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Status of biosecurity and prevalent parasitic diseases in finfish hatcheries of Jessore, Bangladesh

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Abstract

The present study was conducted to know the status of biosecurity and prevalent parasitic diseases in finfish hatcheries of Jessore district. The peak season of seed production was found April to May. Management of biosecurity has been practiced to prevent disease outbreaks and exert quite satisfactory. It was observed; hatchery owners cleaned their hatchery units regularly and maintained hygiene (76.66%), water quality (56.66%), disinfected equipments (76.00%), stocked disease free broods (76.00%) and quarantine (56.66%). Prevalence of diseases were- lernaeasis (34.10%), argulosis (23.86%), leeches (11.36%), dactylogyrosis (7.95%), gyrodactylosis (10.23%) and others (12.50%) in brood fish and fry. In broods, average prevalence was 16.67% with 9.25% mortality. Besides average prevalence was 10-15% with 10% mortality in fry. The epizootiological pattern showed the highest frequency of parasitic diseases during winter because of loss of appetites. The study demonstrated that sumithion was used by (93.32%), magic (46.33%), depterax (56.67%), lime with $KMnO_4$ (80.00%), lime with salt (66.67%) and lime- salt- $KMnO_4$ (50.00%) by hatchery owners respectively for treatments. Lack of assistance, proper knowledge and suitable therapeutics with its proper use were the major problems in the hatcheries.

Keywords: Finfish hatchery, biosecurity, parasitic diseases, Jessore

INTRODUCTION

Success of aquaculture production depends mostly on uninterrupted and timely supply of quality fish seed. The supply of fish seed earlier depended on the collection of naturally produced fry from different wild sources. The natural sources of seeds become declined due to the consequences of environmental degradation and other anthropogenic consequences. As a result dependency on artificial fish seed production and distribution increased considerably over the last 30 years. To meet the present demand and considering future potentials, a large number of hatcheries have been established in different parts of the country. Currently total numbers of government and private fish hatcheries are 76 and 931 respectively and both of their production was 629175.53 kg during 2010-11 (DoF 2012). Although there seems a huge success of fish hatcheries in producing large quantity of seeds, there is a question mark of their quality. Farmers often complain about twisted body, spinal deformities, poor growth, susceptibility to disease of hatchery produced fry.

Disease is one of the major constrains to aquaculture and may eventually become a limiting factor to the economic success of the emerging fish hatcheries. Most of the hatchery operators do not have good understanding of health and disease issues in their system. Also, there is no

health certification system or diagnostic laboratory in Bangladesh to check the health status of fish brood and seed. As a result, fish farmers do not know whether their fish had been carrying pathogens prior to stocking.

In a recent study, a number of diseases in brood fish and spawn in different hatcheries of Mymensingh, Jessore and Bogra districts of Bangladesh (Yamin 2007). Hatchery owners reported some diseases in brood which included argulosis (34.09%), epizootic ulcerative syndrome (EUS) (28.41%), gill rot (9.09%), dropsy (11.36%) and nutritional diseases (5.68%). The prevalence of disease in brood fish was about 15-20% with 5-10% mortality of infected fish. Diseases were more frequent in winter season and after striping when the fish became weak. The prevalence of disease in fry was about 5-10% with an average mortality rate of 10% (Faruk *et al.* 2004). The average prevalence of diseases in brood fishes was about 15-20% which varied hatchery to hatchery. Hasan and Ahmed (2002) worked on some issues of finfish hatcheries and nurseries in some selected areas of Bangladesh. They reported 7.60% loss of net profit in carp hatcheries and nurseries due to diseases.

Parasitic diseases in hatchery are one of the most important factors limiting the growth and survival of fry and fingerlings. Diseases caused by parasites are no exceptions, and only a few cases have so far been documented in wild populations (Jones 2005). Gill myxoboliasis, caused by *Myxobolus* and *Henneguya*, has caused heavy losses in Indian major carps, mainly Catla catla in Bangladesh. Hossain *et al.* (1994) reported that 61% of carp fry in nurseries of the greater Mymensingh district were infected with ectoparasites. The highest mortalities of carp fingerlings were due to the infection by *Trichodina*, *Myxobolus* and *Dactylogyrus*. Chandra *et al.* (1996) reported high prevalence of myxosporeans in juvenile Indian major carps (*Labeo rohita* and *Cirrhinus cirrhosus*) in nursery ponds of Mymensingh. They reported severe gill infections caused by five species of the genus *Myxobolus*. Heavy mortalities of carp associated gill myxoboliasis have raised concern among Bangladeshi fish farmers (Chandra *et al.* 1996). Ahmed (2004) reported that the freshwater louse, *Argulus* caused mortality, growth loss and economic loss to the carp farms and hatcheries. Ahmed (2004) also developed an environmentally friendly treatment for *Argulus* in carp brood stock ponds in Bangladesh.

Establishing biosecurity in aquaculture facilities is very important to prevent or restrict the introduction and spread of disease within or between fish production facilities. A biosecurity program is comprised of a variety of practices, policies and procedures used on a farm in order to reduce the risk that pathogens introduction, their spreading and reduce conditions that are stressful to the fish (Bebak 1998).

It is thus important from an economic point of view, for fish farming that we have knowledge of the occurrence of parasite in freshwater fishes. Once we have sound background knowledge, it may at least be possible to avoid undesirable human interference in natural waters, and even to control some of the more harmful parasites.

METHODOLOGY

Study area and duration: The study was carried out in the finfish hatcheries, located at the Chanchra area of Jessore district, Bangladesh (Figure 1). Study duration was one year, from March 2012 to January 2013.

Figure 1: Map of Jessore district showing the study area, Chanchra (Source: Banglapedia 2014)

Data collection: Thirty out of eighty eight hatcheries were randomly selected during the study period for data collection. The data were collected on monthly basis through a structured questionnaire. After finalizing the questionnaire, direct interviewing of the hatchery owners or hatchery managers were carried out. In order to minimize errors, data were collected in local units. These were subsequently converted into appropriate units.

Data analysis: Collected data were analyzed using Microsoft Excel 2007.

RESULTS

Status of the hatcheries: Most hatcheries in the study area were involved in producing seeds of monosex tilapia (*Oreochromis niloticus*), Indian major carps (*Catla catla*, *L. rohita* and *C. cirrhosus*) and Thai pangus (*Pangasianodon hypophthalmus*). It was found that 18 hatcheries produced only carps, 6 hatcheries produced only

monosex tilapia, 3 hatcheries produced carps with tilapia, 2 hatcheries produced carps with Thai pangus, and the rest 1 hatchery produced seeds of all the mentioned species.

The hatchery activities were found to be started from late February or March and continued up to August or September with a peak from April to May. The duration of hatchling cycles in hatcheries was about 4-5 days and the number of cycles per year was between 30 and 35 depending on size and facilities of hatcheries. Hatchery owners in the study area got the highest output in March-April and the lowest in May-June. The highest demand for fry started from April and continued until June while the lowest was found from November to January. It was observed that 3 types of lands were used to establish hatchery facilities which included leased land (35%), owned land (12.5%) and owned with leased land (52.50%).

Status of biosecurity in hatcheries: Biosecurity status in the hatcheries was assessed through some selected activities or measures that have generally been practiced to prevent or spread of diseases which are summarized in Table 1. 76.66% hatchery owners maintained general hatchery hygiene carefully. They always cleaned their essential equipments *i.e.* nets, buckets and tanks. In 21 hatcheries (70%) the disinfecting method maintained properly. They usually used potassium permanganate ($KMnO_4$) as disinfectant. In all hatcheries (100%) hatchery units were cleaned as per required. About 70% hatchery operators used disease free broods for stocking into the brood ponds.

Hatchery operators confirmed the health status of brood just clinically not by any laboratory test. 56.66% hatchery owners found to quarantine incoming broods. It was found that they kept new broods in separate tanks for few days before releasing into the brood pond. They used underground water supplied via deep tube well. 66.67% hatchery owners removed dead fry and spawn from their facilities when required. No hatchery owner was found to use any vaccine to their brood fish (Table 1).

In the present study, majority (83.33%) of the hatcheries maintained disease monitoring program regularly. None of the hatcheries found to be used protective clothing for their own staff or visitor. For maintaining good health, 73.33% hatchery owners always supplied nutritional feed for their brood fishes. Restriction of movement inside hatcheries was not a common practice and there was no hatchery maintained this biosecurity measure (Table 1).

Sources of broods: Collection of brood fish from different sources by hatchery owners is shown in Figure 2. Eighteen hatcheries collected brood from Bangladesh Fisheries research Institute (BFRI), 3 hatcheries used their own brood and 1 hatchery collected from other hatcheries. Only 2 hatcheries collected brood from natural sources like Halda and one from Jamuna River and rest 6 hatcheries collected from brood bank.

Table 1: Status of biosecurity in finfish hatcheries

Activities	*No. of hatchery*	*Percentage (%)*
Maintenance of hatchery hygiene	23	76.66
Cleaning of hatchery units	30	100.0
Disinfection of equipments	21	70.00
Use good water	18	60.00
Quarantine procedure	17	56.66
Stocking disease free brood	21	70.00
Removal of dead fry/spawn	20	66.67
Water quality monitoring	17	56.66
Disease monitoring	25	83.33
Supply nutritional feed	22	73.33

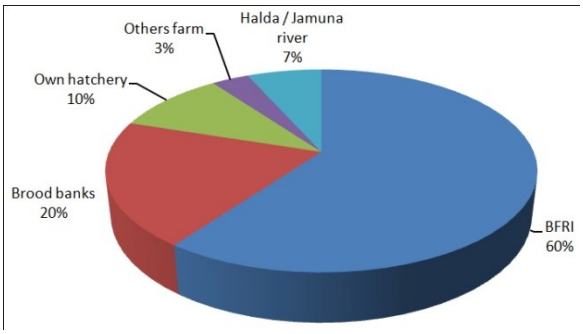

Figure 2: Sources of brood fishes

Disease of brood fish: The occurrence of parasitic diseases in brood fish is shown in Table 2. The prevalence of parasitic disease was 16.67% while the mortality was not that much, only 9.25%. Parasitic diseases were more frequent in winter season and after striping when the fish become weak.

Table 2. Types of diseases and prevalence

Diseases	*No. of affected hatchery*	*Prevalence (%)*
Lernaeasis	30	34.10
Argulosis	21	23.86
Leeches	10	11.36
Dactylogyrus	7	7.95
Gyrodactylus	9	10.23
Others	11	12.50

The mortality of fish depends on the quality of brood fish, hatchery conditions and monitoring systems. The percentage of mortality determined by the approximate

assumption of the respondent hatchery owners. The average mortality rate, due to these parasitic diseases, was 9.25% (Figure 3).

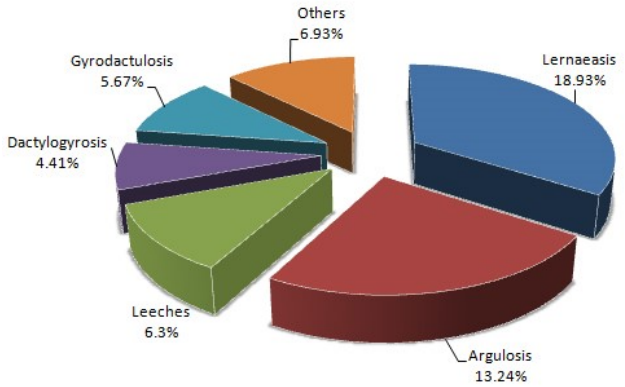

Figure 3: Mortality rate of fish due to various parasitic diseases

Diseases in fry: Parasitic disease was found common in fry. The prevalence of disease in fry fish was 10-15% with an average mortality rate of about 10%. Moreover it was found that 57% studied hatcheries were free from deformities in fry and remaining hatcheries faced some sort of deformities. Physical conditions and temperature stress caused fry mortality. Some fry were died in hatcheries due to high temperature, electricity failure and negligence of duty of operators.

Disease occurring season in hatchery: In this study, majority 73% hatchery owners reported that they recorded disease during winter season (Figure 4). Most of hatchery owners sold diseased fish and few of the hatchery owner reported that they did not do anything with the diseased fish.

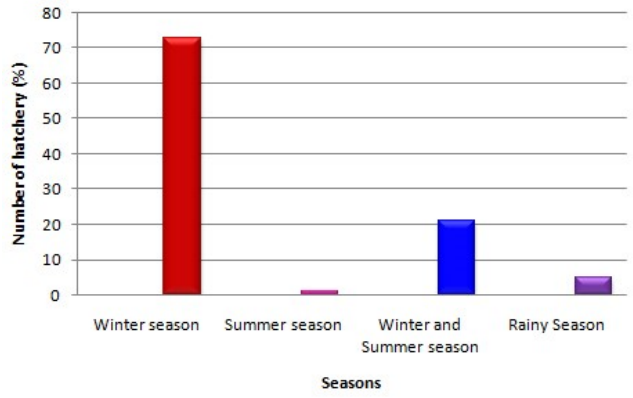

Figure 4: Disease occurring seasons in finfish hatchery

Treatment of parasitic disease affected fish: About 90% hatchery owners undertaken some health management practices in response to disease problem. A number of measures were reported for health management of brood fish. Liming was the most common practice followed by application of salt, $KMnO_4$, sumithion, dipterax, magic etc. It was found that highest number of hatchery owners (93.32%) used sumithion. Some owners did not treat their diseased fish at all. No hatchery used any antibiotics which are shown in Table 3.

Table 3: Chemicals used for disease treatment

Chemicals	*No. of hatchery*	*Percentage (%)*
Sumithion	28	93.32
Magic	13	43.33
Dipterax	17	56.67
Lime and $KMnO_4$	24	80.00
Lime and Salt	20	66.67
Lime, salt and $KMnO_4$	15	50.00

Reporting of diseases to the relevant organizations: It was found 16.67% hatchery owners contacted to the freshwater sub-station of BFRI at Jessore and 13.33% to the Upazilla Fisheries Officer (UFO) for solution and 70% owners did not contact anyone.

Problems in treating diseases: The hatchery owners faced several problems when they encounter particular parasitic disease in their hatcheries. These included lack of trained person for application of medicine (3.00%). Assistance in managing health from non-governmental organization (NGOs) and government organizations was also very low. Apart from health management problems the hatchery owners motioned they were having problems with water supply.

DISCUSSIONS

Quality fish seed production is the prerequisite for sustainable aquaculture. Over the last two decades Bangladesh became self-sufficient in producing and distributing fish seed to the users but the quality has been deteriorated. Different types of pathogenic organisms, negative selection of broods, Inbreeding, inter-specific hybridization, and improper brood stock management are quite common problems especially in the private hatcheries. These factors result in quality deteriorate of fish seeds, low growth rate, high mortality, deformities, and disease problems and less fecundity (Hussain and Mazid 1997).

Production of quality seeds in a hatchery mainly depends on the proper maintenance of the brood-stock. In this study it was found that the maintenance of the brood-stock by the hatchery owners was quite satisfactory. The hatchery operators used healthy and disease free broods and also maintained proper age and weight of the broods during spawning. This is the main reason that they would able to produced quality fry. Although in lower incidence, deformed fish fry was reported by the hatchery owners

which may be due to the use of some poor quality brood stock for seed production. Furthermore, occurrence of deformed larvae was found common for spawn produced late in the breeding season.

The present study revealed that the most prevalent parasitic disease is lernaesis, argulosis, leaches, dactylogyrosis and gyrodactylosis. This result is quite similar with the study conducted by Faruk *et al.* (2004) and Mazid (2001). The average prevalence of these diseases was 16.67% where the highest prevalent disease was lernaesis (34.10%) and the lowest prevalent disease was dactylogyrosis (7.95%).

This was due to the higher stocking density, inexperience hatchery owners, poor input and poor understanding of fish health management (Faruk *et al.* 2004). A few years ago, most of the hatchery owners reported argulosis as the major problem mainly in the carp brood stock ponds in the study areas which the farmers could easily recognize. Ahmed (2004) reported that the freshwater louse, *Argulus* causing the disease argulosis has become a major threat to the fish farmers in Bangladesh as it induces mortality, growth loss and economic loss to the carp farms and hatcheries. In the present study, it was found that most of hatchery owner reported that lernaesis is major problems in finfish hatchery at Jessore region. This disease is caused by crustacean parasitic infections and widely found in Indian major carp, especially in brood fish. It causes heavy mortality of broodstock (18.93%) and fish seeds. All the parasitic infectious disease reported by the hatchery owners, could not be confirmed by laboratory study. It would have better if laboratory diagnosis could be performed with diseased fishes to identify the pathogens involved in different types of parasitic diseases.

This study exposed that, most of the diseases in the study area occurred during winter season. Similar conditions were also reported by some other researchers (Faruk *et al.* 2004, Mazid 2001, Chandra 1996). During this time the water level of broodstock ponds dropped to the minimum and the water quality also become poor. The immune system of fish suppressed during this time due to low temperature.

Though some hatchery owners were found to keep the newly collected brood in separate tank they actually did not maintain proper quarantine procedure. The time interval required for a quarantine period can vary, but will generally take between 45-60 days. During this time, the fish can be closely monitored for clinical signs of disease, sampled for diagnostic health techniques, and treated if warranted. Maximum of the hatchery owners maintained their hatchery hygiene and disinfected equipment quite regularly. Post (1987) mentioned that fish pathogens can be transferred from holding unit to holding unit via the fish and rearing waters, and also on shared equipment and by personnel. Therefore, disinfection of materials, hands and footwear to prevent transfer of disease pathogens is a commonly used some chemicals in finfish hatchery.

Hatchery owners in Jessore region used $KMnO_4$ as disinfectant. An important method of disease prevention is providing hatcheries with pathogen-free water source. In the present study, underground water lifted through pump was the primary water source of almost all hatcheries though these are susceptible to risks associated with dissolved gases (Delabbio *et al.* 2004). However, the majority of hatcheries measured water temperature, dissolved oxygen levels, and pH quite regular basis. No hatchery owners in Jessore region were found to use any vaccine to their brood fish. This was obvious because currently only few vaccines are available against fish disease most of which are for salmon, trout, and catfish. Use of vaccines does not prevent the introduction of parasitic pathogens. Vaccination of fish against a certain pathogen reduces the infectious load of the pathogen within a population and therefore reduces infection pressure on a population (Delabbio *et al.* 2004).

Different types of chemicals are used by the hatchery owners at Jessore region for the treatment of parasitic diseases. The most prevalent disease lernaesis is treated by sumithion or dipterax. The dose of this treatment was found to apply as 80-160 gm sumithion per 33 decimal and the duration of this treatment was 6-7 days. Salt, lime and potash are used to treated leach. Magic, salt and lime are used for controlling argulus. Potassium permanganate and sodium chloride are used to removing dactylogyrus and gyrodactylus. Ashburner (1983) revealed the application of trichlorfon at a range of 0.5 mg/l active ingredient with indefinite bath; repeat every 7 days for 28 days prevent the infestation of *Lernaea* (anchor worm). Repeated treatments might be required to prevent re-infestation by emerging larval stages of *Lernaea*. The number of drugs and chemicals approved for treating diseases of fish and shellfish is limited. Currently, 39 chemicals are approved for use in aquaculture. Five other compounds (povidone iodine, quatemary ammonium compounds, potassium permanganate, copper sulfate, and diquat dibromide) are approved for use in treating cutaneous bacterial infections or external parasites (Meyer and Schnick 1989).

In this study it was found that, the reporting of fish disease by the hatchery owners was very low which was due to the lack of awareness about fish disease and also due to lack of reporting places or diagnostic laboratory

from where hatchery owners can get advice and other support service. As a consequence there were severe lack of taking preventive and treatment measures by the hatchery owners. Hatchery owner's response to disease problems was generally application of chemicals, with little understanding of their effectiveness, when better result might have been obtained by changes in management practice.

CONCLUSION

Production of quality seeds in a hatchery mostly depends on maintenance of proper quality of each unit present in a hatchery. Parasitic diseases in a hatchery have become an alarming factor which may be controlled by taking appropriate biosecurity measures. From the findings of this study it may be concluded that maximum hatchery owners of the study area face enormous problems during production cycle which may cause considerable losses of them. Considering this condition Government and Non-Government organizations should come forward and take indispensable steps to resolve these problems.

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