

A study on the effects of Biopesticide *Tephrosia purpurea* on Biochemical parameters of freshwater Fish *Channa punctatus*

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Abstract

In the present study we observed impact of sublethal concentration of aqueous extract of *Tephrosia purpurea* on biochemical parameters of fresh water fish *Channa punctatus*. The median lethal concentration (LC₅₀) of aqueous extract of *Tephrosia purpurea* was 4.5 gL⁻¹ in 72 hrs and 4 gL⁻¹ in 96 hr. Some biochemical parameters were analyzed to determine the influence of sublethal concentration of aqueous extract of *Tephrosia purpurea* on *Channa punctatus*. The range value obtained for the blood, glucose, blood cholesterol was significantly higher in 3 days and 7 days, while serum protein and serum urea was significantly lower, in 3 days and 7 days.

Key words : *Tephrosia purpurea*, *Channa punctatus*, Biochemical aqueous extract.

Indiscriminate use of pesticides towards chemical pollution is a major and serious problem as compared to terrestrial ecosystem. Fishes being aquatic animals become target of pesticides either by direct uptake or through the skin or gills during respiration or orally by drinking pesticide contaminated water or by feeding on pesticide contaminated prey¹⁰. In the recent years the use of medicinal plants as effective alternatives of synthetic pesticide and fertilizers has gained more importance⁴. *Tephrosia purpurea* a biopesticide commonly known as Sarapunkha or saraphonk is also known as fish poison, the plant grows throughout India and western Himalayas upto

an elevation of 1500 meters. The roots leaves and seeds contain Tephrosin, digvelin, quercetin, isotephrosin, rotenone, purporin, flavonone sitosterol and lupeol³. Its toxic principle rotenone is responsible to kill fish.

Channa punctatus fresh water snake headed fish is readily available throughout the year and easily adapts to laboratory conditions. It is an air breathing, predatory and carnivorous fish belonging to order ophiocephaliformes, family Ophicephalidae. In the present study we have examined the effect of the sublethal concentration of aqueous extract of *Tephrosia purpurea* on the biochemical parameters of

Channa punctatus.

Selection and maintenance of fishes: The fresh water air breathing fish *Channa punctatus* ranging from 16-20 cm in length and 58-63 gm in weight collected from local fish market, Ganga river in Narora and canals present in Aligarh. They were treated with potassium permanganate for 5 minutes to get rid of any dermal infection. Fishes were stored in glass aquaria measuring 75 cm x 37.5 cm x 37.5 cm and containing dechlorinated tap water. Experimental water condition were pH 7-7.1, dissolved oxygen 6.8-7.5 g/L, temperature 15-30°C, alkalinity 630 mg/L, hardness 8.2 mg/L, non-carbonate hardness 82 mg/L. Fishes were allowed to acclimatize to the laboratory conditions for 15 days, before commencement of experimental studies.

Collection and preparation of aqueous extract of Tephrosia purpurea : The plants of *Tephrosia purpurea* were collected from Regional Research Institute of Unani Medicine, Aligarh U.P. India and rural

areas of district Aligarh. After washing, plants were dried in shade for 3 days and then in oven at 50°C for 2 days, the plant material was ground mechanically and soaked for 12 hrs, boiled for 30 minutes and filtered by Whatman's filter paper to prepare the experimental concentration of 0.25 mg/litre.

Biochemical study :

The blood glucose was estimated by the o-toluidine method, serum protein was determined by the modified biuret and Dumas method, serum cholesterol was estimated by the method of Wybenga and Pileggi¹¹ and serum urea was determined by the DAM method⁷.

Statistical Analysis of Data :

The data obtained from this investigations were subjected to various statistical tools. The difference in the means (\pm SEM), between groups were assessed using Fisher's 't' test. A p-value of $P < 0.01$ was taken as highly significant (#) and $p < 0.05$ was taken as significant [*].

Table-1. Alteration in biochemical parameters of *Channa punctatus* exposed to sublethal concentration as well as in control for aqueous extract of *Tephrosia purpurea*

Parameters	Control	Exposure Time	
		3 days	7 days
Blood glucose	72.27 \pm 0.154	99.60 \pm 1.387***#	102.82 \pm 0.1404***#
Serum cholesterol	131.46 \pm 0.313	135.01 \pm 0.62***#	225.84 \pm 6.88***#
Serum protein	9.84 \pm 0.0544	9.28 \pm 0.0240***#	8.77 \pm 0.0309***#
Serum urea	271.38 \pm 0.79	237.4 \pm 2.036***#	214.28 \pm 3.708***#

** - significant at $P < 0.05$; *** - highly significant at $P < 0.05$; # - significant at $P < 0.01$

Aqueous extract of *Tephrosia purpurea* induced significant increase in blood glucose and serum cholesterol while significant decrease in serum protein and serum urea after 3 days and 7 days of exposure (Table-1).

Biochemical biomarkers are commonly used for detecting or diagnosing physiological change in fish exposed to various toxic substance. The increase in blood glucose when exposed to sub-lethal concentration of aqueous extract of *Tephrosia purpurea* is similar to those reported in *Catla catla* exposed to *Cynodon dactylon*⁶ and in *Cirrhina mrigala* exposed to *Azadirachta indica*⁸. In the present investigation hyperglycaemia in fish may be due to toxic action of *Tephrosia purpurea*, which inhibits cholinesterase at neuroeffector sites in the adrenal medulla leading to hyper secretion of adrenaline and acceleration of gluconeogenesis. The increase in serum cholesterol is similar to those reported in *Labeo rohita* exposed to medicinal plants⁵ and *Clarias gariepinus* exposed to *Tephrosia vogelii*¹. The increased value of serum cholesterol could be linked to inhibitory potency of rotenone which may impair the electron transport activity of fish. The decrease in serum protein is similar to those reported in *Channa punctatus* exposed to *Euphorbia tirucalli*⁹ and in *Cirrhina mrigala* exposed to *Azadirachta indica*⁸. The decrease in serum protein may be due to impairment of protein synthesis by *Tephrosia purpurea* due to necrosis of hepatocyte cells. The decrease in serum urea is in contrast reported by Banaee *et al.*,² in *Oncorhynchus mykiss* exposed to *Jatropha*

curcas. The decrease in value of serum urea may be correlated to the failure of the hepatic function and elevation of ammonium ion concentration.

The present study showed that aqueous extract of *Tephrosia purpurea* affects the biochemical parameters of fresh water snakeheaded fish *Channa punctatus*. These parameters could be effectively used as potential biomarkers of *Tephrosia purpurea* extract toxicity to freshwater fish in the field of environmental biomonitoring. So we can say that *Tephrosia purpurea* can be used as an ecofriendly biopesticide. However further studies on withdrawal treatment may help to use it as a safe biopesticide.

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