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RESEARCH ARTICLE

SYNTHETIC FEED ADDITIVES ON FECUNDITY AND FERTILIZATION OF DIFFERENT FISH (*C.CATLA, L. ROHITA, C.MRIGALA*) SPECIES

Venganna.P, Samba Naik. A and Mude.Jagadish Naik*

Department of Zoology, Acharya Nagarjuna University, Nagarjuna Nagar, Guntur, Andhra Pradesh, India

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A B S T R A C T

The present study is to investigate the effect of selective Synthetic feed like Agrimin and Fishmin having some additive components for enhancing on certain metabolic profiles and yield parameters of the cultivable fish species like *Catla catla*, *Labeo rohita*, *Cirrhinus mrigala.* The fishes selected for the study are considered into two groups viz. control group and experimental group .The control group of fishes are fed with control feed i.e. Groundnut cake, rice bran. The experimental group of fishes shall further be divided into two groups, Agrimin and Fishmin which are commercially available, have been selected for the study. The first group of experimental fish was fed with control feed mixed with Agrimin. The second groups of experimental fish are being fed with control feed mixed with fishmin. Hence the feed i.e., control feed+Agrimin Fishmin, supplied to the two groups of experimental fishes shall be called as synthetic feed. Elevation of rate of fecundindity and rate of fertilization was observed when fed withe agrimin and fishmin fed fish speciest. Agrimin or fishmin treatment enhanced the fertilization rate and all the changes were found to be statistically significant over their corresponding control values.

INTRODUCTION

Fecundity plays a major role and much attention now a day as they play key role in fish stock management. This is the most important aspect of fish biology. Fecundity is a measure of reproductive capacity of female fish and its adaptation to various conditions of environment. Range of fecundity has been determined for many fishes which provide information of population dynamics, racial, characteristic production and stock recruitment problems. The important studies on fish fecundity were made by Hora and Pillary (1962), Sukumaran (1969) Roa and Rao (1999) and Sakhere (2000).Fecundity is usually defined as the number of ripening eggs found in the female just prior to spawning. This contrast with fertility which is the number of eggs lay. The fecundity of fishes as that of other animals ensures the survival of the species under varying conditions. Welcome (1979) used fecundity for the number of eggs produced by a mouth breeding and fertility for the number of young produced.

Large fecundity evolves under conditions of heavy mortality, particularly when this is due to predators. Changes in individual fecundity are regulated by changes in the food supply. Faster growing individuals usually have a high fecundity than slower growing ones of the same size (Bagenal, 1971). The species responds to changes in the environment by changes in its fecundity. The absolute fecundity is dependent on the length and weight of the female (Biswas, *et al*., 1984).The number of eggs laid by various groups of fishes varies considerably i.e., from a few large eggs as in several sharks to three thousand millions of eggs in the ocean sunfish (*Mola mola*). On the whole, the fecundity of fishes is much higher than that of terrestrial vertebrates (Sharma and Grover 1982). The most fecund fishes are those which have floating as well as pelagic eggs. With respect to specific gravity, two egg types exist among ostiecthys. They are the buoyant of planktonic eggs, which is very common in marine fish families, and the non buoyant type, which is common in fresh water fishes. Fishes having protective devices for the eggs are usually provided with a low fecundity in marine fishes usually somewhat higher than those of fresh water or migratory fishes. The number of eggs contained in an ovary of a fish is termed as the individual, absolute or total fecundity. Jobling (1996) suggested that if suitable conditions are not found the eggs may become artresic, degerate and ultimately reabsorbed in the body. (Pope *et al* 1961) and Galkina (1970) found this with salmon. Therefore an attempt is made on this investigation to study the rate of fecundity of selected fish species fed with synthetic feed that are Agrimin and Fishmin.

Reproductive cycle may be viewed as an integrated response of the individuals of a population to the environment both in a functional and a temporal sense. Temporal patterns of reproductive cycle may result through a complex coordination of a number of endogenous factors with respect to interacting exogenous factors at a given time and over a time period by members of a population (Rajender Rao *et al.*, 2003) and reproductive behaviour like court play plays a major role in the successful forming and culture of fish species.

Fertilization is the fusion of male and female gamates, which

in animals are the spermatozoan and the ovum respectively. It results in the formation of a zygote, from which the body of the off spring is formed. In the majority of fishes fertilization is external, but in a number of species, both egg laying and those in which the eggs develop inside the maternal body. Internal fertilization takes place, in connection with which they have often evolved special copulatory organs. In their simplest form the copulatory organs are represented by anal papiliae, as in the lampray (cyclostomes) and also in number of fishes - cottids : gobies and certain others (Brown 1957).

In the female shark and skate internal fertilization occurs in both egg laying and viviparous species. Rohu is poly gamous fish and eggs of Rohu are demersal and sink to the bottom. Eggs when fully fertilized measures 4.5-5.0 mm in dia meter and are round, transparent, non adhesive, and reddish in colour. Yolk is spherical and devoid of oil globules (Chakrabarthi, 1998). In Indian major carps like *catla, rohu* and *mrigal* external fertilization takes place. In most species the eggs are more stenothermal than juvenile or older fish and are the most vulnerable stage in the life cycle to the effects of thermals stress. These effects will influence not only the survival of individual fish but also the ultimate survival of the population.

Plane of work

The fishes selected for the study shall be divided into two groups viz. control group and experimental group: age, two years .The control group of fishes shall be fed with control feed i.e. Groundnut cake, rice bran. The experimental group of fishes shall further be divided into two groups, Agrimin and Fishmin which are commercially available, have been selected for the study. The first group of experimental fish shall be fed with control feed mixed with Agrimin. The second group of experimental fish shall be fed with control feed mixed with fishmin. The two groups of experimental fish shall be fed twice a day at 10 a.m. and at 5 p.m. The exposure period selected for the study is 30 days,after 30 days the fishes were killed and isolated the tissues like muscle and liver at 40C .

Chemicals and synthetic feed

Agrimin and Fishmin which are commercially available have been selected for the study. All other chemicals used are of technical grade from sigma, St. louis, USA, SDH, CDH (India).

Agrimin

Agrimin is a product from Glaxo, Mumbai, India. A product with high quality supplement of minerals with essential amino acids for cattleand fish feeding. Regular supplement of Agrimin helps in maintaining healthy growth and higher productivity.

Direction for use

Can be mixed in Cattle and fish feed at the rate of 1-2% of feed (or) Large animals - 20 to 30 gms daily Small animals - 5 to 10 gms daily.

Fishmin

Fishmin is a product from Arias Agro-vet industries Pvt. Ltd., Mumbai, India. A product with high quality supplement of minerals, mainly for aquatic animals. However, the author mixed fishmin with control feed at the rate of 1-2% for his study.

Determination of Rate of Fecundity

Fecundity which represents the number of eggs released from a breeder is calculated in the following way. Before carrying out the breeding experiment the weight of the female is recorded with the help of a single pan balance. After the eggs are released, the weight is recorded again. The difference in the Weight indicates the mass of eggs released. This is converted into rate and % fecundity.

$$\text{Rate of fecundity} = W_1 - W_2$$

Where

W_1 = Weight of the female before releasing eggs.

W_2 = Weight of the female after releasing eggs.

From the mass of eggs released, the number of eggs is counted by transferring them into a 10 ml measuring cylinder without water. The rate of fecundity is calculated by dividing the number of eggs released with the weight of the fish.

The % of fecundity is calculated by using the following formula.

$$\%\, of\ Fecundity = \frac{No.of\ eggs\ released}{Weight\ of\ the\ fish} x100$$

Determination of Rate of Fertilization

After breeding, all the eggs are collected from the breeding tub and shifted to the hatching tub. While taking the sample eggs from the hatchery, the eggs are churned well and the eggs are collected into 10 ml measuring jar without water.

Thus collected eggs are transferred into a 50ml beaker which contains water. The eggs are counted with the help of petridish one by one. Thus the total number of eggs can be calculated while counting bad eggs (unfertilized eggs) and good eggs (fertilized eggs) separately. The rate of fertilization is calculated with the help of the number of fertilized and unfertilized eggs by using the following formula.

No. of fertilized eggs = Total No. of Eggs - No. of unfertilized eggs.

And the percentage of fertilization is calculated by using the following formula.

$$\%\, Fertilization = \frac{No.of\ \ fertilized\ eggs}{Total\ No.of\ eggs} x100$$

Statistical analysis has been carried out using INSTAT software. The data was analyzed for the significance. The results were presented with the P-value

RESULTS AND DISCUSSION

Fecundity represents the number eggs laid by the female. This directly gives an indication of the rate of fertility in any organisms including fishes. The results of present investigation on the rate of fecundity in selected fish species shows maximum in Agrimin over Fishmin. (Table 1) (Fig. 2)

These differences among the two types of synthetic feeds , which are found to be highly significant (P<0.001) may be attributed to the nature of the growth and food habits of major carp as suggested by AliKunhi (1957).

Table 1 Effect of Agrimin & Fishmin on the rate of fertilization & fecundity in various fish species

Name of the Feed	Name of the parameter					
	Rate of fertilization			Rate of Fecundity		
	Labeo rohita	*Catla catla*	*Cirrhinus mrigala*	*Labeo rohita*	*Catla catla*	*Cirrhinus mrigala*
Control Feed						
AV	1.35	0.88	1.50	1.86	1.34	2.72
SD	±0.055	±0.074	±0.036	±0.024	±0.56	±0.37
PC						
t						
Control Feed + Agrimin						
AV	2.88	2.57	2.72	3.868	3.655	3.90
SD	±0.62	±0.016	±0.066	±0.94	±0.34	±0.77
PC	113.33	192.04	81.33	107.95	172.76	43.38
t						
Control feed + fishmin						
AV	2.57	1.61	2.22	2.97	2.40	3.21
SD	±0.056	±0.077	±0.35	±0.19	±0.24	±0.16
PC	90.37	82.95	48.00	59.67	79.10	18.01
t						

Each value is the mean ± SD of 7 samples; AV – Average, SD – Standard Deviation, PC – Percentage change over the control; * P<0.001, N.S.- Not significant

Fertilization that is union of male and female gamates is external in Indian Major Carps as in the case of any other fish. Therefore it is found to be influenced by environmental factors of aquatic media and nutrients. The results on fertilization indicate that the selected fish species registered a higher rate of fertilization in Agrimin than Fishmin (Table-1 Fig.1). This might be due to nutritional status. It is also reported that in most species the eggs are more stenothermal than Juvenile or older fishes and are the most vulnerable stages in the life cycle to the effects of thermal stress. These effects will influence not only the survival of individual fish but also the ultimate survival of the population. Further courtship behaviour between male and female which forms a pre-requisite for fertilization will only be highly successful in undisturbed waters and provided micro nutrients as reported by Elliot (1981). *L.rohita* as a column feeder might have experienced least thermal changes and disturbances in the middle portion of the water because of generally calm and quite aquatic conditions. That's why the column feeder *L.rohita* has shown a significantly higher rate of fertilization in highly nutrient Agrimin over Fishmin. It is followed by *C.mrigala and C.catla* (Table-1&Fig. 1).

The higher rate of fecundity in Agrimin is due to the increased presence of micro nutrients and amino acids. These observations are supported by the fact that the water on acid soil is generally less productive than on alkaline soils as suggested by Alikunhi (1960). Further the Agrimin and Fishmin particles might have absorbed considerable amount of nutrient elements like phosphates, potassium and nitrogen to enhance the nutritional status to produce more planktons, the micro food for fishes. This is also supported by Salaskar and Yeragi (2003) as the plankton population on which the total aquatic life depends directly or indirectly. Salaskar and Yeragi (2003) found abundant growth of phytoplankton's and zoo planktons having high concentration of pH.

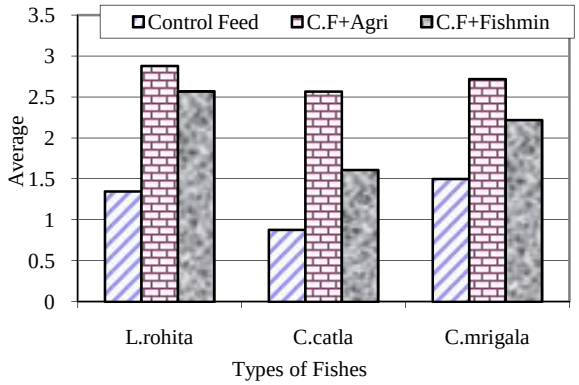

Figure 1 Impact of Agrimin and Fishmin on the *Rate of Fertilization* of Selected Fish species *C.catla, L.rohita, C.mrigala*

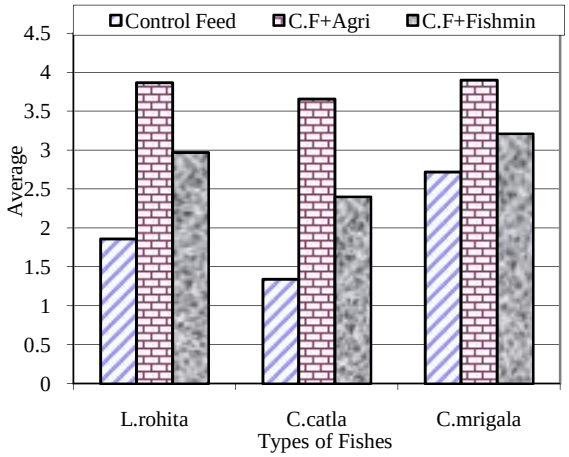

Figure 2 Impact of Agrimin and Fishmin on the *Rate of Fecundity* of Selected Fish species *C.catla, L.rohita, C.mrigala*

These plank tonic blooms are known to produce more oxygen in the water to increase the overall metabolic activities including the breeding and fecundity of fishes. In such conditions these extra nutrients present in Agrimin and Fishmin must have stimulated reproductive capacity including increased rate of egg production. Feed types influenced significantly the feed intake, growth, ovary weight and fecundity in three types of carps. The results clearly showed that, fish fed with agrimin showed higher feeding rate in comparison and mixed diets while the latter higher performance in conversion rate and fecundity. This may be due to the soft nature and palatability of feeds which did not contain growth stimulating components. The mixed diet promoted better growth perhaps due to the presence of different components, stimulating growth with required compositions. Nandeesha *et al.* (1994) reported that mixed feeding schedules were superior to the high protein of single diet because nitrogen retention was high in fish fed with mixed schedules.Feed intake of fish depends on size of the prey and predator, quality, density, physical attractiveness and mode of presentation of food (Hastings and Dickie, 1972;

Mathavan, 1976; James *et al.*, 2007). Feeding with adult *Artemia* provides more protein and most essential aminoacids intake and growth more than pellet feed during the early rearing period. Cohi salmon *Oncorhynchus kistuch* fry fed with *Artemia* sp. grew faster than those fed with supplementary diets (Kim *et al.*, 1996) and this supports the poor performance of pelleted feed.

It also suggests that pelleted diet is not suitable for growth to juvenile *B. splendens.* Degani (1991) found that juvenile *Trichogaster trichopterus* fed with live feed grew faster than those fed on formulated feed because of the palatabilty, high consumption rate and chemical compostion of the former. The rate and efficiency of conversion were greatly reduced during spawning periods in *B. splendens*. The reproductive capacity of fish is also influenced by dissolved micro nutrients and pH of water as Sinha *et al.,* (1990) regarded pH as one of the influencing factors of the productivity of a water body.

Thus basing on results at fecundity it may be concluded that the experimental fish *C.mrigala* is found to have a higher reproductive potential as compared to *C.catla or L.rohita.* Agrimin has resulted in higher fecundity in the experimental fish than fishmin. The greater the nutrients higher will be the fertilization rate as noted in the present study. The presence of more nutrients in the water might have facilitated the union of sperm and ova when compared to their union in low nutrient water. It has also been reported by Braum (1978), most fresh water fishes have demersal eggs with a specific gravity greater than fresh water is also noticed in the present study.

Many of the fresh water fish eggs including those of the major carps are temporarily adhesive but the period of adhesiveness is short and restricted to the time immediately after explosion. The eggs are prevented from floating away and are located above the bottom mud, thereby ensuring a sufficient water circulation over the surface. This will provide a good platform for breeding processes and thus effective fertilization. Such a good platform for breeding purposes might have been formed in waters with more turbidity and mud.

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