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Acute Toxicity of Premium Motor Spirit to the Guppy (*Poecilia reticulata*, Peters, 1859)

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Abstract: Static bioassays were made to determine acute toxicity of premium motor spirit on *poecilia reticulata*. Lethal doses of the oil were determined using LC_{50} software programmes based on Finneys probit statistical method. The 96 LC_{50} value of the oil for guppy was estimated as 1.69 (1.13-2.43) mg L^{-1}. The fish exhibited behavioural changes in the form of aggression, rapid gulping of water, increased opercular movement and abnormal swimming movements. The significance of this sublethal effect particularly as a stress indicator of petrol oil contamination was discussed.

Key words: Acute toxicity, premium motor spirit, *Poecilia reticulata*

INTRODUCTION

There has been considerable interest in the use of small fish models for detecting potential environmental toxicants and carcinogens. *Poecilia reticulata*, has long been recognized and used widely as a standard test species. The fish is valuable for investigating the effects of carcinogenic and or toxic water borne hazards to humans. Williams *et al.* (2003) reported that the chronic carcinogenicity bioassays with guppy and potentially with other small fish species are feasible and scientifically valid.

The popularity of this fish as a standard test species is attributed to it being easy to maintain and handle in the laboratory and also as a result of a large body of background information on their responsiveness to a range of classes of toxicants and carcinogens.

Poecilia reticulata has been used as a test species for metals such as Zinc (Malagrino and Mazzilli, 1994), cadmium chloride (Yilmaz *et al*., 2004a), Insecticides such as alpha-cypermethrin (Yilmaz *et al*., 2004b), Chloropyrifos methyl, a wide spectrum organophosphorus insecticide (Mahmut *et al*., 2005), 3 rodent carcinogens (nithromethane, propanediol and 1-2-3, trichloropropane), (Grace *et al*., 2006), nitrites (Kroupova *et al*., 2004), benzene derivatives (Costescu, and Diudea, 2006), laundry detergent (Otitoloju, 2006) and spent engine oil (Otitoloju and Okusada, 2003; Otitoloju, 2006).

The aim of the present study was to determine the acute premium motor spirit toxicity to the guppy, *Poecilia reticulata*.

MATERIALS AND METHODS

Adult *poecilia reticulata* were collected with a scoop net from an uncovered gutter and transported to the laboratory in bags filled with water from the point of collection. They were kept in holding tanks for 5-6 days to allow them acclimatize to laboratory conditions (relative humidity, 70±20%, temperature 26±2°C, salinity 16 psu) before using them in bioassays.

The test animals were acclimatized gradually to the salinity condition of 16 psu to prevent a sudden osmotic change. This salinity condition was used in all bioassays in order to standardize and simulate a typical brackish water medium.

Single action bioassay: The effluent was collected from a well located in Ipaja, area of Alimosho Local Government, Lagos State, Nigeria.

The underground water supply in this community became contaminated in 1994 because of leakage and seepage from a Nigerian National Petroleum Cooperation major pipeline which runs through the territory and conveys premium motor spirit from the Mosinmi Jetty to the Ejigbo fuel depot.

Predetermined volume of stock solution or serially diluted solution of lower strength were measured out into bioassay containers (12 plastic bowls of 9 cm length, 8.5 cm diameter and 3 L volume) and made up to 1000 mL. Ten specimen each of *P. reticulata* were used in the bioassay. Mortality assessment was carried out after 24, 48, 72 and 96 h.

Assessment of quantal response: Fishes were assumed to be dead when there was no body or opercular movement, even when prodded with a glass rod.

Statistics: The dose response data were analyzed by probit analysis after Finney (1971), using SPSS 7.5 for windows:

LC_{50} = The concentration that kills 50% of the population.
LC_{95} = The concentration that kills 95% of the population.

Table 1: Relative acute toxicity of premium motor spirit against *Poecilia reticulata*

Animal	Time (h)	LC_{50} * CL (mg L^{-1})	Slope±SE	DF	Probit line equation	TF
Poecilia reticulata	24	7.17 (5.55-9.31)	2.51±0.51	1.0	Y = 2.85 + 2.51x	4.3
	48	4.90 (3.58-6.88)	1.76±0.26	2.0	Y = 3.79 + 1.76x	2.9
	72	2.99 (2.20-4.13)	1.69±0.23	2.0	Y = 4.20 + 1.69x	1.8
	96	1.69 (1.13-2.43)	1.35±0.22	2.0	Y = 4.70 + 1.35x	1.0

* CL = 95% Confidence Limit. SE = Standard Error. DF = Degrees of Freedom. TF = Toxicity Factor

LC_5 = Sub lethal concentration that causes, 5% response (mortality of exposed organism and their 95% confidence limit (CL).

RESULTS AND DISCUSSION

The analysis of dose response data for premium motor spirit when tested against *P. reticulata* revealed that the LC_{50} values ranged from 1.69 (96 h LC_{50}) to 7.17 (24 h LC_{50}) (Table 1).

The biological effects of oil on aquatic animals have been evaluated (Ugheche, 1990). This include interference with migration of fishes to the spawning grounds, leading to reduced Juvenile populations (Leniham and Fletcher, 1977), acting as a physical poison, forming a barrier on the water surface and thus restricting oxygen transfer (Enajekpo, 2000).

The major component of premium motor spirit is hydrocarbons and they are known to be oxygen demanding wastes which create a Biological Oxygen Demand (BOD) that could completely deplete the oxygen resources in a given body of water (Helm, 1980).

The exposure of *Poecilia* to premium motor spirit resulted in the exhibition of aggressive behaviour, rapid gulping of water, increased opercular movement and abnormal swimming movements. Fadiya (2002) reported similar behavioural responses in *Poecilia* when exposed to aluminium effluents Yilmaz *et al.* (2004a) and Mahmut *et al.* (2005) reported that behavioural changes of *Poecilia* included swimming in imbalanced manner, capsizing, attaching to the surface, difficulty in breathing, gathering round air vents, less general activity, loss of equilibrium, erratic swimming and staying motionless at a certain location generally at midwater level for prolonged periods.

Continuing works in fresh water ecology has focused on the search for species that indicate certain environmental conditions, particularly forms of pollution. *Poecilia* could be used as such an indicator organism, since its obvious behavioural response in an oil stressed environment could serve as an early detection system, upon which control measures can be initiated before the full impact or lethal effect becomes apparent.

Responses of organisms have been identified as an important tool for monitoring recovery or effectiveness of mitigation measures employed during clean up programmes (Gunn and Sadd, 1974; Xu, 1999; Dorn and Salanitro, 2000).

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