Conservation of 'Sar-punti' *Systomus sarana* (Hamilton, 1822) through Induced Breeding in the State of Tripura

Hirak Sarkar[1], Dibakar Bhakta[2*] and Alok Chakraborty[3]

[1]Fishery Officer, Department of Fisheries, Govt. of Tripura
[2]Scientist, Regional Research Centre, ICAR-CIFRI, Vadodara-390 022, Gujarat*
[3]Superintendent of Fisheries, Department of Fisheries, Govt. of Tripura
E-mail: [1]hiraksarkar@rediffmail.com, [2]dibakarbhakta@gmail.com

Abstract—*Systomus sarana (olive barb) a tropical freshwater fish locally known as 'Sar-punti' commercially used both as food and ornamental fish. As per IUCN status the species is under the category of Least Concern (LC) but reported to be vulnerable in India and critically endangered in the neighbouring country Bangladesh. As a part of live gene bank programme Department of Fisheries, Government of Tripura initiated rearing and propagation of threatened fishes of the state. With a view of this, an experiment was conducted in Lembucherra Government fish seed farm, west Tripura district to observe the induced spawning of 'Sar-punti' during the month of May, 2013 through stripping process. Four set of experiment were conducted in pre breeding season of the state to find out the most suitable doses of pituitary gland (PG). Brood fishes were reared in the adjacent earthen pond with proper diet composition and optimum water quality parameters. A total 12 broods (6 male and 6 female) were selected for each set of experiment. The female brooders were first injected with PG extract and after 6 hours of interval second dose of PG extract were given to the female as well as male brooders. Female were injected with the total dose of 4 mg (T_1), 6 mg (T_2), 8 mg (T_3) and 10 mg kg^{-1} body weight (T_4) respectively and all the male were given equal dose of 3 mg kg^{-1} body weight. Hatching were started after 18-24 hours of hormone administration and better results in the term of ovulation, fertilization and hatching rate were recorded at 8 mg dose (T_3) compare to other doses (T_1, T_2 and T_4). The ovulation rate and fertilization rate were recorded 100% and 63.15±2.34% with respective hatching rate was 51.24±1.97% at T_3 treatment during the month of May. The success of the present study will be useful to propagate other important rare species of the state through live gene banking.*

Keywords*: Induced breeding, Systomus sarana, fertilization rate, hatching rate, Conservation, Tripura state.*

1. INTRODUCTION

Systomus sarana (Olive barb) locally known as 'Sar-punti' a native fish to Afghanistan, Pakistan Bangladesh, India, Nepal, Bhutan, Sri- Lanka, and Thailand [1, 2]. The species has high demand for its excellent taste and high nutritional value among barb species within south Asian countries [3]. This fish used both as food fish and ornamental fish [4]. The species reported to be vulnerable in India [5] and critically endangered in Bangladesh [6]. Adults occur in rivers, streams, lakes and backishwaters, can tolerate wide fluctuation of salinity and moves always in groups. The species breeds in running water during monsoon month [1]. According to Chakraborty *et al.* [3] spawning of 'olive barb' occurs in two stages, once in May to mid September with peak in June and the second spawning time in the months of August to September. *Systomus sarana* have moderate growth rate compared to the major carps, higher consumer demands of the species makes it a suitable candidate species in diversifying carp culture. Jena *et al.* [7] mentioned that the species could be culture with carps which would increase the total production.

Considerable works carried out to breed the species through inducing agent with mixed success. Bhatnagar [8] reported natural breeding of *S. sarana*, but spawning did not contribute to recruitment as population of the species gradually decreasing from the natural environment. Chaudhuri and Alikunhi [9] and Chaudhuri [10] had successfully bred *S. sarana* in India through carp pituitary injection. In recent years artificial breeding of *S. sarana* conducted by several researchers through PG extract and synthetic hormone [11-16]. Very little efforts were made on brood stock development, breeding, seed rearing and grow-out culture of minors in the country. The present experiment was conducted by inducing hormone through stripping process of 'Sar-punti' to standardized the dose of PG extract in non-breeding period in aspect of ovulation rate, fertilization rate and hatching rate in the state of Tripura.

2. MATERIAL AND METHODS

The experiments were conducted in Lembucherra Government fish seed farm, West Tripura district under Department of Fisheries, Government of Tripura. Healthy brood stock of both male and female were maintained in the nearby earthen pond for the study. Brooders were provided with special formulated

feed with 4-5% of body weight on daily basis (Table 1). One day before the breeding matured, healthy and uninjured fishes were netted out from the pond and sexed on the basis of sexual dimorphic characteristics. The suitable brooders were conditioned by keeping them into hapa for about 24 hours with continuous aeration without any feed.

After proper conditioning healthy brood fish were taken out from the hapa by hand net. Four set of experiment were conducted with four different doses of Pituitary gland (PG) extract (4, 6, 8, and 10 mg kg^{-1} body weight for female and an equal dose of 3 mg kg^{-1}body weight for male fish). Both the sexes were given a single dose of intra-muscular injection by 1 ml syringe for all the four set of experimental brooders to minimize handling pressure. After injection brooders were transferred to the breeding cistern with sufficient water circulation. Ovulation was observed after 6-7 hours and once ovulation completed brooders were taken out from the cistern and stripped out. With help of a feather stripped out milt and eggs were mixed and fertilization was done externally. The fertilized eggs were shifted to hatching pool with continuous water flow for hatching. Water parameters were maintained optimum throughout the experimental period. Hatching was started after 18 hours of fertilization of eggs and completed within 24 hours. The ovulation rate, fertilization rate and hatching percentage were calculated by employing following formulas:

Ovulation rate (%) = No. of fish ovulated / Total No. of fish injected × 100

Fertilization rate (%) = No. of fertilized eggs / Total No. of eggs in the sample × 100 and

Hatching rate (%) = No. of spawn / No. of fertilized eggs × 100

Table 1: Feed ingredients used for rearing of *Systomus sarana* brooders

Name of the ingredients	Percentage composition used
Rice bran	35
Mustard oil cake	22
Dry fish	16
Wheat bran	16
Soya bean meal	10
Vitamin and mineral premix	1

3. RESULTS AND DISCUSSION

In the present study four set of experiment were conducted by inducing different doses of PG extract during the month of May, 2013 in captive condition. The results established the standard dose of PG extract in aspects of ovulation rate, fertilization rate and hatching rate through stripping during non breeding months in the state of Tripura. During the experiment water parameters were maintained in optimum range and the value was water temperature 30.4 to 30.7 ^{O}C and pH 7.3 to 7.8.

The average ovulation, fertilization and hatching rate in different treatment showed in the Table 2. In aspect of ovulation rate, treatment T_2, T_3, and T_4, confirmed maximum (100%) ovulation while in treatment T_1 the rate was found 83%. The success of fertilization is depending on the quality of the brood stock and the ambient water condition. In the present study, maximum fertilization rate was recorded in T_3 (63.15±2.34) followed by T_2 (57.12±5.14), T_4 (55.76±4.78) and T_1 (33.37±7.97) respectively. The fertilization rate were significantly different ($p<0.05$) from each other treatments. The highest average hatching rate was also recorded in T_3 (63.15±2.34) followed by T_2 (47.24±3.60), T_4 (46.98±4.05) and T_1 (32.70±4.67) respectively. The hatching rate were significantly different ($p<0.05$) from each other treatments.

Table 2: Results of induced breeding of *Systomus sarana* by administered "Pituitary gland" extract

Treatment	Nos. of fish	Total body wt. (g)	Sex ratio (M:F)	Doses of PG (mg/individual)	Ovulation rate (%)	Fertilization rate (%)	Hatching rate (%)	Water temp (^{O}C)
T_1	Male 6 Female 6	512 750	1:1	4.0 3.0	83	33.37± 7.97	32.70 ±4.67	30.70 ±2.17
T_2	Male 6 Female 6	523 761	1:1	6.0 3.0	100	57.12± 5.14	47.24 ±3.60	30.55 ±2.23
T_3	Male 6 Female 6	520 765	1:1	8.0 3.0	100	63.15± 2.34	51.24 ±1.97	30.30 ±2.10
T_4	Male 6 Female 6	509 743	1:1	10.0 3.0	100	55.76± 4.78	46.98 ±4.05	30.05 ±2.01

The most suitable ambient water temperature for breeding of most indigenous small fishes was reported to 27 to 29ºC [11 and 17]. The temperature ranged during the present study was found very much suitable for the fish spawning.

Kohinoor *et al.* [18] found no ovulation response of *P. sarana* while injected with PG extract below 4.0 mg kg^{-1} body weight of the female breeders. They found 6 mg PG extract kg^{-1} body weight was suitable for ovulation of *P. sarana*. Siddik *et al.* [15] found 81% fertilization rate at 5.5 mg PG extract kg^{-1} body weight of *P. sarana* during the month of June. Further they mention that, there was no ovulation and fertilization during the month of April with same dose of PG extract. Mazid and Kohinoor [19] recommended a single dose of 5-8

mg PG extract kg^{-1} body weight for female and 4 mg PG extract kg^{-1} body weight of male is sufficient for successful breeding of *P. sarana*.

Siddik *et al.* [15] reported, 74% hatching rate of 'olive barb' *P. sarana* while PG extract was used at 5.5 mg kg^{-1} body weight of female and 2 mg kg^{-1} body weight of male fish with 1:1 sex ratio. Bhuiyan *et al.* [20] observed 71.80±2.00% of hatching rate of *P. gonionotus* while female fishes were administered with 6 mg of PG extract kg^{-1} body weight of fish. Hatching rate of 80% was achieved by Chakraborty *et al.* [12] while using PG extract at 6.5-mg kg^{-1} body weight of female with single dose. Mijkherjee *et al.* [5] reported 70% hatching percentage of *P. sarana* administered with pituitary extract at 4 mg kg^{-1} body weight of female and 2.5 mg kg^{-1} body weight of male. A better spawning rate of *P. sarana* was observed by Akhteruzzaman *et al.* [11] while used 6 mg of PG extract kg^{-1} body weight of female fish. Haque and Ahmed [21] observed 35-90% of hatching rate by injecting *P. gonionotus* with pituitary gland at 6 mg and 3 mg kg^{-1} body weight of female and male respectively. Chaudhuri [9] reported that *P. sarana* hatched out within 13-17 hours of injection through pituitary gland. The peak spawning season of *S. sarana* in the state of Tripura was observed from July-August month.

A little higher dose of PG hormone is required at the beginning and after peak breeding season and comparatively lower doses is require during the peak spawning season of the fishes [22-24]. The present study was conducted during the pre spawning season of the species in the state and little higher doses were required to achieve the best performance in aspects of ovulation, fertilization and hatching. The findings of the present study show conformity with the findings of the above authors.

4. CONCLUSION

In comparison with major carps and other minor carps, *S. sarana* responds easily in hypophysation and released eggs fully in captive condition [25]. It is a slow growing fish in confined waters but shows fast growth in open waters like rivers, reservoirs etc. The species has great value both in fresh condition as well as fermented products in the north eastern states. The study would be beneficial for successful captive breeding of *S. sarana* and other related minnow carps as well as to conserve this valuable species in the region.

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