Bioconversion Efficiency and Growth in the White Shrimp, *Penaeus indicus* (Milne Edwards), Fed with Decomposed Mangrove Leaves

S. Athithan and V. Ramadhas

Abstract

Food conversion efficiency and growth in the white shrimp *Penaeus indicus* fed with decomposed mangrove leaves of *Avicennia marina* and *A. officinalis* were monitored under laboratory conditions. It was observed that test animals fed with the decomposed leaves of *A. marina* had higher assimilation efficiency (87.96%), gross growth efficiency (10.82%), net growth efficiency (12.3%) and relative growth rate (0.0603 g/day) than those fed with *A. officinalis*. The relatively higher growth registered in the animals fed with decomposed leaves of *A. marina* was attributed to its high calorific and protein content.

Introduction

Utilization of decomposed mangrove leaves as a component of finfish and shellfish feed has been tested by several researchers (Sumitra-Vijayaraghavan and Wafar 1983; Sambasivam and Krishnamurthy 1986; Tharadevi 1989). Many bottom-feeding and filter-feeding finfish, shellfish and copepods have been reported to efficiently utilize decomposed mangrove litter as a prime food source (Newell 1965; Pomeroy 1980; Rao and Nair 1984). However, decomposed mangrove leaves have not been used as the only ingredient in fish feed (without the inclusion of any other ingredient). Hence, the utility of decomposed mangrove leaves as quality food in shrimp farming deserves scientific consideration. The present study details the changes in growth parameters and feed conversion efficiency of *Penaeus indicus* fed exclusively with decomposed leaves of *Avicennia marina* and *A. officinalis*.

Materials and Methods

Trials were conducted with two types of mangrove vegetation, namely, *A. marina* and *A. officinalis* with three replications each. The feed used for the experiments was prepared by decomposing the two types of leaves, gathered from the Tuticorin mangrove swamp in India, for a period of six weeks. The decomposed leaf samples along with the associated meiofauna were kept in the freezer for one day to kill all the meiofauna. *P. indicus* collected from the wild (20-21 mm carapace length; 81 mg mean dry weight) were used for the feed trials and the initial dry weight of individual animals was recorded using subsamples. The two types of leaf samples were taken out from the freezer, thawed and used separately as feed and the animals were fed *ad libitum*. Unconsumed leaves and feces were removed daily, washed in freshwater and finally dried. After an experimental period of 18 days, the dry weight of the animals was recorded by drying them in a hot air oven (at 70°C) to constant weight.

Results and Discussion

The growth parameters recorded for the experimental animals fed with the two types of decomposed leaves are given in Table 1. The shrimps consumed a relatively higher quantity of decomposed leaves of *A. officinalis* than of *A. marina*. However, the comparative fecal output was lower in *P. indicus* fed with *A. marina* and hence the assimilation efficiency was higher in *P. indicus* fed with *A. marina* (87.96%) than those fed with *A. officinalis* (82.29%). The values of gross growth efficiency, net growth efficiency and relative growth rate were higher when fed with *A. marina*. In the case of animals fed with *A. officinalis*, in spite of higher assimilation, a spurt in metabolism had brought down the assimilation efficiency. The decomposed leaves of *A. marina*

Table 1. Food conversion efficiency and growth in Penaeus indicus *fed with the decomposed leaves of* A. marina *and* A. officinalis*.

Particulars	*A. marina*	*A. officinalis*
Initial dry weight (g, w1)	0.091 (± 0.003)	0.091 (± 0.002)
Final dry weight (g, w2)	0.307 (± 0.006)	0.287 (± 0.004)
Weighed mean (g, W; where W = (w1 + w2)/2)	0.199 (± 0.005)	0.189 (± 0.002)
Production of flesh (g, P; where P = w2 - w1)	0.216 (± 0.008)	0.196 (± 0.006)
Consumption of feed (g, C)	1.998 (± 0.008)	2.196 (± 0.016)
Fecal output (g, F; where F = C – A)	0.240 (± 0.007)	0.388 (± 0.012)
Assimilation (g, A; where A = C – F)	1.758 (± 0.044)	1.807 (± 0.053)
Metabolism (g, R)	1.541 (± 0.046)	1.611 (± 0.031)
Assimilation efficiency (A/C x 100)	87.960 (± 3.518)	82.290 (± 2.826)
Gross growth efficiency (P/C x 100 or K1)	10.820 (± 0.368)	8.934 (± 0.097)
Net growth efficiency (P/A x 100 or K2)	12.300 (± 0.052)	10.860 (± 0.068)
Relative growth rate (g/day)	0.060 (± 0.003)	0.058 (± 0.002)

*Calculations made on dry weight basis with standard deviation values in parentheses.

appeared to be superior to *A. officinalis* due to its high calorific and protein content (Athithan 1990) and a higher rate of conversion of the assimilated food into flesh. The study indicated that mangrove leaves, adequately decomposed to attain the highest protein content, could be readily assimilated by cultivable brackishwater shrimps to attain good growth.

Acknowledgements

The authors are grateful to the Dean of the Fisheries College and Research Institute, Tuticorin, India, for providing facilities and encouragement.

References

Athithan, S. 1990. Studies on food value and nutritive elements of decomposed mangrove leaves. Tamil Nadu Veterinary and Animal Sciences University, Madras, India. M.F.S. thesis. 70 p.

Newell, R.C. 1965. The role of detritus in the nutrition of two marine deposit feeders, the prosobranch *Hydrobia ulvae* and bivalve *Macoma balthica*. Proc. Zool. Soc. Lond. 144:25-45.

Pomeroy, L.R. 1980. Detritus and its role as a food resource, p. 84-102. *In* R.S.K. Barnes and K.H. Mann (eds.) Fundamentals of aquatic ecosystems. Blackwell Scientific, Oxford, UK.

Rao, T.S.S. and S.R.S. Nair. 1984. Trophic relationships in mangrove ecosystems, a summary, p. 87-91. *In* Report of the Second Introductory Training Course on Mangrove Ecosystems, UNDP/UNESCO.

Sambasivam, S. and K. Krishnamurthy. 1986. Mangrove foliage in the diet of the penaeid prawn, *Peneaus indicus*. Indian J. Mar. Sci. 15:114-116.

Sumitra-Vijayaraghavan and S. Wafar. 1983. Further studies in using mangrove foliage as prawn feed. Mahasagar 16(3):309-316.

Tharadevi, C.S. 1989. Energy content and utilization of mangrove vegetation. Madurai Kamaraj University, Madurai, Tamil Nadu, India. M.Phil. thesis. 70 p.

S. ATHITHAN *and* V. RAMADHAS *are from the Fisheries College and Research Institute, Tuticorin - 628 008, India.*