acuminate at

apex, often with twisted acumen, margins entire or wavy, thickly papery to thinly leathery, glabrous, pinnately veined with 9-15 pairs of lateral veins.The average longevity of the snail varies among the species and with the local environmental conditions [6]. In many malaria endemic countries, like the tropics, the extract of *Khaya grandifoliola* is used as an antimalarial herbal remedy. The bark and seeds of *K. grandifoliola* are the most common parts used for treatment and are extracted by infusion or decoction. The extracts have proven to fight against the *P. falciparum* parasite. The bitter-tasting bark is used in traditional medicine. It is widely used as a treatment against fever caused by malaria, whilst decoctions are also taken to treat stomach complaints including gastric ulcers and diarrhoea caused by intestinal parasites; pain after childbirth; and gonorrhea.

2. Materials and methods

2.1 Study design:

This was experimental study. The evaluation of the efficiency of the six extracts for killing freshwater snails was based on the "controlled test designed" (Modified from Moskey and Harwood, 1941) [8]. Briefly: in the present study, adult snails were maintained under the same conditions and used as an animal model for testing the molluscicidal activity of crude extracts.

2.2 Study area and study period:

The study was conducted in Al-Keriab area in East Nile locality, Khartoum State-Sudan during period from December 2016 to April 2017.

2.3 Sample size:

A total of 190 snail samples were collected from the main water canals supplying the irrigated schemes of the study area were included in this study.

3. Methods

3.1 Snails sampling:

A survey was made for the water contact site in the study area. Sampling of snails was carried out using a deep scoop described by Amin *et al*. (1972) [9]. The deep scoop was made of metal square frame 30 cm x 30 cm on which steel gauze was soldered and covered on one side by lighter gauze of one millimeter mesh. The frame was soldered to a long metal bar to act as a handle. Hand picking of snails attached to aquatic plants, bed-rocks and other objects was also done. Hand gloves were worn as precautions against infection during each snail search.

3.2 Preparation of plant extracts:

One gram (1g) of powdered air-dried *Khaya grandifoliola* barks were macerated for 24 hours in 2.5 liters of ethanol. This was concentrated in-vacuo to dryness using water bath to obtain the ethanolic extract. The same quantity of *Khaya grandifoliola* powders were macerated with distilled water at room temperature for 24 hours. The resultant mixture was then filtered using Whatman's filter paper and the filtrating material was concentrated to dryness using water bath to obtain aqueous extract of the two plants. This was scrapped and stored at -4C. For the molluscicidal activity testing, aqueous and ethanolic extracts were first homogeneously suspended in canal water with serial dilutions (1g/l, 0.5g/l, and 0.25g/l). Thereafter, they were tested for the molluscicidal activity

3.3 Testing of snails:

Adult snail samples were obtained from the irrigation canal in Al-Keriab area, East Nile locality. Snails were grouped to 13 groups, 10 snails each, every snail group were maintained in a plastic container containing 100ml of canal water.

3.4 Molluscicidal activity tests:

Serial concentrations in gram per liter were freshly prepared with distilled water from the ethanol and aqueous dry extracts of *Khaya grandifoliola* barks. Different concentration solutions 1 g/L, 0.5 g/L, 0.25 g/L were prepared. Molluscicidal evaluation of the ethanolic and aqueous extracts of the plants was performed according to WHO guidelines. The test snails (10 each) were challenged with various concentrations of both the ethanolic and aqueous extracts of the plant. After 24 hours of exposure to the ethanol and aqueous extracts of *Khaya grandifoliola* barks, the snails were transferred to fresh dechlorinated water and maintained for another 24 hours. Death of snails was confirmed by the absence or no reaction to irritation of the foot with a needle to withdrawal movement. dechlorinated water (negative control) and niclosamide (Yomesan®) (positive control), were used to monitor the susceptibility of snails and to compare its potency with the ethanolic and aqueous extracts. Lethal concentrations were determined.

4. Results

The investigation revealed that the highest mortality rate (100%) was reported with concentration of 1 g/L of crude aqueous extracts of *Khaya grandifoliola* while the lowest mortality rate (70%) was reported with 0.25 g/L (Table 1). The difference in rates between all concentrations of aqueous extracts of *Khaya grandifoliola* was found to be statistically significant at p. value= 0.000.

The results showed that the mortality rates between all concentrations of ethanolic extracts of *Khaya grandifoliola* were equal (60%) (Table 2).

Table 1: The molluscicidal activity of aqueous extracts of *Khaya grandifoliola* barks

***K.grandifoliola* Extracts Barks**	**No. Examined**	**Status**	**1 g/L**	**0.5 g/L**	**0.25 g/L**
Aqueous	10	Death	10	8	7
		%	100	80	70

Table 2: The molluscicidal activity of ethanolic extracts of *Khaya grandifoliola* barks

***K.grandifoliola* Extracts Barks**	**No. Examined**	**Status**	**1 g/L**	**0.5 g/L**	**0.25 g/L**
Ethanolic	10	Death	6	6	6
		%	60	60	60

5. Discussion

The present study aimed to study the molluscicidal activity of aqueous and ethanolic extracts of *Khaya grandifoliola* bark against freshwater snails. So, experimental snail study performed in different concentrations of aqueous and ethanolic extracts. Our study reported that the highest mortality rate (100%) was reported with concentration of 1 g/L of crude aqueous extracts of *Khaya grandifoliola* while the lowest mortality rate (70%) was reported with 0.25 g/L. The results showed that the mortality rates between all concentrations of ethanolic extracts of *Khaya grandifoliola* were equal (60%). These findings were in agreement with findings of Anto *et al*. (2013) [10] who showed the similar results.

6. Conclusion:

This study concluded that the aqueous extracts of *Khaya grandifoliola* barks possess100% molluscicidal property at concentration of 1 g/L.

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