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Molluscicidal Effects of *Ageratum conyzoides* and *Datura stramonium* on *Bulinus globosus* and *Lymnea natalensis*

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Abstract**—**Schistosomiasis is a vector-borne water-based disease transmitted by *Bulinus globosus,* causing haematuria in the urine of man, while fascioliasis is a trematode zoonosis infectious transmitted by *Lymnaea natalensis* causing liver disease in man and animals. Adult *Bulinus globosus* and *Lymnaea natalensis* were used for the experiment. Aqueous leaf extract of *Ageratum conyzoides* and *Datura stramonium* were prepared into 25, 50, 75, 100, 200 and 400 ppm concentrations. Ten snails of each species were exposed to different concentrations in triplicates, and dechlorinated water was used as control at 24h, 48h, and 72h exposure. The results revealed that 100 ppm of both plants leaves extracts indicated mortality rates between 76.7% and 100% at 24h, 48h, and 72h for both snail species. ($P < 0.05$). In conclusion, the extract exercised molluscicidal activity to control the snail vector at lethal doses LC_{50} (66.611-72.021 ppm), CI = 63.083-77.90 ppm and LC_{90} (92.623-102.350), CI = 87.715-110.12 ppm.

Keywords**—**Snail, plant leaf, aqueous extract, mortality.

I. Introduction

SCHISTOSOMIASIS is one of the neglected tropical diseases that cause serious health problems in the tropical and subtropical region of the world and Nigeria in particular [1]. Schistosomasis is a vector-borne water-based disease caused by *Schistosoma* blood flukes [2]-[4]. Human and animal fascioliasis is a trematode zoonosis of importance in public health. Fascioliasis is a parasitic worm infection caused by liver fluke. The disease is a plant-borne parasitic trematode zoonosis and also grouped as a Neglected Tropical Diseases (NTDs) which affect human, cattle and sheep [4].

The snails hosting the parasite are the most viable targets. Selective plant extracts are required as current molluscicides which are non-toxic to other organisms [3], [5]. The use of plant extract in controlling freshwater snails of medical and veterinary importance is becoming interesting due to their environmentally friendly, accessible and the application is simple [5]-[8].

Plants such as *Ageratum conyzoides* and *Datura stramonium* are viable potential sources as alternative molluscicides that are enriched in biologically potential compounds: alkaloids, tannins, saponins, and terpenoids. These two plants are locally grown and common in this study area.

The research is aimed to assess the efficacy of the plant leaf aqueous extracts of *Ageratum conyzoids* and *Datura stramonium* against the adult of *B. globosus* and *Lymnaea natalensis* and to determine the lethal limit of the two plant leaf aqueous extracts on *B. globosus* and *L. natalensis.*

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II. Materials and Methods

Collection of Snail Samples

Adult *Bulinus globosus* (8-10 mm) and *Lymnaea natalensis* (9-11 mm) were collected from river Elemi in Ado Ekiti, Ekiti State, Nigeria. The snails were transported to the Zoology and Environmental Biology, Ekiti State University, Ado Ekiti, in a perforated lids plastic bowl and acclimatized for 3 days at room temperature 26 °C in aged tap water. The snails were fed with per-boiled dried lettuce (*Lactuca sativa*) leaf before the application of plant extracts on the snails [5].

Collection of Plant Materials and Preparation of Plant Extracts

The plants, *Ageratum conyzoides* and *Datura stramonium* were collected from the vegetation around Ado Ekiti and identified by an expert Technologist, in the Department of Plant science and Biotechnology, Faculty of Science, Ekiti State University, Ado Ekiti.

The aqueous leaf extracts of *A. conyzoides* and *D. stramonium* were prepared as carried out by Belayhun et al. [5]. 1 g of plant leaf powder was soaked in 800 ml aged tap water in a tight flask and shook for 24h on an orbital shaker to 110 rpm. The solution was restored to 1000 ml and used directly as stock solution of 1000 ppm as used by Mwonga et al. [9].

Test on Adult Snails

Graded concentrations of 25, 50, 75, 100, 200 and 400 ppm were prepared from the stock solution. Ten adult snails were exposed to each dilution for 24h, 48h and 72h in three replicates and the control experiment was set up using only aged tap water for each snail species.

Snail Mortality/Survival Rate

The snails were exposed to treatments in relation to different plant lead extract concentrations (25, 50, 75, 100, 200, and 400 ppm) and exposure time of 24h, 48h and 72h. The snails were removed from petri-dish and washed and retained in aged water. The morality rate was recorded after the test snails were allowed a 24 h recovery period.

Data Analysis

Data were analysed using probit regression analysis in IBM SPSS software version 2D, to determine the Lc_{50} and Lc_{90} values, which denote lethal doses for 50% and 90% mortality respectively. The related Chi-square X^2 and analysis of variance values were used to deduce the Pearson's goodness of-fit-for the appropriateness of probit model of the data [10].

III. Results

The molluscicidal potency of the leaf aqueous extract of *Ageratum conyzoides* with respect to the morality rate of *B. globosus* revealed 76.7% of 100 ppm concentration at 24h exposure while 100% mortality rate of *B. globosus* ranged from 100 ppm concentration at 72h to 400 ppm at 24h, 48h and 72h exposure period (Table I). Chi-square test showed that, there is a significant difference $X^2 = 25.435, P < 0.05$ between the concentration of *Ageratum conyzoides* and mortality of *B. globosus*. Lc_{50} value is 74.021 ppm (95% CI = 70.323 ppm – 77.90 ppm) and Lc_{90} value is 102.353 ppm (95% CI = 96.61 ppm – 110.12 ppm) of *Ageratum conyzoides* and the mortality of *B. globosus*. There is a significant difference in the mortality rate of *B. globosus* based on the different concentrations of aqueous extract of the plant leaf *Ageratum conyzoides*, $P < 0.05$, $F = 79.993$.

Table II showed that the molluscicidal effect of *Datura stramonium* on *B. globosus* was 83.3% mortality rate with 100 ppm at 24h exposure and 96.7% of 100 ppm at 48h of exposure. The 100% mortality rate of *B. globosus* was ranged from 100 ppm at 72h to 400 ppm at 24h, 48h, and 72h exposure period. Chi-square test showed that, there is a significant difference $X^2 = 22.819$ at $P < 0.05$ between the concentrations of *D. stramonium* and mortality of *B. globosus*. Lc_{50} value is 70.623 ppm (95% CI = 66.997 ppm – 74.365 ppm) and Lc_{90} value is 98.294 ppm (95% CI = 92.844 ppm – 105.477 ppm) of *D. stramonium* and the mortality of *B. globosus*. There is a significant difference in the mortality rate of *B. globosus* based on the different concentrations of aqueous extract of the plant leaf *D. stramonium*, $P < 0.05$, $F = 108.248$.

TABLE I
CONCENTRATIONS OF AQUEOUS EXTRACT OF PLANT LEAF (*AGERATUM CONYZOIDES*) AND MORTALITY RATE OF *B. GLOBOSUS*.

Concentrations	24h		48h		72h	
ppm	No of snail exposed	Mortality rate (%)	No. of Snail exposed	Mortality rate (%)	No of snail exposed	Mortality rate (%)
25	30	0 (0.0)	30	0 (0.0)	30	0 (0.0)
50	30	4 (13.3)	30	6 (20.0)	30	8 (26.0)
75	30	7 (23.3)	30	15 (50.0)	30	18 (60.0)
100	30	23 (76.7)	30	28 (93.3)	30	30 (100)
200	30	30 (100)	30	30 (100)	30	30 (100)
400	30	30 (100)	30	30 (100)	30	30 (100)
Control (H_2O)	30	0 (0.0)	30	0 (0.0)	30	0 (0.0)

TABLE II
CONCENTRATIONS OF AQUEOUS EXTRACT OF PLANT LEAF (*DATURA STRAMONIUM*) AND MORTALITY RATE OF *B. GLOBOSUS*.

Concentrations	24h		48h		72h	
ppm	No of snail exposed	Mortality rate (%)	No. of Snail exposed	Mortality rate (%)	No of snail exposed	Mortality rate (%)
25	30	0 (0.0)	30	0 (0.0)	30	0 (0.0)
50	30	5 (11.7)	30	8 (26.7)	30	9 (30.0)
75	30	10 (33.3)	30	15 (50.0)	30	20 (66.7)
100	30	25 (83.3)	30	29 (96.7)	30	30 (100)
200	30	30 (100)	30	30 (100)	30	30 (100)
400	30	30 (100)	30	30 (100)	30	30 (0.0)
Control (H_2O)	30	0 (0.0)	30	0 (0.0)	30	0 (0.0)

TABLE III
CONCENTRATIONS OF AQUEOUS EXTRACT OF PLANT LEAF (*AGERATUM CONYZOIDES*) AND MORTALITY RATE OF *L. NATALENSIS*.

Concentrations	24h		48h		72h	
ppm	No of snail exposed	Mortality rate (%)	No. of Snail exposed	Mortality rate (%)	No of snail exposed	Mortality rate (%)
25	30	0 (0.0)	30	0 (0.0)	30	0 (0.0)
50	30	5 (16.7)	30	7 (23.3)	30	10 (33.3)
75	30	10 (33.3)	30	18 (60.0)	30	26 (86.7)
100	30	25 (83.3)	30	26 (86.7)	30	30 (100)
200	30	30 (100)	30	30 (100)	30	30 (100)
400	30	30 (100)	30	30 (100)	30	30 (100)
Control (H_2O)	30	0 (0.0)	30	0 (0.0)	30	0 (0.0)

The molluscicidal activities of the leaf aqueous extract of *A. conyzoides* on *L. natalensis* showed 86.7% mortality rate with 75 ppm concentration at 72h of exposure. While there were 83.3% and 86.7% mortality rates of *L. natalensis* with 100 ppm concentration at 24h and 48h exposure respectively. The 100% morality rate of *L. natalensis* ranged from 100 ppm

concentration at 72h to 400 ppm concentration at 24h, 48h and 72h exposure (Table III). Chi-square test revealed that there is a significant difference $X^2 = 30.604, P < 0.05$ between the concentrations of *A. conyzoides* and mortality of *L. natalensis*. Lc_{50} value is 69.343 ppm (95% CI = 64.293 ppm – 74.539 ppm) and Lc_{90} value is 97.890 ppm (95% CI = 90.759 ppm – 108.174 ppm) of *A. conyzoides* and the mortality of *L. natalensis*. There is a significant difference in the mortality rate of *L. natalensis* based on the different concentrations of aqueous extract of the plant leaf *A. conyzoides*, P < 0.05, F = 49.970.

Table IV revealed that the leaf aqueous extract of *D. stramonium* in relation to the morality rates of *L. natalensis* were 73.3% and 86.7% of 75 ppm concentration at 48h and 72h of exposure. With 100 ppm concentration, the mortality rates were 83.3%, 93.3% and 100% at 24h, 48h and 72h of exposure respectively. The mortality rates with 200 ppm and 400 ppm concentrations recorded 100% at 24h, 48h and 72h of exposure. Chi-square test revealed that, there is a significant difference $X^2 = 27.782, P < 0.05$ between the concentrations of *D. stramonium* and mortality of *L. natalensis*. Lc_{50} value is 66.611 ppm (95% CI = 63.083 ppm – 70.142 ppm) and Lc_{90} value is 92.623 ppm (95% CI = 87.715 ppm – 98.960 ppm) of *D. stramonium* and the mortality of *L. natalensis*. There is a significant difference in the mortality rate of *L. natalensis* based on the different concentrations of aqueous extract of the plant leaf *D. stramonium*, P < 0.05, F = 79.563.

TABLE IV
CONCENTRATIONS OF AQUEOUS EXTRACT OF PLANT LEAF (*DATURA STRAMONIUM*) AND MORTALITY RATE OF *L. NATALENSIS*

Concentrations	24h		48h		72h	
ppm	No of snail exposed	Mortality rate (%)	No. of Snail exposed	Mortality rate (%)	No of snail exposed	Mortality rate (%)
25	30	0 (0.0)	30	0 (0.0)	30	0 (0.0)
50	30	3 (10.0)	30	8 (26.0)	30	10 (33.3)
75	30	15 (50.0)	30	22 (73.3)	30	26 (86.7)
100	30	25 (83.3)	30	28 (93.3)	30	30 (100)
200	30	30 (100)	30	30 (100)	30	30 (100)
400	30	30 (100)	30	30 (100)	30	30 (100)
Control (H_2O)	30	0 (0.0)	30	0 (0.0)	30	0 (0.0)

The statistical analysis revealed that there were significant differences in the mortality rates of *B. globosus* and *L. natalensis* based on the different concentrations of aqueous extracts of the plant leaf *A. conyzoides* and *D. stramonium,* P < 0.05.

IV. DISCUSSION

The overall results of the toxicity test of the plant species (*A. conyzoides* and *D. stramonium*) aqueous extracts on the snail species (*B. globosus* and *L. natalensis*) demonstrated that the rates of mortality observed varied with the increase in concentrations of the plant of extracts at different exposure hours. However, no death of the snails was recorded in 24h with 25 ppm concentration in all the exposure time (24h, 48h, and 72h). This may probably due to low accumulation of the extract to effect death of the snails. This is in consonance with the findings of Rahman et al. [4], Perezia et al. [7] and Hammani et al. [3].

On the other hand, as the concentration increases even with 50 ppm, deaths of snails were recorded in all exposure time (24h, 48h and 72h) from 10.0% to 33.3%. In addition, the tested plant extracts showed high rate of mortality of the snails with 75 ppm to 400 ppm concentrations from 23.3% to 100% death rate, this may be probably due to increase in concentration of the plant extracts (75, 100, 200 and 400 ppm) and the period of exposure (24h, 48h, and 72h) which has actually effected death of some snails to total number of snail used in this research. This is compared well with of Opeyemi et al. [11]-[14].

In conclusion, this showed that the effective doses of the leaf plant extract against the two snails, slightly differ from each other. This indicates that the two plant leaf extracts may affect high molluscicidal activity on freshwater snails.

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