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Preliminary Study on the Feeding Schedule of Laboratory Reared of Bonylip barb Larva, *Osteochilus vittatus* Cyprinidae

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Abstract

A preliminary study was conducted on the feeding schedule of laboratory reared larvae of *O. vittatus*. The feeding schedule consisted (1) *Artemia nauplii* from 10 to 15 days, *Moina* sp from 15 to 20 days, *Tubifex* worms from 20 to 40 days, (2) *Artemia nauplii* from 10 to 20 days, *Moina* sp from 20 to 25 days, *Tubifex* worms from 25 to 40 days, (3) *Artemia nauplii* from 10 to 25 days, *Moina* sp from 25 to 30 days, *Tubifex* worms from 30 to 40 days, (4) *Artemia nauplii* from 10 to 30 days, *Moina* sp from 30 to 35 days, *Tubifex* worms from 35 to 40 days. The feeding schedules were significant differences on growth performance of *O. vittatus* larvae and there were no significant differences on survival rate. The results indicated that feeding schedule *Artemia nauplii* from 10 to 15 days, *Moina* sp from 15 to 20 days, *Tubifex* worms from 20 to 40 days showed better growth performance in terms of the parameters measured.

Keywords: Feeding schedules; Live diets; Growth; Survival; *Osteochilus vittatus*; Larvae

Introduction

Bonylip barb fish (*O. vittatus*, Cyprinidae) is a freshwater fishery commodities native to Indonesia [1,2]. This species live in Singkarak Lake, Maninjau Lake and Koto Panjang Reservoir West Sumatra Province [3-5], have a strategic value that is (a) as a source of food non cholesterol for rural community and urban [6], (b) as a source of income for rural community around the area Maninjau Lake [3], Singkarak Lake [7], Arang-Arang Lake [8], Koto Panjang Reservoir [9] and Kampar Kanan River [10], (c) has been successfully used as a biological agent to reduce the blooming of phytoplankton in Maninjau Lake [6], (d) can be applied to restocking and introduction to waters lakes and reservoirs that is experiencing blooming phytoplankton fish farming activities due to floating net cages.

The problems now is (a) there has been a rare of *O. vittatus* in Maninjau Lake [11,12], Singkarak Lake [13,3], Arang-Arang Lake [8], Koto Panjang Reservoir [9], Kampar Kanan River [10], (b) blocking of migration routes, sedimentation of spawning ground in Maninjau Lake [3,14], loss of habitat, spawning and food supply due to fluctuating water level in Singkarak Lake [15], changes in running water into stagnant in the Kampar River for Hydroelectric power plant Koto Panjang [16]. In Kampar Kanan river a major threat to biodiversity of fish, among others damming rivers and sand mining in river water bodies [10], (c) uncontrolled introduction of exotic fishes among others *Oreochromis niloticus*, *Oxyeleotris marmorata*, *Channa lucius* so that elimination of native species [5].

In order for Bonylip barb (*O. vittatus*) is not endangered from their native habitat, is very important to do aquaculture. The fish aquaculture activities can be started from the process of domestication [17]. A database for domestication of *O. vittatus* are already available, among others morphological characterization [3], genetic variation [4], growth model [18], food habits [19] and aspects of reproduction [5]. Domestication can be started from the larva rearing, fingerling and broodstock. In the larval rearing, live diets is one of the factors that affect the growth and survival [20-23].

Live diets suitable for fish larvae that have full nutrient value, easily digested, and in accordance with the mouth opening, moving its active so that the larvae are stimulated to eat [24,25]. *Artemia nauplii*,

Moina sp, *Daphnia* sp, *Tubifex* worms, Copepods, Rotifer successful in increasing the growth and survival of several species of fish larvae, among others *Chitala Chitala* larvae [20], *Oncorhynchus mykiss* larvae [26], *Clarias gariepinus* larvae [27,28], *Rachycentron canadum* larvae [29], *Osphronemus gourami* larvae [30]. The present study focuses mainly on the feeding schedule of live diets on the growth performance and survival of *O. vittatus* larvae.

Materials and Methods

Broodstock

Adult female and male of *O. vittatus* were obtained from a Kampar Kanan River, Kampar Regency Riau Province and have been kept for >1.5 years in concrete tank size 4 × 2 × 0.7 m, the volume of water 5,600 liters. The average weight of broodstock is 250 ± 25 g/individuals with the stocking density 100 individuals/concrete tank [31]. The concrete tank water comes from ground water to debit 0.2 m³/second, concrete tank water temperature ranged from 26 to 28°C. Feeding was done twice daily and fish were fed a predetermined ration of 5% body weight/day. During the adaptation of fish fed with commercial (pellets) with proximate composition are water content (% dry weight) 12.0%, crude protein 28.0%, lipid 5.5%, crude fiber 6.2% and crude ash 13.0%. The spawning *O. vittatus* conducted with GnRH_a stimulation with dopamine antagonist at a dose of 0.5 ml/kg body weight and conducted artificial spawning. Hatching eggs carried on fiber tubs (200 cm × 80 cm × 40 cm), height of water in the fiber tubs is 20 cm, and water temperature during embryonic development ranged from 28 to 29°C, pH 6.8 to 7 and dissolved oxygen 5.6 to 6.8 mg/L [32].

First feeding of larvae started 5 to 10 days post-hatching with

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commercial starter food (Equchi BP) with proximate composition are water content (% dry weight) 4%, crude protein 42%, lipid 14%, and crude ash 7%. This feed in the form of powder and water soluble media and the maintenance needed by larva *O. vittatus*, because larval *O. vittatus* cannot consume *Artemia* nauplii. As the treatment is the gave a schedule the different types of live diets on the growth and survival of fish larvae *O. vittatus* aged 10 to 40 days.

Larva rearing

After 9 days, the larvae hatched, the larvae were taken from the moving plates and were put to the 12 unit aquarium. Size of each aquarium is 40 cm × 20 cm × 20 cm. The water level was about 15 cm depth (water volume of tank, 8 L) and 1n2 hours after, it was recorded that the some larvae began to swim actively. Initial densities of larvae were 15 larvae/L. *Artemia nauplii* and *Moina* sp was offered at the initial amount of 500 individuals/larvae, increasing in equal quantities each five days [33]. Whereas *Tubifex* worms are given 100% (wet weight) of biomass weight/day. Table 1 suggests the proximate value of natural feed of *Artemia nauplii*, *Moina* sp and *Tubifex* worms. The research consisted of 32 treatments and three replications with schedule gives natural feed is as follows:

schedule 1	=	<i>Artemia nauplii</i> from 10 to 15 days, <i>Moina</i> sp from 15 to 20 days, <i>Tubifex</i> worms from 20 to 40 days.
schedule 2	=	<i>Artemia nauplii</i> from 10 to 20 days, <i>Moina</i> sp from 20 to 25 days, <i>Tubifex</i> worms from 25 to 40 days.
schedule 3	=	<i>Artemia nauplii</i> from 10 to 25 days, <i>Moina</i> sp from 25 to 30 days, <i>Tubifex</i> worms from 30 to 40 days.
schedule 4	=	<i>Artemia nauplii</i> from 10 to 30 days, <i>Moina</i> sp from 30 to 35 days, <i>Tubifex</i> worms from 35 to 40 days.

The physico-chemical condition of water including water temperature, pH, dissolved oxygen (DO), total dissolved solids (TDS), were measured early in the morning prior to feeding at depth of 5 cm by using a multiparameter water analysis instrument. Total alkalinity and total hardness were determined by the sulphuric acid titration method as per APHA [34]. Ammonia and nitrite concentrations were determined at the same time using spectrophotometer kits. Dead larvae were removed and counted twice a day, simultaneously to water changes, to estimate the percentage of survival rate per 24 h. On the last day of the experiment, all the remaining larvae were individually counted for the calculation of actual survival rate.

Indices of growth

Growth parameters were determined using both length and weight.

Growth absolute weight (mg)	=	$\frac{\text{final weight (mg)} - \text{initial weight (mg)}}{\text{time (days)}}$ [35]
Growth absolute length (mm)	=	$\frac{\text{final length (mm)} - \text{initial length (mm)}}{\text{time (days)}}$ [35]
Growth rate (mg/day)	=	$\frac{\text{final weight (mg)} - \text{initial weight (mg)}}{\text{time (days)}}$ [22]
Growth rate (mm/day)	=	$\frac{\text{final length (mm)} - \text{initial length (mm)}}{\text{time (days)}}$ [22]
Specific growth rate (%/day)	=	$\frac{\ln(\text{final weight (mg)}) - \ln(\text{initial weight (mg)})}{\text{time (days)}} \times 100$ [28].

Feeds	Protein (%)	Lipid (%)	Ash (%)	Crude fiber (%)	Water Content (%)
<i>Artemia</i> [31]	52.2	18.9	9.7	2.04	81
<i>Moina</i> sp [32]	37.38	13.29	11	11	90.60
<i>Tubifex</i> worms [33]	51.9	22.3	5.3	2.04	87.7

Table 1: Proximate analysis of *Artemia nauplii*, *Moina* sp and *Tubifex* worms.

Specific growth rate (%/day)	=	$\frac{\ln(\text{final length (mm)}) - \ln(\text{initial length (mm)})}{\text{time (days)}} \times 100$ [28].
Survival (%)	=	$100 \times \frac{\text{no. of survivors}}{\text{no. of initial fish}}$.

Statistical analysis

Data were analysed using one way analysis of variance [36] and differences in means were compared using Least Significance Difference at P=0.05. Analysis was done using a statistical software programme (SPSS version 13).

Results

Table 2 shows the results of the different feeding schedule natural feed on the growth of absolute weight, final weight, growth rate and specific growth rate (body weight). The feeding schedule had a significant effect on growth performance ($p < 0.05$). The highest values obtained in fish fed with schedule *Artemia nauplii* from 11 to 15 days, *Moina* sp from 15 to 20 days, *Tubifex* worms from 20 to 40 days. While the least values were found in fish fed with schedule *Artemia nauplii* from 11 to 30 days, *Moina* sp from 30 to 35 days, *Tubifex* worms from 35 to 40 days. The result of final length, growth of absolute length, growth rate (length) and specific growth rate (length) is shown in Table 3. A similar trend found for weight measurements was also observed for length measurements. Mortalities occurred in all the treatment aquarium (Tables 2 and 3), survival ranged from 90.00% to 96.67% ($p > 0.05$).

Discussion

The results of this study stated that the growth of the weight and length is best *O. vittatus* larvae with *Artemia nauplii* feeding for five days, *Moina* sp for five days and live *Tubifex* worms for 20 days. Researchers have reported success larval rearing fish fed with zooplankton [31]. The zooplankton species include the genus *Moina* sp (Cladoceraans) success for feed *Chanos chanos* larvae [37] and *Clarias macrocephalus* larvae [38]. Furthermore, larval rearing European catfish (*Silurus glanis*) success with live *Tubifex* worms [39]. *Artemia nauplii* have also been reported as a good starter diet for freshwater and marine fish [40-44], because of its balanced nutritional composition [29]. An advantage of *Artemia nauplii* is that they can be kept for considerable periods of time. *Moina* sp have also been reported stater diet for fish larva [45,46]. *Tubifex* worms can also be used as an initial feeding fish larvae [30,47]. According to [21] that larval rearing depends on the availability of appropriate sized and nutritionally adequate food for the larvae.

Various researchers have used live feeds for fish larval nutrition with success. These include the use of *Artemia nauplii*, [48,29], Rotifers [49,29], Cladoceraans [50], and wild Zooplankton [51]. Fish larvae are attracted to live food by their movement, and the success of the use of live foods depend on a number of factors which include the nutritional composition of the live foods as well as the size of the live foods in relation to the mouth gape of the fish larvae. Small fish larvae tend to prefer prey of small size [28].

The longer the *Tubifex* worms given to the larvae *O. vittatus*, the higher the growth rate, feeding *Tubifex* worms during the 20-days average growth rate was 0.29 ± 0.03 mg/day, for 15 days was 0.14 ± 0.02 mg/day, for 10 days was 0.11 ± 0.02 mg/day and for 5 days was 0.06 ± 0.04 mg/day. *Chitara chitara* larvae fed live *Tubifex* worms during the 28-days average growth rate was 2.40 ± 0.72 g/day, followed by larvae fed fish eggs was 2.15 ± 0.71 g/day, dried *Tubifex* worms was 2.12 ± 0.40 g/day, larvae Chironomous was 1.91 ± 0.44 g/day, Spirulina was 1.79

Parameter	Schedule 1	Schedule 2	Schedule 3	Schedule 4
Initial weight (mg)	1.6 ± 0	1.6 ± 0	1.6 ± 0	1.6 ± 0
Final weight (mg)	10.42 ± 1.62 ^a	5.94 ± 0.507 ^b	4.85 ± 0.67 ^c	3.25 ± 0.67 ^d
Growth of absolute weight (mg)	8.82 ± 35 ^a	4.34 ± 0.51 ^b	3.25 ± 0.67 ^c	0.49 ± 0.15 ^c
Growth rate (mg/day)	0.29 ± 0.03 ^a	0.14 ± 0.02 ^b	0.11 ± 0.02 ^b	0.06 ± 0.04 ^c
Specific growth rate (%/day)	6.24 ± 0.33 ^a	4.37 ± 0.18 ^b	3.69 ± 0.31 ^c	2.36 ± 0.18 ^d
Survival (%)	96.67 ± 4.33 ^a	93.05 ± 6.14 ^a	90.00 ± 9.01 ^a	96.11 ± 3.76 ^a

Table 2: Growth of weight and survival (means ± S.E) of *O. vittatus* larvae reared with different feeding schedules.

Parameter	Schedule1	Schedule2	Schedule3	Schedule4
Initial length (mm)	5 ± 0	5 ± 0	5 ± 0	5 ± 0
Final length (mm)	20.13 ± 1.00 ^a	16.93 ± 0.54 ^b	13.71 ± 0.37 ^c	11.35 ± 0.24 ^d
Growth absolute length (mm)	15.13 ± 1.00 ^a	11.93 ± 0.54 ^b	8.71 ± 0.37 ^c	6.35 ± 0.24 ^d
Growth rate (mm/day)	0.50 ± 0.03 ^a	0.40 ± 0.01 ^b	0.29 ± 0.01 ^c	0.21 ± 0.06 ^d
Specific growth rate (%/day)	4.64 ± 0.11 ^a	4.06 ± 0.08 ^b	3.36 ± 0.05 ^c	2.73 ± 0.06 ^d
Survival (%)	96.67 ± 4.33 ^a	93.05 ± 6.14 ^a	90.00 ± 9.01 ^a	96.11 ± 3.76 ^a

Table 3: Growth of length and survival (means ± S.E) of *O. vittatus* larvae reared with different feeding schedules.

± 0.38 g/day, Daphnia was 1.42 ± 0.79 g/day and Plankton was 1.37 ± 0.77 g/day [20].

Some researchers have recorded positive results with live *Tubifex* worms especially in freshwater fish larval culture [20,23,30]. *Tubifex* worms are reported to be of better nutritional value with proximate composition are water content (mg/100 mg wet weight) 87.19 ± 0.83, crude protein 57 ± 0.58, lipid 13.3 ± 0.06, ash 3.60 ± 0.16 and higher amino acids was 7.28 mg/100 mg dry weight, i.e lysine, leucine, arginine, valine, threonine, phenylalanine, isoleucine, tyrosine, histidine, and methionine, but it also contains the total fatty acid content was 7.28 mg/100 mg dry weight [51,52].

All the water parameters were under the tolerance limit of fish and they did not exhibit any distress during the experiment. Dissolved oxygen (DO) is the key factor in rearing of larvae because larvae need optimum level of oxygen for maintaining their physiological condition [20]. In the present study, mean dissolved oxygen level in the recirculatory fish aquarium was 8.6 ± 0.21 mg/L at 10.00 h. The water pH was 7.8 ± 0.5 during rearing period, a higher level whereas mean free CO₂ was 0.50 ± 0.04 mg/L. In the daytime, fish consumed more oxygen while their carbon dioxide excretion reduced the pH range.

Temperature plays an important role in larval rearing. An average water temperatures ranged from 27 to 29°C respectively. The results of the mean values of other water quality parameters in the recirculatory systems were as follows; alkalinity 33.51 ± 0.15 mg/L, hardness 110.86 ± 6.40 mg/L, total dissolved solids 152.22 ± 2.34 mg/L. Ammonia and nitrite concentration were on the lower side and ranged between 0.005 to 0.007 mg/L, and 0.03 to 0.06 mg/L respectively.

It is concluded that provide *Artemia nauplii*, *Moina* sp, *Tubifex* worms with different schedules for 30 days significantly affected the growth of *O. vittatus* larvae.

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