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The Water Pollution Effect of Tephrosia used in Fishing in Agatu Local Government Area of Benue State

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Abstract: *This paper seeks to discourage the use of Tephrosia vogelii in fishing to eradicate its water pollution effects in Agatu Local Government Area of Benue State. A 96 hour laboratory bioassay test of the extract from the plant, Tephrosia vogelii for the mean lethal concentration LC_{50} was carried on healthy, juveniles of Tilapia zilii. A test for some physio-chemical parameters of the extract solution used for the 96 hour test was also carried out. The mean lethal concentration of 9.7mg/l was established with wide variations observed between the physio-chemical parameters of the water treated with the extract of Tephrosia vogelii and those of the untreated water. In the treated water some abnormal behavior responses such as restlessness, gulping for air, attempt to fly out of the water, eratic swimming, loss of equilibrium and resting motionless at the bottom of the tank were observed in the Tilapia zilii juveniles while no such observations were made in the control test water (where extracts of Tephrosia vogelii was absent) experiment. A discussion of the result and findings was done with useful recommendations made.*

Keywords: *Water pollution, Tephrosia vogelii, Fishing, Agatu LGA*

INTRODUCTION

Potable water, as an essential requirement of life, has some well known qualities regarding chemical, physical and biological characteristics which cannot be compromised, especially for health. These qualities include colour, odour, taste, turbidity and PH (UNEP 1989).

A typical drinkable water sample has the following properties; Temperature (25.2°c), Total dissolved solids (Tds: 22 ppm), Chemical oxygen demand (COD; 110 ppm), Alkalinity (60 ppm), Nitrate (1.7 ppm), Ammonia (0.8 ppm), Coliforms (70 per 100ml), Seechi reading (4.5 meters) and Carbon dioxide (0.75 ppm), Nnemeka (2004). The physical, chemical and biological properties above are expected components of potable water. Any variation in the contents and quality will affect the value and usefulness of the water body (Nnemeka: 2004).

Agatu people obtain drinking water from nearby streams and River Benue. The streams run into River Benue as its tributaries and therefore, serve as sources of fish protein as well. Nets, baskets and baited hooks were, until recently, the main instruments used for fishing activities in the streams in both dry and wet (rainy) seasons but occasionally explosives, DDT (Dichloro-Diphenyl Trichloroethane) and other organochlorinated compounds were used.

Government legislation against the use of explosives and organochlorinated chemicals by Decree 59 (1989) to protect people, aquatic organisms and the general environment has led the fishermen in Agatu local government area to intensify the growth and use of *Tephrosia vogelii* for dry season fishing when the water volume has drastically reduced in the streams.

The leaves of the plant (*Tephrosia vogelii*) are pounded and placed in baskets which are then placed in barricaded water and shaken several times. Barriers are made at both ends across a section of the stream 200-300 meters in length to prevent water from flowing and fish from escaping. The shaking of the basket in a water causes the pounded *Tephrosia vogelii* to stir and leak in solution into the water to kill the fish (Ekpendu, 2002).

Successive barricading of the streams and fishing in this method leads to massive pollution of the water. The water obtained from such polluted water bodies is unfit for drinking and domestic use. The effects of drinking such water include salivation, diarrhea, tremor, uncoordinated movement, paralysis, convulsion, respiratory failure and death (FEPA I989).

Tephrosia vogelii is a leguminous plant which Tiv people call 'Kuba'. The Idoma people call it 'Oha' while the Agatu people from Idoma speaking area distinguish the different species of *Tephrosia* on the basis of the degree of fish killing potency, growth rate, leaf size and seed features. Oha akpalla (*Tephrosia vogelii*). Oha egbulu (Tephrosia bracteolata), and Oha bugubugu (Tephrosia pediceta). The most toxic Tephrosia species is *Tephrosia vogelii* which forms the main part of this study.

The fast increase in Nigeria's human population has witnessed a commensurate increase in protein requirement. The dream to realize protein increase is being threatened by water pollution caused by dangerous fishing methods that have led to decline in the population and diversity of fish in the study area.

The most important fish to be considered in this study is Tilapia zilli. Tilapia zilli belongs to the family ciclidae (Trewavas 1982). Tilapias are mostly in tropical and

subtropical regions of the world. They have become a priority fish for culture in the tropics because of their fast growth, efficient use of natural aquatic feeds, propensity to consume a variety of supplementary feeds, herbivorous nature, resistance to diseases 8M handling, ease of reproduction in captivity to tolerance to a Wide range of environmental conditions. Some of the cultured species have been shown to survive dissolved oxygen concentrations of 0.1mg/l as they grow in a PR range of 5-1 l and tolerate an unionized ammonia concentration of 2.4m8/l (Tomlovel, 2000).

Tephrosia vogelii is a leguminous shrub in the family-Fabaceae (A. Chev). The plant is wide spread in parts of tropical Africa such as South Africa, the Masarene Island, Madagascar and East indies. It is often planted. Leaflets 6'10 pairs, Lanceolate 2.5cm long; 1.2cm broad. Flowers purplish, fruity hairy, 7.12cm long and nearly 1cm broad and about 6-8 seaded (Feacher M., 2006).

STUDY AREA

The study was carried out in a section of the middle part of River Olugwu, in Agatu local government area of Benue State. River Olugwu has its source near Afor in Ankpa local government area of Kogi State and runs through the western part of Agatu local government area of Benue State to its mouth, south and north River Benue, at utugolugwu, about 91 kilometers from its source. The river serves as a source of drinking water and fnsh protein for nearby villages such as Olidaka, Enogaje, Oshigbudu, Ogbangede, Enugba, Engla, and Usha.

The local government area is located north of Benue south between latitudes 6° and 7°N and latitude 7° and 8°E and covers a total land area of 1,100 square kilometers. The area shares boundaries with a part of Nasarawa State on the north, Apa local government of Benue State area on the south, Ankpa local government area of Kogi State on the west and Gwer West local government area of Benue state on the east.

The area has a tropical climate which manifests in two distinct seasons; dry and wet both of which affect the river water volume differently in turns. In dry season the water volume decreases from November to May and in wet increases from June to October due to the absence and presence of rainfall respectively.

MATERIALS AND METHODS

Leaves of *Tephrosia vogelii* were pounded, dried and filtered to obtain the fine particle extract. Acute 96 hour static bioassays were conducted in the laboratory of Benue Environmental Protection Agency, Makurdi using the method by (Sprague, *et a1.* 2001). 20 Juveniles of Tilapia zilli collected from the middle course of River Olugwu and transported in an aquarium containing 200ml volume natural water from the same source of the river (River Olugwu) were used for the experiment.

Each Tephrosia zilli juvenile weighing 6.90$\pm$2g and averaging 6.50$\pm$1.5cm in length was used for the bioassays. The fish were transferred into dechlorinated Makurdi municipal water where they (Tilapia juveniles) were acclimatized for two weeks under photoperiod and ambient temperature of 29$\pm$1.8°C which was maintained throughout the test period. The fish were fed daily with soya bean meal and water change at three (3) interval. Static acute tests were carried out to determine 96 hour LC_{50} value of Tephrosia vogelii. The fish were starved for 24 hours prior to and during the toxicity test.

Desired concentrations were made for Tephrosla vogelll at 8.5, 9.5, 10.5, 11.5, and 12.5mg/l were prepared. Toxicant solutions were renewed after 4 hours in the bioassay tests. Ten (10) fish were exposed to each of the five (5) toxicant concentrations of *Tephrosia vogelli* extract in 5000cm^3 of municipal water in a tank. In each series of tests there was a control in which ten (10) fish were exposed to untreated water from the same source (dechlorinated Makurdi municipal water).

Dissolved oxygen water temperature and the general COMMON of the fish were observed before and after each bioassay. They were examined for mortality after 15, 30 minutes; 1, 4, 8, and 12 hours and then two (2) times daily until the end of the 96 hour exposure period. Fish were considered dead when the gill or opercular movement stopped and there was no response to a gentle prodding.

The numbers of dead fish were recorded and they were removed immediately from test solutions to avoid fouling the media. The 96 hour median lethal concentration and slope function were calculated following Lichfleld and Tallarida (2004) method. A graph of percentage mortality was then plotted against the concentrations of test substance (*Tephrosia vogelii*).

Dissolved oxygen and temperature of test water were taken using Winkler's (2000) and thermometer respectively. The Winkler method involves fixation with (MnSo4.H4So4) and Alkaline iodine which releases elemental iodine in proportion to oxygen. The iodine is titrated with sodium triosulphate solution at a concentration calibrated to estimate oxygen in mg/l (milligram of oxygen per litre of water).

RESULTS AND DISCUSSION

The variations between the physio-chemical parameters 0f the test solution and those of the control water in the experiment are shown in table 1.

The LC_{50} value derived from the toxicity test revealed that Tilapia zilli is sensitive to *Tephrosia vogelii*. At higher concentrations percentage mortality increased as shown on the graph below.

The LC_{50} value for 96 hours was 9.7mg/l.

The LC_{50} value in the present study for Tilapia zilli is similar to the findings of Bewarang and Martins (2005) who used different concentrations of a fish poison plant, *Mundulea sericea*, for the same purpose. Rao et al (2003) reported that the LC_{50} value of Elson for clarias gariepinus was 0.0010ml/l for 48 hours exposure. Hague et a1 (1993) observed that the LC_{50} value of Ronil on clarias gariepinus of 9.7cm in length was 1.67ml/l exposed for 96 hours period.

At higher concentrations of *Tephrosia vogelii*, several abnormal behaviours such as restlessness, erratic swimming, periodic flying out of water and falling back into it(water), air gulping, loss of equilibrium and resting motionless at the bottom of the tank were observed.

Mucus was observed to have accumulated on the gills and around the opercula. The above behaviours agree with the observations of Bewarang and Martins (2005) who reported that these abnormal behavioural responses were found in the fish they exposed to toxicants.

Avoaja and Oti (1997) made the same observations of erratic behaviours in fish exposed to toxicants and attributed them to various disorder.

The mucus accumulation on the gill epithelium and around the opercula could be an indication of the int1ammation of the mucus glands. The restlessness could be done to decrease in dissolved oxygen, damage to gill filaments, suffocation and impaired osmo-regulation.

This study on *Tephrosia vogelii* is similar to the findings of Oti (2000) and Annune et al (1994) who reported these abnormal behavioural responses in fmgerlings of the hybrid, hetero-clarias exposed to toxicants at 96 hours period. Unlike in the control experiment water medium where the physio-chemical parameters remain normal, the temperature, alkalinity, PH and dissolved oxygen in the test water fluctuated widely and adversely for being treated with *Tephrosia vogelii*.

Ekpendu (2002) reported that the death of fish exposed to a poison plant, *mundulea sericea* may be attributed to the destruction of such vital organs as kidney, gills, liver, brain and pancreas. Ekpendu was however, silent on the mean lethal concentration of the toxicant. Annune et al (1994) also reported that gill tissues are the most sensitive to water pollutants since gills are the primary site for respiration and osmo-regulation.

From the investigation it was found that *Tephrosia vogelii* contain some active ingredients which may have acted synergistically with adverse effects on the ftsh to cause their death. The death rate of Tilapia vogelii increases with increase in concentration of *Tephrosia vogelii*.

RECOMMENDATIONS

-There should be federal and state legislation against the use of *Tephrosia vogelii* in fishing with strong monitoring by environmental agencies or authorities.

-Fishing methods should be restricted to the use of hooks, nets, and baskets.

-Public attention should be drawn to the water pollution effects of *Tephrosia vogelii* to discourage its use in fishing.

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