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Alava, Veronica R. & Pascual, Felicitas P.

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Carbohydrate Requirements of *Penaeus monodon* Juveniles

Veronica R. Alava and Felicitas P. Pascual

Aquaculture Department
Southeast Asian Fisheries Development Center
P.O. Box 256, Iloilo City, Philippines

Penaeus monodon juveniles (initial mean weight=0.62 g) were fed semi-purified diets containing 10, 20 and 30% trehalose, sucrose or glucose for eight weeks. Results showed that shrimps fed 20% trehalose gave the highest growth rate. Of the three types of sugars tested, trehalose promoted the best growth rates, followed by sucrose and glucose. When the level of sugar was considered, 20% gave the best growth rate and 30%, the lowest. The type as well as level of sugar greatly affected the body crude protein and body lipid ($P < 0.01$), while survival was mainly affected by type of sugar alone ($P < 0.01$). Trehalose and sucrose diets promoted better survival than glucose diets. A negative linear correlation ($r = -0.70$) between the body crude protein and body lipid was obtained.

Earthworm, Marine Annelids and Squid as Feed Ingredients in Formulated Diets for Juvenile *Penaeus monodon*

Felicitas P. Pascual

Aquaculture Department
Southeast Asian Fisheries Development Center
P.O. Box 256, Iloilo City, Philippines

Earthworm and annelids were incorporated in diets for *Penaeus monodon* juveniles (mean weight 0.54 g) either in wet or dry form. These protein sources were added in amounts needed to replace 10% of the animal source of protein. Other sources of protein in the diet were shrimp head meal, fish meal, and defatted soybean meal. Diets were computed such that two-thirds of total protein came from animal sources and one-third from vegetable sources. Other components of the diet were rice bran, sago palm starch, cod liver oil and a vitamin-mineral mixture. Another diet, used as maintenance diet, served as control. Postlarvae were randomly stocked at 6 individuals/tank in a flowthrough system with 5 replicates/treatment. Each of the oval fiberglass tanks had three 10-cm diameter PVC pipes for shelter. The prawns were fed 10% of biomass twice daily.

Although treatment means for percent weight gain were not significantly different, the diet that contained dried earthworm or annelid meal gave higher weight gain than diets containing the wet form. The earthworm diet gave higher weight gain than diets containing annelids. Survival rate also followed a similar pattern as that of weight gain. Shrimp fed earthworm (wet or dried) gave survival rates numerically

higher than those fed marine annelids. Shrimp fed the control diet had survival rates lower than those fed earthworm-containing diets but higher than those fed the wet annelid diet.

In another experiment, earthworm or squid was incorporated in the diet. Survival rates of shrimp with earthworm or squid in the diet were significantly higher than those fed the control. Weight gains were not significantly different from each other. Food conversion was generally low. The drawback in the use of earthworm, annelids and squid is that they are relatively expensive compared to fish meal and shrimp head meal.

Effects of Some Water-Soluble Vitamins on the Growth of *Penaeus monodon* Juveniles

Mae Catacutan

Aquaculture Department
Southeast Asian Fisheries Development Center
P.O. Box 256, Iloilo City, Philippines

and

Akio Kanazawa

Faculty of Fisheries, Kagoshima University
4-50-20 Shimoarata-cho, Kagoshima 890, Japan

The response of *Penaeus monodon* juveniles (ave. wt.=0.076 g) in terms of survival and growth rates to vitamin test diets was observed in a 35-day feeding experiment. The prawns were reared in 60-l oval tanks containing filtered seawater in a flowthrough system of ambient temperature and salinity. The treatments consisted of a control (complete vitamin mix), a vitamin-free diet and nine other diets, each lacking one of the vitamins in the mixture. At the end of the feeding trial, the survival rates in all treatments ranged from 80 to 100%, while weight gain ranged from 74 to 40%. Significantly lower weight gains were obtained from choline chloride-free diet ($P < 0.05$) and vitamin-free and inositol-free diets ($P < 0.01$) than from control.

Ruppia maritima and *Najas graminea* as Natural Foods for *Penaeus monodon* Juveniles

Jurgenne H. Primavera and
Rogelio Q. Gacutan

Aquaculture Department
Southeast Asian Fisheries Development Center
P.O. Box 256, Iloilo City, Philippines

Ruppia maritima (*kusay-kusay*, Hiligaynon) and *Najas graminea* (*digman*, Hiligaynon) are macrophytes growing in local brackishwater ponds believed to provide food and shelter to prawns and fishes. Their effect on growth and sur-