*Biosciences, Biotechnology Research Asia* Vol. **6**(1), 257-260 (2009)

# Effect of feed on the reproductive performance of *Penaeus monodon* brood stock

**N. SHETTU and C. JAYAPRAKASH**

P G and Research Department of Zoology, Pachaiyappa's College, Chennai - 600 030 (India).

(Received: February 01, 2009; Accepted: March 03, 2009)

**ABSTRACT**

The effect of feed on reproductive performance of wild collected and hatchery reared *Penaeus monodon* in terms of fecundity (number of eggs spawned) and number of nauplii hatched with hatching percentage was investigated after feeding the brooders with three different feeds viz., polychaete worms, crabs and polychaete worms and crabs. Each experimental group of the brooders was fed with the respective feed at the rate of 12% of the body weight, four times per day. Data collected on body weights of the brooders, number of eggs spawned by the brooders, number of nauplii hatched and the hatching percentage were analysed by one-way classification ANOVA and Q-test. There was no significant difference among the mean weights of the brooders of the three experimental groups. The brood stock response in terms of total number of eggs (fecundity) spawned was significantly more in groups fed with polychaetes than in the group fed with crabs alone. Likewise, number of nauplii hatched and the percentage of hatching was significantly higher in brooders fed with polychaetes than those fed with crabs alone.

**Keywords:** Penaeus monodon, polychaete worms and crabs.

## INTRODUCTION

Development of aquaculture in India is now centered on shrimp due to its high unit value realization and export demand. With its rich natural resources in the form of brackish water bodies suitable for shrimp aquaculture, India is bound to emerge as one of the leading shrimp harvesters in Asia (Ghosh *et al*., 1994). The major bottleneck in development of shrimp aquaculture is the non-availability of quality seeds. The production of quality post - larvae in hatchery depends upon the healthy brood stocks collected from the sea. Male brooders generally mature in captivity so that induced maturation mainly concerns females. Three basic approaches have been employed to induce ovarian maturation in penaeids - endocrine (eyestalk ablation), nutritional, and environment. Hitherto, maturation in *P.monodon* has been induced only through eyestalk ablation although diet and environmental parameters may also enhance the reproductive performance (Primavera, 1978; Millamena *et al*., 1986).

In the present study, an attempt has been made to unravel the effects of two natural feeds, polychaete worms and crabs on the reproductive performance of wild- collected *Penaeus monodon*.

## MATERIAL AND METHODS

The present study was carried out in "Matha Prawn Hatchery", 35 km away from Chennai. Brooders of *Penaeus monodon* were obtained from Pazhayar, Nagapattinam District of Tamil Nadu. Forty-five female brooders weighing between 90 and 290 g and 30 male brooders, weighing between 80 and 200 g, were used for the study. The brooders were acclimated to ambient water conditions at the hatchery in a quarantine room. Brood stock quality was assessed based on physical condition of the animals. They were stocked at a density of 5 animals per square meter, at 1:2 male: female ratio. The water parameters maintained in the tank throughout the experimental period was salinity 28 to 30 ppt; temperature 27 to 30$^0$C and pH 7.8 to 8.2.

The brooders were conditioned for a period of ten days before the eye stalk ablation was carried out. Brooders were divided into three groups. The group I was fed with polychaete worms, the group II with crabs, and group III with polychaete worms and crabs. Polychaete worms were used in fresh live condition, after rinsing in clean seawater in a sieve. Crabs were cleaned individually by removing appendages, pinchers, gills and exoskeleton cut into 2 to 4 pieces, and stored in the deep freezer, until used for feeding.

Individual weights of brooders in each group were recorded and the total biomass of each tank was calculated. Each feeding group consisted of 15 females and 10 males. For all the three groups the individual weights were taken and the total biomass in each tank was calculated. Each group was fed with 12% of its total body weight at a frequency of 4 times/day.

The water in the maturation tank where newly ablated female and male brooders were stocked pre-treated with 4 ppm antibiotics. This was to ensure that the wound of the crushed eyestalk would not be infected. The antibiotic treatment was given for 3 consecutive days. Water level was maintained at 60 cm.

In maturation tank, aeration was turned off for maximum visibility. Sourcing of gravid females was undertaken with the help of underwater flashlight held perpendicularly against the breeder's abdomen illuminating the part where ovary was obviously visible. Females were checked individually, and those in stage IV were singled out using scoop net. Females could be easily identified due to their one-eye compared to males having both. All the stage IV female brooders that were collected were distributed to tubs/basins, with aeration, after they were first disinfected in 300 ppm formalin for 5 minutes. Subsequently, they were washed by dipping in pure clean seawater, and then placed in the spawning tanks.

Prior to stocking of spawners in spawning tank, 10 ppm of EDTA was added to the water. The spawning area was kept dark throughout the night and was free from any unnecessary disturbances. No feeding was given when the spawner was in the spawning tank.

Early in the morning of the following day each spawning tank was inspected for a pinkish to orange scum attached to the sides of the tank, indicating that spawning had occurred. The animals were then removed individually from the tank, using scoop net, and each were checked for spawning condition. Unspawned ones were, returned to the maturation tank from where they were sourced. The spawned brooders were separated to a newly prepared maturation tank.

Detailed egg evaluation was carried out after 10 a.m. in order to allow complete development of eggs to nauplii so that fertile and unfertile eggs could be easily identified. The eggs were observed under a compound microscope. Fertilized eggs could be easily identified by the symmetrical nature of cell divisions. Frequently, appendages and setae were also visible. Unfertilized eggs appeared as opaque or dark brown sphere, with very irregular cell divisions.

The water level in the hatching tank with eggs, to be estimated was maintained up to a mark of known volume. Using a 5 ml inverted pipette a 3 ml sample was obtained from the tank, and released into a petridish. The eggs were counted with naked eye against a white background. Three samples were counted from each harvesting bucket and the average was calculated.

The total number of eggs in a hatching tank was calculated using the formula:

$$\text{Total No of eggs} = \frac{\text{Mean number of eggs in the sample}}{\text{Sample volume (ml)}} \times \text{Total volume of water in the hatching tank (ml)}$$

The nauplii hatched out in about 12 hours, and reached the 6$^{th}$ sub-stage, N6, within 36 hours. The counting of nauplii was carried out using the similar method adopted for egg counting.

## RESULTS AND DISCUSSION

The summary data relating to body weight of the brooders, total number of eggs spawned,

number of nauplii hatched with percentage of hatching in each group and the statistical analysis of the above are presented in Table 1. A comparison of the number of eggs spawned and number of hatched eggs in each feeding group is shown in Figs. 1 and 2.

There is no significant difference in the mean weights of the brooders of the three groups. Brood stock response in terms of fecundity i.e., total number of eggs spawned, is significantly higher in group III fed with polychaetes and crabs and group I fed with only polychaetes than in group II fed with only crabs. Likewise the number of nauplii hatched was higher in groups I and III than in group II. The results of the present experiments thus clearly indicates that the reproductive performance in terms of number of eggs spawned, number of nauplii hatched and the hatching percentage is significantly better in brooders fed with polychaete worms

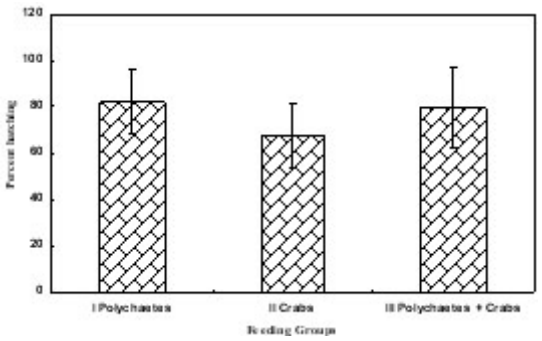


**Fig. 1: Percentage hatching of eggs of brooders reared in different live feeds**

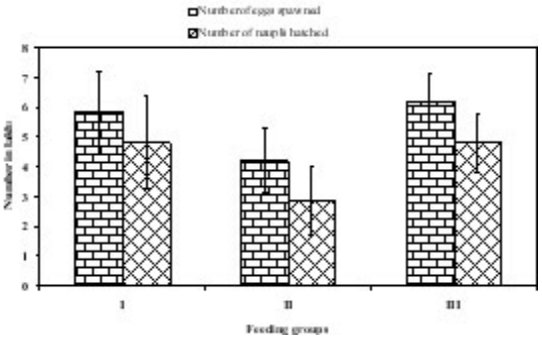


**Fig. 2: Spawing and hatching of eggs from brooders reared in different feeds**

(group I) and in those fed with polychaete worms and crabs (group III). The better reproductive performance may be attributed to the high nutritional value of the polychaete worms.

The importance of nutritional quality of the diet on the reproductive performance and larval survival has been experimentally demonstrated in lobsters, prawns and shrimps. For instance, ovarian maturation and spawning could be induced in captive.

*P. setiferus* when these diets were supplemented with lipids rich in $C_{20}$ and $C_{22}$

**Table 1**: **Spawning and hatching of eggs from brooders reared with three types of feeds**

| Feeding | [1]Body weight (in g) Mean ± SD | [2]No. of eggs spawned (in lakhs) Mean ± SD | [3]No. of nauplii hatched (in lakhs) Mean ± SD | Percentage of hatching Mean ± SD |
|---|---|---|---|---|
| Group I(Polychaetes) | 196.67 ± 47.42 | 5.82 ± 1.37 | 4.81 ± 1.58 | 81.97 ± 13.68 |
| Group II(Crabs) | 191.33 ± 61.4 | 4.21 ± 1.10 | 2.88 ± 1.16 | 67.34 ± 13.86 |
| Group III(Polychaetes + Crabs) | 180.67 ± 47.43 | 6.18 ± 0.98 | 4.82 ± 0.98 | 79.52 ± 17.46 |

**Note:**

- There is no significant difference among the mean body weights of the three groups; ANOVA: F: 0.36; P = 0.7.
- The means of Group I and Group III do not differ significantly; The mean of Group II is significantly lower than the means of Group I and Group II; ANOVA: F: 12.24; P < 0.001; Q-test: Significant difference at 0.05 LS, 1.1.
- The means of Group I and Group III do not differ significantly; The mean of Group II is significantly lower than the means of Group I and Group II; ANOVA: F: 11.68; P < 0.001; Q-test: Significant difference at 0.05 LS, 1.2.

polysaturated fatty acids (Middleditch *et al*., 1979). High survival rate could be achieved in the juveniles of lobsters (Conklin *et al*., 1980) and *P. japonicus* (Deshimeru, 1981) when soybean lecithin and phospholipids were incorporated into their diet. Reproductive performance, in terms of total number of spawnings, eggs and nauplii production, average hatch rate of eggs and larval quality of pond-reared *P. monodon* brood stock, increased significantly when the diet contained lipids from different sources (Millamena *et al*., 1986). The best performance was recorded when the diet contained lipid in the form of cod liver oil, followed by soybean lecithin. However, a combination of cod liver oil and soybean lecithin gave only the poorest overall response. Thus cod liver oil supplemented diet was found to be a suitable diet for successful maturation and spawning of pond-reared *P. monodon*.

In contrast, certain diets such as frozen adult *Artemia* biomass fed to the peppermint shrimp *Lysmata wurdemani* (Lin and Zhang, 2001) and moist artificial diet fed to wild caught *P. monodon* (Gey *et al*., 1997) did not improve the reproductive performance of the respective species.

The results of the present study showed that a diet of polychaete worms is significantly effective in enhancing the reproductive performance of the wild-collected, hatchery-reared *P. monodon*. The polychaete worms are probably rich in nutrients that promote the reproduction of the prawns. Further investigation on the biochemistry of the polychaete worms, especially the qualitative and quantitative aspects of their lipid contents, would help to understand the efficiency of these worms as brood stock feed.

**ACKNOWLEDGEMENTS**

The authors are grateful to the management of Matha Prawn hatchery for the permission and Chief Technician. Mr. M. Laxmanan and Mr. V. G. Karthick for their kind co-operation to conduct the experiment.

**REFERENCES**

1. Conklin, D. E., L. R. D'Abramo, C. E. Bordner. And N. A. Baum., A successful purified diet for the culture of juvenile lobsters; the effect of lecithin. *Aquaculture* **21**: 243-249 (1980).
2. Deshimeru, O. K., Studies on nutrition and diet for prawn, *Penaeus japonicus*. Mem. Kogoshima prefect, *Fish. Exp. Stn*. **12**(72): 31-33 (1981).
3. Gay, E. Mersdon, McGuran, J. J., Hansford, S. W. and Burke, M. J., A most artificial diet for prawn broodstock: its effect on the variable reproductive performance of wild caught *P.monodon*. *Aquaculture*. **149**(1-2): 145-156 (1997).
4. Ghosh, S. K., Palaniswamy, K. and Pathak, S. C., Technical Appraisal Manual, Shrimp and Freshwater Prawn Hatchery, NABARD 87 (1994).
5. Lin, J. and Zhang, D., Effect of brood stock diet on reproductive performance of the peppermint shrimp *Lysmata wurdemani*. *Journal of Shellfish Research,* **201**: 361-363 (2001).
6. Middleditch, B. S., Missler, S. R., Word., D. G., Mcvey, J. B., Brown, A. and Lawrence, A. L., Maturation of penaeid shrimp: dietary fatty acids. *Proc. Annu. Meet. World Maricult. Soc.* **10**: 427-476 (1979).
7. Millamena, O. M., Primavera, J. H., Pudadera, R. A., Caballero, R. V., The effect of diet on the reproductive performance of pond-reared *Penaeus monodon* Fabricius broodstock. Maclean, J.L., Dizon, L. B., Hosillos, L. V., *eds. The First Asian Fisheries Forum: Proceedings;* (1986) May 26-31; *Manila, Philippines. Manila: Asian Fisheries Society,* 593-596 (1986).
8. Primavera, J. H., Induced maturation and spawning in five-month-old *Penaeus monodon* Fabricius by eyestalk ablation. *Aquaculture.* **13**: 355-359 (1978).