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Research Note

Transportation Prototype for Live Distribution of Mud Crab in Seafood Supply Chain

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Mud crabs of the genus Scylla have been considered as a potential species for aquaculture and is widely regarded as one of the most promising alternatives to penaeid shrimp culture in crustacean fisheries. The development of mud crab fishery has been quite slow initially, compared to other exportable commodities like tuna and shrimp. But later, a shift in the scenario occurred on account of its enhanced demand in both domestic and export markets. Therefore, the development of proper transportation techniques became critically important and attempts were made in the mid-fifties to store live crabs in large tanks onboard fishing vessels, with continuous aeration, water circulation and temperature regulation of seawater (Roach, 1956). In India, mud crab marketing practices vary in different parts of the country. They are sold primarily in the live condition, although some are sold as frozen and as cooked products. These species fetch very high prices, where they are regarded as a luxury food.

In India, the demand for live crab is more or less confined to places near the fishing centres. However, the market reach of these species can be increased if effective transportation techniques are developed thereby enhancing the demand for this crustacean delicacy than what is existing at present. Further there is a good export potential for these crustacean species in live condition. Currently bamboo baskets are being employed for domestic transportation while thermocol boxes are used for export purposes. However, thermocol boxes have issues of recycling, creating environmental problems.

In contrast to other crab species, mud crabs are known to leave the water voluntarily under certain circumstances as their metabolic systems are apparently more adaptable to 'breathing' in air. Reports suggest that mud crabs to have relatively high oxygen consumption in air and are able to handle the correspondingly high rates of carbon dioxide accumulation (Poole et al., 2008). Environmental factors like favourable temperature and humidity are known to enhance their survival rate which imparts an enormous operational advantage in successful post-harvest handling of these animals. Considering these aspects, attempts were made to develop a prototype for live mud crab transportation and compare the longevity of mud crab in both traditional container and the prototype.

The container for the current study was fabricated using low cost plywood and lined with aluminium foil for thermal insulation and had an outer dimension of 35 x 33 x 45 cm and inner dimension of 30 x 30 x 40 cm. It was partitioned vertically into two chambers: the upper one for storing crab and lower horizontally sliding one for storage of ice to maintain low temperature and moist condition in the storage chamber (Fig. 1). The two chambers were separated by stainless steel wire mesh so as to avoid direct contact of crab with the ice. Five perforations of 1 cm diameter each were provided in the box lid to facilitate aeration in the storage chamber. Handles were provided on both sides of the box for easy handling during transportation.

Live crab (*Scylla serrata*), having an average size of 265 g was procured from a local culture pond at Kochi, Kerala. Immediately after capture, the crabs were washed in potable water and bound with

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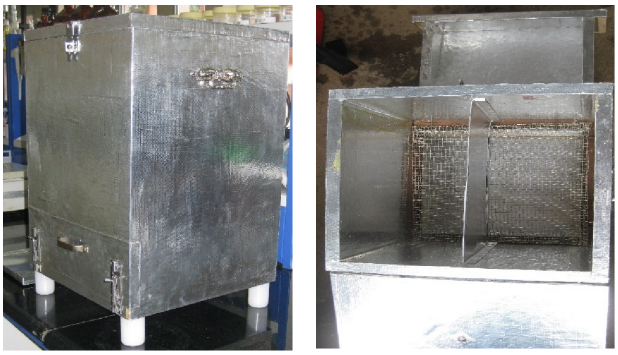

Fig. 1. Prototype for live mud crab transportation

coarse twine to render their claws immobile and were divided into three lots of equal numbers (n = 10) for packing. They were minimally handled to avoid stress. Studies have reported the practice of immobilizing the claws for easy handling as well as preventing damage caused by inter-struggle exhibited by the species (Shelley & Lovatelli, 2011). First lot of crabs, referred to as traditional control was packed in covered bamboo baskets having a diameter of 30 cm and height of 40 cm (Fig. 2). Second and third lots of crabs were packed in fabricated container with one lot kept as control and the other lot *viz.,* pre-dipped for 5 min in 25 ppt saline water maintained at 5ºC, referred to as treated lot. Ninlanon (2011) reported that one of the best conditions of pre-cooling process was dipping mud crab in 5ºC seawater for 5 min which extended the survival rate as well as resulted in high muscle yield compared to other treatments. During the study, the crabs were sprinkled thrice daily with water from the culture pond to maintain high relative humidity thereby preventing the chances of dehydration. Studies have reported dehydration to have a significant effect on performance and survival of crabs (Allen et al., 2012). Samples were observed for their survival rate (%) as well as weight loss (%) during the study period.

During storage of crabs in traditional bamboo basket, the temperature and relative humidity of the was noted using Temp Tec hygrometer. An average temperature of 27ºC and relative humidity of 89% was observed during the study period. The survival rate in crabs stored in the bamboo basket was 100% till 6th day of storage and an average mortality rate of about 20% per day with complete mortality towards 11th day was observed. An average weight loss of 11.90% was recorded in crabs stored in bamboo baskets.

Fig. 2. Traditional bamboo basket used for live mud crab transportation

The method of chilled packing accounts for temperature-induced anaesthesia in crabs minimizing their respiratory requirements, stress, anaerobiosis and results in extending the duration of shipping. The temperature and relative humidity in the prototype were continuously monitored and an average temperature of 20ºC and relative humidity of 79% was observed during the storage period. Flake ice was filled periodically in the lower chamber of the container replacing melted water, thus maintaining the low temperature and high relative humidity. However, the relative humidity was comparatively lower to that observed in bamboo baskets which must be on account of the direct influence of environmental conditions in latter, as the experiment was carried out during monsoon period.

The survival rate was 100% till 3rd day for control lot in fabricated container and a daily average mortality rate of about 17% was observed with complete mortality towards 13th day whereas in dip treated lot, mortality started from 2nd day onwards indicating a mortality rate of 17% per day and absolute mortality towards 14th day. The average weight loss of control lot in fabricated container was 8.47 and 7.59%, in dip treated lot of crabs. It was also noted that the dip treated lot of crabs were slightly stressed compared to the control lot and few crabs exhibited foaming. The crabs were air stored

prior to treatment which may be the reason for stress exhibited by them. Ammonia excretion following re-immersion of marine crustacea has been inadequately studied (Durand et al., 2000). The inability to remove ammonia from their system would be a major contributing factor to this high stress and mortality rates observed in treated crabs. It could also explain the other stress reactions exhibited in these crabs, e.g. foaming and inertia.

The study proved that the survival rate of crabs could be extended up to 13 days in fabricated containers compared to 11 days in the case of bamboo baskets. However initial survival was better for crabs stored in bamboo baskets compared to those stored in fabricated container. This must be on account of the thermal shock experienced by the latter due to the low temperature in fabricated container. Hence, additional optimization studies are required to improve the initial survival of crabs in the prototype. Further, comparison of the meat quality of crabs stored under different storage conditions can benefit in projecting the marketing of these commodities. In addition, studies on development of improvised foldable designs with more efficient, cheaper and lighter materials are envisaged for extended storage and transportation of crabs.

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