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Present status on the use of antibiotics and chemicals in shrimp hatcheries and grow-out ponds and their environmental implications in Bangladesh

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Abstract. The aim of this study is to document the current status on the use of antibiotics, chemicals and biological products used in shrimp hatcheries and grow-out ponds in Bangladesh. In the last decade, coastal aquaculture practised traditionally in south western and south eastern parts of Bangladesh has developed into a big industry. With the rapid expansion of shrimp grow-out facilities, the hatchery industry has progressed rapidly during the last five years. A major disease outbreak, namely white spot disease in 1995 struck the shrimp aquaculture throughout the country and resulted in increased use of chemotherapeutics for disinfection and treatment. Among the 50 operating hatcheries of Bangladesh, 40 (80%) were surveyed in which 7 different antibiotics, 6 disinfectants and 2 different biological products were used for controlling common diseases. The study also covered 50 grow-out ponds of which 30 were in southwestern and 20 were in southeastern part of Bangladesh. The study included 8 semi-intensive and 42 extensive farms. Diseases were treated with 15 commercial products belonging to 3 antibiotics classes. The antibiotics currently used in shrimp aquaculture in Bangladesh are chloramphenicol in the name of CL-33, prefuran, oxytetracycline, furazolidone, erythromycin, neomycin sulphate, kenamycin sulphate and ciprofloxacin.

Key words: Antibiotics, disinfectant, hatchery, grow-out pond, shrimp, Bangladesh

সারাংশ: বাংলাদেশ চিংড়ি হ্যাচারী ও চাষকৃত পুকুরে ব্যবহৃত জীবাণু প্রতিরোধী পদার্থ, রাসায়নিক ও জীব সংক্রান্ত দ্রব্যাদির বর্তমান অবস্থান তুলে ধরা হয়েছে এই গবেষণার উদ্দেশ্য । গত এক বছরে বাংলাদেশের দক্ষিণ-পশ্চিম ও দক্ষিণ-পূর্ব এলাকায় নিবিড় পদ্ধতির জলজ চাষ একটি বড় শিল্পে পরিণত হয়েছে । চিংড়ি চাষের দ্রুত প্রসারের ফলে গত ৫ বছরে হ্যাচারী শিল্পের দ্রুত বিস্তার ঘটেছে । বিগত ১৯৯৫ সালে পুরো দেশে চিংড়ির জলজ চাষে হোয়াইট স্পট রোগের ফলে বড় ধরনের বিপর্যয় ঘটেছে এবং যার কারণ স্বরূপ রোগজীবাণুনাশক ও চিকিৎসার জন্য রাসায়নিক মিশ্র প্রয়োগের ব্যবহার বেড়েছে । বাংলাদেশের ৫০টি চলমান হ্যাচারীর মধ্যে জরিপকৃত ৪০টিতে সাধারণ রোগ প্রতিরোধের জন্য ৭ প্রকার জীবাণু প্রতিরোধী পদার্থ, ৬ প্রকার রোগবীজনাশক ও ২ প্রকার জীব সংক্রান্ত পদার্থ ব্যবহৃত হয় । এই গবেষণায় বাংলাদেশের দক্ষিণ-পশ্চিম এলাকায় ৩০টি ও দক্ষিণ-পূর্ব এলাকায় ২০টিসহ মোট ৫০টি চাষকৃত পুকুর ও অর্ন্তভূক্ত করা হয়েছে যার মধ্যে ৮টি আধা-নিবিড় ও ৪২টি নিবিড় ফার্ম রয়েছে । বাংলাদেশে চিংড়ির জলজ চাষে ব্যবহৃত জীবাণু প্রতিরোধী পদার্থ হচ্ছে: সিএল-৩৩ নামে ক্লোরামফেনিকল, ফ্রিফিউরেন, অক্সিটেট্রাসাইক্লিন, ফিউরোরা জেলাইডেন, ইরাইথ্রোমাইসিন, নিউসাইসিন সাইফেট, কেনামাইসিন সালফেট এবং সিপ্রোফ্লোক্সাসিন ।

Key Words: জীবাণু প্রতিরোধী পদার্থ, রোগবীজনাশক, হ্যাচারী, চাষকৃত পুকুর, চিংড়ি, বাংলাদেশ।

Rezumat. Scopul acestui studiu a fost îmbogățirea datelor din literatură cu privire la folosirea antibioticelor, a compușilor chimici și biologici utilizați în creșterea creveților în Bangladesh. În ultimul deceniu, acvacultura tradițională practicată în sud-vestul și sud-estul Bangladesh-ului s-a dezvoltat rapid într-o adevărată industrie. Odată cu expansiunea rapidă a facilităților creșterii creveților, stațiile de reproducție au progresat la fel de rapid în ultimii cinci ani. O boală serioasă, cunoscută ca pătarea albă din 1995, a adus cu sine o creștere a utilizării chermoterapeuticelor pentru dezinfecție și tratament. Dintre cele 50 stații de reproducție funcționale, 40 (80%) au fost luate în strudiul nostru ca folosind șapte antibiotice diferite, șase dezinfectanți și doi produși biologici diferiți, toate acestea fiind folosite în scopul controlului unor boli comune. De asemenea, am luat în studiu 50 bazine de pământ sau ponduri de creștere, din care 30 sud-vestice și 20 sud-estice, opt ferme semi-intensive și 42 extensive. Bolile sunt tratate cu 15 produse comerciale, aparținând la trei clase de antibiotice. Antibioticele folosite sunt cloramfenicolul ca CL-33, prefuranul, oxytetracyclina, furazolidonul, erythromycina, neomycina sulfată, kanamycina sulfată și ciprofloxacina.

Cuvinte cheie: antibiotice, dezinfectante, stație de reproducție, ponduri, creveți, Bangladesh.

Introduction. The coastal aquaculture in Bangladesh is not a recent development. Over the past 40 years the local people used to practice traditional culture locally called Gher-culture. They used to introduce tidal water within the paddy fields during pre-monsoon for aquaculture and during monsoon they used the same fields for paddy plantation. There was no fry stocking, no artificial feeding, liming, fertilization and aeration. At the initial period, the size of the ghers were about 100-500 ha and the production rate was very low. The fact that shrimp farmers and owners could not afford to manage the large ghers, they could not afford to buy huge post-larvae, large amounts of fertilizers and feeds. They only stock natural post larvae and harvest the marketable size shrimps and they are totally dependent on natural productivity.

By mid-seventies the size of the ghers were minimized i.e., 20-100 hector by different governmental and nongovernmental body. Most of the ghers have only one channel, that is used both as inlet and outlet. In early 1990s, some farmers started the semi-intensive culture. Since 2000, shrimp farming has played a key role in national economy. It becomes the second most important export product. The area under shrimp farming has increased from 64,000 ha in 1989-1990 to 170,000 ha in 2003, with the number of shrimp farms increasing from 10,300 in 1998 to 40,000 in 2003 (DOF 2002; Nuruzzaman & Muniruzzaman 2003; Milstein et al 2005). Unfortunately the average size of the farm is not equal, some farm size is 10 ha or more and some are small i.e. 1 or 2 ha. The total farmed shrimp production was estimated 64970 MT in 2002 and the country earned about US $ 350 million by exporting about 29,700 MT of processed shrimp in the same year (DOF 2002). The main centers of shrimp production of Bangladesh are located at Khulna-Satkhira - Bagherhat district in the southwestern region and Chittagong-Cox's Bazar districts in the southeastern region of the country. With the rapid expansion of shrimp grow-out facilities the hatchery industry has progressed rapidly during the last few years. At present, there are 56 shrimp hatcheries in Bangladesh, out of which 50 are running. The hatchery industry has developed on different levels of economic and management scale.

A major disease outbreak in 1994-1995, namely white spot disease struck the shrimp aquaculture throughout the country and resulted in increased use of antibiotics, chemicals i.e. chloramphenicol, furazolidone and formalin for treatment and disinfection. Farmers do believe that the viral disease could be removed by the application of antibiotics. Recently, probiotics most of which are exotic strains is also being used in shrimp aquaculture in Bangladesh. The high stocking density in hatchery and culture ponds is conducive to the spread of pathogens and the aquatic environment, with regular application of protein-rich feeds which are ideal for culturing bacteria (Moriarty 1999). The disease is then treated with antimicrobials, bactericidals and chemicals rather than the underlying cause. When pathogenic bacteria or viruses are detected, farmers and hatchery workers apply antimicrobial compounds to the feed and water. Many farmers and hatchery workers also use antibiotics as prophylactic even when pathogens are not detected.

Use of antimicrobials, chemicals, fertilizers and pesticides in aquaculture has threaten the biodiversity of coastal environment. Antibiotics and disinfectants chemicals like copper compounds, iodophorms, formalin, malachite green etc can create health hazards for the persons handling them as well as can kill non-targeted organisms if discharged into the main water body through effluents (Vijayakumaran 1997).

Graslund & Bengtsson (2001) reported that the quality and the quantity of the use of chemicals used in the south-east Asian aquaculture sector were scarce. Most of the countries have no perfect data on the amounts of chemicals, antibiotics, pesticides used in aquaculture inside their territory. However chemical manufacturer does not release this information even though they do not know the ultimate use of their products. In Bangladesh there have no document/data about the use of drugs, chemicals and antibiotics in shrimp aquaculture. There has been a tendency that individual farmers and hatchery technicians select their own treatment regimes and do their own experiment.

The purpose of this study is to document the current status on the use of antibiotics, chemicals and biological products used in shrimp aquaculture in Bangladesh

taking into consideration about shrimp disease problems and occupational health hazard and environmental implication of chemotherapeutics.

Materials and Methods. This study was carried out between Feb-2007 to Jun-2008 in the southwest region of Bangladesh, in the Satkhira and Khulna district and south east region in Cox's Bazar district. A total 50 ghers were surveyed. Among them 20 were in south eastern and 30 were in south western region. Ghers of varying sizes i.e. 10-200 hectares (traditional) and 2-12 hectares (semi-intensive) were randomly selected from Nowbeki, Ashasuni, Munshigong, Pikegacha of southwestern part and Rampura, Khuruskul and Chakaria of southeastern part. Almost all hatcheries were selected in Cox's Bazar and Teknaf area. Figure 1 shows the selected site of the investigated area. Information related to the use of antibiotics and chemicals to treat shrimp farming and hatchery diseases and on the clinical signs of disease were collected based on a personally interviewed pre-defined questionnaire. The questionnaire was designed to collect information on the use of chemicals, disinfectants and antibiotic agents for shrimp hatchery disease as well as grow-out facilities. Collected information were presented in tabular form and were compared with those of other authors.

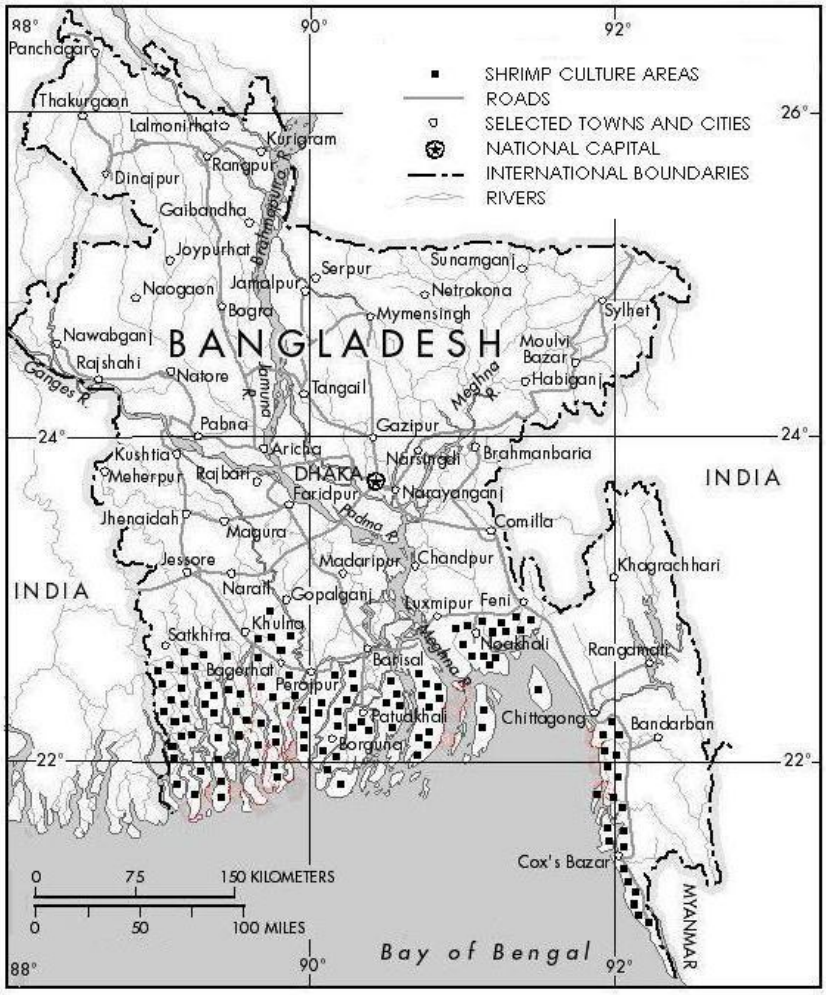

Figure 1. ■ The investigated area where the present study was done.

Results

During Hatchery Operation. A wide range of antibiotics and chemicals were used to control bacteria, fungi and protozoa in the shrimp hatcheries in Bangladesh. Seventy percent of the surveyed hatcheries used formalin and 30% used malachite green to control parasites in broodstock holding tanks. Sixty percent surveyed hatcheries used formalin and 40% hatcheries used povidone iodine (PVP) as a disinfectant in broodstock before placed to the spawning tank. Forty percent of the hatcheries used the Ciprofloxacin, 30% used chloramphenicol, 15% used erythromycin, 10% used prefuran and 5% used oxytetracycline in broodstock maintenance to prevent possible bacterial infections after eye stalk ablation (Table 1).

Table 1

Antibiotics and drugs used for broodstock maintenance in *Penaeus monodon* hatcheries in Bangladesh

Antibiotic/Chemical	% Hatcheries	Dosage range (ppm)	Pathogen/purpose
Formalin	70	200 (5 minutes) 20-30 (few hour)	Ectoparasites, Epibionts, Cilliates
Malachite green	30	1-1.5	Fungi, Epibionts
Formalin	60	50-100	Disinfection of broodstock
Povidone iodine	40	20	
Ciprofloxacin	40	4-6	Used as a broad spectrum antibiotic, after eyestalk ablation against possible bacterial infection
Chloramphenicol	30	8-10	Do
Erythromycin	15	12-20	Do
Prefuran	10	2-4	Do
Oxytetracycline	5	10-20	Do
Povidone iodine	80	50 (1 minute dip)	Egg washing
Formalin	20	100 (30 sec. dip)	Do

Eighty percent hatcheries used povidone iodine (PVP) and 20% used formalin for eggs/nauplii washing. Ciprofloxacin, chloramphenicol (CL-33), prefuran, furazolidone and oxytetracycline have been widely used by many hatcheries as prophylactic treatments for vibriosis disease. For prophylactic and metaphylactic treatment in larval rearing operation chloramphenicol, ciprofloxacin, erythromycin, malachite green and furazolidone were used by 40%, 25%, 15%, 12% and 8% of surveyed hatcheries respectively to control luminous bacteria (Table 2). In larval and post larval rearing facilities malachite green, formalin and oxytetracycline were used by 45%, 25% and 30% hatcheries respectively to control shell disease. Treflan and malachite green were used as antifungal agents. Eighty percent of the hatcheries used treflan and 20% used malachite green to control fungal diseases of *P. monodon* larvae. Seventy percent of the surveyed hatcheries used formalin and 30% hatcheries used malachite green to control protozoans in larval rearing operation. Table 3 provides a detailed list of chemicals presently used in shrimp hatcheries in Bangladesh. Probiotics, which are beneficial microorganisms that kill/prevent multiplication of pathogenic bacteria have recently introduced to shrimp hatcheries and culture farm in Bangladesh. Probiotics, mostly *Bacillus* strain were used and assumed that the strain produced an antibiotic that inhibited the *Vibrio* growth, then the *Vibrio'*s mortality rate would increased, allowing the dominance to the Bacillus, even if the antibiotic were not produced at high enough concentration to kill all *Vibrio* cells directly (Moriarty 1999).

Table 2

Antibiotics and chemicals used for treating larvae and post larvae in the shrimp hatcheries of Bangladesh

Antibiotic	% Hatcheries	Dosage (ppm)	Disease name	Larval stage	Pathogen
Ciprofloxacin	20	4-8	Vibriosis	Mysis, PL	*Vibrio parahaemolyticus* *Vibrio anguillarium*
Chloramphenicol (CL-33)	25	8-10			
Prefuran	10	1			
Furazolidone	30	2-5			
Oxytetracycline	15	10			
Chloramphenicol	40	10	Luminescent bacteria	Mysis, PL	*Vibrio Harveyi* *Vibrio splendious*
Ciprofloxacin	25	2-5			
Erythromycin	15	4-8			
Malachite green	12	0.075			
Furazolidone	8	2-3			
Chloramphenicol	40	10	Filamentous bacteria	Zoea, Mysis, PL	Leucothrix mucor
Neomycin sulphate	30	10			
$KMnO_4$	15	2.5-5			
Formalin+ Malachite green	15	0.01+0.01			
Malachite green	45	0.0075	Shell disease	PL	Bacteria belonging to *Vibrio, Aeromonas* and *Pseudomonas* group.
Formalin	25	25			
Oxytetracycline	30	2-4			
Treflan	80	0.01-0.1	Larval mycosis	Nauplii, Zoea, Mysis	Legenidium spp.
Malachite green	20	0.0075			
Malachite green	30	0.0075	Protozoan infection	Zoea, Mysis, PL	Zoothamnium spp. Epistylis spp. Vorticella spp.
Formalin	70	10-25			
Methelene Blue	40	8-10	Black Gill disease	PL	Chemical contamination
Prefuran	25	1			
Malachite green	35	0.0075			

Table 3

List of chemicals and drugs used in shrimp hatcheries in Bangladesh

Purpose	Chemical/drugs	Dosage
Disinfection of inflow seawater	Sodium hypochlorite	10-12 ppm
Chelation of heavy metals in inflow seawater	EDTA	10 ppm
Disinfection of discharge water	Sodium hypochlorite	20-30 ppm for not less than 60 min
Determination of presence of chlorine in seawater	Ortho-toluidine	3 drops in 5 ml water sample
Neutralization of chlorine in treated seawater	Sodium thiosulfate	1 ppm for every 1 ppm residual chlorine
Chelation of heavy metals in: broodstock holding tanks and hatching tanks water	EDTA	10-12 ppm

Disinfection of broodstock entry inside the hatchery	Formalin	50-100 ppm (15-30 minutes)
	Erythromycin Prefuran Oxytetracyline	50 ppm (10 minutes)
Disinfection of broodstock following spawning	Iodine-PVP or Formalin	20 ppm for 15 sec (dip) 500 ppm (10 sec)
Treatment of spawning tank	EDTA Chloramphenicol	10 ppm 4 ppm
Washing and disinfecting eggs	Iodine-PVP or Formalin, and Treflan	50-100 ppm for 1-3 min 100 ppm for 30 sec 0.05-0.1 ppm (to reduce fungal infections)
Treatment of hatching tank	EDTA Chloramphenicol Prefuran Oxytetracycline	10 ppm 4 ppm 1 ppm 4 ppm
Preparation of larval tanks for stocking nauplii	Sodium hypochlorite	200 ppm (8-10 hrs)
Disposal of discarded larvae	Sodium hypochlorite	20 ppm
Removal of epibiont fouling from postlarvae	Formalin	20-30 ppm for 1 hr with full aeration
Stress testing of postlarvae	Formalin	30 min
Decapsulation of *Artemia* cysts	Caustic soda (NaOH) and Chlorine liquid	40 g in 4 ml
Disinfection of *Artemia* nauplii	Sodium hypochlorite solution or Chloramine-T or both	20 ppm 60 ppm for 3 min
Treatment of water in spawning and hatching tanks	Treflan	0.05-0.1 ppm
Footbath	Sodium (calcium) hypochlorite solution	40-50 ppm
Disinfection of equipment (containers, hoses, nets etc.)	Sodium hypochlorite Hydrochloric acid	20-30 ppm 10% solution
Disinfection of hands	Iodine-PVP or Alcohol	20 ppm 70%
Cleaning and disinfection of tanks used for broodstock spawning, egg hatching holding for nauplii and postlarvae, hatching of *Artemia*	Sodium hypochlorite and/or Hydrochloric acid Formalin	100 ppm 10% solution 100 ppm
Disinfection of algal culture tanks	Sodium hypochlorite followed by Hydrochloric acid	50-100 ppm 10% solution
Disinfection of sand filters	Sodium hypochlorite	20 ppm
Disinfection of cartridge filters	Sodium hypochlorite	10 ppm
Washing of feed preparation equipment (knives, tables, mixers etc.)	Iodine-PVP	20 ppm

Shrimp Culture Pond. During Water Intake. Lime and bleaching powder were used to treat the water on all surveyed semi-intensive farms but extensive (traditional) farms did not use these chemicals, they enter the water directly into their pond without any treatment.

During Pond Preparation. Lime was extensively used as disinfectants during pond preparation both extensive and semi-intensive ponds (85% of extensive farm and 100% of semi-intensive farms). Eighty five percent of surveyed extensive farms where ponds cannot be completely drain out used tea-seed cake to eradicate predators. Tea-seed cake and liquid ammonia were also used to eradicate predators in all surveyed semi-intensive farms. Organic and inorganic fertilizers like cow dung, urea, super phosphate and materials like dolomite were also being used to remove NH_3, H_2S and other toxic pollutants during the pond preparation. Fertilization is a standard practice in pond preparation to promote growth of natural food and consequently shrimp production. The amount of fertilizer required varies with intensity of culture. About 26% of the surveyed extensive farm and 87% of the semi-intensive farms used the above mentioned materials during their pond preparation (Table 4).

Table 4

Organic and inorganic fertilizers used during pond preparation in traditional and semi-intensive shrimp farms in Bangladesh

Fertilizers/chemicals	Dosage	Extensive (N=42)	Semi-intensive(N=8)
Lime ($CaCO_3$)	75-100 kg/ha	85%	100%
Dolomite	30 kg/ha	25%	100%
Tea seed cake	4-4.5 kg/ha	26%	100%
Liquid Ammonia	25-50 kg/ha	none	75%
Cow dung	1200 kg/ha	85%	100%
Urea	50-100 kg/ha	26%	100%
Super Phosphate	20-50 kg/ha	26%	100%

During Grow-out Operations. During grow-out period different types of feed and feed supplements, fertilizers and prophylactic chemicals, antibiotics and fungicides were used to clear water and kill unwanted bacteria, fungi and protozoans. The chemicals found during the grow-out operations were lime (25% of semi-intensive and 84% of extensive farm) and organic/inorganic fertilizer (30% extensive and 75% semi-intensive). During grow-out operation, disease is an important problem both in semi-intensive and extensive shrimp farms in Bangladesh. About 75% semi-intensive and 38% of extensive farms were found disease affected during the investigation period. Of the disease affected farms, most of the extensive farmers didn't apply any chemicals or antibiotics. Only few extensive farmers used oxytetracycline (mixed with feed) and formalin to control common diseases. On the other hand, use of chemicals and antibiotics for disease treatment was higher on semi-intensive farms. About 100% of semi-intensive farms used antibiotics like oxytetracycline, erythromycin, furazolidone, ciprofloxacin, antibacterial like sulphamethaoxazole with trimethaoprim and chemicals like malachite green, copper sulphate, formalin, oxolinic acid to control common shrimp diseases (Table 5).

Table 5

Different antibiotics and drug used for treatment in shrimp grow-out pond in Bangladesh

Antibiotics/chemicals	Dosage	Disease name/purpose	Farm type
Lime	80-100 kg/ha	Water treatment	Semi-intensive
Dolomite	30 kg/ha	Water treatment/ Soft shell disease	Traditional + Semi-intensive
Bleaching powder(chlorine)	5-10 ppm	Water treatment / Crooked leg disease	Semi-intensive
Tea seed cake	4-4.5 kg/ha	Tail rot	
Formalin	15-25 ppm	Protozoan disease, Shell disease *(Epistylis spp. Vorticella spp.* etc.	Traditional + Semi-intensive

Malachite green	0.75-3 ppm	Black gill disease, Red discoloration	Semi-intensive
Copper sulphate	2-3 ppm	Blisters, Filamentous bacterial disease, Ectoparasitic infection	Semi-intensive
Methylene blue	8-10 ppm	Black gill disease	Semi-intensive
Potassium permanganate	2.5-5 ppm	Filamentous bacterial disease, Ectoparasitic infection	Semi-intensive
Mahua oil and tea-seed cake	2-10 kg/ha	To eradicate predators	Traditional + Semi-intensive
Malathion	0.5-2 ppm	Ectoparasitic disease	Semi-intensive
EDTA (Ethylene diamine tetra acidic acid	5-10 ppm	Vibriosis	Semi-intensive
Antibiotics			
Oxytetracyline	8-10 ppm	Luminous bacterial	Traditional + Semi-
Erythromycin	2-3 gm/kg feed	disease, Black splinter disease, other bacterial	intensive. Semi-intensive
Furazolidone,	10-15 ppm	disease	Semi-intensive
Ciprofloxacin	4-5 ppm		Semi-intensive
	4-5 ppm		
Antibacterials			Semi-intensive
Sulphamethaxazole	0.5-2 ppm	Common bacterial disease	

Discussion. Antibiotics, antibacterials and antifungal drugs like chloramphenicol (CL-33), oxytetracyline, furazolidone, prefuran, ciprofloxacin, sulphonamide and malachite green are in use in shrimp hatcheries and culture farms in Bangladesh. There are three basic types of treatment prophylactic, metaphylactic and therapeutic (Bell 1992). Prophylactic treatment is best used when a long history of disease allows for accurate prediction (Bell 1992). Table 4 shows the different types of treatment in shrimp culture farm in Bangladesh.

The present study reveals that the concentration of prefuran and furazolidon used to control *vibrio* infection in Bangladesh are lower than the doses used by Baticados & 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 erythromycin and oxytetracyclin are similar with the doses used by other countries as reported by Baticados & Paclibare (1992) and Rattanavinijkul et al (1988). Malachite green has been used at levels of 0.002 to 0.01 ppm and treflan of 0.01 to 0.1 ppm is more or less similar to the doses used by other countries as reported by Bell & Lightner (1992).

In coastal shrimp farming, the present investigation showed that lime and fertilizers were most commonly used chemicals for water and soil treatment. Formalin, malachite green, copper sulphate were also used to control some common bacterial and fungal diseases. Chloramphenicol, oxytetracycline and erythromycin were the most common antibiotics used to control *Vibrio* bacterial diseases.

Chlorine is widely used in hatcheries and culture ponds, but its use stimulates the development of multiple antibiotic resistance genes in Bacteria (Murray et al 1984). However chlorination is done to kill small aquatic invertebrates which might act as reservoirs of disease. Water in the reservoir is usually dechlorinated before being utilized for production purpose. Improper dechlorination might cause health problems to the farmed animal itself and when discharged, might kill the micro flora and smaller invertebrates in the environment. Other chemical disinfectants like copper compounds, formalin, malachite green etc. can create health hazards for the persons handling them

as well as can kill non-targeted organisms if discharged to the main water body through effluents (Vijayakumaran 1997).

Unlike many other countries, where strict regulations are enforced in use of antibiotics, no such enforcement is made in Bangladesh. However, the government of Bangladesh banned the use and store of chloramphenicol and nitrofurazolidone in shrimp aquaculture in 2002. The FDA (1998), legalized five drugs for use in U.S. aquaculture and 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 & 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 & 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 et al 1998).

It is assumed that antibiotics or disinfectants are used to kill bacteria, some bacteria will survive as strains of the pathogen or others, because they carry genes for resistance. This will then grow rapidly because their competitors are removed. Any virulent pathogens that re-enter the pond or hatchery tanks, perhaps form within biofilms in water pipes or in the guts of animals can then exchange genes with the resistant bacteria and survive in further high doses of antibiotics. Thus antibiotic-resistant strains of pathogens evolve rapidly.

The most important reasons to control the use of antibiotics and chemicals in shrimp aquaculture 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.

Conclusion. To overcome the problems mentioned hatchery and culture farm 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. Probiotics which are available in Bangladesh are exotic strains and its behavior and efficacy in Bangladeshi situation have not been tested. Indigenous probiotics should be developed and used for shrimp hatcheries and culture farms in Bangladesh. Immune enhancers and immunostimulants can also be used for shrimp hatcheries and culture farms in Bangladesh. β Glucans and some lipopolysaccharides simulate the cell wall configuration of *vibrios* and are effectively used as immunostimulants in shrimp culture. Immune enhancers and immunostimulants could be repeatedly used as we know that shrimps have no specific immune system, they have only innate immune system. Moreover, vaccines might be impractical because of absence of specific immune system in shrimps. e-mail.

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