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# Fecundity of *Colisa fasciatus* (Bl. & Schn.) as an Index of Distillery effluent toxicity

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***Abstract :*** *In beginning of 21st century, various industries have been set up for boosting the production of various substances of commercial importance. A distillery factory has been established in industrial development area of Gorakhpur (GIDA). It releases its effluent in the adjoining field/aquatic bodies that directly or indirectly pose a threat to aquatic biota in general and fishes in particular. Present paper deals with effect of different concentrations of distillery effluent (5, 10 & 20%) on fecundity of Colisa fasciatus (Bl. & Schn.) a freshwater tropical perch. Observations reveal that 5% distillery effluent concentration brought least significant declining in the fecundity of experimental fish Colisa fasciatus. However, 10 and 20% effluent concentration produced significant (p<0.05-0.01) declining in the fecundity in this fish after 30 days of exposure during late spawning phase. Causes for declining in absolute fecundity has been illustrated.*
***Key Words*** *: Distillery effluent, Absolute Fecundity, Spawning phase, Colisa fasciatus.*

## I. Introduction

Aquatic bodies are highly vulnerable to pollution since these act as immediate sinks for the consequences of human activity. India is the major producer of sugar in the world having about 579 sugar mills and 319 distilleries (Patil and Ghole,2010). Apart from sugar and alcohol, sugar industries generate many by-products and waste materials (Raju and Manickan, 1997). Industrial effluents in developing countries are indiscriminately discharged into aquatic ecosystem and even into nearby fields without any pretreatment (Srivastava et.al.,2007; Shukla and Shukla, 2012a,b). Industrial effluents ingeneral contain a variety of pollutants such as heavy metals, pesticides, detergents, organic and inorganic salts etc., which create serious problem to the non-target fauna, especially fishes (Ramakrishnan et.al.,1999; Ramakritinan et.al.2005). Different biochemical indices have different sensitivities to varied environmental factors and chemicals. In fish, changes in biochemical parameters and their degree depends upon the concentration of pollutants and duration of exposure (Venkatramreddy et.al. 2009).

The major effective parameters in distillery effluent are dissolved solids, chlorides, sulphates, less amount of highly toxic sulphides and a high percentage of dissolved organic as well as inorganic matters (Joshi, 1999:Ramakritinan et.al.,2005). In addition, high biological oxygen demand causes depletion of dissolved oxygen and proves deleterious to aquatic fauna. The distillery effluent is a potent complex water pollutant in two ways, first, its highly colorful nature that may block sunlight and hence becomes detrimental to aquatic life and second, it has a high pollution load that results in eutrophication of water (Joshi, 1999; Ramakritinan et.al.,2005). Thus, the untreated effluents pose a toxic impact on fish and aquatic fauna (Krishna and Prakash, 2010; Shukla and Shukla 2012a,b). Hence, it becomes essential to reduce the toxic level of various pollutants in the distillery effluent before discharging it into adjacent water course or land. Various studies have been carried out on the toxicity of industrial effluent on various biochemical parameters in the fishes. (Kumar et.al., 1995; Pant and Adholeya, 2007). However, deleterious impact of different concentrations of distillery effluent on the absolute fecundity of freshwater fishes is scarce. Hence, present study was undertaken to record the effect of different concentrations of distillery effluent (5,10 and 20%) on the absolute fecundity of a tropical freshwater perch, *Colisa fasciatus* .

## II. Materials and Methods

Distillery effluent samples were collected from three sites. Sampling was done from the depth ranging from 20-25cm. Precautions were taken to avoid any disturbance by loose segments. As analytic technique, the procedures outlined by APHA (2005) was followed for analysis (Table 1). Adult specimens of *C. fasciatus* (weight 28.98 $\pm$ 2.36 gm) were procured from local lake for the study and were brought to the laboratory in an oxygen pack. They were acclimatized for 7 days under natural photoperiod in glass aquaria containing laboratory tap water having temperature 21.30 $\pm$ 1.64$^0$C; pH 7.28 $\pm$ 0.22 ; hardness as $CaCO_3$ 1283.0$\pm$6.24 mg/l and electrical conductivity 1283.00µmhos/cm. They were fed with dried shrimp powder daily but feeding was allowed only after 5 days during the experimental period. The experiment run for 30 days. Physicochemical analysis of distillery effluent was done by method outlined by APHA (2005) as shown in Table 1.

*Colisa fasciatus* is an annual breeder perch. Its reproductive cycle though has been divided into six phases as reported by Pandey and Mishra (1981). However, only late spawning has been chosen to observe alterations in fecundity under different concentrations of effluent when compared with control. In late spawning phase 10 fishes were kept in control and each experimental media. GSI index of female of *Colisa fasciatus* specimens in control and experimental media was recorded using the formula :

GSI = Total weight of gonad / Total weight of body

10 female fish specimens were kept in control as well as 5, 10 and 20% distillery effluent in 20 liters of tap water. To determine the fecundity, 2gms of sub sample were taken from each ovary from the fish and preserved in Gilsomi fluid for 24 hours. Counting was done with help of needle and finally calculated the absolute fecundity by using the formula :

F = N.WG / Wg

Where F= Fecundity, N= No. of egg counted, WG= Total weight of gonad and Wg= Total weight of sub sample.

## III. Results and Discussion

**Table 1**:Physico-chemical characteristics of distillery effluent of GIDA, Gorakhpur (U.P.)

| Parameters | Units | Raw distillery effluent |
|---|---|---|
| Temperature | ($^0$C) | 32.5+2.2 |
| pH | $mgl^{-1}$ | 4.0-5.2 |
| Oxygen | $mgl^{-1}$ | ND |
| COD | $mgl^{-1}$ | 8000-12000 |
| BOD | $mgl^{-1}$ | 1500-1800 |
| Total Solids | $mgl^{-1}$ | 3600-4200 |
| Suspended solids | $mgl^{-1}$ | 1800-2200 |
| Volatile solids | $mgl^{-1}$ | 6000-8000 |
| Total hardness | $mgl^{-1}$ | ND |
| Free CO2 | $mgl^{-1}$ | ND |
| Organic nitrogen | $mgl^{-1}$ | ND |
| Total nitrogen | (%) | 0.80-1.20 |
| Total phosphours | (%) | 0.034-1.02 |
| Potassium as $K_2O$ | $mgl^{-1}$ | 1.16-1.28 |
| Sulphate as $SO_4$ | $mgl^{-1}$ | 3200-3800 |
| Ferrous | $mgl^{-1}$ | 260-340 |
| Suphide | $mgl^{-1}$ | 160-240 |
| Calcium as $Ca^{++}$ | $mgl^{-1}$ | 180-260 |
| Chloride as $Cl^{--}$ | $mgl^{-1}$ | 500-680 |
| Salinity | (ppt) | ND |

ND= not determined; Values are mean of eight replicates ±SE

**Table 2: S**howing GSI and absolute fecundity in *Colisa fasciatus* under 5,10 and 20% distillery effluent when compared with control (n=6)

| Experimental Set Up | Body weight(gm) | Weight of ovary (gm) | GSI | Absolute Fecundity (F) | % decling in Fecundity |
|---|---|---|---|---|---|
| Control | 14.4±1.22 | 3.02 | 0.208 | 1303.26±16.22* | - |
| 5% Distillery effluent | 13.8±1.32 | 2.82 | 0.203 | 1282.60±14.48* | 1.581 |
| 10% Distillery effluent | 12.84±1.40 | 2.36 | 0.183 | 1188.28±12.14** | 8.82 |
| 20% Distillery effluent | 12.60±1.38. | 2.18 | 0.173 | 888.18±10.32*** | 31.84 |

* Insignifiant; ** = P<0.05; *** = P<0.01

The gonosomatic index (GSI) of *Colisa fasciatus* under control and 5, 10, 20% distillery effluent has been shown in table 2. The spawning season of *Colisa fasciatus* has been recorded from late June to September. Absolute fecundity of 10 specimens in four sets has been calculated individually (Table 2) under control and stress. Results reveal that 5% effluent concentration produced least effect on absolute fecundity where as 10% effluent produced slight significant alteration (P<0.05) but 20% distillery effluent produced highly significant alterations in the absolute fecundity (Table 2).

Fecundity and the reproductive capacity have a broad relationship with various intrinsic as well as extrinsic factors. Reproduction and fecundity of *Botia almorhae* has been studied by Joshi (2008). Some workers have studied the fecundity of some fishes (Sharma and Goswami, 1997; Kalita and Goswami 2007; Shukla and Shukla, 2014). In study of *Monopterus cuchia*, the absolute mean fecundity is 917(624-1197) which indicates a low fecundity as reported by Kalita and Goswami (2007). The higher value of Kn and K in the two years and above age group in the month of April- June indicates reproductive maturity and spawning period of this species. On the other hand the gonadal development is insignificant in the age group of 6 months and one year which is indicated by low condition factor and relative condition factor in *Monopterus cuchia*. Fecundity under paper and pulp mill effluent stress has been observed by Shukla and Shukla, 2014 and revels declining only at higher concentration (20%) of effluent. However, distillery effluent reveals deleterious impact on fecundity of *Colisa fasciatus* even at low concentration (10%). Reduction in the absolute fecundity under 10 and 20% effluent concentration may be attributed to the interference of effluent constituents in the oogenesis as well as vitellogenesis process and hence significant decline in the absolute fecundity has been observed in *Colisa fasciatus.*

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