

Gill diseases in carps

a Kolleru lake perspective

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Gill-associated pathogens of fishes are the major disease causal agent leads to production loss to the farming community all over the country including the Kolleru lake area (major aquaculture production site of India). Because of inappropriate diagnosis, the treatment regimes remains mostly ineffective. Proper diagnosis and immediate appropriate action provided by fish health experts can reduce the loss by controlling diseases.

Key words: Carps, Diseases, Perspective

GILL diseases are one of the major problems in the freshwater aquaculture industry. As gills are the major organ for gaseous exchange from the water and being in direct contact with surrounding water, any abhorrent condition may lead to homeostasis disturbances in fishes. Kolleru is the largest freshwater lake in India located between Krishna and Godavari districts of Andhra Pradesh.

In November 2002, the Kolleru was designated under International Ramsar Convention. Kolleru and its surrounding area is the most promising major aquaculture production site in India.

PATHOGENS OF GILL DISEASES

There are several types of disease causing agents being identified affecting gills which include parasites, virus, bacteria and fungi, producing more or less similar gill damages with more or less similar clinical signs and symptoms leading to diagnostic problems.

Parasites

Some of the important gill associated pathogens are being discussed here with available remedial measures for bringing up quick

practical solutions to the farming community.

Dactylogyrosis

Causal organism: The causative organism of dactylogyrosis is *Dactylogyrus* sp., a monogenetic trematode ectoparasite, which primarily infects gills of freshwater fishes. It is also known as gill fluke. There are enormous numbers of parasitic species recorded under the genus and most of them are host-specific. Gill flukes are oviparous monogeneans having two pairs of anchors and 4-eye spots. Some examples are *D. vastator*, *D. extensus*, *D. anchoratus*, *D. lamellatus* etc.

Spread: *Dactylogyrus* sp. is having a direct life-cycle which enables it to transfer from one fish to another fish through water and direct contact. Contaminated water with *Dactylogyrus* eggs is a major source of disease spread. Newly introduced infected fish is also a potent source of infection.

Diagnosis: It is done by observing

clinical signs and confirmatory diagnosis.

Clinical signs: The infective fish displays high mucus production and pale discoloration, and swelling of gills. Surfacing of infected fishes are also common phenomena as fishes become less tolerant of low oxygen conditions.

Confirmatory diagnosis: Gill scrap/squash-microscopy is an easy and effective way of identifying the *Dactylogyrus* infection in gills. Species level diagnosis can be done by using PCR and other advanced molecular tools along with taxonomy.

Treatment: Amitraz (12.5%) of two applications at weekly interval (50 ml/acre-mt) and Deltamethrin (1.25%) of one application after



Fig 1. *Dactylogyrus* sp. infecting fish gills.

three days of application of Amitraz seem to be quite effective. Formalin (37%) can also be used at 2 litre/acre meter water (single application with aeration) under experts' supervision during sunny day. Dietary addition of ascorbyl polyphosphate (500 mg/kg feed) or levamisole hydrochloride would be beneficial to reduce further stress to the fish.

Prevention: Maintaining good water quality is one of the key factors for reducing this particular parasite, and increased organic load is the major predisposing factors for *Dactylogyrus* infections. Hence, increase water exchange and aeration along with reduction of organic load in pond will be helpful in limiting/preventing *Dactylogyrus* infection in pond. Liming in many instances (pre or post-exposure to parasiticides) seem to be quite beneficial.

Myxosporean infestation

Causal organism: Myxosporeans are highly specialized metazoan ecto- and endo-parasites of fishes. They are characterized as multicellular spores with polar capsules containing polar filaments. There are many conflicts in existence about host and organ specificity of myxosporeans. Many myxosporean species were found to be involved with the gill infections of freshwater fishes i.e. *Henneguya* sp., *Sphaerospora* sp., *Myxobolus* sp., etc. Sometimes mixed species of myxosporean also infect fish gills, causing complexity of clinical signs.

Spread: Transmission is primarily horizontal as spores transmit from one host to another. Myxosporeans are having indirect life-cycles i.e. involve a secondary host to complete its life-cycle. They produce cyst in the infected organ which is a trophic phase of their life-cycle containing numerous numbers of mature spores.

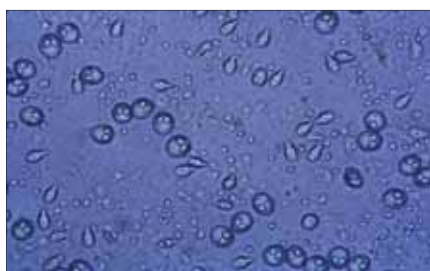


Fig. 2. Myxosporean infecting fish gills

Diagnosis: The diagnosis is done on the basis of clinical signs and confirmatory dissections.

Clinical signs: High mucus production in gills and presence of whitish fine to small cauliflower like nodules can be observed (cysts of myxosporidean spores). Surfacing and gulping of air by the fishes are typically noticed. The spores can also be noticed on fin surfaces. In fact, fine granular whitish spores on fin surfaces are indicative of infection initiation and steps need to be taken at that point to look into preserving good water quality.

Confirmatory diagnosis: Gill scraping and microscopy can detect the myxosporean presence in a fish sample. Taxonomic identification of myxosporean is based on number of shell valves, spore shape and position of the polar capsule etc. Molecular-based diagnosis is also a very trustworthy method for myxosporean diagnosis.

Treatment: Deltamethrin (1.25%) treatment, three times applications at weekly interval in the pond along with Amitraz (12.5%) 50 ml/acre meter water-body one application after three days of deltamethrin application seem to be quite effective. Formalin (37%) at 2 litre/acre meter water of single application is also effective.

Prevention: Special care should be taken during fry and fingerling rearing, maintaining good water quality; removal of annelids from the water-body are some of the tools for restricting the infection in a pond. Regular liming and avoiding excess feeding or under feeding are also beneficial.

Bacteria

The bacterial diseases are as follows:

Bacterial gill disease

Causal organism: The causative agent of bacterial gill disease *Flavobacterium columnare* (*F. columnare*) is found in freshwater ecosystem, belongs to the family Flavobacteriaceae. *F. columnare* is a motile, long, thin, rod-shaped bacterium, strictly aerobic. *F. columnare* can survive for extended



Fig. 3. Bacterial gill infection

periods of time in water without host.

Spread: Horizontal transfer of the bacterium is the major mode of disease transmission. Gills are proved to be the key release site of *F. columnare*. Dead fishes spread the disease at a higher transmission rate compared to living infected fish. *F. columnare* is widely distributed in freshwater ecosystem worldwide and can infect both wild and cultured fishes.

Diagnosis: The diagnosis is done on the basis of clinical signs and confirmatory dissections.

Clinical signs: Complete destruction of the gill filament, necrosis starting initially at the tip of gill filaments and further progressing towards the gill arch are most commonly noticed. Loss of appetite and sluggish movement are also associated with the disease. Pale discoloration of base of the dorsal and pectoral fin can also be observed (saddle back disease) along with gill damage.

Confirmatory diagnosis: Gill scraping and microscopy can preliminarily diagnose the bacteria by its long slender, rod-shaped structure. Isolation and identification of the bacterium using both biochemical and molecular methods are widely accepted.

Prevention: Good management of the fish farm, reducing stress factor during culture period and immediate removal of dead fishes can reduce the disease intensity and occurrence. Vaccination of the fishes against *F. columnare* can be a good option to prevent the disease but till now there are no such vaccine in India available although active research is going on.

Treatment: Use of pond disinfectants, particularly iodine

group of disinfectants along with liming of ponds at weekly interval during infection seems to be quite promising. Feeding of immunostimulant-based diet during the infection period quickens the treatment effectiveness.

Virus

Some of the viral diseases are discussed here.

Koi Herpes Virus disease

Causal organism: Koi Herpes Virus Disease is caused by Koi Herpes Virus (KHV), a double stranded icosahedral DNA virus belonging to Herpesviridae (cyprinid herpes virus 3) family. Mainly the virus infects common carps and koi carp in freshwater ecosystem. The susceptibility of Indian major carps to this disease is not known yet.

Spread: The virus was first reported from Israel in 1998 and upto now reported from more than 26 countries. Mode of transfer is horizontal i.e directly from infected fish to susceptible host or through water. After releasing from infected host the virus may incorporate with the plankton and transfer to another host. The on-going active targeted surveillance programme in the region using PCR-based screening tools has not detected any positive case from the region so far.

Diagnosis: The diagnosis is done on the basis of clinical signs and confirmatory diagnosis.

Clinical signs: Grossly the infected gills may reveal pale discoloration with white necrotic patches. In the diseased fishes increased respiratory frequency can be observed. Haemorrhages over the body surface and gills are also noticed.

Confirmatory diagnosis: For conformational diagnosis, isolation of virus using cell line and electron microscopy, histopathology of the infected organs, molecular methods and ELISA-based method are some of the key diagnostic tools. Polymerase chain reaction (PCR) is the most widely used detection method for KHV. Most of the PCR primers have been designed based on the TK gene of KHV. Recently LAMP method also has been



Fig. 4. KHV infected fish gills (Source: <https://marinescience.blog.gov.uk/2016/07/01/khv-fishery-angler-net-equipment>)

developed for the detection of KHVD. The Central Institute of Freshwater Aquaculture has developed a PCR-based diagnostic kit for rapid and sensitive detection of this virus.

Treatment: No treatment method is available till date for this particular viral pathogen worldwide. In Israel a live attenuated vaccine against KHV was developed and now available.

Prevention: Maintaining biosecurity in farm will help in restricting entry of KHV to the farm. The fish seed while importing for stocking to the ponds should be screened for the KHV antigen. Importing of fish seed from KHV prevalent zone should be avoided. Continuous health status monitoring of the fishes under culture would help in maintaining zero prevalence status in a particular region. Strong aquatic quarantine in a region or country is necessary for preventing its entry along with targeted surveillance.

Fungus

Some of the mycelial diseases are discussed here.

Branchiomycosis (Gill rot)

Causal organism: Gill rot is a fungal disease of freshwater fishes caused by two species of *Branchiomyces* i.e. *Branchiomyces anguinus* and *Branchiomyces demigrans*.

Spread: The transfer of fungal pathogen is mainly horizontal through spores via water or from infected fish. After reaching susceptible host the spores germinate and produce hyphae which adversely affect the host.

Diagnosis: The diagnosis is done on the basis of clinical signs and confirmatory diagnosis.

Clinical signs: Infected fishes become lethargic and sensitive to low oxygen stress. Fungal hyphae develops in the gills and very commonly necrotic areas can be observed (marbling appearance). Fishes remain at the surface of the water.

Confirmatory diagnosis: Gill scrap-microscopy is an easy and effective way of identifying *Branchiomyces* infection in fishes, with the aid of fungal stains. Isolation and identification of fungal hyphae using molecular methods is widely used.

Treatment: Once the fishes are infected with *Branchiomyces* sp., there is very little scope for the farmers to treat it. Strict sanitation and disinfection may help. Formalin can be useful as mentioned earlier.

Prevention: Avoidance of fungal pathogen is the best way to manage the disease. Maintaining good water quality and removal of all possible stress factors also helps in avoiding the disease outbreak. Stocking of disease free seeds is very important. Infected pond should be dried properly before next culture as the fungal hyphae can hide in the bottom soil. Avoiding netting induced injury to fish is also important.

Findings of the surveillance programme

Under National Fisheries Development Board funded National Surveillance Programme for Aquatic Animal Diseases, CIFA has done extensive screening for one gill associated pathogen i.e. koi herpes virus (KHV) using level III diagnostics under active surveillance. From Kolleru area (Krishna and West Godavari districts of Andhra Pradesh), total 24 farms were selected randomly, and total 1,731 fishes were collected and screened for the



Fig. 5. *Branchiomyces* sp. infected fish gills (Source: <http://aquafind.com/articles/Fungal-Diseases-Of-Fish.php>)

presence of this particular virus. Fortunately none of the samples screened was found to be positive for KHV during our study started from 2014 to till date.

How farm managers can respond?

Aquaculture with a scientific touch can greatly help the farmers for sustainable development of the sector. Presumptive diagnosis, and use of drugs and chemicals based on those should be greatly discouraged. It is always better to consult nearby fisheries officials for any problems encountered by the farmers.

It is reported that maintaining good water quality can greatly eliminate chances of diseases in the aquatic organisms. Use of good quality seed, maintaining proper stocking density, proper feeding and fertilization with stress-free environment are the main formulae behind a profitable culture and harvest. Hence, any problem encountered in the farm should be handled properly by informing the government approved fisheries diagnostic centers including CIFA for accurate and time bound diagnosis and remedial measures.

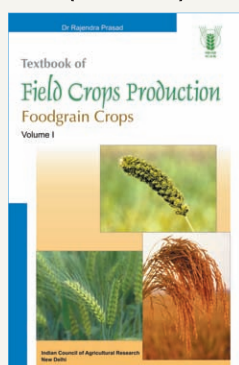
SUMMARY

The intensive fish farming practices since many years in pond polyculture system have led to fish being affected by different diseases including those of gill associated nature. The gill diseases are not only limited to the mostly cultured Indian major carp species, but also seen in catfish species, the second most cultured fish in that region.

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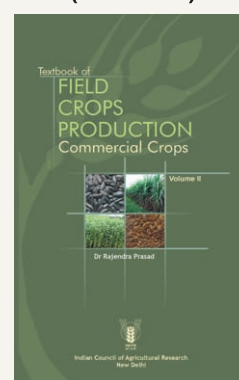
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