The status and treatment of serious diseases of freshwater prawns and crabs in China

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Chinese mitten-handed crab (*Eriocheir sinensis*), Giant river prawn (*Macrobrachium rosenbergii*) and Oriental river prawn (*Macrobrachium nipponense*) are important high-quality freshwater products in China. Their culture began in the 1970s and the total output of these products had reached 700 thousand tons by the end of 1999. However, disease issues have become increasingly serious. Every year the economic losses caused by diseases amount to thousands of million Yuan; in 2000 losses due to trembling disease in crab were 2-3 thousand million Yuan while 60-70 percent farmers in Guangdong, Guangxi, Jiangsu and Zhejiang great losses totaling hundreds of million Yuan due to white body disease of *M. rosenbergii*.

The diseases of fresh water prawns and crabs are caused by a combination of pathogenic, nutritional, physiological, and environmental factors. In this article I would like to outline the general characteristics of these diseases and their corresponding treatments.

Disease features

As crustaceans, freshwater prawns and crabs grow quickly and have short life cycles. Owing to differences in their physiology and ecology, these animals differ from other aquatic animal in terms of their pathogens, infections and treatment. Realizing these features is very beneficial and helpful.

Fresh water prawns and crabs are highly sensitive to pathogens. The reasons are:

- Prawns and crabs are lower aquatic animals with simple organ structure and function. Their immune system is inferior to that of vertebrates and higher animals does not appear to have the ability to 'remember' pathogens in the same way (though there is some recent evidence to suggest they may have other mechanisms).
- Prawns and crabs are highly sensitive to pathogens during the molting period when they cannot feed, have a week body and poor mobility.
- The gills of prawns and crabs are easily infected as they lie in the base of the thoracic limb or even their appendix, and are in direct contact with the pathogen-bearing water.
- The shorter life cycle and faster metabolism of these animals results in weaker resistance to enemies.

Prawns and crabs need good water quality. They like to live in a place where there is clean water and plant life. The incidence of disease is higher in low quality water, particularly if oxygen levels are low. For example, black gill disease generally follows an increase in levels of organic detritus, and both black gill and trembling disease in crabs tend to occur where there is a lack of plants.

The worse the water quality, the higher the occurrence of diseases because of their poor low-oxygen tolerance. For example the outbreak of black gill disease usually follows an increase in organic detritus in the water; if there is a lack of plants freshwater crabs will often become infected by black gill and trembling disease.

Diseases generally progress quickly and result in high mortality. The circulatory system of prawns and crabs is open so pathogens can easily reach target organs and the whole body through the plasma lymph. For example, in several days *Torulopsis mogii* disease can cause broodstock of *Macrobrachium rosenbergii* to die group by group; prawns and crabs larvae can be completely wiped out by Vibiosis; it is only 15 days from initial observations of trembling disease to mass mortalities of 80-100 percent.

Complications and succession with one disease leading to another are common. To illustrate this with examples, sessilinasis infection is usually an omen of impending bacterial and virus disease; the initial cause of trembling disease in fresh water crab is a bacteria but it is often followed by viral infections, and 30 different kinds of pathogenic bacteria have been isolated from focus of black-spot disease.

Different conditions and animals require different treatments. For instance, splash dosage of lime powder to fresh water prawn and crab is 15-20mg/l, while for fish a more suitable dosage is 25-30mg/l and 60-70mg/l for turtles. Caution should be exercised with chemical treatments – some are dangerous for the stock, or illegal to use in animals destined for human consumption. If chemotherapeutants are used then appropriate withholding periods should be strictly observed before market.

Most of these animals require brackish water during their early life stages, adapting to freshwater later on. Most require an adaptation period and salinity has an important influence on their growth and development. The animals are vulnerable to infection during this period as it is stressful. Great care should be exercised not to stress the animals any further or disease may result.

Serious diseases of fresh water prawns and crabs

Sessilinasis

This is a very common and harmful condition caused by a number of pathogens including *Zoothemnium* sp., *Vortscella* sp., *Carchesium* sp., *Epistylis* sp., *Gastrionauta* sp. and *Intranstylumpalaemoni* sp. all of which belong to Peritrichida. Sessilinasis and animals are symbionts. Once infected, cotton wool-like growths appear attached to the gill, spawn and body surface. The gills turn black and rotten which reduces respiration and excretory capacity, and making feeding difficult. This disease is more serious in the breeding season. Once these parasites get into the breeding ponds they will quickly reproduce and cause heavy mortalities of juveniles. The mortality rate is often 60-80 percent. The main cause of this disease is elevated nutrient and organic matter content in water.

Vibiosis disease

Vibiosis disease is very harmful to freshwater prawn and crab. The death rate of prawn is often 30-50 percent and greater for post-larva, zoea-larva and megalopa-larva. If the juveniles are infected in the breeding season, there will be heavy or complete losses. Frequently application of antibiotics is not a solution as it can induce the appearance of antibiotic-tolerate bacterial strains.

The pathogens include *V. anguillarum*, *V. alginolyticus*, *V. parahaemolyticus*, *V. mimicus* and others. Plasma lymph is the main target organ. High stocking density, mechanical damage or infection, infestation with parasites, too much feeding and polluted water all can induce this disease.

Some infected adult animals have no obvious symptom, while others show mucus secretion and discoloration, erratic swimming, loss of appetite, poor phototaxis, reduced growth and metamorphosis, crawling beside ponds with rotten abdomen and appendages. Bacteria and plasma cell gather into opaque white clots in the gill and other tissue. The dying animals have a dark hepatopancreas, turbid muscle, with a lot of blood clots, and die en masse.

White-body disease

This condition is also called white tail disease, muscle necrosis disease and white spot disease. The main susceptible species is *Macrobrachium rosenbergii*. This pathogen was brought to China with prawn seed from Thailand. It first appeared in Guangdong and Guangxi province but has now spread to the south of Jiangsu, Zhejiang and the other provinces with an attack rate 60-90 percent and mortality rate above 50 percent in 2-8cm *Macrobrachium rosenbergii*. Outbreaks occur from April to June every year, yet the main target is prawn larvae. In Jiangsu the prawn was completely wiped out. Heavily infected prawn are recognized by white spots, which are initially a trace of spots in the tail, followed by a halt in moutling, decreased appetite, reduced mobility, a turbid abdominal muscle, white body (excluding the head) and necrotic muscle without elasticity.

Possible causes of this condition include parasites in the muscle, bacteria and malnutrition. Poor environmental conditions can induce the disease.

Trembling disease

This condition is also called limb-trembling disease, wide-claw disease, numb-claw disease or circle-leg disease. It affects fresh water crabs. Although bacteria have been isolated from diseased prawns one or more virus may be responsible. A spherical RNA virus with no capsule has been reported to be the pathogen, which normally lives in intestine and becomes harmful once invading the central nervous system (Lu Hongda, 1999). A spherical reovirus-like virus with no capsule and 55nm size is also believed to be one of the pathogens (Xue Renyu, 2001). Another virus has been observed growing into cyporyctes in the endoplasmic reticulum. In addition, vibiosis and *Aeromonas hydrophila* have been isolated from diseased crabs. Contaminated water, mingling of varieties, in breeding, high stocking and irregular sizes, and poor nutrition can all serve as inducing factors. The main targets are two-year old and adult crabs with an incidence rate above 30 percent and mortality of 80-100 percent. The epidemic season is from May to October and peak period is from August to October. This disease is very harmful along the Yangtze River especially in Jiangsu and Zhejiang province.

Principal countermeasure

Traditional methods are not always effective in treatment of serious diseases of fresh water shrimp and crab. The author believes that only when we change our idea to new ones will we make progress. Specifically, following ideas are helpful:

- The traditional strategy of "stamping out the pathogens" is difficult to apply in the aquatic environment, particularly once a pathogen has become endemic to an area. A more practical approach is "combined control and prevention". The presence of pathogens doesn't usually lead to significant disease in itself – there are normally a number of contributing factors that lead to an outbreak, such as poor nutrition, water or environmental quality. These factors weaken the resistance of the host or disturb the balance in favor of the pathogen.
- We should therefore consider how to utilize beneficial and neutral microbes or inactive pathogenic microbes to compete with and restrict the activity of other pathogens, maintaining a state of balance and peaceful coexistence with the host. Such a preventative approach better than traditional medical 'treatment' of disease outbreaks – which are only effective after disease has occurred and losses have been sustained.
- We can directly apply micro-ecological preparations (probiotics), feed additives to nourish beneficial microbes, or use highly specific anti-microbial drugs to restrict harmful microbes to help beneficial and neutral microbes compete for and occupy living space. We can also improve the farming environment and make greater use of artificial feeds, which help to keep the pond environment suitable for stock and

beneficial microbes. The presence of a small quantity of pathogenic microbes in the water and animals is normal and acceptable. If we try to totally eradicate pathogens we will disrupt the micro ecological balance, which may induce loss of physiological balance of the stock, leading to proliferation of pathogens and disease.

- Controlling farm volume and implementing rotational farming practices with fallowing of culture areas is a highly effective disease control measure. As the number of farms in an area grows more disease problems are experienced. Limiting the number and area of farms helps to prevent major disease problems and provides the best benefit and consistent development of freshwater shrimp and crab aquaculture. Since some pathogens are specific to a particular host, allowing farming areas to rest between crops can keep pathogen numbers down and maintain the safety of products, quarantine risk and impact on the environment.
- Implement health management centered on disease prevention and protection of the environment, while not rejecting responsible drug usage as a useful tool. At present, "health management" is a resounding slogan in aquaculture and key to successful culture. Health management includes scientific breeding, farming, water usage, and feeding and drug usage.
  Appropriate drug usage requires the following: A diagnosis must be made in order to select an appropriate drug and treatment regime. Other factors contributing to the disease, such as environmental conditions or nutrition must be addressed simultaneously. Drugs that are potentially harmful to humans or the environment should not be used, withdrawal periods must be applied to allow drug residues to be eliminated.
- Effectively apply disease quarantine procedures and monitor in order to bring large-scale epidemics under control. Emphasis should be placed on investigating disease epidemiology including season, area and condition in order to identify important factors and times. Quarantine measures should be established and their effectiveness monitored; and appropriate regulatory and institutional controls implemented.
- Develop and make use of biological products and techniques. Biological products include vaccines and toxoids, high-immune serum, interferon, antitoxins and other treatment products. Recent developments in these areas have great potential for aquaculture.

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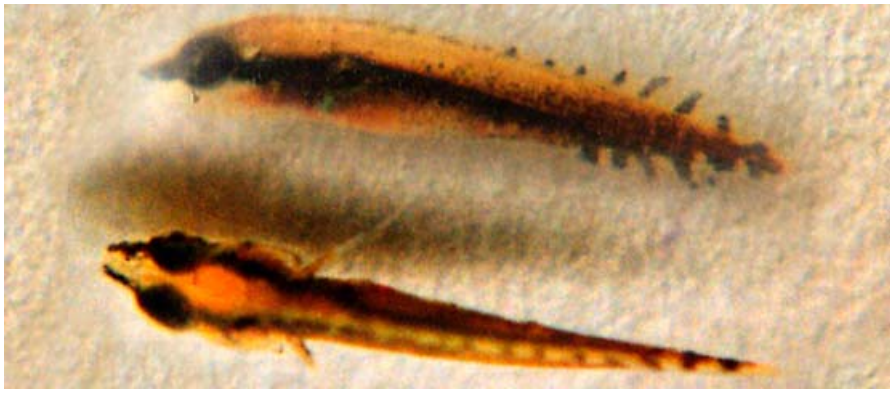

The 3 weeks old young fry of M.aculeatus

Captive breeding of *M.aculeatus*

Set	Size of Brood Fish	Water	Spawning	Survival
1.	Male: 17.5cm (15.4 g) 19.2 (17.0g) Female: 18.0cm (19.50g) 20.30cm (21.20g)	29.5^{0}C pH 7.9	Fertilization: 88% Hatching: 48% Incubation time: 30-33 hrs.	12 % (at 30 days)
2.	Male: 18.5cm (16.6g) 18.3cm (16.0g). Female: 20.0cm (20.90g) 19.10cm (19.50g)	29^{0}C pH: 8.2	Fertilization: 92% Hatching: 35% Incubation time: 36-38 hrs.	9 % (at 30 days)
3.	Male: 17.3 cm (10.60g) 16.50cm (8.0g) Female: 18.50cm (13.5g).	28.3^{0}C pH: 7.6	Fertilization: 85% Hatching:60% Incubation time: 40- 42 hrs.	14 % (at 30 days)

Fecundity and Gonado-somatic Index of *Macrognathus aculeatus*

Fish (g)	Ovary (g)	GSI ratio	Sample (g)	No.of eggs	Eggs/g fish
11.9	1.40	1:8.50	0.40	164	48
16.6	1.80	1:9.20	0.20	75	40
15.9	1.70	1:9.30	0.40	179	47
35.0	3.30	1:10.60	0.40	320	75
25.8	2.80	1:9.20	0.30	172	62
21.0	**2.20**	**1:9.36**	**0.34**	**182**	**54.40**