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EFFECT OF PACKING DENSITY AND HABITAT MATERIAL ON THE SURVIVAL AND DURATION OF *PENAEUS INDICUS* POST LARVAE DURING OXYGEN-PACKED TRANSPORTATION

Geetha Sasikumar and Jayasree Vadhyar K

Colleg of Fisheries, Kerala Agricultural University, Panangad, Cochin - 682 506.

Abstract: The survival and duration of the Indian white shrimp, *Penaeus indicus* post-larvae (PL_{20}) packed with oxygen under uniform water quality conditions were studied at packing densities of 200, 300, 400 and 500 PL/1, with and without habitat material which was in the form of hollow 10-15 mm bits of transluscent plastic straw at a ratio of 1 bit: 2 PL. The effect of packing density on the cumulative percentage survival was significant. The duration of obtaining 100% survival ;which was taken as the 'safe duratioin of transport' was significantly different at all the packing densities tried. The habitat material had significant effect on enhancing the duration of transport at higher packing densities of 400 and 500 PL/during the later period of packing i.e., at 70% survival. The duration of 100% survival was not altered significantly with the introduction of the habitat material. The duration of transport was inversely related to the survival rates. The water quality parameters - dissolved oxygen, ammonia-N, free carbon dioxide and pH - were also studied with and without the habitat material at the different packing densities, initially and finally at 70% survival, and the changes that took place in the oxygen-packed experimental jars were discussed.

1. Introduction

The shrimp post-larvae are cannibalistic in behaviour and hence on being transported under oxygen packing, do not often reach their destinations in totality, Cannibalistic tendencies develop due to insufficient space (Subrahmanyam, 1973), higher temperature (Shigueno, 1975) and in association with moulting (Varghese *et al.*, 1975; Segal and Roe, 1975; New and Singholka, 1985; Subrahmanyam, 1986). Lowering of temperature reduces the moulting frequency and thereby discourages cannibalism (Shigueno, 1975; Singholka 1982). At normal temperature in the tropics, provision of habitat material in the oxygen filled transporting containers was found to reduce cannibalism in the giant freash water prawn, *Macrobrachium rosenbergii* post-larvae since it serves as a shelter for the over-stressed weaklings and the newly moulted ones which are vulnerable to predation (Alias and Siraj, 1988; Jayasree - Vadhyar *et al.*, 1992). The present study was aimed at determining the effect of packing density and hollow habitat material on the survival and duration of oxygen-packed seed of *Penaeus indicus* during transportation.

2. Materials and Methods

Hatchery reared *P. indicus* post-larvae (PL_{20}) of average weight 10 mg were used for the experiment. They were maintained initially in 1 ton capacity rectangular fibre glass tank after acclimating them from 32 ppt to 25 ppt salinity of the tank water at ambient temperature of 30±1°C. They were fed *ad libitum* using powdered dry clam and minced prawn meat. Aeration was provided in the tank. The feed remnants and excretory wastes were removed from the tank by siphoning, once daily. Twenty four hours prior to the starting of the experiment, feeding was stopped.

Transparent rigid plastic, air tight jars of 600 ml capacity were used for packing the shrimp seed under uniform oxygen pressure, water quality and quantity. The screw type lid of each jar was provided with a one-way valve for regulating the flow of oxygen as well as for fecilitating the reading of oxygen pressure in the experimental jars on a pressure gauge. Bourdon type pressure gauge with a precision of 0.02 Kg/cm², fitted with a pressure resistant hose, regulating knob and pressing nipple served to fill in the oxygen in the experimental jars from an oxygen cylinder. This fecilitated confirmation of uniform initial oxygen pressure within the jars (*see* Jayasree-Vadhyar *et al.*, 1992).

The shrimp post-larvae from the tank were packed in the experimental jars at four different packing densities of 200, 300, 400 and 500 PL/1 in the following manner, The required numbers of the post-larvae were counted and transferred to the experimental jars with 100ml water of 25 ppt salinity. Hollow transluscent plastic straw of 5 mm diameter cut into bits of 10-15 mm length were introduced into the jars after thoroughly washing them, in the ratio 1 bit: 2PL. The jars used as control were not packed with the habitat material. Immediately after transferring the post-larvae and the habitat material, the experimental jars were closed tightly and filled with oxygen from the oxygen fylinder under uniform pressure of 0.2 Kg/cm^2 as detailed by Jayasree-Vadhyar *et al.* (1992).

The experimental jars which were filled with 100ml water of 25 ppt salinity and with oxygen at 0.2 Kg/cm^2 ambient temperature of 30 ± 1°C, but without shrimp seed were opened immediately after filling, for collecting water samples initially for analysing the water quality parameters.

The study was statistically planned as a factorial experiment with three replications in completely randomised design and the results analysed (Das and Giri, 1979).

Observations were made by noting the time of initial mortality of the oxygen-packed shrimp seed in the experimental jars at hourly intervals, and thereafter, the number of suvivors was counted at two hourly intervals until 70% survival occurred. The jars were periodically shaken to simulate transport conditions. At the time of 70% survival, the jars were opened and the water samples were collected for final water quality analyses. Initial and final quality of the packing medium was analysed using standard procedures (Strickland and Parsons, 1972). The parameters analysed were dissolved oxygen (Winkler's method), ammonia-N (phenol-hypochlorite spectrophotometric method). free carbon dioxide (alkalimetric titration method) and pH (potentiometric method).

3. Results and Discussion

The cumulative percentage survival of the oxygen-packed shrimp seed with and without the habitat metarial under different packing densities is detailed in Table 1. The effect of packing density on the survival at 100%, 90%, 80% and 70% of the oxygen-packed shrimp seed was significant ($P<0.05$). The duration of 80% and 70% survival rates at higher packing densities of 400 and 500 PL/1 was comparatively longer in the jars with the habitat material than in the control. At 400 PL/1, by the end of 14 h, the survival was 5% more than in the control. At 500 PL/1, 80% survival rate was observed by the end of 12 h with the habitat material in the jars, whereas, the same survival rate was observed by the end of 6 h without the habitat material in the jars. This revealed a two fold increase in the duration of 80% survival, with habitat material.

The maximum time length of obtaining 100% survival was taken as the 'safe duration of transport' of the oxygen-packed shrimp seed (Jayasree Vadhyar *et al.*, 1992). Durations of obtaining survival rates from 100% down to 70% of the oxygen - packed shrimp seed with and without the habitat material under different packing densities are given in Table 2. There was significant difference ($P < 0.05$) in the safe duration of transport at all the packing densities tried. The effect of the habitat material on the safe duration of transport at all the four packing densities tried was not significant ($P> 0.05$). Similar trend was observed at 90% and to some extent at 80% survival rates. The introduction of the habitat material significantly ($P<0.05$) increased the duration of transport at

Table 1. Cumulative percentage survival of oxygen-packed *P. indicus* seed with (A) and without (B) habitat material, under different packing densities.

Packing density (PL/1)	Treatment	Duration (h)												
		2	4	6	8	10	12	14	16	22	24	32	34	40
200	A	100	100	100	100	100	100	100	95	90	90	80	75	70
	B	100	100	100	100	100	100	100	95	90	90	85	80	70
300	A	100	100	100	95	95	90	90	85	75	75	70	70	
	B	100	100	100	95	95	90	90	90	80	75	70		
400	A	100	100	95	90	85	80	80	75	75	70			
	B	100	100	95	90	85	80	75	75	70				
500	A	100	95	90	85	85	80	75	70					
	B	100	90	80	80	80	75	70						

*Each value is a mean of triplicates.

Table 2. Duration for different survival rates of the oxygen-packed *P. indicus* seed, with (A) and without (B) habitat material under different packing densities.

Packing density (PL/1)	Duration (h)*							
	100%		90%		80%		70%	
	A	B	A	B	A	B	A	B
200	14.0	14.17	26.8	27.16	33.34	33.5	40.5	40.66
300	6.0	6.5	15.0	15.34	21.67	23.0	33.16	32.16
400	4.5	3.66	7.5	7.17	13.33	13.33	24.66	22.5
500	2.33	2.0	5.5	4.33	12.33	10.83	15.83	13.33

*Each value is a mean of triplicates.

higher packing densities of 400 and 500PL/l at the later period of packing, i.e., at 70% survival rate. The duration of transport was inversely related to the survival rates. The above trends were also highlighted by Jayasree-Vadhyar *et al.* (1992) who used similar habitat material in their study, dealing with the giant fresh water prawn post-larvae.

The average values of dissolved oxygen, ammonia-N, free carbon dioxide and pH pertaining to the water quality analyses are summarised in Table 3. A lower final dissolved oxygen level was observed in the control, showing that the introduction of the habitat material could reduce the consumption of dissolved oxygen. However, it may be noted that the final dissolved oxygen values in all the experimental jars were far above the minimum level of 1.5 - 2.5 ppm. The accumulation of ammonia-N in the packing medium was not reduced significantly ($P>0.05$) with the introduction of the habitat material, even though a slight increase of it was observed in the control. The reduction in the free carbon-dioxide accumulation in the packing medium at the higher packing densities may be due to the incorporation of the habitat material and its utilization by the shrimp post-larvae. Alias and Siraj (1988) and Jayasree-Vadhyar *et al.* (1992) noticed significant reduction in carbondioxide accumulation by the incorporation of habitat material in the packing medium. The pH of the packing medium was lowered from 8 to 7 by the time 70% survival occurred. The final levels of the water quality parameters were within the tolerance limits of the species.

4. Conclusions

Cannibalism was less pronounced at the lower packing densities due to the availability of sufficient space and less

Table 3. Water quality parameters* in the oxygen-packed jars with the habitat material (A) and without it (B) at different packing densities, at 70% survival

Packing density (PL/1)	Habitat material treatment	Dissolved oxygen (ppm)	Ammonia-N (ppm)	Free carbon dioxide (ppm)	pH
Initial		28.30	0	0	8.0
200	A	21.19	5.07	51.25	7.9
	B	19.70	5.86	49.28	7.9
300	A	17.65	10.04	57.16	7.7
	B	17.33	10.46	55.19	7.6
400	A	18.44	10.28	72.90	7.5
	B	14.18	11.08	72.90	7.5
500	A	13.39	10.56	61.10	7.0
	B	11.82	10.56	63.07	7.0

*The given values are average of triplicate values.

crowding which in turn increased the survival rates and duration of transport of the oxygen-packed shrimp seed. However, even at the lowest packing density tried (200PL/1), cannibalism could not be ruled out. It was observed during the early hours of packing when the post-larvae were seen hyperactive with a tendency to jump out of water and adhere to the walls of the jars, above the water level. This tendency was more intense at higher packing densities such as 400 and 500 PL/1 whcih admittedly could not be checked with the introduction of the habitat material. However, during the later period of oxygen packing, the hollow habitat material apparently served as a shelter especially for the over- stressed weaklings and the newly moulted post-larvae, thereby increasing the duration at the higher packing densities.

References

1. Alias A Z and Siraj S S (1988). *Aquaculture and Fisheries Management* 19: 39-43.
2. Das M N and Giri N C (1979) *Design and Analysis of Experiments*. Wiley Eastern Limited Publ.
3. Jayasree Vadhyar K, Nair C M, Singh B I S and Joshi K (1992). In: Silas, E G (Ed.) *Fresh Water Prawns*. Kerala Agricultural University, Symposium series in Fisheries 1: 159-164.
4. New M B and Singholka S (1985) *Fresh Water Prawn Farming*. A manual for the culture of *Macrobrachium rosenbergii*, F A O Fish. Tech Paper 225 (Rev 1): 28-29.
5. Segal, E and Roe A (1975). *Proc World Maricul*. Soc 6: 67 - 88.
6. Shigueno K (1975). *Shrimp Culture in Japan*. Association of International Technical Promotion, Tokyo, First Edition: pp.153.
7. Singholka S (1982), In : New, M B (Ed.) *Giant Prawn Farming* Elsevier Scientific Publishing Company : 157-160.
8. Strickland J D H and Parsons T R (1972). A Practical Hand book of Sea Water analysis. *Bull. Fish. Res. Bd. Can* 167, 2nd Edition: pp. 311.
9. Subrahmanyam M (1973). *Indian J Mar Sci* 2 (1) : 63-65.
10. Subrahmanyam M (1986). *Training in Giant Fresh water Prawn Farming*, C I F R I Bulletin No.47 : 10-23.
11. Varghese P U, Ghosh A N and Das P B (1975). *Bull Dept. Mar. Sci Univ. Cochin* 7(4) : 781 -789.

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