

Fish and Shellfish Diseases in Culture Systems

III. Defenses against infection

C. Thankappan Pillai

Central Marine Fisheries Research Institute, Cochin-18

"If infection leads to indisposition the system offers immunity"

In the previous article of this series, infection and kinds of infection have been discussed. Now, let us examine how a case of infection is overcome by the host before the infection leads to a serious disease succeeding a variety of host's defenses.

In both poikilothermic and homeothermic animals quite an efficient defense mechanism is present and one may be surprised on the incidence of diseases inspite of all such protective measure.

When a pathogen infects a host, there may be some initial abnormalities in the host because of infection, multiplication of the pathogen, release of microbial toxin and due to the efforts made by the host to defend itself from the pathogen. This protective response against tissue damage is called inflammatory reaction. Certain characteristic features of inflammatory reaction are temperature variation, pain, uneasiness, redness, swelling and loss of function. If the cause(s) of inflam-

mation are removed, the tissues come to normal and on account of tissue proliferation, any minimum damaged tissue may also get repaired in due course. When an infection at it's mild stage is overcome by the host, no further symptoms may appear. If not, even a mild attack may change into systemic infection and may finally lead to general death which is the cessation of the complete vital functioning of all the organs as a result of accumulated disorders in the body system. To restrict premature local * / general death due to infection in all the living beings their defense mechanism will systematically be functioning to defend themselves from infections. The protective measures in a host against infection(s) are called defense mechanism and for more convenience they may be classified as structural, cellular and humoral although the present trend is to classify the defense system as cellular and humoral.

STRUCTURAL DEFENSE

Skin and slime or mucous form the structural defense system. The internal tissues and organs of the body

are protected from the external environment by the skin and slime. These structures function as physical barriers against infections. Moreover, slime is considered to have antipathogen activity. Because of such special mechanisms, this system of defense inhibits / removes pathogens that infect the host. The presence of fatty acids in the skin is also believed to possess antipathogen property.

CELLULAR DEFENSE

If the skin and slime are damaged by any means, the pathogen find entry into the body. As soon as the internal cells are attacked, this system of defense become alert and start functioning opening with inflammatory reaction. In a few seconds time, the blood vessels dilate, become more permeable and plasma from the blood is poured over the attacked area. The pathogens arriving at this area are killed in the plasma because of its antipathogen property and / or they may be made susceptible to further attack of leucocytes. Leucocytes are present in the blood. They are attracted to the site of infection and the pathogens are invaded. In the attack, if the pathogens are not fully destroyed, the leucocytes may be removed from the site by the blood stream and lymph node like organ (spleen) takes over charge of attack against the pathogens. As there is no lymph nodes in fishes (lymph nodes trap and kill pathogens in higher animals) the work for destroying the pathogens is carried out by the spleen which serve as lymph node like organ.

The pathogen has to face another defense system which is called reticulo-endothelial system (RES). This is a system of phagocytic cells scattered

throughout the body. This system is considered to be responsible for segregating phagocytosed material from the body. There are two population of macrophages (reticulo - endothelial cell having the capacity for phagocytosis). One is fixed and the other is circulating. The promonocytes of the haemopoietic organs, monocytes of the blood and lymph, macrophages of loose connective tissue, free and fixed macrophages of the spleen, kidney and the fixed macrophages of the atrial lining of the heart form the reticulo-endothelial system.

THE CHARACTERISTIC FEATURES OF THE RES ARE :

1. The atrium has got significant phagocytic activity in fish whereas this activity is not present in other higher animals.
2. There is no lymph nodes in fishes but lymph node like organ, spleen is present.
3. The liver whose Kupffer cells, almost inert in fishes, are alert in phagocytic activity in higher animals.

HUMORAL DEFENSE

In addition to the above defenses, one more set of defense functioning is called humoral (fluid) defense. This is found working at various intervals independently and along with other defenses like structural and cellular. The various humoral defenses are:

NATURAL NON-SPECIFIC ANTIBODIES:

These natural antibodies are considered to have antipathogen properties.

COMPLEMENT :

This system, is a complex of enzymes, and has got an effective antipathogen property.

CREACTIVE PROTEIN (CRP) :

It is considered to be normally present in the fish serum and functions as a defense factor against pathogens.

INTERFERON :

This is an important antiviral agent.

LYSOZYME :

Lysozyme, an important weapon of host's defense factor, functions well against various varieties of pathogens. It is present in the slime, skin, serum and phagocytic cells.

NATURAL HAEMOLYSINS :

Certain substances called natural haemolysins detected in the serum are considered to have antipathogen qualities and the capacity to lyse foreign red cells.

SPECIFIC ANTIBODIES :

Another significant defense is specific antibodies belonging to the class

of serum proteins called immunoglobulins (Ig). While in mammals five distinct classes of Ig are identified, in teleosts only one class of immunoglobulin (IgM) is clearly detected. The antibodies can act in a variety of ways. Based on their biological activity, they may be categorised as agglutinating antibodies which work against particulate antigens; precipitating antibodies which function as antitoxins (antitoxic antibodies) by precipitating soluble antigens and neutralising their toxins; and virus-neutralising antibodies which act against viruses and make them inactive.

In general the structural and cellular defenses will be acting against any invader as they are non specific in their activity and the significant difference in the defense system of fishes and shellfishes is that acquired antibodies detected in fishes are not noticed in shellfishes except antibody like substances.

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3-2 Sarugakucho, Shibuya-ku, Tokyo.

Telephone: 431-8447-8,

Telex: ESKAY J23551

Southern Sea Foods Ltd.

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Telephone: (212) 679-3110

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