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The Use of Antibiotics in Shrimp Hatcheries in Bangladesh

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Abstract: Among the 40 operating hatcheries of Bangladesh 32 (80%) were surveyed in which 8 different antibiotics and 5 disinfectants were used for controlling common diseases. A total of 35 antimicrobial treatments were recorded during the 18 months of observation, including 20 (57%) antibiotic treatments and 15 (43%) disinfectant treatments. Disinfectants were also used for purposes other than disease treatment, e.g., disinfection of the water, tanks and utensils.

Key words: Antibiotic, disinfectant, shrimp, Bangladesh

Introduction

Within the last decade, shrimp culture has progressed very rapidly in Bangladesh. Around 1,70,000 ha of land area have been allocated for the shrimp culture. Shrimp farming is practiced in Bangladesh as monostock of the black tiger prawn, *Penaeus monodon*. The entire culture is almost depends on hatchery reared post larvae. With the rapid expansion of shrimp grow out, the hatchery industry has progressed rapidly during the last five years. The shrimp hatchery industry has developed on different levels of economic and management scale. In Bangladesh, there are no hatchery sources of antibiotic used data. Without proper scientific investigation into treatment regimes, there has been a tendency for individual hatchery to select their own treatment regimes and to do their own experiment. Little knowledge exists among hatchery operators as to the hazardous effects of the chemicals in use. Lack of legislation on the use of antibiotics in aquaculture has led to the uncontrolled use and improper selection of chemicals for use in shrimp hatcheries. A number of recent reports, press releases and on-going investigations have raised legitimate public concerns about the safety of antibiotic drug usage in aquaculture (Alderman and Hastings, 1998).

This study deals with the trends in the use of chemicals and antibiotics for treatment and prevention of diseases in the shrimp hatcheries of Bangladesh. It reviews the diseases occurring in shrimp hatcheries treated with chemicals, the antibiotics used, problems and constraints associated with their use, legislation related to their use and provides some recommendations.

Materials and Methods

This survey was conducted during January 2002 to June, 2003. Of the 40 operating hatcheries, 32 (80%) were surveyed. Information related to the use of drugs and chemicals to treat shrimp hatchery diseases and to the clinical signs of disease was collected based on a personally interviewed pre-defined questionnaire. The questionnaire was designed to collect information on the use of

chemicals and antibiotic agents for broodstock maintenance and larval and post larval rearing and on the technical capabilities of hatchery personnel.

Results and Discussion

A variety of chemicals were found to be used in Bangladesh shrimp hatcheries for increased and controlled production of seed in hatcheries, increased feeding efficiency, improvement of survival rates and control of pathogens. Chloramphenicol, Erythromycin, Oxytetracycline and Prefuran were found to be widely used with varying success to control all types of bacteria (Table 1). Forty percent of the hatcheries used the chloramphenicol, 25% hatcheries used erythromycin, 20% used prefuran and 15% used oxytetracycline in broodstock maintenance to prevent possible bacterial infections after eye stalk ablation (Table 2). Seventy five percent of the surveyed hatcheries used formalin and 25% used malachite green to control parasites in broodstock holding facilities (Table 2). Treflan and malachite green have been used as antifungal agents. Eighty eight percent of the hatcheries used treflan and 12% hatcheries used malachite green as antifungal agents in larval rearing operation (Table 1). Prefuran, furazolidone and oxytetracycline have been widely used by many hatcheries as prophylactic treatments for vibrio infection. For prophylactic and metaphylactic treatment in larval rearing operation chloramphenicol, erythromycin, malachite green, furazolidone and neomycin sulphate were used by 31, 25, 12, 13 and 19% of surveyed hatcheries, respectively to control luminous bacteria. In larval and post larval rearing facilities malachite green, formalin and oxytetracycline were used by 47, 25 and 28% hatcheries respectively to control shell disease. Sixty eight percent of the surveyed hatcheries used formalin and 32% hatcheries used malachite green to control protozoans in larval rearing operation of shrimp hatcheries in Bangladesh.

Table 1: Antibiotics usage for treating larvae and post larvae in the shrimp hatcheries of Bangladesh

Antibiotic	Hatcheries%	Dosage (ppm)	Disease name	Larval stage	Pathogen
Prefuran	37	1	Vibrio	Mysis, PL	Vibrio parahaemolyticus
Furazolidone	50	2-5	infection		Vibrio anguillarum
Oxytetracycline	13	10			
Chloramphenicol	31	10	Luminiscent	Mysis, PL	Vibrio harvey
Erythromycin	25	2-4	bacteria		Vibrio splendidus
Malachite green	12	0.075			
Furazolidone	13	3			
Neomycin sulphate	19	10			
Chloramphenicol	41	10	Filamentous	Zoea,	Leucothrix mucor
Neomycin sulphate	31	10	bacteria	Mysis, PL	
KmnO ₄	12	2.5-5			
Formalin+ Malachite green	16	0.01+0.01			
Malachite green	47	0.0075	Shell disease	PL	Bacteria belonging to
Formalin	25	25			<i>Vibrio, Aeromonas</i> and
Oxytetracycline	28	2-4			<i>Pseudomonas</i> group.
Treflan	88	0.01-0.1	Larval	Nauplii,	Legenidium spp.
Malachite green	12	0.0075	mycosis	Zoea, Mysis	
Malachite green	32	0.0075	Protozoan	Zoea,	Zoothamnium spp.
Formalin	68	10-25	infection	Mysis, PL	Epistylis spp. Vorticella spp.
Methelene Blue	40	8-10	Black Gill	PL	Chemical contamination
Prefuran	28	1	disease		
Malachite green	32	0.0075			

Table 2: Prophylactic treatment used for broodstock maintenance in *Penaeus monodon* hatcheries in Bangladesh

Antibiotic/Chemical	Hatcheries (%)	Dosage range (ppm)	Pathogen
Chloramphenicol	40	10	Broad spectrum antibiotic, After eye ablation for possible infection
Erythromycin	25	20	Do
Oxytetracycline	15	20	Do
Prefuran	20	2-4	Do
Formalin	75	200 (5 min)20-30 (few h)	Ectoparasites, Epibionts, Ciliates
Malachite green	25	1-1.5	Fungi, Epibionts

Most of the chemicals and antibiotics used in the shrimp hatcheries surveyed fall into neither the metaphylactic nor the therapeutic treatments. Mostly prophylactic treatment was used based on observation of the clinical signs of diseases. Some of the therapeutic agents used to treat shrimp diseases may result residues in shrimp tissue that are a potential health hazard to human. The FDA (1998) currently legalized five drugs for use in US aquaculture these are Oxytetracycline HCL, Sulfamerazine, combination drug containing Sulfadimethozine and Ormetoprim, Formalin and Tricaine Methanesulfonate. The antibiotics Chloramphenicol and Nitrofurans (Prefuran) are banned worldwide for use in food production because of their potentially serious side effects. Chloramphenicol can cause fatal aplastic anemia and Nitrofurans are classified as carcinogen (GESAMP, 1997; Graslund and Bengtsson, 2001) Oxytetracycline is known to enhance the production of plasmid mediated resistance in aquatic bacteria (Shotts *et al.*, 1976) and Erythromycin develop strains resistant (Primavera *et al.*, 1993). Dierberg and Kiattisimkul (1996) reported that malachite green is a respiratory poison, persistent residues in tissues of seafood. Treflan a possible human carcinogen induces thyroid and liver tumours in mammals (Hurley, 1998).

The present study reveals that the concentration of Prefuran and Furazolidon used to control vibrio infection in Bangladesh are lower than Baticados and Paclibare (1992). The concentration of Chloramphenicol used in Bangladesh shrimp hatcheries to control different bacterial diseases are three to four times higher than other countries (Ruangpanich, 1988). The dose rate of Erythromycine and Oxytetracycline are similar with other countries (Baticados and Paclibare, 1992; Rattanavinijkul, 1987). Malachite green has been used at levels of 0.002 to 0.01 ppm and Treflan of 0.001 to 0.002 ppm in other countries (Bell and Lightner, 1992).

The most important reasons to control the use of antibiotics in shrimp hatcheries are the risk of development of resistant bacteria. When bacteria have acquired resistance, it is impossible to get rid of them with the antibiotic that caused the resistance. On the other hand the antibiotics are occupational health hazards. Skin exposure as well as inhalation of dust from antibiotic powder may cause health problems to workers and others that are present when antibiotics are being handled.

To overcome these problems hatchery management should be familiar with the laws of the pertinent antibiotic use and comply with the restrictions of regulating authorities for the importing countries. In lieu of antibiotics, hatcheries are encouraged to employ effective disinfection, sanitation and probiotics. Hatcheries should develop shrimp health management plans that indicate procedures to avoid the introduction of diseases, maintain good water quality and shrimp health monitoring and disease diagnosis techniques. Plans should also explain the steps to be taken when a diagnosed disease will be treated with approved chemicals.

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