Bull. Nat. Inst. of Oceanogr. & Fish., A.R.E., 1995, Vol.(21) No. 2: 501 - 515

SPAWNING AND LARVAE PRODUCTION IN NILE TILAPIA (OREOHORMIS NILOTICUS) BREEDERS UNDER DIFFERENT FEEDING REGIMES.

BY

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Key words : Fish Reproduction, Nile Tilapia.

ABSTRACT

Reproductive performance and production of Nile tilapia, Oreohormis niloticus, larvae were tested under two different feeding regimes. The results indicated that, there is a considerable difference in food requirements before and after ovulation. Excellent egg and larvae production can be obtained using the following regime: Shortly after ovulation a fat (9.13 %) and carbohydrate (49.52 %) rich diet should be used to accelerate the egg development. After the completed vitellogenesis the females need more protein rich food (25.73 %), less fat (4.56 %) and carbohydrate (46.93 %) for not only building-up of sexual products but also to prevent unnatural fatness of the ovaries. While when the females fed with diet rich in fat (9.13 %), carbohydrate (49.52 %) and protein (25.20 %) all the time, this diet causes fattening of the organs, especially ovaries, and thus reduce normal process of reproduction.

Egg dimensions, percentage hatch and newly hatched larvae length were not different (P< 0.05) among the two feeding regimes.

INTRODUCTION

The traditional Egyptian fish culture depended mostly on tilapia larvae and wild fry fished in the Northern Lakes and River Nile. Not only did the numbers and species harvested vary from season to season, but the retail price for fry was relatively high. Thereby, the need to control spawning of reared tilapia became increasingly urgent. In Egypt, fertilized eggs were produced only by means of natural fertilization in spawning ponds. However, artificial fertilization is preferred because this technique have made possible the mass supply of fry for large scale culture in ponds and other enclosed water bodies (Woynarovich and Horváth, 1980; Aureli, 1988; Essa and Salama 1994).

In raising brood fish, care has to be taken not only to select the best specimens but also adequate food must be given to ensure proper development of the gonads. Unfavorable nutritional conditions may cause poor fecundity, poor fertility, deformed embryos, week larvae and the males may not produce good quality milt (Watanabe *et al.*, 1984; Kanazawa, 1985; Omar, 1986; Rose, 1990 and EL-Ebiary, 1994). The most common problems in artificial feeding of broodfish are: lesser nutritive value and the feeding is not adjusted in relation to the fish stock and their activity during the spawning season. Therefore, the objective of the present study was to evaluate the effects of different feeding regimes on reproductive performance and larvae production of Nile tilapia, *Oreochromis niloticus*, breeders.

MATERIAL AND METHODS

The present study was demonstrated at the Alexandria Fry Production Center, Alexandria Governorate Fish Farm in Lake Maruit, in co-operation with Fish Breeding and Nutrition Laboratory at National Institute of Oceanography and Fisheries, Alexandria-Egypt.

1. Spawning:

Our experiments were carried out with Nile tilapia (***Oreohormis niloticus)*** females of 7-9 months old of the same spawn, which achieved sexual maturity under natural fish pond conditions. Nile tilapia females were stocked in May

15,1994 from the fish ponds into fiberglass basins (2.10 m length x 1.6 m width x 0.8m depth, 2.5m water volume) to spawn under natural photoperoid. The water flow of 1-2 lit./min was secured and provided by a sprinkler hanging above the basin. Average water temperature in the basins ranged from 24 to 28 °C.

Because of restricted possibilities, the breeders were divided into two groups (two replicates spawning basins per group). Fish in each group were fed with pellets of different composition according to investigation requirements, at a rate of 1.5% of total body weight per day, as follows:

First group:

Consists of two fiberglass basins. In each basin eight females were stocked with four males (2:1 ratio of females to males). The broodstocks of the first group were started to feed in 15 May with artificial feed (Feed I) poor in fat (4.56 %) and starch (46.93 %) and rich in proteins (25.73 %). After each spawning batch, the fish were fed for 6-8 days with feeds rich in fat and starch besides feeds rich proteins (Feed II). From the tenth day to the time of next spawning batch, the fish fed Feed I again, and so on for 112 days (16 week).

Second group:

Consisted of two fiberglass basins also. The fish of this group were fed with Feed II only for 112 days (16 week).

The comparison and chemical analysis of the two experimental diets (Feed I and II) are shown in Table (1).

Females (with an average body weight of 84.6 g) and males (108.2 g) of comparable weight were stocked together in each basin to minimize injures caused by the aggressive behaviour of the males The spawning was checked daily and the eggs were removed from female mouthbrooders one day post-spawning. The eggs were counted, measured and then artificially hatched as explained in the next section. Fecundity was defined as the number of eggs produced/kg body weight of each female and was determined only for females that their eggs were incubated artificially according to Smitherman *et al.*, (1988).

Table (1): Composition of the experimental diets (% by weight).

Component	***Diet No.***	***Feed I***	***Feed II***
Fish meal		10	18
Soybean meal		20	23.5
Blood meal		--	5
Wheat milling by-product		--	50.2
Wheat bran		15	--
Rice bran		23	--
Cotton seed cake		15	--
Yellow corn		14.5	--
Bone meal		1.2	--
Yeast		--	2
Vitamin and mineral mixture		1.3	1.3
Constituent (% by weight)			
Moisture		13.17	11.05
Crude protein		25.73	25.20
Lipid		4.56	9.13
Carbohydrate		46.93	49.52
Ash		9.91	5.10
Gross energy (K cal/Kg feed)		3293.40	4810.90

Fig. (1)

Figure 1: Funnel-type incubators (1.51 each) employed in incubation of Nile tilapia, *O. niloticus*, eggs at water temperature 24-28°C.

2. Hatching:

Fertilized eggs were transferred directly to hatch in funnel-type incubators made from 1.5 liter clear plastic bottle (Fig. 1). The number of eggs per incubator was 500. The taps supplying water to the incubator devices are fixed on the water supply pipe at intervals 20 cm distance. Water flows in at the bottom and flows out over the upper edge of the incubator. The flowing water keeps the egg mass suspended and in continuos motion throughout the entire water column. Only slow water flow was provided in the incubators (0.2-0.5 liter/min.), but when the larvae begin to hatch, the water flows was gradually increased and adjusted until the end of hatching (about 1.0 liter/min).

During eggs incubation period, the following parameters were calculated:

I. Time required for developing fertilized eggs in hours.
ii. Hatching rate = the number of live larvae/total number of eggs samples x 100 (Horváth, 1981).
iii. Dead embryos and larvae were counted and removed daily.

Hatched larvae were allowed to remain in the incubators until yolk sac absorption was completed at six to seven days post-hatching.

At the end of experiments, fish carcass samples were collected and analysed as described by AOAC (1975).

3. Statistical analysis:

A one-way analysis of variance (ANOVA) was used to obtain feeding regime and experimental error effects according to Snedecor and Cochran (1967).

RESULTS AND DISCUSSION

Indoor production of tilapia eggs and fry is possible. Tilapia will spawn readily in confinement within the optimum temperature range of 25-28°C (Aureli, 1988 and Essa, 1993).

Within the experimental temperature range of 24 °C to 28 °C, female Nile tilapia (***Oreohormis niloticus***) spawned 8 times in intervals as short as two weeks within 112 days, in the fish of the first group [fed with feed I, 4.56 % fat; 46.83 % carbohydrate; and 25.73 % protein, before spawning activity- and with Feed II, rich in fat (9.13 %) and carbohydrae (49.52 %) besides rich in proteins (25.20 %), directly after spawning for 6-8 days]. Fish of the second group (fed with Feed II only all the time) were spawned in intervals longer, approximately 18 days, 6 times within 112 days (Table 2). Aureli (1988); Essa and Salama (1994) reported that female tilapia can spawn in intervals as short as two weeks if they are not allowed to incubate the eggs.

Also, the fish of the first group produced 30% more eggs/female than those of the second group. Therefore, the mean production of eggs/Kg female body weight of the first group (14225 ±107) was significantly ($P < 0.05$) higher than those of the second group, 10964 ±119 (Table 2). Thus, the increased spawning frequency of the first group females would enable more efficient production of greater numbers of eggs.

In the first feeding regime, used by the first group females, it apparent that feeds rich in fat and starch (Feed II) provide a more efficient source of energy which would highly promote the vitellogensis of fish with ovulated ovaries and also sparing protein for building-up of sexual products (eggs or milt) in the gonads which start soon after the previous spawning. Great part of the energy is also accumulated in the ovaries, which prevents unnatural fattening of other organs. Feed I (less in fat and starch and rich in proteins) given to female fish ready for ovulation will prevents unnatural fatness of the ovaries.

In the second feeding regime, used by the second group females, Feed II (rich in fat, 9.13 % and carbohydrate, 49.52 %) given to female fish ready for ovulation will cause fatness which would relatively reduce normal process of reproduction (Horváth, 1978; Pathmasothy, 1985; Springate ***et al.***, 1985). These

Table (2): Means for reproductive traits of *O. niloticus*, spawned under two different feeding regimes by using artifical spawning technique, with standard error of means in parantheses*.

Item	First Feeding regime	Second feeding regime
✪ Female weight (g)	84.4[a] (2.06)	84.8[a] (2.21)
✪ No. of eggs/kg female	14225[a] (107)	10964[b] (119)
✪ No. of spawns measured	8	6
✪ Egg length (mm)	2.00[a] (0.003)	1.90[a] (0.007)
✪ Egg width (mm)	1.47[a] (0.005)	1.42[a] (0.009)
✪ Time required for developing eggs- in hours.	70-90	70-90
✪ Percentage hatch (%)	86.30[a] (4.02)	82.70[a] (3.92)
✪ Newly hatched larvae length (mm)	5.0[a] (0.018)	4.9[a] (0.014)

* Means in the same row with different superscripts differ significantly ($P < 0.05$).

finding are supported by the results of the chemical composition of fish breeders carcass (Table 3). These results indicated that, the least deposition of fat was recorded in the first feeding regime which had the minimum fat content (3.45 %), while it was 7.80% in the second feeding regime. This could be correlated with the high concentration of fat content in Feed II (Table 1).

According to many nutrition workers, higher nutritive value diets tended to give larger ovaries and fecundity for tilapias (Santiago ***et al.***, 1981; Essa, 1993), rainbow trout, ***Salmo gairdneri*** (Springate ***et al.***, 1985) and ***Leptobarbus hoevenii*** (Pathmasothy, 1985).

The results revealed also that, there was considerable variation in the size of the spawns produced by individual females (Table 2) due to the variability in fecundity of individual females. Hulata ***et al.***, (1980) and Mires (1982) observed enormous variability in fecundity between females of the same group, even with constant environmental conditions.

On the other hand, no differences were found in egg length, egg width, percentage hatch or newly hatched fry length among the two feeding regimes (Table 2). Pathmasothy (1985) found the same results for ***Leptobarbus hoevenii,*** whereas there was no differences in the egg weight, length and width between three diets with variable protein levels.

Results of the young fry production experiment under two feeding regimes are shown in Table (4) and Fig. (2). The highest total larvae productions ($P<0.05$), expressed in terms of larvae/groupand larvae/g female (Table 4), larvae/female as well as larvae/ female/ day (Fig. 2), were found in the first group females which spawned under the first feeding regime. Total larvae production per g female and per female/day for the first group were 12.26 larvae and 9.25 larvae, respectively, while that for the second group were 9.06 and 6.87 larvae, respectively. Total larvae production per group (8 females) during the 112 day study (16 week) ranged from 6,152 for the second group to 8,285 for the first group. Larvae production gradually increased through the sixth and seventh clutch, when all treatments reached maximum larvae production (Table 4).

Table (3): Proximate composition (±SE) of fish breeers over the experimental test period (112 days).

Item	Initial	After 112 days (% wet weight)	
		First group	Second group
Moisture (%)	77.57±1.81	78.23±0.89	74.70±1.62
Crude protein (%)	13.81±1.27	14.27±0.85	14.42±0.74
Lipid (%)	4.46±0.07	3.45±0.42	7.80± 0.11
Ash (%)	3.70±0.53	3.56±0.42	2.08±0.20

Table (4): Means for young fry production (±SE) of *O. niloticus* hatched during 6-8 clutch for 112 days, produced under two feeding regimes. Each mean is the average of two replications.

No. of clutch	*Treatment*			
	First feeding regieme		Second feeding regieme	
	Total larvae per group*	No. of larvae/g of female weight	Total larvae per group*	No. of larvae/g of female weight
1	123±43	0.19	104±19	0.15
2	984±201	1.46	566±311	0.83
3	1126±315	1.67	622±294	0.92
4	1252±619	1.85	1094±592	1.61
5	1301±412	1.93	0	0
6	1365±574	2.02	1789±695	2.64
7	1563±470	2.31	1977±638	2.91
8	571±229	0.84	0	0
	A		B	
Total larvae**	8285	12.26	6152	9.06

* One group = 8 females + 4 males.

** Means not followed by the same letter are different (P < 0.05).

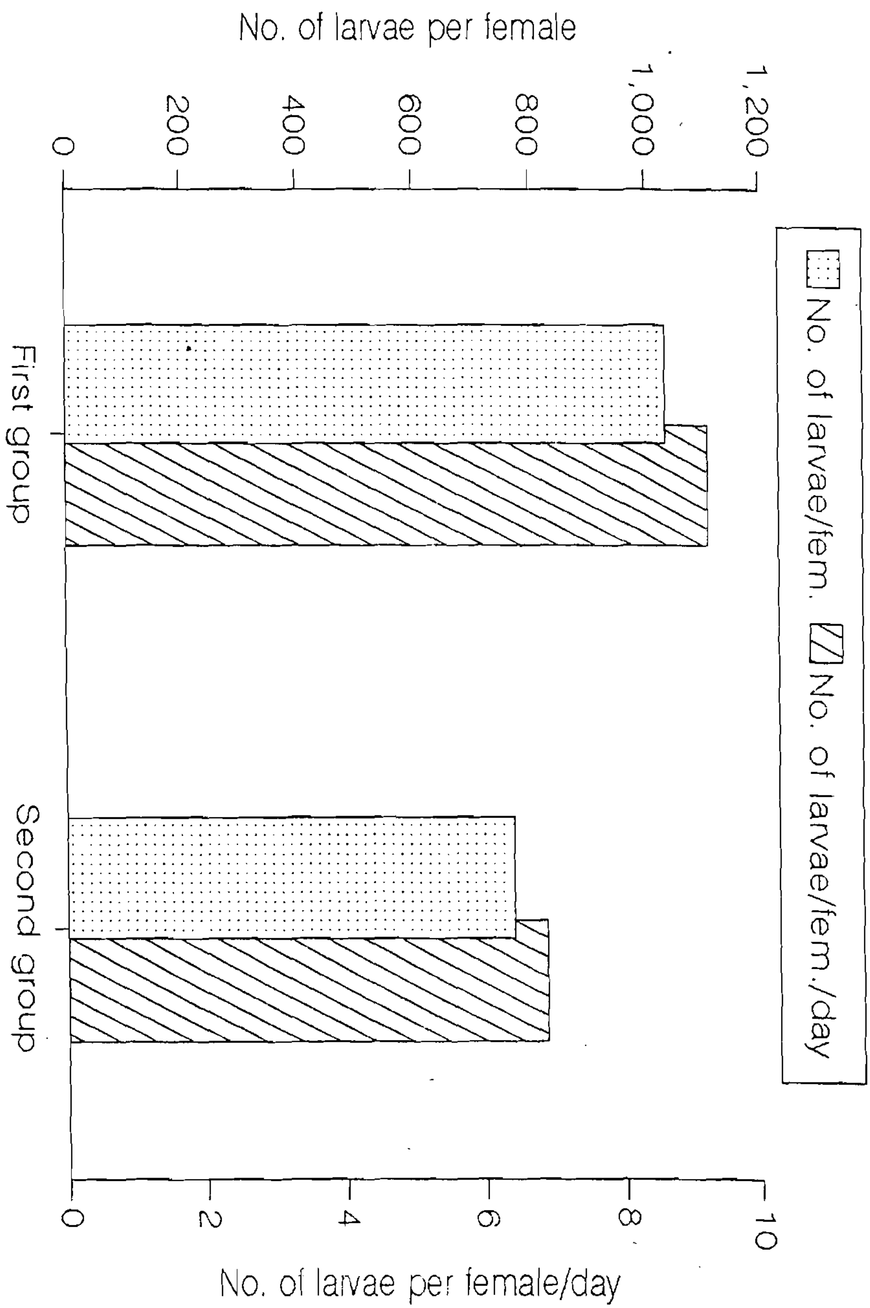

Figure 2: Group means for total numbers of *O. niloticus* larvae per female and per female/day during the culture period, 112 days.

Based on the results of these experiments, larvae production appeared to be influenced by both feeding regime and spawning frequency. The trend of increased production during the study was attributed to the natural increases in clutch size associated with successive spawns due to: in case of the first feeding regime, after each ovulation the feeding was changed from Feed I to Feed II. But in case of the second group, fish were fed with Feed II for all the time.

The large variation in larvae from individual groups at each clutch (Table 4) possibly resulted from a combination of factors: variability in fecundity of individual females (Mires, 1982), differences in spawning time of individual females (David and Leslie, 1983), and the relative asynchrony of spawning cycles between individual females (Jalabert and Zohar, 1982).

In summary, besides temperature, a considerable role is played by the feeding of spawners. Excellent egg and larvae production can be obtained using the following regime: Shortly after the spawning when the ovary of the Nile tilapia, ***O. niloticus***, females is empty a fat and carbohydrate rich diet should be used to accelerate the egg development. It that time the energy accumulates in the ovary. After the completed vitellogenesis the females need more protein rich food and poor in fat and carbohydrate because a fat and carbohydrate rich diet caused fattening of the organs, especially ovaries, which would relatively reduce normal process of reproduction.

ACKNOWLEDGMENT

My sincerest thanks are due to the group of Alexandria Governorate Fish Farm, Alexandria-Egypt for the helpful assistance and the facilities they offered me throughout this work.

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