TFR
Trends in Fisheries Research
An International Peer-Reviewed Journal

www.sciencejournal.in

CESTRUM NOCTURNUM (L) A PROSPECTIVE PISCICIDE FOR CONTROL OF PREDATORY FISH *CHANNA PUNCTATUS* (BLOCH.).

Jawale C. S.*, Vinchurkar A. S., Dama L. B.*, Pawar Kishor****, Dama S.B.[#] and Shaikh Yasmeen[##]**
*Department of Zoology, HPT Arts and RYK Science College, Nashik-422005, Maharashtra, India.
**Joint Director, Higher Education (Maharashtra State), Solapur Region, Solapur
***Department of Zoology, D. B. F. Dayanand College of Arts and Science, Solapur-413002, Maharashtra, India.
****Department of Zoology, KSKW Arts and Science College, Nashik-422001, Maharashtra, India.
[#]Department of Zoology, Dr. B. Ambedkar, Marathwada University, Aurangabad, Maharashtra, India.
[##]Department of Zoology, Dr. Rafiq Zakaria College for Women, Navkhanda, Jubilee Park, Aurangabad (M.S.), India
(*E-Mail- csjawale@hotmail.com)

ABSTRACT
Piscicidal activity of methanolic extract of Cestrum nocturnum leaves against predatory fish *Channa punctatus* and their behavioural changes were investigated. *C. nocturnum* leaves extract shows the remarkable piscicidal activity. It shows there was significant negative correlation between LC_{50} values and exposure periods when observed till 72 hr. During the toxicity experiment the fish shows the behavioral changes such as suffocation, rapid movement, and spiraling and convulsion period to death. Piscicidal activities show their dependence with concentration and time. This piscicidal activity may be due to their adverse effect on respiratory as well as energy production of fish. During bioassay experiments, a phenomenon of recovery was observed in stupefied fishes when fishes were shifted to untreated water after showing a partial symptom of death at LC_{100} dose. This indicates the tolerance and detoxifying capacity of fish to toxic principal. This nature of the fish stupefying property of *C. nocturnum* extracts could be advantageous in aquaculture for fish catching and releasing into new isolated site.

KEY WORDS: *Cestrum nocturnum*, *Channa punctatus*, Fish behavior, Piscicide

INTRODUCTION

The presence of predatory and weed fishes in cultured pond is a serious problem for culturing edible freshwater fishes. These fishes adversely affect the cultured fish population by sharing food and habitat of major cultivated carps. *C. punctatus* is the common predatory fish which have low food value and due to predatory nature, they engulf the fingerlings of cultured carp at several stages of their rearing (Jhingran, 1975), thus adversely affect the cultured carp production and put a great loss to the fish farmer. For eliminating unwanted population of *C. punctatus* from cultured ponds, fish farmers made several efforts, by using of synthetic pesticides (Marking, 1992). Due to their long term persistence in the water and fish body, they adversely affect both the quality of fish and their status (Cullen and Connell, 1992). A better alternative for these harmful synthetic piscicides is environmentally safe plant origin piscicides which are less expensive, biodegradable, readily available, easy to handle and safe to mankind and environment (Marston and Hostettmann, 1985; Singh *et al.*, 2010). The C. nocturnum also showed Larvicidal Activity on Aedes *aegypti* (Jawale *et al.*, 2010); it is also showed insecticidal activity against *Tribolium castaneum* and *Tribolium confusum* (Jawale and Dama, 2010).

A large number of plants belonging to different families (Kulakkattolickal, 1989) and their products (Bhatia, 1970) have been used for controlling unwanted fish population not only in India but also all over world (Chiayvareesajja *et al.*, 1987; Jawale and Dama, 2010). The toxicity of plant extract to the freshwater fish has been studied by number of investigators (Bhatta and Sing, 1985; Bhatta *et al.*, 1987; Bhatta and Farswam, 1992). But the piscicidal activity and degradation property of *Cestrum nocturnum* on the freshwater fish are studied rarely (Patil and Jawale, 2002). Hence, the present paper deals with the piscicidal activities of methanolic extract of *C. nocturnum* leaves on the common air breathing predatory fish *C. punctatus*.

MATERIALS AND METHODS

Green tendered and well developed plant leaves were collected from the gardens in Nashik (Maharashtra) and were air dried in a shady place to retain their active ingredients intact. Dried leaves were powdered in a table model grinder for extraction. Powdered leaves (500 gm) were socked in methanol in airtight wide mouth bottle and kept for 7 days. After that, the cold extract from the bottles along with methanol was filtered. Around 4.2 gm dried hydroscopic extract was obtained. It was kept in the desiccators until assayed. Dried extract was used for toxicological testing. Stock solution was prepared by dissolving plant extract (1gm) in (1lit) distilled water to make its strength 1000 ppm. Different concentrations were prepared by adding a required dose of stock solution in water.

Fish *Channa punctatus* 12.5 (2.5) g body weight, length, 10.1 (0.15) cm were collected from the river. They were brought to laboratory and maintained separately in glass aquariums under controlled laboratory conditions (2720C and 755% RH; 16 h day light) for 7 days with optimum aeration. Piscicidal activity was carried out by acute static bioassay

of various ppm concentration of alcoholic extract as per the protocol given in APHA (1989). The fishes were exposed for 24, 48, 72 hours at different concentration of extract. Mortality was recorded at every 24 hr. up to 72 hr. exposure period. Fishes were considered dead if they failed to respond to a stimulus provided with glass rod. The recorded mortality data was used to calculate the LC_{50} values, upper and lower confidence limits, slope function and regression results according to probit log method (Finney, 1971). During toxicity experiments the LC_{100} dose for 24 hr. was used to study, recovery phenomenon in fishes. After releasing 10 fishes in the treated water, they show convulsion and immobilize phase before complete death at around 5-6 hr. of toxicity. After obtaining 30% mortality all remaining fishes were transferred to untreated water. Survival was observed for next 72 hrs. Experiment was performed in triplicate to verify the observations.

RESULTS

The acute toxicity studies of leaves extract of *C. nocturnum* were determined at different time intervals and presented in table 1. There was a significant negative correlation between LC_{50} values and exposure periods i.e. LC_{50} values decreased from i.e., 24 to 72 hr. If exposure periods increase the LC_{50} values decreases 46.44 ppm (24 hr) > 40.32 ppm (48 hr) > 30.13 (72 hr). The toxicity study shows the overall picture of test progress and indicates that the rate of mortality increased with increasing concentration of plant extract in a linear fashion.

Table 1. LC_{50} values and regression equation results for *C. punctatus* treated with *C. nocturnum* extract.

Exposure period in hours	LC_{50} in ppm	Regression equation
24	46.44	Y= 0.0972 X + 0.0093
48	40.32	Y= 0.1002 X - 0.001
72	30.13	Y= 0.0998 X + 0.0093

Y mortality rate, x concentrations

During acute toxicity studies of exposures to methanol extract of *C. nocturnum* leaves caused significant behavioural changes in the predatory fish *C. punctatus*. When fishes were kept in toxic medium, they dart in all directions, breathing rapidly, held mouth wide open and kept the fines stretched laterally. After 2-3 min, restlessness subside, this brief initial period of restlessness may not be mistaken as symptoms of poisoning, later the fish settled quietly at the bottom, the first symptoms of loss of sensitivity (response) was characterizes by raising of the fins, subsequently a rigorous, spasmic and mostly superficial movements of the fins and rapid respiration was observed. Often the mouth was partially closed and slight twitching of the jaws was discernable. After the laps of 10-15 hrs there is a discharge of mucus through the gills and a mucus layer was formed on eyes and all over the body. Fish remain in the state of exhaust, and stupefaction. They did not respond to external stimulus and remained diagonally suspended in the water. In the last hours of exposure there was loss of body equilibrium and fish shows turning over the back, lastly attempts were made to avoid the toxic medium by jerky swimming, jumping out of the water, accelerated and arrhythmic respiration, but slowly the movements were staggered, mouth is slightly opened, fins and tail become rigid, total dullness in the eyes and body colour become totally lifeless. Finally fish died with rigor mortis in curved formed. In recovery experiments all fishes after showing initial symptoms of poisoning were transferred to fresh untreated water. They shows profuse mucus secretion and darkening of body colour, reduced hyper movements, finally all poisoning symptoms subside and fishes looks normal. All 70% fishes survived without any mortality.

DISCUSSION

The toxicity data of the present study indicate that the significant positive correlation between dose and mortality. It may be due to increased concentration of extract in aquarium water and resulted in more intake or entry of active moieties in the fish body. There is no significant different between observed and expected mortality. Since calculated chi-square values are less than the table chi-square value. Thus, it is expected that extracts of *C. nocturnum* plant will be a useful indigenous natural product for killing predatory fish in fish and shrimp farms.

Toxicity experiments showed that methanol extract of *C. nocturnum* leaves, caused significant behavioural changes in fish *C. punctatus*. In the present study the abnormal behaviour of the fish may be due to suffocation, leading into forceful respiration efforts. Various Phytochemists reported the presence of saponin in *Cestrum* species (Karowya, 1971; Riaz and Chaudhari, 1993; Viqar et al 1993; Haraguchi *et al.*, 1999.) and saponin is well documented for its destructive action on the respiratory surfaces of aquatic organism (Marston and Hostettmann, 1991; Hostettmann and Marston 1995; Chaieb *et al.*, 2007).

The initial increase in opercular movement and rigorous swimming can be taken as index of the suffocation stress felt by the fish exposed to plant extract. Subsequent increase secretion of mucus may be to prevent excess entry of extract

molecule present in the medium to minimize damage to gill epithelium (Gill et al 1991) similar behavioural responses were also observed in plant extract exposed fishes (Goodmann *et al.,* 1985). Recently, Shaikh *et al.,* (2012) observed Behavioural changes of fresh water bivalve molluscs *Lamellidens marginalis* due to acute toxicity of cadmium. During recovery experiment, fish survival may be due to rapid detoxification of toxic principle entered in the blood stream; simultaneously excess mucus secretion may help in healing of respiratory surface and facilitate the gas exchange through the body surface (Tiwari and Singh 2005). This experiment also indicates the local action of the phytotoxicant, and it may not be of kind of neurotoxic or accumulating type of poison. This property of phytotoxicant is at most importance in the recapturing aspect in aquaculture. Although long term toxic effect has to be studied further to establish its commercial use. Thus, there is a potential for using leaves extract of *C. nocturnum* for killing predatory fish in freshwater aquaculture. However, the effective concentration must be determined against the predatory air-breathing fishes such as *Clarias* sp., *Channa* sp, and *Anabas testudineus* that are generally more tolerant to toxicants than other fishes. The demand for good piscicides (cheap, efficient and safe for consumers) has increased with the further expansion of aquaculture.

The control and eradication of unwanted fishes in the pond requires the use of effective piscicides (Konar, 1973). Dama *et al.,* (2000). Investigated to control of the helminthiasis vector snail *Lymnaea auricularia* by fresh water fish, *Clarius batrachus*. Most of the fish farmers report to the use of chemical piscicides that prove to be very effective although these chemicals are rather dangerous to the environment and can do more harm than good. Alternative piscicides that are not hazardous to the environment and have shorter residual effects must be used. The results of the study showed that locally available plants to be used as piscicide which can be an alternative to harmful chemical piscicides that can be widely used today to eradicate unwanted fishes in the ponds. Further studies are undertaken to evaluate the toxicity of this extract on the commercially important fishes. Isolation, purification and characterization of piscicidal principal from the *C. nocturnum* are in progress.

REFERENCES

APHA., AWWA and WPCF (1989). Standard Methods for the examination of waters and waste waters, 16 Ed. APHA, Washington. pp.413.

Bhatia H.L. (1970). Use of Mahu oil cake in fishery management. *Indian Farming.* **20**: 39-40.

Bhatt J P., and V. S. Farswam, (1992). Haemolytic activity of piscicidal compounds of some plants to a fresh *Barilius bendalensis* (Ham*). J Environ Biol.* **13**(4): 333–342.

Bhatt J. P., Dobryal A.K. and Farswam Y**. S.** (1987). Growth response in the fry of *Schizothrorax richardsonii* (Gray) to the plant toxins. *J Environ Biol,* 8(2): 207–215.

Bhatt J.P. and Singh H. R. (1985). Effect of *Engelhardita colebrookiana* (Linn.) on a freshwater teleost *Barilius bendelisis* (Ham). *Sci Cult.* **51**(4): 132–133.

Chaieb Ikbal, Ben Halima Mounia and Ben Hamouda Habib (2007). Toxicity experiments on the saponin extract of *Cestrum parqui* (Solanaceae) on some insect species. *J. Entomol.* **4**(2): 119-120.

Chiayvareesajja S., Mahabusarakam W. Maxwell J.E., Wiriyachitra P. and Towers G. H. N. (1987). Thai piscicidal plants. *J. Sci. Soc. Thailand.* **13**: 29-45.

Cullen M.C. and D. W. Connell, (1992). Bioaccumulation of chlorohydrocarbon pesticides by fish in the natural environment. *Chemosphere.* **25**(11): 1579-1587.

Dama L.B., Kirdak R.V., Hafeez Md. and Jadhav B.V. (2000). Control of the Helminthiasis vector snail *Lymnaea auricularia* by fresh water fish, *Clarius batrachus*. *J. Experimental Zool. India.* **3**(2): 137-139.

Finney, D.J., 1971. *Probit analysis*. S. Chand and Company Ltd. Ram Nagar, New Delhi, 333 pp.

Gill T.S., Pandey J. and Tewari H. (1991). Individual and combined toxicity of common pesticides to teleost, *Puntius conchonius*, Hamilton. *Indian J. Exp. Biol.* **29**(2): 145-148.

Goodmann L.S., Gillman A.G., Rall T.W. and Murad F. (1985). *The pharmacological basis of therapeutics*. Macmillan Publishing Company, New York.

Haraguchi M., Mitidane M., Morita H., Tokeya K.V., Itokowa H., Mimaki V., Hostettmann K., and A. Morston, (1995). *Saponins: chemistry and pharmacology of Natural products*. Cambridge University Press.

Jawale C.S., Kirdak R.V. and Dama L.B. (2010). Larvicidal Activity of *Cestrum nocturnum* (Solanaceae: Solanales) on Aedes *aegypti. Bangl. J.Pharmacol.* **5**: 39-40.

Jawale C.S. and Dama L.B. (2010). Hematological changes in the fresh water fish, *Cyprinus carpio* exposed to sub-lethal concentration of piscicidal compounds from *Cestrum* species (Family : *Solanaceae*). *Nat. J. Life Sci.* **7**(1): 81-84.

Jawale C.S. and Dama L.B. (2010). Insecticidal potential of *Cestrum* sp. (Solanaceae: Solanales) against *Tribolium castaneum* and *Tribolium confusum* (Herbst) (Coleoptera- Tenebrionidae). *Deccan Curr. Sci.* **3**(2): 155-161.

Jawale C.S. and Dama L.B. (2010). Preparation and Characterisation of Tincture of sphaeranthus Indicus (L) by co-chemical characteristics. *Biosci. Disc*. (1): 18-20.

Jhingran V.G. (1975). *Fish and fisheries of India*. Hindustan Publishing Corporation (India), New Delhi. pp.954.
Karowya M.S., Rizk A.M., Hammouda F.M., Diab A.M. and Ahmad Z. F. (1971). Phytochemical investigation of certain *Cestrum* species. *Planta Medica.* **20**(4)**:** 363-367.
Konar S.K. (1973). Concept of selective toxicants in aquaculture. *Journal of Inland Fisheries, Inland Fisheries Soc. Ind.* **5**:145-153.
Kulakkattolickal A.T. (1989). Piscicidal plants of Nepal: ripe fruit of *Catunaregam spinosa* (Thunb.) (Rubiaceae) and leaves of *Polygonum hydropiper* L (Polygonaceae) as fish poisons. *Aquaculture.* **78**: 293-301.
Marking L.L. (1992). Evaluation of toxicants for the control of carp and other nuisance fishes. *Fisheries.* **17**:6-12.
Marston A. and Hostettmann K, (1985). Plant molluscicides. *Phytochem.* 24: 639-652.
Marston A. and Hostettmann K. (1991). Plant saponins: Chemistry and molluscicidal action. *Proc. Phytochem. Soc. Europe.* **31**:264-286.
Patil M. and Jawale C. (2002). Biocidal activity of *Cestrum nocturnum* Linn. In: Proc. Seminar. Mungikar A.M., and A.S. Bhuktar, (Eds). *Plant resource development*. Department of Botany, Dr. B. A. Marathwada University, Aurangabad, India. pp.128.
Riaz M. and Chaudhary F. M. (1993). Chemistry of the medicinal plants of the genus *Cestrum* (Fam:Solanaceae). *Hamdard Med.* **36**(3): 128–134.
Singh S., Yadav R. and Singh A. (2010) Molluscicides from some common medicinal plants of eastern Uttar Pradesh, *India. J. Appl. Toxicol*. **30**(1):1-7.
Shaikh Yasmeen, Suryawanshi G.D., Dama L. B. and Mane U.H. (2012). Behavioural changes of fresh water bivalve molluscs *Lamellidens marginalis* due to acute toxicity of cadmium. *DAV Int. J. Sci.* **1**(2): 103-106.
Tiwari S. and Singh A. (2005). Possibility of using latex extracts of *Nerium indicum* plant for control of predatory fish *Channa punctatus. Asian Fish Sci.* **18**:161-173.

