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High Density Rearing of *Labeo rohita* (Hamilton) Spawn Indoors using Different Diets

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Three day old spawn of *Labeo rohita* was reared in indoor tanks with eight different diets, consisting of live feeds, formulated feeds, conventional feeds and different combinations of the above. The experiment was carried out in circular FRP tanks of 83 l capacity with a stocking density of 10,000 m^{-3}. The duration of the experiment was 21 days. The diets of *Artemia nauplii* and *Moina* have given higher mean specific growth rate (16.45 and 15.3 respectively) and normalized biomass index (352.12 and 267.76 respectively) without any significant statistical difference, while *Moina* + formulated feed and *Artemia* + formulated feed have given higher mean survival rates (88.6 and 88.3%, respectively).

Key words: *Labeo rohita*, growth rate, biomass index, live feed, formulated feed

Rohu, *Labeo rohita*, is the most widely cultured of Indian major carps (Shivananda & Varghese, 1996). The non-availability of adequate number of good quality seed of the right size for the growout operations is a major problem in many countries including India. India's present production of about 14,500 million fish seed is not adequate even to stock 50% of the available fresh water resources (Basavaraja & Antony, 1997). Although the techniques in induced breeding of carps have undergone many improvements, total seed production has not increased proportionally, possibly because there were no corresponding improvements in the spawn rearing techniques (Nair *et al.*, 1989). Carp spawn is usually reared in out door nursery ponds where they feed on naturally available plankton and supplementary feed (ground nut oil cake and rice bran in 1:1 ratio). The survival rate from spawn to fry in the outdoor nursery systems usually ranges from 30-50% (Alikunhi, 1957; Keshavappa *et al.*, 1990). The mortality in nursery ponds, among other factors, is due to lack of proper food (Lal & Kapur, 1986). Being small and tender, at the same time predatory in nature, carp larvae should be provided with sufficient population of tiny animalcules, preferably rotifers and cladocerans for better survival and growth. A nutritionally adequate introductory feed holds the clue to successful larviculture. The purpose of the present study was to evaluate the efficacy of eight different feed combinations for the rearing of *Labeo rohita* spawn indoors.

Materials and Methods

Three day old rohu spawn collected from the jar hatchery of the Fisheries College, Kerala Agricultural University, Kochi with an average length of 6 mm (weight 3.5 mg) were used for the experiment. A total of 9600 healthy spawn were used for the study. Circular FRP tanks of 83 1 capacity with 0.54 m diameter and 0.34 m height, filled to a height of 0.18 m with an effective water volume of 40 l were used for the experiment. 400 numbers of spawn were stocked in each tank and continuous aeration was provided. The live feeds used for the study were newly hatched *Artemia nauplii*, mass cultured *Moina micrura* and mixed zooplankton. A formulated feed and conventional carp larval feed were also used for the experiment.

Biomarine brand *Artemia* cyst incubated and hatched to nauplii in 20 ppt saline water in cylindroconical FRP tanks and harvested after 18-24 h, using standard techniques were

used for the experiment. *Moina* was cultured in outdoor concrete tanks. The original stock for inoculation was isolated from a fresh water pond, and a pure culture carried out using the technique developed by Thressiamma *et al.* (1991). Periodic harvesting was done with No.8 plankton net and passed through a 300 micron mesh sieve to get animals of smaller size.

A particulate diet was formulated using locally available ingredients, to get 40% protein. The ingredients (except vitamin mix and antibiotic) for the test diet were mixed thoroughly with water (1:1.25 w/v) and then hand kneaded to get soft dough. The mixture was autoclaved at atmospheric pressure for 30 min., cooled, and then vitamin mixture (1.5%) and antibiotic (0.15%) were added. The dough was again mixed thoroughly, pelletized and dried in hot air oven at 60°C, till the moisture content reduced to less than 10%. The pellets were then ground and passed through a 300 micron mesh sieve and stored in an air tight plastic container.

A feed containing powdered groundnut oil cake and rice bran was used in one treatment together with mixed zooplankton, containing *Daphnia, Moina,* copepods and others. A stocking density of 10,000 m^{-3} was employed. Eight combinations of feed (Table 1) were tested.

Feeding was done daily *ad libitum* at 6 h intervals. When the combination of live feed and artificial feed was given, the feeds alternated starting with live feed at 6 a.m. About 30% of the water was exchanged daily after siphoning off the left-over feed and excreta just before the first feeding of the day. Water quality parameters were analyzed to ensure that the parameters were at desired levels. After a period of 21 days, the survival rate, specific growth rate and normalized biomass index were calculated.

Table 1. Different diets used for the experiment

Code	Ingredients
A :	Rice bran and groundnut oil cake in 1:1 ratio + mixed zooplankton
B :	Size graded *Moina micrura*
C :	Newly hatched *Artemia* nauplii
D :	Formulated feed
E :	*Moina* + formulated feed
F :	*Artemia* + formulated feed
G :	First three days *Moina* and then formulated feed
H :	First three days *Artemia* nauplii and then formulated feed

The experiment was conducted using Completely Randomized Design with three replications for each of the eight treatments. The results were analyzed using the Analysis of Variance technique, wherever necessary. Arc sine transformation was applied before analyzing the data. Pair-wise comparisons were also made using the Critical Difference method (Snedecor & Cochran, 1973).

Results and Discussion

During the experiment, water temperature ranged from 27.1°C to 31.8°C, pH varied from 6.0 to 7.5 and the dissolved oxygen content varied from 9.8 to 10.9 ppm. The total hardness recorded was between 40 and

Table 2. Survival and specific growth rate of *L. rohita* fry reared on different feeds

Treatment	A	B	C	D	E	F	G	H
Survival* % (mean±SD)	43.28± 0.816	64.20^{a}± 2.499	65.43^{b}± 2.055	61.36^{a}± 1.633	70.53^{c}± 3.300	70.07^{c}± 1.700	64.41^{ab} ±1.247	63.92^{a}± 0.943
Specific growth rate (mean±SD)	12.09± 0.247	15.30± 0.037	16.45± 0.020	14.05± 0.064	14.83^{d}± 0.015	14.75^{d}± 0.066	14.7^{d}± 0.021	14.79^{d}± 0.058

* Treatments with same superscript do not differ significantly

60 ppm. The ammonia content varied from 0.24 to 0.44 ppm. There was no significant difference in any of the above water quality parameters among the experimental tanks. The mean survival rates of the *L. rohita* fry fed with different diets are shown in Table 2. The results of the present study revealed that maximum survival could be realized for the spawn fed on a mixed diet of *Moina* with formulated feed (88.6%) and *Artemia* with formulated feed (88.3%). The spawn fed *Artemia* nauplii had better survival rate than the *Moina*-fed ones (82.6% and 81%, respectively). Statistically similar mean percentage survivals were obtained when the fry were fed with *Moina* for first three days and formulated feed later, and with *Artemia* nauplii for first three days and formulated feed later. The fry fed with formulated feed alone had lower mean percentage survival (77%) compared to the treatments where live foods were given. In the conventional method of rearing, survival was the lowest (47%). The results compare favourably with those obtained by Lakshmanan *et al.* (1967) for catla and rohu (74.37% and 53.8% respectively), Sinha & Ramachandran, (1985) for catla (87%), Jaini (1989) for common carp (73.5%) and Jena *et al.* (1996) using artificial feed, for rohu and catla spawn (67.8% and 41.6% respectively).

Maximum mean weight gain was observed for the fry fed on *Artemia* nauplii alone, followed by *Moina* alone (110.7 and 86.69 mg, respectively). The mean weight gain of fry fed with formulated feed alone was 66.9 mg. Better mean weight gains were observed when *Artemia* nauplii and *Moina* were incorporated in the diet along with the formulated feed (77.5 and 78.7 mg, respectively). Similar mean weight gains were observed when the fry were fed with *Artemia* nauplii for the first three days and formulated feed later (78.2 mg), and *Moina* for the first three days followed by formulated feed (76.7 mg). This is in conformity with the results of Dadrowsky *et al.* (1978) in common carp larvae. The lowest mean weight gain in the present study (44.4 mg) was noticed in the fry fed by conventional methods (Table 3).

Table 3. Weight gain of *L. rohita* fry fed on different diets

Diets	Initial average weight (mg)	Final average weight (mg)	Weight gain (mg)	Mean weight gain (mg)±SD
A	3.5	43.9	40.4	40.93±2.32
	3.5	47.5	44.0	
	3.5	41.9	38.4	
B	3.5	86.7	83.2	83.47±0.68
	3.5	86.3	82.8	
	3.5	87.9	84.4	
C	3.5	111.2	107.7	107.23±0.46
	3.5	110.9	107.4	
	3.5	110.1	106.6	
D	3.5	66.8	63.3	63.43±0.90
	3.5	68.1	64.6	
	3.5	65.9	62.4	
E	3.5	78.5	75.0	75.27±0.25
	3.5	79.1	75.6	
	3.5	78.7	75.2	
F	3.5	77.3	73.8	74.00±1.07
	3.5	78.9	75.4	
	3.5	76.3	72.8	
G	3.5	76.9	73.4	73.27±0.34
	3.5	77.1	73.6	
	3.5	76.3	72.8	
H	3.5	78.7	75.2	74.73±0.96
	3.5	79.1	75.6	
	3.5	76.9	73.4	

Maximum mean SGR was observed in the fry fed on *Artemia* nauplii alone, followed by that fed on *Moina* alone (16.45 and 15.30, respectively) (Table 2). All other methods have given similar mean SGR of about 14, except the conventional methods (12.09). The SGR noticed by Mohanty *et al.* (1993) was a little higher (17.19) than that from the present study. Jena *et al.* (1996) could realize a still higher SGR of 27.52 for rohu fry.

Maximum normalized biomass index (NBI) in the different treatments are presented in Fig.1. Maximum NBI could be obtained for the fry fed on *Artemia* nauplii alone (352.12) followed by *Moina* alone

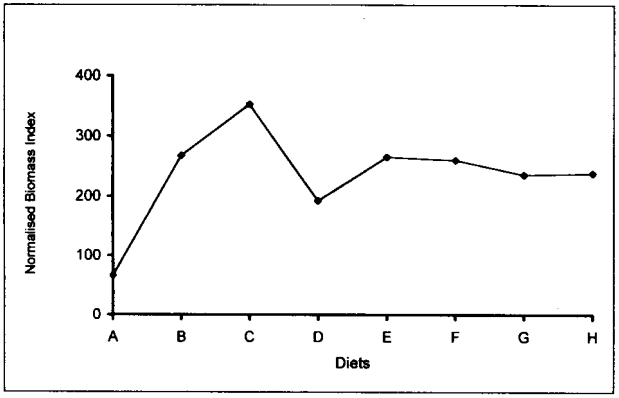

Fig. 1. Mean normalised biomass indexof *Labeo rohita* fry fed on different diets.

(267.76). Statistically, similar NBI values (in the range of 235-238) were recorded for the fry reared on the live feed + formulated feed. A mean NBI of 192.09 was obtained for the formulated feed alone, whereas the lowest value was recorded for the fry reared by the conventional method (66.07).

In nursery rearing, both growth and survival are important. In the present experiment, better mean weight gains were obtained when the spawn was given live feeds like *Artemia* nauplii and *Moina*. However, the practice of feeding the fry with *Artemia* alone could not be suggested for practical purposes because of its prohibitive cost and also uncertain availability. Farmers could culture *Moina* easily with limited inputs, in the farm itself. Owing to these reasons, a feeding regime consisting of *Moina* and a formulated feed is recommended for optimum growth and survival of the *L. rohita* fry.

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References

Alikunhi, K.H. (1957) *Farm. Bull.* I.C.A.R., **20**, 144

Basavaraja, N. & Antony, J.M. (1997) *Indian J. Fish.* **44**, 165

Dabrowski, K., Dabrowska, H. & Grudniewaski, C. (1978) *Aquaculture*, **13**, 257

Jain, A.K. (1989) *Indian J. Fish.*, **36**, 28

Jena, J.K., Mukhopadhyay, P.K. & Muduli, H.K. (1996) *J. Aqua. Trop.*, **11**, 299

Keshavappa, G.Y., Devaraj, K.V., Basavaraj, Y. & Seenappa, D. (1990) *J. Aqua. Trop.* **5**, 131

Lakshamanan, M.A.V., Sen, P.R., Murthy, D.S. & Chakraborthy, D.P. (1967) *F.A.O. Fish. Rep.* **44**, 373

Lal, K.M. & Kapur, K. (1986) *J. Aqua. Trop.*, **1**, 139

Nair, C.M., Thampy, D.M., Sankaran, T.M., Sebastian, M.J. & Syamlal, P. (1989) in *Proc. Nat. Sem. Freshwat. Aqua.*, p.1, C.I.F.A., Bhubaneshwar

Shivananda, M.H. & Varghese, T.J. (1966) *J. Aqua. Trop.* **11**, 1

Sinha, V.R.P. & Ramachandran, V. (1985) *Freshwater Fish Culture*, p.30, I.C.A.R., New Delhi

Snedecor, G.W. & Cochran, W.G. (1973) *Statistical Methods*, 6th edn, p.593, Iowa State University Press, Iowa

Thresiamma, J., Mercy, T.V.A. &Thampy, D.M. (1991) *J. Zool. Soc. Kerala* **1**, 21