FIELD COLLECTION AREA

The interception point in the River Cauvery at Jederpalayam of Cuddalore District of Tamil Nadu is a traditional collection spot of freshwater prawns *Macrobrachium malcolmsonii*. At Jederpalayam, cross the river Cauvery, a bed regulator is available which serves as a collection point for the migrating prawn. The collection center was visited once in a month and data were collected in respect of total landings in numbers, average size of prawn etc. The location of Jederpalayam near River Cauvery and the various landing centres are indicated in fig. 1 and 2.
FIG. 2 COLLECTION SPOT OF MACROBRACHIUM MALCOLMSONII
AT JEDARPALAYAM ACROSS CAUVERY RIVER

STANLEY RESERVOIR

SALEM DISTRICT

ERODE DISTRICT

CAUVERY RIVER

NAMAKKAL DISTRICT

KOTHAMANGALAM VILLAGE

BED REGULATOR WHERE THE SEEDS GET AGGLOMERATED
The bed regulator across River Cauvery at Jederpalayam
Photos showing the male and female
*Macrobrachium malcolmsonii* H.milne Edwards
2. ANIMAL FOR LABORATORY TEST

Test animals (M. malcolmsonii) were collected from Jederpalayam bed regulator during night hours and transported to the laboratory at Gandhigram University by oxygen packing. These animals were acclimatized for a fortnight before commencing the laboratory trials. Acclimatization was done in cement cisterns (5 feet 1 x 3 feet w x 3 feet h). The loading rate was 100 g / m2. During acclimatization the animals were fed with feed pellets having 25 percent protein twice a day (7 and 16h).

3. FEED FORMULATION FOR ESTIMATION OF PROTEIN REQUIREMENT

To assess the protein requirement of M. malcolmsonii (1.2 + 0.4 cm size), ten experimental feeds (feeds 1 to 10) were compounded with protein levels ranging from 18 to 36 percent at 2 percent interval as per Ali’s square method (1980). Raw materials like fishmeal, prawnmeal, groundnut oil cake, sesame oil cake, tapioca flour and rice bran were procured, cleaned, dried, powdered and passed through 425 micron sieve and analysed for protein (microkjeldhal), fat (soxhlet), ash (muffle furnace) and carbohydrate (difference method) values (AOAC. 1984).

Using Ali’s method the composition of the feed was calculated in the following way:

To calculate the composition of IS percent protein \( i \) ed (feed 1), the protein values of the raw materials to be incorporated in the feed were listed as indicated below.
M. Malcolmsonii larvae of different sizes

Feeding trial
vitamin and mineral mix and extruded in the form of noodles using an extruder having perforation of 1.2 mm diameter. The noodles were dried at room temperature first and then dried in hot air oven for 6h at 60°C and stored in airtight containers until use (Raj, 1989 and Daniel and Kalavalli, 1991).

5. PHYSICO CHEMICAL ANALYSIS OF THE FEED PELLETS

Feed pellets were tested for the diameter using a screw-gauge and the pellet stability was tested as per Hasting (1982) procedure. One gram of feed was taken in a wire gauze which was then immersed in water for one hour. The wet material along with the gauze was removed without much disturbance and dried to constant weight. The material that remained was known and expressed in percentage.

All the ten feed pellets were powdered and passed through 425 micron sieve and analysed for protein (microkjeldhal), fat (soxhlet), ash (muffle furnace), carbohydrate (difference method) and energy values (bomb calorimeter). The protein energy ratio was also calculated.

6. FEEDING TRIAL

Feeding trials were conducted on M.malcoimsonii of 1.2 ± 0.4 cm size using the ten feeds prepared (feeds 1-10). The animals were sorted into batches of ten each and weighed immediately with maximum care avoiding any injury or pronounced stress.
Then each batch was released in a rectangular plastic trough (45 cm x 35 cm w x 15 cm h) having 10 l of water fitted with aerators (Fig 3). Animals were fed *ad libitum* at 6, 12 and 18h with the experimental feeds. The unfed materials if any were removed after one hour and correction was made to compute the actual quantity consumed. Approximately 70 percent of the water was removed and replaced by fresh tap water on alternate days.

The experiments were conducted for 45 days with triplicates. The prawns were weighed once every 15 days and the experiments were terminated after 45 days. The prawns were sacrificed and dried in hot air oven at 60°C, powdered and the carcass was analysed for protein content. Other parameters like growth (difference between final and intial weight in g), average weight (final weight + intial weight / 2, in g), percentage of growth (growth (g)/ initial weight (g) x 100), gross growth efficiency (growth in g / feed consumed in mg x 100), rate of consumption (feed consumed in mg/ average weight in g x duration of experiment in days), rate of production (growth in mg / average weight in g x duration of experiment in days), feed conversion ratio (feed consumed in mg / growth in g), protein efficiency ratio (growth in g / dry protein consumed in g) and protein energy ratio (protein in g / calorific value) were calculated.

7. SELECTION OF OPTIMUM PELLET SIZE

Presentation of the feed in a suitable form is an important factor to be considered while preparing the feed. Though dry
pellets are convenient for preparation and administration, care should be taken to administer pellets of suitable size for prawns of various sizes. Naturally smaller prawns have smaller mouth and larger prawns have larger mouth and hence it is essential to find out the optimum pellet size suitable for rearing juveniles of different sizes. To find out the same, pellets of various diameters were prepared using perforated dyes of different diameters. Feed pellets having 30 percent protein were compounded as per Ali's square method (1980) using fishmeal, prawnmeal, groundnut oil cake, sesame oil cake, tapioca flour, rice bran and vitamin and mineral mix following the procedure of Raj (1989). The kneaded dough was passed through extruders with perforations of various diameters (0.25, 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5 and 5.0 mm), dried and stored in airtight containers. All the above feed pellets (feeds 11-21) were analysed for physico-chemical parameters like size, stability, rate of sinking and percentage of protein, fat, carbohydrate, ash and energy values.

Sinking rate of pellets was measured in the following way. Ten pieces of pellets of each feed having different length was selected and dropped on the surface of glass cylinder filled with water (one meter depth and 5 cm diameter). The settling time of each pellet was recorded and the average rate of sinking was determined.

A feeding trial was conducted for 45 days using the juveniles of four different sizes (1.2 ± 0.2, 3.2 ± 0.2, 5.1 ± 0.1 and 7.1 ± 0.3 cm) on the feed pellets to find out the optimum size of the pellet suitable to their size. Juveniles of 1.2 ± 0.2 cm size
were tested on pellets of 0.25, 0.5, 1.0, 1.5, 2.0, 2.5, 3.0 and 3.5 mm diameters. Animals of 3.2 ± 0.2 cm and 5.1 ± 0.1 cm were tested against pellets of all the eleven diameters and animals of 7.1 ± 0.3 cm size were tested against pellets of all the sizes except the first three as indicated in the table below.

<table>
<thead>
<tr>
<th>Pellet size (mm)</th>
<th>0.25</th>
<th>0.49</th>
<th>1.01</th>
<th>1.49</th>
<th>2.00</th>
<th>2.47</th>
<th>3.00</th>
<th>3.51</th>
<th>4.02</th>
<th>4.51</th>
<th>5.01</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>± 0.3</td>
<td>± 0.01</td>
<td>± 0.02</td>
<td>± 0.04</td>
<td>± 0.05</td>
<td>± 0.07</td>
<td>± 0.09</td>
<td>± 0.03</td>
<td>± 0.02</td>
<td>± 0.04</td>
<td>± 0.05</td>
</tr>
</tbody>
</table>

* indicates the pellets tested  ○ Indicates the pellets not tested

The rate of consumption, rate of production, feed conversion ratio, percentage of growth, gross growth efficiency and protein efficiency ratio were calculated and the size of pellet suitable for culturing juveniles of 1.2 ± 0.2, 3.2 ± 0.2, 5.1 ± 0.1 and 7.1 ± 0.3 cm size was optimized.

8. FEEDING REGIME

In nature, *M. malcolmsonii* exhibits the habit of continuous feeding both during day and night. While feeding this species, this natural feeding habit also should be taken care of, otherwise it may lead to poor growth rate. Hence experiments were carried out to find out the effect of different feeding frequencies on the feed intake and production in the juveniles of *M. malcolmsonii* of four
different sizes. Animals of 1.1 ± 0.1, 3.2 ± 0.2, 5.1 ± 0.1 and 7.1 + 0.2cm size were selected from the well acclimatized juveniles and subjected to chosen feeding regimes viz. once a day, twice a day, thrice a day, four times a day, five times a day and six times a day over a period of 45 days. All the four groups were fed on isoproteinaceous (30 percent) feed pellets of various sizes (diameter) i.e. feeds 22, 23, 24 and 25. The animals were fed at a rate of 8 percent of the body weight following the earlier experience gained in the laboratory.

The time of administration of feed is indicated below.

<table>
<thead>
<tr>
<th>Feeding regimes</th>
<th>Notation</th>
<th>Hours of feeding during a day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Once a day</td>
<td>1/1</td>
<td>6</td>
</tr>
<tr>
<td>Two times a day</td>
<td>2/1</td>
<td>6 &amp; 12</td>
</tr>
<tr>
<td>Three times a day</td>
<td>3/1</td>
<td>6, 12 &amp; 18</td>
</tr>
<tr>
<td>Four times a day</td>
<td>4/1</td>
<td>6, 12, 18 &amp; 21</td>
</tr>
<tr>
<td>Five times a day</td>
<td>5/1</td>
<td>6, 9, 12, 15 &amp; 18</td>
</tr>
<tr>
<td>Six times a day</td>
<td>6/1</td>
<td>6, 9, 12, 15, 18 &amp; 21</td>
</tr>
</tbody>
</table>

Feed was equally divided into required number of portions depending on the feeding regime and administered at various hours of the day as indicated in the table. Excess feed was collected after an hour, dried and weighed and correction was made to arrive at the actual quantity of the feed consumed. The rate of consumption, rate of production, feed conversion ratio, gross growth efficiency and protein efficiency ratio were
calculated and the optimum feeding regime suitable for culturing the juveniles of *M. malcolmsonii* was identified.

9. FEEDS USING CONVENTIONAL AND NON-CONVENTIONAL INGREDIENTS

**EXPERIMENT-!**

A set of ten different feeds were prepared (feeds 26 - 35) incorporating different conventional and non-conventional protein sources of animal and plant origin. Prawnmeal fishmeal, groundnut oil cake, sesame oil cake, ricebran, tapioca, bajra (*Permisetum americamtm*), ragi (*Eleusine coracana*), greengram (*Phaseolus aureus*), soybean (*Glycine max*) and spirulina (*Spiridina fusiforms*) were procured, cleaned, dried and powdered. Pilameal (*Pila globosa*) was prepared in the laboratory by boiling the deshelled and chopped mollusks for 30 minutes and separating the solid portion by squeezing through a clean cotton cloth and drying at 60° C and then powdering.

The ingredients were mixed to get isoproteinaceous feeds containing 30 percent protein and prepared into dry pellets and the feed pellets were tested for size, pellet stability, protein, fat, carbohydrate, ash and energy values. The protein energy ratio was also calculated.

Feeding trials were conducted as per the procedure indicated earlier using *M. malcolmsonii* of 1.3 ± 0.3 cm size (10 organisms in each trough with triplicates) for all the ten feeds (feeds 26 to 35) following a feeding regime of four times a day (6, 12, 18 and
21 h) for a period of 45 days. The rate of production, feed conversion ratio, percentage of growth and protein efficiency ratio were calculated and ideal combinations suitable for the cultivation of *M. malcolmsonii* were identified.

**EXPERIMENT-2**

There is always a heavy demand for feed materials of animal husbandry. The production of the above is unable to meet the demand and hence an attempt was made in the present study to incorporate greengram *Phaseohis aureus* which is a locally available legume, in the feed of prawn, in the place of oil cakes. But this legume is known to posses antinutritional factors (Al-Bakir *et al.*, 1982) and hence it was subjected to certain simple physical treatments to reduce the antinutritional factors and to improve the digestibility before incorporating the same in the feed. A control feed incorporating oil cakes and five experimental feeds incorporating the processed greengram were compounded for this experiment. The treatments carried out were as follows:

- **Drvina** - The whole seeds were cleaned and dried in hot air oven at 60° C

- **Soaking** - The whole seeds were soaked in tap water for 24h. The excess water was drained, the seeds were washed with fresh tap water and then dried in hot air oven at 60° C.
Roasting - The whole seeds were subjected to roasting in open pan till they turned golden yellow in colour.

Autoclaving - The whole seeds were autoclaved for 30 minutes with excess of water at 15 lb pressure and the autoclaving medium was drained. The seeds were then washed in fresh tap water and dried in hot air oven at 60°C.

Germination - The whole seeds were soaked in tap water for 24h, tied tightly in cloth bags and allowed to germinate in moist condition. The germinated seeds were dried in hot air oven at 60°C.

The seeds subjected to the above treatments were separately powdered and incorporated in the feed along with other ingredients like fishmeal, prawnmeal, wheat flour, rice bran and vitamin and mineral mix. A control feed (groundnut oil cake) and five experimental feeds incorporating greengram subjected to various treatments (feeds 36 to 42) were prepared in the form of isoproteinaceous (30 percent) dry pellets (1.20mm diameter). The pellets were analysed for physico chemical composition. A 45-day feeding trial was conducted using *M. malcohnsonii* of 1.2 ± 0.4 cm. The animals were fed on the control and experimental feeds at the rate of eight percent of the body weight. The feed was administered four times a day at 6, 12, 18 and 21 h. The live
height budget and the protein efficiency ratio were calculated. The above trials were carried out in triplicate.

EXPERIMENT-3

Since heat treatments of plant materials are known to improve the growth rate of prawn (as per Experiment-2 above), experiments were initiated to study the difference between the effect of dry heat (roasting) and moist heat (autoclaving) on the plant protein sources before incorporating them in the feed. It is also known that the time taken for such treatments helps in improving the feed quality considerably (Kato et al., 1981). Hence another set of feeds were prepared in which the plant protein sources like groundnut oil cake, sesame oil cake, bajra, and ragi were subjected to heat treatments to improve the feed quality and to reduce antinutritional factors. Groundnut oil cake and sesame oil cake were broken into very small pieces and the whole grains of bajra and ragi were cleaned. All these plant protein sources were subjected to treatments like roasting and autoclaving as follows.

Mild roasting - The ingredients were separately subjected to mild roasting in an open pan till the material became golden yellow.

Intense roasting - The ingredients were separately subjected to intense roasting in an open pan till the material became brown.
Autoclaving for 20 minutes - The ingredients were separately autoclaved for 20 minutes with excess of water at 15 lb pressure. The autoclaved medium was drained and ingredients were dried in hot air oven at 60°C and then powdered.

Autoclaving for 30 minutes - The ingredients were separately autoclaved for 30 minutes with excess of water at 15 lb pressure. The autoclaved medium was drained and ingredients were dried in hot air oven at 60°C and then powdered.

The ingredients like fishmeal, prawnmeal, groundnut oil cake (raw and treated), sesame oil cake (raw and treated), bajra (raw and treated), ragi (raw and treated) and vitamin and mineral mix were mixed and prepared in the form of isoproteinaceous (30 percent) dry pellets (1.2 mm diameter). The pellets (feeds 42 to 46) were subjected to physico chemical analysis and administered four times per day at 6, 12, 18 and 21 h in triplicates at the rate of 8 percent of body weight. A 45-day feeding trial was conducted using juveniles of *M. malcolmsonii* of 1.3 ±0.3 cm size against the control (raw) and four experimental feeds (treated) and the live weight budget and the protein efficiency ratio were calculated following the formula mentioned earlier.