Short Communication

The use of antibiotics and disinfectants in the freshwater prawn (*Macrobrachium rosenbergii*) farms of north and south 24 Parganas districts of West Bengal

Abstract

The freshwater prawn (*Macrobrachium rosenbergii*) farms and hatcheries of north and south 24 Parganas districts in West Bengal were surveyed for the details of antibiotics and disinfectants used for controlling the prawn diseases and pathogens. During the survey, 4antibiotics and four 4disinfectants were found to be used commonly by the farmers during a 12-month period of study. The chemicals used in the culture systems as antibiotics or disinfectants for the culture water, tanks, other utensils, and others have serious health hazards for both the cultured prawns and human beings. The study also indicates no herbal medicines, and probiotics are being used in prawn farms.

Key words:
Antibiotics, disinfectants, freshwater prawn farm, Macrobrachium rosenbergii

Introduction

Polyculture in freshwater fish–prawn farms, prawn farms, and rice–prawn farming are the tradition of West Bengal, especially in the delta regions of north and south 24 Parganas districts. With the growing demand in domestic markets as well as in foreign markets, the culture of freshwater prawn has proved its economic importance and become burgeoning business in West Bengal. The giant freshwater prawn, *Macrobrachium rosenbergii*, De Man,[1] locally known as "*Golda Chingri*" (Bengali), plays an important role in the economy of West Bengal by earning valuable foreign exchange, generating employment, improving the socioeconomic conditions of the backward people and raising protein-based food production besides the culture of fishes, paddy, and other organisms. Nevertheless, the biggest problem faced by the farmers every year in this sector due to the viral, bacterial, or parasitical diseases. The farmers do not give any treatment forviral diseases that attack the stock, as these are incurable. The bacterial diseases are treated by different antibiotics to avoid the outbreak of deadly diseases. The quality of the water and soil is always maintained by using disinfectants.

The present study deals with the antibiotics and chemicals that are used in the freshwater prawn farms and hatcheries intwodistricts (north and south 24 Parganas) of West Bengal for the control of disease outbreaks.

The prawn farming industry has been subjected to criticism from an environmental point of view. Concern has been expressed regarding the use of chemicals in farms and its potential impacts on the environment and human health.[2-4].

Materials and Methods

The survey was conducted during January 2009 to February 2010 in different fish–prawn farms based on freshwater

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wetlands (bheries) in 2districts (north and south 24 Parganas) of West Bengal in India. About 50 farms, including wetland culture systems were surveyed and the information related to the use of different chemicals, drugs, antibiotics, herbal medicines, and probiotics used in the farms or wetland culture systems were collected by the basis of personal interview with different farmers or members of the cooperative societies culturing the prawns by predefined questionnaire.

Result

A variety of drugs are being used predominantly in different farms of the districts to reduce the attack of the different pathogens, to improve the survival rate and to increase the intensity of feeding leads to better growth rate. The common antibiotics oxytetracycline, erythromycin, chloramphenicol, nitrofurans were found to be used to control the bacterial pathogens successfully. Most of the farms use chloramphenicol (40%) followed by oxytetracycline (23%) and erythromycin (20%).

Besides these antibiotics, the farms use disinfectants,such asformalin, malachite green, potassium permanganate, and methylene blue (MB), to disinfect the water and for parasitical diseases caused by petrichous protozoan ciliates, and some bacterial pathogens [Table 1]. No fish farms of two districts were found to use any herbal medicines and probiotics to treat the prawns or their seeds.

Discussion

The chemicals that being used in the prawn farms and the hatcheries are effective mostly prior to the infection, or at the preliminary stages of the infection. Mostly the farmers used prophylactic treatment measures based on eye observations of clinical signs. Food and Drug Administration (FDA)[5] legalized 5drugs/chemicals in US aquaculture, such as oxytetracycline, sulfamerazine, ormetoprim, formalin, tricainemethanesulfonate. FDA[6,7] legalized the following drugs for using as animal drugs: Finquel (MS-222), Tricaine-S (MS-222), Formalin-F, Paracide-F, Parasite-S, Romet 30, Sulfamerazine in Fish Grade, Terramycin-200, Chorulon, 35% PEROX-AID, Aquaflor, Aquaflor-CA1, TERRAMYCIN-343, OxytetracyclineHCl Soluble Powder-343, OxyMarine, TETROXY Aquatic, and Terramycin-200 for Fish.

Theoretically, chemicals other than antibiotics that are added to the shrimp ponds, or byproducts from the applied substances, that have a bioaccumulation potential, could be found as residues in the shrimps. However, little attention has been paid to the risk of residues other than antibiotics in farmed shrimps, and no data from such investigations have been found, Gräslund and Bengtsson.[3]

The antibiotics chloramphenicol (mostly used in the farms) andnitrofurans are banned worldwide for use in the production of foods because of their serious side effects. Chloramphenicol may cause fatal aplastic anemia and nitrofurans are classified as carcinogens.[3,8,9]

Aftab Uddin *et al*.[9] reported to control the uses of antibiotics in prawn farms due to the risk of development of resistant bacteria. When the bacteria have acquired resistance, it is

Table 1: Antibiotics and disinfectants used in the prawn farms of north and south 24 Parganas districts of West Bengal during the study period (January 2009 to February 2010)

Antibiotics/disinfectants	Farms visited (%)	Dosage (ppm)	Diseases	Pathogens
Chloramphenicol	40	10	Filamentous bacteria Luminous bacteria	*Leucothrixmucor* *Vibrio harvey* *Vibrio splendious*
Oxytetracycline	23	10 3–5	Vibrio infections Bacterial shell diseases	*Vibrio parahaemolyticus* *Vibrio anguillarium* *Vibrio* spp., *Aeromonas* spp. *Pseudomonas* spp.
Erythromycin	20	2–4	Luminous bacteria	Vibrio harvey Vibrio splendious
Nitrofurans	10	1–2	Black gill disease	
Formalin	81	10-25	Protozoan ciliates	*Zoothamnium* spp.,*Epistylis*spp., *Vorticella* spp., *Acineta* spp.,
Malachite green	34	0.075 0.0075	Luminous bacteria Shell diseases Protozoan ciliates	*Vibrio harvey* *Vibrio splendious* *Vibrio* spp., *Aeromonas* spp.,
Formalin +malachite green	22	0.01+0.01	Bacterial diseases, protozoan diseases	*Pseudomonas* spp. *Zoothamnium* spp.,*Epistylis*spp.,
Potassium permanganate	14	3–5	Luminous bacteria, Shell diseases	*Vorticella* spp., *Acineta* spp.,
Methylene blue	35	8–10	Protozoan ciliates	*Zoothamnium* spp.,*Epistylis* spp., *Vorticella* spp., *Acineta* spp.,
Herbal medicines and probiotics	0	–	–	–

impossible to get rid of them with antibiotics that caused the resistance.

Frappaolo *et al.*[10] reported that the use of antibiotics to control bacteria population and maintain a healthy environment for prawn culture becomes popular. A wide range of antibiotics isnow being used to treat bacterial diseases and to control bacterial population in the hatcheries and prawn farms. The use of antibiotics for treatment arise various antibiotic-resistant bacteria. The resistance was transfer to pathogenic bacteria, and led to reduce efficacy of antibiotic treatment for disease caused by the resistant pathogens.

The antibiotics when used in the prawn farms create health hazards when exposed on the skin or inhaled.[9] Same problem was observed in the fish farms of 2districts, where the workers suffered skin irritation and respiration problems due to the use of such chemicals.

Malachite green is a respiratory poison reported by Dieberg and Kiattisimkul.[11] Malachite green is not very soluble in water, and it binds to sediments reported by Bergheim and Asgard.[12] It accumulates in biota but mostly in simple organisms. In fish, malachite green can be found in all organs in great quantities, including kidney.[13] Residues of 2400 μg/g have been found in fish, and they are persistent.[14]

In water, potassium permanganate is quickly transformed into nontoxic manganese dioxide, which precipitates out. It is toxic for phytoplankton reported by Reardon and Harrell,[15]and Gräslund and Bengtsson.[3]

MB at low concentrations in the body, exist in equilibrium and form a reversible oxidation–reduction system, which is the basis for MB's function as an electron donor/acceptor and free radical scavenger. As such, MB has the potential to affect a wide variety of physiologic reactions. Its effect on red blood cells is to reduce the heme from methemoglobin to hemoglobin. Paradoxically, at higher doses, this equilibrium is destroyed and an excess of methemoglobin is produced as reported by Curry.[16] The formation of hydrogen peroxide as a byproduct can lead to oxidation of the red-cell membranes, denaturation of hemoglobin, hemolytic anemia, and Heinz body formation.[17,18]Recent research has focused on the vasoactive properties of MB. In response to agents, such as acetylcholine and bradykinin, the vascular endothelium produces nitric oxide (NO) through the action of NO synthase. NO activates soluble guanylatecyclase, which raises the levels of cyclic guanosine monophosphate (cGMP), opening calcium-sensitive potassium channels and producing membrane hyperpolarization, smooth muscle relaxation, and vasodilatation.[19-22]

Formalin is toxic to aquatic life at low concentrations, with 96 h LC 50 of 1–1000 μL/L.[8] Some fish are sensitive to it, so a bioassay is recommended before use as reported by Noga.[23] Inhibitions of growth and mortality have been reported for phytoplankton and macrophytes (aquarium plants). Its algicidal property can further reduce oxygen. Toxicity is more important in low pH water and at a high temperature. When stored at room temperature, formalin can develop a white precipitate of paraformaldehyde, which is more toxic than pure formalin as reported by Douet *et al.*[24]

Disinfectants are drained in the local water bodies lead to pollution. The problems can be eliminated by implementing laws to control the hazardous drugs. The farms may use procedures to avoid the introduction of diseases in prawns by regular water quality management, probiotics, or other herbal medicines with fewer side effects. If the farms are infected with pathogens leading to diseases, the prawns must be treated with approved chemicals.

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I, **Mr. Himanshu Gupta** hereby declare that the particulars given above are true to the best of my knowledge and belief.

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