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EFFICIENCY OF INTEGRATED ACCLIMATION TANKS ON ENHANCING THE SURVIVAL RATES OF SHRIMP POST-LARVAE

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Abstract: In this study, integrated acclimation tanks of three different capacities were used for evaluating the survival rates of the shrimp post-larvae *in vitro* and in farm. The post-larvae of shrimp were subjected to acclimation with the integrated acclimation tanks and stocked in happa and in culture tank, in farm and *in vitro*, respectively. As a control, acclimation in shipment bag was also done. The survival rate in 1000 litres capacity-integrated acclimation is 93% while that of 250 litres is 90%. Similar results were obtained for *in vitro* studies. In farm, minimum 6% to 9% variation of survival rates was found for shipment bag-acclimated post-larvae. And there was 10% variation in survival rates of the post-larvae when acclimated *in vitro* in tanks. The results indicated that the post-larvae acclimated in the proposed integrated-acclimation tank exhibited increased survival rate.
Keywords: Integrated acclimation tank, acclimatization, shrimp post-larvae, *in vitro* studies, increased survival.

Introduction

Aquaculture is one of the important sectors in food industry. Especially, shrimp culture has been attractive due to growing demand for protein-based food and reasonably good pricing at the market. The production of shrimp during culture is influenced by physical, chemical, and biological factors such as dissolved oxygen, pH, salinity, feeding mechanism, microbial infections etc. In addition, the post-larvae harvested from hatchery and transported to the farm will experience stress due to harvest and transport. It should be noted that the post-larvae in hatchery has a constant environment. During the rapid introduction of post-larvae to a new fluctuating environment in grow out ponds, even the healthier post-larvae suffered by the stress. The stresses induced by transportation and fluctuating condition in grow out ponds play a major role in survival rate of the post-larvae.

Acclimation of post-larvae prior to stocking in grows out ponds helps to reduce the stress of the post-larvae [1-7]. Numerous researches for the past two decades have acknowledged the

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importance of acclimation and its benefits on increasing the survival rates of the post-larvae [2-7]. Acclimation can be of long term acclimation and short term acclimation. Short term acclimation is generally adopted by the local farmers. In dry season, salinity differs less in between the pond and hatchery. Hence acclimation can be done using grow-out pond water [2]. For long term acclimation a dedicated nursery system is required and it costlier. In order to have short term acclimation a tank that can be portable with all the units such as aeration and pumping set up etc is required. This paper describes about the integrated acclimation tanks (IAT) and their efficiencies in increasing the survival rate of the post-larvae in grow out ponds.

Experimental

Modelling of acclimation tank

The acclimation tank of different capacities 500 L, 750 L and 1000 L were fabricated using light weight fibre reinforce plastics (FRP) material. Independent tanks were integrated with the accessories that are required for acclimation of the shrimp post-larvae. The independent tank accessories that were required for acclimation of shrimp post-larvae are oxygen motor for aeration and a provision to create vortex to separate the weak and strong post-larvae.

The fabricated FRP tanks were provided inside with ring of PVC pipes of 19 mm inner diameter and spacing between the circular PVC pipe rings is 120mm and spacing between the nozzles is 120 mm with an angular degree of 45°-50°. The number of nozzles varies on independent tank depending on the diameter of the tank. With the circular ring and nozzles provided in the acclimation tanks vortex were created in the tank. For separation of weaker post-larvae a circular 300 mm inner diameter, hollow stand of 1m were embedded with 60 micron mesh at the outer. 0.5 HP centrifugal self priming pump is used for pumping of water in to the tank for creation of vortex. An outlet valve is provided at the centre for discharging of water along with the acclimated post-larvae.

Estimation of survival of acclimated post-larvae

The experimental procedure adopted for evaluating the efficiency of the designed IATs *in vitro* and in farm is explained as follows. The IATs were used in stocking of the 10 days old shrimp post-larvae *in vitro* and in farm. Each IATs were used thrice for acclimatization and stocking of 10 days old post-larvae.

The stocking density was 75 numbers per litre for evaluation in farm for all the three models. Meanwhile, the stocking densities for *in vitro* studies were 50, 40, 30 numbers per litre for 1000 L, 500 L, and 250 L IATs, respectively. The separation of strong and weaker post-

larvae were done by creating vortex and separation was done by 30 cm diameter hollow stand embedded with 60micron mesh which was kept concentrated at the centre in the acclimation tank. The three ponds were provided with happa of size 2.5 x 1.5 x 1 m and the acclimated post-larvae in acclimation tanks are stocked in happa at the pond. Table 1 describes the technical specification of each IATs volume and also the actual filled volume of the tank during the acclimations. Fig.1 shows the inner view of the IATs with components and accessories along with the spacing.

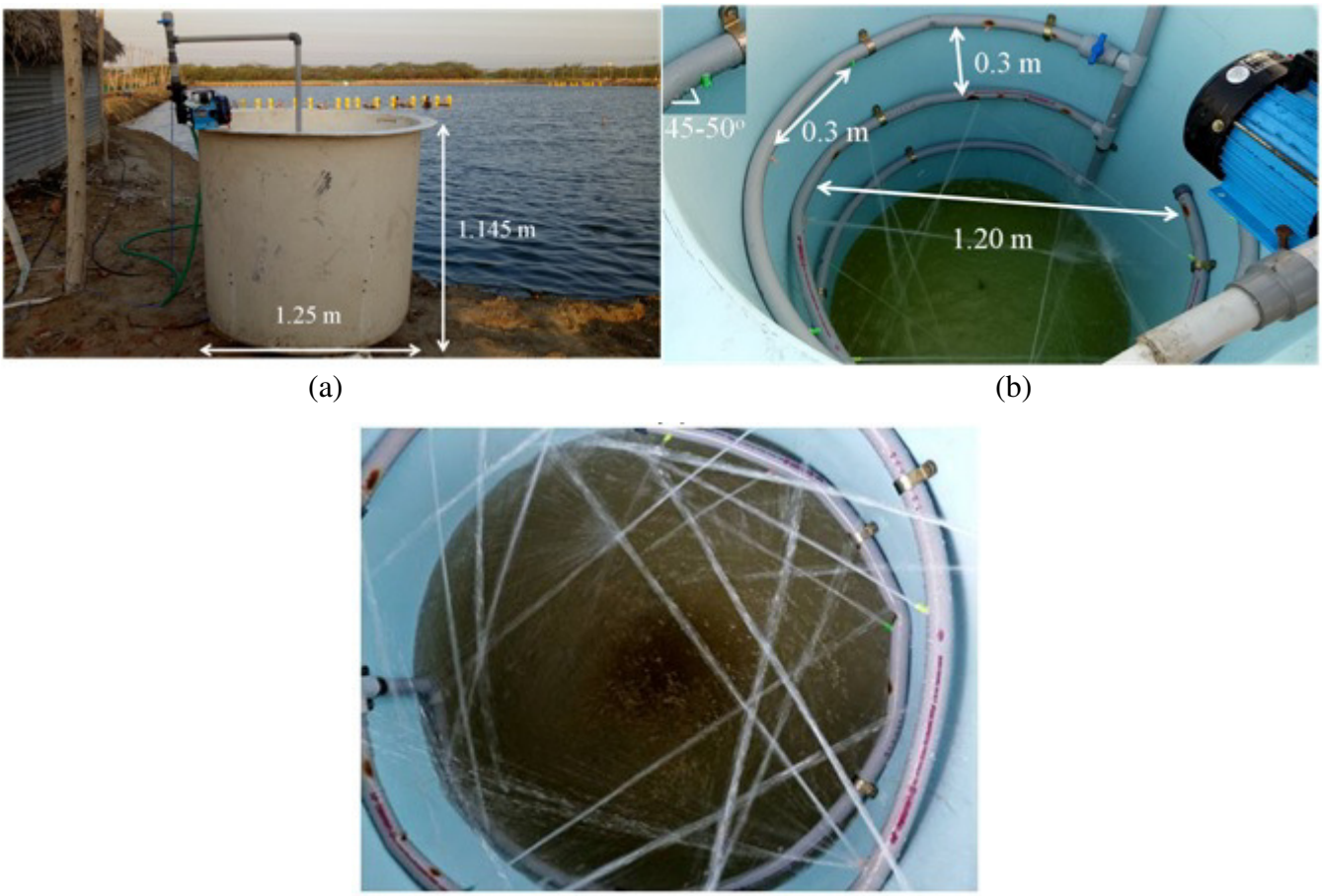
Table 1. Technical specifications of integrated acclimation tanks (IATs)

Tank	Height (m)	Inner radius (m)	Total Volume (L)	Actual filled volume (L)
1	1.1	0.6	1243	1000
2	0.55	0.6	622	500
3	0.5	0.45	318	250

The post-larvae acclimated in IATs were directly stocked in to the culture tank. And the shipment bag-acclimated post-larvae were stocked in culture tanks in *in vitro*. On the same farm 10 bags of post-larvae of 10 days old were stocked by acclimation in shipment bags. Happa of size 2.5 x 1.5 x 1 m were provided and the post-larvae that are acclimated in shipment bag of 10 numbers are transferred in to the happa. The water quality parameters such as pH, salinity, alkalinity and dissolved oxygen were monitored in the stocked happa for 3 days. Then the post-larvae were taken from happa and the survival rate of the shrimp post-larvae was evaluated.

Results and Discussion

The IATs with three different storage capacities were designed and fabricated as shown in Figure 1 and Table 1. The post-larvae were acclimated in the IATs both *in vitro* and in farm. The post-larvae were taken from happa of the ponds and compared for survival rates. The *in vitro* samples were taken from the culture tank. The comparison between the survival rates of post-larvae from different IATs in farm as well as *in vitro* were done in order to correlate the IAT capacities and survival rates of post-larvae. Table 2 shows the survival rates and the standard deviation for all the evaluated conditions such as control, *in vitro*, and in farm.



(a) (b)

(c)

Figure 1.(a) Integrated acclimation tank and (b) inner view of tank and (c) showing of vortex

Table 2. Survival rate of 10 days old post-larvae in happa after acclimation

Acclimation Tank (IAT)	Survival rate (%)	σ
1	93	2.5
2	91	1.5
3	90	0.58
Shipment bag (Control)	84	3.2

σ - standard deviation

The survival rates in IAT 1 ie 1000 litres capacity integrated acclimation is 93% while that of 250 litres is 90%. But the standard deviation for tank1 and tank 3 has significant difference in survival rates of post-larvae. In *in vitro* also the tank1 and tank 3 has exhibit similar results as that of the farm stocked survival rate. Meanwhile the Fig 2 a&b clearly evidences that survival rates in tank 3 shows a consistent rate when compared with the tank 1 in both the cases.

Table 3. Survival rate of 10 days old post-larvae in *in vitro* after acclimation

Acclimation Tank	Survival rate (%)	σ
1	95	2.1
2	92	1.2
3	91	0.58
Shipment bag (in control)	85	3.6

σ - standard deviation

Indeed these consistent survival rates in tank3 in both *in vitro* and farm acclimated and stocked post-larvae is due to the lower stock density of post-larvae. In tank 1 the number of post-larvae stocked per stocking is 4 folds that of the post-larvae stocked in tank3. The survival rates were mainly calculated from the post-larvae stocked in happa at farm. The happa stocked with tank3 had less density of post-larvae stocked when compared with the tank1.

Thus the results clearly indicate that the density of post-larvae may have a role on the influencing the survival rates simultaneously in *in vitro* and in farm for tank3. The survival rate increased to 80% when acclimatizated for 20 days *M. monoceros* [4]. An extended acclimation time increased the survival rates of the post-larvae in 2 days acclimation [3]. The table 4 evidences that the water quality parameters are more or less similar without fluctuating in both the cases for tank1 and tank 3. It should be noted that the tank 3 is ideal for acclimation for stocking of post-larvae for farms having numerous ponds since it could acclimatize more post-larvae than other tanks.

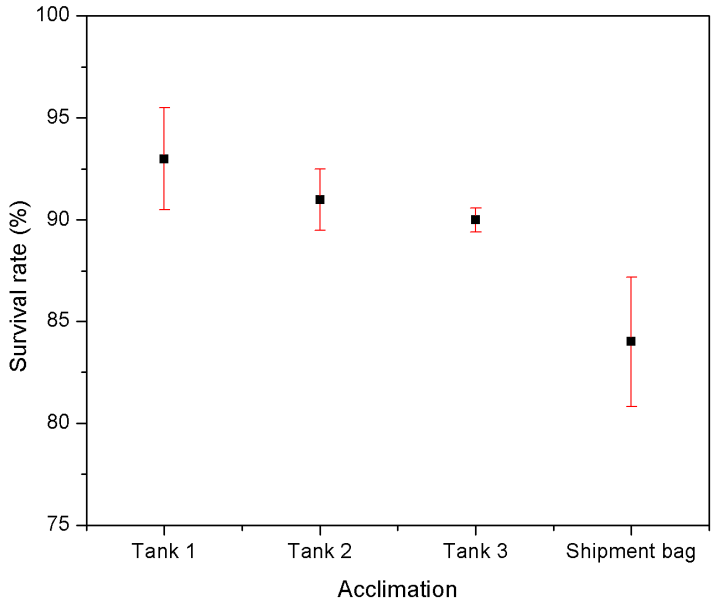
The post-larvae acclimated in shipment bags exhibit similar survival rates in farm is 84% and 85% *in vitro*. The standard deviation results indicated that shipment bag acclimated post-larvae survival rates are similar in both *in vitro* and in farm. Fig 2 evidences that shipment bag acclimated post-larvae and the post-larvae from IAT has a vast difference in survival rates. Post-larvae of 12-14 days can be acclimatized to fresh water as they withstand osmotic stress [5-6].

Table 2 and 3 has enlighten that in farm the minimum 6% to 9% variation of survival rates is there for shipment acclimated larvae with that of acclimated with tanks. And there is 10% variation in survival rates of the post-larvae when acclimated in tanks *in vitro*. These results clearly throw light that acclimation of post-larvae has increased the survival rates and also

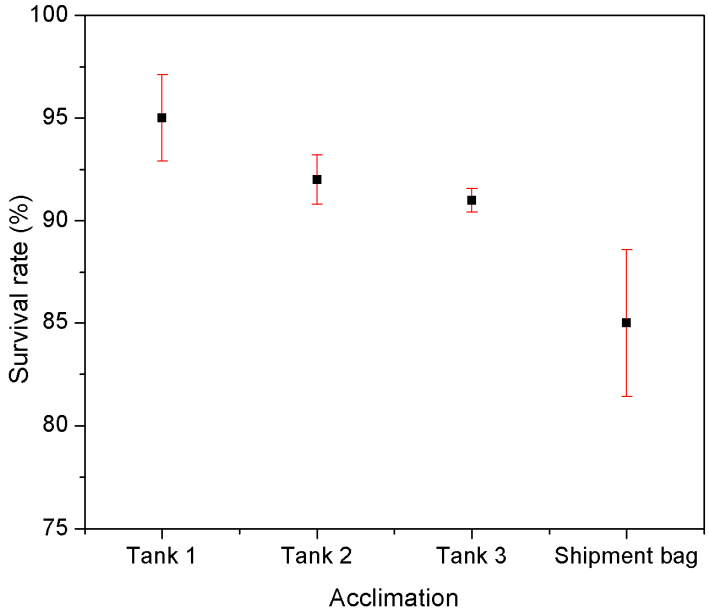
acclimation is an adaptable technique for increasing the survival rates. Low salinity shrimp farmers has acknowledged the benefits of acclimation of post-larvae before stocking [1-2].

Table 4. Water quality parameters during stocking in happa and *in vitro* evaluation.

Water quality parameter	Day (in happa)			Day (*in vitro*)		
	1	2	3	1	2	3
pH	7.9	8.0	7.9	7.8	7.8	7.7
Salinity (ppt)	31	31	31	25	25	25
Alkalinity (ppm)	221	218	203	202	199	197
DO (ppm)	5.0	5.5	6.1	5.1	55	6.0



(a)



(b)

Figure 2. Survival rate of 10 days old post-larvae after acclimation in tank 1-3 and shipment bag in (a) happa and (b) *in vitro*.

Conclusion

The integrated acclimation tanks with different capacities were fabricated and evaluated for the efficacy of acclimation of post-larvae of shrimp in farm and in *in vitro.* The increased survival rate in both *in vitro* and farm indicated that the tanks are efficient for acclimation. The post-larvae acclimatized prior to stocking with these types of tanks acts as stress relieving mechanism that makes post-larvae adaptable for fluctuating environmental conditions. Further studies would be required on prolonged acclimatization in order to understand more about the correlation between acclimation and survival rates of the post-larvae.

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