Prevalence of Parasitic Diseases in Carps in *Bheries* of West Bengal, India

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Abstract

Parasitic prevalence is more in carps in *Bheries* of West Bengal region, India because all the farmers are using seawage waste water for their culture. The seawage water contains 99% of water and 1% of other materials include pathogens like bacteria, virus, and large parasites include external, internal parasites. It can cause first primary infection, it is the main source for the secondary bacterial infection and it can cause mortality in culture fishes. The farmer has so much economic loss due to this parasitic diseases. It very important to study the parasitic diseases in *Bheries* of West Bengal region.

1. Introduction

Parasitic diseases in *Bheries* (enclosed field having standing water, locally termed as this) of West Bengal is more prevalence than other states. The main reason is the farmer of *Bheries* in West Bengal mostly they are using seawage water of Kolkata, without any treatment. The seawage water contains 99% of water and 1% of other materials include pathogens like bacteria, virus, and large parasites include external, internal parasites. Not only this it contains viruses, organic and inorganic substances present in molecular colloidal or liquid waste from kitchen and bathroom, but exclude faecal matter and urine. Parasite of fish can either be external or internal. Parasitic infections often give an indication of the quality of water since parasites generally increase in abundance and diversity in more polluted waters (Poulin, 1992; Avenant-Oldewage, 2002). 1% of all pathogen causing severe problems in *Bheries* of West Bengal. But farmers are not taking any remedy in *Bheries*, sometimes they are applying lime. One of the major issues in fish production through the aquaculture is loss associated with disease. Improper and faulty management practice followed in fish culture system are often stressful to fish. Under stress condition, fish suppresses the immune responses and alternatively pathogen attack take place subsequently suffer from disease. The farmer should strive to decrease the stress causing factors and take appropriate measures to present the entry of pathogenic organisms by strictly adhering to the fish health monitoring programme.

2. Effect of Aquatic and other Life

In West Bengal, the sewage-fed *bheries* where fish are reared in nearly 4,000 ha of water area can be cited as an example where, although it is a unique and inexpensive system of rearing fish. The ecological conditions limit the average production to only 1,500 to 2,000 kg ha^{-1} (Patnaik, 1990). Water quality is creating stress to fish. Here, the high microbial consumption of dissolved oxygen (1.8 mg L hr^{-1}) indicates exhaustion of dissolved oxygen for a few hours at night, creating stressful conditions for fish. Moreover, un-ionised ammonia levels are also high. Organic waste under the influence of bacterial action deplete the dissolve oxygen by consuming it in biochemical oxidation reaction. This may suffocate the fish and other aquatic animals. With mild pollution fish may acquired a flavour that renders their flesh unfit for use as a food, where as the more severe contamination the fish become more stress,

so pathogenic attack is more; so fish gets sick or disease and finally die. Parasitic infection and diseases were some of the factors hindering high productivity in fish farming (Doglel et al., 1961; Kayis et al., 2009).

3. Effect of Public Health and Safety

The principal hazard to public health from polluted stream are mainly due to the presence of pathogenic bacteria from domestic seawage, toxic materials (acids, alkaloids, specific poisons like cyanide and heavy metals, salts) and from industrial wastes. Danger to the public health from pathogenic microorganisms and parasites contains fish food. These parasites produce the toxins which can cause adverse effect on public health.

4. Why are Diseases Important to Aquaculture?

So much economic loss in each different year (shown Table 1). 1971: *Flexibacter columnaris*, a bacterium, kills 14 million wild fish in Klamath lake. The Idaho trout industry loses 10% on every dollar made to disease (death, weight loss). In Asian developing countries, economic loss estimated was at least US $1.4 thousand million due to diseases in 1990 alone. Reports from China suggested losses of US$ 1 thousand million due to shrimp viral disease outbreaks in 1993. According to a World Bank report, global losses due to shrimp disease are around US $3 thousand million.

5. Common Parasitic Diseases in *Bheries* of West Bengal

Diseases in aquaculture are not only caused due to single event but are the end results of a series of linked events involving the interaction between the host, the environment and the presence of pathogens (Figure 1) Pathogens may may include viruses, bacteria, parasites, fungi, either a single species or mixture of different pathogens may cause diseases.

An important investigation of fish diseases in India was carried out by Paria and Konar (1999) in West Bengal in 1994-96. The survey included 17 districts, covering a total of 1,332 impounded water bodies selected at random. Estimates of the prevalences of various diseases seen in the ponds are given in Table 6. The prevalence of EUS ranged from 32.7 to 72.7%;

Table 1: Available estimates of economic losses due to Epizootic Ulcerative Syndrome (EUS)

Country	Year	Amount
Thailand	1983-1993	US$ 100 M
Bangladesh	1988-1989	US$ 4.8 M
Indonesia	1980-1987	US$ 235 000
Pakistan	1996	US$ 300 000
Eastern Australia	Annually	US$ 700 000
India (Bihar, Orissa and Kerala)	1989-1992	US$ 870,000
Sri Lanka	Up to 1993	US$ 800,000

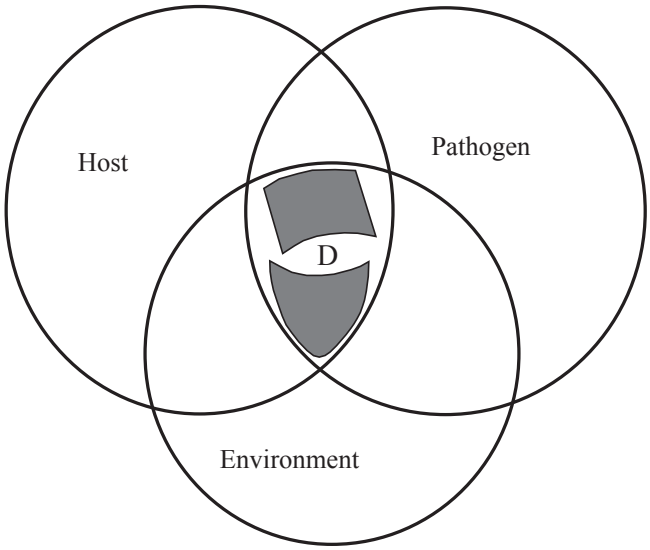

Figure1: Interaction between the host, the environment and the presence of pathogens (D=Disease)

argulosis, from 0.8 to 9.8%; malnutrition, from 10.0 to 32.3%; gill rot, from 8.3 to 34.4%; dropsy, from 3.3 to 14.4%; tail and fin rot, from 2.4 to 10.4%; tumours, from 0.8 to 7.3% and fungal diseases, from 1.1 to 2.2%.

5.1. Disease problems in bheries

According to M.C. Nandeesha (2002) in sewage fed farms, bacterial diseases are not common. Even when there were problems with Epizootic Ulcerative Disease (EUS) in recent years with carps in other areas, carps in these sewage-fed ponds remained uninfected. However, parasitic infections by *Lernea* (anchor worm) and *Argulus* are common and there is a need to develop techniques for the control of this problem. Parasites can divided in to external and internal parasites. Ecto-parasites were the most dangerous group that causes severe mortalities (Shalaby and Ibrahim, 1988). About 80% of fish diseases were parasitic especially in warm water fish (Eissa, 2002).

5.1.1. Bacterial diseases

Bacterial diseases are frequently encountered in all stages of fish causing heavy mortality and production loss. These microorganisms become pathogenic when fishes are immunocompromised by some forms of stress. Bacteria, that are significant pathogens of carps are predominantly gram -ve types. These pathogens come in contact with their potential host either being carried over by water or by direct contact or by their presence in the food. Depending on the virulence and immunological status of the host, the symptoms of the disease are expressed in various forms. Some of the common bacterial diseases encountered in carps are given in Table 2. To know the bacterial disease status of the fish, study was conducted in three major aquaculture zones of India viz. coastal areas of Orissa (Zone I), 925 km^2 area of kolleru lake of Andhra Pradesh

(Zone II), freshwater and wastewater aquaculture areas of West Bengal (Zone III). Information regarding different culture practices and disease status, collected from progressive fish farmers and state fisheries department officials from the year 2003-2005 along with the disease incidence data from 1999 to 2003 obtained from fish health management division of CIFA, were analysed. Bacterial diseases such as dropsy, columnaris, ulcer, septicaemia, fin rot/ tail rot, bacterial gill disease and diseases due to mixed bacterial infections were recorded in all the three-aquaculture zones.

5.1.2. Fungal diseases

Fungal spores are ubiquitous in all freshwater system (Table 3). Fungal infections of fish by omvicetes, commonly known as water moulds, are wide spread in freshwater ecosystems affecting cultured fishes, Usually fungal diseases occur by secondary infections, poor tarn management practices, infestation etc. But there are several reports of these occurring as primaryinfectious agents of fish. Major groups of fungus causing fish disease belong to achyla, aphanomyces, branchiomysis, fusarium etc. Among these, saprilegnea, branchimysis are more specific for carps. But sapralegnia is considered as dreaded disease since itaffects fish at all stagesand even fish eggs.

5.1.3. Protozoan diseases

Investigation by Roger and Gainer, 1975 and Charkrof, 1976, had shown the gills to be infested by different protozoan parasites Protozoan diseases are among the most significant of all parasitic diseases. Large scale mortalities of fry and fingerling of carp species are common due to such infections. Most of the organ systems are infected by these parasites, which can cause mortalities in fish. Protozoans become pathogenic to their host and can cause clinical disease when the fish becomes immunosuppressed or otherwise debilitated, perhaps due to adverse environmental conditions. Some found/ isolated frequently in carp are given in Table 4.

Table 2: Incidence of different bacterial disease in different Indian major carps in Zone III (freshwater and wastewater aquaculture areas of West Bengal)

Disease	Zone III (freshwater and wastewater aquaculture areas of West Bengal)
Dropsy	12.18±2.52
Columnaris	13.80±1.56
Ulcer	11.9±1.81
Septicaemia	8.14±1.45
Fin rot/ tail rot	10.7±2.02
Mixed bacterial infections	6.0±1.29
Bacterial gill disease	16 .14±2.24
Others	21.14±4.32

5.1.4. Helminth diseases

Worm diseases of fishes are caused by the groups monogenia, digenia and cestodes. Although many of them do not cause much harm to carp species, these parasites in association with other parasite groups cause serious damage to the host fishes resulting in growth retardation and mortality. Among monogenetic trematodes, *Gyrodactylus* sp. and *Dactylogyrus* sp. are most important. *Dactylogyrus* infects the gill whereas *Gyrodactylus* is affects only skin. Some of the common helminth diseases in carps are listed in Table 5.

5.1.5. Crustacean diseases

Crustacean parasites are frequent'y found to infest fishes. These are mainly ectoparaites and 3 groups viz. Branchiura (*Argulus* sp.), Copepoda (*Lerrnae* sp., *Ergasilus* sp.) and Isopoda (*Isopod* sp.) are responsible for fish diseases. Among these, two crustacean parasites, *Lernea* sp. (anchor *worm)* and *Arguius* sp. (fish louse) are most wide spread and commonly found parasitiziing major carp species and sometimes causing large scale damage in nursery, rearing and stocking ponds. However, low infestations of crustacean parasites do not cause serious damage to fish except causing irritation and localized ulceration. Some of the common crustacean diseases in fish are cited in Table 6.

5.1.6. Viral diseases

All known viruses are infective agents. They are often host-specific and in some instances, they have high specificity for certain tissues. As viral diseases of fish are geographically limited, disease free areas consider them as exoticdiseases. Although many viruses have been isolated from the carp fam-

Table 3: Common fungal diseases in carps

Disease	Causative agent	Organs affected	Symptoms	Cause
Saprolegniasis (ctton wool disease)	*Saprolegnia* parasite (in fish moulds)	Fins, gills, mouth, eye and muscle	White to brown cotton like patches, skin lesions, lesions of internal organs, fungal hyphae penetrating into dermis and muscle, fish become weak and lethargic.	Poor handling, high stoking decreased water level, netting injury.
Branchiomycosis (gill rot)	*Branchiomyces sanguinis*	Gills	Gill discolouration, gill necrosis, hyphae in blood capillaries.	Poor handling, high stoking decreased water level, netting injury.

Table 4: Common protozoan diseases recorded in carps

Diseases	Causative agents	Organs affected	Symptoms	Causes
Ichthyophthiriosis (white spot disease)	*Ichthyophthinus multifilus*	Skin, fins and gills	Cysts of white spots, respirstory stress, restlessness, excess mucus secretion, lifting and separation of gill epithelium.	Low oxygen level, raise in water level and temperature.
Trichodiniasis	*Trichodina* sp.	Skin, gills	Pale color gills, excess mucus secretion, mild hyperplasia, darkening and patches on skins .	High stocking, poor water quality.
Costiosis	*Ichthyboda necator* (*Costia necatrix*)	Gills and skin	Pale color gills, excess mucus secretion, blue grey film overskin and gills, hyperplasia of gill epithilum, erratic movement flashing.	Poor water quality.
Myxosporodiasis	*Myxosporidian* sp.	Gills, scales, skin, intestinal tissue.	Cysts on body and internal organs, excess mucus secretion, weakness, emaciation, necrosis and destruction of target tissue	Loe chloride content(<400) ppm, temperature fluctuation in winter.

Table 5: Common helminth diseases recorded in carps

Disease	Causative agents	Organs affected	Symptoms
Dactylogyrosis	*Dactylogyrus* sp. (gill fluke)	Gills opericula	Gill colour fades, excess mucus secretion, dropping of scales, restlessness, gathers near inflow of water and gaps for air, appear anaemic.
Gyrodactylosis	*Gyrodactylus* sp. (skin fluke)	Skin	Dark blue or opacity of skin, flashing, gather at water inflow and gaps for air.
Diplostomiasis (black spot disease)	*Diplostomium pigmentata*	Skin and eye	Black pigments on skin nodules, opacity of lens exophthalmia , blindness.
Ligulosis	*Ligula intestinalis*	Intestine	Abdominal distension, rupture o f wall, compression of visceral organs, retorted growth, decreased feeding.
Sanguinocolasis	*Sanguinicola inermis*	Heart and gills	Damaged and pale gills, bulging opericula, exophalmia, lethargy, emaciation, spiral movement.

Table.6. Common crustacean diseases recorded in carps

Disease	Causative agents	Organs affected	Symptoms
Argulosis	*Argulus foliaceus A. engalensis*	Skin and fins	Loss of appetite, eratic swimming, restlessness, skin loss, haemarrhagic and ulcerative lesions over the body.
Ergasilosis	*Ergasilus sieboldi*	Gills and opericulum	Necrosis of respiratory, epithelial cells and tissues, excess mucus secretion,surfacing, hyperplasia, retorted growth.
Lernaesis	*Lernae cyprinaecea, L. bengalensis*	Mucus, tissues and scales	Erratic movement, ulceration,sloughing off, emaciation, scale loss, necrosis of tissues.

ily, fish diseases due to viruses have not been reported in India as far as carpspecies is conceren. Some of them produce high mortalities in young fish andlittle or no loss in adults, which may become carriers. Some viral diseases arecarps reported from other countries are presented in Table 7.

6. Distribution of Parasites in Different Organs of Carps

Most of the parasites present in exotic carps were organ specific.

6.1. Prevalence of trichodinaspin carps

In all carps, *Trichodina* sp. were found exclusively in the gills and skin of the fishes and absent in all the other organs. *Trichodina* sp. were extensively isolated from gills of tilapia and catfishes (Derwa; 1995; Osman, 2001; Younis, 2004 and El-Shahat, 2004) which corroborated the present findings. Emere and Egbe, 2006, who reported highest load of protozoan parasites in the gill of *Synodontis clarias.*

6.2. Prevalence of chilodonellaspin carps

Chilodonella sp. were found exclusively in the gills and skin of all the three experimental fishes and absent in all the other organs. The prevalence of these parasites were found com-

Table 7: Common viral diseases recorded in carps

Disease	Agents	Sps mostly affected	Organs affected	Clinical signs
SVC	Rhabdoviruscarpio (birnavirus)	Common carp, koi carp, grass carp	Skin, gills	Fish gathering at outflows, dark colouration, loss balance, inflammation, haemorrhagic of skin and gills
Koi herpes virus	Cyprinid herpesvirus-3	Koicarp, common carp, gold fish	Intestine, gills and spleen	Mottled appearance, respiratory distress, red and white patches, sunken eyes, blisters on skin, gill necrosis
Grass carp haemorrhagic disease	Reo virus Piconovirus	Grass carp	Internal organs, skin	Ventral haemorrhagic inflammation, bleeding in scales base

paratively slight highed in the skin of all the fishes. Durborow, 2003, reported *Chilodonella* glides over the fish's gill and skin surfaces which supported the present findings. Two species of *Chilodonella* occur on freshwater fishes, *Chilodonella cyprini* (Moroff, 1902) occurring on the skin and gills of carp *Cyprinus carpio*(L) and *C. hexasticha* (Kiernik, 1909) on the skin and gills of tench (*Tincatinca*) which also corroborated the present observation. Imai et al., 1985 and Ogawa et al., 1985, has been reported *Chilodonella hexasticha* from the gills of tropical ornamental *Symphysodon discus*, cichlids (*Oreochromis mossambicus, Oreochromis niloticus, Oreochromis aureus*), and coldwater cyprinids (*Abramisbrama, Abramisballerus, Bliccabjoerkna, Cyprinuscarpio*).

6.3. Prevalence of trichinellasp in carps

Trichinella sp. were observed exclusively in the intestine (100%) of *Cyprinus carpio* though they were absent in all the other organs of the fishes. These parasites were not found in any organs of *Hypopthalmicthys molitrix* and *Ctenopharyngodon idella* during the study period. Jones (1994) reported that host and organ specificity is determined by ecological requirements of the hosts and the parasites. Polanski (1961a) reported that the main factors determining the variety of parasitic fauna as well as the intensity and incidence of infection can be summarized as follows: the diet of the host, lifespan of the host, the mobility of the host throughout its life including the variety of habitats it encounters, its population density and the size attained, large hosts provide more habitats suitable for parasites than do small ones.

The probable reason for the availability of this parasite only in intestine may be due to the feeding habit of the hosts or due to the organ specific nature of the parasites.

6.4. Prevalence of Acanthocephalan sp. in carps

Acanthocephalan sp were not observed in any organs of *Hypopthalmicthys molitrix* and *Cyprinus carpio* during the entire study period. In *Ctenopharyngodon idella* these parasites were found solely in the stomach (40%) and intestine (73.33%) though they were absent in all the other organs. The prevalence of these parasites were more in intestine.

Tweb and Ahmed (1981) reported acanthocephalans from the liver, mesentery in addition to stomach and intestine. Ahmed and Ezaz (1997) observed this in body cavity, mesenteries and intestine which agreed with the present observation.

6.5. Prevalence of nematodes in carps

The nematodes were observed in all the organs such as body cavity, mesenteries, liver, kidney, stomach, intestine, ovary, testes and fat bodies of the three hosts examined but they were absent in gills and skin. Ahmed and Ezaz (1997) and Tweb and Ahmed (1981) observed nematodes from the same vital organs of *Heteropneustes fossilis*, *Channa* sp. and *Clarias batrachus.*Nematodes such as *Rhabdochona* or *Spinitectus*, common in the intestines of fish of all families (Paperna, 1964 and Khalil, 1971). According to Bilqees and Fatima (1993), Bilqees and Parveen (1996) and Bilqees et al. (1998), different nematode larvae were found comparatively in higher rate in stomach and intestine which interferes with digestion and poor appetite in fishes.

6.6. Prevalence of epistylis sp. in carps

According to Esch et al. (1976) and Miller & Chapman (1976), the colonies of the *Epistylis* sp cause lesions ("red sore") on the fish skin opercular perforations in the fish gills which corroborated the present observation.. These parasites are usually found on the skin and fins of fishes as reported by Durborow (2003). Kellicott (1883) reported the basal portion of the primary stalks of *Epistylis* sp penetrated through the epidermis and into the hypo dentine of the scales of the fish hosts.

6.7. Prevalence of zoothamniumsp in carps

These parasites were absent in *Cyprinus carpio*. In *Ctenopharyngodon idella* the highest prevalence of these parasites were also found in skin (75.00%) compared to gills while in all the other organs they were absent. According to Paperna, (1980), and Lom and Dykova (1992) parasitic ciliates, particularly sessilines protozoa genera as *zoothamnium*, which infect skin and gills of fishes. They are obligate parasites, which utilize gills and skin merely as a substrate for attachment. Thus, their pathogenicity is attributed to the mechanical interference with gas exchange activity. The aforesaid report supports the present findings.

6.8. Prevalence of vorticella sp in carps

The prevalence of *Vorticella* sp. in *Hypopthalmicthys molitrix* were not found in any organ during the study period. These parasites were observed in *Cyprinus carpio* exclusively in the gills and skin with a peak on skin (80%) while they were absent in the rest of the organs. In *Ctenopharyngodon idella*, the highest prevalence of these parasites were also found in skin (80%) compared to gills while in all the other organs they were absent. A great number of Vorticellids on the skin of debilited, moribund fish and prey on the body surface of the fishes and feed on the tissues (Migala and Kazubski, 1972), which supports the present findings. Ectoparasitic protozoa attack the fish and cause massive destruction of the skin and gill epithelium (Sterud et al., 2003 and Enayat et al., 2008) which also approved the present findings.

6.9. Prevalence of developmental stages of eggs/parasites in carps

Developmental stages of digenetic trematodes (*Prohemistomum* sp.) were recovered from intestine and different internal organs of *Tilapia* sp., catfish and mullets as were recorded by Shalaby et al., 1996 and Amer and El-Ashram, 2000, which corroborated the present findings. Spores or other forms of waiting stages are such as encysted forms of *Chilodonella hexasticha* werefound in the gills (Rowland et al., 1991). Nematodes (such as the Oxyuridae and Kathlanidae) are monoxenous (single host) and occur in the intestines of detritus feeders and omnivorous fish (Khalil, 1971).

6.10. Prevalence of parasites (Unidentified) in carps

As suggested by Borg (1960), Omoniyi et al. (2002), Rahman et al. (2002) the heavy load of parasites on the gills relative to other parts of the body impaired the gills from functioning well as an organ of respiration, which approved the present findings. Smith, 1981, reported that most protozoan parasites inhabit the intestine because of their general feeding habits which may be the probable reason for the availability of these parasites (unidentified) in intestine.

7. Conclusion

Kolkata city seawage is extensively used for fish culture in *Bheries* of West Bengal, before seawage is added to Bhery it is diluted with fresh water this may be reson cause of somany parasitic or pathogenic diseases in *bheries* of west Bengal. But the farmers of *Bheries* of West Bengal they can not use any treatment, simply they will harvest all the fishes whenever disease occurs in *Bheries*. Some time they can use lime, disinfectant to the *Bheries*. Till now they are using traditional methods. Government support is needed to the farmers. Farmers maintaing poor water quality, health maintenance. Innovate technologies introduce to the farmers to treat diseases in *Bheries* of West Bengal. Finally I am concluding this paper, government support, subsidy needed to the farmers. Most of the farmers are uneducated so by conducting programmes, seminars by the government, teach the farmers how to treat, controlling the diseases.

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