The main diseases of African clary catfish when grown in closed water supply installation and cage farms

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Abstract. In this paper, an analysis of the literature on the diseases of Clarias catfish (Clarias gariepinus) carried out. The main bacterial, parasitological and viral diseases that are characteristic of the soma under the conditions of a recirculating aquaculture system have identified. In addition to this, a study of the pathogenic microflora of the Claria catfish carried out. Crops of biological material showed the presence of pathogenic genera such as Acinetobacter ssp., Pseudomonas Fluorescens, Aeromonas Hydrophilia, as well as opportunistic species: Eikenella sp. and Salmonella sp., whose virulence for C. Gariepinus has not confirmed.

1. Introduction

African Clarias catfish (Clarias gariepinus) is a popular aquaculture object in Russia and other countries, as it has high growth rates, does not require special hydrochemical conditions, and can withstand a high planting density. During cultivation in Russia, clarius catfish showed high resistance to certain bacterial viral and parasitic lesions. This is partly due to the content in artificial conditions, where the spread of infections that cause pathology is unlikely due to lack of contact with the environment.

When cage cultivation in ponds coolers, the likelihood of parasitic infestations increases many times. This is compounded by the fact that in cages channel catfish is grown together with other species of fish that may be sources of infection [1-10].

Despite the high viability, clary catfish can be affected by infections of a bacterial nature, with the onset of adverse environmental conditions. The most critical decrease in temperature below the optimal values (24-26 °C) and the accumulation of a large amount of organic matter in water.

This article summarizes data on diseases of clarius catfish in Russian aquaculture and the results of independent research on the basis of the Russian-Scandinavian Center for Research and Innovation in Aquaculture, Moscow State Technical University named after Razumovsky K.G. (PKU)

Since Clarium catfish is most often grown in small-scale ultrasonography by small farms, information on the degree of infection is virtually absent.

2. Materials and methods

In the study of fish, standard methods of ichthyopathological practice were used [11-21]. An external examination performed, in the presence of damage to the skin and gill lobes, scrapings made for
further microscopy. Fish selected with signs of clinical damage, isolated and used to study for the presence of pathogenic microorganisms. At the time of sampling, the water temperature was 26 °C, the index Ph 8.0.

A total of 24 samples of biological material were taken: from the base of the pectoral fin, the damaged portion of the caudal fin and ulceration of the lateral side of the body. Microbiological studies carried out using conventional techniques [22-23]. A direct smear performed from the affected areas, after which sowing was performed on Tryptone-soy agar. Cultivation lasted for 24 hours in a thermostat at a temperature of 25 °C, then sprouted colonies were studied, which were differentiated using conventional tests [22]. Native preparations are stained with methylene blue and microscopically at 1000-x magnification.

- Parasitic diseases

Of the parasitic diseases of canal catfish noted in literary sources, the most frequently mentioned lesion is the equi-ciliary infusoria of Trichodina sp. (found in 20% of individuals), Epistylis sp. (in 15% of individuals), which can cause the death of individual fish specimens [3]. Separate specimens of Gyrodactylus spp., Of several species, are also noted on gill lobes [1]. Fish affected by these ectoparasites are characterized by blanching of the skin, excessive secretion of mucus, as well as ulcers on the lower body. The most common parasite is Gyrodactylus sp., It can already be found in 30% of individuals [15].

Soma is susceptible to the disease Ichthyophthiriosis (White Spot Disease), the most common and persistent disease in many commercial and ornamental fish species [5-6; 19]. This disease is caused by the ecoparasitic ciliary infusoria Ichthyophthirius multifiliis, which mainly affects fins and gills, is characterized by white spots over the entire surface of the fish’s body. In the fight against this disease, the Ich vaccine is used [7]. However, this vaccine does not always show its effectiveness, as the study [8] notes the presence, in addition to the standard immune response, of other protective mechanisms.

Among pathogens of parasitic diseases, Klariyeva also noted: Contracecum sp., Clinostomum sp., Camallanus sp., Eustrongylides sp., Ligula intestinalis and Proteocephalus sp. [12]. The occurrence of these species varies by habitat, however, in the ultrasound, the probability of their development is practically absent [13]. The reason for this is that intermediate hosts are present in the life cycle of parasites, which are not present in the ultrasound. Despite this, parasitic worms of the genera Capillaria and Contracecum can be found in Klariya catfish [16]. These types of worms can cause damage or destruction of internal organs, in some cases lead to infertility, blindness. They are especially dangerous for juvenile fish, as they significantly reduce the growth rate. Helminths of the species Clarias gariepinus and Synodontis clarias can cause point necrosis of epithelial tissues, as well as provoke inflammatory processes [17].

- Viral diseases

Viral diseases of the Canal (Ictalurus punctatus) and Clarias catfish (Clarias gariepinus) may have been detected in several farms in the Moscow and Kaluga region, but no reliable confirmation of this information was obtained. According to clinical signs, the lesions resembled the herpes virus that affects cyprinids. This virus is also known as: CCV (Channel Catfish Virus). It is worth noting that this viral disease occurs in general in the entire Siluridae family [24-27].

Viral diseases enter the farms of Europe and the Russian Federation together with fish stock from southeast Asia, even in the absence of clinical signs, fish can be a carrier of a disease that manifests itself in other fish [25]. Clinical signs most often occur if catfish is cultivated at high temperatures. Viral diseases affect individuals of various ages, while the clinical manifestations of the disease can be of a different nature, the most common of which are: changes in fish behavior, refusal to feed the violation of the integrity of the skin and a number of others [24].

In the case of infection with the herpesvirus disease caused by the RNA virus [26], mostly young fish were affected, while adults older than 6 months were indifferent to infection. Infected fry weaken, weakly moving near the surface of the water, after sinking to the bottom, they die. The fight against this virus is to destroy infected fish, drain water from the pool and disinfect it with bleach.
Bacterial diseases

The most dangerous diseases of a bacterial nature can be caused by 17 genera of bacteria: Aeromonas caviae, A. hydrophila, A. salmonicida, A. sobria, Bacillus sp., Edwardsiella tarda, Plesiomonas shigelloides, Pseudomonas sp., P. aeruginosa, Salmonella sp., Streptococcus sp. Staphylococcus aureus, Staphylococcus epidermidis [10]. However, the most common among them are: Aeromonas hydrophila and Flexibacter columnaris [2; 18].

The F. Columnaris strain found in India [9] showed resistance to 29 of the 37 antibiotics tested. This happened on the basis that only a few, the most affordable, types of antibiotics were used everywhere, which led to the emergence of a new strain resistant to them. Diseases of bacterial etiology are often exacerbated by fungal and viral infections and the complexity of their differentiation. For this reason, antibiotic therapy alone is not effective and requires either the use of complex drugs or the determination of resistance.

The main causes of bacterial infections can be considered the combined action of the following factors: temperature, organic pollution of the aquatic environment, high planting density. Prevention of bacterial diseases consists in the use of: water treatment with ultraviolet light, the use of probiotic drugs, ozonation of water. It is known that for Clari catfish, those preparations that include the bacteria Bacillus subtilis and Bacillus licheniformis have a positive effect. These microorganisms inhibit a large number of gram-positive and gram-negative pathogenic bacteria [28-35]. Also, an increase in resistance to Aeromonas hydrophila catfish is known when garlic (Allium sativum L.) is added to food [4].

3. Results

There were also cases of bacterial pathologies of Clarius catfish in the Moscow State University of Technology and Aquaculture, which were represented by the following clinical picture: the lesion began with milky-white spots on the fins of the fish (figure 1 B), the reddening of the antennae, which then spread to the whole body (figure 1 A). With the course of the disease, the spots merged with each other, the skin was destroyed, capturing subcutaneous tissue to the surface of the muscle layer. At autopsy, it was noted: a significant increase in the liver, on the surface of which a large number of hemorrhages are located, an enlargement of the spleen and an expression on the inner side of the abdominal wall.

Weakened individuals cease to feed and gain mass, thereby losing marketable properties. If you do not carry out therapy and neglect the improvement in the quality of the aquatic environment, the disease progresses extremely quickly, and death occurs within 2-3 days.

According to the results of studies with 22 samples, it was revealed (table 1): Acinetobacter ssp. found in all samples, which is a conditionally pathogenic bacteria, often found in the aquatic environment; Pseudomonas fluorescens was reliably detected in the sample from the caudal fin, however, it could be present at other collection sites (differentiation was carried out using UV sources. Aeromonas hydrophilia was found in the sample from an ulcer in the anal fin; Staphylococcus aureus was also found in samples from ulcers and necrotic Mustache catfish.

Bacteria of the genera Eikenella sp. and Salmonella sp., which are pathogenic for certain fish species, but there are no reliable data on pathogenicity for clary catfish. In addition to these pathogenic genera, other microorganisms were found that are typical of the aquatic environment, but are not a key cause of the disease. In most samples, bacteria belonging to the intestinal group were found, but their additional differentiation was not carried out.

4. Discussion

Based on our data, it can be downloaded that the main pathogen involved in the development of the disease could be the species Aeromonas hydrophilia, which was found in most affected areas of the catfish skin. With necrosis of 30% of the skin, the death of the skin occurs, as a result of the loss of the osmotic balance and the action of exogenous bacteria (figure 1 C). The pathogenicity of A. hydrophilia for Klariya catfish has already been noted by a number of researchers [10; 11; 14].
In general, this organism is quite common in warm waters, which indicates the possibility of its spread in the ultrasound. The main danger of this species, most of its strains and other members of the genus, is its high resistance to antibiotics [28].

Figure 1. Catfish skin pathologies – (A) Rear fin necrosis.; (B) Anal fin ulcers; (C) Pectoral fin ulcers; (D) Total necrosis of the lateral part of the body.

The species Pseudomonas fluorescens has a large spectrum of lytic enzymes, which allows it to destroy fish tissue, causing internal bleeding [31]. This species is opportunistic, causing the development of opportunistic bacterial diseases, with a combination of unfavorable factors for the cultivation of catfish. According to the authors of this article, P. Fluorescens is not the main cause of catfish disease in the conditions of ultrasound, but only exacerbates the existing pathology.

Bacteria of the genus Acinetobacter ssp. were widespread in all samples, but their pathogenicity for catfish cannot be confirmed. Despite this, there is evidence of pathogenic species (A. Iwoffii), which have similar symptoms and are found in Clari soma [32]. In addition, other fish species have diseases caused by the species A. johnsonii, A. junii / johnsonii, A. calcoaceticus [34], but there is only indirect evidence of the possibility of infection by the Siluridae family [33].

Of the detected microorganisms, Aeromonas hydrophilia has the highest virulence; all other representatives of the microflora are concomitant, giving a picture of myxobacteriosis.

Specialists ichthyology and microbiologists, developed a treatment regimen that showed good results. To restore the skin, potassium permanganate was used, the fish was treated three times, within three days, in a solution of 1g / m³. For the prevention of repeated infections, the SUB-PRO probiotic was used [29, 30], which was added to the feed according to the following method: the feed pellets were sprayed with a weak agar-agar solution and then, before the polymerization, dry powder of the bacterial preparation was added, at the rate of 3 g per kg.
Table 1. Tests of the most characteristic samples. (+) Positive reaction; (-): negative reaction; (0): weak positive reaction (defaults to positive); (x): This test was excluded.

| Sample Number | Gram stain | Catalase | Oxidase | Mobility | Morphology |
|---------------|------------|----------|---------|----------|------------|
| 1             | -          | +        | -       | -        | Coccus     |
| 2             | -          | +        | -       | -        | Coccus     |
| 4             | +          | +        | -       | +        | Coccus     |
| 5             | +          | -        | 0       | 0        | Bacilli    |
| 6             | x          | +        | -       | x        | x          |
| 7             | -          | -        | +       | -        | Coccus     |
| 8             | -          | 0        | 0       | -        | Bacilli    |
| 11            | +          | -        | 0       | 0        | Bacilli    |
| 12            | -          | +        | 0       | 0        | Coccus     |
| 13            | +          | +        | -       | +        | Bacilli    |
| 15            | -          | +        | 0       | +        | Bacilli    |
| 16            | x          | +        | 0       | x        | x          |
| 17            | -          | +        | -       | -        | Coccus     |
| 19            | -          | -        | -       | -        | Bacilli    |
| 20            | x          | -        | -       | x        | x          |
| 21            | x          | -        | x       | x        | x          |
| 22            | -          | +        | 0       | -        | Coccus     |

5. Conclusion
Based on the results of the studies, it follows that Clary catfish has a high resistance to a viral, bacterial and parasitological nature. The following factors can provoke the development of bacterial diseases: a sharp drop in temperature, a high density of planting and the accumulation of a large amount of organic matter in the water of the ultrasound.

According to the results of the analysis of literary sources, it revealed that the reason for the death and loss of the presentation of the Clariya soma is due to bacterial infections. Pathogenic microflora is present in the water of ultrasonic testing and the maximum species diversity develops in a multicultural environment, for example with Carp and other warm-water fish species. Microbiological analysis of fish with signs of bacterial diseases showed the presence of pathogenic and conditionally pathogenic bacteria: Acinetobacter ssp., Pseudomonas Fluorescens, Aeromonas Hydrophilia, Eikenella sp. and Salmonella sp., as well as a number of bacteria of the intestinal group.

Treatment of fish skin with potassium permanganate and the addition of probiotic preparations (at a concentration of 3 g per kg of feed), in particular, SUB-PRO, should be considered an effective way of preventing and treating fish with moderate lesions.

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