EVALUATION OF POLYCHAETE (*Nereis cultrifera)* MEAL AS AN INGREDIENT IN SHRIMP BROOD-STOCK FEED

[1]R. SURESH KUMAR, [2]P. ANANDAN, AND [3]R. KRISHNAMURTHY,

P.G. & Research Department of Advanced Zoology and Biotechnology, Government Arts College, Nanthanam, Chennai Tamil Nadu, India - 600 035.

Abstract: Marine polychaete worms, both wildly collected and farmed are used as live bait for fishing and majorly as live broodstock feed in shrimp hatcheries. In this study naturally collected polychaete worms were freeze dried and added as an ingredient in formulated shrimp broodstock diet. The experiment was carried out for fourty five days. Ten *Litopenaeus vannamei* brooders of which five males and five females were made into a batch. Four such batches were stocked in individual tanks and fed with four different types of pellet diet, with six time feed intervals in a day. Feed is formulated using base ingredient as 30%, 60% and 100% freeze dried polychaete meal replacing proportionate quantity of fish meal. Growth characteristics, feed acceptability and FCR were tested and the experiment shown that the feed formulated with 60% of polychaete meal has shown a better growth rate compared to other formulations.

Index Terms **:** *Polychaete worms, Ennore estuary, L vannamei brood stocks, Nereidae.*

I.INTRODUCTION

Polychaetes are considered as an important source of live feed for marine carnivores. They contain long chain fatty acids, prostaglandins and bromo-phenols, with the latter attributed to enhance the seafood flavor of the farmed products. Shrimp hatcheries in India use the polychaete worms *N. cultrifera* collected from the East coast of South India especially in the regions of Ennore estuary, Cuddalore, Mandapam etc and other species are imported from various countries. Especially members of the Nereidae (e.g. *Nereis virens* - Netherlands, *N. Nuntia* - Thailand, *N. diversicolor* - China, *N.aibuhitensis* - Taiwan) are currently being used and cultured for this purpose.

The use of polychaetes for feeding crustaceans and fish is also increasing because it ensures adequate nutrition for reared brood-stock. Polychaete worms have been identified as a source of essential fatty acids and have an important role in the development of the gonads. Generally, the best results come from high lipid, coldwater species such as *Nereis* spp. and *Glycera* spp.

Bloodworms (marine polychaetes *Glycera dibranchiata* and *Americonuphis reseii* and *Artemia biomass* (ongrown Artemia) are used for diet supplementation. Bloodworm is the most expensive ingredient used in hatcheries of the Western atmosphere, and maturation operators feel it to be indispensable for stimulation of ovarian maturation[1]. Artemia biomass usually boosted with specific nutrients has been reported to stimulate ovarian maturation, increase spawn frequency and improve larval quality[2,3&4]. Artemia biomass can also be included into artificial broodstock diets as a freeze-dried meal to increase. In most situations, a combination of fresh food and artificial diets gives better results than a feeding regime that consist of fresh food only [5,6,7&8]. The following study evaluated the use of formulated feeds containing polychaete meal (extracted from *Nereis cultrifera*) in the rearing of *Litopenaeus vannamei* growth trials.

II. MATERIALS AND METHODS

Broodstocks of Pacific white shrimp, *Litopenaeus vannamei* are imported by hatcheries and subsequently reared for seed production. Experiments were carried out with the brooders of the Coastal Shrimp hatchery, Nellore, Andhra Pradesh, India in their premises. The shrimp brooders were imported from Shrimp Improvement systems (SIS), Florida - USA. The Polychaete worms were collected wild from the Ennore estuary near Chennai and converted to freeze dried meal by the process of Lyophilization. The photographs of the collection process are given below.

The experiment was set up indoors as part of a recirculation system, which included mechanical and bio-filtration units, a protein skimmer and a sand filter. Water temperature was kept at 28°C, salinity at 32 ppt, and lighting was set at 12 hours daily. Temperature and DO levels were measured daily, while total ammonia nitrogen, nitrate, and pH were measured weekly.

Table 1 : Formulation and composition of experimental feeds (per kg as fed)

Formulation	Fish Meal	30% Polychaete	60% Polychaete	100% Polychaete
Ingredients				
Fish Meal	520	340	180	0
Polychaete Meal	0	180	340	520
Wheat Gluten	100	100	100	100
Potato Starch	280	270	260	255
Vitamin & Mineral	10	10	10	10
Di-calcium phosphate	0	10	20	30
Fish oil	50	50	50	45
Sodium Alginate	20	20	20	20

Analyzed Composition				
Dry matter (gm)	918	920	925	922
Ash (gm)	130	128	127	125
Lipid (gm)	102	106	109	107
Crude protein (gm)	410	413	400	392
Gross energy (MJ)	18.40	18.51	18.67	18.77
Digestible protein (gm)	352	354	344	338
Digestible energy (MJ)	14.83	14.72	14.67	14.53
DP/DE ratio (gm/MJ)	23.7	24.1	23.4	23.3

Different types of pellet diet were prepared by mixing the dry ingredients with a binder and water as per the composition listed in Table 1, extruded through a meat grinder and dried at 45°C in hot air oven for 24 hours. The resulting pellets had a diameter of 2.5mm and were stable up to 18 hours in water.

Growth trial

Four batches of ten *Litopenaeus vannamei* brood stocks with 5 males and 5 females of 20 gm weight initially were stocked in 1000 L tanks. Feeds were formulated to contain 40 percent protein and 10 percent lipid and include polychaete meal by replacing proportionate quantity of fish meal (Table 2). Shrimp were fed manually 5% of the total body weight up to six times daily. Any uneaten pellets were siphoned out at the end of the day and accounted for.

Fig.1. Wild Collection of Polychaete Worms In Ennore Estuary

Feed intake was thus quantified and evaluated in relation to growth response. The trial lasted for 45 days and shrimp were sampled initially and at the end of the experiment for subsequent growth analysis till they reach 35 gm body weight and ready for eye stalk ablation. Through comparative body composition of the shrimp carcass the relationship between dietary protein and energy intake is calculated. Protein and energy deposition was also assessed, which allowed estimation of the utilization efficiency of the feed ingredients incorporated in the diets.

Table 2 : Performance parameters of *L. vannamei* brooders fed with polychaete diet

Diet Treatment	**100% Fish Meal**	**30% Polychaete**	**60% Polychaete**	**100% Polychaete**
Weight initial (gm)	20.7±0.06	20.6±0.06	20.7±0.00	20.5±0.03
Weight final (gm)	35.5±0.37	36.0±0.22	36.3±1.01	35.4±0.45
SGR	1.20±0.08	1.24±0.09	1.26±0.18	1.21±0.25
Feed intake (gm) Day/shrimp	1.035±0.02	1.030±0.03	1.035±0.05	1.025±0.04
FCR	3.15±0.17	3.01±0.26	2.99±0.19	3.10±0.17
Survival rate	90%	90%	100%	90%

III. RESULTS

Polychaete containing feeds were well accepted by the shrimp and results indicated that digestibility and efficacy of polychaete meal was equivalent to fishmeal. Effects on the supplementation of freeze dried wild polychaete to a basal formulated diet for penaeid shrimp have not been yet well documented. Survival of shrimp on all dietary treatments was above 84% with no significant difference among treatments. There was also no significant difference in growth and FCR of shrimp at any time during the experiment. Nevertheless, there is a trend that shrimp on the 'combination' diets were growing slightly faster than the diets based on a single ingredient. Equally, no difference in whole body composition of shrimp was detected among the different treatments (Table 3).

The efficiencies of energy and protein utilization were calculated from energy and protein gained in relation to energy and protein consumed. Here, the superiority of the 'mixed' feeds was more apparent. Gross energy retention efficiency was 15.1 percent for *L. vannamei* fed the 60% polychaete meal, which was significantly higher than the energy efficiency of shrimp on the fish meal and polychaete meal only diets. Similarly the crude protein retention efficiency was significantly higher for *Litopenaeus vannamei* fed the 60 percent polychaete at 22.7 percent compared to shrimp fed the single ingredient diets. No significant difference was observed for energy or protein retention efficiency for shrimp fed with the polychaete only diet compared to the 100 percent control fishmeal diet.

Table 3 : Proximate composition of Brood-stock *L. vannamei* fed diets containing polychaete meal at increasing levels (per gm wet weight)

Dietary treatment	Initial	Fishmeal	30% Polychaete	60% Polychaete	100% Polychaete
Dry Matter (gm)	210	230±6.6	233±8.4	244±9.1	232±11.6
Ash (gm)	30.0	29.3±1.8	27.1±2.0	28.3±0.7	28.0±0.5
Protein (gm)	1.44	162±3.7	162±6.5	170±8.2	161±8.9
Energy (kj)	3.92	4.61±0.1	4.81±0.3	5.13±0.2	4.84±0.3

IV. DISCUSSION

In the present study, effects on the supplementation of freeze dried wild polychaete to a basal formulated diet for penaeid shrimp have not been yet well documented. Growth in captivity of *Nereis diversicolor* was has been successful[9]. *N. diversicolor* has traits that promote its growth, such as a totally benthic life cycle, easy artificial fertilization and lecithotrophic larvae (larvae with food reserves). This last trait results in the delay of the beginning of feeding, which allows the larvae to be fed early with the same food given to adults. Under

laboratory conditions, which is an important step for beginning of its culture, this species demonstrates the ability to use a variety of food items, such as extruded soy, Artemia cysts and pollen, and apparently is able to biosynthesize and metabolize some fatty acids[10]. In fact, it has been demonstrated that under nutrient enrichment conditions, the surface deposit-feeding behavior of *Hediste diversicolor* is enhanced over suspension feeding and/or predation[11].

In the similar reporters Feng and Wang[12] reported that shrimp peptides used feeding stimulant may be useful and low-cost method of improving feed acceptability and growth performance of cultured *Peneaus vannamei*, soybean-based diet as well as those fed a fish meal-based diet. A greater percentage of shrimp (68%) moved toward the position where the diet contining *Spirulina platensis* meal placed, and ingested the diet. It is concluded that the inclusion of 5% of *Spirulina platensis* meal improved the attractability of the feed for *Litopenaeus schmitti*[13]. Murai *et al*.[14] documented that experiment was undertaken to test the effect of supplemental krill meal, earthworm meal, glycine, sucrose or mussel water on diet attractibility of *Penaeus monodon*. Only glycine or mussel water significantly improved diet attractibility.

V. CONCLUSION

Present experiment demonstrated that inclusion of freeze dried polychaete meal in the maturation diet of *L. vannamei* is effective and supported equal growth performance and feed efficiency compared to a standard fish meal diet. Moreover, freeze-dried polychaete meal could thus serve as a total substitution for fishmeal. The final decision however is dependent upon availability and price of the product.

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