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Effect of different feeding regimes on growth and survival of spotted murrel, *Channa Punctatus* (Bloch, 1793) larvae

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Abstract
An experiment was conducted to evaluate the effects of different feeds *viz.*, tubifex (T_1), chicken intestine paste (T_2) and tilapia fish paste (T_3) on the growth and survival of taki, (*Channa punctatus*) in nine trays. A total of 300 larvae /m^2 (average weight 28.70±0.50 mg) was reared for 21 days in each treatment having three replications. The net weight gain of the larvae in T_1 (122.30±1.24 mg) was significantly higher (P<0.05) than those of T_2 (113.18±1.042 mg) and T_3 (104.58±1.30 mg). The percent length gain, percent weight gain, SGR and survival rate were also significantly (P<0.05) higher in T_1 (345.90±2.91, 426.14±4.33, 7.91±0.04 and 74.00±1.00) than that in T_2 (334.91±1.72, 394.34±3.63, 7.61±0.03 and 37.67±1.53) and T_3 (323.61±2.82, 364.39±4.55, 7.31±0.05 and 34.33±0.58). Considering the present findings, live feed tubifex could be accepted as the best diet for mass seed rearing of *C. punctatus* in hatcheries. Water quality parameters were within the suitable range and there was no significant (P<0.05) variation among the treatments.

Keywords: larvae, spotted murrel, feeding regime, growth

1. Introduction
Murrels, commonly known as snakeheads, are found in Afghanistan, Pakistan, India, Sri Lanka, Nepal, Bangladesh, Myanmar and China [11]. Its natural habitats are swamps, ponds and ditches. Due to the taste and medicinal value, Spotted murrel, *C. punctatus* (Channiformes: Channidae) becomes one of the most popular and highly priced freshwater snakehead fish species of Bangladesh. Captive seed production and larval rearing of this species have been accomplished experimentally, but are not presently done on a large scale [21, 22]. Besides, wild stocks are decreasing due to environmental degradation [9] and anthropogenic pressure. The development of induced breeding as well as larval and fry rearing techniques is essential for conservation of this species. The larval stage is the most critical stage among the entire production cycle for many important commercial fish species which is affected by husbandry practices such as density [10, 12] and food [15, 16, 23] and also digestion of the food. Few reports on the food and feeding habits and diet patterns [28, 13] of snakeheads are available. Successful larval rearing of snakehead depends on a complete understanding of dietary requirements at the first feeding and diet requirement as fish grow. After complete yolk sac absorption, the post larvae need small live feed such as rotifer, tubifex etc during first exogenous feeding [20]. Fish farmers in Bangladesh are unable to culture murrels due to non-availability of feed and seed. Unlike rearing of carp fry that has been standardized, feeding post larvae is a herculean task and no readymade feed has been either formulated or recommended for rearing of murrels [27]. Considering the above views the present study was undertaken to determine the effects of different feeds on the survival and growth of the larvae of taki (*C. punctatus*) fish.

2. Materials and Methods
Study area and description
The experiment was carried out at the Fisheries Field Laboratory Complex of the Faculty of Fisheries, Bangladesh Agricultural University (BAU), Mymensingh, for a period of 21 days during 16 May to 6 June 2011. The experiment was carried out in 9 metallic trays having a water depth of 10 cm of each tray. Nine trays were divided into 3 treatments with 3 replications.

For stocking of the larvae the trays were washed and cleaned thoroughly and filled up with water. Five days old induced bred larvae of *C. punctatus* from BAU hatchery were stocked @ 300 larvae/ m^2. Three different types of feed *viz.*, tubifex, chicken intestine paste and tilapia fish paste were used in T_1, T_2 and T_3 respectively. Feeding was done @10-15% body weight 2 times daily. Continuous aeration was provided for proper oxygen supply with porous PVC pipes. Weekly sampling was done to determine the growth of larvae and to adjust the feed rations. The weight (mg) was taken in an analytical balance and the length (mm) was measured by placing the larvae on a Petri dish placed on a 1mm graph paper. After 21 days of experiment the larvae were collected from each tray. After harvesting, all fries of each tray were counted and weighted individually to ascertain the health condition and survival.

Measurement of water quality and growth parameters

Physico-chemical parameters of water, such as Dissolved Oxygen (DO), temperature, carbon-dioxide, and pH were recorded daily from each tray. Water temperature was recorded with a Celsius thermometer. The pH of the water samples was measured by a direct reading digital pH Meter (Jenway, model 3020) and dissolved oxygen was also measured by using a digital DO meter (YSI, model 58) on the spot. The carbon dioxide level was also measured by burette test.

Specific growth rate (SGR), health condition and survival rate were calculated according to the following equation:

SGR (%/day) = {Ln (final body weight)-Ln (initial body weight) ×100 /culture period (day)

Health condition (mg/mm) = Weight of larvae / Total length of larvae

Survival (%) = (Final numbers-Initial numbers) ×100

The growth parameters of the larvae were all tested using one-way analysis of variance (ANOVA). All results (P<0.05) were further tested using Duncan's Multiple Range Test (DMRT) to identify significant differences between means among the treatments. The statistical analysis was performed with the aid of an excel worksheet of Microsoft office software version 2007 program and the SPSS version 11.5 software program at the 5% level of significance.

3. Results and Discussion

Growth and survival of the larvae

Average body weight and average body length of taki fry in all treatments was same of 10.80 mm and 28.70 mg, respectively. In the present study, the average final length was obtained 48.16±0.31, 46.97±0.18 and 45.75±0.30 mm in T_1, T_2 and T_3 respectively. The results of growth, SGR, survival and health condition are depicted in Table 1.

Table 1: Growth parameters of taki, *Channa punctatus* during 21 days experimental period in different treatments.

Parameters	T1	T2	T3
Mean initial length (mm)	10.80±0.48	10.80±0.48	10.80±0.48
Mean final length (mm)	48.16±0.31^a	46.97±0.18^b	45.75±0.30^c
Mean initial weight (mg)	28.70±0.50	28.70±0.50	28.70±0.50
Mean final weight (mg)	151.00±1.24^a	141.88±1.04^b	133.28±1.31^c
Health condition (mg/mm)	3.14±0.01^a	3.02±0.01^b	2.91±0.01^c
SGR (%/day)	7.91±0.04^a	7.61±0.03^b	7.31±0.05^c
Survival (%)	74.00±1.00^a	37.67±1.53^b	34.33±0.58^c

Significant level: P<0.05

The final average weight was obtained 151.00±1.24, 141.88±1.04 and 133.28±1.31mg in T_1, T_2 and T_3 respectively. The gains in lengths and weights of the larvae were 37.36±0.3 mm, 36.17±0.1 mm and 34.95±0.30 mm and 122.30±1.24 mg, 113.18±1.042 mg and 104.58±1.30 mg respectively in T_1, T_2 and T_3. The growth patterns (length gain and weight gain) of the larvae under different treatments are shown in Fig.1 and Fig.2.

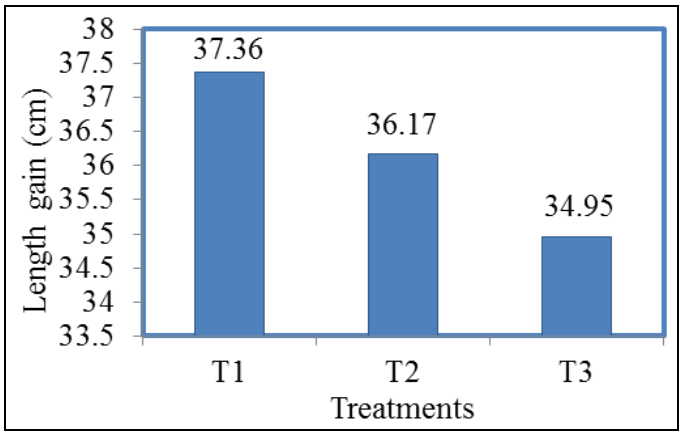

Fig 1: Comparison of length gain of larvae reared in three feeding regimes

More or less similar results were found in case of *C. punctatus* larvae rearing in the laboratory condition using tubifex as feed [14]. Thai Koi (*A. testudineus*) obtained average length of 14.66±0.38 cm and weight of 57.22±2.93 g for 50 days experiment by applying handmade feed which contained 38% protein [24]. It was found 32.47 to 40.45 g weight in local Koi during 5 month experimental period and the feed was compound as of rice bran, mustard oil cake and fish meal at a ratio of 3:1:1 [1].

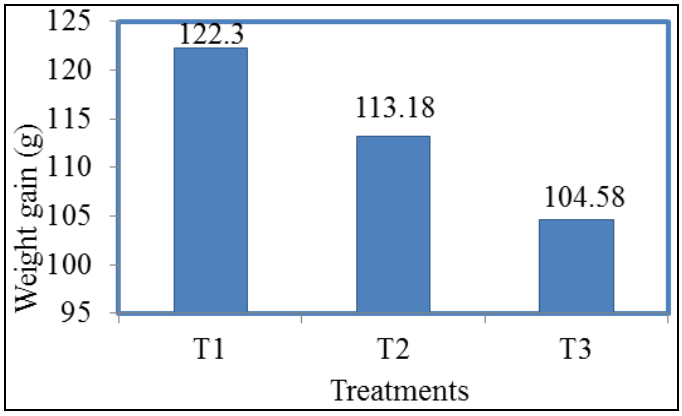

Fig 2: Comparison of weight gain of larvae reared in three feeding regimes

The percent length gain (345.89±2.91), percent weight gain (426.14±4.33) and SGR (7.91±0.04) were found highest in T_1 followed by 334.91±1.71, 394.34±3.63 and 7.61±0.03 in T_2 and 323.61±2.82, 364.39±4.55 and 7.31±0.05 in T_3 respectively. Statistical analysis by ANOVA indicated the existence of difference among growth parameters of larvae of three treatments. DMRT showed that percent length gain, weight gain, SGR and survival of larvae of T_1 was significantly higher (P<0.05) than those of T_2 and T_3. Tubifex worms are very popular live feed used for feeding larvae of carnivorous and omnivorous fish species [8]. Considerably better growth and survival rates of larvae were observed with Tubifex worms over formulated feeds in a number of catfish species such as *Clarias batrachus* [24], *Clarias macrocephalus* [25], *Heteropneustes fossilis* [2].

The average SGR was recorded in the present study were 7.91±0.04, 7.61±0.03 and 7.31±0.05 in T_1, T_2 and T_3 feeding with tubifex, chicken intestine paste and tilapia fish paste respectively. More or less similar results were obtained of SGR in case of *C. punctatus* larvae rearing in the laboratory condition using tubifex as feed [14]. SGR values were obtained 1.27- 1.85% in *Puntius gonionotus* fed with varying dietary protein levels (15-55%) under laboratory condition [31]. The SGR values obtained in the present study was higher than those of [31].

In the present study, the survival rates (%) of *C. punctatus* larvae were 74%, 37% and 34% in T_1, T_2 and T_3 respectively. The highest survival rate was recorded in T_1 which is similar with the results found by [14]. The survival rates of pangasid catfish (*Pangasius hypophthalmus*) were 95.2%, 96.0% and 96.8% and the survival rates of silver carp (*Hypophthalmichthys molitrix*) were 83.2%, 85.2% and 86.0% in polyculture system in ponds for 135 days experimental period and the survival rate was higher than the present study [5].

In the present study, feeds were supplied 2 times a day. Feeding frequency has a direct impact on the growth and survival of catfish, *Clarias macrocephalus* larvae [25]. They conducted an experiment with 5 days old larvae of *Clarias macrocephalus* under 5 feeding frequency i.e. 0 time/day, 1 time/day, 2 times/day, 3 times/day and 5 times/day with live feed (Moina and/or Tubifex worms) for a period of 28 days. A feeding frequency of 3 times per day was proved best for rearing the larvae of *C. macrocephalus*. On the other hand, after detailed study a feeding frequency of 2 times per day was advocated as the most suitable for rearing of *Clarias batrachus* larvae [24].

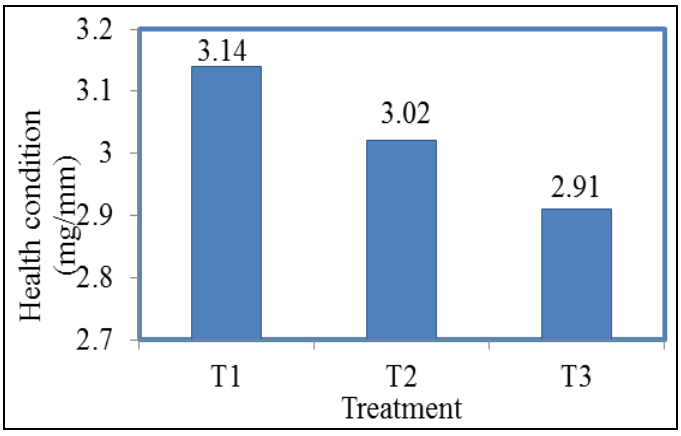

Fig 3: Comparison of the health condition of larvae reared in three feeding regimes

Larval health condition (Fig. 3), implies that T_1 (3.14 mg/mm) showed highest performance among the three treatments while T_3 (2.91 mg/mm) showed the lowest performance. Zooplankton contains many digestive enzymes such as proteases, carbohydrases and lipases, which might assist the digestion process in the gut of fish larvae [26]. These organisms serve as living capsules of nutrition for sustenance and replacement of tissues as well as maintenance of metabolism and optimal growth of cultivable species [18, 3].

Water quality parameters

During the experimental period temperature (^{0}C), dissolved oxygen (DO), carbon dioxide (CO_2), ammonia nitrogen (NH_3-N) and pH were recorded and are displayed in Table 2.

Table 2: Mean (±se) values of water quality parameters of different treatments during the study period.

Parameters	Treatments		
	T1	T2	T3
Temperature (^{o}C)	26.63±0.75	26.63±0.48	26.63±0.63
pH	6.97±0.17	6.87±0.19	6.98±0.13
DO (mg/L)	5.15±0.81	5.13±0.74	5.08±0.64
CO_2 (mg/L)	2.45±0.10	2.33±0.38	2.40±00.27
NH3-N (mg/L)	0.08±0.10	0.17±0.15	0.18±0.11

In the present study, temperature was varied between 26.0 ^{0}C and 27.5 ^{0}C with the mean of 26.63±0.75, 26.63±0.48 and 26.63±0.63°C in T_1, T_2 and T_3 respectively. There was no significant (P<0.05) variation among the treatments. Similar results were found by [4, 30, 7, 29]. The dissolved oxygen (DO) was found to vary from 5.08 to 5.15 mg/L in different treatments in the present experiment. More or less similar results were reported by [30]. Dissolved oxygen content of water was considered 5.00 to 7.00 mg/L to be fair or good in respect of productivity and water having dissolved oxygen below 5 mg/L to be unproductive [6].

The pH values varied from 6.8 and 7.2 respectively, during 21 days of experimental period [17] who recorded pH of 7.2 to 7.3 in the research ponds of Bangladesh Agricultural University campus. The carbon dioxide (CO_2) range was found to vary from 2.00 to 2.7 mg/L. Free carbon dioxide (CO_2) more than 20 mg/L may be harmful to fish and even lower concentrations may be equally harmful when dissolved oxygen concentrations are less than 3 to 5 mg/L [19]. According to above recommendation it is clear that the range of carbon-dioxide (CO2) found in the experiment was not harmful at all for the larvae. The values of ammonia nitrogen (NH_3-N) were ranged from 0.03-0.26 mg/L. This range is not harmful to the larvae culture in laboratory condition.

4. Conclusion

Considering the larval health condition, percent length gain, percent weight gain and SGR it can be conclude that Tubifex might be considered as the best diet for larval rearing of taki, *C. punctatus.* Further study and research are needed to bring necessary refinement in the larval rearing and fingerling production techniques of *C. Punctatus* to face the challenge of "food crisis" and also to conserve this species.

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