Bangladesh J. Zool. **42**(2): 153-159, 2014

GIANT FRESHWATER PRAWN (*MACROBRACHIUM ROSENBERGII)* BROOD DEVELOPMENT IN WINTER SEASON

S. B. Saha* and M. J. Alam[1]

Bangladesh Fisheries Research Institute, Brackishwater Station, Paikgacha, Khulna, Bangladesh

Abstract: Realizing the importance of giant freshwater prawn, *Macrobrachium rosenberbii* supply mature brood for extending the culture period for the successful production of marketable size, a study was conducted for development of broods of the species in the winter season by increasing temperature of water using green house concept. For this purpose, two ponds were covered with transparent polyethylene sheet fastened in bamboo frame and two ponds with no such covering. The ponds were equally stocked with prawn @ 5000 indv./ha (female:male::8:1) on 8th December 2009 and reared up to 9th March 2010. Temperature of water of the green house ponds was much higher than that of open ponds. Prawns started to be gravid after stocking in the green house ponds and 45-55% prawn became berried up to 9th March. But no remarkable development of gonad except a very few (2.5%) gravid prawn at the later part of rearing in one of the open pond was observed.

Key words: Brood development, *Macrobracium rosenbergii*, green house.

INTRODUCTION

Shrimp is the second largest export earning commodity of Bangladesh. Production process of shrimp/prawn plays a vital role in the development of socioeconomic conditions of the country. In Bangladesh, two types of shrimp are generally being produced through aquafarming. These are major culture brackishwater shrimp (*Penaeus monodon*) locally called *Bagda*, which is reared in coastal brackishwater ponds and giant freshwater prawn (*Macrobrachium rosenbergii*) locally called *Golda*, which is reared in both freshwater bodies and low saline *ghers*. This freshwater prawn currently offers a good potential for large scale commercial aquaculture primarily because of available established breeding and larval rearing techniques under captivity, available techniques of grow-out rearing and high demand in the international market. Besides, due to frequent mass mortality of *Bagda* caused by viral invasion, farmers are becoming very much cautious about stocking of this shrimp in their *ghers* and many of the *Bagda* shrimp farmers in low saline areas have already intended to shift their culture pattern to *Golda* and mixed culture of *Golda* and *Bagda. Golda* is also produced in the paddy fields (Anon 2009). The main constraint of

*Author for correspondence: <sbikashsaha@yahoo.com>. [1]Present address: Bangabandu Sheikh Mujibur Rahman Agricultural University, Gazipur, Bangladesh.

production of *Golda* is the late availability of seed, lack of quality seed, and relatively larger culture period (at least six months) to become marketable size. Generally, broods of *Golda* become available in late March to April and it needs maximum 40 days to produce post larvae of this prawn. That means seeds of *Golda* become available in late May for stocking and after 4~5 months rearing, temperature of water decreased to a level (<20^{o}C), which becomes uncongenial for the growth of this prawn. As a result, it becomes sometimes difficult to produce *Golda* with good marketable size. Though extensive studies have conducted on the larval rearing and culture of *M. rosenbergii*, very few studies have been conducted on the early development of broods. Daniels *et al.* (1994), Bo *et al.* (1999), Aktas *et al.* (2003) and Hoang *et al.* (2002) evaluated the effect of photoperiods and temperatures for accelerating gonadal development of different shrimp species including *M. rosenbergii.* Das *et al.* (1996) evaluated different pelleted diets and recommended a diet containing 40% protein with an energy level of 400 kcal/100 g diet as a broodstock feed for *M. rosenbergii*. Venkataramani *et al.* (2002) revealed that broodstock production was higher and more than 60% in animals fed with fish meal incorporated feed. If supply of broods of *Golda* can be ensured in February, it will be possible to make seeds available for stocking in late March and farmers will get sufficient time with optimum climatic conditions to produce marketable prawn. With this view, experiment has been conducted to accelerate development of broods of giant freshwater prawn, *M. rosenbergii* by maintaining increased temperature of water during winter season using green house facilities.

MATERIAL AND METHODS

The study was conducted in four on-station earthen ponds of 0.1 ha each of the Brackishwater Station, Paikgacha, Khulna. The selected ponds were dried and bottom deposits were excavated out. Necessary temperature of water of two ponds was tried to increase and maintained at a congenial level using 'green house' concept. For this purpose, two ponds were fully covered with transparent polyethylene sheet fastened in frame, made of bamboo (Fig. 1). These two ponds were treated as green house pond (GP1 & GP2). GP1 was covered with 0.6 mm thick polyethylene sheet and GP2 with 0.4 mm thick polyethylene sheet. The other two ponds were kept open and treated as control (OP). After excavated out the deposited bottom sludge, soil of all ponds was treated with quick lime (CaO) @ 250 kg/ha. After then, ponds were filled up with tidal water (salinity, < 1.0 ppt) up to a depth of one meter. Animalcule of the ponds was killed by applying rotenone and dipterex, both @ 1.5 ppm. After taking out all dead animals, water of the ponds was treated with dolomite @ 20 ppm and fertilized

with urea @ 2.5 ppm and TSP @ 3.0 ppm. After growing sufficient plankton, all four ponds were equally stocked with adult healthy *M. rosenbergii* @ 5000 Nos/ha (Female:male::8:1) on 8th December 2009. Size of the stocked male prawn was 95-104g and that of female prawn was 52-58g. Before stocking, the prawns were disinfected by a bath of 8-10 min in 20 ppm formalin water. The stocked prawns were fed with commercial pellet feed (protein, 35%) supplemented with vitamin premix. Feed was supplied @ 4-5% of total prawn biomass. Feeding behavior of prawn in each pond was monitored by using a feed check tray in the pond. Water of all ponds was treated with dolomite @ 12.50 kg/ka fortnightly. After 15 days of stocking, at least 25% stocked prawns were observed at fortnightly interval by cast netting to check any development of gonad. Temperature, pH, salinity, alkalinity, dissolved oxygen and hardness of water were checked at seven days interval following standard methods (AHPA, 1992). The evaporated water of the ponds was refilled with tidal water. After 91 days of rearing, all stocked shrimps were harvested and segregated depending upon the development of gonad. Spent female prawns were identified by observing wide empty abdominal pouch.

Fig. 1. Green house constructed over experimental ponds.

RESULTS AND DISCUSSION

Water quality parameters: Temperature is the main triggering factor for the development of broods of *M. rosenbergii*. As shown in Fig. 2a, morning temperature of water of the green house ponds (GP) was 22.6°C to 29.0°C and that of open ponds (OP) was 17.5°C to 25.5°C during rearing period from 8th December 2009 to 9th March 2010. Temperature of water of both types of pond was higher in the evening than that of morning. In the evening, temperature varied from 27.1°C to 33.6°C and 19.0°C to 30.5°C in the GPs and OPs, respectively (Fig. 2b). Up to 70 days of culture, there was no need of regulation

of temperature in the GPs as the temperature did not increase beyond 32~33°C. After that, increase in afternoon temperature of the GPs was regulated by opening the polythene sheet at two opposite corners of each pond. It is remarkable to note that water temperature of GP1 was always higher to some extent (0.4-1.6°C) than that of GP2. This might be due to the higher thickness of 0.6mm of polyethylene sheet used in GP1 than that of 0.4mm thick polythene sheet in GP2. The thick polyethylene sheet retained higher temperature than that of thin polyethylene. Up to 70 days of culture, evening temperature of water of OPs never exceeded 25°C. Salinity of water of the ponds was lowest of <1.0 ppt during stocking and increased up to 3.0 ppt at the later stage of culture due to addition of tidal water with higher salinity. pH of water of all ponds was always alkaline and variation in pH among different ponds was very insignificant (Fig. 2c). Depth of water was always maintained at a level of around one meter in all ponds.

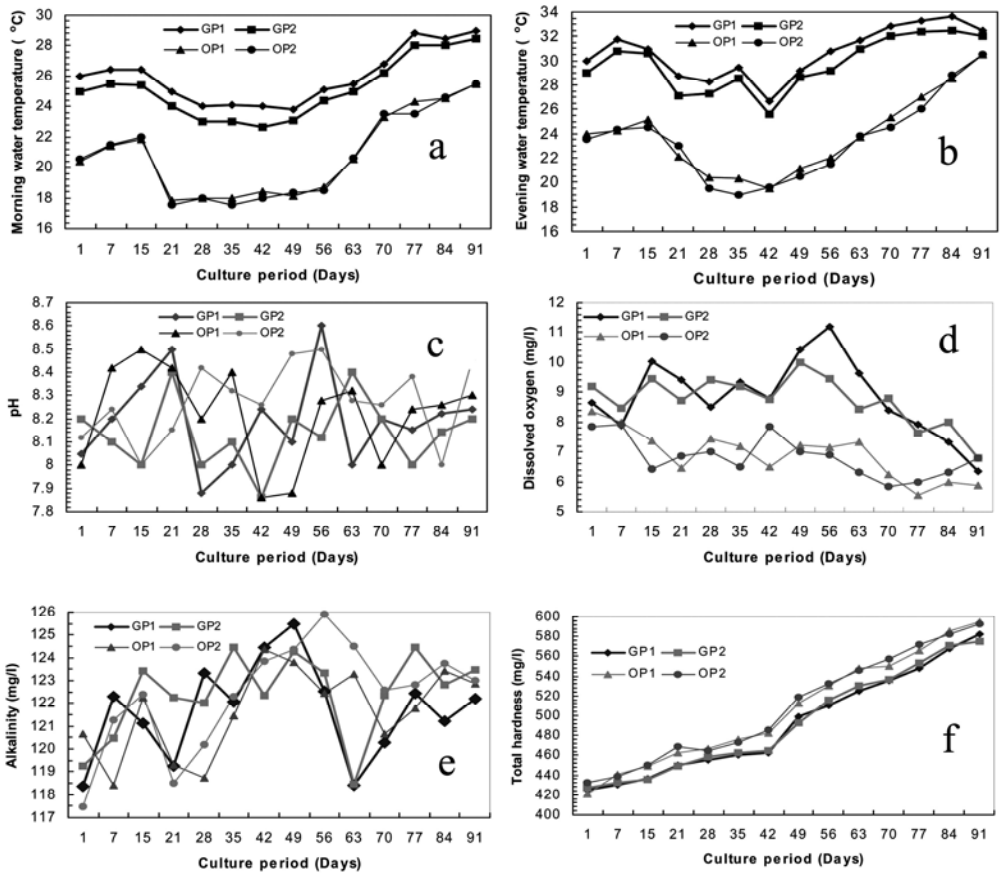

Fig. 2. Water quality variables (temperature, pH, dissolved oxygen and alkalinity) of different treatments of *Macrobrachium rosenbergii* culture ponds.

Though dissolved oxygen (DO) of both types of pond tends to decrease with the progress of culture period, it did not decrease below critical level. DO of GPs was 6.34~10.45 mg/l and that of OPs was 5.56~7.84 (Fig. 2d). It was shown that the concentration of DO was also higher in GPs than those of OPs. There was no significant variation in alkalinity between two types of ponds. Alkalinity of the green house ponds was 118.34~125.47 mg/l and that of open ponds was 117.45~124.50 mg/l (Fig. 2e). Hardness of water of both types of ponds was almost similar and varied from 420.40 to 595.20 mg/l (Fig. 2f).

Development of gonad of prawn: As shown in Table 2, the stocked non-gravid female prawns started to be gravid after stocking and gravid females were found throughout the culture period in the green house pond 1. 2.5% females became berried during mid January. During 91 days of rearing a total of 45% of the stock females became berried and ready for hatching. In the green house pond 2,

Table 1. Pattern of development (% of stocked prawn) of gonad of *Macrobrachium rosenbergii* in green house pond (GP) and open pond (OP).

Date	GP1			OP 1		
	No visible development	Gravid	Berried	No visible development	Gravid	Berried
08.12.09	100	0	0	100	0	0
22.12.09	85.00	15.00	0	100	0	0
06.01.09	75.00	25.00	0	100	0	0
20.01.09	65.00	32.50	2.50	100	0	0
03.02.09	57.50	37.50	5.00	100	0	0
18.02.09	45.00	45.00	10.00	100	0	0
09.03.09	32.50	40.00	27.50	97.50	2.50	0
08.12.09	100	0	0	100	0	0
22.12.09	90.00	10.00	0	100	0	0
06.01.09	75.00	25.00	0	100	0	0
20.01.09	65.00	35.00	0	100	0	0
03.02.09	50.00	40.00	10.00	100	0	0
18.02.09	45.00	40.00	15.00	100	0	0
09.03.09	32.50	37.50	30.00	100	0	0

gravid females were first observed on 22nd December and found up to the end of culture period. In this pond, berried female was first observed in the early February and a total of 55% females became berried during 91 days of rearing. But no prawn became berried in the open ponds throughout the culture period and poor development of gonad of a few prawns (2.5%) was observed in the open pond 1. Early appearance of a few (2.5%) berried females in GP1 might be due difference in maturation of the stocked females.

Being ectothermic, *M. rosenbergii* obtain their heat from the water in which they live. Temperature affects the chemical and biological processes of ectothermic organisms in the water. At low temperature, prawn does not take sufficient feed. Newman *et al.* (1982) measured assimilation efficiency of feed of adult *M. rosenbergii* at temperature range of 22–34°C and found that significantly less feed was ingested by prawns at water temperatures below 25°C than at higher temperatures. In the present investigation, feed was uniformly used depending on the prawn biomass in both types of pond. In the open ponds, morning temperature of water was less than 20°C and evening temperature was less than 25.0°C for the initial 63 days of rearing. Throughout this period, there was sufficient (20-25%) left over feed in the feed check tray indicating that interest of prawn for feeding was poor in the open ponds. In the green house pond, very less (<5%) left over feed was observed in the feeding tray throughout the rearing period. As the temperature of water was well enough for the normal physiological activities, prawn ate supplied feed up to satiation and received sufficient energy for normal physiological activities which ultimately help in developing gonad of prawn in the green house ponds. Bo *et al.* (1999) used geothermal water to increase temperature of water of *M. rosenbergii* rearing ponds and also reported that increase in temperature can accelerate the growth and gonadal development of over-wintering shrimp and stimulate the coupling and egg-laying. Brood development might not be affected by salinity of water. Yen and Bart (2008) investigated reproduction of female prawns reared in 0-18 ppt salinity and reported that females broodstock reared in lower salinity reproduced early. In the present investigation salinity water was almost same in all ponds and ranged from <1.0 ppt to 3.0 ppt.

Increase in water temperature for enhancing the gonadal development of prawn through application green house concept is a new introduction in Bangladesh aquaculture. The findings of the study will be very much helpful for the present prawn production system. Further research is needed for the standardization of the technique.

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Manuscript on 8 December, 2013 and Revised on 15 September, 2014)