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OPTIMISATION OF *HYDRILLA* PLANT IN THE REARING ENVIRONMENT OF TAMBRAPARNI BARB (*DAWKINSIA TAMBRAPARNIEI*) JUVENILES

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ABSTRACT : Tambraparni barb is one of the endangered barb variety from Western Ghats, which was successfully domesticated and bred at ICAR-Central Institute of Freshwater Aquaculture, Bhubaneswar, India. It has a global ornamental potential in planted aquarium and are exported to many nations from the wild. An experiment was conducted for 45 days to estimate the optimum quantity of *Hydrilla* plant required for better growth and survival of tambraparni barb. Three-month old juveniles having length and weight 20.2±0.5 mm and 296± 25 mg, respectively are reared in FRP tanks of 360 litres water holding capacity (120 × 60 × 50cm^3) without providing aeration. Four treatments with different quantities of *Hydrilla, viz*. 0.25 kg, 0.5 kg, 1 kg, 1.5 kg and a control tank without *Hydrilla* was taken and 25 number of fishes were stocked per tank. The fishes were fed with a commercial feed *ad libitum*. The present study concludes that the optimum requirement of *Hydrilla* plant required for successful rearing of tambraparni barb with significantly better growth and survival is 0.5- 1 kg *Hydrilla*, may be suggested for rearing as it provides better shelter and environment.

Key words : Growth, *Hydrilla*, ornamental, tambraprni barb.

INTRODUCTION

Dawkinsia tambraparniei (Silas, 1953), commonly called as tambraparni barb, is an endangered cyprinid found only in streams of the Thamrabarani river in Tirunelveli district, Southern Tamil Nadu, India. This species is commonly available in aquarium trade since, it is preferred fish kept in home as well as public aquaria due to its brilliant body and fin colour. It is a pelagic, riverine species found in moderate flowing streams and rivers with bed rock and sandy bottom. It is endemic to the Western Ghats of India. The species was described originally as *Puntius arulius* tambraparniei by Silas (1953) from Thamrabarani river. Later, it was raised to specific status by Pethiyagoda and Kottelat (2005) and this species has been placed under the new genus *Dawkinsia* (Pethiyagoda *et al*, 2012).

The species is generally selected for aquarium purposes due to its beautiful coloration as well as shoaling behaviour. It is mostly suited for planted aquarium to resemble various biotopes including flowing river, active streams built with gravel, sand, etc. The aquarium can be further modified with driftwood branches and roots. Also we can have a bushy environment fully surrounded by plants.

From 2011, this species listed as endangered in IUCN red list. This is due to the restricted distribution of the species to less than 5000km square extent and less than 100 km square area occurring in only 3-5 fragmented locations. There are numerous ongoing threats for decline of such indigenous fish species including habitat decline due to various anthropogenic activities like mining, construction of dam and industrial pollution. Populations of the species are known to be declining as per the recent survey conducted. Because of these threats, this species was assessed as endangered in the IUCN red list (Dhanukar, 2011). Hence, it is the need of the time to increase the population of species and restoring it thereby removing it from the red list. For this, commercial practice of culturing the species should be started and enhanced further. Breeding and larval rearing techniques of this species are standardised at Central Institute of Freshwater Aquaculture (ICAR-CIFA), Bhubaneswar, India.

Barbs are often sensitive to water quality deterioration and are unable to thrive in harsh conditions. Routine exchange of water is needed for aquariums where such

fishes are kept. Tambraparni barb is an omnivorous fish species feeding mainly on insects, worms, detritus, etc. For maintaining proper diet in the aquarium, live feed like tubifex, bloodworm, zooplankton, etc may be provided. The shelter of plants helps in improving their health and thereby maintaining improved status of the fish species.

Tambraparni barb can be reared well in tanks containing aquatic plants. In order to estimate the optimum quantity of *Hydrilla verticillata* (waterthyme) plant in rearing of tambraparni barb juveniles an experiment was conducted for a period of 45 days to study the growth perfomance and survival.

MATERIALS AND METHODS

This experiment was conducted in the ornamental fish culture unitof ICAR-CIFA during March-May, 2018. The species selected for experiment was tambraparni barb (*Dawkinsia tambraparniei*). *Hydrilla* plant is selected for experimental purpose since, it can be a suitable aquatic plant. It is easily available and lower light conditions are required as compared to others. Based on the advantages of *Hydrilla* over the other aquatic plants an experiment is carried out to check the optimum quantity of *Hydrilla* required for better growth of the species without any aeration.

Hydrilla plants were collected from the adjacent ponds and are washed thoroughly with portable water. Then it was disinfected with $KMnO_4$ @ 10mg/lit for 10 minutes. Only the leaves of the plant were dipped in to the solutions not the roots and then the plants were rinsed thoroughly. This will kill live snails, eggs and other parasites.

The *Hydrilla* plants were soaked in cotton cloth and weighed before introduction to the rearing tanks. The different weights of hydrilla plant as 0.25 kg (T_1), 0.5 kg (T_2), 1 kg (T_3), 1.5 kg (T_4) are kept in the treatment tanks in triplicate. Also a control tank (C) in triplicate was taken without *Hydrilla* plants was taken. After the *Hydrilla* plants were introduced, three month old tambraparni juveniles were stocked @ 25 numbers/tank in360 liter tanks in a non-aerated system. Before stocking the fishes, length and weight of the fishes were measured as 20.2±0.5 mm and 296±25 mg, respectively.

From the very next day the fry were fed with the commercial feed (spirulina based) given to the larvae @ 0.5gm twice a day. Feeding was done adlibitum. Siphoning was done once a week for 30% water exchange. The sampling for growth and survival were done at 15 days interval. The water quality parameters were recorded at an interval of 15 days. The tanks were not provided with aeration during the experimental period. The study was carried out for a period of 45 days. Length gain, weight gain, Specific growth rate (SGR) and survival was computed and analysed using SPSS (Statistical Package for Social Sciences).

To study the dissolved oxygen content in different treatment tanks, hourly analysis was done for three alternate days by using DO meter (EUTECH INSTRUMENTS PCD650 DO METER).

RESULTS AND DISCUSSION

The physicochemical parameters such as pH, CO_2, alkalinity, P_2O_5, NH_4N, NO_3 conductivity and dissolved oxygen were recorded in optimum range during the experimental period (Table 1).

The mean body length of tambraparni barb fry at the time of stocking was 20.2±0.5mm. The mean body length of spawn on 15th day was highest in tank T_2 (0.5kg *Hydrilla*) and T_3 (1 kg) whereas lowest in tank T_4 (1.5kg *Hydrilla*) (Table 2). Here no significant difference ($p>0.05$) was recorded between T_2 (0.5kg) and T_3 (1 kg). On 30th day and on 45th day also same pattern was recorded. Length has shown decreasing trend in T_4 and it shows significant difference with other treatments.

The mean body weight at the time of initial stocking was 296±25 mg. The mean body weight during the whole experimental period was recorded highest in the T_2 (0.5 kg) tank whereas lowest in T_4 (1.5kg) tank (Table 3). The mean body weight in T_2 (0.5kg) tank was significantly different ($p>0.05$) from T_4 (1.5kg), T_1 (0.25kg) and control tank.

Length gain (mm/day) in T_2(0.5 kg) and T_3 (1 kg) tank was significantly higher ($p<0.05$) than T_1 (0.25 kg), T_4 (1.5 kg) and control tank (Fig. 1 and Table 4). In present study, the highest length gain (mm/day) was recorded in T_2 (0.5 kg) tank (0.5355±0.264 mm/day) whereas lowest length gain (mm/day) was in T_4 (1.5 kg) tank (0.27111±0.251 mm/day).

In present experiment after 45 days rearing of Tambraparniei fry, the highest weight gain (mg/day) (19.2888±0.933 mg/day) was recorded in T_2 (0.5 kg) tank whereas lowest in T_4 (1.5kg) (9.9555±1.145 mg/day).

The specific growth rate (SGR) was presented in Fig. 3 and Table 3. The highest SGR was recorded in T_2 (0.5kg) tank whereas lowest in T_4 (1.5 kg). However, there was significant difference ($p>0.05$) in SGR among treatments.

In present experiment, the survival of fry at the end of experiment was recorded and in every tank there was less number of mortality. The highest survival was recorded in T_3 (1 kg) tank (100%) whereas the lowest in

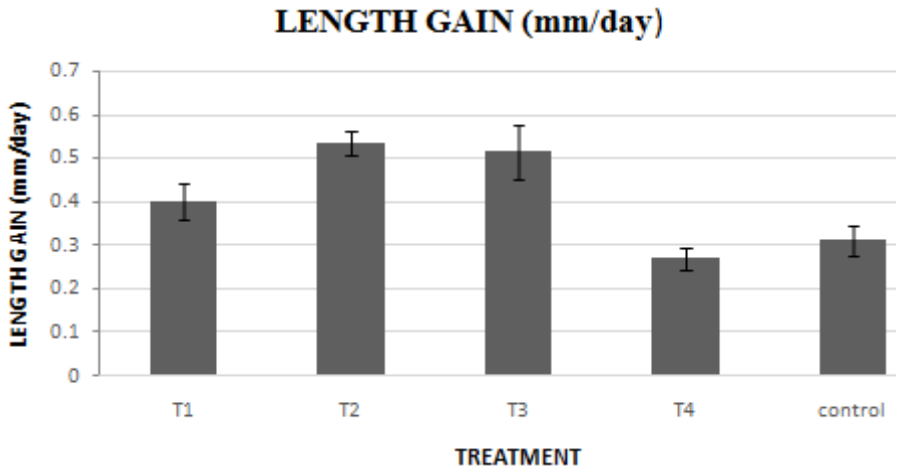

Fig. 1 : Length gain in tambraparni barb fry reared in different quantities of *Hydrilla*.

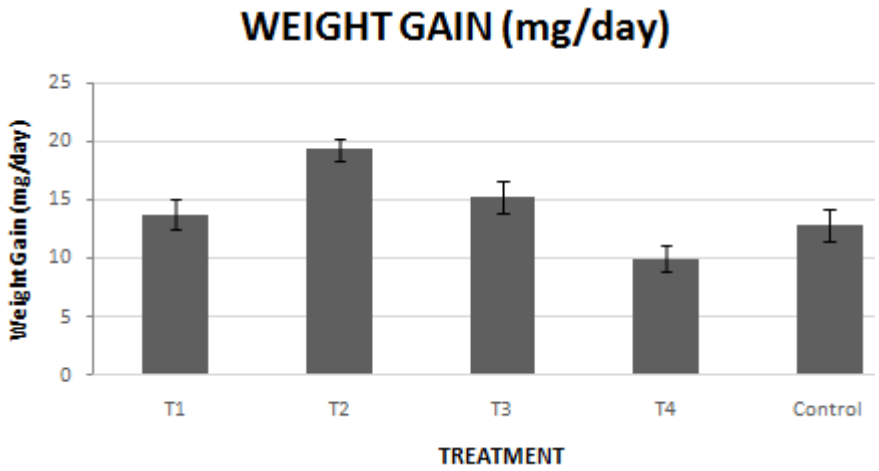

Fig. 2 : Weight gain of tambraparni barb fry reared in different quantities of *Hydrilla*.

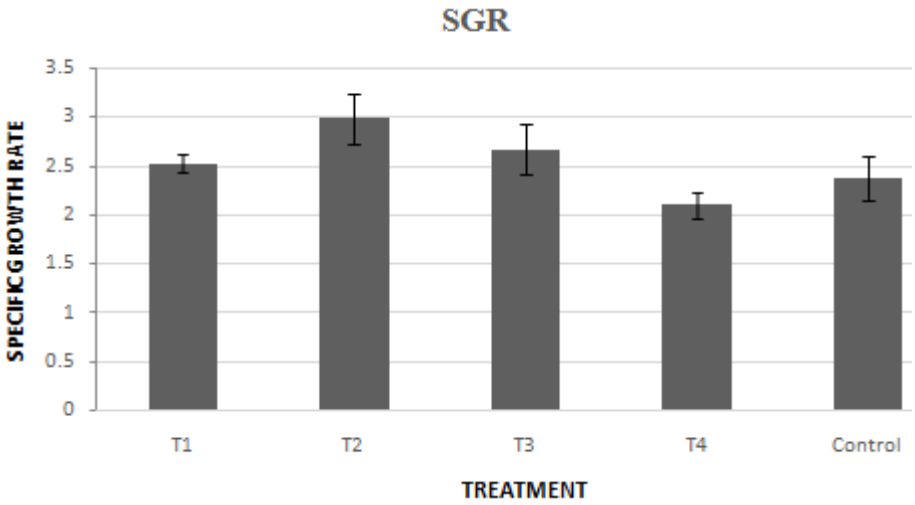

Fig. 3 : Specific growth rate of tambraparni Barb Fry reared in different quantities of *Hydrilla*.

T_4 (1.5kg) (82%). The survival in T_2 (0.5kg) was the second highest (Fig. 4 and Table 5).

The dissolved oxygen concentration (mg/ml) was recorded, and the highest concentration was recorded in the control tank and the reason may be because of green algae in the tank. However variation in dissolved oxygen was shown increasing trend with increased quantity of plant. In the experiment T_2 tank maintain the dissolved oxygen level at optimum throughout the day and night. The highest DO concentration recorded during 1.30pm-3.30pm of the day and the lowest concentration recorded during 6.30 am -8.30 am.

Table 1 : Physio-chemical parameters of water during the experiment period.

Parameters	T_1	T_2	T_3	T_4	Control
pH	7.73 ± 0.49	7.81 ± 0.76	7.7 ± 0.39	7.8 ± 0.52	7.9 ± 0.44
Free CO_2 mg/C	4 ± 0.99	4 ± 1.35	5.6 ± 0.98	4 ± 1.21	3.3 ± 1.43
Alkalinity (mg/l)	161.6 ± 4.87	150 ± 8.32	140 ± 4.28	152 ± 2.42	150 ± 4.47
P_2O_5 (mg/l)	0.11 ± 0.01	0.10 ± 0.01	0.09 ± 0.01	0.14 ± 0.02	0.16 ± 0.01
NH_4N (mg/l)	0.05 ± 0.01	0.05 ± 0.01	0.06 ± 0.01	0.05 ± 0.01	0.06 ± 0.01
NO_3N (mg/l)	0.04 ± 0.01	0.03 ± 0.01	0.04 ± 0.01	0.04 ±0.01	0.04 ± 0.01

Table 2 : Mean body length (mm) of tambraparni barb fry reared in different quantities of *Hydrilla* at different time point.

Treatment	Initial	15th Day	30th Day	45th Day
T_1	20.2^{a}±0.77	23.4^{ab}±2.89	28.4^{ab}±3.25	38.3^{bc}±3.45
T_2	20.5^{a}±0.40	28.3^{b}±3.34	36.6^{b}±4.86	44.6^{c}±4.57
T_3	20.1^{a}±0.88	29.6^{b}±1.66	37.6^{b}±4.98	43.3^{c}±4.25
T_4	20.6^{a}±0.40	22.9^{a}±2.89	25.2^{a} ± 2.87	32.8^{a}±3.69
Control Tank	20.7^{a}±0.77	23.4^{a}±1.78	27.3^{ab}±3.27	34.7^{b}±4.31

Table 3 : Mean body weight (mg) of tambraparni barb fry reared in different quantity of *Hydrilla* plant at different time point.

Treatment	Initial	15th Day	30th Day	45th Day
T_1(0.25kg)	294^{a}±29	348^{a}±32	665^{b}±26	914^{b}±112
T_2(0.5kg)	308^{a}±29	412^{b}±21	720^{c}±36	1176^{c}±139
T_3(1kg)	296^{a}±14	403^{b}±35	735^{c}±41	982^{bc}±93
T_4(1.5kg)	284^{a}±44	331^{a}±15	535^{a}±330	732^{a}±112
Control tank	302^{a}±31	341^{a}±23	613^{ab}±67	878^{b}±87

In the present experiment, it was seen that the tank containing high quantity of plant *i.e.* T_4 (1.5 kg) showing less growth throughout the experiment because lack of swimming space and the tank T_2 (0.5kg *Hydrilla*) showing better growth compared to other tanks. Length gain was highest in T_2 and T_3 whereas weight gain was highest in T_2. Specific growth rate was highest in tank containing 0.5 kg *hydrilla* and lowest in tank containing 1.5 kg hydrilla. Survival was lowest in tank with highest density of plant (T_4). Dissolved oxygen has reached critical limits in tanks having high density of plant quantity (1-1.5 kg) during early morning hours.

Hydrilla is a hardy species that can thrive well in all possible water conditions. It begins photosynthesizing early in the morning, giving it an advantage and also spreads efficiently through sunlight. No native predators are available that eat *Hydrilla* and so their growth is not checked. At 1st glance, *Hydrilla* on the surface looks very dense but this is only at the top, but below it looks like a wooded forest. This creates many good hideouts. This is good for the food chain too since many benthic organisms are found attached to the plant. *Hydrilla* acts as a filtering organism that cleans any muddy water and grows faster from 2 feet deep to 18 feet depending on the clarity of the water. Increased abundance of *Hydrilla* leads to increased transparency of aquarium water.

Cailteux *et al* (1994), made a comparison of fish growth in vegetated and non-vegetated lakes. He stated that the lowest fish growth was obtained at high plant density in case of largemouth bass. The results in the present study also clearly states that growth rate decreases with increasing plant density. Even the studies prove that smaller fishes are found in areas having higher aquatic macrophytes (Randall *et al*, 1996). Killigore *et al* (1989) cites similar diets as one of the reason for lower growth in fishes residing in higher aquatic density. Studies also suggest change in feeding preferences over age for the change in growth (Spitzer *et al*, 2000). Keshavanath *et al* (2004) found that importance of the refuge potential of aquatic plants for prey communities in natural water bodies and fishponds. Aquatic macrophytes also act as artificial substrate to enhance periphyton production food in fish ponds.

Aquatic plant communities (emergent and submerged plants) are important for ensuring the dynamics of aquatic ecosystems having particular role in both biotic and abiotic processes (Carpenter and Lodge, 1986; Jeppesen *et al*, 1998). Fish distribution and abundance are influenced by the richness of available plant species (Savino and Stein, 1982; Wiley *et al*, 1984; Spitzer *et al*, 2000). Structural variation is found due to the available aquatic macrophytes both in pelagic and littoral zone thereby harbouring prey species from predators (Dionne and Folt, 1991; Schriver *et al*, 1995; Persson, 1993; Beklioglu and Moss, 1996; Manatunge *et al*, 2000).

Aquatic plants help in removal of heavy metals from water thereby acting as a bioremediation tool (Wang *et al*, 1996; Schneider *et al*, 2001; Keskinkan *et al*, 2003). Also *Hydrilla* can be a better option since it has filtering effect and helps in maintaining total alkalinity and

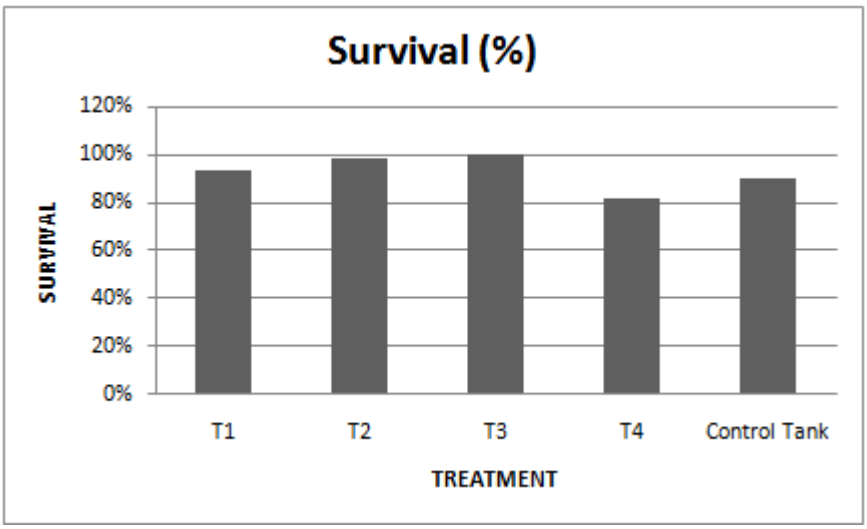

Fig. 4 : Survival of tambraparni barb fry reared in different quantities of *Hydrilla*.

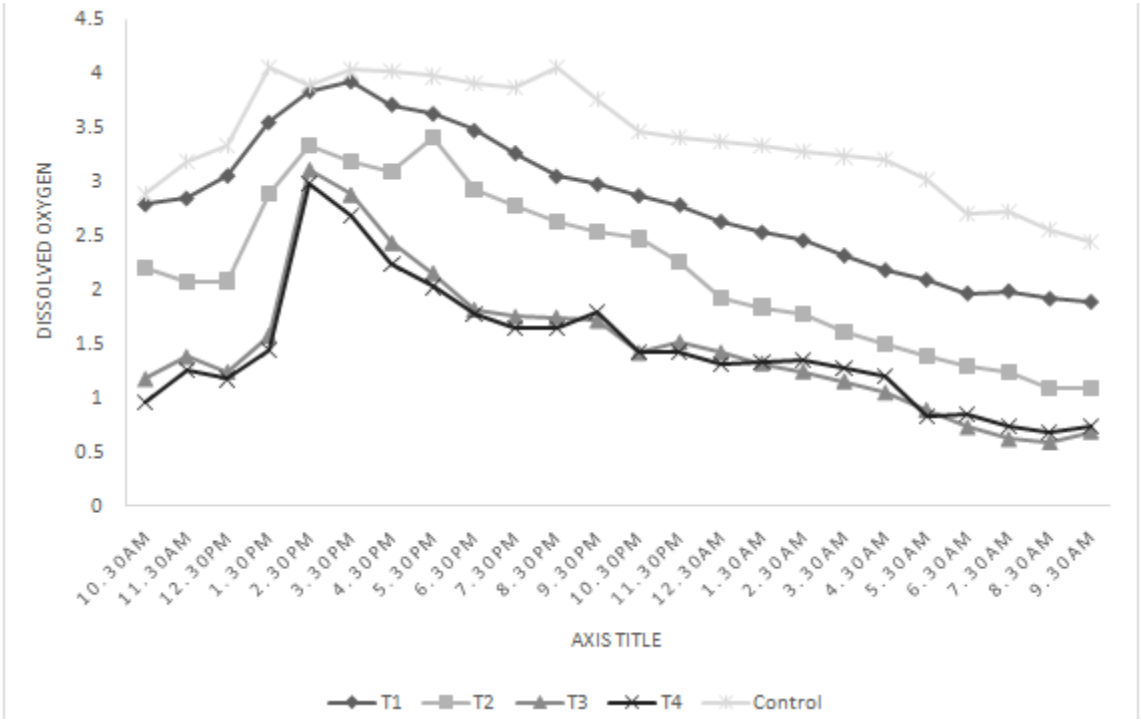

Fig. 5 : Dissolved oxygen concentration (mg/l) in different experimental tanks containing different amounts of *Hydrilla* plants with respect to time.

hardness. It also reduces high levels of calcium, magnesium, potassium and total phosphorus. Physiological responses on hydrilla act as good accumulators of lead, copper, ferrous and cadmium.

CONCLUSION

The study suggests that rearing of tambraparni barb larvae can be done with the introduction of *Hydrilla* upto a range of 0.5 kg, which helps in better growth and survival of the species by enhancing the water quality as well as maintaining proper DO level. The experiment reveals that high density of plant (above 1 kg) has negative effect on growth of the fishes. Tanks without plant showed less growth compared to tanks with plants upto 1 kg.

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Conflict of interest

The authors declare that they have no conflict of interest.

Ethical approval

All applicable international, national and / or institutional guidelines for the care and use of animals

were followed by the authors.

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