UNIVERSITI PUTRA MALAYSIA

EVALUATION OF FREE-LIVING NEMATODES PANAGRELLUS REDIVIVUS AS STARTER FOOD FOR MALAYSIAN RIVER CATFISH, MYSTUS NEMURUS (CUVIER AND VALENCIENNES) LARVAE

MANUEL ALBAN LARON

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By

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Thesis Submitted in Fulfilment in the Requirement for the Degree of
Master of Science in the Faculty of Agriculture
Universiti Putra Malaysia

October 2001

DEDICATION

This thesis was written in memory of my most beloved father and mother Fructouso Laron and Gregoria Alban.

This work is also dedicated to all researchers who had contributed directly and indirectly in the quest of knowledge.

Abstract of the thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Master of Science

EVALUATION OF FREE-LIVING NEMATODES *PANAGRELLUS REDIVIVUS* AS STARTER LIVE FOOD FOR MALAYSIAN RIVER CATFISH, *MYSTUS NEMURUS* (CUVIER AND VALENCIENNES) LARVAE

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October 2001

Chairman: Associate Professor Dr. Mohd. Salleh Kamarudin

Faculty: Agriculture

The performance of *Panagrellus redivivus* on growth and survival of *Mystus nemurus* larvae was assessed in this study. Prior to the assessment study, the optimal stocking condition for *M. nemurus* larvae was determined.

A stocking density of 10 larvae L^{-1} gave the highest growth and survival during the 16-days rearing period. However a stocking range of 25-43 larvae L^{-1} was recommended for commercial hatchery production. The performance of *P. redivivus* was compared with *Brachionus* spp., *Moina* spp., *Chironomus* spp. and *Artemia* sp. Larvae fed with *Chironomus* spp. exhibited the best growth ($P<0.05$) compared to those fed with *P. redivivus, Brachionus* spp., *Moina* spp. and *Artemia* sp. No significant differences in growth were found among those fed with the later live foods. Nevertheless, these live foods gave

a significantly higher survival than *Chironomus* spp. In the following study, *M. nemurus* larvae fed smaller *P. redivivus* on the first week followed by bigger *Chironomus* spp. showed improved survival and growth than those fed on *Chironomus* spp. or *P. redivivus* alone. This combination also gave better results than those of *Artemia* nauplii.

Another study was conducted to determine the optimal feeding density of *P. redivivus* for *M. nemurus* larvae. The results of two feeding trials showed that the optimum feeding density on the first week and second week of feeding were 60 nematodes mL^{-1} and 125 nematodes mL^{-1}, respectively. This feeding regime was adopted in the following experiment.

Finally, *P. redivivus* was evaluated as the first food for the weaning of *M. nemurus* larvae to an artificial diet. The results showed no significant effect ($P>0.05$) of gradual weaning from Day 4 and direct weaning at Day 8 of exogenous feeding with *P. redivivus* as the first food on the survival and growth of catfish larvae. *P. redivivus* was found to be suitable as an *Artemia* replacement (as the first food) for the weaning of *M. nemurus* larvae.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Master Sains

PENILAIAN NEMATOD *PANAGRELLUS REDIVIVUS* SEBAGAI MAKANAN AWAL LARVA IKAN BAUNG, *MYSTUS NEMURUS* (CUVIER DAN VALENCIENNES)

Oleh

MANUEL ALBAN LARON

Oktober 2001

Pengerusi : Prof. Madya Dr. Mohd. Salleh Kamarudin

Fakulti : Pertanian

Prestasi nematod *Panagrellus redivivus* ke atas pertumbuhan dan kemandirian larva ikan baung (*Mystus nemurus*) telah dinilai dalam kajian ini. Sebelum kajian penilaian dijalankan, kadar perlepasan optimum bagi larva ikan baung telah ditentukan.

Kadar perlepasan 10 larva L^{-1} telah memberi pertumbuhan dan kemandirian tertinggi dalam tempoh 16 hari pengkulturan. Kadar perlepasan 25-43 larva L^{-1} bagaimanapun telah disarankan untuk pengeluaran benih ikan baung secara komersial. Prestasi *P. redivivus* telah dibandingkan dengan *Brachionus* spp., *Moina* spp., *Chironomus* spp. dan *Artemia* sp. Larva yang diberi *Chironomus spp.* menunjukkan pertumbuhan tertinggi ($P<0.05$) berbanding dengan larva yang diberi makanan hidup lain. Tidak ada perbezaan ketara dalam pertumbuhan didapati di antara makanan hidup selain nematod. Bagaimanapun makanan hidup ini memberikan peratus

kemandirian yang ketara ($P<0.05$) lebih tinggi daripada *Chironomus* spp. Dalam kajian yang berikutnya, pemberian *P. redivivus* yang bersaiz kecil pada minggu pertama diikuti dengan *Chironomus spp.* yang bersaiz lebih besar pada minggu yang seterusnya dapat mempertingkatkan lagi pertumbuhan dan kemandirian larva berbanding dengan larva yang hanya diberi *Chironomus* spp. atau *P. redivivus* sahaja. Kombinasi ini juga memberi keputusan yang lebih baik dari nauplii *Artemia*.

Satu lagi kajian telah dijalankan untuk menentukan kepadatan optimum pemberian makanan *P. redivivus* kepada larva ikan baung. Keputusan dari dua percubaan menunjukkan kepadatan pemakanan optimum pada minggu pertama dan kedua ialah pada 60 nematod mL^{-1} dan 125 nematod mL^{-1}, masing-masing. Regim pemberian makanan ini digunakan untuk eksperimen yang seterusnya.

Pada penghujung kajian, prestasi *P. redivivus* sebagai makanan awal dalam penyampihan larva ikan baung ke diet tiruan dinilai. Keputusan kajian menunjukkan tidak ada perbezaan ketara ($P>0.05$) pada kemandirian dan pertumbuhan larva di antara penyampihan beransur bermula dari hari ke-4, atau penyampihan terus pada hari ke-8 selepas larva memulakan pemakanan eksogenus. Dalam kajian ini, *P. redivivus* didapati sesuai sebagai pengganti *Artemia* (sebagai makanan awal) dalam penyampihan larva ikan baung (*Mystus nemurus*).

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And above all, to the God Almighty for making all this possible.

I certify that an Examination Committee met on 18th October 2001 to conduct the final examination of Manuel Alban Laron on his Master of Science thesis entitled "Evaluation of Free-living Nematodes *Panagrellus redivivus* as Starter Food for Malaysian River Catfish, *Mystus nemurus* (C&V) Larvae" in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulations 1981. The committee recommends that the candidate be awarded the relevant degree. Members of the examination Committee are as follows:

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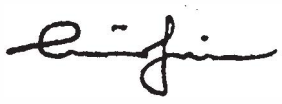
This thesis submitted to the senate of the Universiti Putra Malaysia has been accepted as fulfilment of the requirement for the degree of Master of Science.



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DECLARATION

I hereby declare that the thesis is based on my original work except for quotations and citations, which have been duly, acknowledge. I also declare that it has not been previously or concurrently submitted for any other degree at UPM or other institutions.

Manuel Alban Laron

Date: 15/11/2001

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LIST OF ABBREVATIONS

ANOVA	Analysis of Variance
AOAC	Association of Official Analytical Chemist
BW	Body weight
BSA	Bovine Serum Albumin
C & V	Cuvier and Valenciennes
$CHCl_3$	Chloroform
CH_3OH	Methanol
CRD	Complete Randomized Design
DHA	Decosahexanoeic acid
DMRT	Duncan Multiple Range Test
DW	Dry weight
DO	Dissolved oxygen
EFA	Essential fatty acid
Expt.	Experiment
FAME	Fatty acid methyl esters
HCL	Hydrochloric acid
H_2SO_4	Sulfuric acid
HUFA	Highly unsaturated fatty acid
MSA	Methanol sulfonic acid
MUFA	Mono unsaturated fatty acid
N	Normality

NaCl	Sodium chloride
NaOH	Sodium hydroxide
NPK	Nitrogen Potassium Phosphorous
NPU	Net protein utilization
RGR	Relative growth rate
RPM	Revolution per minute
SAS	Statistical analysis system
SEAFDEC	Southeast Asian Fisheries Development Center
SFA	Saturated fatty acid
SRG	Specific growth rate
SEM	Standard error of mean
TRT	Treatment
µm	Microgram
UPM	Universiti Putra Malaysia
UV	Ultra violet
YSI	Yellow spring instrument

CHAPTER I

INTRODUCTION

Background of the Study

Baung or river catfish, *Mystus nemurus* (C&V) is one of the popular indigenous and well-accepted freshwater food fishes in Malaysia (Khan et al., 1990). This species has a high dress-out percentage (44.1%), which is comparable to that of poultry (Kamarudin et al., 1987). Its lean portion contains high protein (92.2% DW) and low fat (1.3% DW). The fish flesh has a soft texture, tastes well and contains fewer bones (Thalathiah et al., 1988).

In aquaculture, the fish is considered a "new" species and its production in Malaysia has only become significant in 1993 due to the success in its artificial breeding program (Thalathiah et al., 1992; Kamarudin, 1999). Baung is now raised either semi-intensively in ponds and pens or intensively in floating cages. Its 1998 production was estimated at 587 tons and valued at US$ 1,259.400.00 (FAO, 1998).

Mystus nemurus spawns throughout the year (Khan et. al., 1990) and induced breeding of this fish is a routine practice in several hatcheries. However, the supply of fingerlings is still insufficient for grow–out ponds due to low survival of larvae in most of the hatcheries in the country. In this regard, the successful large-scale rearing of *M. nemurus* larvae has yet to be

refined. If unchecked this, could become the major constraint to the flourishing river catfish industry in the country.

Statement of the Problem

A successful larval mass production of fishes and crustaceans primarily depends on the availability of an abundant source of suitable food at their earlier stages (Matlak and Matlak, 1976; Chauduri, 1979; Izjuterdo et al., 1989). Among the various species of live food organisms, zooplankton *Brachionus* spp. (Watanabe et al., 1983; Juario et al., 1984; Villegas, 1990) and *Artemia* species (Lovell, 1990) have been most extensively used in the larval rearing of various kinds of marine and freshwater fish species of commercial importance.

At present, research work in improving the nutritional value of live food organisms is mostly focused on *Artemia* and *Brachionus* species. In practice, most of the farmers and hatchery operators are totally dependent on using *Artemia sp.* as food for fish and crustacean larvae during larval rearing. In addition to occasional shortages of supply, although it is mostly readily available for aquaculture use, this imported live food species in the form of cysts (eggs) is very expensive and assurance of high quality standard and consistent supply is not guaranteed. Variation in the hatching quality exists among sources of *Artemia* and its nutritional value also varies from time to time and from places of origin (Sorgeloos et al., 1986; Lovell, 1990).

Alternative measures should be made in order to help minimize the importation and use of *Artemia* sp. Indigenous species of live food organisms which, have great potential as larval feed and can be easily mass produced at low cost should be used as substitutes. Information on these live food organisms is lacking and a study is needed to evaluate the potential of selected live food organisms for Malaysian catfish, *M. nemurus* larvae.

The results of this study could improve the existing larviculture technology through the utilization of various species of live food organisms. Furthermore, it could also help in refining the larval rearing techniques of *M. nemurus* towards achieving better growth, survival and quality fry production.

Objectives of the Study

a. To determine the optimum stocking density of *Mystus nemurus* larvae.

b. To evaluate the potential of *Panagrellus redivivus* and other selected live food organisms for larval rearing of *Mystus nemurus* larvae.

c. To determine the optimum feeding density of *P. redivivus* for larval rearing of *Mystus nemurus* larvae.

d. To evaluate the effects of different combinations of live food on growth and survival of *Mystus nemurus* larvae.

e. To determine the performance of *Panagrellus redivivus* on growth and survival of *Mystus nemurus* larvae during weaning.

CHAPTER II

LITERATURE REVIEW

Use of Live Food Organisms

It has been widely recognized that many of the cultured larval fishes are planktivores and that they are totally dependent on live food organisms. It has been reported that fish larvae showed poor growth and survival when they are exclusively nourished by dry feeds. The digestive enzyme system of the newly hatched larvae is believed to be not fully developed for the utilization of dry feeds (Sharma, 1991). However, live food organisms when consumed contain necessary digestive enzymes, which facilitate food digestion in fish larvae. These exogenous enzymes either participate directly in the digestive process or indirectly activate the endogenous production of enzymes by the larvae (de Verga and Bohm, 1992).

Several groups of zooplankton may be used for feeding larval fish, prawns and crabs. A suitable and appropriate food for the larvae, however, is seldom provided because of certain constraints such as lack of information on the larval mouth size or gape and the undeveloped jaws of the larvae by the time the yolk is completely absorbed. Some of the commonly used live food organisms for larviculture include rotifers, cladocerans, copepods, free-living nematodes and *Artemia* nauplii.