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STUDY OF FECUNDITY AND INDUCED BREEDING OF *MYSTUS VITTATUS*

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Abstract: The present study deals with the estimation of fecundity and induced breeding of *Mystus vittatus* by using carp PG hormone. Four different doses were tested, viz. 6, 8, 10 and 12 mg/kg body weight for female and 3, 4, 5 and 6 mg/kg body weight for male. For each dose, three different sex ratios were maintained, viz. 1♂: 1♀, 2♂: 1♀ and 3♂: 2♀. The hormone doses 8 mg/kg for female and 4 mg/kg for male provided the best result in the sex ratio 2♂: 1♀. This treatment combination revealed 80% fertilization and 56% hatching rates. Mean survival percentage of the spawns up to 10 days was 60%.

mvi-ms‡¶ct †Usiv gv‡Qi wW‡gi cwigvY wbYq Ges wcwR ni‡gvb w`‡q G‡`i KwÎg cRbb NUv‡bv eZgvb M‡elYv Kv‡hi mv‡_ m¤úwKZ Pvi ai‡bi wewfb gvÎvq ni‡gvb c‡qvM Kiv nq †hgb, ¯x gv‡Qi Rb¨ ^`wnK IR‡bi 6, 8, 10 I 12 wgtMvt/†KwR Ges ci"l gv‡Qi Rb¨ 3, 4, 5 I 5 wgtMvt/†KwR| cwZ gvÎvi R‡b¨ wZb ai‡Yi †hŠbvbcvZ e¨envi Kiv nq †hgb - 1♂: 1♀, 2♂: 1♀, 3♂: 2♀| 2♂: 1♀ †hŠbvbcv‡Z, ci"‡li Rb¨ ^`wnK IR‡bi 4 wgtMvt/†KwR Ges ¯x gv‡Qi Rb¨ ^`wnK IR‡bi 8 wgtMvt/†KwR gvÎv me‡P‡q fvj djvdj †`q| GB wUU‡g›U t_‡K 80% dwUjvB‡Rkb Ges 56% n¨wPs cvIqv hvq| 10 w`b chš gv‡Qi †cvbv †e‡P _vKvi Mo wQj 60%|

Key words: Fecundity, Induced Breeding, *Mystus vittatus*.

INTRODUCTION

Mystus vittatus is locally known as "Tengra", is fresh water Small Indigenous Species (SIS) commonly occurring in inland water areas of Bangladesh. *Mystus sp.* are preferred by the people for delicious taste, high nutrient profile and its availability throughout the year. Many minor and trace elements, such as sodium, potassium, calcium, iron, iodine, zinc, magnesium and phosphorus are present in the *Mystus* species (Hossain 1999, Rao *et al.* 1999). Main drawback of the culture of *Mystus* species is the lack of seed availability, smaller body size, slower growth etc. There is a great potential of this species to start its seed production (Wahab *et al.* 2003). Knowledge about fecundity of a fish is essential for evaluating the commercial potentialities of its stock, life history, practical culture and actual management of the fishery (Lagler 1956, Doha and Hye 1970). So, to save this species from its extinction through induced breeding a complete knowledge about its biology including breeding behavior, fecundity, fertilization and hatching is also essential. Induced breeding is an effective means to save a species from its extinction as the seed production of any species is completely dependent on brood stock development.

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OBJECTIVES

- To optimize the dose of PG hormone for induced breeding of *M. vittatus*.
- To observe the breeding behavior of *M. vittatus*.
- To check the fertilization and hatching rates of *M. vittatus*.
- To estimate the fecundity of *M. vittatus*.

MATERIAL AND METHDS

This study was performed during the spawning season of *M. vittatus* from June to August 2010 under artificial breeding condition at "Fish Seed Multiplication Farm (Gallamari, Khulna)", under the Department of Fisheries, Government of the People's Republic of Bangladesh and in the Fish Biology Laboratory of Fisheries and Marine Resources Technology Discipline, Khulna University.

Mature broods were collected from the different natural water bodies. The collected brood fishes were then kept in the concrete tank of the hatchery with continuous water shower. After two days of conditioning, the broods were used for induced breeding purpose.

Tubifex was given as live feed to brood fishes. *Tubifex* was collected from the aquarium market of Khulna city and was supplied twice daily.

Male and female fishes can easily be distinguished in the breeding season. Males and females differed in color. In mature female, the abdomen was soft and swollen. During the spawning season their distended abdomen could easily help to recognize the mature females.

Induced breeding was performed by the artificial propagation method with carp pituitary hormone injection. For hormone administration the brood fish were placed on a sponge. Then they were wrapped with a soft and moist cloth and the injection was pushed just beneath the muscular portion of dorsal fin. Only a single dose was given to both males and females. Four different doses were tested. The doses were: 6, 8, 10 and 12 $mgkg^{-1}$ body weight for female and for male 3, 4, 5 and 6 $mgkg^{-1}$ body weight. After pushing the hormone injection, 3 different sex ratios were maintained for each dose. The maintained sex ratios were- 1 ♂: 1 ♀, 2 ♂: 1 ♀ and 3 ♂: 2 ♀.

After hormone injection both the males and females were kept together in the breeding hapa with continuous water showering. Hapas were settled in the concrete tanks of the hatchery. Water temperature in the tanks was 28-30°C. The males and females released their gametic materials approximately 17-18 hours after injection.

To observe the breeding behavior, each and every movement and activities were observed from the time after injection until the completion of spawning.

Immediately after spawning the males and females were removed from the breeding hapas. For the assessment of fertilization rate, 200 eggs were taken randomly in a clear petridish containing water. The fertilized eggs were checked by magnifying glass. The fertilized eggs were easily separated by the presence of transparent shell with gray spot within the egg shell, while the unfertilized eggs were opaque. Then the fertilized eggs were counted and the rate was determined by using the following equation:

$$\text{Fertilization rate} = \frac{\text{No. of fertilized egg x 100}}{\text{Total no. of egg}}$$ (Alam *et al.* 2006)

To estimate the hatching rate, 500 fertilized eggs were isolated and were kept in another hapa with continuous water shower. Then the actual number of hatchlings was counted and the hatching rate was determined.

Fecundity was estimated by gravimetric method. In total 50 female broods of different sizes were collected from five different localities (Khulna, Jessore, Satkhira, Jhenaidah and Narail) of the country. The total weight of the ovary was taken by electronic balance. A small portion of the ovary was taken from total ovary and weighed. Then it was allowed to soak in saline solution in a clear petridish and the number of the eggs was counted. Thus the fecundity was obtained by using the following formula:

F = (Total gonad weight × N)/weight of the small gonad cut (Alam *et al.* 2006)

F= fecundity, N= Number of eggs counted

The survival rate of the larvae was determined up to 10 days. To calculate the survival rate, the number of such larvae was counted just after hatching and after 10 days.

RESULTS AND DISCUSSIONS

The mean fecundity rates of tangra (*M. vittatus*) according to different body weight class have been presented in the Fig. 1. The mean fecundity rate was calculated to be of 33,386 eggs per female and this fecundity clearly shows a greater deviation from the fecundity estimated by Azadi *et al.* (1987). This may be due to the difference in environment and location as the environmental conditions are not same in Chittagong and the areas from where the samples were collected for the present study. Mean fecundities according to different length class have also been presented in the Fig. 2. The figures clearly state that the mean fecundity of *M. vittatus* was found to vary according to the body size. A moderate degree positive correlation (linear relationship) was found between

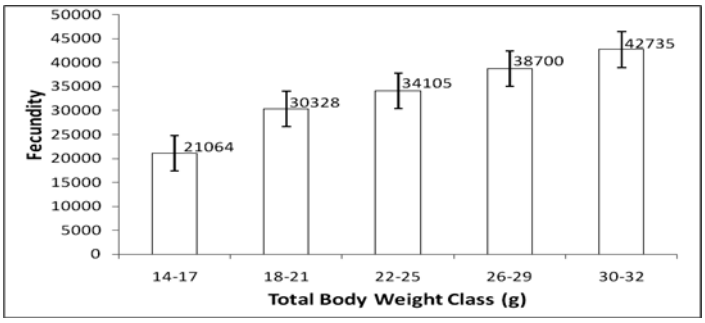

Fig. 1. Mean fecundity of *Mystus vittatus* according to different body weight class.

fecundity and body weight and a strong positive correlation was observed between fecundity and total length (Figs. 3 and 4). The correlation co-efficient between fecundity and total length was 0.903, between fecundity and total body weight was 0.842. In the present study, the fecundity of *M. vittatus* ranged from 18,210 to 44,620. The maximum number of eggs was obtained from a specimen of 14.3 cm in total length and 31 g in body weight whereas minimum number of eggs was obtained from a specimen measuring 10.6 cm in total length and 15.0 g in body weight.

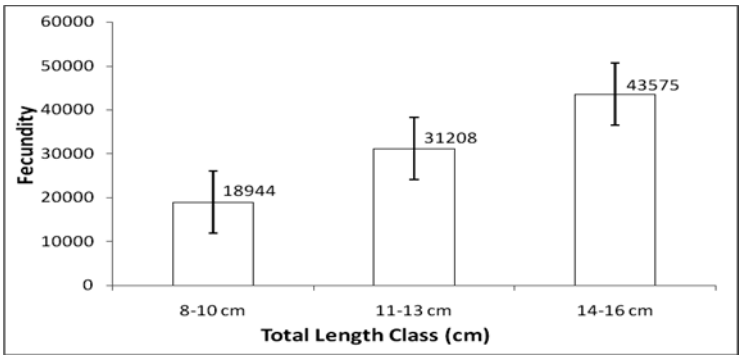

Fig. 2. Mean fecundity of *Mystus vittatus* according to total length class.

The spawning activity appeared after several minutes of post injection. *M. vittatus* was found to spawn in pairs, while the male was observed to become active and to chase the female for several seconds. A male was observed to clasp up a female and to position himself to her rear. The pair immediately commanded swimming and contacting each other with their lateral sides. The chasing and resting continued for several times. After this, two males and one female place their genetalia all together. Mating between male and female continued for 5-8 minutes and then settled down.

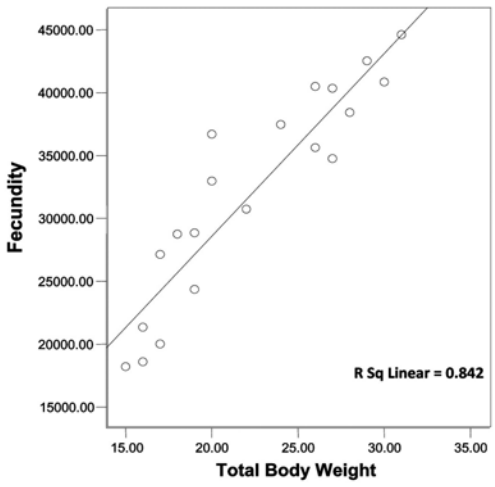

Fig. 3. Regression line between fecundity and total body weight of *M. vittatus*.

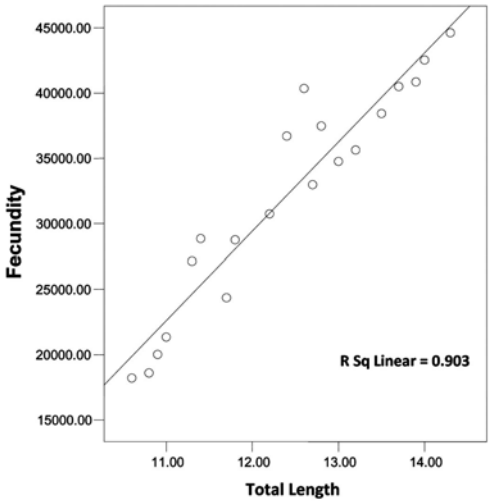

Fig. 4. Regression line between fecundity and total length of *M. vittatus*.

In the present experiment, spawning was occurred within 16-18 hours of hormone injection application. The different doses were 3, 4, 5 and 6 mg/kg for male and 6, 8, 10, 12 mg/kg body weights for female. Three different sex ratios were maintained for each dose; 1 ♂: 1 ♀, 2 ♂: 1 ♀ and 3 ♂: 2 ♀. Only the 2 ♂: 1 ♀ sex ratio was found effective in induced breeding in the present experiment. Different hormone injection doses at this sex ratio provided 57-80% fertilization rates and 32-56% hatching rates. However, different hormone doses in case of the other two sex ratios (1 ♂: 1 ♀ and 3 ♂: 2 ♀) had no effect on the spawning of *M. vittatus*. This could be explicated that these sex ratios were not suitable for the induced breeding of this species. In case of every sex ratios, 3mgkg^{-1} body weight PG hormone dose for male and 6 mg/kg body weight for female had no effect on the induced breeding of *M. vittatus*.

The administration of the appropriate dose of hormone is the basis for the successful induced breeding; the condition of the brood fish, sex ratio and the environmental conditions are also equally important (Pillay 1964). The hormone dose for induced breeding varies from species to species; some fishes require a very high dose, some species require a small dose and some require a moderate dose (Hoq 2006).

The mean fertilization rate of *M. vittatus* has been presented in the Fig. 5. The highest fertilization rate was found to be 80% whereas the lowest rate was 57%. The average hatching rates of *Mystus vittatus* have been shown in the Fig 6. The highest and lowest hatching rates were found to be 56% and 32%

respectively. The hormone dose 4mg/kg for male and 8mgkg^{-1} for female (T-2) provided the highest fertilization (80%) and hatching (56%) rates, 5 mg/kg dose for male and 10 mg/kg for female (T-3) provided 76% fertilization and 50% hatching rates, 6 mg/kg dose for male and 12 mg/kg for female (T-4) provided 57% fertilization and 32% hatching rates. Normally the SIS shows comparatively lower fertilization and hatching rates with regard to the larger carps (Wahab *et al*. 2003). But the findings of the present research is satisfying in the sense that the treatment combinations revealed comparatively better breeding success

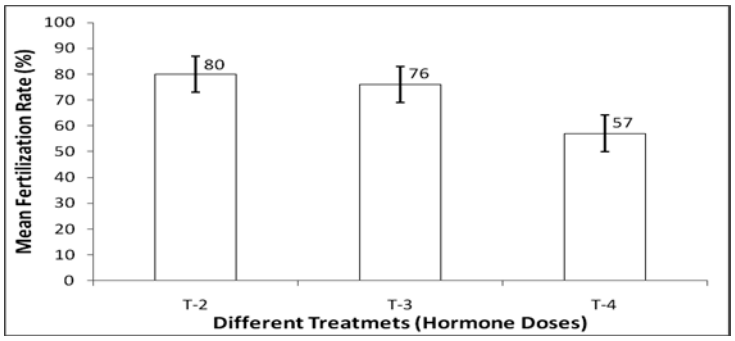

Fig. 5. Mean fertilization rates of *M. vittatus* at different doses of PG hormone.

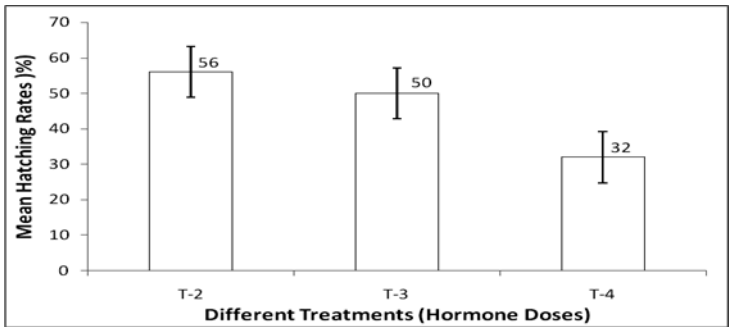

Fig. 6. Hatching rates of *M. vittatus* at different doses of PG hormone.

in terms of fertilization and hatching rates. Fertilization and hatching rates indicate the status of well being of the broods used in breeding and also the quality of hatchery management. It helps to improve the hatchery product and thereby the production. Some factors are believed to be responsible for the success of breeding. These factors are involved in regulating induced breeding and these are good management of brood fish (Bromage 1998), feeding and manuring (Springate *et al.* 1985), age and size of brood fish (Bromage, 1998),

doses of hormone used (Nandeesha *et al.* 1990) and over ripening egg quality (Springate *et al.* 1985).

The survival rate of the spawns up to 10 days has been presented in the Fig. 7. The mean survival rate was found to be 60% after 10 days but the survival rate varied from treatment to treatment. Highest survival rate (68%) was found in Treatment-2 and the lowest rate was found as 50% in Treatment-4 where as Treatment-3 provided a moderate (62%) survival rate.

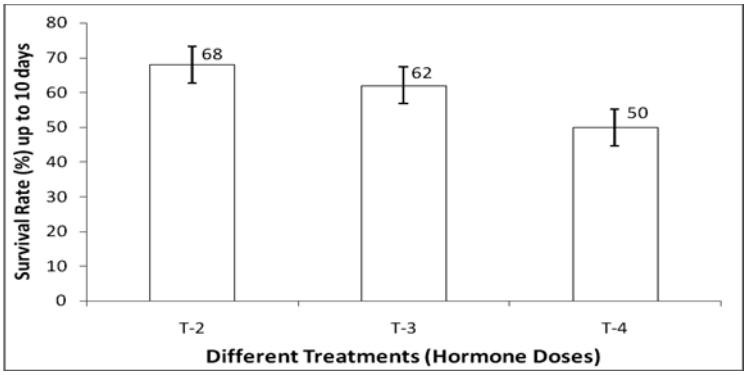

Fig. 7. Survival rates of the spawns after 10 days.

The survival rate of 5-day old hatchling of *Mystus gulio* was varied from 55.5-67.3% (Sarker *et al.* 2002; Alam *et al.* 2006). In the present study, *M. vittatus* also showed more or less similar pattern of survival rate like as another tangra species *M. gulio*.

CONCLUSION

Induced breeding was successfully performed in *Mystus vittatus* by using carp pituitary hormone injection with appropriate sex ratio. Thus, seed production of this species can be started in the hatcheries of Bangladesh to incorporate this species for poly-culture with carps. As different SIS and native species of Bangladesh are under tremendous threat, successful hatchery operation and seed production of these species can save them from their extinction and thereby ensuring biodiversity conservation in nature. As this species is highly demandable, further research is needed to start commercial seed production and culture of this species.

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