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Growth and Survival of Swollen Hindgut Syndrome (SHG) Infected *Penaeus monodon* (Fabricus, 1798) Postlarvae, in Farm Grow-Out System

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Abstract: Swollen Hindgut syndrome (SHG) of tiger shrimp *Penaeus monodon* postlarvae is a common problem in shrimp hatcheries. Postlarvae infected with SHG are generally rejected by the hatcheries and farmers, as stocking of SHG seeds or postlarvae are presumed to cause several problems such as size variation, white faecal disease, loose shell syndrome etc resulting in severe loss in farm production and earnings. In the present study, an attempt has been made to evaluate the growth and survival of SHG affected postlarvae in a commercial shrimp grow out farm at Bapatla, a coastal village of Andhra Pradesh in the southeast coast of India. The postlarvae were reared in ponds of 1 acre (4000 m^2) ± 100 m^2 water spread area at a stocking density of 5/m^2, for a period of 165 ± 5 days. About 60 % of the postlarvae stocked in the experimental ponds were affected with SHG at the time of stocking. Growth, survival and food conversion ratio (FCR) of the affected postlarvae were compared with the normal seeds which served as the control. The results of our study showed that there is no significant difference (p>0.05) in growth, survival and FCR between the SHG affected postlarvae and the normal. Microscopic observation after 48 hrs revealed that an average of only 12% of the seeds was infected with SHG. The trial results indicated that SHG infected *P. monodon* larvae can be utilized for farming as their performance would be similar to the normal seeds if good management practices (GMPs) are followed by the shrimp farmer.

Key words: Swollen hindgut syndrome · *Penaeus monodon* · Growth · Survival · Postlarvae · Good management practices

INTRODUCTION

Tiger shrimp (*Penaeus monodon*) culture is one of the most profitable ventures in the aquaculture industry in India. Commercial farming of tiger shrimp involves stocking of shrimp seeds (postlarvae) in earthen ponds, rearing them to marketable sizes, harvesting and selling to processors or exporters. The success of a crop is greatly dependent on the quality of seeds stocked in ponds. Shrimp seeds for stocking are mostly procured by farmers from the commercial shrimp hatcheries. Farmers collect seed samples from hatcheries and get them tested at commercial seed testing/evaluation laboratories before stocking. These labs rate the seed based on several parameters such as size, appetite, Muscle-Gut ratio, performance in stress tests, presence of viruses etc and advice the farmers to either stock or reject the seed. One such seed quality parameter is the presence of Swollen Hind Gut syndrome. Though no earlier study on SHG syndrome indicated that seeds with SHG perform badly in grow out ponds, shrimp farmers generally avoid stocking infected seeds as many labs which analyze seed quality in India advice outright rejection of SHG infected seeds. Farmers also presume that stocking of SHG seeds or postlarvae could cause severe loss in farm production. Thus, over the last few years, millions of seed affected by Swollen Hindgut Syndrome (SHG) from hatcheries all across the country were rejected by labs and farmers. While a large portion of these are drained away by the hatcheries, millions are sold at cheaper rates to small scale farmers who generally do not get the seed analyzed at testing centres before stocking.

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Swollen hindgut syndrome (SHG) is a morphological deformity that tends to occur at later post larval (PL) stage, typically after PL10 and was first reported by Lavilla Pitogo *et al.* [1] in *P. monodon* postlarvae. SHG mainly affected the hindgut and to some extent, the posterior midgut. Postlarvae infected with SHG show enlargement and distension of the hind-gut folds and its junction with the midgut. This abnormality affects the rhythmic movements in the rectal region in the shrimps resulting in difficulty in expelling the faecal pellets [2]. Lavilla-Pitogo *et al.* [1], reported SHG as a disease which impose direct loss on the hatchery and grow-out systems. Unlike the rapid mortalities associated with viral disease such as white spot syndrome and yellow head virus, progression of SHG is gradual leading to low level mortalities without affecting swimming activity. Aftabuddin and Akter [3] also opined that unlike WSSV, though SHG does not show mass mortality of *P. monodon* larvae, it is still considered to be a budding problem of concern to many shrimp farmers in India.

It has been suspected that natural food and artificial feed quality, bad husbandry practices, water quality and presence of toxic substances from chemical prophylactics are responsible for SHG [1]. Uma *et al.* [4], isolated antibiotic resistant *Vibriyo harveyi* from SHG affected *P. monodon* postlarvae from hatcheries in the east coast of India and opined that indiscriminate use of antibiotics could be the reason for the development of antibiotic resistant *Vibriyo harveyi* in shrimp hatcheries. Jaganmohan and Prasad [5] studied the effect of probiotics on growth of SHG infected seeds. Presently, the occurrence of size variation in shrimps in grow out ponds, low survival rates, occurrence of white faecal strands and loose shell syndrome are all attributed to the presence of SHG in seeds. Information on farm grow-out performance of SHG seeds is scanty and research on SHG is also very limited [3, 4].

Though most SHG infected seeds are healthy in all other respects including the absence of the deadly WSSV, they are still drained causing severe losses to hatchery operators as well as the shrimp aquaculture industry on the whole. A study was therefore undertaken in a grow-out farm at Bapatla in Andhra Pradesh on southeast coast of India to assess the growth and survival of a batch of SHG affected seed. This paper highlights our observations and the results of the performance of SHG postlarvae.

Fig. 1: Location map of the test and control ponds

MATERIALS AND METHODS

The study was carried out in a farm site located (Figure 1) at Bapatla, a coastal village 3 kms away from Bay of Bengal in Guntur District, Andhra Pradesh. Twenty ponds, each with a water spread area of 1.0 acre ± 100 m^2 were utilized for the study. A batch of shrimp seed infected with SHG was procured from a commercial shrimp hatchery at Bapatla in Andhra Pradesh. The seeds were packed, transported, acclimatized to pond conditions and stocked as per Best Management Practices practiced by the farmers in the area. The normal SHG free seeds from the same batch and of the same age but from a different hatchery tank were also obtained from the same hatchery and stocked on the same day. All the ponds stocked had the same water source and more or less same water quality parameters throughout the crop. Seeds were stocked at a density of 5 pieces/m^2 (20000/pond). 10 ponds stocked with SHG infected seeds (60% seeds infected) served as the experimental ponds and the remaining 10 ponds stocked with normal seeds served as the control. The presence of SHG was confirmed by direct microscopic examination of the post larvae [6].

Representative sample of 100 postlarvae (PL) were placed in mesh hapas of 1m x 1m x1m dimensions for each pond to assess the initial survival in ponds as well as to examine the presence of SHG. The postlarvae in both the experimental as well as the control ponds were fed with

Table 1: Data on various water quality parameters recorded from the ponds

Parameter	Range
Salinity(ppt)	10-20
pH	8.2-9.0
Temperature (°C)	27-32
DO levels (ppm)	3.5-7.0
Transparency (cms)	35-60
Ammonia (ppm)	0.0-0.1

feed fortified with gut probiotics and vitamin C right from the beginning of the field trial to enhance their immunity and growth. The PLs from the hapas were observed for the presence of SHG, 48 hours after stocking. Thereafter, the juveniles were routinely observed to check health status and growth on weekly basis. Water quality parameters for all the ponds were constantly monitored and maintained (Table 1) at best possible levels with good management practices. The shrimps were reared for a period of 165 ± 5 days and the data obtained were subjected to student's *t*-test to determine the difference between the test and control groups.

RESULTS AND DISCUSSION

The performance of SHG infected seeds and the normal ones in terms of growth and survival are presented in table 2. The average hapa survival rate in the ponds stocked with SHG seed was recorded as 97.0±1.11% after 24 hours of stocking. Microscopic observation of the postlarvae in the experimental ponds 48 hours after stocking, revealed the presence of SHG infection (Figure 2a) in only 12% seeds on an average. In some ponds, there were no signs of SHG at all (Figure 2b) and on further observation on the 3rd and 4th day, the gut could not be observed properly because of muscle opacity and

Table 2: Performance of SHG infected *P. monodon* seeds *Vs* control (Mean ± SE; n = 10)

Parameters	SHG infected *P.monodon* seeds	Normal SHG free *P.monodon* seeds
Hapa Survival (%)		
24 hours after stocking	97.0±1.11	97.8±0.78
ABW at harvest (g)	45.70±0.88	44.90±0.79
Survival at harvest (%)	92.17±1.28	89.21±2.37
FCR	1.81±0.02	1.83±0.03

colouration in slightly grown seed. In the control ponds, the hapa survival after 24 hrs was 97.8±0.78%. On termination of the trial study (165±5 days of the culture period), the shrimps of average size of 45.70±0.88 g were harvested from the test ponds and the average daily growth achieved was 0.276 g d^{-1}. The normal postlarvae achieved an average daily growth 0.272 g d^{-1} and the harvested shrimps recorded an average body weight of 44.90±0.79 g. The growth of the normal postlarvae was not significantly higher than the SHG affected ones (t=0.670, $P>0.05$).The mean survival of the SHG seeds was recorded as 92.17±1.28 % and that of the normal ones was 89.21±2.37 %. The survival rate also did not vary significantly (t=1.099, $P>0.05$). The FCR of the SHG affected shrimps and the normal was evaluated as 1.81±0.02 and 1.83±0.03 respectively. These values were also not significantly different at 0.05 level (t=0.318, $P>0.05$).

The results obtained on growth and survival of the test and control groups indicated that there is no significant difference between the two groups ($P>0.05$). The same trend was observed in other parameters such as average body weight gained and FCR. According to FAO [7], the SHG has been a common problem in Indian shrimp hatcheries since 2002. Though there is no clear cut

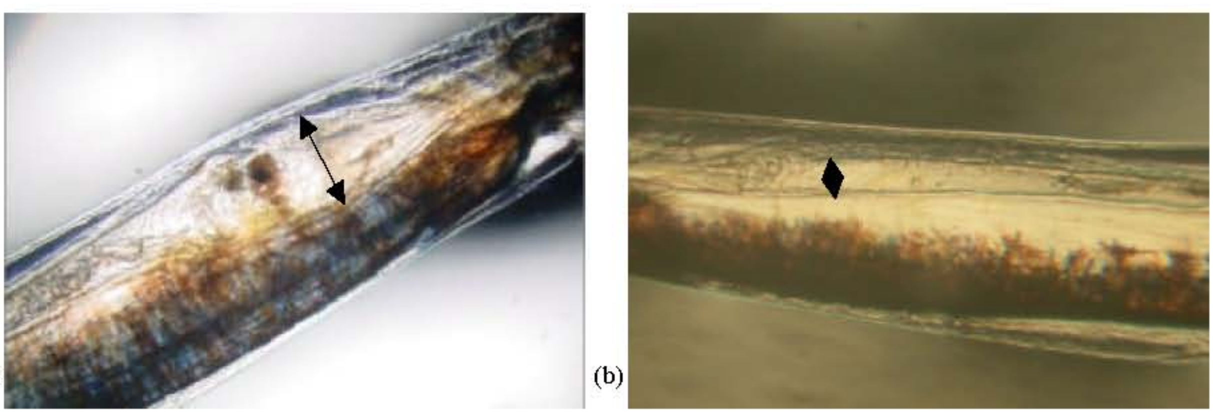
(a) (b)

Fig. 2a: Hindgut of SHG infected *P. monodon* postlarva (magnification 10 X)
Fig. 2b: Hindgut of normal *P. monodon* postlarva (magnification 10 X)

information on the root cause of SHG, there is a general belief that, the reason may be due to toxins produced in larval rearing tanks due to substandard natural and artificial diets, poor husbandry practices etc. Our study indicated that the SHG is a reversible condition when stocked in grow out ponds provided the water quality in the rearing systems are maintained at optimum required levels and the larvae are fed with quality diets. Complete recovery of seeds with SHG to normal condition was observed within 3-4 days of stocking in grow out ponds. The present study ascertains that SHG infected larvae can be utilized for shrimp farming by adoption of best farm management practices. Sudden change from relatively high stocking densities for shrimp seed maintained in hatcheries to comparatively low densities at the grow-out farms can also be a factor for the quick recovery of SHG infected seeds.

The water quality parameters maintained throughout the culture period in all the ponds could have probably played crucial role in reducing stress of the animals and contributed to better growth and survival of the shrimps. The salinity range in the present study was 10-20 ppt. Muthu [8] recommended a salinity range of 10-35 ppt for *P. monodon* culture. Chen [9] opined that a salinity range of 15-20 ppt is optimal for culture of *P. monodon*. Similarly, the pH range in the present study was 8.2-9.0, which is also reported to be optimal for *P. monodon* culture [10].The dissolved oxygen concentration ranged between 3.5-7.0 ppm and the temperature between 27-32°C. Temperature range of 28-32°C supports normal growth [5] as observed in our study. The transparency mainly depends on the presence of phytoplankton. The optimum secchi disc reading should be 30-60 cm [11]. The transparency of 35-60 cm recorded in our study falls within the reported optimum level. The ammonia concentration in the rearing system was less than 1 ppm, which is again a clear indication of good water quality [5].

Based on our results we conclude that the SHG infected *P. monodon* postlarvae can be cultured and harvested as similar to the normal seeds provided the best farm management practices are followed by the shrimp farmer.

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REFERENCES

1. Lavilla-Pitogo, C.R., M.G. Paner and R.D. Travina, 2002. Swollen hindgut syndrome (SHG) in hatchery reared *Penaeus monodon* postlarvae. In: Diseases in Asian Aquaculture IV (eds, Lavilla-Pitogo C.R., Cruz-lacierda) Fish Health Section. Asian Fisheries Society, Manila, pp: 151-158.
2. SEAFDEC/AQD report, 1994. R. and D. for Sustainable Aquaculture. Diseases of tiger shrimp, pp: 30.
3. Aftabuddin, S. and N. Akter, 2011. Swollen hindgut syndrome (SHG) of tiger shrimp *Penaeus monodon* (Crustacea, Malacostraca, Penaeidae) post larvae: Identification of causing pathogenic bacteria and their sensitivity to some antibiotics. AACL Bioflux, 4(1).
4. Uma, A., K. Saravanabava, R. Singaravel and A. Koteeswaran, 2008. Antibiotic resistant *Vibrio harveyi* isolated from swollen hind gut syndrome (SHG) affected *Penaeus monodon* post larvae from commercial shrimp hatcheries. Tamil Nadu J. Vet. Anim. Sci., 4(1): 16-19.
5. Jaganmohan, P. and S.V. Prasad, 2010. Effect of probiotics on the growth and survival of *Penaeus monodon* infected with SHG at postlarval stage. World J. Fish and Marine Sci., 2(4): 311-316.
6. Karunasagar, I., I. Karunasagar and R.K. Umesha, 2004. Microbial diseases in shrimp aquaculture In: Marine microbiology, pp: 128.
7. FAO, 2007. Improving *Penaeus monodon* hatchery practices-Manual based on experience in India. Fisheries technical paper, pp: 446.
8. Muthu, M.S., 1980. Site selection and type of farms for coastal aquaculture of prawns. Proceedings of the symposium on shrimp farming, Marine Products Export Development Authority, pp: 97-106.
9. Chen, H.C., 1980. Water quality criteria for farming the grass shrimp *Penaeus monodon*. In: Proceedings of the 1st international conference on culture of penaeid prawns/shrimps. (eds. Y. Take, J.H. Primavera and J.A. Liobrea) pp: 165.
10. MPEDA., 2006. Media campaign on Welfare schemes of Central Government, pp: 27-28.
11. Saha, S.B., C. Bhattacharyya and A. Choudhury, 1999. Preliminary observations on culture of *Penaeus monodon* in low saline waters. Naga, 22(10): 30-33.