Comparison for the Efficacy of Column Purified Fractions of Sinna occidentalis and Moringa oleifera against Bulinus globosus (Intermediate Host of Schistosoma haematobium) from Goronyo and Shagari Dams, Sokoto State, Nigeria

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ABSTRACT

Introduction: Although, used of molluscicides to control the intermediate host of schistosomes is the best method of choice to control the spread of the snail fever among the people, synthetic molluscicides widely used are cost effective, not available and toxic to the aquatic lives and people that are completely or partially dependents on rivers or lakes water for their everyday supplement.

Aim: this research was aimed at investigation and comparison for the molluscicidal efficacy for S. occidentalis and M. oleifera leaves extracts against B. globosus (intermediate host of Schistosoma haematobium).

Methodology: Each of the plant was grinded into powder and purified through column using different solvents, B. globosus snails were collected from Shagari and Goronyo dams; we identified the animal using chart initially, later on the animals were confirmed as B. globosus by malacologist from Ahmadu Bello University Zaria, Nigeria; the Molluscicidal efficacy of the plants was tested against B. globosus and compared according to world health organization guidelines; mortality was calculated using Abbott’s formula and analysis of variance (ANOVA) was used to determine if there is significant different between the mean mortality at P≤0.05; qualitative Phytochemical analysis was conducted to determine the chemicals presence in each plant and their combination.

Results: Present study reviled that fractions of the leaves combination showed significantly higher mortality of B. globosus in the present study followed by Fractions of S. occidentalis then that of M. oleifera. For the plants combination, extracts purified using methanol are highly toxic followed by fractions purified using hexane, then ethyl acetate fractions and least Molluscicidal potential was recorded in the fractions obtained using ethanol. S. occidentalis fractions of hexane were highly toxic followed by fractions of methanol, then fractions of ethyl acetate and least mortality was recorded from the fractions of ethanol. Similarly, for the M. oleifera, it was observed that, fractions of Methanol were highly toxic followed by hexane fractions then ethanol fractions and least mortality was observed in the fractions of ethyl acetate.

Conclusion: Column purified fractions for the combination for two plants leaves were highly potent for the control of B. globosus followed by S. occidentalis then M. oleifera.

Keywords: Bulinus globosus; Comparison; Moringa oleifera; Purified; Sinna occidentalis.

I. INTRODUCTION

Schistosomiasis also called snail fever or Bilharziasis was considered among the major diseases neglected in tropical regions, caused by flukes belonging to phylum Platyhelminthes, class; trematoda and genus Schistosoma [1]. Five different Schistosoma species were identified to cause Schistosomiasis infections [2]. Species of Schistosoma haematobium and Schistosoma mansoni occurred highly in the Africa, the South America, the Middle East and the west India whereas Schistosoma japonicum species are found in the Republic of China, the Indonesia and the Philippines.
while *Schistosoma mekongi* and *Schistosoma intercalatum* are found in the Mekong River of South East Asia, the Middle Africa and West African parts of the world [3].

Genera of *Buflinlus* and * Biomphalaria* snails are known to transmit the infective stage (Cercaria) of Schistosomiasis, and infections with schistosomes are characterized by itchy, skin rash (swimmer’s itch) and local swelling which can start about 24hrs after the initial infection and lasts for about 4 days [4]. Infected individuals may have fever, enlarged liver and spleen, lymph nodes and eosinophilia but this illness usually lasts for one to three weeks [5]. After months or years, infected individuals may experience painful or difficult urination (dysuria), blood in urine (hematuria), urethral obstruction, kidney damage as a result of urine obstruction (obstructive nephropathy), and enlargement of penis [6], [7].

Although schistosomiasis infection is highly increasing during rainy season [8], many human activities such as passing excreta by infected individual in a fresh water, construction of irrigation channels, dams and flood irrigation of crops increased infection with schistosomes in the country [9], [10].

Snail’s fever affects over two hundred and forty million (240,000,000) people worldwide, many children and young adults are at greater risk in the tropics and subtropics region [11]. Over 90% of the infection occurs in sub-Saharan Africa and almost 300,000 people die annually [12], [13]. The highest prevalence of this infection is seen in Nigeria (29 million), which is closely followed by United Republic of Tanzania (19 million) then Ghana and Democratic Republic of Congo (15 million) making up the top five countries in Africa with *Schistosoma* infection [14].

Although, from Nigerian states, the most infected group is the children, everybody else is at greater risk of contracting the disease if in contact with infested water [15]. Epidemiological survey on urinary schistosomiasis in selected schools of Minna, Niger state revealed that, 12.9% children were infected [16]: 17.8% people were infected in Kano State [17]; 19.0% people in Ebonyi central of Ebonyi State were infected [18]; [19] reported that, 30.5% people were infected in Kefi town of Nasarawa State and 46.6% individuals were infected from Ogbadibo Local Government Area, Benue State [20].

Despite the fact that, in the year 2012, the Federal Ministry of Health (FMH) reported that schistosomiasis has been completely mapped out of Nigerian states (Zamfara, Kwara, Ekiti, FCT, Ondo, Gombe, Ogun, Enugu and Sokoto) [21], there are re-emergence of these diseases in some areas of these states, as preliminary study on occurrence of schistosomiasis conducted among people in Abarma Village of Gusau Local Government of Zamfara in which 74.0% were found infected [22]; moreover, Singh and [23], reported 60.8% children in some riverine areas of Sokoto were infected with schistosomiasis.

Although, among the current methods of the control of Schistosomiasis infections are reduction of morbidity and elimination through integrated measures for the control of intermediate hosts of schistosomiasis [24], synthesized chemical molluscicides used for such method were hazardous to the aquatic lives and human health [25], [26]. Due to toxic nature of synthetic molluscicides there are needs to determine the best control methods of Schistosomiasis in order to reduce spread of the disease [27]. Moreover, in the environment like as Shagari and Goronyo where majority of the people are dependents on fresh water bodies (lakes, rivers and dam), it is highly dangerous to use synthetic molluscicides for the control of intermediate host of schistosomes.

*Sinna occidentalis* and *Moringa oleifera* are plants been used among the people for many reasons such as food, flavor, medication among the people in different part of the world. Therefore, molluscicidal efficacy these plants against intermediate host of *S. haematobium* (*B. globosus*) were evaluated to be an increment efficient, non hazardous, efficient, cheep, and available way of controlling urinary Schistosomiasis among people of Goronyo, Shagari Local Government Areas of Sokoto State, Nigeria as well as other part of world where Schistosomiasis infections are common.

II. METHODOLOGY

A. Area of the Study

Present studies were carried out inside the General Biology laboratory, Department of Biological Sciences, Sokoto State University, Sokoto. Sokoto was in northwestern part of Nigeria; it had common borders with Republic of Niger to the North, Kebbi state of Nigeria to the west and Zamfara state to the east. Sokoto has people population of 3,702,676, the vegetation is Sudan savannah, it lies within the longitude between 4° 8’E and 6° 5’ E and latitude between 12° 0’N and 13° 54’ N, the state experience four (4) to five (5) months rainfall annually (June to September or October) and 8 to 7 months dry season (from October to may), Sokoto has relative humidity vary from 10 to 25% during dry season and 51 to 75% during the rainy season with annual average temperature of 33.2 °C, the maximum daytime temperatures are generally under 40 °C most of the year, and the dryness makes the heat bearable. The warmest months are February to April, where daytime temperatures can exceed 45 °C; the highest recorded temperature is 47.2 °C. The settlement areas around Sokoto have various types of fresh water bodies such as lakes and rivers [28]. *B. globosus* snails were collected from Shagari and Goronyo dam; both Shagari and Goronyo local governments had dam namely Shagari dam and Goronyo dam, respectively. Many people around the two dams are extremely poor and dependent on fishing and other farming activities for source of their income and nutrition; they also used water from the rivers and dams for their home activities.

B. Plants Collection and Preparation of Powder

*S. occidentalis* and *M. oleifera* leaves used for the present study were purchased from Goronyo market, Goronyo Local government, Sokoto, the plants were mounted and maintained in herbarium press then transported to herbarium for identifications and authentications, the two plants were authenticated and identified as *S. occidentalis* and *M. oleifera* in department of biological sciences Usman Danfodiyo University Sokoto and voucher number was deposited as UDU/ANS/0110 and UDUS/ANS/0225 for *S. occidentalis* and *M. oleifera* respectively. Thereafter, the

DOI: http://dx.doi.org/10.24018/ejbio.2020.1.6.45
fresh leaves of the plants were air dried under shade and
grinded into powder using pestle and motor then stored in a
sterilized container to avoid contamination [29].

C. Snail Collection

Three thousand (3000) adult snails with shall range
between 11 to 13 mm were collected from Goronyo and
Shagari dams of Goronyo and Shagari Local Governments
respectively between 9:00am to 12:00 noon by using scoop
which comprised wooden frame and net. The snails were
brought to the General Biology Laboratory, Department of
Biological Science, Sokoto State University in 25 liters
bucket containing water from the source of collection; the
length of the snails’ shells were measured using a Veneer
Caliper [30].

D. Preparation of Extracts

The extracts of each plant leaves were prepared using
cold maceration method. Five hundred grams (500 g) of the
plant was weighted and soaked in to 3000 ml of solvent in
tightly covered bottles then mixed and allowed for three
days (72 hour) at 20 °C, each suspension was shaken
vigorously after each 24 hours. Each suspension was sieved
using a mesh then filtered through a Whatmann filter paper
each of the plant filtrate was purified using column
chromatography [31].

E. Column Purification

The columns were place vertically using a stand and
clamp, two hundred milligram (200 mg) of cotton wool was
inserted inside the column and pushed down to prevent the
escape of silica gel, 140 g of silica gel with 60-120 mesh
was added into the column, in each purification of each
extract solvent to be used was added to flush through the
column and make wetted, while flushing the column, it was
slapped several times to remove the air bubbles, dropping
funnel was attached on top of the column, extract to be
purified was poured gently in to the column, methanol,
ethanol, ethyl acetate and hexane were used differently for
the purification of each of the plants extract, the mobile
phase was added continuously for each plant purification
until the extract eluted, fractions were collected using plastic
measuring cylinder, 32 fractions were collected from each
plants and each of the fraction showing similar colour with
one another were matched together hence, four (4) fractions
were obtained and labeled as F1, F2, F3 and F4 [32].

F. Identification and Maintenance of the Snails

Identification key was used initially to identify B.
globosus species inside General Biology laboratory,
Department of Biological Sciences, Sokoto State University
Sokoto as described by [33]. Afterward, identified snails
were transported to Museum of Natural History; Zoology
Department of Ahmadu Bello University Zaria for
confirmation of the B. globosus species by Malacologist, the
cabinet number assigned to the identified animals was 7B,
then the snails were transported back to the General Biology
Laboratory, Sokoto State University for molluscicidal
activity study.

G. Preparation of the Concentrations Used for the Toxicity
Experiment

After preparation of stock solution, concentration of each
of the plant extract was obtained using serial dilution
formula (C1V1=C2V2), the final volume used was adjusted to
obtained various concentration of the plant extract in
milligram per liter. Therefore, 120 mg/l was prepared and
used for the toxicity experiment of each fraction of each
plant against B. globosus.

H. Molluscicidal Efficacy Test

Each of the plants extracts for S. occidentalis and M.
oleifera (leaves) and their binary combination was tested for
molluscicidal activity against B. globosus based on [34]
guidelines procedure for molluscicidal activity test adopted
by [35] with some modifications, in which ten (10) adult B.
globosus were introduced into troughs containing 120 ppm
different fractions, the experimental animals were
monitored for 96 hours inside the experimental container in
starve condition, treatment in each fraction was replicated
five (5) times, to confirm the mortality of the experimental
animal, absence of response to the needle probe was used as
an indication for the snails death. Another ten snails for each
treatment was immersed in separate borehole water with the
same condition without treatment to serve as control.
Mortality was calculated using Abbott’s formula by
subtracting number of survival snails in the treated group
from number of survivals from the untreated group multiplied by
hundred.

I. Phytochemical Analysis

Qualitative and quantitative phytochemicals of the plant’s
leaves were determined using methods described by [36]-
[39].

J. Statistical Analysis

Mortalities were calculated using Abbott’s formula, one-
way Analysis of Variance (ANOBA) followed by Duncan
Multiple Range Test were used to determine statistically
significant differences between means (P<0.05) using IBM-
SPSS software package version 20.

III. RESULTS

Molluscicidal efficacy of S. occidentalis and M. oleifera
singly and their combination against B. globosus were time
and concentration dependents, the animals were observed
attempting to escape from the toxicity of the extracts
immediately after introducing them into experimental
container of each fraction, by distressing and becoming
firmly attached to the wall of experimental container then
died eventually, shells of the snails also were filled up, pores
were also observed on the foot of some snails and shell’s
color of the snails changed from brown to dark brown and
mortality was recorded after 24 hour for the period of 4 days
(96 hours).

A. Molluscicidal Efficacy of M. oleifera against B.
globosus after 96 Hours

Fractions of methanolic leaves extracts of M. oleifera
showed higher mortality of B. globosus [where F2 showed
92.0% (9.2±0.374 ) mortality, F3 caused 76.0 (7.6±0.400)
mortality, F1 accounted for 72.0% (7.6 ±0.200) mortality while F6 showed 56.0% (5.6±0.245) mortality with significant difference (P=0.000) followed by fractions of hexane extract [in which F2 caused 66.0% (6.6±0.245) mortality, F1 showed 56.0% (5.6±0.245), F3 with 48.0% (4.8±0.200) and F4 showed 40.0% (4.0±0.316) with statistical significant difference (P=0.001)] then ethanolic extracts [whereby F4 showed 62.0% (6.2±0.374) mortality, F3 showed 46.0% (6.6±0.400) mortality, F2 caused 40.0% (4.0±0.316) mortality while F1 showed 38.0% (3.8±0.374), however, significant difference was observed (P=0.000)] and least mortality of B. globosus was recorded in the fractions of Ethyl acetate [whereby 54.0% (5.4±0.400), 48.0% (4.8±0.374), 40.0% (4.0±0.316) and 34.0% (3.4±0.400) mortalities where recorded in F1, F2, F3 and F4 respectively with statistical significant difference (P=0.008)] as shown in Table 1.

| Fraction Number | Mean No. of Died B. globosus | Values of Mortality at P ≤ 0.05 | Mortality of B. globosus (%) |
|------------------|------------------------------|---------------------------------|-----------------------------|
| Hexane Extract   |                              | 0.001                           | 6.6±0.245                   |
| F4               | 4.0±0.316                    |                                 | 40.0                        |
| F3               | 4.8±0.200                    |                                 | 48.0                        |
| F1               | 5.6±0.245                    |                                 | 56.0                        |
| F2               | 6.6±0.245                    |                                 | 66.0                        |
| Methanol Extract |                              | 0.000                           | 6.6±0.245                   |
| F4               | 5.6±0.245                    |                                 | 56.0                        |
| F3               | 7.2±0.200                    |                                 | 72.0                        |
| F2               | 7.6±0.400                    |                                 | 76.0                        |
| F1               | 9.2±0.374                    |                                 | 92.0                        |
| Ethyl acetate    |                              | 0.008                           | 6.6±0.245                   |
| F4               | 3.4±0.400                    |                                 | 34.0                        |
| F3               | 4.0±0.316                    |                                 | 40.0                        |
| F2               | 4.8±0.374                    |                                 | 48.0                        |
| F1               | 5.4±0.400                    |                                 | 54.0                        |
| Ethanol Extract  |                              | 0.000                           | 6.6±0.245                   |
| F1               | 3.8±0.374                    |                                 | 38.0                        |
| F2               | 4.0±0.316                    |                                 | 40.0                        |
| F3               | 4.6±0.400                    |                                 | 46.0                        |
| F4               | 6.6±0.374                    |                                 | 62.0                        |
| Control          | 0.000                        |                                 | 0.000                       |

B. Molluscicidal Efficacy of S. occidentalis against B. globosus after 96 Hours

It was observed that, fractions of hexane extracts of S. occidentalis were more effective for the mortality of B. globosus [where 96.0% (9.6±0.245), 84.0% (8.4±0.245), 68.0% (6.8±0.200) and 60.0% (6.0±0.316) were recorded in F4, F3 and F2 respectively with statistical significant difference (P=0.000)] followed by methanolic extract [in which 74.0% (7.4±0.245), 62.0% (6.2±0.374), 54.0% (5.4±0.510) and 48.0% (4.8±0.374) mortalities were observed in F3, F4, F1 and F2 respectively with statistical significant difference (P=0.001)] then fractions of ethyl acetate extracts [where F4, F3, F2, F1 showed 68.0% (6.8±0.200), 60.0% (6.0±0.316), 48.0% (4.8±0.200) and 42.0% (4.2±0.200) respectively with significant difference (P=0.000)], however, ethanolic extracts of S. occidentalis showed least mortalities of the snails [whereby 50.0% (5.0±0.316), 48.0% (4.8±0.200), 40.0% (4.0±0.000) and 34.0% (3.4±0.245) mortalities were observed in F4, F3, F2 and F1 respectively with significant difference (P=0.000)] (Table 2).

C. Molluscicidal Efficacy for the Combination of the Two Plants against B. globosus after 96 Hours

After 96 hours in to various fractions of different solvents of the plants combination, it was reported that, fractions of Hexane extracts showed highest mortality of the snail [where F2 and F3 showed 100% (10.0±0.000) mortality of the snails while F1 and F4 showed 98.0% (9.8±0.200) and 82.0% (8.2±0.200) mortalities respectively with statistical significant difference (P=0.000)]; followed by fractions of methanol with 100% (10.0±0.000), 90.0% (9.0±0.316), 76.0% (7.6±0.510) and 66.0% (6.6±0.245) mortalities in F4, F3, F2 and F1 respectively with significant difference (P=0.000); then fractions of ethyl acetate [which showed mortality of 98.0% (9.8±0.200), 78.0% (7.8±0.200), 72.0% (7.2±0.200) and 64.0% (6.4±0.245) for F4, F3, F2 and F1 respectively with significant difference (P=0.000), while least mortality was reported in ethanol [where F4, F3, F2 and F1 showed 96.0% (6.0±0.245) 84.0% (8.4±0.510), 76.0% (7.6±0.245) and 64.0% (6.4±0.245) mortality was reported respectively with significant difference (P=0.000) as reported in Table 3.

D. Phytochemical Constituents of the Plants

Phytochemical analysis of S. occidentalis reveiled that, alkaloids, flavonoids, saponins, tannins, and glycosides were present in excess, cardiac glycosides and volatile oils were moderately present while balsams, steroids and antraquiones quietly present whereas analysis phytochemical constituents of M. oleifera showed excess flavonoids, saponins, glycosides and antraquiones. Although, alkaloids, volatile oils, tannins and steroids were moderately presents, balsams and cardiac glycosides were presents in least quantities while all the phytochemicals were found in excess in the combination of the two plants.
with exception of volatile oils and balsams which were found moderately present as shown in Table 4.

**TABLE 3: MOLLUSCICIDAL EFFICACY FOR THE COMBINATION OF TWO PLANTS AGAINST B. GLOBOSUS AFTER 96 HOURS (N=10).**

| Fraction Number | Mean No. of Died B. globosus | Values of Significant at *P* < 0.05 | Mortality of B. globosus (%) |
|-----------------|-------------------------------|-------------------------------------|----------------------------|
| Ethyl acetate   | 0.000                         |                                     |                            |
| Extract         |                               |                                     |                            |
| F1              | 6.4±0.2.45*                   | 64.0                                |                            |
| F2              | 7.2±0.2.20*                   | 72.0                                |                            |
| F3              | 7.8±0.2.20*                   | 78.0                                |                            |
| F4              | 9.8±0.2.20*                   | 98.0                                |                            |
| Hexane Extract  | 0.000                         |                                     |                            |
| F1              | 8.2±0.2.20*                   | 82.0                                |                            |
| F2              | 9.8±0.2.20*                   | 98.0                                |                            |
| F3              | 10.0±0.2.00*                  | 100.0                               |                            |
| F4              | 10.0±0.2.00*                  | 100.0                               |                            |
| Methanol Extract| 0.000                         |                                     |                            |
| F1              | 6.6±0.2.24*                   | 66.0                                |                            |
| F2              | 7.6±0.5.10*                   | 76.0                                |                            |
| F3              | 9.0±0.3.16*                   | 90.0                                |                            |
| F4              | 10.0±0.2.00*                  | 100.0                               |                            |
| Ethanol extract | 0.000                         |                                     |                            |
| F1              | 6.4±0.2.45*                   | 64.0                                |                            |
| F2              | 7.6±0.2.25*                   | 76.0                                |                            |
| F3              | 8.4±0.5.10*                   | 84.0                                |                            |
| F4              | 9.6±0.2.45*                   | 96.0                                |                            |
| Control         | 0.0±0.2.000                   | 0.0                                 |                            |

**NOTE:** From each of the above tables, mean numbers of the snail died were expressed as Mean ± SEM of five replicates. Value in row with different superscript differs significantly at *P* ≤ 0.05 level using One Way ANOVA followed by Duncan Multiple Range Test. 
N=Number of Bulinus globosus inside each treatment which is ten (10).

**TABLE 4: PHYTOCHEMICAL ANALYSIS OF S. OCCIDENTALIS AND M. OLEIFERA.**

| Phytochemical Components | S. occidentalis | M. oleifera | Combination of the plants |
|--------------------------|-----------------|-------------|--------------------------|
| Alkaloids                | +++             | ++          | +++                      |
| Flavonoids               | +++             | +++         | +++                      |
| Saponins                 | +++             | +++         | +++                      |
| Tannins                  | +++             | ++          | +++                      |
| Glycosides               | +++             | +++         | +++                      |
| Cardiac glycosides       | +               | +           | +                        |
| Volatile oils            | ++              | +           | +                        |
| Balsams                  | +               | +           | +                        |
| Steroids                 | +               | +           | +                        |
| Antraquinones            | +               | +           | +                        |

**Key:**

Excess Present = +++
Moderate Present= +
Quite Present = +

IV. DISCUSSION

Molluscicidal effect of *S. occidentalis* and *M. oleifera* leaves extracts singly and their combination against experimental animals were time dependents, because the higher the increase in time the higher the rate of mortality observed in the treated groups, the present finding was not contrary to the report of [40] who observed that molluscicidal toxicity of *Agave filifera* extract on *B. alexandrina* was time dependents, similarly [41], observed that, efficacy of Bauhinia variegata and Mimusop selengi extracts against *Lymnaea acuminata* was time and concentration dependents, nevertheless, [42], observed that, molluscicidal potential of *Annona naga* and *Chenopodium ambrosioides* against *B. alexandrina* were attributed due to increased time of exposure and concentration dependents. This was also supported by [43] and [44], [45], also stated that, molluscicidal potency of *M. oleifera* leaf extracts and *Momordica charantia* fruits against snail *Lymnaea acuminata* were time and concentration dependents.

Experimental animals’ distresses, changing colour and filling up of the shells as well as swelled pores on the foot of the snail were due to toxicity of the plants extracts on *B. globosus*. According to [46], the inference from these observations was that, the tissue of the cephalopodal mass had accumulated water, which caused haemorrhage at lethal concentration of the active plant extracts that caused snails’ distress, filling up of the shell and pores on the foot of the snail. Nevertheless, the observation made in this study of the foot-sole surface epithelium by preventing its normal osmo-regulatory function [47]. This finding was similar with the reports of [48], similarly, [48], observed movement of snails to the side of the container in an attempt to escape from the test media containing *Alitheran therasissis* treated water. [49], also reported, that, the snails showed several behavioral responses, including the “distress syndrome” described for other Planorbid species, indicative of intoxication and they stated that, swelling of the tissues was not restricted to the tentacles, but involved the whole cephalopodal mass.

Although, significant difference was observed between mean mortality of the snails treated in fractions of each plant used after 96 hours of the experimental set up, higher mortalities were recorded in combination of the plants extracts and when compared to the single forms of the two plants, the combination of the two plants had higher toxicity against *B. globosus* than the single form of the plants. Although this report is contrary to [50], who observed that, use of plant extracts singly, especially in the case of *Simna occidentalis* is more effective than combination of two or more plants against the test organism (*Lymnaea ovum*) snail. It was similar to observation of [51], who reported at, the use of plant in combination, is more effective than individual plants towards snail control. Similarly, this finding was also in agreement with the work of [52] who reported that, combination of two plants showed more effectiveness in the control of *Biomphalaria alexandrina*. In addition, it suggested that combinations of equal parts of custard apple seed powder with oil from *Cedaredrus, Deodara Roxh*, and *Aczdirachta indica*, was more toxic than the individual components of these plants [53]. It was observed that, powdered seed of *Annona Squamosa* and *Lawsonia inermis* were potent against *Lymnaea acuminata* and *Indoplanorbi sexatus* and combination of these plants increased higher molluscicidal potential against the animals than it single forms [54].

Phytochemical observed into tested plants could be consider as one of the major factor that caused higher mortality of the experimental animals because animals treated with the plants combination showed higher mortality while potent phytochemicals like alkaloids, flavoines, saponins, glycosides and tannins were recovered in higher amount in the combination. This was in line with the report of some researchers among which included, [55] who reported that, potency of the plants against snails were due
to higher amount of saponins compounds, similarly, [56], observed that, higher amount of tannins, flavonoides glycosides and alkaloids caused higher molluscicidal activity against snail species.

V. CONCLUSION AND RECOMMENDATIONS

Fractions extracted from the combination of the plants leaves had higher molluscicidal potential against B. globosus snails followed by S. occidentalis and least molluscicidal efficacy was observed in the column purified fractions of M. oleifera. Phytochemicals analysis showed that, compounds that are responsible for the higher mortality of the snails were recovered in excess amount in combination of the plants followed by S. occidentalis then M. oleifera. Hence it was recommended that, the combination of these plants should be used in control of B. globosus and further study should be carryout to investigate the mode of action of the plants against B. globosus by conducting histological and biochemical examinations on some body parts of the experimental animals.

ACKNOWLEDGMENT

Special acknowledgment goes to Tertiary Education Trust Fund (TeTfund) of Nigeria for the sponsorship to conduct this research work through Institution Based Research (IBR), 2017 Intervention. The research team are also grateful to the efforts of Laboratory Technologist and research assistant from Department of Biological Sciences, Sokoto State University, Sokoto Nigeria, the authors appreciate the effort of Professor Kiran Singh from the Department of Biological Sciences, Usmanu Danfodiyo University Sokoto, Nigeria as well as malacologist from Museum of Natural History Department of Zoology, Ahmad Bello University, Zaria for their maximum support for the completion of this work.

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