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EFFECT OF *PARTHENIUM HYSTEROPHORUS* L. LEAVES EXTRACT ON MRIGAL, *CIRRHINUS MRIGALA*

Zoology

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ABSTRACT

The studies were conducted to assess the toxic activity of *Parthenium hysterophorus* L. (Family Apocynaceae) leaves extract on Mrigal, *Cirrihinus mrigal*, fry and fingerlings. Different doses were tried 0.5ml/l, 1ml/l, 1.5ml/l, 2ml/l, 3ml/l, 5ml/l, 10ml/l and 15ml/l. The studies were focused on the determination of lethal concentrations (LC_{50} and LC_{100}). LC_{50} in fry (1.5ml/l) and fingerlings (2ml/l). LC_{100} in fry (2ml/l) and fingerlings (3ml/l). Based on the 96 h lethal concentration, *Parthenium hysterophorus* showed the strongest piscicidal activity. During exposure, fish exhibited discoloration, gulping for air, erratic swimming, loss of reflexes, slow opercular movement and ultimately settling at the bottom motionless. Dissolved oxygen of experimental water decrease when liquid extract concentration increases.

KEYWORDS

Parthenium, mrigal, lethal, oxygen, Lethal concentration.

INTRODUCTION

Parthenium hysterophorus L. (Family Apocynaceae) probably entered India before 1910 (through contaminated cereal grain). Infestation by Parthenium degrades natural ecosystems. Parthenium is reported to have insecticidal, nematicidal and herbicidal properties. It contains several important chemical constituents, mainly histamine, saponin, glucosides and triterpene (sesquiterpene). Crude extract of local plants are frequently being used by traditional communities like tribal and rural population of India and elsewhere. There are numerous bioassay studies on plant extract. The first of such work involving some local plants was reported as early as 1965 (Nakanishi *et al*., 1965). Indian and Chinese major carps displayed abnormal behaviuor exposed to different concentrations of *Nerium oleander*, *Cannabium sativum* and *Parthenium hysterophorus* leaf extracts respectively (Ashraf *et al*., 2010). Very limited work has been done on the toxicity of *Parthenium hysterophorus* on fishes.

The use of plants and their products for curing and managing various ailments has been known to the world since time immemorial, and is gaining momentum these days due to toxic effects by synthetic drugs. Medicines manufactured on principles of natural compounds even by pharmaceutical companies, may lead to a large-scale exposure of humans to natural products (Awasthy *et al*., 2000). Natural products have always played a major role in the development of organic chemistry. The various structural types of natural products contribute not only to new finding or pose challenging synthetic problems but also provide hope that they may become the basis for new biologically active substances of commercial significance (Sukari *et al.,* 1992). Though apparently believed non-toxic, a clean chit offered to these plant products requires strict scientific tests, besides clinical ones on different vital systems, moreso, because these natural products may contain a few harmful ingredients in them as secondary metabolites (Nakamura and Yamamoto, 1982) which may have perilous side effects including mutagenic potentials.

It is, therefore, biological testing has played an important role in toxicity studies of crude leaves extract and its compound. There are numerous bioassay studies on plant extract. This study was conducted as part of the research to study the biological activity of leaves extract of *Parthenium hysterophorus* L. Mrigal, *Cirrhinus mrigala* is one of the important Indian major carp cultured in freshwater throughout India. The report discusses the piscicidal activity of *Parthenium hysterophorus* on non-target fish Mrigal, *Cirrhinus mrigala*.

MATERIALS AND METHODS

Extract preparation

Parthenium hysterophorus leaves were collected from local area. For preparing extracts leaves cut into small pieces. Small pieces crushed in mixture. Then crushed materials taken into a porous cloth and then pressed the crushed materials, liquid oozes out through pores of cloth. The liquid extracts collected in glass bottle and used for experiments. From 310 g leaves obtained 150 ml liquid extract.

Experimental animals

Laboratory reared *Cirrhinus mrigala* fry (4.1 ± 0.2 cm, 3.26 ± 0.3 g) and fingerlings (8.12 ± 0.3 cm, 6.24 ± 0.5 g) were used for toxicity experiments.

Toxicity experiments

Experimental fishes were acclimatized in aquarium for 72 h containing well water at room temperature 26 ^{0}C – 27 ^{0}C. The liquid extract of *Parthenium hysterophorus* different concentration tried on *Cirrhinus mrigala*, fry and fingerlings were 0.5 ml/l, 1 ml/l, 1.5 ml/l, 2 ml/l, 3 ml/l, 5 ml/l, 10 ml/l and 15 ml/l respectively. Experiments were arranged in small size glass aquaria at room temperature. Performance tests lasted for 96 h. The dead fish were removed continuously to avoid pollution related effect and were counted for determination of LC_{50} and LC_{100}. Water parameters like temperature, pH and dissolved oxygen were monitored throughout the exposure period to determine any tangible water quality deterioration effect on fish, which might confound treatment effects (APHA, 1998). Toxicity experiment was performed according to the method of (Singh and Agrawal, 1988). Three small aquaria were set up for each concentration and each aquarium contains ten fishes in 6 l of de-chlorinated tap water. Control animals were kept in similar condition without any treatment. Fishes were considered dead if they failed to respond to vigorous poking with glass rod.

RESULTS

Behavioural changes

Cirrhinus mrigala displayed abnormal behaviors when exposed to different concentrations of *Parthenium hysterophorus* leaf extracts like disturbed swimming, rapid opercular movements, incessant gulping of air, darkening of the whole body and fish settling at the bottom motionless, restlessness, hyperactivity, abrupt erratic and jerky swimming, increased mucus secretion, discolouration of skin, drooping of fins, loss of balance and finally the death. Reddish colour observed near the gill region and in stomach region in all sets. The skin color of the fishes became light grey. In control group there were no such changes observed, that means another factors other than the plant moieties were responsible for alterations in behavior of fish.

Toxicity tests

Cirrhinus mrigala (fry)

When exposed to leaves extract 0.5 ml/l no mortality occurred through out the experiment. At dose 1ml/l, 50 % mortality (LC_{50}, 96 h) and 1.5 ml/l 100 % mortality (LC_{100}, 96 h) observed. At doses 5 ml/l within 15 m all died. At concentration 10 ml/l and 15 ml/l within 10 m all died in both the groups.

Cirrhinus mrigala (fingerlings)

No mortality occurred at the concentration 0.5 ml/l, 1 ml/l and 1.5 ml/l respectively. At concentration 2 ml/l, showed 50% mortality (LC_{50} 96 h) and concentration 3 ml/l observed 100 % mortality (LC_{100}, 96 h). At concentration 5 ml/l within 25 m all died and at dose 10 ml/l and 15 ml/l within 10 m all fishes died in both groups (Table 1 & 2).

DISCUSSION

The mortality of the fish was chosen as the measurable effect to determine the toxicity of the crude liquid extract. It is clear from the

results that *Parthenium hysterophorus* L. crude liquid extract is acute toxic against freshwater fish Mrigal, *Cirrhinus mrigala*, thus, the plant is piscicidal activity. The plant *Parthenium hysterophorus* may be used as a potential source of piscicides as a crude preparation of the leaves extract has sufficient time dependent piscicidal activity. As mentioned in result, the type of behavior responses indicate that tested materials may be neurotoxic, which might be active at the neuromuscular system of fish *Cirrhinus mrigala.*

In the present work also found that DO content of experimental water decreases when extract concentration increases, due to may be increases activity of fishes, the higher metabolic rate results into more oxygen utilization**.** (Dahl, 1985) reported some toxins paralyse fish, others work by reducing oxygen content in water. The stressful breathing behavior exhibited by fish may be as a result of respiratory impairment due to effect of toxicant on the gills. Mortality caused by tested materials showed a significant positive correlation between dose and mortality. It may be due to increase of extract concentration in water resulted in more intakes of their active moieties in fish body. The increase in mortality with increased exposure periods could be affected by several factors, which may be acting separately or jointly (Goodmann *et al*., 1985).

Behavioral changes observed in the present study somewhat similar to toxic study reported in, Indian and Chinese major carps displayed abnormal behavior when exposed to *Nerium oleander*, *Cannabium sativum* and *Parthenium hysterophorus* leaf extracts respectively (Ashraf *et al*., 2010).

Present studies revealed that fish exposed to toxicants exhibit marked behavioral changes like swift opercular movement, sudden jerky swimming body movements, which demonstrated a sensitive indicator of physiological stress in fish. Davis (1973) has observed similar behavior when fish were subjected to sub-lethal concentrations of pollutants. The behavioral responses observed in current studies can be favorably compared with those observed by (Pascual *et al*., 1994) in formalin test on seabass, *Lates calcarifer* fry. Similarly, (Lin and Liu, 1990) reported abnormal movement and high respiration rate in hybrid Tilapia, *Oreochromis mossambicus* induced by ammonia, indicating neurological dysfunction and gill damage. The erratic behaviour prior to death in the present and past studies can be conveniently associated with the impact of toxicants on fish. More efforts are required for chemical analysis and their toxicity on different fish species at biochemical and tissue level. Moreover, control of predatory or trash fishes is not selective.

In the present study also found that the toxicity of the *Parthenium hysterophorus* liquid extract added in to the experimental water, reduced within 8-10 days that does not showed toxic effect on *Cirrhinus mrigala*, advanced fry and fingerlings.

Findings of the present study indicates that the *Parthenium hysterophorus* have potent piscicidal activity on *Cirrhinus mrigala*. So these leaves extract liquid compound cannot be used directly in water bodies or for medicinal purpose, without knowing their structural activity relationship with non-target aquatic organisms. This study can be apply to control the predatory and trash fishes from fish pond but need more research work.

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Table 1. LC_{50} and LC_{100} of *Parthenium hysterophorus* L. leaves extracts for *Cirrhinus mrigala*.

Fish species	Developing stage	LC_{50}	LC_{100}
Cirrhinus mrigala	fry	1 ml/l	1.5 ml/l
	fingerlings	2 ml/l	3 ml/l

There was no mortality in control groups. LC_{50} and LC_{100} at 96 h.

Table 2. 100 % mortality of Cirrhinus mrigala exposed to Parthenium hysterophorus L. leaves extracts.

Fish species	Developing stage	Dose (ml/l)	100 % mortality (within time in m)
Cirrhinus mrigala	fry	5	15
		10	10
		15	10
Cirrhinus mrigala	finger lings	5	25
		10	10
		15	10

There was no mortality in control groups.

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