Journal of Veterinary Research Advances
ISSN: 2582-774X

**Research Article**
Open access

# Molluscicidal activities of lemon grass (*Cymbopogon citratus*) and dry pepper (*Capsicum chinense*) on *Bulinus globosus* snails

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Received on: 28/01/2024 Accepted on: 19/06/2024 Published on: 27/06/2024

## ABSTRACT

**Aim:** Main purpose of the study was to assess molluscicidal potency of hot pepper (*Capsicum chinense)* and lemon grass (*Cambopogan citratus)* extract on *Bulinus globosus* snails.
**Method and materials:** Snail were collected and acclimatized in laboratory conditions, Lemongrass was collected from the surrounding while *Capsicum chinense* was purchased from market. Materials were washed and air dried and pulverized into powder form and aqueous extract was prepared. Ten experimental animals were kept in each aquarium, and exposed to different concentrations of aqueous extracts continuously for 96 h.
**Results:** Mortality was recorded at 12 h, 24 h, 48 h, 72 h and 96 hrs. intervals and no response to a needle probe was taken as evidence of death. Both extract possessed molluscicidal activity against snails but *Capsicum chinense* was less potent than lemon grass. In both cases mortality was time and dose dependent.
**Conclusion:** It was concluded that plants have medicinal and culinary properties and culturally well accepted and may be used for controlling mollusc intermediate host of schistosomiasis.

**Keywords:** *Bulinus globosus*,*Capsicum annuum*, Lemon grass, Nigeria, urinary schistosomiasis , snails.

**Cite This Article as**: Singh K, Zainab IJ and Jitendra Singh (2024). Molluscicidal activities of lemon grass (*Cymbopogon citratus*) and dry pepper (*Capsicum chinense*) on *Bulinus globosus* snails. J. Vet. Res. Adv., 06(01): 59-62.

## Introduction

It was investigated that Urinary Schistosomiasis was highly prevalent in Sokoto State, Nigeria and about 60% population was infected with this disease. The disease is prevalent in all the 36 state of federation including Federal capital territory (Singh and Muddasiru, 2014; Singh *et al*., 2016). The disease is caused by *Schistosoma haematobium* and characterized by bloody urine, lesions and calcification of bladder, kidney failure and bladder cancer in children (Butterworth, 1997; Norberg, 2004), and at the same time, it is the major cause of female genital schistosomiasis (FGS), which is a risk factor for transmission of sexually transmitted diseases including HIV (Raven and Jahnson, 2002). In a previous study carried out in Sokoto and nearby Local Government areas, 85.5% cancer causes were reported from farmers and fishermen and 65.1% squamous cell carcinoma showed histological evidence of chronic urinary schistosomiasis (Mungadi and Malami, 2007).



The eggs of *S. haematobium* are passed with urine from infected persons and hatched in water and developed in miracidium which searches for a suitable fresh water snail (intermediate host) and penetrate it; in the body of snail, it develop in cercaria and leaves the body of host snail and penetrate the body of definitive host (human). Following a migration through the body within the bloodstream, if they meet a partner of the opposite sex, they develop into sexually mature adults, laying eggs and complete its life cycle (Ghandour, 1978).

In the course of their whole parasitic life cycle, the parasites are highly protected, so attacking on parasite itself and controlling the disease is very difficult, but it can be easily controlled by controlling the intermediate host (Singh and Singh, 1997). Many synthetic molluscicides are available with very good results (Mello-silva *et al.,* 2006), but these chemicals are injurious for human and other non-target biota. In sokoto, Nigeria, where a large population (specially Village population) still rely on river water for their every day needs, including drinking (Singh *et al*., 2016); it is not justifiable to use such type of molluscicides in local water

bodies to control intermediate hosts of urinary schistosomiasis.

Also, the available synthetic molluscicides popularly used in control of the intermediate snail hosts of urinary schistosomiasis, are known to develop resistance among exposed snails and pose toxicity to non-target organisms and environment. Such problems have drawn much attention during recent years in renewed interest in the use of plant molluscicides (El-Ansary *et al.*, 2001). These plant molluscicides may provide cheap, locally produced, biodegradable and effective control agents in rural areas of developing countries where schistosomiasis is endemic (Clark *et al.*, 1997). Therefore, the study was planned to evaluate the molluscicidal potentials of *Cymbopogon citrates* and *Capsicum chinense* on *Bulinus globosus* snails, which is intermediate host of urinary schistosomiasis in the area.

## Materials and Methods

Lemon grass (*Cymbopogan citratus*) was collected from biological garden Usmanu Danfodioyo University, Sokoto Nigeria. The lemon grass was air dried (under shade or in the laboratory to avoid denaturing the active component) at room temperature for a week and was later pounded in a powered form with a mortal and pistol and then sieved. Dry chili pepper (*capsicum chinense*) commonly known as Attargu were purchased from sokoto state market, they were cut into pieces and air dried (under shade or in the laboratory to avoid denaturing the active component) at room temperature for some three days and later pounded with pestle and mortal and then sieved. The ground samples were then used for extraction purposes. Doses of6.0g/3L, 8.0g/3L, 10.0g/3L and 15.0g/3L were selected for *Capsicum chinense* and 2.5g/3L, 3.5g/3L, 4.5g/3L, 5.5g/3L were selected for *Cymbopogon citrate.*

The required powdered material was weight out and first mixed in 100 ml of dechlorinated tap water and was soaked for 2 h. After that period, the flask was agitated manually, after every 30 min for 3 h. The mixture was then allowed to settle down and left overnight in the laboratory condition. In each case, the extract was filtered using a clean muslin cloth and filtrate was used for toxicity test and 2900 ml of water was added to the each of the plant extract to make it 3.0L.

*Collection and identification of snails*

Three hundred (300) *Bulinus globosus* snails were collected from Kwakwalawa River along Usman Danfodiyo university road Sokoto. The snails were collected in the morning between 7-9 am, using scoop net and transported to the laboratory in a plastic container, and kept in a container containing de-chlorinated tap water, for 48 h for acclimatization.

The treatment was given into five (5) appropriate labeled plastic buckets containing the different aqueous extract concentrations. Ten snails were introduced in to each container each of the extract concentration was replicated three times to minimize the error. Control experiment without extract concentration was also set up. The exposure period of this experiment was 96hours and snails mortality was recorded every 24 hours. The snails considered dead if they remain motionless in the bottom of the beaker, discolored or failed to respond to mechanical prodding. The dead animals were removed at each observation to avoid any contamination in aquarium water. All experiments were conducted at room temperature 28 ±2 $^{o}$C as adopted by Singh and Singh, (1997). Data generated from this experiment was subject to simple % mortality calculations and tables were presented accordingly.

## Results and Discussion

The mortality rate of treated snail depended on concentration of the extract and duration at all levels. The treatment with 6.0g/3L of dry capsicum extract in 12 hours had little effect on the exposed snails and 10.0g/3L and 15.0g/3L of showed higher effect on treated snails (Table 1).

The concentration of 2.5g/3L of lemongrass extract within 12 hours showed very little effect on the snails and 4.5g/3L of lemongrass extract at higher exposure levels (48 hours, 72 hours and 96hours) showed higher leathal effect on treated snails. In both cases mortality was time and dose dependent. Both plants possess molluscicidal properties against *Bulinus globosus* snails and *Cymbopogon citratus* was more effective (Table 2).

The efficacy of lemon grass and dry pepper on *Bulinus globosus* snails as molluscicide was evaluated. It was discovered that lemon grass (*Cymbopogon citratus*) had high molluscicidal property than pepper. The efficacy of *Capsicum chinense* was observed highest at 15g/3L dose level (5g/L), which demonstrated above 94% mortality among treated snails, while lemon grass showed above 88% mortality at 4.5g/3L (1.5g/L) dose level.

Table 1: Mortality among treated snails as affected by aqueous extract of *Capsicum chinense*

| Exposure Concentration | 12h. | 24h. | 48h. | 72h. | 96h. |
|---|---|---|---|---|---|
| | Mean Mortality (%) | | | | |
| 6g/3L | 16.66 | 22.22 | 22.22 | 27.77 | 33.33 |
| 8g/3L | 22.22 | 27.77 | 33.33 | 38.88 | 44.44 |
| 10g/3L | 33.33 | 38.88 | 44.44 | 50.00 | 55.55 |
| 15g/3L | 61.11 | 72.22 | 83.33 | 88.88 | 94.44 |
| Control | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

Table 2: Mortality among treated snails as affected by aqueous extract of *Cymbopogon citratus*

| Exposure Period Concentration | 12h. | 24h. | 48h. | 72h. | 96h. |
|---|---|---|---|---|---|
| | Mean Mortality (%) | | | | |
| 2.5g | 5.55 | 16.66 | 22.22 | 27.77 | 38.88 |
| 3.5g | 11.11 | 22.22 | 27.77 | 33.38 | 44.44 |
| 4.5g | 22.22 | 27.77 | 44.44 | 66.66 | 88.88 |
| 5.5g | 27.77 | 33.33 | 44.44 | 66.66 | 88.88 |
| Control | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

The molluscicidal activity showed by both plants was time and dose dependent, which was due to accumulation of higher titer of active compounds of plants with time (Rackley and Shenot, 2008).

The active compounds present in lemon grass are Myrcene, Neral, Geranial, Geranic acid, Linalool, Citronellol. Citronellol is known to trigger concentration dependent allergic reactions when exposed to animals. Linalool is known to behave as a competitive antagonist of glutamate, and as a non-competitive antagonist of NMDA receptors in brain cortical membranes (Harborne, 1973). Limonene caused damage to the *L. monocytogenes* cell membrane and known to decrease in ATP content, ATPase ($Na^+K^+$-ATPase, $Ca^{2+}$-ATPase) activity and respiratory chain complex activity. These biochemical changes inturn cause hinderance in ATP synthesis by inhibiting the activity of the respiratory complex and ATPase and affect respiration and energy metabolism by inhibiting the function of the respiratory chain complex (Han *et al*., 2020). These changes in physiology of exposed mollusc could be linked to the leathal effect of the extracts.

The chili's (*Capsicum chinense)* typical spicy taste is conferred by alkaloids called capsaicinoids, which is known to have neurotoxic effects (Rackley and Shenot, 2008). It also contains other substances, such as vitamines and antioxidents (flavonoids, carotenoids) which have biological activity as well. The fresh juice of chili is known to inhibit neutrophil migration and reduce vascular permeability in mice (Rackley and Shenot, 2008). Study also suggests that *Capsicum chinense* extract cause protease inhibition and alpha amylase activity and inhibit the growth of microorganisms such as *C. lindemuthianum* and *F. solani* (Da Silva *et al*., 2021). Other study showed that lavonoids rupture of cell membranes (Faria *et al.* 2018) and cause heart rate reduction (Singab *et al*. 2006). Similar physiological changes caused by active moieties in the body of treated snails could be attributed to death.

*Cymbopogon citratus* and *Capsicum chinense* possess molluscicidal activities against tested snails and it was found that extract of *C. citratus* was more effective than *C. chinense*. In both cases the observed effect was time and dose dependent.

## Conclusion

It was concluded that *Capsicum chinense* and *Cambopogan citratus* have medicinal and culinary properties and culturally well accepted and may be used for controlling mollusc intermediate host of schistosomiasis in the area. Further their active moieties have antimicrobial activities against many strains of harmful bacteria and fungi. This could be taken as an added advantage for its molluscicidal use in local rivers and dams. Since a fraction of the population is still dependent on river water for their everyday domestic needs and use of these plants in such water bodies can treat the water and improve its quality.

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