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Report on Mucus Aggregation in *Catla catla* associated with Extensive Culture Tanks

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ABSTRACT

Aquaculture is one of the fast growing and important food-producing sectors in India. In contrast to the aquaculture production, a silent factor that threatens the productivity is diseases and its impact. In comparison with infectious diseases, low attention is drawn in the case of non-infectious diseases. Several behavioral abnormalities are unobserved at field level due to their low prevalence and economic losses. Non-infectious diseases are mainly caused due to improper management practices in a culture. The current study was based on field observations of fish tanks cultured with three species Catla (*Catla catla*), Rohu (*Labeo rohita*) and Pangus (*Pangasius sp*.). In this case report, a peculiar sign of morbid fishes with excessive production of mucus in an abnormal fashion without symptom was observed. Nutrient-rich poultry manure was used as a feed and manure for the development of natural feed in fish culture tanks was believed to be the cause of concern. High mortalities were noticed in Catla population in the polycultural tanks. Finally, fishes were recovered after the treatment with lime and limiting the use of poultry litter.

Key Words: Catla, Lime, Mucus, Non-infectious diseases, Poultry manure.

INTRODUCTION

Aquaculture is one of the fastest developing sectors with the advancement of recent technology. India stands at 2nd position in aquaculture production in which lion share forms Indian Major Carps (IMC). IMC includes *Catla catla* (catla), *Labeo rohita* (rohu) and *Cirrhinus mrigala* (mrigal) contributing 70–75 per cent in freshwater aquaculture (Mishra *et al,* 2017). Besides to IMC in India, a variety non-indigenous fishes like grass carp (*Ctenopharyngodonidella*), silver carp (*Hypothalmicthys molitrix*), common carp (*Cyprinus carpio*), pangasius (*Pangasio donhypopthalmus*), tilapia (*Oreochromis spp*), pacu (*Piranthus brachypomus*) and other catfishes are being cultured. Among these, recent trend of culturing pangasius and tilapia in India was highly predominant and fetch a high market price. In the polyculture system, hoist a combination of fish species having various food habits where, as in environmental state affect the part of the feed that is not taken up by fish and waste from one species can be as foodstuff for another in polyculture. Odisha is blessed with a myriad of water resources distributed all over its geographical area.

Disease outbreak observations were increased with the intensification of aquaculture *viz.,* high stocking densities, excessive use of supplementary feeds, manures, fertilizers, and other chemical and therapeutic agents (Mishra *et al,* 2017). The term diseases refers to various kinds of pathogens such as bacterial, protozoal, fungal, viral, and parasitic. It is hard to avoid all these phylogenetic

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divergent organisms, from neither wild nor rearing ecosystems by using any of the currently available treatment measures. Nevertheless, with proper preventive steps, we can combat this challenge from infectious diseases (Assefa and Abunna, 2018). On the other hand, non-infectious diseases in which, no biological agent like bacteria, fungi, viruses, and parasites are involved. Non-infectious diseases are due to a lack of balanced nutritional diets, and poor water quality conditions. This type of disease condition and other minor health anomalies might not contribute, to a large number of economic losses in semi-intensive and intensive fish farming. Yet, in small-scale farms, this turns to be a serious delinquent. This type of case reports related to minor health anomalies is seldom complied in extensive and natural-fed systems. However, they need to be addressed for better production.

Organic manure application in fish tanks

Medium and large-scale farmers prefer to choose inorganic manures for the fortification of pond water that helps in maintaining the quality of water. While, small scale farmers go for organic manure for the enrichment of pond water by corresponding the carbon and other nutrient ratios to overcome the costly affair of feed supplementation. The application of organic manures was also one way of farm waste disposal, in rural areas. Fish do also consume manure directly and release the metabolites out into the water for supporting the growth of plankton (Little and Edwards, 1999). Fishes like carps and tilapia feeding low in the food web are the best species for such management operation (Little and Satapornvanit, 1996). There are several types of organic manures; cow dung, poultry litter, and semi-liquefied pig manure are the widely used organic manures.

In the above-mentioned fertilizers, poultry manure is the top most used all over the world due to its high availability; high solubility good phosphorus levels, and lower prices. Nevertheless, it is considered hazardous material affecting the quality of water parameters. In addition to that, it also possesses huge amounts of pathogenic microbes (Petersen *et al,* 2002; Jha*et al,* 2008). A report by Guan and Holley, (2003) had found zoonotic pathogens can survive and persist above 4 m in raw manures. In the current case study, the observation was made in the field where poultry manure was used as a feed and fertilizer for the culture of fish.

The litter (OM) when added to fish tanks will contaminate the water and increases the Biological Oxygen Demand (BOD). It also accentuates the ectoparasite problem, leading to hemorrhages and lesions in fish. Again in control of parasitic infections, fish farmers usehighly toxic pesticides that penetrate the bio-cycle, posing a serious health hazard to the end consumers. The purposeful eutrophication of water leading to blooms of toxic blue-green algae has also been raised as an issue (Maclean, 1993).Neither poultry farmers nor fish farmers were aware of the serious issues involved but both have found easy solutions – the former's concern is to dispose of it the easy way and the latter sees it as a low-cost way of increasing the phytoplankton in their tanks.

MATERIALS AND METHODS

Study area

The case study reported in an extensive (traditional) culture farm atBhattachinchivillage. The current study area is located between geological coordinates 18.81° N Lat. and 82.71° E Long in Jeypore Block ofKoraput District, Odisha, India. The total area of the farm is 7.53 ha, with an effective water spread area (EWA) 5.8 ha. The four earthen ponds were used to stock three species, EWA, stocking particulars of each tank was given in Table 1.

Pre-and post-management practices adopted

Stocking of fishes was done at the stage of juveniles of size 50 – 70 g weight. During the culture, the application of manures was done by scattering two times, for the entire four months of

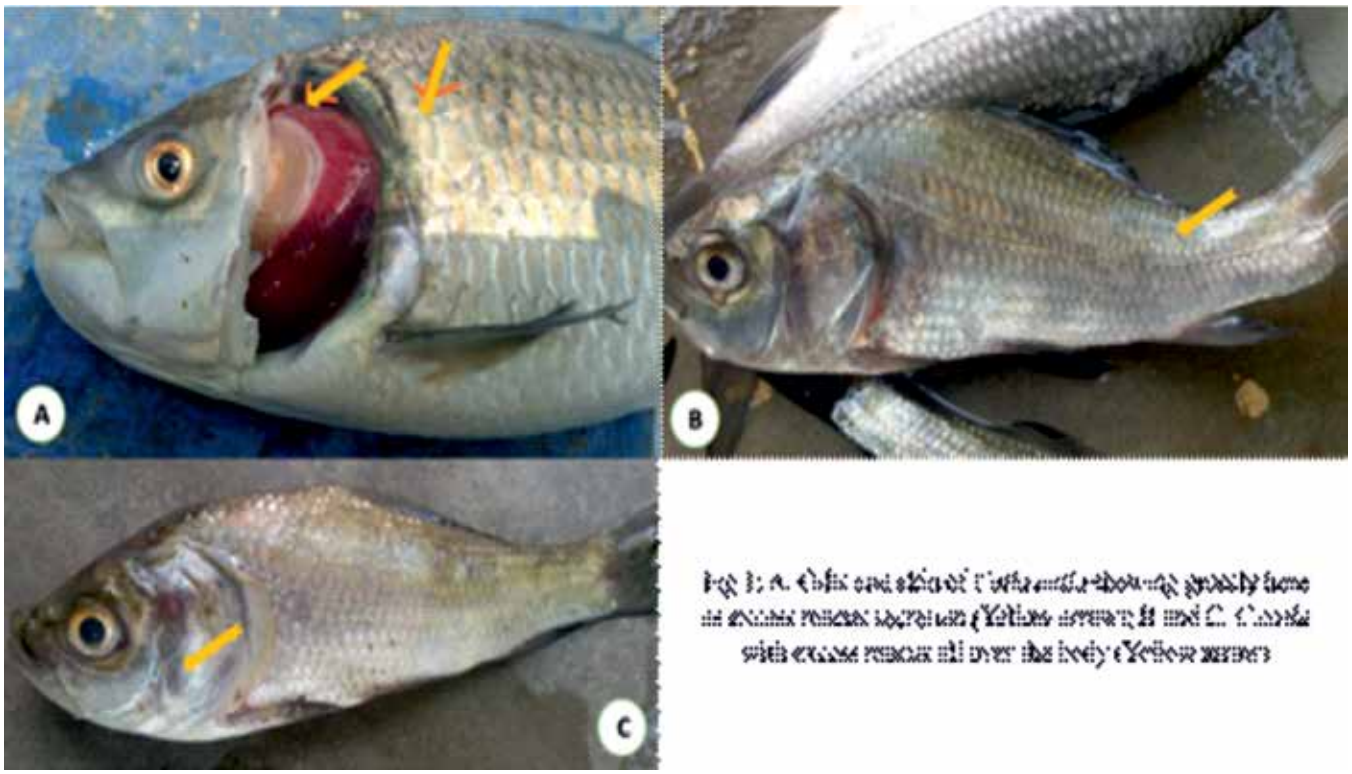
Table 1: Details of the fish tank size and stocking densities.

Tank number	EWA in ha	Depth in mt	Species stocked	Stocking density
1	2.0	1.5 m	Rohu, Catla	7,000 (Rohu)+ 2,500 (Catla)
2	1.6	1.5 m	Rohu	7,500
3	1.2	1.5 m	Rohu	5,500
4	1.0	1.5 m	Pangasius	6, 500

culture period to maintain the plankton density. Chicken droppings were used as organic fertilizers in all the four ponds at the rate of 100 kg/ha/month. The application of poultry manure acted as feed and fertilizer as well by supports the growth of live-food organisms such as algae, bacteria, and allied micro-fauna. After manure application, primary production in water was observed through the development of dense phytoplanktongroup.Also, the culture tanks were fed with locally available ingredients like groundnut oil cake (GNOC) and rice bran(RB) twice a week.

Abnormal fish behavior in the study

In this polyculture, Catla was noticed to be the most vulnerable fish with excessive mucus production in Tank no. 1. Nearly, 30 per cent of the fishes were showing signs of morbidity and around 10per cent of fishes died during the study period. A thick deposit of mucus or slime on the body and gills were noticed in dead and moribund fishes (Fig. 1). Other clinical signs like pale gills, hemorrhages, parasitic infection, and dropsy were absolutely absent. In the month of March 2018, the culture was initiated, after 4 months culture period *i.e.*in mid-July the signs of abnormalities were observed in a large size fish of weight 450 – 650g. During



this situation, basic water quality parameters were monitored and the average readings were given as follows: Temperature (26 to 31ºC), pH (6.2 to 7.0) and Dissolved oxygen (4.1 to 5.2).

Treatment

In an attempt to salvage crop loss and improve yields, farmers resort to using therapeutics. In early stages, the farmer unknowing choice was usage of antibiotics (Enrofloxacin) for the treatment of fish. Even though there was no improvement in condition neither in mucous production nor in die-offs. During the observations we recommended, to go for 30-50 per cent of water exchange, application of agriculture lime @100-200 kg/ha, Common salt @ 15-25 kg/ha. However, the farmer applied lime @ 150 kg/ha. Again after the treatment, water quality parameters were tested for few days at regular intervals, the average readings were given as follows: Temperature (26 to 31ºC), pH (6.8 to 7.5) and Dissolved oxygen (4.8 to 5.7).

RESULTS AND DISCUSSION

In general, the prime reason for the huge shedding of mucus will be due to either bacterial or parasitic infestation on the epithelial layer of fish skin and gills (Whitman, 2004). Sometimes, eutrophication, algal blooms of harmful algae may also lead to the production of high mucus (Roberts, 2012). During this investigation, it was noticed that farmers were administrating antibiotics without any confirmation of the causative agent (etiological agent). Moreover, the pond was treated with Enrofloxacin, which was a strictly banned antibiotic in Indian aquaculture. However, this treatment did not show any kind of result in the management of abnormality. Clarifying the cause of the abnormality is not a bacterial origin, as antibiotics are highly effective against bacterial infections (Treves-Brown, 2013).

Use of chicken manure

Chicken manures are virtuous sources of phosphorus content, a major limiting nutrient in freshwater environments. Several researchers described the application of processed poultry litter in fish farming and integrated fish culture practices (Bhatnagar and Devi, 2013;Little and Satapornvanit, 1996) were in agreement with sustainable aquaculture. An increase in the fish yield concerning inclined algal productivity was observed by the addition of an appropriate amount of poultry manure as fertilizer in the culture system (Kang'ombe*et al*, 2006). Nevertheless, few reports were also published in favor of various adverse effects of using raw chicken litter (Kyakuwaire*et al,* 2019). Moreover, the above authors recommended using fermented chicken manure instead of raw chicken manure to reduce microbial load and yield good quality fish. Usages of raw chicken manure in high quantities are considered to risk due to excess loads of nutrients, deterioration of water.

In contrast, in this case, ponds were excess fertilized with raw chicken manure nearly 1 kg/ m^2 (10000/ha) twice in the initial four months of culture. Whereas, the recommended dose of 100-200 kg/ha/day (6000 kg/ ha/month) (Schroeder, 1978) and in the tilapia farming it is recommended to apply 5000 kg of droppings/ha/year with 5 per cent supplemented feed (Njoku, 1997). Application of manure at high doses can cause deterioration of water and lead to blooms of toxic blue-green algae and indirectly results in depletion of oxygen and pH levels were also been reported as an issue of concern (Maclean, 1993).

Effect of pH

The pH was noticed to be lower in comparison with optimal levels. Restriction over the usage of poultry manures and the application of lime facilitated to maintain the water pH fluctuation. After 15d the fishes were further examined, there were no signs of physical damage or slime secretion and within that period no mortality absorbed. Thus, confirming the case to be resulted due to adverse water quality issues (especially pH) which got deteriorated with the application of inappropriate doses of chicken dropping.

During the process of water exchange, and sample netting abnormal fish found were given a

salt bath with proper aeration as 10 g salt/l of water for 30 min. Further, treated fish were released into the pond, and turmeric was incorporated with groundnut oil cake and rice bran mixture as per the inclusion rate decided. The herbal feed was continued for a period of 15d, later the fishes were further examined. Lime was applied to maintain the water pH fluctuation and resulted in declining the problem of excess mucus production and further mortality was limited to a larger extent. Ideal water quality parameters were the key corner for successful fish farming (Bhatnagar and Devi, 2013).

Use of antibiotics

Besides that, often avianswere fed with antimicrobials/prophylactics for controlling bacterial diseases during production and this can develop antibiotic resistance in the gut bacteria. After the application of this manure to the fish pond, there is a chance of horizontal gene transfer (HGT also known as lateral gene transfer) of resistant genes into the aquatic microflora that includes fish pathogens. Thus, this encourages the emergence of potent antimicrobial-resistant (AMR) strains ending with disease outbreaks (Aly and Albutti, 2014). Additionally, presences of *Escherichia coli* and *Salmonella* spp. enteric bacterial pathogens which are of public health concern (Kyakuwaire*et al,* 2019).

In the study, Catla was the severely affected fish, during early morning time; since it is one of the sensitive fish among carps. EspeciallyCatla was more sensitive to pH fluctuations and inputs such as fertilizer and feed should be avoided to ensure optimum growth of this species (Das *et al,* 2006). Excess mucus is also due to variation in the physiological ions balance in the fish such as calcium and magnesium or hardness. These minerals are essential for the intra and extracellular homeostasis (Jobling, 2012).

CONCLUSION

The present investigation addressed the adverse effects of using unprocessed poultry litter in fish farming. Such use, especially at high intensities can decline the pH levels, which in turn influences the physiological ions balance resulting in excess mucus production and mortality. Optimizing the water quality parameters by limiting the use of raw poultry manure and application of lime had solved the concern of interest.In conclusion, antibiotics must bethe last option of treatment. The antibiotics usage in aquaculture was of a more serious concern than terrestrial and human purposes. Thus, it is recommended to provide an adequate education for the farmer communities through professional fisheries/veterinary graduates to prevent the disastrous development of antibiotic resistance in export commodities and domestic consumption of farmed fishes in India

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