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Toxicity and Behaviour of *Clarias Gariepinus* (Burchell, 1822) Fingerlings subjected to Piscicidal Plant Extract of Aidon *Tetrapleura Tetraptera*

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ABSTRACT: The study was carried out to investigate the toxicity of water extract of *Tetrapleura tetraptera* fruits on catfish (*Clarias gariepinus*) fingerlings. The experiment was carried out under laboratory conditions for 96 hours with 30 fingerlings treated with each of the six graded concentrations (0g/300ml, 15g/300ml, 30g/300ml 45g/300ml, 60g/300ml and 75g/300ml) of dried fruits of *Tetrapleura tetraptera*. The study showed that the higher the concentration of the extract the higher the mortality of fingerlings while the toxicity of the extract reduced with time. Fifty percent mortality of the fingerlings was recorded at 24, 20 and 16 hours for 45g/300ml, 60g/300ml and 75g/300ml concentrations of extracts respectively. The result also showed that there were significant differences ($P < 0.05$) among the graded concentrations in relation to mortality of fingerlings while the LSD revealed that 45g/300ml, 60g/300ml and 75g/300ml concentrations of extract were not significantly different ($P>0.05$) in relation to mean mortality of fingerlings. The treated fingerlings were observed to show erratic swimming and loss of balance at high concentrations of extract. It is recommended that more studies be carried out on other parts of *Tetrapleura tetraptera* and their effect on different fish species. @ JASEM

In extensive and semi-intensive aquacultural practices, a common problem is the presence of wild and unwanted organisms. Typical examples are frogs, mollusks, insect larvae and fish weeds. A conventional means of eradicating these unwanted organisms is the application of synthetic compounds called biocides. Examples are sodium cyanide, not often recommended because of their toxicity to fish and other aquatic species as well as humans. Most of thee biocides contaminate the environment and their application is unfriendly. Derris root powder, a derivative of a plant (*Derris elliptica*) is the most popular pesticide used in aquacultural practices to eradicate unwanted fish. This biodegradable extract is expensive and unaffordable by majority of fish farmers in Nigeria. It is therefore, of considerable interest to investigate other plants derived pesticides which are not only available but also cheap, effective and biodegradable that could substitute for derris root powder. These qualities are possessed by some local plants in Nigeria thus they have a role to play in the eradication of wild, resident species of fish from aquacultural ponds prior to stocking because many of these species prey on or compete with fry and fingerlings of desired fish species. Some indigenous plant species in Nigeria with piscicidal potentials have been reported by Obot (1996). These include *Cassia alata, Erythrophloem ivorensis, Omphalocarpum elatum and Piptadenastrum africanum.* Others are *Albizia ferruginea, Albizia adianthifolia, Strychnos aculeata* and *Tetrapleura tetraptera* (commonly called Aidon). These species are all used as local fish poisons in different parts of Nigeria. *Tetrapleura tetraptera* (Schum and Thonn) Taub is a tropical rainforest species belonging to the family leguminosae. In Nigeria, it occurs in the rainforest belt of Southern Nigeria. The dry fruits of *Tetrapleura tetraptera* (traditionally used as spice in South Eastern Nigeria) have been analysed for toxic compounds in the fruit, shell, pulp and seed. The toxic constituents assayed included saponins, oxalates, tannins, phytates and hydrogen cyanide (Essien *et al* 1993). The physical, toxic and emulsifying properties of the powdered aqueous and alcoholic extracts of the ripe fruits of *Tetrapleura tetraptera* have been reported by Orafidiya *et al* (1994), Olaifa and Adenuga (1988). Based on the toxic properties, the main objectives of the study are therefore to evaluate the water extract of ripe and dried fruits of *Tetrapleura tetraptera* for its potential as fish poison and to determine the mortality rates of the different graded concentrations of the extract as well as observe behavioural changes in *Clarias gariepinus* fingerlings subjected to these graded concentrations.

MATERIALS AND METHODS

This study was carried out in the Department of Fisheries, Cross River University of Technology, Obubra Campus, Nigeria. With exception of the control experiment, five graded concentrations of water extract of *Tetrapleura tetraptera* were prepared using powder from the fruits. To obtain fruit powder, ripe and dropped *Tetrapleura tetraptera* fruits were collected from the wild, air-dried for 4 days and then pulverized. To obtain a fine powder, the fruits were pounded in a traditional African mortar. A range of dilutions was made with water to obtain solution of varying concentrations. These graded concentrations per 300ml of water contained 75g, 60g, 45g, 30g and 15g of powder giving a weight/volume (W/V) ratio of 1:4, 1:5, 3:20, 1:10 and 1:20 respectively. The solutions were left overnight and then filtered to obtain the extract. Six (6) aquaria (A, B, C, D, E and F) were used for the study. Each aquarium measuring 60 X 50 X 90cm^3 was stocked with ten (10) fingerlings of *Clarias gariepinus* obtained from the Cross River University of Technology Fish Farm Obubra Campus. The fingerlings were acclimated for 2 weeks and were fed twice daily during the period of acclimation. Feeding was stopped 24 hours prior to the commencement of the experiment. One hundred and eighty fingerlings were used for the experiment with average length of fingerlings measuring 7.35cm.

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The treatments (concentrations in g/300ml of water) were assigned to the experimental units (Aquaria) at random; using a table of random numbers as described by Akindele (1996). Aquarium A and its replicates received no treatment and served as control throughout the experiment. Aquaria B, C, D, E, F and their replicates were treated with the 15g, 30g, 45g, 60g, and 75g of water extracts derived from the fruits of *Tetrapleura tetraptera* respectively. The aquaria were covered with netting materials to prevent the fish from jumping out. The mortality of fingerlings in each aquarium was monitored at 4 hours interval for 96 hours, the percentage mortality and mean mortality per treatment were determined. The behavioural pattern of the fish after introduction of the extract was critically observed. Data collected were analysed using percentages and tables. Completely Randomized Design (CRD) and Fisher's Least Significant Difference (LSD) as described by Akindele (1996) were also employed to analyse data generated.

RESULTS AND DISCUSSION

Table 1. Mortality OF *Clarias gariepinus* Fingerlings Subjected to different concentrations of Water Extracts of *Tetrapleura tetraptera* Fruits for 96 Hours

Clarias gariepinus fingerlings survival in the treated media decreased markedly with increase in concentration of water extract of *Tetrapleura tetraptera* fruits. The results show that 96.67% of catfish fingerlings survived in the control experiment throughout the 96 hours duration of the experiment while in other treatments the fingerlings reacted to water fruit extracts. The mortality rates at varying concentrations are shown Table 1. Time for 100% mortality for 75g/300ml of the concentration of the water extracts of *Tetrapleura tetraptera* was 40 hours while 50% mortality was recorded at 15 hours for the same concentration. For the 45g/300ml and 60g/300ml, 100% mortality of fingerlings was recorded at 52 hours and 40 hours while the corresponding 50% mortality was recorded at 15 hours for the same concentration. For the 45g/300ml and 60g/300ml 100% mortality of fingerlings was recorded at 52 hours and 40 hours while their corresponding 50% mortality was recorded at 24 hours and 20 hours respectively. Apart from the control, the 15g/300ml and 30g/300ml recorded 3.33% mortality while 30g/300ml recorded 16.67% mortality of fingerlings. This clearly indicates that the higher the concentration of water extracts of *Tetrapleura tetraptera,* the higher the mortality of fingerlings.

Mortality of *Clarias gariepinus* fingerlings followed a particular trend in the treated media. Mortality increased sharply and then decreased gradually as the number of hours increased (Table 1). This implies that the toxicity of *Tetrapleura tetraptera* water extract disappeared with increase in time (hours). This is due to its biodegradable properties. The different treatments (concentration) of the water extract of *Tetrapleura tetraptera* were subjected to statistical analysis to test if there are significant differences among the various treatments in relation to mortality of *Clarias gariepinus* fingerlings. Using the one-way analysis of variance (ANOVA), the result is significant ($P<0.05$) as shown in Table 2. This implies that there are significant differences among the various graded concentrations in relation to mortality of *Clarias gariepinus* fingerlings. Follow up procedures, using Fisher's Least Significant difference (LSD) to test for difference among pairs of means, showed that concentrations of 0g/300ml (control), 15g/300ml and 30g/300ml were not significantly different ($P>0.05$) from each other (Table 3). Similarly there were no significant differences ($P>0.05$) between the 45g/300ml, 60g/300ml and 75g/300ml concentration of the plant extracts. Behavioral changes were observed in the fingerlings during the study. The fingerlings exhibited normal swimming behaviour in the control (0g/300ml) while erratic swimming was observed among fingerlings in the treated media. The treated fingerlings showed slow movement with the tendency of fingerlings settling down at the bottom of the aquaria, motionless for about 25 – 30 minutes with decrease in opercula beat. In some cases the fingerlings exhibited inconsistent jumping, loss of balance and incessant gulping of air. This stressful and erratic behaviour observed was due to the water extract of *Tetrapleura tetraptera* fruit on the fish organs. At higher concentrations (45g/300ml, 60g/300ml and 75g/300ml), the fingerlings appeared in a more distressed condition at first, later they became inactive followed by loss of balance and finally sank to the bottom of the aquaria, lying on their side in a moribund state. At lower concentrations (15g/300ml and 30g/300ml), the fingerlings did not appear in a distressed condition for long periods. Though the solution at these concentrations (15g/300ml and 30g/300ml) were still irritating to fingerlings, as the number of hours increased after treatment, the fingerlings swam freely and this was an indication that the water extract from *Tetrapleura tetraptera* fruits has lost its potency. This agrees with the work of Onusiruka and Ufordike (1994) and Aguigwo (1998) who subjected different fish species to varying toxicants.

Observation on the body of the treated fingerlings showed presence of mucus, the thickness (data not included) of which is directly proportional to the concentrations of the extracts. This implies that the higher the concentrations, the higher the thickness of mucus. Other observations made include excessive defeacation and changes in fish colour.

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Table 1. Mortality OF *Clarias gariepinus* Fingerlings Subjected to different concentrations of **Water Extracts of** *Tetrapleura tetraptera* **Fruits for 96 Hours**

Conc.	TIME (HOURS)																												
g/300ml	0	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60	64	68	72	76	80	84	88	92	96	TM	M (%)	MM	±S.E.
0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	3.38	0.33	0.27
15	-	-	-	-	-	2	-	-	-	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	5	16.67	1.67	0.27
30	-	-	-	3	-	-	2	2	-	-	1	-	1	1	-	-	-	-	-	-	-	-	-	-	-	10	33.33	3.33	0.27
45	-	-	-	4	4	4	3[a]	3	3	3	-	2	2	2[a]	-	-	-	-	-	-	-	-	-	-	-	30	100.00	10.00	0.47
60	-	-	-	5	5	5[a]	4	4	4	2	1[b]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	30	100.00	10.00	0.82
75	-	-	6	5	4[a]	3	3	3	3	2	1[b]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	30	100.00	10.00	0.82

WATER EXTRACTS OF *Tetrapleura tetraptera* **FRUITS FOR 96 HOURS.**

[a] Time for 50% mortality: 45g/300ml = 24 hours
60g/300ml = 20 hours
75g/300ml = 16 hours

[b] Time for 50% mortality: 45g/300ml = 52 hours
60g/300ml = 40 hours
75g/300ml = 40 hours

Key	
TM	Total Mortality
M (%)	Percentage Mortality
MM	Mean Mortality
S.E.	Standard Error

Table 2. Analysis of Variance (ANOVA) for Mortality of Fingerlings in Relation to Various Treatments.

Source of variation (SV)	Degree of freedom (DF)	Sum of squares (SS)	Mean squares (MS)	Variance ratio (F-cal)	F-tab $\alpha = 0.05$
Among Concs. (Treatments)	5	208.07	41.61	3.79*	3.11
Within Concs. (Error)	12	125.07	10.48		
Total	17	333.78			

*Denotes significant ($P<0.05$).

Table 3. Mean Mortality of *Clarias Gariepinus* Fingerlings subjected to different concentrations of Water Extract of *Tetrapleura Tetraptera.*

Conc. (g/300ml)	Mean Mortality
75	10.00[a]
60	10.00[a]
45	10.00[a]
30	3.33[b]
15	1.67[b]
0	0.33[b]

Means with the same superscript are not significantly different ($P> 0.05$).

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CONCLUSION AND RECOMMENDATION

This study showed that *Tetrapleura tetraptera* fruits have substantial piscicidal potentials to eradicate unwanted fish in aquacultural ponds. It can also be used for harvest of fish in streams, ponds and rivers without causing harm to the environment. The constituents of the extract are biodegradable and thus diminish within a short period after exposure. Chakraborty *et al* (1972) observed that whatever type of piscicidal plant extract used, there are found to be poisonous to fish but not on the consumers. This is because all the extracted constituents from the plant have short live span. The water extract of *Tetrapleura tetraptera* is therefore an ideal plant toxin to be used for harvesting fish and also for eradicating fish weeds from nursery and rearing ponds before stocking. Since fingerlings succumb only to higher concentrations of the extracts within a short period of time. It is recommended that the extract be used in selective eradication of aquatic organisms from nursery and rearing ponds before stocking.

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