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Short Note

Effect of alum on the histological changes of silver barb (*Barbodes gonionotus*)

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Abstract
Studies were conducted to know the effects of alum on the histological changes of silver barb (*Barbodes gonionotus*) fry in the aquarium. The use of up to 0.5 g/L of alum for 120 hours as means of treatment of fish diseases is safe. At this level, no abnormal behavior and pathological alteration were observed in the organs of experimental fish. As the doses increased to 1.25 g/L and above (1.5 g/L), experimental fishes exhibited abnormal movement and with marked histopathological changes in the various organs. A dose of above 0.5 g/L should be strictly prohibited.

Key words: *Barbodes gonionotus*, Alum, Histopathology

The treatment of alum is mainly used in aquaculture to remove the turbidity of pond water and a concentration of 30 mg/L alum could reduce turbidity from an initial 340 NTU (Nephelometric Turbidity Units) to less than 30 NTU in four hours (Hart and McGregor 1982). But alum treatment rendered water acidic and not suitable for fish culture and a mixture of lime and alum removed turbidity and water was rendered suitable for fish (Biswal and Roy 1991). Alum treatment of ponds reduces soluble reactive phosphorus (SRP) and total phosphorus (TP) concentrations in ponds (Masuda and Boyd 1994). The alum was used as water purification material for drinking in remote areas of Bangladesh, where tube-well was not available. Recently, alum is using in aquaculture for fish health management. But the fish farmers do not know the suitable doses. Hence, the present work was under taken to know the tolerance level and histological changes on different organ of silver barb.

Six treatments were considered in the present experiment. First treatment (T_1) was control having no alum mixed, but treatment 2 (T_2), treatment 3 (T_3), treatment 4 (T_4), treatment 5 (T_5) and treatment 6 (T_6) were maintained at 0.5 g/L, 0.75 g/L, 1.0 g/L, 1.25 g/L and 1.5 g/L alum, respectively. The fishes were acclimatized in galvanized iron drum with tap water. Required amount of powdered alum were mixed in water and aerated for one hour. Then ten healthy fishes were released in each aquarium. Average size of the fishes was 11.42 $\pm$ 0.82 cm in length and 17.3 $\pm$ 2.21 g in weight. The death (due toxicity of alum) fishes were caught by hand net to collect samples for histological analysis. Number of fishes and time of mortality were recorded throughout the experimental period. Samples for histological

analysis were collected from skin, muscle, gill, liver and kidney and fixed in 10% neutral buffered formalin. Physico-chemicals parameters of aquaria water *viz.*, temperature, pH, total alkalinity (mg/L), total ammonia (mg/L) and dissolved oxygen (mg/L) were recorded. Confidence level (CL) were calculated using the formula (Gomez *et al.* 1986), $C L = 100\{1-2(½)^N\}$. Where N was the number of exposed organism (fish).

No fish died at concentration 0.5/L during experimental period. However, fishes died at different time with the different alum concentration except treatments 1 and 2. Normal behaviors of fishes were changed especially at the time of death. Fish did not show any change of body color after treatment. In the treatment 3, 25% fishes died after 72 hours of the start of the experiment and no fishes died in the remaining period. All fishes died within 4 hours and 35 minutes at T_4, within 3 hours and 45 minutes at T_5 and within 1 hour and 35 minutes at T_6.

The range of dissolved oxygen (DO) of the aquarium water was from 4.9 to 5.9 mg/L. The water temperature ranged from 24.8 to 27.5°C during the experimental period. The range of pH was from 6.8 to 7.7, alkalinity from 140 to 160 mg/L and ammonia from 0.19 to 2.812 mg/L. The dissolved oxygen range and temperature of aquarium water was favorable for fishes. pH and total alkalinity of the aquarium water were slightly decreased with the increase of alum concentration at end of the experiment. But, the total ammonia was highly increased with increase of alum concentration of aquarium water. Mainly highly increased ammonia was found where fishes died. These remarkable changes in ammonia may be due to release of excess excreta for stress of fish before their death in the aquaria. These changes of water quality could affect the normal physiology of fishes (Subasinghe 1995).

Histological observation of skin and muscle of experimental fishes

In both the treatments 1 and 2, structure of skin and muscle was almost normal throughout the experimental period (Fig. A_1). Whereas, in treatments 3 and 4, myotomes of the muscle had slight disintegration showing minute vacuums (v) (Fig. A_2). However, in the treatments 5 and 6, epidermis of skin were lost partially, dermis splitted (↑) and muscles had necrosis (n) and vacuums (v) (Fig. A_3).

Histological observation of gill of experimental fishes

In the treatments 1 and 2, histological structure of gills was normal (Fig. B_1). But in the treatments 3 and 4, gill had cubbing (cb), necrosis (n), and pyknosis (p) (Fig. B_2). Whereas, in the treatments 5 and 6 gill exhibited hypertrophy (hy), hemorrhage (H), necrosis (n), loss of secondary gill lamellae (↑) (Fig. B_3).

Histological observation of liver of experimental fishes

In the low dose treatment (T_2) and control, histological structure of livers was almost normal (Fig. C_1). However, in the treatments 3 and 4 hepatocytes of liver had minute vacuums (v) and necrosis (n) (Fig. C_2). Whereas, marked necrosis (n) and wide vacuums (v) were noticed within the liver sections of treatments 5 and 6 (Fig. C_3).

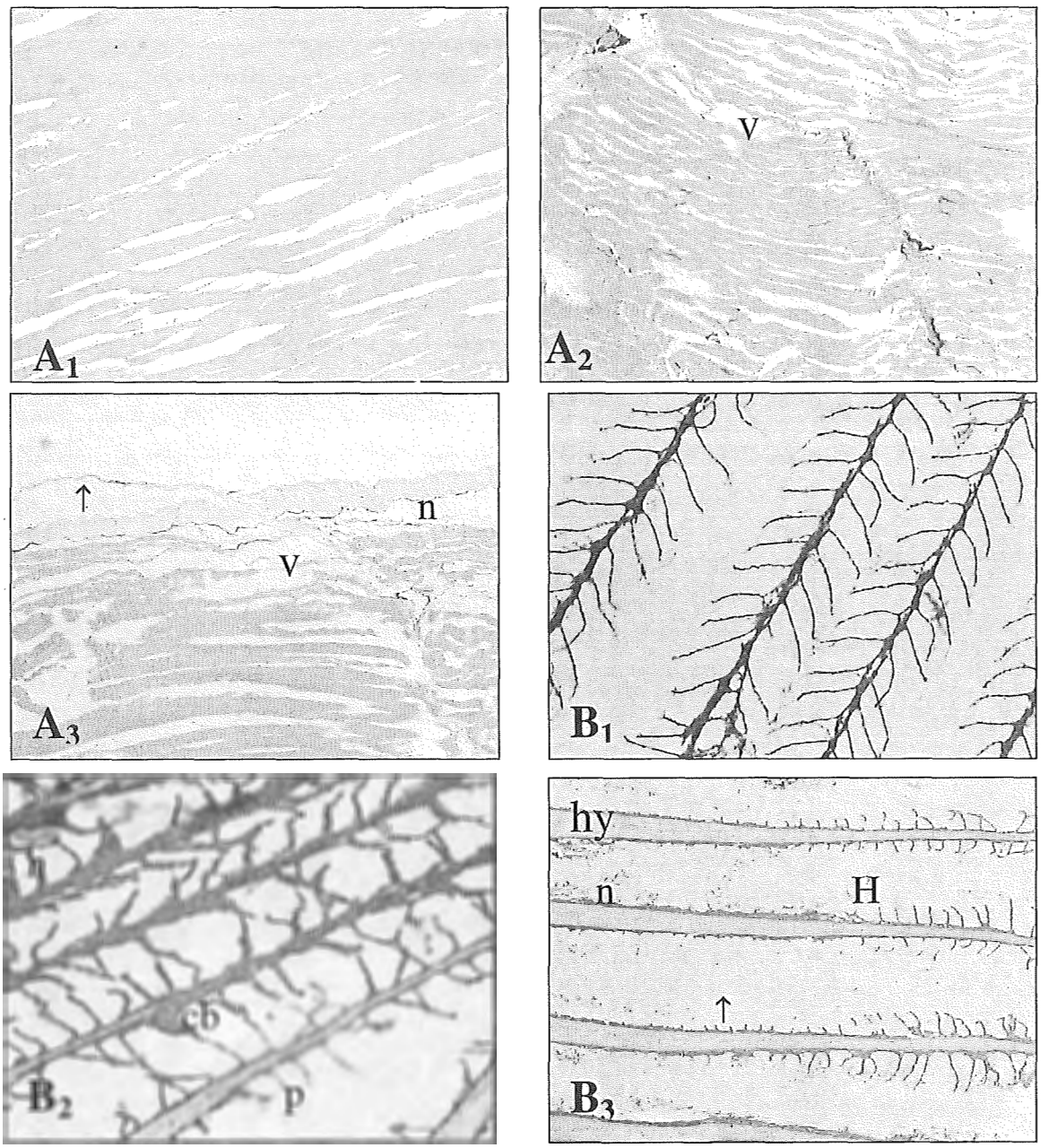

Fig. A_1 Section of the muscle from T_2 showing its normal structure. H and E × 175.
Fig. A_2 Section of muscle having minute vacuums (v) in T_4. H and E × 175.
Fig. A_3 Photomicrograph of the skin and muscle from T_6 showing loss of epidermis, splitting dermis (↑), necrosis (n) and vacuums (v). H and E × 175.
Fig. B_1 Section of gill from T_1 exhibiting normal structure of gill. H and E × 175.
Fig. B_2 Section of gill from T_4 with cubbing (cb), necrosis (n), and pyknosis (p). H and E × 175.
Fig. B_3 Photomicrograph of gill showing hypertrophy (hy), hemorrhage (H), necrosis (n), loss of secondary gill lamellae (↑) in T_6. H and E × 175.

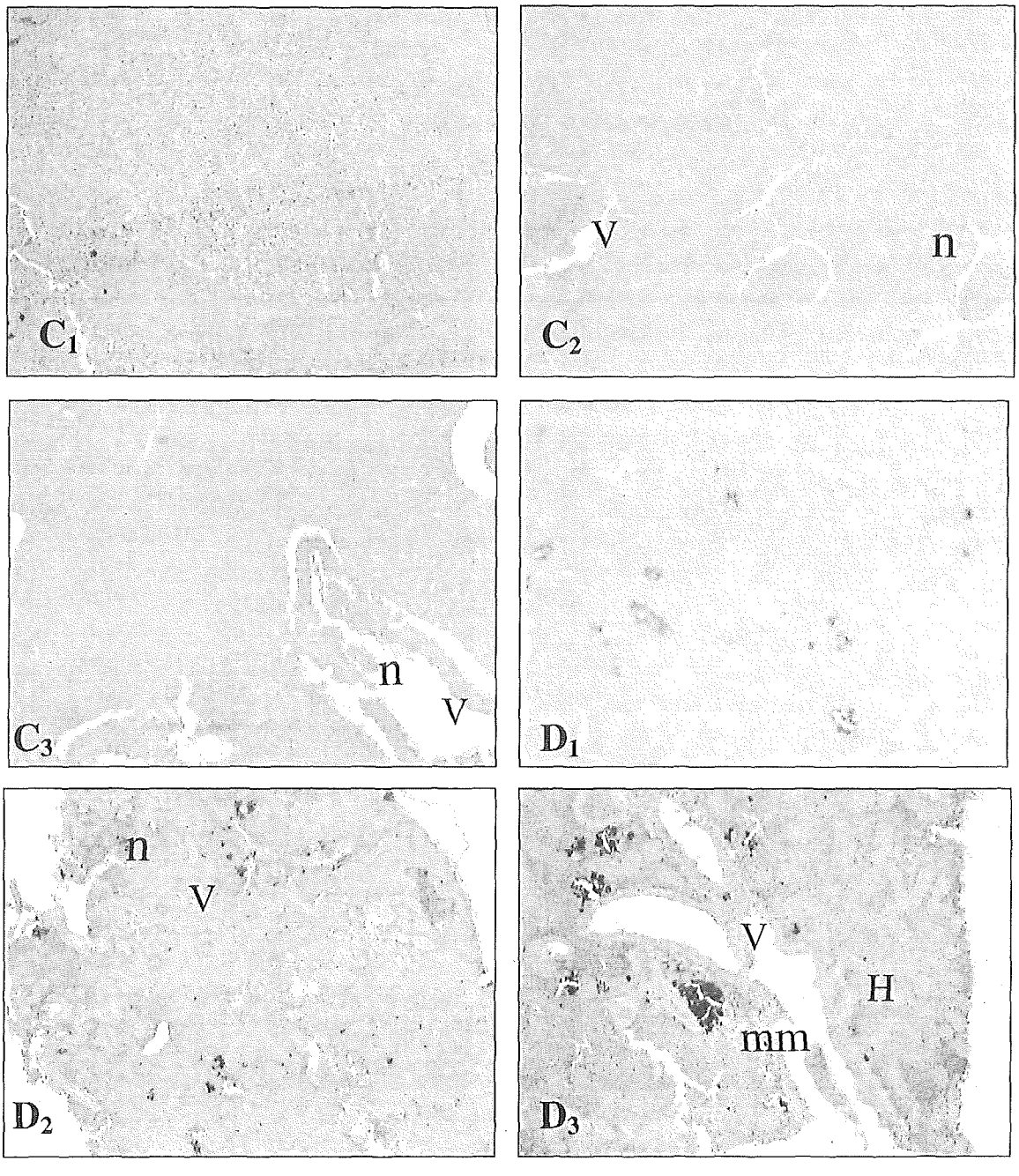

Fig. C_1 Section of liver from T_2 showing normal structure of liver. H and E × 175.
Fig. C_2 Photomicrograph of liver showing minute vacuums (v) necrosis (n) in T_3. H & E × 175.
Fig. C_3 Section of liver from T_6 with marked necrosis (n) and vacuums (v). H and E × 175.
Fig. D_1 Section of kidney from T_1 exhibiting its normal structure. H and E × 175.
Fig. D_2 Section of kidney from T_4 showing minute necrosis (n) and vacuums (v). H & E × 175.
Fig. D_3 Photomicrograph of kidney from T_5 with necrosis (n), melanomacrophages (mm), hemorrhage (H) and vacuums (v). H and E × 175.

Histological of structure of kidney of experimental fishes

Structure of the kidney exhibited normal in the treatments 1 and 2 (Fig. D_1). Again, the structure of kidney in the treatments 3 and 4 had minute necrosis (n) and vacuums (v) (Fig. D_2). However, in the treatments (T_5 and T_6) kidney structure had marked necrosis (n), wide vacuums (v), hemorrhages (H) and melanomacrophages (mm) (Fig. D_3).

Histological changes were observed in skin, muscle, gill, liver and kidney of the treated fishes except fishes treated with 0.5 g alum/L. In the treatments 3 and 4 myotomes had slight disintegration showing minute vacuums. Secondary gill lamellae were partially missing having clubbing and hemorrhage. The structure of kidney in T_3 and T_4, had tubular necrosis, vacuums and hemorrhage. In the high dose treatments (5 and 6), epidermis of skin was lost partially, dermis splitted and muscles had necrosis and vacuums. Again, primary gill lamellae were swollen, secondary gill lamellae were missing in many places having hemorrhage and necrosis.

Alum is a low cost and widely used chemotherapeutic in aquaculture of Bangladesh. From the finding of the present investigation, it was observed that use of up to 0.5 g/L of alum for 120 hours as means of treatment in fish diseases is safe. At this level, no abnormal behavior and pathological alteration were observed in the organs of experimental fish. It was also observed that as the doses increased to 1.25 g/L and above (1.5 g/L), experimental fishes exhibited abnormal movement and with marked histopathological changes in the various organs. Thus it needs proper attention in the application of alum as a drug in aquaculture. A dose of above 0.5 g/L should be strictly prohibited.

References

Biswal, P. K. and S. C. Roy, 1991. Turbidity control in freshwater aquacultural ponds. National Symposium on New Horizons in Freshwater Aquaculture, 23–25 January, 1991. Proceedings, 1991, pp. 106-107.

Gomez, E.D., A.D.L. Cruz, V.B. Chaver, D.H. Miles and G.J.B. Cajipe, 1986. Toxicant from mangrove plants: Toxicity of aqueous extracts to fish. *Philippine J. Sci.*, 115(2): 81-89.

Hart, B. T. and R.J. McGregor, 1982. Flocculation of retention pond water. Tech. Memo. Superv. Sci. Alligator Rivers Reg. Aust. Canberra Australia Australian Government Publ. *Serv.*, 5: 5.

Masuda, K. and C.E. Boyd. 1994. Effects of aeration, alum treatment, liming, and organic matter application on phosphorus exchange between soil and water in aquaculture ponds at Auburn, Alabama. *J. World Aquacult. Soc.*, 25(3): 405-416.

Subasinghe, R.P., 1995. Note on fish disease diagnosis and health management training workshop held from 22 to 25 February, 1995. BFRI, Mymensingh, pp. 3-21.

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