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Md. Hasan-Uj-Jaman
Department of Fisheries & Marine Bioscience, Jessore University of Science & Technology, Jessore-7400, Bangladesh.

Shoumo Khondoker
Department of Fisheries & Marine Bioscience, Jessore University of Science & Technology, Jessore-7400, Bangladesh

Jannatul Ferdaus
Department of Fisheries & Marine Bioscience, Jessore University of Science & Technology, Jessore-7400, Bangladesh

Md. Tareq Ahmed
Department of Fisheries & Marine Bioscience, Jessore University of Science & Technology, Jessore-7400, Bangladesh

Sattyajit Sana
Department of Fisheries & Marine Bioscience, Jessore University of Science & Technology, Jessore-7400, Bangladesh

Md. Nazmul Hasan
Department of Fisheries & Marine Bioscience, Jessore University of Science & Technology, Jessore-7400, Bangladesh

Fokrul Hasan
Department of Fisheries & Marine Bioscience, Jessore University of Science & Technology, Jessore-7400, Bangladesh

Correspondence
Md. Hasan-Uj-Jaman
Department of Fisheries & Marine Bioscience, Jessore University of Science & Technology, Jessore-7400, Bangladesh

Effects of *Achyranthes aspera* to the growth performance of Rohu (*Labeo rohita*)

Md. Hasan-Uj-Jaman, Shoumo Khondoker, Jannatul Ferdaus, Md. Tareq Ahmed, Sattyajit Sana, Md. Nazmul Hasan and Fokrul Hasan

Abstract
The present study evaluated the effect of dietary doses of *Achyranthes aspera* extract as a natural antibiotic on growth performance of Indian Major Carp, Rohu, *Labeo rohita* average weight (28.1±1.2 g) and the mean length 19.30 ± 0.43 cm were divided randomly into 4 treatments (a control and other groups treated with the extract of 2%, 4% and 6% in the diet with 3 replicates and density of 15 fish per each replicate. After 4 weeks of feeding, growth parameters such as Weight Gain (WG), Specific Growth Rate (SGR) and Food Conversion Ratio (FCR) were examined. 6% doses of *Achyranthes aspera* showed the highest significant result of the final length-weight and growth indicators on first week, second week and fourth week respectively. The results suggests that the dietary supplementation of *Achyranthes aspera* extract act as immunostimulants, and growth promoter in *Labeo rohita.*

Keywords: *Achyranthes aspera, Labeo rohita,* growth parameter, herbs

1. Introduction
Aquaculture, probably the fastest growing food producing sector of the world and plays an important role in the socioeconomic development of many countries in view of its potential contribution to national income, nutritional security, social objectives and sustainable large export earnings [1]. Fisheries sector of Bangladesh, thus, becomes highly diversified in resource types and species [2]. The Indian major carp, the rohu, *Labeo rohita*, is an important commercial fish in our aquaculture and also a vital source of the protein food supply for the people of Bangladesh [3]. *L. rohita* is the most important among the three Indian major carp species used in polyculture systems [4]. The compatibility of Rohu with other carps like Catla and Mrigal made it an ideal candidate for carp polyculture systems. In the fingerling stage, there is a strong positive selection for all the zooplanktonic organisms and for smaller phytoplankton like desmids, phytoflagellates and algal spores. On the other hand, adults show a strong positive selection for most of the phytoplankton. Day by day, the contribution of carp species in aquaculture is increasing. In 2004-2005 it gave 22.30% production in our total production [5]. Fresh water aquaculture in Bangladesh is mainly carp-based and accounts for a considerable proportion of total aquaculture production. Aquaculture plays an important role in the welfare of mankind. It is emerging as one of the most viable and promising enterprises for providing notional and food security for humans.
Disease problems have resulted a great loss for the fish farmers. The uses of herbal compounds as immunostimulants has been increasing very fast in aquaculture day by day. The practices of antibiotics and pesticides are avoiding in the modern age because they have harmful effect. Many countries have banned the aquacultural products due to the presence of antibiotics residual [6]. Different antibiotics and drugs has been used to treat parasitic infection in fish which created problems [7]. Herbs have been widely used in veterinary and human medicine as they are not only safe for consumers, but are also available throughout Asian subcontinent [8]. *Achyranthes aspera*, an herb belonging to the family Amaranthaceae was found to potentiate the immunity in mice [9]. In recent times, immunostimulants of herbal origin have been shown to have the capacity to boost disease resistance and growth promoter in fish [10]. Aeromonas and Pseudomonas are the major bacteria fish pathogens which are widely distributed in aquatic organisms in nature [11]. As the culture of *L. rohita* has increased, there has been an increase in incidence of disease outbreak and it was found that they are more susceptible to disease in comparison to the exotic carps [12].

Neem leaves, garlic and turmeric powder have been good for the health of fry of Indian major carp, *Catla catla*. It has been used widely as a disease resistant for the replacement of antibiotics [13]. It is a warm water freshwater fish species that is native to Asia. It is cultivated commercially [14] in other parts of the world, including Australia and South America, because of its fast growth rate, facile cultivation and high feed efficiency ratio [15]. A natural population of wild carp is widely distributed throughout the Iranian waters of the Caspian Sea, mainly in coastal waters of the Golestan province [16]. It is a potential species for fish culture and is highly tolerant to changes in water pH [17]. *Quillaja saponin* mixture was reported as performing as growth developer for common carp, *Cyprinus carpio* through diet [18]. In several seafood have antibiotic residues consignments exported from India were recently rejected by European countries and this has caused economic losses to the Indian aquaculture [19]. The objective of this investigation was to test the ability of *Achyranthes aspera* as a herbal diet to potentiate the growth performance of the rohu, *Labeo rohita*.

2. Materials and Methods

2.1 Fish and Management

Labeo rohita, rohu were obtained from the commercial fish farm located in Chanchra Hatchery, Jessore, Bangladesh and experimented to the laboratory of Fisheries and Marine Bioscience department, Jessore University of Science and Technology (JUST). The fish were acclimatized and stocked in (12) indoor aquariums for three days under two feeding regimes, control: four groups, test: four groups (0%, 2%, 4%, 6%). In the investigational period the water parameter was dissolved oxygen (DO) 7.1±0.5 mg/l, water temperature, p^H and TDS (Total Dissolved Solid) were 24±0.8 ^{0}C, 5.94±0.21 and 434±0.29 mg/l respectively and two-third water exchanged daily by siphoning.

2.2 *A. aspera* extract preparation

A. aspera was grown in the field near the field of University of Science and Technology (JUST). Roots of the plant were crushed into small pieces. After that the desired amount of root pieces were ground in mortar and pestle with water. The extract was separated by filtering through net. Sediment was again thoroughly washed in water and added to the previous extract by filtering. The sediment was discarded. The herbal powder (100g) was mixed with 1000 ml of 95% ethanol in a 2000 ml conical flask and stored at room temperature for the following 7 days. During that time fish were fed normal feed (without herbal extract) at a rate of 4% of their body weight twice a day at 10.00 am and 21.00 h for 3 days. But no feed provided to the fish in the arrival date.

Table 1: Composition of artificial diets

Ingredients/100 g of feed	Experimental diet	Control diet (Basel diet)
Protein	34	34
Crude fiber	6	6
Crude ash	18	18
Moisture	11	11
Lipid	6	6
Fat	3	3
Root extract of plant	0.2% (T1) 0.4% (T2) 0.6% (T3)	Nil

2.3 Growth performance

At the end of the feeding trail, growth performance of the fish was evaluated in terms of the following parameters, percentage weight gain (WG), specific growth rate (SGR) and feed conversion ratio (FCR) were determined according to Choudhury *et al.,* [20].

2.3.1 Weight (g) gain

Weight gain of the silver carp was calculated by the following formula –

$$\text{Weight (g) gain (\%)} = \frac{Final\ weight - Initial\ weigt}{Initial\ weight} \times 100$$

2.3.2 Specific growth rate

The specific growth rate of silver carp was calculated as-

$$\text{SGR (\%)} = \frac{Final\ weight\ (g) - Initial\ weigt(g)}{No.of\ days} \times 100$$

2.3.3 Feed conversation ratio

Feed conversation ratio was calculated by using the following formula –

$$\text{FCR} = \frac{Feed\ given\ (dry\ weight)}{Body\ weight} \times Weight\ gain$$

$$\text{Feeding rate: } \frac{\text{Diet consumption } - \text{No.of days}}{Weight\ gain}$$

2.4 Statistical analysis

Values for each parameter measured were expressed as the arithmetic mean ±standard error (SE) by using Tukey statistical analysis by stat soft 2007. Effects of herbal diets on growth performance, hematological and immunological parameters were tested using one- way ANOVA and the mean values were compared by using Duncan's multiple range tests at 5% level of significance [21].

3. Results

The four doses diets were equally accepted by the fish and there was no mortality or disease in any treatment. There were significant differences in average weight gain, SGR, or FCR (Table 2). In every cases of feeding the 6% doses diet were showed significant result. The growth parameters of rohu, *L. rohita* fed with different doses of ***A. aspera*** supplementation diet are shown in Table 2:

Growth parameters	Doses	Week 1	Week 2	Week 4
WG	0%	19.23 ± 0.44	19.44 ± 0.44	19.78±1.12
		19.25 ± 0.43	19.48 ± 0.45	19.83±1.17
		19.43 ± 0.42	19.61 ± 0.47	20.12±0.98
	2.0%	20.46±0.83	23.26±0.81	25.54±1.13
		20.44±0.81	23.15±0.71	25.34±1.18
		20.42±0.93	23.24±0.73	25.69±0.91
	4.0%	20.52±0.63	22.02±0.56	24.53±0.67
		19.99±2.53	22.45±0.71	23.48±0.83
		20.54±1.28	22.34±0.73	23.24±0.73
	6.0%	20.81±0.85	21.46±0.76	26.50±0.76
		21.29±0.61	21.41±0.72	26.44±0.63
		21.21±0.54	21.67±0.59	26.48±0.65
SGR	0%	1.71±0.90	1.00±0.54	1.42±0.76
		1.43±0.71	1.28±0.80	1.57±0.63
		1.71±1.14	1.61±0.66	1.93±0.65
	2%	1.3±0.23	1.70±0.52	1.72±0.22
		1.2±0.16	1.20±0.26	1.50±0.72
		1.4±0.19	1.83±0.19	1.67±0.39
	4.0%	1.49±0.27	1.28±0.1	1.5±0.1
		1.78±0.15	1.39±0.1	1.5±0.1
FCR	0%	1.42±0.44	1.17±0.3	1.6±0.4
	1.0%	1.4±0.2	1.4±0.2	1.6±0.2
	2.0%	1.1±0.4	1.3±0.4	1.3±0.3
	3.0%	1.4±0.3	1.4±0.2	1.5±0.2

Data expressed as mean ± SD, *significantly different from controls *(P<0.05)*, n=15.
WG: Weight gain, SGR: specific growth rate, FCR: feed conversion ratio

4. Discussions

According to Food and Agriculture Organization (FAO) of the United Nations, the aquaculture production has raised from about 28.3 million tons to 40 mt in 2009 [22]. Aquaculture is one of the rapidest growing food- producing sectors around the world. The effect of *A. aspera* on the growth performance in aquatic animal has not been established, though it has been used as an important herb. The specific growth rate showed an increased trend in all the five experimental groups; however it was significantly higher in 6% *A. aspera* added diet fed fishes. Thus it is evident that dietary supplementation of *A. aspera* acted as growth promoter. The same result was found. In nile tilapia *(Oreochromis niloticus*) which was fed with *Echinacea purpurea* and *Allium sativum* stimulated diet showed significantly higher specific growth rate [23], significant increases of specific growth rate also in nile tilapia fed with green tea (*Camellia sinensis*) incorporated diet even when infected with *A. hydrophila* [24]. Effects of dietary herbal additives on fish growth are contradictory. Beside this improved growth rate was found in *O. niloticus* by using *Carum carvi* and *Allium sativum* herbal treatment [25, 26] and *Ocimum basilicum* in *O. niloticus* and *O. aureus* [27]. Incorporation of *A. aspera* in the diet might have improved palatability, digestion and absorption of nutrients. Influences of dietary *Aloe vera* supplementation on growth which have been valued with another species with varied results. According to Farahi *et al.,* [28], dietary *Aloe vera* supplementation was not efficient (*P*>0.05) in growth performance (Body weight increase BWI, SGR and FCR) of rainbow trout (*Oncorhynchus mykiss*) but was reported beneficial for immunity and survival rate of fish. According to Gopalakannan *et al.,* [29], some medicinal plants at levels of 1% in Mono Sex Nile Tilapia (*Oreochromis niloticus*) diets have a positive response on growth performance, feed conversion, nutrient utilization, protein efficiency and physiological parameters. Influences of dietary medical plants supplementation on growth have been evaluated with several aquacultured species with varied results. They have studied on Thai pangus polyculture with carps has been increasing for its high potential, however very few attempts were made to compare its growth using different types of feed [30]. This study was showed that the herbal diets in fish feed had effective on the growth performance on *Oreochromis niloticus* [31, 32]. *Gynostemma pentaphyllum* a customary Chinese herbal medicine blend into fish feed caused a raised weight gain, feed conversion efficiency and specific growth rate in grass carp *Ctenopharyngodon idella* [33]. Dietary supplementation of *Q. saponin* enlarged the growth rate in *C. carpio* [18].

5. Conclusion

In conclusion, a dietary *Achyranthes aspera* level of 6% provides the best WG, SGR and FCR for *Labeo rohita*, rohu without adversely affecting health deformities or feed utilization. Such treatment could have economical benefits for carp farming and be used in organic carp culture. The results presented here indicate the potential of using the *A. aspera* as an environmental friendly as a growth promotor antibiotic of rohu, *L. rohita* and might act directly even in low concentrations. So it has been concluded that *A. aspera* herb has a great potential as antibacterial compound.

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