



UNIVERSITI PUTRA MALAYSIA

***POMACEA INSULARUS* (GASTROPODA: PILIDAE): ITS CONTROL
UNDER THE INTEGRATED PEST MANAGEMENT (IPM) CONCEPT**

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***POMACEA INSULARUS* (GASTROPODA: PILIDAE): ITS CONTROL UNDER
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By

EDI SURYANTO

**Thesis Submitted in Fulfilment of the Requirement for the
Degree of Doctor of Philosophy in the Faculty of
Science and Environmental Studies
Universiti Putra Malaysia**

December 2000



Dedicated to

My wife,

Dwi Triyanti Abadi Asih

My children,

Arjuna Eka Purnama

Bayu Dwi Kurniawan,

Candra Trihasana Marsyawan

and *Dewi Oktamasari Yasintia*

**Your constant encouragement, sacrifice
and support is highly appreciated**

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My parents in law, *H.R.M. Soenardi* and *Hj. Ny. Koestiyah*

Your “do’a” for my success is very much acknowledged

My elder sister, *Rr. Sri Mulyantiningsih*

My younger brother, *R. Jendra Wardhana*



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December 2000

Chairman: Professor Madya Dr. Jambari H. Ali

Faculty: Science and Environmental Studies

Three control measures of *Pomacea insularus* as parts of IPM (Integrated Pest Management) components were studied; firstly the development of plant molluscicides, secondly the use of fish as its biological control and thirdly its utilisation as quail (*Coturnix coturnix japonica*) feed. Leaf powder of yellow flame (*Peltophorum pterocarpum*) was found to be quite effective in killing the snails. The powder is water soluble (28% solubility) and yielded high extracts (25% of water extraction and 23% of methanol extraction). The LC₅₀ value of this powder solution is about 91 mg/L at 72 h. exposure, on two-week-old test snails. Saponins were the active compounds found in the yellow flame leaves. Kept in solution form, the molluscicide strength deteriorated after 30 days with toxicity level reduced to 34%. The toxicity of the molluscicide in the field trials was found to be twice lower than that of Tea Seed Cake (TSC) powder, a molluscicide used in Malaysia. The broadcasting application of 150 kg/ha of this leaf powder molluscicide in 15 cm deep rice field (equivalent to 100 mg/L) killed 100% of the adult snails in three days as



compared to about 75 kg/ha (equivalent to 50 mg/L) of TSC. Study on the control of the snails using fishes revealed that black carp, *Mylopharyngodon piceus* and hybrid African catfish, *Clarias* sp. were good snail predators. In the laboratory trials the former was more vigorous, consuming at the rate of 60% of its body weight, within 24 h, while the latter consumed only 7%. Due to the shape and size of its mouth, black carps had greater ability in swallowing the snails than catfish. Young black carp of 25 g in size could consume snails of up to about 1.0 cm in shell length. There were high correlations between the size of snails consumed and the size of fish and the mouth width, with the equation of $Y = 0.26 \text{ Ln}(X) + 0.16$ ($r^2 = 0.93$) and of $Y = 0.4 \text{ Ln}(X) + 1.25$ ($r^2 = 0.93$), respectively. Adult catfish (119 – 171 g) could only consume snails of up to 1.5 cm shell length. Results from the release of catfish into the rice field showed a clear trend of a reduction in the snail population. Macroinvertebrates populations presence in the rice field were another source of food supply to the fish, thus enabling the fish to grow without being given supplementary food. Biological control of this snail using fish was, however, confronted with the problem of predators such as birds, crab, eel and otters. Snail meal contained high protein (32%) and mineral (26%). It could be a substitute for fish meal, meat and bone meal or soya bean meal as quail feed without having any effect on its growth performance. Birds fed with snail meal also performed as good as those given commercial feed. The performance indices such as average daily gain (ADG), feed conversion ratio (FCR) and carcass percentage of birds given snail meal protein was comparable with those given conventional protein source. A palatability test conducted had shown that meat of the bird fed with snail meal was



well accepted by food panelists. Each control measure of snails that has been studied demonstrated promising results. Thus the implementation of the control measures could be exercised in the field integrally to achieve managable control of the population of *Pomacea insularis*.



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***POMACEA INSULARUS* (GASTROPODA: PILIDAE): KAWALAN
BERASASKAN KONSEP PENGURUSAN MAKHLUK
PEROSAK BERSEPADU**

Oleh

EDI SURYANTO

Disember 2000

Pengerusi: Profesor Madya Dr. Jambari H. Ali

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Tiga kaedah kawalan siput gondang emas, *Pomacea insularus* yang merupakan sebahagian daripada Kawalan Makhluk Perosak Bersepadu (IPM) telah dikaji untuk mengetahui keberkesanannya. Pertama adalah penghasilan moluskisida tumbuhan. Kedua adalah penggunaan ikan sebagai agen kawalan biologi dan yang ketiga adalah kegunaan siput sebagai makanan burung puyuh (*Coturnix coturnix japonica*). Serbuk daun batai laut, *Peltophorum pterocarpum* didapati merupakan moluskisida yang berkesan untuk membunuh siput. Daun batai laut mudah terlarut (20% kelarutan), menghasilkan lebih tinggi ekstraks (28% ekstraks air dan 23% ekstraks metanol). Nilai LC_{50} larutan serbuk ini adalah 91 mg/L, pendedahan 72 jam, terhadap siput ujian berumur dua minggu. Saponin adalah sebatian aktif yang terdapat dalam daun batai laut. Disimpan dalam keadaan larutan, racun siput ini merosot kekuatannya selepas 30 hari dengan ketoksikannya menurun kepada 34%.



Kajian racun ini di lapangan mendapati bahawa ketoksikannya hanya separuh daripada Tea Seed Cake (TSC), iaitu sejenis racun siput yang digunakan di Malaysia. Dengan menabur serbuk racun ini pada kadar 150 kg/ha di sawah yang kedalamannya 15 cm (setara 100 mg/L) didapati telah membunuh 100% siput dewasa berbanding dengan 75 kg/ha (setara 50 mg/L) TSC. Kajian kawalan siput menggunakan ikan mendapati bahawa kap hitam, *Mylopharyngodon piceus* dan keli Afrika hibrid, *Clarias* sp. adalah pemangsa yang baik. Kajian di makmal menunjukkan bahawa ikan kap hitam adalah pemangsa siput yang lebih baik yang mampu memakan siput sehingga 60% berat badannya dalam masa 24 jam sementara ikan keli hibrid hanya memakan 7% berat badan sahaja. Disebabkan oleh bentuk dan ukuran mulutnya, kap hitam mempunyai kemampuan yang lebih besar untuk menelan siput berbanding ikan keli hibrid. Anak ikan kap hitam yang bersaiz 25 g mampu memakan siput yang bersaiz sehingga 1 cm panjang cangkerang. Sedangkan ikan keli hibrid dewasa (119 – 171 g) hanya boleh memakan siput yang bersaiz sehingga 1.5 cm panjang cangkerang sahaja. Terdapat hubungan yang erat antara saiz siput yang dimakan dengan saiz ikan dan saiz mulut ikan dengan masing-masing, $Y = 0.26 \text{ Ln}(X) + 0.16$, ($r^2 = 0.93$) dan $Y = 0.4 \text{ Ln}(X) + 1.25$, ($r^2 = 0.93$). Keputusan daripada pelepasan ikan keli ke dalam sawah menunjukkan bahawa populasi siput adalah berkurangan. Kehadiran populasi makroinvertebrata dalam sawah padi merupakan satu lagi sumber bekalan makanan kepada ikan, yang membolehkannya membesar tanpa memberi makanan tambahan. Namun kawalan biologi dengan menggunakan ikan ini menghadapi masalah pemangsa seperti burung, ketam, belut dan memerang di sawah. Tepung siput mengandungi protein



yang tinggi (32%) dan mineral (26%). Ianya dapat menggantikan tepung ikan, tepung daging tulang atau tepung kacang soya sebagai makanan puyuh tanpa menjejaskan hasilnya. Puyuh yang diberi tepung siput juga memberikan hasil sebaik yang diberi makanan komersil. Keputusan seperti purata tambahan harian (ADG), kadar konversi makanan (FCR) dan peratus karkas (tulang dan daging) bagi puyuh yang diberi tepung siput adalah setanding dengan puyuh yang diberi protein biasa. Dalam ujian citarasa yang dijalankan didapati bahawa daging puyuh yang diberi tepung siput diterima baik oleh ahli panel makanan. Setiap kaedah kawalan yang dikaji menunjukkan keputusan yang menggalakkan. Justeru penerapan kaedah-kaedah kawalan ini secara bersepadu dapat dilakukan di lapangan bagi mencapai populasi *Pomacea insularis* yang terurus.



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TABLE OF CONTENTS

| | Page |
|---|-------|
| DEDICATION | ii |
| ABSTRACT | iii |
| ABSTRAK | vi |
| ACKNOWLEDGEMENTS | ix |
| APPROVAL SHEETS | xi |
| DECLARATION FORM | xiii |
| LIST OF TABLES | xvii |
| LIST OF FIGURES | xix |
| LIST OF ABBREVIATIONS | xxiii |
| CHAPTER | |
| 1 GENERAL INTRODUCTION | 1 |
| 2 LITERATURE REVIEW | 6 |
| 2.1 Golden Apple Snails | 6 |
| 2.1.1 Introduction of the Snail into Asia | 10 |
| 2.1.2 Damage and Crop Loss | 15 |
| 2.1.3 Environmental Impacts of Snail Invasion | 18 |
| 2.2 The Use of Molluscicides to Control the Snails | 20 |
| 2.2.1 Sybthetic Molluscicides and its Environmental Implication | 20 |
| 2.2.2 Plant Molluscicides | 22 |
| 2.3 Biological Control of the Snails | 28 |
| 2.3.1 Fish as Bio-control Agent | 29 |
| 2.3.2 Ducks as Bio-control Agents | 32 |
| 2.4 Utilisation of Snail as Animal Feed | 33 |
| 2.4.1 Nutrient Contents of the Snails | 33 |
| 2.4.2 Snails as Animal Feed | 34 |
| 3 DEVELOPMENT OF PLANT MOLLUSCIDES FOR CONTROLLING <i>Pomacea insularus</i> | 35 |
| 3.1 Introduction | 35 |
| 3.2 Preliminary Screening of the Local Plant Species for Molluscicides against <i>Pomacea insularus</i> | 36 |
| 3.2.1 Materials and Methods | 36 |
| 3.2.2 Results | 38 |
| 3.2.3 Discussion | 41 |
| 3.3 Some Properties and Laboratory Trials of <i>P.pterocarpum</i> and <i>M. cajuputi</i> against <i>P. insularus</i> | 44 |
| 3.3.1 Materials and Methods | 44 |



| | | |
|-------|--|-----|
| 3.3.2 | Results | 48 |
| 3.3.3 | Discussion | 55 |
| 3.4 | Field Trial of <i>P. pterocarpum</i> against <i>P. insularus</i> | 59 |
| 3.4.1 | Materials and Methods | 59 |
| 3.4.2 | Results | 62 |
| 3.4.3 | Discussion | 65 |
| 3.5 | Conclusions | 67 |
| 4 | FISH AS BIOLOGICAL CONTROL AGENT OF <i>P. insularus</i> IN THE RICE FIELD | 68 |
| 4.1 | Introduction | 68 |
| 4.2 | Some Characteristic and Behaviour of <i>P. insularus</i> , <i>Clarias</i> sp. and <i>Mylopharyngodon piceus</i> | 72 |
| 4.2.1 | Materials and Methods | 72 |
| 4.2.2 | Results | 73 |
| 4.2.3 | Discussion | 88 |
| 4.3 | Feeding Behaviour of <i>Clarias</i> sp. and <i>M.piceus</i> | 80 |
| 4.3.1 | Introduction | 80 |
| 4.3.2 | Materials and Methods | 80 |
| 4.3.3 | Results | 86 |
| 4.3.4 | Discussion | 90 |
| 4.4 | Field Trials on the use of <i>Clarias</i> sp. to Control <i>P. insularus</i> | 95 |
| 4.4.1 | Introduction | 95 |
| 4.4.2 | Materials and Methods | 96 |
| 4.4.3 | Results | 117 |
| 4.4.4 | Discussion | 126 |
| 4.5 | Conclusions | 137 |
| 4 | UTILISATION OF <i>Pomacea insularus</i> AS SUPPLEMENT TO QUAIL (<i>Coturnix coturnix japonica</i>) FEED | 138 |
| 5.1 | Introduction | 138 |
| 5.2 | Materials and Methods | 138 |
| 5.2.1 | Snail Collection and Processing | 138 |
| 5.2.2 | Chemical Analyses and Ration Preparation | 138 |
| 5.2.3 | Feeding Trial of Quails Using Snail Meal | 141 |
| 5.2.4 | Sensory Test | 145 |
| 5.2.5 | Statistical Analysis | 148 |
| 5.3 | Results | 148 |
| 5.3.1 | Properties and Chemical Composition of Snail Meal | 148 |
| 5.3.2 | Performances of Quails Fed with Different Type of Ration | 155 |
| 5.3.4 | Sensory Characteristics of Quail Meat | 157 |
| 5.4 | Discussion | 158 |
| 5.4.1 | Chemical Composition of Snail Meal | 158 |
| 5.4.2 | Performances of Quails Fed with Snail Meal | 159 |
| 5.4.4 | Sensory Characteristics of Quail Meat | 165 |
| 5.5 | Conclusions | 167 |

| | | |
|-----|------------------------------------|-----|
| 6 | GENERAL DISCUSSION AND CONCLUSIONS | 168 |
| 6.1 | General Discussion | 168 |
| 6.2 | General Conclusions | 172 |
| | REFERENCES | 181 |
| | APPENDICES | 187 |
| | BIODATA OF AUTHORS | 193 |



LIST OF TABLES

| | | Page |
|----------|--|------|
| Table 1 | Mortality rate of two-weeks-old <i>Pomacea</i> exposed to various concentrations of plant powders | 39 |
| Table 2 | Some properties of the leaves of <i>P. pterocarpum</i> and <i>M. cajuputi</i> | 49 |
| Table 3 | LC ₅₀ values (24 hours exposure) of various plant molluscicide extracts to snails (<i>Pomacea insularus</i>) | 50 |
| Table 4 | LC ₅₀ values (24 hours exposure) of solutions of <i>P. pterocarpum</i> and <i>M. cajuputi</i> leaf powders against various sizes of snails (<i>Pomacea insularus</i>) | 50 |
| Table 5 | LC ₅₀ values (24 hours exposure) of solutions of <i>P. pterocarpum</i> and <i>M. cajuputi</i> leaf powders exposed at various duration to snails (<i>Pomacea insularus</i>) | 51 |
| Table 6 | LC ₅₀ values (24 hours exposure) of various ages of solutions of <i>P. pterocarpum</i> leaf powder exposed to snails (<i>Pomacea insularus</i>) | 52 |
| Table 7 | Dosages of plant molluscicides applied at the experimental plots | 61 |
| Table 8 | Mean percentage of mortality of snails (<i>Pomacea insularus</i>) exposed to plant molluscicides | 62 |
| Table 9 | Number of snails (<i>Pomacea insularus</i>) released at various fish (<i>Clarias</i> sp.) densities (no/plot) | 97 |
| Table 10 | Number of snails (<i>Pomacea insularus</i>) released at various fish (<i>Clarias</i> sp.) densities (no/plot) | 99 |
| Table 11 | Number of snails (<i>Pomacea insularus</i>) released at various fish (<i>Clarias</i> sp.) densities (no/plot) | 106 |
| Table 12 | Percentage of recovery rate of hibrid catfish (<i>Clarias</i> sp.) from each experimental plots of the second trial | 125 |
| Table 13 | Composition of ration used for feeding trials of quail (<i>Coturnix coturnix japonica</i>) | 142 |
| Table 14 | Palatability test of meat of quail (<i>Coturnix coturnix japonica</i>) | 146 |



| | | |
|----------|---|-----|
| Table 15 | Chemical composition of snail (<i>Pomacea insularis</i>) meal (%) | 148 |
| Table 16 | Feed intake, body weight and ADG of quail (<i>Coturnix coturnix japonica</i>) fed with different types of rations | 150 |
| Table 17 | Growth rate of body weight of quail (<i>Coturnix coturnix japonica</i>) fed with different types of rations | 153 |
| Table 18 | Feed conversion ratio of quail (<i>Coturnix coturnix japonica</i>) fed with different types of rations | 154 |
| Table 19 | Carcass and breast percentages of quail (<i>Coturnix coturnix japonica</i>) fed with different types of rations | 155 |
| Table 20 | Body weight and Average Daily Gain (ADG) of quail (<i>Coturnix coturnix japonica</i>) fed with different types of rations starting at 3-weeks-old | 156 |
| Table 21 | Sensory test of meat of quail (<i>Coturnix coturnix japonica</i>) fed with different types of rations. | 158 |



LIST OF FIGURES

| | | Page |
|-----------|---|------|
| Figure 1 | A special committee set up by the local Agricultural officer comprising representative of farmers, researchers and other agricultural agencies conduct regular monthly meeting to discuss the current status of <i>Pomacea</i> sp | 5 |
| Figure 2 | The life cycle of the snails (Redrawn from Naylor, 1996) | 9 |
| Figure 3 | Yellow flame tree, <i>P. pterocarpum</i> the selected local plant (exhibiting molluscicide activity) when blooming | 43 |
| Figure 4 | Relationship between LC ₅₀ values of solutions of <i>P. pterocarpum</i> and <i>M. cajuputi</i> leaf powders and various sizes of snails (A), various exposure duration (B) and various ages of the solution (C) | 54 |
| Figure 5 | Saponin analogues (Ahmad, 1999) | 56 |
| Figure 6 | Grinding mill used in the production of plant molluscicide. The product is stored in plastic bags (on the right). The bigger bags contain the raw material | 61 |
| Figure 7 | Plot treated with <i>P. pterocarpum</i> powder (the first day) | 63 |
| Figure 8 | Plots treated with <i>P. pterocarpum</i> powder (left) and control (right) of the second day (A); plots treated with <i>P. pterocarpum</i> powder (left) and TSC (right) (B) | 64 |
| Figure 9 | Relationships between body weight and shell length and shell width (A) and between operculum size and shell length and shell width of 246 snails (<i>Pomacea insularus</i>) (B) | 74 |
| Figure 10 | Relationships between body length and body weight (A), between mouth width and body weight (B) of 80 catfish (<i>Clarias</i> sp.) and between mouth width and body length of 24 catfish (<i>Clarias</i> sp.) (C) | 75 |
| Figure 11 | Relationships between mouth width and body weight (A), between mouth width and body length (B) of black carp (<i>Mylopharyngodon piceus</i>) | 76 |
| Figure 12 | Young snails (<i>Pomacea insularus</i>) of about 2-weeks-old kept in a | |

| | | |
|-----------|--|-----|
| | plastic basin (A) and older snails of about 1-month-old reared in a plastic aquarium (B) | 83 |
| Figure 13 | Juvenile black carp (<i>Mylopharyngodon piceus</i>) of about 10 cm length in feeding tank (A) for study of its capability in preying on snails. Plastic aquaria were wrapped in black plastic sheets to avoid external interference during the trial (B) | 84 |
| Figure 14 | Rate of snail (<i>Pomacea insularus</i>) consumption by catfish (<i>Clarias</i> sp.) offered with snails at various percentages of fish body weight | 87 |
| Figure 15 | Rate of snail (<i>Pomacea insularus</i>) consumption by black carp (<i>Mylopharyngodon piceus</i>) offered with snails at various percentages of fish body weight | 88 |
| Figure 16 | Maximum size of snail (<i>Pomacea insularus</i>) consumed by catfish (<i>Clarias</i> sp.) | 88 |
| Figure 17 | Relationships between body weight of black carp and size of snail consumed (A), between mouth width of black carp (<i>Mylopharyngodon piceus</i>) and size of snail (<i>Pomacea insularus</i>) consumed (B) | 89 |
| Figure 18 | Location of experimental plots. Site A Parit 8/TA 6R, Site B Parit 2/TA 6L of rice field of Projek Pembangunan Kerian - Sungai Manik | 100 |
| Figure 19 | Lay out of experimental plots of the first field trial | 101 |
| Figure 20 | Early stage preparation of experimental plots for the first trial: A) wooden poles for supporting plastic sheets and B) plastic sheet partitions | 102 |
| Figure 21 | General view of experimental plots (A). Holding pond at the edge of rice field to acclimatise catfish (<i>Clarias</i> sp.) before releasing into the experimental plots (B) | 103 |
| Figure 22 | Full support and involvement of local agricultural officers during the first trial (A). Weighing catfish (<i>Clarias</i> sp.) before releasing into the experimental plots (B). | 104 |
| Figure 23 | First field trial, releasing catfish (<i>Clarias</i> sp.) into the experimental plots | 105 |
| Figure 24 | Lay out of experimental plots for fish (<i>Clarias</i> sp.), snail (<i>Pomacea insularus</i>) and molluscicides trials | 107 |

| | | |
|-----------|---|-----|
| Figure 25 | Early stage preparation of experimental plots for the second field trial: A) using corrugated zinc sheet (B) inner partitions of the plots used corrugated plastic sheet | 108 |
| Figure 26 | General view of experimental plots of the second trial (A). Freeing the experimental plots from snails (<i>Pomacea insularus</i>) using TSC before the commencement of the field trial (B) | 109 |
| Figure 27 | Lay out of experimental plots for fish (<i>Clarias</i> sp.) and snails (<i>Pomacea insularus</i>) third trial | 110 |
| Figure 28 | In the third trial, all the experimental plots were using corrugated zinc sheet as partitions. The perimeter walls were protected from otter by live wires of 12 volts | 111 |
| Figure 29 | Agriculture field assistant removing the stomach of catfish (<i>Clarias</i> sp.) caught from rice field to study its content (A). The stomach content was examined to determine the natural diet (B) | 112 |
| Figure 30 | Core sampling of macrobenthic organisms to study the natural diet of fish available in the rice field | 113 |
| Figure 31 | Sampling of macrobenthic organisms using core sampler (arrow) (A). Removal of macrobenthos from mud for further sorting in the laboratory (B). | 114 |
| Figure 32 | Harvesting of fish (<i>Clarias</i> sp.) and snail (<i>Pomacea insularus</i>) in the dug up canal of the experimental plots at the end of second field trial | 116 |
| Figure 33 | Profile of day time temperature of water in the rice field | 117 |
| Figure 34 | Profile of DO (A) and temperature (B) of water in the rice field | 118 |
| Figure 35 | Growth of catfish (<i>Clarias</i> sp.) reared in the rice field | 120 |
| Figure 36 | Frequency of snail (<i>Pomacea insularus</i>) found in the stomach of 15 catfish (<i>Clarias</i> sp.) collected from the refuge trench during the first trial | 120 |
| Figure 37 | Population of annelids (A) and gastropods (B) in the rice field | 122 |
| Figure 38 | Population of insects (A) and planktonic crustacean (B) in the rice field | 123 |
| Figure 39 | Percentage of harvested snails (<i>Pomacea insularus</i>) per plot | 126 |
| Figure 40 | Plastic sheet of experimental plots dried up, became brittle (A) | |

| | | |
|-----------|---|-----|
| | due to intense heat during El Nino spell. It became easily crumbled when squeezed (B) | 131 |
| Figure 41 | Damage of plot partitions by stampede by otters (arrow) | 132 |
| Figure 42 | Predators of catfish coming from air and land. Kingfisher (<i>Halcyon smyrnensis</i>) that preys on snails was accidentally glued to the pole of the zinc wall (A). Otter (<i>Lutra perspicillata</i>) found dead on the road after been knocked down by passing motor vehicle (B). Predation by otters is one of the major problem of rearing fish in the rice field | 133 |
| Figure 43 | Injured (arrows) catfish from experimental plots inflicted by otters (A). The uneaten parts (head) (arrows) of catfish caught by otter from holding pond (B) | 134 |
| Figure 44 | Broken shell and flesh of snails (<i>Pomacea insularus</i>) after drying | 139 |
| Figure 45 | Collection of snails (<i>Pomacea insularus</i>) as raw material for feeding trial (A). Note the snails (as black dots) in the stream. Crushed snails dripped dry before oven drying (B) | 140 |
| Figure 46 | Day old quails (<i>Coturnix coturnix japonica</i>) placed in the brooder cages (A) which then were transferred into growing cages at 3-weeks-old (B) | 143 |
| Figure 47 | Weighing the individual birds (<i>Coturnix coturnix japonica</i>) weekly to monitor the development | 145 |
| Figure 48 | The cooked meat of quail (<i>Coturnix coturnix japonica</i>) and the forms to be fill in (A). Sensory test of quail meat in progress (B) and carried out in the Department of Food Science, UPM | 147 |
| Figure 49 | Growth (body weight), Average Daily Gain (ADG) and growth rate (%) of quails (<i>Coturnix coturnix japonica</i>) fed with different types of rations | 151 |

LIST OF ABBREVIATIONS

| | |
|------------------|---|
| ADG | : average daily gain |
| BW | : body weight |
| Comm. feed | : commercial feed |
| Ca | : calcium |
| CF | : crude fiber |
| cm | : centimeter |
| CP | : crude protein |
| DM | : dry matter |
| DO | : dissolved oxygen |
| FC | : Flooding Canal |
| FCR | : feed conversion ratio |
| FI | : feed intake |
| ha ⁻¹ | : per hectare |
| IPM | : Integrated Pest Management |
| IRRI | : International Rice Research Institute |
| L | : litre |
| LC ₅₀ | : lethal concentration (50% mortality) |
| LD ₅₀ | : lethal dosage (50% mortality) |
| m ⁻² | : per square meter |
| NaPCP | : Sodium penta chlorphenolate |
| NRC | : National Research Council |



| | |
|----------|-----------------------------------|
| NRF | : Neighbouring Rice Field |
| NTO | : Non Target Organism |
| P | : phosphor |
| ppm | : part per million |
| PR | : Paved Road |
| PVC pipe | : poly vinyl chlorida pipe |
| r^2 | : coefficient correlation |
| rpm | : rotation per minute |
| SAS | : System of Analytical Statistics |
| SB | : Soil Bund |
| SM | : Snail Meal |
| TSC | : tea-seed cake |
| UPM | : Universiti Putra Malaysia |
| USD | : United States Dollar |
| UV | : ultra violet |
| v/v | : volume per volume |
| w/v | : weight per volume |
| WSM | : whole snail meal |

