A Special Feed for Maturing *Penaeus indicus* Broodstock

Field of the Utility Model

The present utility model relates to the technical field of a fish feed composition. Particularly, it relates to a composition of a special feed for maturing *Penaeus indicus* broodstock, with appropriate levels of lipid and protein that will enhance maturity and develop better egg cell.

Background of the Utility Model

Gonadal maturation is crucial for shrimp hatcheries in order to produce more larvae. Diets for promoting gonad maturation is mainly available in fresh diets and artificial diets are rarely used. A formulated maturation diet which efficiently promotes gonadal maturation and improves larval quantity and quality is beneficial for hatchery operations since it has well-defined nutritional content, long shelf life, stable supply and, most importantly, has low risk of contamination (Chimsung, 2014; Tacon, 2017; Wouters, Lavens, et al., 2001). This is ideally comprised of natural food ingredients usually found around the shrimp habitat.

Gonad maturation start after the eyestalk ablation is performed on female individuals. It is the removal of one or both eyestalks from a crustacean. It is routinely practiced on female shrimps in almost every marine shrimp for onset of reproduction.

A well formulated diet for shrimp gonadal maturation also efficiently improves larval quantity. This is beneficial for hatchery operations since it has well-defined nutritional content, long shelf life, stable supply and, most importantly, has low risk of contamination (Chimsung, 2014; Tacon, 2017; Wouters, Lavens, et al., 2001).

Formulation includes excellent digestible protein, essential fatty acids, and cholesterol and chemo-attractant properties. Fresh feeds typically including polychaete worms, mollusks and crustaceans have been extensively used for shrimp broodstock. Unfortunately, the use of fresh diets is not often recommended due to unpredictable supply and quality (Chimsung, 2014; Wouters et al., 2001; Xu, Zhang, et al., 2017). One of the main components of live feed, polychaetes was also reported to contribut to vulnerability in potent crustacean diseases including white spot syndrome virus (WSSV) and acute hepatopancreatic necrosis disease (AHPND) (Haryadi et al., 2014).

Attempts on creating artificial feed diet formulation in replacement of fresh diets have been limited to moist artificial diet (Marsden et al., 1997) and artificial diets supplemented with fish oil and astaxanthin (Paibulkichakul et al., 2008), arachidonic acid (Xu, Zhang, et al., 2017) or incorporated with large amounts of polychaete meal (Nguyen et al., 2008) or its extracts (Nguyen et al., 2012) were found to yield encouraging results.

Registered patents for shrimp diet for gonad maturation include CN106973834B, CN112841455A, CN112841456A, CN111109449A. These patents included promotion of gonad maturity for a short period of time that would ease hatchery production time. However, most of these still included fresh diets and only limited to selected species. It is noted that different species requires different nutrient needs.

The Indian white prawn, *Penaeus indicus,* is a commercially important aquaculture species and is indigenous in the Philippines. It has a recorded aquaculture production of 1,645.89 Metric tons in 2015 (Fisheries Statistics 2013-2015). Most of the earlier works on the nutrient requirement of this species had focused on the determination of the optimum levels of the growing juvenile. Gonad maturation studies for this species is limited. The problem lies in the availability of feed diets that will help its reproductive capability and increase its hatchery potential and increase its production.

Thus, the object of the present utility model is a feed composition for maturing *Penaeus indicus* broodstock with proper dietary protein and lipid levels that promotes gonad maturity and egg diameter and is comparably effective than using fresh maturation diets.

Summary /Objective of the Utility Model

This utility model relates to the technical field of a composition of gonad maturation diet for *Penaeus indicus* comprising of 45-55% of protein and 12% lipid. The said formulation per 100 grams is further comprising of: Shrimp meal (19.7 -24.6g), Danish Fish meal (19.7-24.6g), Squid meal (19.7-24.6g), Cod liver oil (0-13g), Cholesterol (1.0g), Wheat flour (7.2-14.9g), Gluten (6.0g), Vitamin mix (2.0g), Vitamin C (1.0g), Choline chloride (1.0g), and Mineral mix (2.0g). The vitamin mix per 1 kilogram is further comprising of vitamin A (1,200,000 IU), D3 (200,000 IU), E (20,000 IU), B1 (8,000 mg), B2 (8,000 mg), B6 (5,000 mg), B12 (2,000 mg), niacin (40,000 mg), calcium pantothenate (20,000 mg), biotin (40 mg), folic acid (1,800 mg), and ethoxyquin (500 mg). The mineral mix per kilogram is further comprising of iron (40,000 mg), manganese (10,000 mg), zinc (40,000 mg), copper (4,000 mg), iodine (1,800 mg), cobalt (20 mg), and selenium (200 mg). The diet composition is further comprising of 45%-55% protein and 12%-18% lipid. The feed is produced by dissolving the mixture of cod

liver oil and were blended with the other dry ingredients using a mixer. Water was added to the feed mass, pelletized, steamed for 5 minutes and dried in an oven at 60ºC.

The main object of the present utility model is to provide a diet composition for Indian white prawn (*Penaeus indicus*) that promotes gonad maturation and suitable egg diameter. Another objective also is to provide hatchery farmers a lesser time in fry production.

Brief Description of the Drawing

There is illustrated:

Figure 1. Maturation rate (±SEM) of P. indicus. Y-axis = lipid levels, x-axis = MR, lines = MR per protein level within each lipid level.

Figure 2. Egg diameter and oocyte density in ovary of P. indicus fed artificial maturation diets 45/18 and 55/12 and control diets.

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Detailed Description of the Utility Model

The present invention discloses a feed composition preferably for a diet formulation white tiger prawn (*P. indicus*) that promotes gonad maturation comprising of 45-55% protein to 12% lipid. The said formulation per 100 grams is further comprising of: Shrimp meal (19.7 -24.6g), Danish Fish meal (19.7-24.6g), Squid meal (19.7-24.6g), Cod liver oil (0-13g), Cholesterol (1.0g), Wheat flour (7.2-14.9g), Gluten (6.0g), Vitamin mix (2.0g), Vitamin C (1.0g), Choline chloride (1.0g), and Mineral mix (2.0g). The vitamin mix per 1 kg mixture comprises of vitamin A (1,200,000 IU), D3 (200,000 IU), E (20,000 IU), B1 (8,000 mg), B2 (8,000 mg), B6 (5,000 mg), B12 (2,000 mg), niacin (40,000 mg), calcium pantothenate (20,000 mg), biotin (40 mg), folic acid (1,800 mg), and ethoxyquin (500 mg). The mineral mix per 1 kg mixture comprises of iron (40,000 mg), manganese (10,000 mg), zinc (40,000 mg), copper (4,000 mg), iodine (1,800 mg), cobalt (20 mg), and selenium (200 mg).

The feed diet for Indian white prawn is produced by the process comprising of:

1. Dissolving the mixture of cod liver oil.
2. Blending the oil with the other dry ingredients using a mixer.
3. Adding water to the feed mass.
4. Pelletizing the mixture.
5. Steaming the pellets for 5 minutes.

6. Drying the pellets in an oven at 60ºC.

It is further supported with the proximate analysis (Table 1) of the resulting diet which shows an ideal percentage compared to the other formulations to promote the gonad maturation of Indian tiger shrimp. The 45/18 ratio exhibited the lowest protein-lipid composition while the 55/12 ratio have the highest protein-lipid composition. This makes the 55/12 protein lipid ratio the most suitable for promoting gonad maturation.

Table 1. The proximate composition of the resulting diet with 45-55% Protein and 12-18% Lipid.

Feed Ratio (% Protein/Lipid)	Protein	Lipid	Ash	Fiber	Nitrogen Free Extract (NFE)
45/12	46.3	12.50	10.86	2.23	28.07
45/18	45.81	17.54	10.46	2.25	23.31
55/12	53.11	12.61	12.31	3.03	18.94

The resulting formulation has a survival rate of 90-96% which is relatively higher compared to the usual 93%. Specific growth rate per daily basis (SGR (%day^{-1}) is at 23-24% while the Maturation Rate (Fig. 1) is at 50-55% which means the growth of the fish is now directed toward gonadal maturation.

In Table 1, the Ovary Shadow Ratio (OSR), Hepatosomatic Index (HSI), And Gonadosomatic Index (GSI) of Penaeus indicus fed artificial maturation diet with different levels of protein and lipid is shown. The control diet was composed of fresh frozen squid, mussel and mud polychaete (*Marphysa sp*.) which is the common feed used in experimental studies. The diet formulations were higher than the control in terms of Ovary Shadow Ratio, Hepatosomatic Index (HSI), and Gonadosomatic Index (GSI). This indicates that the formulation diets content can support successful gonadal development of *P. indicus.*

Table 2. The Ovary Shadow Ratio (OSR), Hepatosomatic Index (HSI), And Gonadosomatic Index (GSI) of *Penaeus indicus* fed artificial maturation diet with different levels of protein and lipid.

Feed Ratio (% Protein/Lipid)	Ovary Shadow Ratio (%) (OSR)	Hepatosomatic Index (HSI)	Gonadosomatic Index (GSI)
45/12	46.59	3.97	3.62
45/18	42.58	4.37	2.98
55/12	42.28	4.08	3.17
Control*	42.88	2.48	2.15

In terms of oocyte density (Fig. 2) , the formulation was able to promote larger eggs (in terms of diameter (microns)) which is ideal in producing high quality fry. Results of the Oocyte density is not highly different from the fresh diet (control) which contributes to the effectivity of the diet.