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STUDY ON IMPACT OF AQUA DRUGS AND CHEMICALS ON SHRIMP HEALTH IN BANGLADESH

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ABSTRACT

Ahmed GU, Faruk MAR, Islam KR (2014) Study on impact of aqua drugs and chemicals on shrimp health in Bangladesh. *Marine Res. Aqua.* 2(1), 17-23.

An investigation was carried out to know the impact of aqua-drugs and chemicals on shrimp health in the coastal belt of Bangladesh. Eight different categories of aqua-drugs and chemicals were found to use in shrimp farming activities. They were oxygen suppliers, disinfectants, growth promoters, antibiotics, pond preparator, gas removal, insect killers and microbe killers. In medicine shops of investigated areas, 39 different types of aqua-drugs and chemicals were recorded. Some shrimp of Cox's Bazar region were yellowish, brownish or darker than normal appearance. Clinically health condition of shrimp of Khulna region was better than those of Cox's Bazar region. Histopathologically, muscle of control shrimp (without drugs treated) of all the investigated areas of Cox's Bazar and Khulna regions were almost normal except some vacuums in control shrimp muscle of Fakirhat. In case of midgut of control shrimp there were some vacuums, necrosis and pyknotic cells in Fakirhat and Khulna. In the drugs treated shrimp of all the investigated areas of Cox's Bazar and Khulna regions, there were remarkable pathological changes like necrosis, vacuums and pyknosis in muscle and midgut of shrimp.

Key words: *histopathology, necrosis, pyknosis, vacuums, midgut*

INTRODUCTION

With the expansion of coastal aquaculture in Bangladesh, there has been increasing trend in using aqua-drugs in shrimp health management. Commonly used aqua-drugs in Bangladesh aquaculture are lime, rotenone, various forms of inorganic and organic fertilizers, phostoxin, salt, dipterex, antimicrobials, potassium permanganate, copper sulphate, formalin, sumithion, melathion etc. (Faruk *et al*. 2004). Most farmers used oxysentin 20%, capter, acimox (vet) powder and aquamycine for disease treatment in Jamalpur and Sherpur region (Monsur 2012). Many aqua-drugs may persist for many months in aquatic system, retaining their biocide properties. Some antibacterial, notably oxytetracycline, oxolinic acid and flumequine can be found in sediments at least six months following treatment (Weston 1996). There are problems associated with the use of aqua-drugs and chemicals. Major concerns regarding the use of antibiotics in aquaculture involve the development and transfer of drug resistance to pathogenic bacteria from farmed shrimp to human. Although Reilly (1992) opined that fertilizers posed minimal risk to food safety in aquaculture, when used appropriately and any misuse could lead to hazard in aquaculture products. When aqua-drugs are employed by aqua culturists, certain portions of the applied substances are released directly to the environment. Indiscriminate use of aqua-drugs and chemicals often lead to problems like drug resistance, tissue residues, adverse effect on species biodiversity etc., which ultimately affect the cultured species, humans and environment. Several of these aspects have been well documented (Shamsuddin 2012). It also caused ban of export of shrimp from Bangladesh (Nupur 2010). In July, 1997 the European commission imposed a ban on imports of shrimp products from Bangladesh into the EU on the ground that exports of this commodity did not meet the stringent provisions of EC's HACCP (Hazard Analysis Critical Control Point) regulations. Thus, both the farms and the GoB were put on the dock. The ban put the country's shrimp export industry under severe strain and led to serious market disruptions which had already recovered through implication of necessary measures. There is potential for some chemical compounds used in shrimp culture to pose health risks to site workers. Unfortunately, there is a lack of information regarding the present status and impact of aqua-drugs and chemicals used in Bangladesh shrimp culture industry. Thus, the present study was aimed to investigate the impact of aqua-drugs and chemicals on shrimp health in different farms of Khulna and Cox's Bazar regions.

MATERIALS AND METHODS

Six different sampling stations of three districts namely, Cox'sBazar, Khulna and Bagerhat were selected in the present study. Khulna, Paikgacha, Dhigar (Paikgacha), Bagerhat, Chakaria and Cox's Bazar were the six sampling stations of these three districts. These areas were selected considering the intensity of shrimp farming, shrimp farmers, sellers of aqua-drug and representatives of pharmaceutical companies. Since shrimp culture activities in Cox's Bazar, Khulna and Bagerhat are quite diversified, data were collected from different target groups to have an overall picture of the aqua-drugs and chemicals used in shrimp culture activities in the investigated areas. Questionnaire interview was carried out through PRA, namely Focus Group Discussion (FGD) in every sampling station. Structured questionnaire was designed for shrimp farmers, farm owners and drug sellers who were questioned individually. Drugs used in different places of culture periods for ponds/ghers preparation, water quality improvement, gas removal, oxygen supplier, disinfectants and disease treatment during sampling. Five focus group discussions were held during the present investigation. They were two at Paikgacha, one at Chakaria, one at Bagerhat and one at Cox's Bazar. In an average thirty five (35) participants were present during each Focus Group Discussion (FGD). The participants were shrimp farmers, drug sellers

and farm owners. Chemicals used by the farmers in various forms in the respective regions were recorded. Chemicals available in drug shops used during shrimp culture were also recorded. Samples of shrimp from each study area were collected to detect health condition through clinical and histopathological observations. Sampled shrimp were examined by necked eyes to observe the external signs and color changes, injury, infection in fin and muscle, appendage damage and other abnormalities. For histopathological observation samples were collected by sharp scalpel and forceps and fixed in Davidson's fixative. The samples were then embedded and sectioned at a thickness of 5 µm. The sections were then stained with hematoxylin and eosin stains. Then the sections were mounted with Canada balsam and covered by a cover slip. The slides were examined under a compound microscope (Olympus). The photomicrographs from the stained sections taken by using a photomicroscope. Pathological observation were made from the slides and photographs and compared among different sampling stations.

RESULTS AND DISCUSSION

Aqua-drugs and chemicals producing pharmaceutical companies in the study area

The present study revealed that 30 companies were being supplied different aqua-drugs in the study area and about 76% of the products were supplied by nine companies. These were Fishtech (BD) Ltd. (24%), Novartis Animal Health Ltd. (10%), ACI Livestock and Fisheries (8%), First Care Pharmaceuticals Ltd. (6%), Opsonin Pharma Ltd. (6%), Sigma Agro-Vat Ltd. (6%), Square Pharmaceuticals Ltd. (6%), Eon Animal Health Products Ltd. (6%) and Acme Pharmaceuticals Ltd. (6%). The rest 24% were supplied by the 21 companies- such as Ranata Ltd. (4%), Samco Ltd. (3%), Rals Agro Ltd. (3%), Ellwellas Marketing Ltd. (2%), Al Madina Pharmaceuticals Ltd. (2%), Nature Care (2%), Fish World Ltd. (2%), Techno Ltd. (2%) and others 4% were contributed by local non brand companies (Fig. 1). Shamsuddin (2012) mentioned 28 companies either to produce or market products for aquaculture activities in Mymensingh region. Monsur (2012) reported that eight companies produce and market aqua drugs in greater Jamalpur region.

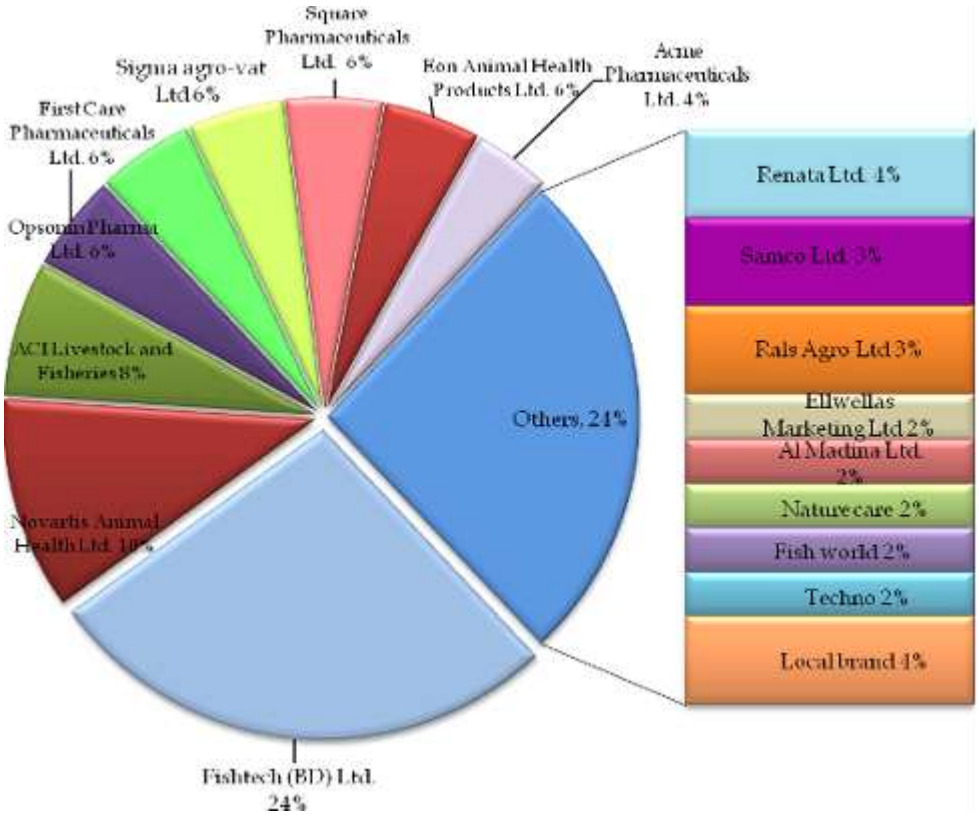

Fig. 1. Aqua-drugs supplying companies in the investigated Khulna region

Gher preparation

During gher preparation, farmers used lime, urea and TSP at different combinations. In addition, the farmers also used cow dung as organic manure. During gher preparation, most of the farmers (58%) used a combination of lime, urea and cow dung in the study area. Only Lime was used by 17% of farmers. During gher preparation, the combination of lime and cow dung were used by 13% of shrimp farmers and Lime, urea, TSP and cow dung were used by 12% of farmers in the study area (Fig. 2).

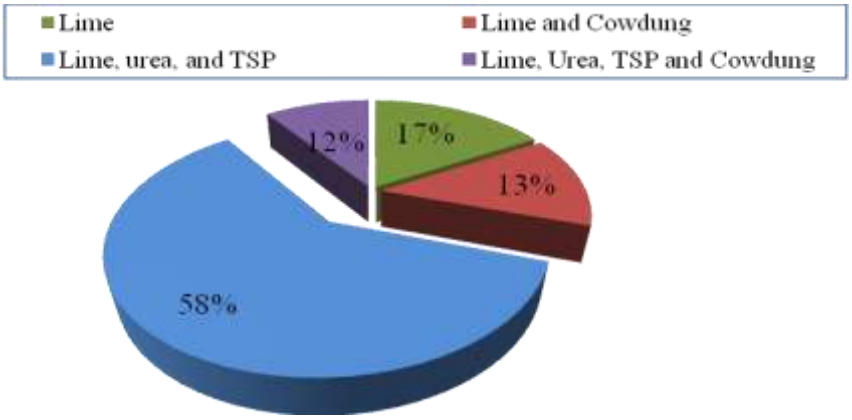

Fig. 2. Aqua-drugs used during gher preparation

Shamsuddin (2012) mentioned that during nursery pond preparation, most of the farmers (60%) used a combination of lime, urea and cow dung but during culture period this combination was used by 29% farmers, only lime used by 17% farmers but during culture period lime was used by 43% farmers. During pond preparation, the combination of lime and cow dung were used by 13% fish farmers and lime, urea, TSP and cow dung were used by 10% fish farmers but during culture period the combination of lime and cow dung were used by 7% farmers and lime, urea, TSP and cow dung were used by 20% fish farmers.

Oxygen supplier

Several chemicals were seen readily available in the chemical shops used for increasing dissolved oxygen in the shrimp gher. These chemicals were oxy life, oxy gold, pure-oxy, oxymax, oxy-dox F etc. Oxygen precursors, probiotics, sodium percarbonate, calcium peroxide and oxytetracycline hydrochloride were the major active ingredients of such chemicals. In Jamalpur and Sherpur region, oxyflow, oxymax, bio care, bio-ox, oxy plus, oxygen plus, oxymore, quick oxygen, oxy-plus, O-plus, oxygrow, oxysun, fish care powder, fish curepas and oxy-gold were recorded by Monsur (2012). In Mymensingh district, oxyflow, oxymax, bio care, bio-ox, oxy plus, oxygen plus, oxymore, quick oxygen, oxy-plus, O-plus, oxygrow, oxysun, fish care powder, fish curepas, oxy-gold were recorded by Faruk *et al*. (2008). All the pharmaceutical companies in Bangladesh still did not explore their business in coastal region; that's why only few types of oxygen supplier were available in the region. On the other hand, farmers of low income groups of Cox's Bazar could not buy such chemicals because of their high price. Shamsuddin (2012) also mentioned that only few farmers used oxy life and oxy gold in Mymensingh region because of high price.

Growth promoters

Based on the result of the present study, aqua boost, aqua nourishes, square aqua mix, penamin and charger gel were recorded from the shops in Khulna region but most of the farmers did not show interest to use all of these growth promoters. Farmers mainly used aqua nourish as growth promoter in Khulna region. Whereas, in the Cox's Bazar region only few farmers used aqua nourish and aqua boost as growth promoters. Farmers also used aqua vit and mega vit as vitamin premix in shrimp culture in Cox's Bazar. Faruk *et al*. (2008) observed that megavit aqua, aqua boost, aqua savor, vitamin premix, grow fast, orgavit auqa, AQ-cell, AQ grow-G, fish vita plus, AQ grow-L, growmax, nature aqua GP, vitamix, F aqua, AC mix and many other chemicals were used as growth promoters to increase production. Shamsuddin (2012) mentioned that aqua boost, bio-grow and charger gel were recorded in Mymensingh region but most of the farmers did not show interest to use these growth promoters. Only few farmers used charger gel (30%) and aqua boost (18%) because of the higher price of growth promoters.

Disease treatment

Basudin, methylene blue, bleaching powder, oxytetracycline, potash were used for WSSV treatment in the present study in Khulna region. Methylene blue, oxytetracycline did not give any positive result for recovery of WSSV disease. Some improvement was noticed while used potash and bleaching powder in the gher. On the other hand farmers in the Cox's Bazar did not use any aqua-drugs for WSSV treatment. According to farmers frequent water exchange would help to reduce the problem. Sultana (2004) mentioned that luminous vibriosis and WSSV diseases were two major diseases in shrimp farming. The author further mentioned that antibiotics, which have been used in large quantities, were in many cases ineffective or result in increased in virulence of pathogens and furthermore caused for concern in promoting transfer of antibiotic resistance to human pathogens. Some farmers occasionally used geolite, bio-oxy, oxy-A, oxy-tox and mega geo as and when necessary. Specially during oxygen depletion farmers used most the mentioned chemicals. According to

farmers, they used mega geo, geolite for water purification. Last year there were white spot diseases in some of the farmer's gher in both of the region. However, they did not use any chemicals or drugs to control the disease. However, according to farmers frequent water exchange would help to reduce the problem.

Clinical observation

Shrimp of different investigated areas had different color in appearance. Some shrimp of Cox's Bazar region were yellowish, brownish or darker than normal appearance in the drug treated ponds. Shrimp of Chakaria were greenish-darker in color. Clinically health condition of shrimp of Khulna region was better where no aqua drug was used than those of Cox's Bazar region (Table 1 and Figures 3. A, B, C and D). Shamsuddin (2012) observed that fishes between aqua-drugs treated ponds and control ponds did not show any clinically remarkable changes. Monsur (2012) also mentioned similar opinion for fishes of greater Jamalpur region.

Table 1. Clinical observation of shrimp in study areas

Study areas	Clinical appearance of shrimp
Cox's Bazar	Clinically healthy but had yellowish-brown color underneath the shell
Chakaria	Clinically shrimp were greenish-darker in color
Khulna	Clinically normal appearance
Paikgacha	Yellowish color
Bagerhat	Yellowish-brown in color

Figures 3. Shrimps of Chakaria (A), Cox's Bazar (B), Paikgacha and Bagerhat areas (C) and Sample in the BAU laboratory (D)

Histopathological observations

Muscle of control shrimp (without drugs treated) of all the investigated areas of Cox's Bazar and Khulna regions were almost normal (Figures 4, 8). Except there were some vacuums in control shrimp muscle of Fakirhat (Fig. 6). However, in the drugs treated shrimp muscle of all the investigated areas of Cox's Bazar and Khulna regions, there were remarkable pathological changes like necrosis, vacuums and pyknosis (Figures 5, 7 and 9).

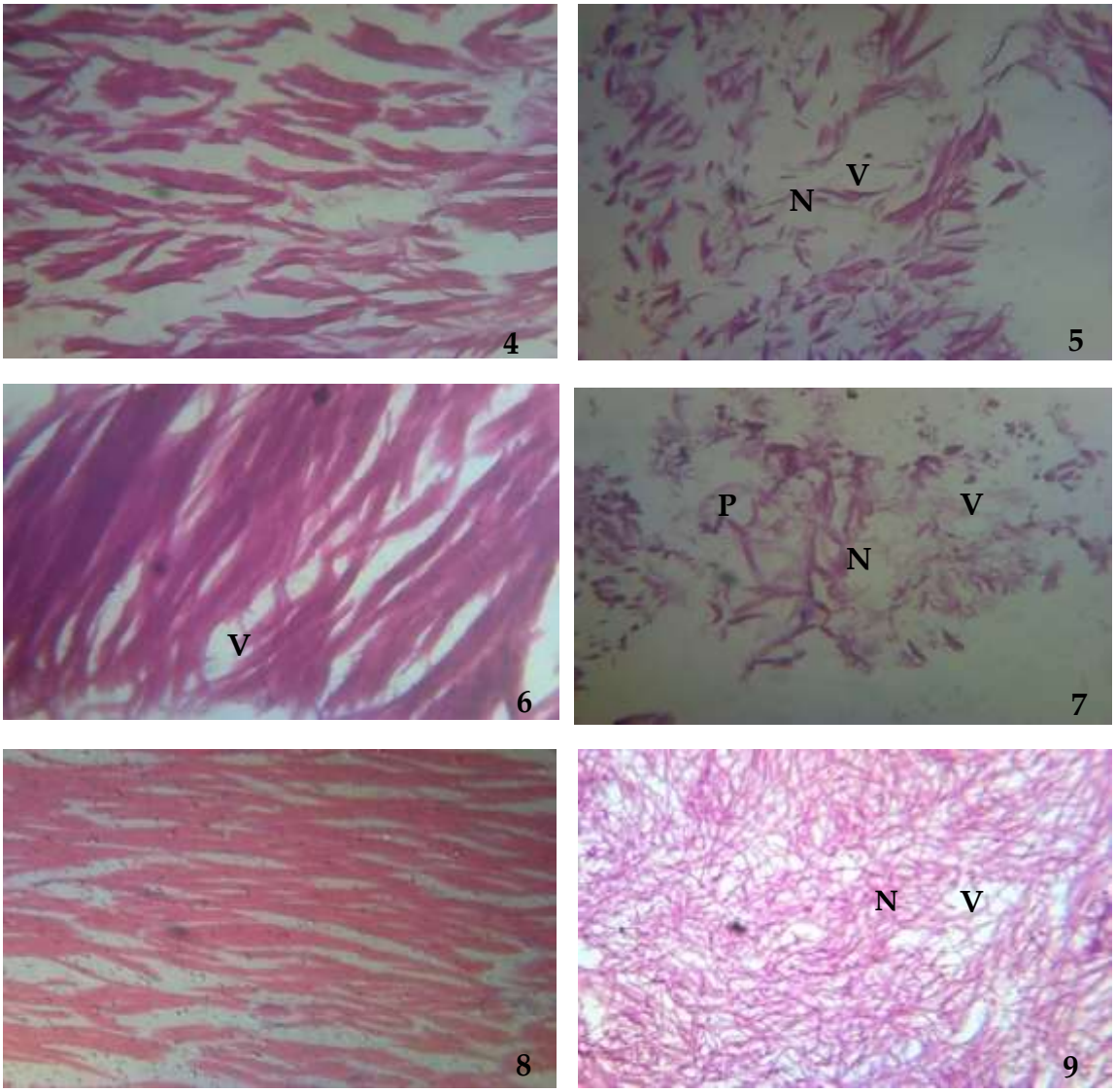

Figure 4. Cross section of control muscle of shrimp collected from Cox's Bazar having more or less normal fashion. H & E x 125.
Figure 5. Section of drug treated muscle of shrimp collected from Cox's Bazar showing vacuum (V) and necrosis (N). H & E x 125.
Figure 6. Photomicrograph of almost normal muscle of shrimp collected from control ponds of Fakirhat except some vaccum (V) H & E x 125.
Figure 7. Cross section of drug treated muscle of shrimp collected from Fakirhat Showing vacuum (V), necrosis (N) and pyknosis (P). H & E x 125.
Figure 8. Section of control muscle of shrimp collected from Khulna sadar having normal arrangement. H & E x 125.
Figure 9. Photomicrograph of drug treated muscle of shrimp collected from Khulna sadar showing mild necrosis (N) and vacuum (V). H & E x 125.

Midgut of shrimp of control pond (without drugs treated) of Cox's Bazar region had almost normal structure (Fig. 10). In case of Fakirhat and Khulna, midgut of shrimp of control ponds had some vacuums, necrosis and pyknotic cells (Figures 12 and 14).

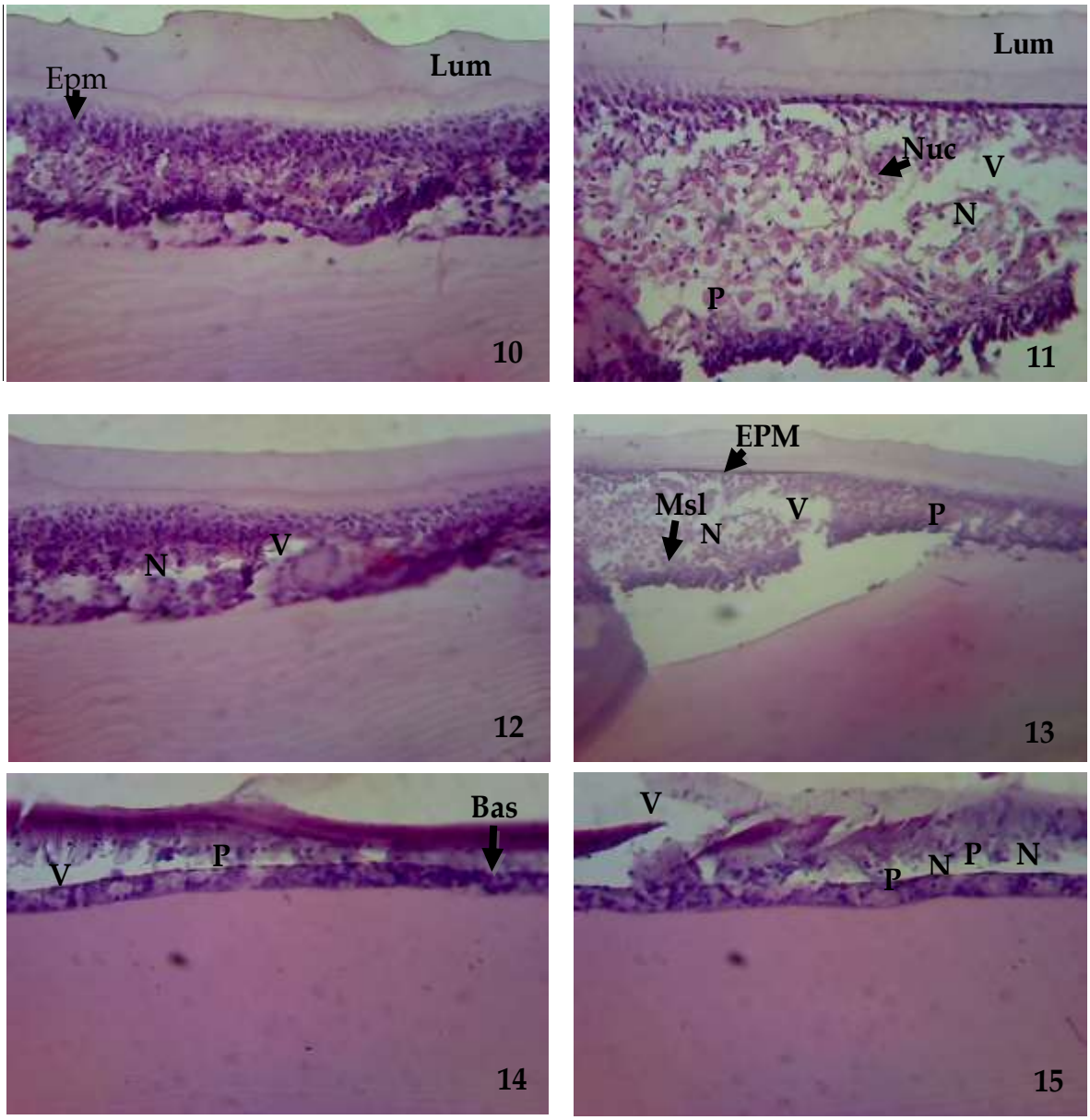

Figure 10. Cross section of midgut of shrimp from control pond of Cox's Bazar showing mucosal epithelium (Epm) and lumen (Lum) are in normal fashion. H & E x 125.
Figure 11. Section of midgut of shrimp from drug treated pond of Cox's Bazar Showing vacuum (V), necrosis (N) and pyknotic cells (P) in the epithelium. H & E x 240.
Figure 12. Photomicrograph of midgut of shrimp of control pond collected from Fakirhat showing epithelium had minor vacuum (V), and necrosis (N). H & E x 240.
Figure 13. Cross section of midgut of shrimp of treated pond from Fakirhat showing mucosal epithelium (EPM) had vacuum (V), necrosis (N), and pyknosis (P). H & E x 125.
Figure 14. Section of midgut of shrimp of control pond from Khulna showing basement membrane (Bas), vacuum (V) and pyknosis (P). H & E x 125.
Figure 15. Photomicrograph of midgut of shrimp of treated pond from Khulna showing large vacuum (V), severe necrosis (N), and pyknosis (P). H & E x 125.

Thus histopathologically, shrimp organs of chemical treated ghers were affected, whereas, in the control ghers the organs were almost normal in structure. So drugs had negative impacts on the health of the shrimp. So use of minimum amount of drugs in shrimp culture should be done.

CONCLUSION

Eight different categories of aqua-drugs and chemicals were found to use in shrimp farming activities. They were oxygen suppliers, disinfectants, growth promoters, antibiotics, pond preparator, gas removal, insect killers and microbe killers. In case of drugs of investigated areas, 39 different types of aqua-drugs and chemicals were recorded from the available shops. Among those, some types were widely used by the farmers such as renamycin, potash, ossi-C, TSP, aquamycine, virex, aquakleen, geolite gold, oxy dox F, polgard plus, charger gel, seaweed, bactisal and deletix. Drugs in shrimp culture mainly used for water treatment, to a less extent for gher preparation and gas removal. Shrimp of different investigated areas were different in appearance clinically. Some shrimp of Cox's Bazar region were yellowish, brownish or darker than normal appearance. Shrimp of Chakaria were greenish-darker in color. Clinically health condition of shrimp of Khulna region was better than those of Cox's Bazar region. However, aqua-drugs had minimum impact on the clinical appearance of shrimp and prawn in the coastal region. Histopathologically, muscle of control shrimp of all the investigated areas of Cox's Bazar and Khulna region were almost normal. However, in the drugs treated shrimp of all the investigated areas of Cox's Bazar and Khulna region had remarkable pathological changes like necrosis, vacuums and pyknosis. Thus it can be mentioned that there were distinct impact of aqua-drugs and chemicals on shrimp health. It is thus necessary to take steps to reduce the use of aqua drugs in shrimp ghers of Bangladesh.

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