

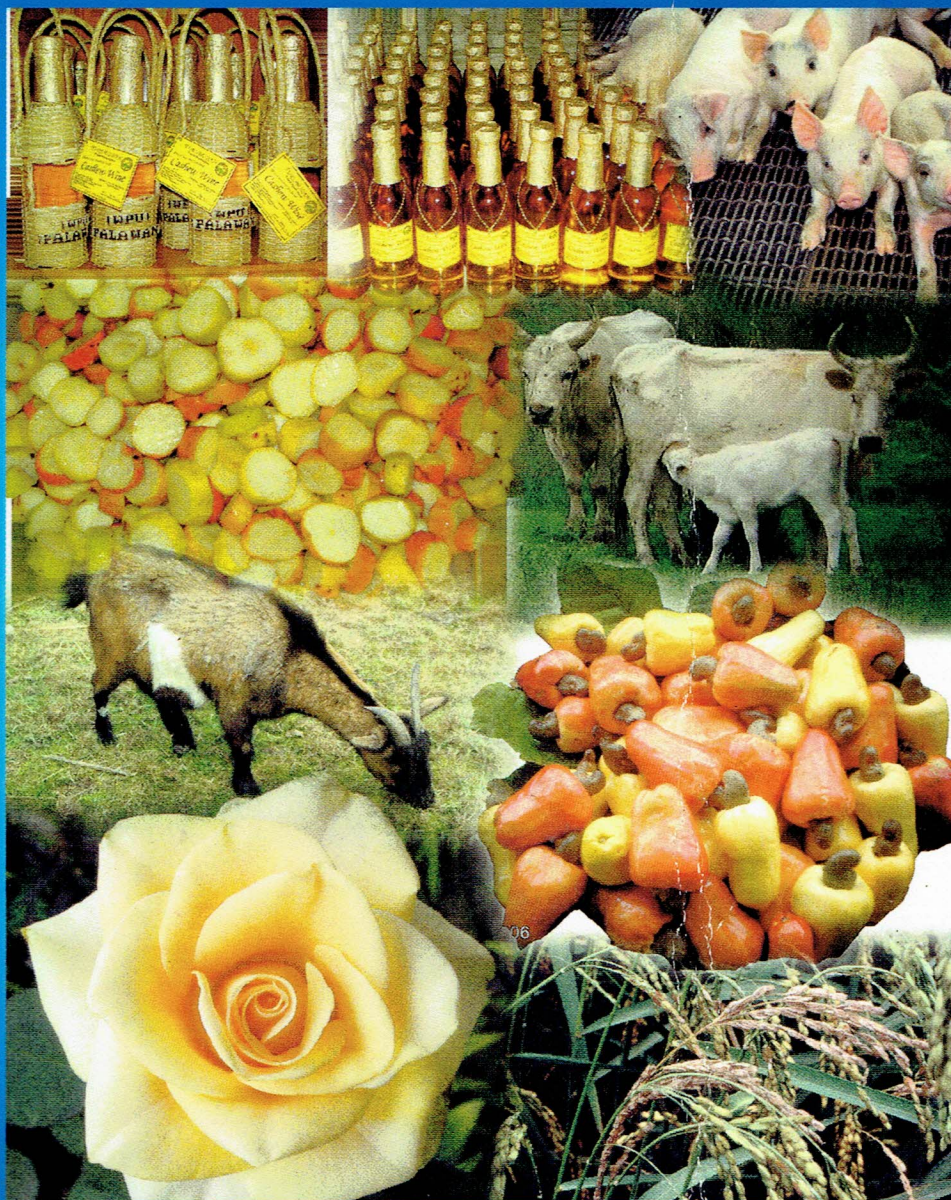


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Learning Styles of Education Students of Western Philippines University School Year 2007-2008

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ABSTRACT

The study determined the learning styles of first year WPU Education students in terms of environmental, emotional sociological, physiological, and psychological aspects. Thirty (30) randomly selected first year Education students in SY 2007-2008 were asked to choose their degree of agreement on the different learning situations listed in the checklist. A five point scale was used in the determination of the respondents' degree of agreement with the various learning situations. The mean score for each learning style was interpreted using the Likert scale.

Results revealed that in the environmental aspect of learning style, the respondents agreed that they concentrate better when there are no disturbances; when they are inside the room or house, and when they are studying in a well-lighted room. In the emotional aspect of learning style, the respondents agreed that they could concentrate better when they are happy and relaxed. As to the sociological aspect of learning style, the respondents believed that they could assimilate better when they worked with their parents, teachers or with older person; when they study alone and when others motivated them to study. As to the psychological aspect of learning style, the respondents' believed that they could remember facts when they read the topic with their eyes only and when they write or illustrate.

Keywords: learning style, aspects of learning style, education students, Western Philippines University

INTRODUCTION

A learning style is the method of learning particular to an individual that is presumed to allow that individual to learn best. It is commonly believed that most people favor some particular method of interacting with, taking in, and processing stimuli or information. Based on this concept, the idea of individualized "learning style" originated in 1970s, and has gained popularity in recent years.

Learning how to learn had been one of the educators' greatest tasks. Training the students to learn every task is every teacher's responsibility just as learning task is every student's priority.

Learning is a behavioral change which is the direct result of experience rather than consequences of inborn connections within the nervous system.

Learning style is one of the aspects of students' innate uniqueness which one must learn to recognize, acknowledge and respect. Although opinions regarding the many aspects of learning vary. How it takes place, what is the best means of promoting it, and how much matter pertaining to it is an accepted fact that learning takes place. That learning does take place when it is universally and unanimously agreed. Learning occurs in and out of schools, in all working hours, and it is continuous from birth until death of normal individual.

One of the most important breakthroughs in education in recent years is the classification of learning styles as they relate to the most important dimension in every learning process - how every learner learns. Learning styles consists of aspects, namely: environmental, emotional, sociological, physiological, and psychological (Dunn and Dunn, 1978). Hence, this study attempted to identify the learning styles of the Western Philippines University education students based on the learning styles aspects described in the Dunn and Dunn Learning Style Model.

METHODOLOGY

Respondents of the Study. Thirty (30) first year students of the College of Teacher Education, Western Philippines University were randomly chosen as the respondents of the study.

Research Design and Method. The descriptive research design was used in the study employing the survey method in gathering the data. The research instrument of Dolor (2003) was adapted in this study. The instrument was composed of a list of situations believed to be associated with the learning of each of the 5 stimuli: environmental, emotional, physiological, psychological, and sociological aspects.

Data Gathering Procedure. Based on the prepared checklist, the students were asked to check the column of their choice (degree of agreement) on the different learning situations listed. The scores obtained were tallied and the mean scores of the respondents were presented, and interpreted.

Data Analysis. Frequency counts, percentages, and means were used to describe the learning styles of the respondents according to Dunn and Dunn Learning Style Model.

A five-point scale was employed to determine their degree of agreement to certain situations that usually occurred while they were learning or studying their lesson.

The rating scale used was as follows:

Strongly agree	5
Agree	4
Neutral/undecided	3
Disagree	2
Strongly disagree	1

The mean scores of each learning style were obtained by dividing the composite scores by the number of cases (respondent group). The means were interpreted based on the following Likert scale:

Strongly agree	4.50– 5.00
Agree	3.50– 4.49
Neutral/undecided	2.50 – 3.49
Disagree	1.50 – 2.49
Strongly disagree	1.00 – 1.49

RESULTS AND DISCUSSION

Demographic characteristic of the respondents

Table 1 shows that of the 30 respondents, 66.66% of the respondents are females and the rest are males.

Table 1. Distribution of respondents in terms of gender.

Gender	Frequency (n=30)	Percentage %
Females	10	33.34
Males	20	66.66

Environmental Aspect

Table 2a shows the learning styles of the respondents classified under environmental aspect. Based on their mean scores, the study revealed that the respondents strongly agreed that they could concentrate better when there is no disturbance (4.7%). The respondents agreed that they could concentrate better when they are inside the room or house (4.395); when they are studying in a well-lighted room (4.365); when they are sitting in a wooden chair (3.73); they could assimilate better when things within sight are in order (4.3); while some of the respondents could concentrate better when they are outside the room and sit under the tree. However, some of the respondents were not sure whether they could concentrate better when they are listening to loud sound like radio (3.03), and when lying in a sofa bed or bed while studying.

Table 2a. Mean scores of the learning styles of the first year education students classified under environmental aspects.

Statements	Mean Scores	Interpretation
I could concentrate/assimilate/absorb/remember better when:		
a. listening to loud sound like radio	3.03	Undecided
b. studying in a well-lighted room	4.365	Agree
c. sitting in a wooden chair	3.73	Agree
d. inside the room or house	4.395	Agree
e. there is no disturbance	4.7	Strongly Agree
f. things within sight are in order	4.3	Agree
g. lying in sofa bed/ bed while studying	3.365	Undecided
h. outside the room and sit under the tree	3.535	Agree

Emotional Aspect

Table 2b shows the mean scores of the learning styles of the respondents classified under emotional aspect.

The respondents agreed that they could assimilate better when they are happy (4.165); and relaxed (3.865); when they make decision and absorb problem quickly (3.865). They were not sure whether they could concentrate better when someone is bothering them.

However, most of the respondents disagreed that they could not concentrate when they are not feeling well (2.465); they are extremely angry (2.475); they are not relaxed (2.465); and when they are depressed (2.295).

Table 2b Mean scores of the learning styles of the first year education students classified under environmental aspects.

Statements	Mean Scores	Interpretation
I could concentrate/assimilate/absorb/Remember better when:		
a. I'm not feeling well	2.465	Disagree
b. make decision and absorb problem quickly	3.83	Agree
c. when I am happy		
d. someone is bothering me	4.165	Agree
e. I am not relaxed	2.5	Undecided
f. extremely angry	2.465	Disagree
g. I am relaxed	2.475	Disagree
h. I am depressed	3.865	Agree
	2.295	Disagree

Sociological Aspect

Table 2c shows the mean scores of the learning styles of the respondents classified under sociological aspect.

The study revealed that the respondents agreed that they could concentrate better when studying with their parents or teachers (4.33); when studying alone (4.1); when working with older person (3.565); and when others motivate them to study (3.5).

On the other hand, they were not sure whether they could concentrate or not when working with group as a member (3.4); working with the group as leader (3.365); working with the group (3.365); or studying with their best friends or friends.

Table 2c. Mean scores of the learning styles of the first year education students classified under sociological aspects.

Statements	Mean Scores	Interpretation
I could concentrate/assimilate/absorb/Remember better when:		
a. I'm studying alone	4.1	Agree
b. studying with by best friends or friends	3.33	Undecided
c. working with group as leader		
d. studying with my parents or teacher	3.365	Undecided
e. involved with older person than younger ones	4.33	Agree
	3.565	Agree
f. working with group as a member		
g. when others motivated me to study	3.4	Undecided
h. I'm with the group	3.5	Agree
	3.365	Undecided

Psychological Aspect

Table 2d shows the mean scores of the learning styles of the first year education students classified under sociological aspects.

The study revealed that the respondents strongly agreed that they remember better when topics are present in a step by step sequential structure, leading toward understanding the lesson (4.73). They agreed that they could absorb better when they take a break before they proceed to the task until it is completed (4.195); when their attention concentrates in detail first (4.365); when they prefer to analyze and think about the topic (4.23); when they are introduced to the concept or idea before beginning to work on a task (4.195); when they are involved in an interesting task (4.0). However, they are not sure whether they could assimilate better when spending longer time in studying (3.235); or spending shorter time in studying (2.63).

Table 2d. Mean scores of the learning styles of the first year education students classified under psychological aspects.

Statements	Mean Scores	Interpretation
I could concentrate/assimilate/absorb/ Remember better when:		
a. topic is presented to me is step by step/sequential structure, leading toward understanding the lesson	4.73	Strongly Agree
b. I take break before I proceed to the task until it is completed	4.195	Agree
c. my attention concentrates in detail first	4.365	Agree
d. I prefer time to analyze and think about the topic	4.23	Agree
e. introduced the concept or idea before beginning to work on a task	4.165	Agree
f. involved in interesting task		
g. I spend longer time in studying	4.0	Agree
h. I spend short time in studying	3.235	Undecided
	2.63	Undecided

Physiological Aspect

Table 2e shows the mean scores of the learning of the respondents classified under the physiological aspects.

Table 2e. Mean scores of the learning styles of the first year education students classified under physiological aspects.

Statements	Mean Scores	Interpretation
I could concentrate/assimilate/absorb/Remember better when:		
amore senses are involved in a task	3.43	Undecided
a. I listen to a lecture discussion or conversation	3.93	Agree
b. I read the topic with my eyes only	3.495	Agree
c. I am eating finger food	3.995	Agree
d. I write or illustrate	3.665	Agree
e. during morning or daytime	3.73	Agree
f. during evening or nighttime	4.065	Agree
g. I read things orally	3.725	Agree

The study revealed that the respondents agreed that they could remember better when they read the topic with their eyes only (3.93); when they are eating finger food (3.995); when they write or illustrate (3.665); when they study during morning or daytime (3.73); and when they study during evening or nighttime (4.065) and when they read things orally (3.725). On the other hand, they disagree that they could remember better when more senses are involved (3.43); and when they listen to lecture discussion or conversation (3.725).

Conclusion

Based on the result of the study, the researchers conclude that the respondents could concentrate, assimilate, absorb, or remember better the topics/lessons in different learning styles.

Recommendations

Based on the conclusion, the following recommendations were made:

1. The teachers and administrators should consider the learning styles of the students in order for them to learn more.
2. Teachers should assess the learning styles of their students to enable them to choose and adapt the methods, strategies, and techniques best suited for each learner.

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The Effect of Different Root Hormones on the Propagation of American Rose (*Rose centrifolia*) Stem Cuttings under Germinating Chamber

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ABSTRACT

This study was conducted to determine the most effective hormone for root development of American Rose stem cuttings. There were four (4) treatments used in the study namely: T₁ - control; T₂ - full strength ANAA; T₃ - full strength Hormex; and T₄ - pure coconut water. Analysis of Variance revealed that the differences among treatment means were not significant in terms of the number of roots developed and survival rate of rose stem cuttings. However, there was a significant difference among the treatment means on the average length of shoot developed. ANAA, coconut water and distilled water (control) significantly influenced the elongation of shoots of American Rose stem cuttings.

Keywords: root hormones, American rose, Rose centrifolia, ANAA

INTRODUCTION

Roses, member of genus *Rosa* (Rosaceae), have long been one of the major cutflower crops. The industry is based largely on the hybrid tea rose, a perpetually blooming, long-stemmed rose whose pedigree incorporates many species. In greenhouse culture, the plants are budded or grafted onto *Rosa manetti* vigorous root stock.

Roses are grown all year round, but heaviest demand (and the highest prices for the blooms) is during the major florist holidays of Christmas, Valentine's Day, Easter and Mother's Day. Commercial nurseries in the Southern and Western United States propagate rose plants.

Realizing the pressing need of increasing demand for planting materials, the study focused on the possibility of rapid propagation of rose cuttings with the use of root hormones such as ANAA, Hormex, and coconut water. These hormones were proved to be very useful in propagating some plants. They are

found to be capable of inducing root growth especially in asexually propagated plants.

Rose stem cuttings are moderately difficult to propagate thus, the problem of high mortality of stem cuttings always arises. Hence, this study attempted to determine the plant growth hormone that could best promotes root development of American rose stem cuttings.

METHODOLOGY

The experiment was conducted using the Completely Randomized Design (CRD) with four (4) treatments and three (3) replicates. The treatments were as follows: T₁- Control (distilled water), T₂- Full strength ANAA, T₃- Full strength Hormex, and T₄- pure coconut water). Fifteen (15) sample plants in each treatment per replication were established as basis of observation.

Soil media preparation. Fine river sand (0.10-0.25 mm) was collected from Aborlan River, Aborlan, Palawan. The sand was drenched with hot water to sterilize the soil and eliminate disease causing microorganism.

Construction of propagation chamber. A propagating chamber (1.0 m wide, 0.85 m high and 1.5 m long) was constructed with bamboo slates as frames and transparent plastic sheets as walling and roofing to control the relative humidity. Around 6 inches thick of stones (2.0-3.0 inches diameter) were spread inside the propagating chamber. The sterilized river sand about 4 inches thick was then placed on top of the stones to serve as the soil media. The chamber was divided into twelve equal plots for the different treatment and replications.

Preparation of Rose stem cuttings. One hundred-eighty (180) cuttings of American Rose were cut into 4 inches length using a pruning shear. Only healthy stem cuttings were selected.

Treatment media preparation. Two hundred fifty (250 ml) of ANAA, Hormex and young coconut water (pasteurized at 80°C) were used as treatment media.

Application of Hormones. The basal end of the cuttings were dipped in 4 treatments for one hour at room temperature.

Planting of cuttings. The cuttings were planted as soon as they were withdrawn from the treatment by inserting the basal end in slanting position at a depth of 1 inch inside the clonal propagating chamber. The soil was slightly pressed around the planted cuttings to prevent the dislodging.

Care and management. Proper care and management were carried out until the end of the study. Mist spray was applied to the plants in the morning and in the afternoon to prevent wilting. The stems cuttings were cultured for three (3) months.

The data collected were number of roots developed after 20 days, length of roots developed, final number of roots developed, average length of shoots developed, survival rate and average temperature inside the germinating chamber.

The data gathered were analyzed using Analysis of Variance (ANOVA) at 5% significance level.

RESULTS AND DISCUSSION

The rose cutting in all treatments except in Treatment 3 (full strength Hormex) developed the same number of roots after 20 days of propagation (Table 1). In terms of average length of roots developed, cuttings in Treatment 4 (treated with coconut water) exhibited the longest roots ($\mu=2.96$ inches). This was followed by cuttings in treatment 3 (treated with Hormex), treatment 1 (control) and treatment 2 (treated with ANAA) with mean root lengths of 1.6 inches, 1.19 inches, and 1.14 inches respectively (Table 1). Though the use of coconut water resulted to highest mean root length developed, analysis of variance between treatment means in terms of length of roots developed is not significant.

On the final number of roots developed, cuttings in treatment 4 highest number of roots developed ($\mu=4.67$). This was followed by cuttings under the control group ($\mu=4.23$ roots) and those treated with ANAA ($\mu=3.0$ roots). Cuttings treated with Hormex exhibited the least number of roots developed ($\mu=1.0$ roots) (Table 1). Though the final number of roots developed after the propagation period is variable, the analysis of variance indicated that there were no significant differences among treatment means.

In terms of the average length of shoots developed. The cuttings planted in treatment 1 (control) produced the longest shoot with a mean of 6.77 inches. This was followed by cuttings in Treatment 4 and Treatment 2 with means of 4.97 inches and 4.5 inches, respectively. On the other hand, cuttings in Treatment 3 produced the shortest shoot with a mean of 0.50 inches (Table 1). ANOVA revealed a significant difference among treatment means.

On the survival rate of cuttings, data indicated that highest survival rate was recorded among control plants (33.33%), followed by those treated with coconut water (23.30%). Cuttings treated with Hormex and ANAA had the same survival rate of 10.0%. Though survival rate of rose cuttings under the different

treatment varies, analysis of variance indicated that the difference between treatments is not significant.

Table 1. American rose cuttings' mean number of root developed after 20 days, average length of roots developed, final number of roots developed, average length of shoots developed and survival rate.

Treatments	Number of roots developed after 20 days	Average length of roots developed (inches)	Final number of roots developed	Average length of shoots developed	Survival rate
T ₁ - Control (Distilled water)	1.0	1.19	4.23	6.77	33.33
T ₂ - Full strength ANAA	1.0	1.14	3.00	4.50	10
T ₃ - Full strength Hormex	0	1.60	1.0	1.5	10
T ₄ - Pure coconut Water	1.0	2.96	4.67	4.97	23.30
F value	ns	0.850 ^{ns}	1.52 ^{ns}	6.38*	ns

ns- not significant

* - significant

The above data indicated that the application of root hormones to American Rose cuttings do not influence their root development and survival rate, however it affects the development of their shoots. According to the Encyclopedia Americana (1996), the ability of the stem cuttings to develop roots is variable. It includes the factors that depend on the species, age, and development of plant, the type and location of the stem, the time of the year, and various other environmental factors during the propagation process. Further according to Foskett (1994), the use of auxins i.e. ANAA and Hormex can have either positive or negative effect as plant growth regulator depending on its concentration which was not evaluated in this study. The use of coconut water enhances shoot development due the presence of gibberellins, a growth regulator which enhance root development (Rodly and Dear, 1979). Likewise, the cytokinin found in ANAA stimulate root development (Meredith *et al.* 1970). The data further indicated that rose cuttings can be propagated even without the use of root hormones.

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Dolo (*Fragracea cochinchinensis*) Leaf Meal as Deworming Agent and Component of Swine Ration

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ABSTRACT

This study focused on determining the effects of a ration with varying levels of dolo leaf meal against gastrointestinal nematodes and on the growth performance of swine. Twelve (12) growing pigs were fed with three (3) different rations containing 0%, 5%, and 10% dolo leaf meal, respectively following the Completely Randomized Design (CRD). Feeding period lasted for 95 days. Data on the effects of the rations on the growth performance of the swine were obtained.

No significant differences on the initial weight, final weight, total feed consumption, average bi-weekly weight gain, total gain in weight, average daily gain, feed conversion efficiency, feed cost per kilogram in weight were obtained from different treatments. But, there was a highly significant difference in the percentage reduction of worm egg per gram count between control and the two treatments (ration with 5% and 10% dolo meal)

Keywords: dolo, Fragracea cochinchinensis, gastrointestinal nematodes,

INTRODUCTION

Parasites have long been a problem for swine producers. These parasites can cause economic loss to the producer in many ways including: decrease feed efficiency, increase time to market, and decrease carcass value. They further cause irritation, impaction, indigestion and lack of appetite. Parasites also cause nutrient deficiency by competing with the host and by causing poor digestion, gut ulceration and even blood loss. Even a small number of the large roundworm, *Ascaris suum*, depress feed intake and daily gain and cause a depression in weight gain.

Herbal medicine is commonly used to prevent and control diseases in animals. Some herbal plants had been proven for ethno veterinary practices among them is the *Fragracea cochinchinensis*, commonly called dolo. This plant is endemic to Palawan especially in the municipality of Roxas, Taytay, Aborlan and Bataraza. The plant is made of 10.5% protein, 3.10% fat, 13.2% fiber, 5.9%

moisture, 6.80% ash and 60.5% NFE based on the proximate analysis conducted by the Bureau of Plant Industry (LDC, 2003). This plant is also claimed by some farmers to be useful against internal parasites of pigs. Thus, this study was conducted to evaluate the effects of swine ration with varying levels of dolo leaf meal against gastrointestinal nematodes and on the growth performance of swine.

METHODOLOGY

Twelve (12 heads) of weanling were divided into three (3) treatments as follows: T₁: ration with 0% dolo leaf meal, T₂: ration with 5% dolo leaf meal and T₃: ration with 10% dolo leaf meal following the Completely Randomized Design (CRD) with each treatment containing four (4) observations.

Draw lots were used to randomly assign the experimental animals in their respective pens and to determine the designation of the treatments to the pen.

The sun dried and thoroughly milled dolo leaves were mixed with rice bran, corn meal, fish meal, copra meal and soybean meal. The formulated feed ration for each treatment is shown in Table 1. Individually, the animals were fed twice a day with the amount required by the feed consumption standard.

Table 1. Experimental ration for starter, grower and finisher.

Ingredients	Ration for Starter (18% CP)			Ration for Grower (16% CP)			Ration for Finisher (14% CP)		
	T ₁	T ₂	T ₃	T ₁	T ₂	T ₃	T ₁	T ₂	T ₃
Rice bran	48.57	45.48	48.57	48.57	45.48	42.40	53.95	50.84	47.74
Corn meal	32.38	30.32	32.38	32.38	30.32	28.26	35.97	33.89	31.82
Dolo leaf meal	-	5.00	-	-	5.00	10.00	-	5.00	10.00
Fish meal	6.67	6.72	6.67	6.67	6.72	6.80	4.54	4.62	4.70
Copra meal	4.76	4.78	4.76	4.76	4.78	4.81	2.52	2.57	2.62
Soy bean meal	7.62	7.70	7.62	7.62	7.70	7.73	3.02	3.08	3.12
Total	100	100	100	100	100	100	100	100	100

The data gathered were the pigs' initial weight, final weight, bi-weekly weight gain, average weight gain after the feeding period, average daily weight gain, mortality rate, average feed consumption, feed conversion efficiency, egg count and egg per gram count.

Egg per gram count per pig was obtained using the Modified McMaster Technique. Percentage reduction in egg per gram count was derived by dividing the difference of initial and final egg per gram count to the final egg per gram count multiplied by 100.

All data gathered were subjected to Analysis of Variance (ANOVA).

RESULTS AND DISCUSSION

Growth Performance

The pigs fed with ration containing 5% dolo leaf meal had the highest average final weight compared to the pigs fed with purely (0% dolo leaf meal) ration and ration with 10% dolo leaf meal. However, ANOVA showed that the average final weight of pigs among treatments is statistically the same which implies that incorporation of dolo leaf meal (5% and 10%) in the ration neither increase nor decrease the final weight of swine after 95 days of feeding.

Table 2. Average final weight (AFW), bi-weekly average weight gain (BWA WG), average weight gain (AGW), average daily weight gain (ADWG), average feed consumption (AFC) and average feed conversion efficiency (AFCE) of pigs and percentage reduction of worm egg count of pigs (PREWC).

Treatment	AFW (kg)	BWA WG (kg)	AGW (kg)	ADWG (kg)	AFC (kg)	AFCE (kg)	PREWC (%)
I - 0% DLM	67.75	5.25	31.50	0.33	155.30	4.99	10.97
II - 5% DLM	73.25	6.20	37.25	0.39	149.32	4.02	100.00
III - 10% DLM	65.00	5.46	32.75	0.34	136.42	4.16	100.00

Furthermore, pigs fed with 5% dolo leaf meal registered the highest bi-weekly average weight gain, average weight gain after 95 days of rearing, and average daily gain compared to those fed with 0% dolo leaf meal and 10% leaf meal (Table 2). Nevertheless, statistical analysis revealed that the differences of mean in terms of the three (3) measures of weight gain among the three (3) treatments are not significant. On the other hand, pigs fed with purely ration (0% dolo leaf meal) posted the highest average feed consumption and average feed conversion efficiency compared to those pigs that consumed ration with 5% and 10% dolo meals. Analysis showed that the treatments were not statistically different in terms of average feed consumption and average feed conversion efficiency. The above data indicated that dolo meal ration do not influence the growth performance of swine.

Effect on Gastrointestinal Nematodes

The nematode eggs were identified and counted using the Modified McMaster Technique. The morphological appearance of the eggs observed resembled the morphological appearance of *Ascaris suum*, which have rough bile stained, and external protein layer; *Metastrongylus spp.*, which are small subglobular and contain a vermiform embryo; and *Macracanthorhynchus hirudinaceus*, which have three cementic ellipsoidal shell surrounding an embryo. An outer egg shell which is thinner at the poles was also observed.

Feed ration with 5% and 10% dolo leaf meal reduced the egg worm count of pigs by 100% while only 10.97% reduction in egg worm count was observed in pigs that were fed with ration containing 0% dolo leaf meal (Table 2). ANOVA analysis revealed that the differences in the mean percentage reduction of worm egg count among treatments are highly significant. Figure 1 shows that there was a sharp decrease in the bi-weekly reduction of egg worm count of pigs that consumed ration with dolo leaf meal as ingredient (5% and 10%).

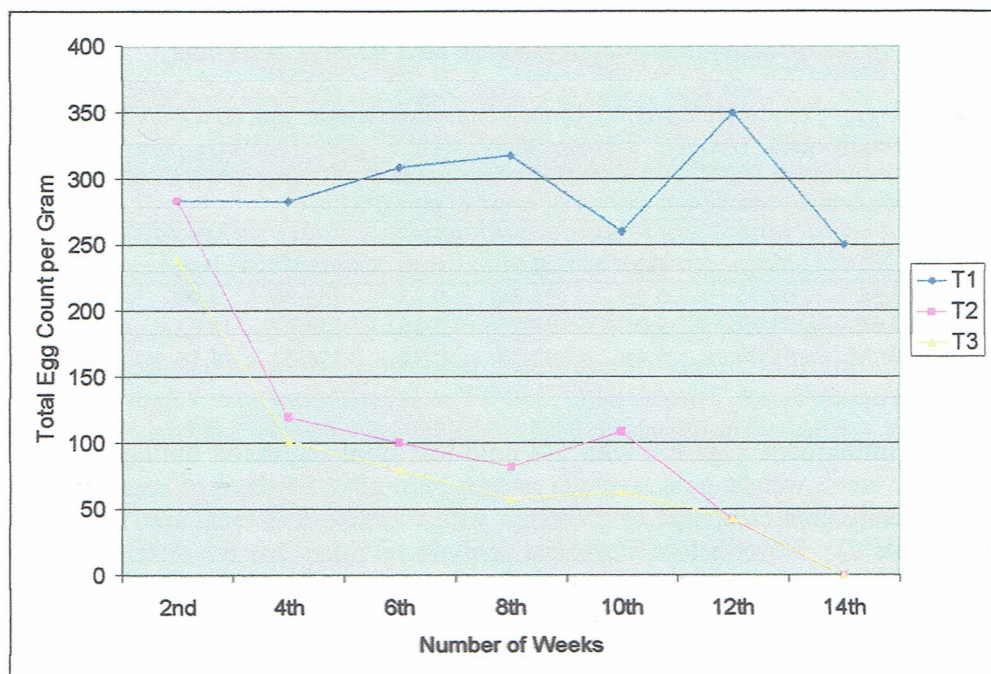


Fig. 1. Bi-Weekly Reduction in Egg Count.

Conclusion

On the basis of the results of the study, dolo leaf meal can be used as feed ration for swine by up to 10% to reduce gastrointestinal nematodes without impairing the growth performance of swine.

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Indigenous Fruits Marketed in Aborlan Public Market, Aborlan, Palawan

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ABSTRACT

This study was conducted to describe the demographic characteristics of indigenous fruit sellers; generate data on species, harvest/market season, sources, time availability and volume sales of indigenous fruits sold in the Aborlan Public Market and to determine the problems encountered by the indigenous fruit sellers.

The indigenous fruits marketed in Aborlan Public Market were: "anonas" (*Annona reticulata* Linn), "badak" (*Artocarpus champeden*), "kandis" (*Garcinia lateriflora*), "durian" (*Durio zibethinus* Murr.), "guatis" (*Annona squamosa* Linn), "marang" (*Artocarpus odoratissima* Blanco), "manti" (*Nephelium* sp.), "rimas" (*Artocarpus altilis*), "seryali" (*Flacourta indica*) and "tabo" (*Willughbeia* sp.). Most of the fruits came from different barangays of Aborlan, Palawan while others came from Rizal, Palawan. "Manti" and "tabo" were available in market from June to November while "guatis" fruits were sold only from September to October. Other indigenous fruits were available only for one month. These fruits were commonly sold during Sundays except for "guatis" and "tabo". The problems encountered by the respondents were: difficulty in transporting their products, lack of storage facility, price fluctuation, unfavorable climatic condition and low price of indigenous fruits.

Keywords: indigenous fruits, Aborlan, Palawan, fruit sellers

INTRODUCTION

Indigenous fruit trees play a vital role in livelihood security for many rural community members especially during periods of famine and food scarcity (Saka *et al.* 1994).

Indigenous fruit trees are important traditional sources of nuts, fruits, spices, leafy vegetables, edible oil and beverages. Like vegetables, indigenous fruit trees provide vitamins and minerals essential for the proper maintenance of human health (Okafor 1985). According to Maghembe *et al.* (1994), the nutritional value of indigenous fruit bearing tree species indicates that many are rich in sugar, essential vitamins and minerals while others are high in vegetable oil and protein.

7

Of the more than 8,000 species of flowering plants recorded in the Philippines, about 200 indigenous or introduced fruit trees and shrubs were domesticated and have gained popularity among Filipinos. Of this number, five are categorized as major fruits since they contribute substantially to the country's domestic and foreign markets. Among them are mango, banana and pineapple. Forty to fifty percent are considered minor or promising fruits since they have potential for development for local and foreign markets. Many of these fruits are still abundant and widely distributed throughout the country. The less-known trees, on the other hand are of limited occurrence, and many are now rarely found even in their original habitats (Madulid, 2003).

Some of the promising indigenous Palawan fruits which may not be too familiar to the urban or young people are the following: "durian" (*Durio zibethimus* Murr), "manti" (*Nephelim sp.*), "marang" (*Artocarpus odoratissimus* Blanco.), "anonas" (*Annona reticulate*), "badak" (*Artocarpus champeden.*) and "rimas" (*Artocarpus artilis*).

Palawan is endowed with rich natural resources specifically forest and marine resources. Part of these forest resources are the indigenous fruits which are also consumed as food especially by those living near the forest. However, it has been observed that there are indigenous fruits gathered and marketed in Aborlan, Palawan which were not properly identified. Hence, this study.

METHODOLOGY

A total of 25 indigenous fruit sellers in the Public Market of Aborlan, Palawan from June 2007 to January 2008 were personally interviewed using a structured interview schedule.

The data gathered were the respondents' demographic characteristics (age, sex, address, total annual income and annual income from selling indigenous fruits), mode of selling, market outlet and nature of selling and the available indigenous fruits in the market including its source, time availability, volume sold and selling price.

Data were summarized and presented in tabular form and analyzed using statistical tools such as frequency count, percentage, range, total and average.

RESULTS AND DISCUSSION

Demographic Characteristics of the Respondents

The age of the indigenous fruit sellers ranged from 21-60 years old with an average of 38.92 years. Most (36%) of them are 31-40 years old while the least of them (16%) are 51-60 years old. This implies that the sellers are still middle-aged and very much strong for this kind of business. Majority (92%) of them are females while only 8% are males.

The sellers reside in Cabigaan (24%) and Mabini (20%) while the rest come from other barangays of Aborlan except for one seller who resides in Narra, Palawan. Annual income from all sources ranged from P30, 000.00-39,000.00. Majority (80%) had P30, 000.00-34,000.00 while the least (20%) had P35, 000.00-39,000.00 annual income. Their average annual income from all sources is P32, 000.00. With regards to their annual income from selling indigenous fruits, most (23 or 92%) of the sellers earned P1, 000.00-4,200.00 while only two (8%) of them had P4,300.00-5,000.00 income. The average annual income derived by the sellers from selling indigenous fruits is P2, 508.00.

Selling Information

Majority (96%) of respondents sold their products on retail basis while the least (36%) of them sold on wholesale basis. Likewise, most (96%) of them marketed their products in Aborlan Public Market while others (12%) marketed their products within the barangay and only one (4%) respondent sold fruits in Puerto Princesa City. The respondents sold their products on per piece basis (68%) and per kilogram basis (52%) (Table 2).

The ten (10) indigenous fruits marketed in Aborlan Public Market were Anonas, Badak, Kandis, Durian, Guatis, Marang, Manti, Rimas, Seryali and Tabo (Table 3).

Table 1. Demographic characteristics of the respondents.

Characteristics	Frequency (n=25)	Percentage (%)
Age		
21-30	4	16.00
31-40	9	36.00
41-50	8	32.00
51-60	4	16.00
Average	38.92 years	
Sex		
Male	2	8.00
Female	23	92.00
Address		
Barake	1	4.00
Cabigaan	6	24.00
Gogognan	1	4.00
Iraan	1	4.00
Mabini	5	20.00
Magbabadil	3	12.00
Magsaysay	1	4.00
Narra	3	12.00
Aborlan Proper	1	4.00
Sagpangan	2	8.00
Tagpait	1	4.00
Annual income from all sources		
30,000.00-34,000.00	20	80.00
35,000.00-39,000.00	5	20.00
Average	P32,000.00	
Annual income from selling indigenous fruits		
P1,000.00-1,700.00	6	24.00
1,800.00-2,500.00	9	36.00
2,600.00-3,400.00	4	16.00
3,500.00-4,200.00	4	16.00
4,300.00-5,000.00	2	8.00
Average:	P2,508.00	

Table 2. Distribution of the respondents according to nature of sale, market outlet and mode of selling.

Information	Frequency (n=25)*	Percentage (%)
Mode of selling		
Retail	24	96.00
Wholesale	9	36.00
Market outlet		
Within the barangay	3	12.00
Aborlan Public Market	24	96.00
Puerto Princesa City	1	4.00
Nature of selling		
Per piece	17	68.00
Per kilogram	13	52.00

* Multiple Responses

**Source, time availability, volume sales and selling price
of indigenous fruits sold**

Among the ten (10) indigenous fruits marketed in Aborlan Public Market from June 2007 to January 2008, "manti" (*Nephelium Sp.*) had the highest volume of sales with a total of 67,700 pieces sold at 100 pieces for P20.00 or P0.20 per piece. Sources of "manti" were mostly from nearby barangays of Aborlan with majority of supply coming from Barangay Magbabadil, Aborlan. The fruits were available in the market from June to November 2007 (Table 3)

Likewise "tabo" were on sale from June to November 2007 with total volume sales of 960 pieces sold at 4 pieces for P20.00 or P5.00 per piece, coming from Barangay Sagpangan and Cabigaan. On the other hand, a total of 10 pieces of "rimas" from Barangay Magsaysay were sold in September 2008 at P15.00 per piece. "Seryali" coming from Barangay Cabigaan sold at 50 pieces for P5.00 that generated a total volume sales of 400 pieces were available in the market in August 2007 "Kandis" that came from Barangay Sagpangan generated a total volume sales of 100 pieces in August 2007 which were sold at 25 pieces for P5.00. A total of 105 pieces "guatis" from Poblacion and Barangay Tagpait was sold at P20.00 per kilogram while 20 pieces of "Anonas" from Barangay Gogognan were sold at P5.00 each on January 2008.

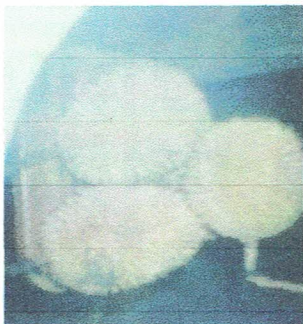
Other species of fruits such as "badak" (55 pcs sold at 3 pcs for P20.00) and "marang" (12 pieces sold at P30.00 each) came from Rizal, Palawan while "durian" (18 pcs sold at P70.00/kg.) came from Barangay Cabigaan and Rizal town. Moreover, barak, marang and durian were offered for sale in September 2007.

Data show that not all of the indigenous fruits marketed in Aborlan Public Market are gathered from Aborlan, Palawan. Fruits like "marang", "badak" and "durian" came from Rizal, Palawan. Also, it can be noted that most of these fruits were marketed during Sundays which is the market day or "tabuan" in Aborlan.

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Table 3. Indigenous fruits marketed in Aborlan Public Market from June 2007-January 2008.

Local Name	Appearance	Scientific Name	Family Name	Description	Economic Importance
Anonas		<i>Annona reticulata</i> Linn.	Annonaceae	The skin of the fruit is reddish-brown in color and with hexagonal lines. The flesh contains brown seeds and is yellowish-white with granular texture.	Edible fruit
Badak		<i>Artocarpus champeden</i>	Moraceae	The fruit is called a syncarp. It is small, oblong and jackfruit-like without pyramidal spines. It is a multiple fruit, when opened shows a fleshy receptacle and numerous carpels fused together.	Edible fruit

Kandis		<i>Garcinia lateriflora</i>	Guttiferae	The fruit is a berry 3-4 cms. in diameter with numerous seeds. It is small, acid fruit with varying degree of sweetness and a melting mangosteen-like texture and flavor.	Edible fruit
Durian		<i>Durio zibethinus</i> Murr	Bombacaceae	The fruit is round or ellipsoid rather large (15 to 25 cms. long) and weighing as much as 3 kilograms or more. Its hard rind is covered with short, stubby, extremely hard pyramidal sharp spines called "duri" hence called durian.	Edible fruit

Guatis		<i>Annona squamosa</i> Linn	Annonaceae	The fruit is a cross between guyabano and atis fruit. It has a scaly skin and almost round and about 10 cms. wide. It has lemony, milky and tart taste.	Edible fruit
Marang		<i>Artocarpus odoratissima</i> Blanco	Moraceae	The fruit is large averaging about 10 cms. long and sometimes weighing 1,000-1,800 grams. It is roundish oblong, thickly studded with short brittle greenish yellow spines. The rind is thick and fleshy. The flesh is snowy white, very sweet, juicy and aromatic.	Edible fruit

Manti		<i>Nephelium Sp.</i>	Sapindaceae	The fruit grows in terminal, loose clusters of 10-13 fruits and signal ripeness by turning red and yellow. Each one is 5-6 cms. long, surrounded by short to long soft spines. A pinch opens the skin to reveal the pearly white, translucent flesh which may be thin or thick, dry to very juicy, acid to very sweet.	Edible fruit
Rimas		<i>Artocarpus altilis</i>	Moraceae	The fruit grows one, two or sometimes three together, are green when young, and greenish yellow when ripe. The rind is thin and smooth although its surface is marked by polygons. The pulp is slightly fibrous, firm, mealy, pale yellow or whitish, and with a mild sweetish flavor when ripe. It is seedless.	Edible fruit

Table 4. Source, time availability, total volume of sales and selling price of indigenous fruits sold in Aborlan Public Market from June 2007 to January 2008.

Species/Name	Total volume of sales	Selling price (P)	Source of fruits	Time availability (day)	Time availability (Month)
Anonas	20	P5.00 each	Gogognan	Saturday	January
Badak	55	3 for P20.00	Rizal	Sunday	September
Kandis	100	25 for P5.00	Sagpangan	Sunday	August
Durian	18	P70 per kilo	Cabigaan Rizal town	Sunday	September
Guatis	105	P20 per kilo	Poblacion Tagpait	Wednesday Sunday	September- October
Marang	12	P30 each	Poblacion Tagpait	Sunday	September
Manti	67,700	100 for P20	Magbabadil Barake Iraan San Juan Mabini Gogognan Sagpangan Poblacion Sandoval Magsaysay	Sunday	June - November
Rimas	10	15.00 each	Magsaysay	Sunday	September
Seryali	400	50 for P5.00	Cabigaan	Sunday	August
Tabo	961	4 for P20.00 (P5.00)	Sagpangan Cabigaan	Sunday	June- November

Problems Encountered by the Respondents

Based on the multiple responses of the respondents, the problems they encountered were: difficulty in transporting their products (88%), lack of storage facility (68%), price fluctuation (64%), unfavorable climatic condition (40%), and low price of fruits in the market (16%) (Table 5).

Table 5. Problems encountered by the respondents.

Problem	Frequency (n=25)	Percentage (%)
Difficulty in transporting their products	22	88
Lack of storage facility	17	68
Price fluctuation	16	64
Climatic condition	10	40
Low price	4	16

Conclusion

The indigenous fruits identified in Aborlan Public Market are native to Palawan and the Philippines. These fruits can be potential source of food in times of food crisis. Hence, information about them must be fully disseminated and strictest measures must be employed to conserve them.

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Development of Motor Driven Banana Chipper

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ABSTRACT

This study was conducted to design and fabricate a motor-driven banana chipper, and evaluate the chipping performance variability of the fabricated machine.

Performance evaluation was based only on its capacity in kg/hr with thickness requirement of 2 to 3mm and the chips must be whole and relatively uniform. The developed machine was tested three times using 10 kilograms of banana per trial. The machines' viability was assessed using measures of project worth such as payback period and return on investment (ROI).

Performance evaluation revealed that the chipping capacity of the developed chipper is ranging from 240 to 260 kg/hr which is higher than that of the existing chippers that has a capacity between 100 to 160 kg/hr only.

Investment analysis also showed that the machine is viable. The total fabrication cost is P32,313.00 and the return on investment and payback period is 362.53 % and 3.3 months respectively.

Keywords: banana chipper, chipping capacity, motor-driven banana chipper

INTRODUCTION

The demand of processed or semi-processed banana chips for local and for export consumption is still growing and has a very large market (Ediindia.org, 2007). In the world market, the Philippine banana chips is one of the most sought after edible goods because of its nutritional value. Thus, banana chips has a bright potential in the international market. However, the international market requires strict compliance to quality standards, thus the banana chips industry must continually improve product quality by improving processing equipment to sustain the growth of banana chips industry.

Most of the banana chips entrepreneurs still use the manual method because of the absence of low-cost, locally available and efficient chipping machine. Existing foreign-invented chipping machines are very expensive, difficult to acquire, with low efficiency chipping performance. On the other hand, the manual process is low in capacity, very tedious & labor intensive, not safe to operator and results to inconsistent chip thickness. Hence, a motor-driven banana chipper is designed to address these problems.

METHODOLOGY

The resources used in developing the motor-driven WPU banana chipper and their corresponding cost are shown in Table 1.

Table 1. Investment cost of developing the WPU banana chipper.

Item	Quantity	Unit	Unit Price (Php)	Total Price (Php)
Materials:				
1 Gauge # 16 stainless sheet	1/6	sheet	8000.00	1,333.00
Gauge # 22 stainless sheet	1.5	sheet	5000.00	7,500.00
1 1/2 x 1 1/2 x 1/4" angled bar	4	length	600.00	2,400.00
Stainless knife	2	pc	300.00	600.00
1" ø solid steel shafting	3	ft	250.00	750.00
1/2 hp, capacitor start, single phase electric motor	1	unit	5500.00	5,500.00
1" ø pillow block bearing	2	pc	600.00	1,200.00
1" x 2" ø Type B, single pulley	1	pc	250.00	250.00
1" x 3" ø Type B, single pulley	1	pc	350.00	350.00
1" x 8" ø Type B, single pulley	1	pc	500.00	500.00
40" Type B, V-belt	1	pc	400.00	400.00
44" Type B, V-belt	1	pc	500.00	500.00
1" x 3/1/4" stainless bolt w/ nut	40	pc	15.00	600.00
1/4" x 1" rivets	1	box	600.00	600.00
Ordinary welding rod	5	kg	90.00	450.00
Switch	1	pc	300.00	300.00
Wire	7	m	40.00	280.00
Automotive paint	1	qt	400.00	400.00
Rust converter	1	qt	400.00	400.00
Sub-total				24,313.00
Labor				8,000.00
INVESTMENT COST				31,313.00

Design Considerations

The design criteria used in the development of the machine are the following:

1. The machine parts should be available locally.
2. Machine is durable and economical.
3. The machine can be fabricated in local machine shops.
4. Higher chipping capacity and chipping efficiency than the existing machines used in the country.
5. Safe and easy to operate.
6. Easy maintenance and operation.
7. Adjustable blade height and replaceable

Target Design Features

Chipping Capacity	:	250 – 300 kg/hr
Prime Mover	:	½ hp single phase electric motor
Number of operator	:	1 or 2
Transmission system	:	belt and pulley
Chips thickness	:	set at standard 2 to 3 mm (adjustable)
Number of inlet hoppers	:	12
Blade	:	2 pieces, stainless blade
Chipping disk	:	20" diameter, made of stainless
Length	:	0.95 m
Width	:	0.8 m
Approximate weight	:	30 kg
Frame	:	1 ½" x 3/16" angled bar
Inlet and outlet hopper, side & top cover	:	Stainless sheet

Fabrication

Prior to fabrication, a detailed drawing was first made as to the design considerations. It was constructed by the following order of activities; a) the frame, b) chipping assembly, c) inlet and outlet hoppers, d) transmission system, and e) cover.

Machine Description

The designed chipper is generally a cabinet type (Figure 1). Its height is 0.9 meters while its length and width is 1 m and 0.5 m, respectively. The frame is made up of angular bars. The chipping disk consists of two stainless blades arranged radially. There are 12 hoppers with 6.3 cm and 5.1 cm diameters size. These hoppers and the cover are made of stainless sheets. Its transmissions system consists of belts and pulleys and is driven by a ½ hp electric motor.



Fig. 4. The motor-driven WPU banana chipper.

Evaluation and Testing

The designed chipper was pre-evaluated to determine the right blade orientation, blade sharpening angle and the optimum angular speed of the chipping disk that give the best chips quality that meet the standard chips requirement. The thickness requirement is between 2 to 3 mm, must be whole and the cut surface must be smooth according to the Banana Chips Processors Cooperative in Maligaya, Aborlan, Palawan.

Chipping capacity, average thickness, and the relative chipping efficiency were the factors considered in the test. Three trials with ten kilograms per trial were used. The following formulas were used in the testing and evaluation:

1. Chipping capacity, C

$$C = \frac{W}{T}$$

Where;

W = weight of chips, kg

T = time spent in chipping, hr

C = capacity, kg/hr

2. Average thickness, T_a

$$T_a = \frac{T_t}{S}$$

Where;

T_t = total thickness, mm

S = number of samples

Data Analysis

The chipping performance of the developed banana chipper was evaluated by comparing its chipping capacity to existing banana chipper.

Measures of project worth were used to determine the viability of the designed chipper. This includes the determination of the total cost (fixed and variable), gross and net income and the computation of payback period and the rate of return on investment (ROI).

The following assumptions and formula are used in the analysis.

Assumptions:

1. Operation : 6 hours/day
2. Capacity: 360,000 kg/yr
3. Price of pulp: P0.50/kg
4. Labor Cost: P200.00/day
5. Repair and Maintenance: 5% of Original Cost
6. Depreciation method: Straight line method
7. Life Span: 10 years
8. Salvage Value: 10% of Original Cost
9. Rent from machine use: P 0.50/kg
10. Interest on Capital: 20 % of Original Cost

Formulas:

$$\text{Fixed cost} = D + I$$

Where:

D = depreciation

I = interest on investment

$$\text{Variable cost} = F + L + M + O$$

Where:

F = fuel/electricity

L = labor

M = maintenance

O = lubricants

$$\text{Total cost} = \text{Fixed cost} + \text{Variable cost}$$

$$\text{Gross income} = \text{Capacity} \times \text{Price of pulp}$$

$$\text{Net income} = \text{Gross income} - \text{Total cost}$$

$$\text{Payback period} = \text{Purchase cost} / \text{Net income}$$

$$\text{Return on investment} = \text{Annual Net Income} / \text{Total investment}$$

RESULTS AND DISCUSSION

Machine Performance

The machine capacity is ranging from 240 to 260kg/hr and an average of 251.63 kg/hr as shown in Table 2. The chips qualities met the standard requirement with thickness ranging from 2 to 3 mm, whole chip and relatively uniform.

Table 2. Chipping capacity (kg/hr) of the banana chipper

Trial	Chipping Capacity(kg/hr)
1	258.8
2	245.4
3	250.7
Total	754.9
Mean	251.63

Comparative Performance

As shown in Table 3, the fabricated chipper showed better chipping performance compared to the existing banana chippers. The BS banana chipper, which is foreign-invented and next in rank, is still significantly lower in capacity than the new one. It has the same power source, a 1/2 hp electric motor. It is followed by the Agustin Banana chipper which has a capacity ranging from 100 to 130 kg per hour. The Nayre chipper and manual method have nearly similar capacity of 12-16 kg/hr and 8-12 kg/hr, respectively. The table shows that the developed chipper is more efficient than other existing banana chippers.

Table 3. Capacities of banana chippers (kg/hr)

Chipper	Capacity (kg/hr)
Developed Machine	240-260
BS Banana Chipper	140-160
Agustin Banana Chipper	100-130
Nayre Banana Chipper	12-16
Manual Chipping	8-12

Investment Analysis

The net income per year amounted to P 117,144.60. The return on investment and payback period is 362.53 percent and 3.3 months payback period respectively (Table 4). The analysis reveals that the machine is viable and quickly recoups cost of investment.

Table 4. Economic analysis of the designed chipper

Particular	Value (Php)
I. Investment Cost	32,313.00
Materials	24,313.00
Labor	8,000.00
II. Annual Operational Cost	
A. Fixed Cost	9,370.77
Depreciation	2,908.17
Interest	6,462.60
B. Variable Cost	53,484.63
Labor	48,000.00
Repair and Maintenance	1,615.65
Electricity	3,222.72
Lubricant	646.26
III. Volume of chips per year	360,000 kg/yr
IV. Gross Income (at P0.50/kg)	180,000.00
V. Net Income	117,144.60
VI. Return on Investment	362.53 %
VII. Payback Period	0.27 yr or 3.3 months

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Effect of Corot (*Dioscorea hispida* Dennst.) Extract Against Insect Pests of Lowland Rice

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ABSTRACT

This study compared the effects of corot extracts and commercial insecticide on insect pests and yield of lowland rice. Five (5) treatments namely: (T₁ - Control (No spray); T₂ - 30% corot tuber extract + 70% tap water; T₃ - 30% corot leaves extract + 70% tap water; T₄ - 30% corot stem extract + 70% tap water, and T₅ - commercial insecticide, with three (3) replications were used in the study.

Rice plants treated with commercial insecticide and 30% corot tuber extract had significantly lowered the number of larval insect pest (stem borer larvae) and flying insect pests (rice bugs and rice black bugs) and average number of unfilled grains due to insect feeding compared to the 30% corot leaves extract, 30% corot stem extract, and the untreated plants. Likewise, plants treated with commercial insecticide and 30% corot tuber extract had significantly higher insect pest mortality compared to the other treatments. However, commercial insecticide is more effective than 30% corot tuber extract. Furthermore, the use of commercial insecticide had significantly higher yield than the rest of the treatments. The other treatments have comparable results.

Keywords: corot, Dioscorea hispida, flying insect pests, lowland rice

INTRODUCTION

Rice (*Oryza sativa* Linn.) locally known as "palay" is the main food of many Filipinos. The brown rice has a high caloric value and is a good source of vitamins, minerals and protein. Rice and its by-products are used in varied ways as food, feed and source of industrial products.

In 2005, the total rice production of the Philippines was 15,109,000 tons which utilized a total land area of 4,163,000 ha. Furthermore, Filipinos have consumed a total of 10,722,000 tons rice in the same year.

In order to meet the demand of rice, farmers must fully maximize their harvest from their land but their production is constantly constrained by many factors like pests and diseases. To solve the problems on pests and diseases, farmers rely on the use of inorganic pesticides. However, the use of inorganic pesticides is coupled with high cost, development of insect resistance and greater concern for environmental protection, thus other alternatives have to be considered. Botanical pesticides offer an alternative to synthetic pesticides. Botanical pesticide fitted very well into the concept of sustainable agriculture since it came from renewable resources and can be grown by the farmers themselves right in their backyard.

Yam (*Dioscorea hispida* Dennst.) locally known as "corot" is abundant here in Palawan. This plant is a wild crop that does not need any intensive care. It is a climbing plant with a prickly stem twinning to the left with trifoliate heavy leaves. The tuber contains a toxic substance, hence it must be detoxified first before it can be cooked as food. It is for this reason that the researcher would like to test its toxicity against rice insect pest.

This study specifically aimed to: 1) determine the effect of corot extracts against rice insect pests; 2) determine what part of the corot plant is effective for the control of rice insect pests; 3) compare the efficacy of corot extracts from commercial pesticides for the effective control of rice insect pests; and 4) compare the yield between rice plants treated with the extracts of different parts of corot and commercial insecticides.

METHODOLOGY

Complete Randomized Design (CRD) was followed in this study with five (5) treatments and three (3) replications per treatment. The treatments used were: Treatment 1 – control - no spray, Treatment 2 – 30% corot tuber extract (CTE) + 70% tap water, Treatment 3 – 30% corot leaves extract (CLE) + 70% tap water, Treatment 4 – 30% corot stem extract (CSE) + 70% tap water and Treatment 5 – commercial insecticides. Five plants per plot served as sample plants.

Land preparation. An area of 160 square meters was plowed and harrowed thoroughly to incorporate weeds and rice stubble with mud for further decomposition. The area was divided into three (3) blocks and each block was further subdivided into five plots, measuring 2 x 2 meters each. A one-meter leeway between blocks and plots and one meter border was provided.

Seed preparation. An area of 20 square meters was cleared, plowed and harrowed thoroughly. After harrowing, the bed was elevated and leveled properly. Water was drained before seed sowing.

Seed treatment and seeding. Two kilograms of rice seeds put inside a plastic sack was soaked in water for 24 hours and was incubated for another 24 hours in a shady place. The germinated seeds were broadcasted evenly in seedbed.

Fertilizer application. Seven hundred fifty (750) grams complete fertilizer during the final harrowing and 10 days after sowing (DAS) were applied to the seedbed. Complete fertilizer was applied at the rate of 50 kg/ha or 5 grams/square meter as basal. Area was top dressed with urea at the rate of 150 of 150 kg/ha or 15 grams/plot, a week before panicle initiation or 55 days after transplanting.

Transplanting and replanting. Twenty-one days after sowing, the seedlings were pulled and transplanted at a distance of 20 x 20 cm and at the rate of one seedling per hill. Replanting of missing hills was done 3-5 days after transplanting to avoid uneven maturity.

Collection and preparation of corot extract. Collected tubers, leaves and stems of corot from Tigman, Aborlan, Palawan were cleaned and chopped into small pieces with a sharp knife and pounded thoroughly with mortar and pestle. The pounded plant materials were soaked in tap water for 24 hours in 1:1 ratio (1 kg plant material + 1 L tap water). After soaking, the different plant materials were squeezed with cheese cloth to separate the juice from the meat. The extracted juice served as the stock solution.

Application of extracts. Five days after transplanting, the rice plants were sprayed with different corot extracts and commercial insecticide (Karate). Karate insecticide was sprayed following the rates on its label. Spraying was done early in the morning at 7 days interval until 3 weeks before harvesting the rice.

Irrigation and drainage. Three days after sowing, the seedbed was irrigated at a depth of 2 centimeters and increased gradually up to 5 cm depending on the height of the seedlings. The plots were irrigated at a depth of 3 centimeters. The level of water was gradually decreased at hard dough stage. The field was totally drained 15 days before harvesting.

Weeding. Hand weeding was done when weeds are observed growing in the area during the first 40 days from transplanting.

Control of pests and diseases. The seedbed was enclosed with a 4 x 5 x 1 m screen net to prevent insect pest infestation during the seedling stage. Mollusks were handpicked and fungicide was sprayed when rice plants show fungus infections. Rodents were captured using traps and nylon was used to drive away birds.

Harvesting. The rice panicles were harvested at 80-85% physiological maturity. Harvesting was done manually with a sickle. Sample plants were harvested first.

Threshing, weighing and drying. The grains were threshed manually. After threshing, harvest from each plot was weighed. Weighed palay were placed in plastic sacks and sun dried until it reached 14% moisture content. The dried grains were placed in labeled plastic bags.

The data collected were the mean number of larval and flying insect pests, mean number of plants damaged by insect pests, mean number of insect mortality, mean number of unfilled grains, plot yield and computed yield per hectare. The computed yield per hectare was derived by multiplying the quotient of 10,000 sq. m. and plot area in sq. m. to the yield per plot.

Data gathered were subjected to Analysis of Variance (ANOVA) and Duncan's Multiple Range test (DMRT) to test the differences between treatment means.

RESULTS AND DISCUSSION

Mean number of larval insect pests (Stemborer larvae) infesting rice plants

The lowest mean number of stemborer larvae (12.00) was observed in rice plants treated with commercial insecticide (T_5). This is followed by those treated with 30% corot tuber extract (T_2), 30% corot leaves extract (T_3) and 30% stem extract (T_4) with the mean stemborer larvae of 13.67, 24.33 and 26.33, respectively. On the other hand, the untreated plants (T_1) obtained the highest number of stemborer larvae with a mean of 27.67 (Table 1). DMRT showed that rice plants treated with commercial insecticide and 30% corot tuber extract had statistically lower number of stemborer larvae compared to those rice plants treated with 30% corot leaves extract and 30% corot stem extract and the untreated rice plants. This indicates that the 30% corot tuber extract has insecticidal properties that is comparable to commercial insecticide.

Mean number of flying insect pest infesting the rice plants

Rice plants treated with commercial insecticides (T_5) had the lowest number of rice black bugs and rice bugs with a mean of 42.3, followed by those treated with 30% corot tuber extract (T_2) with a mean of 51.7. Rice plants treated with 30% corot stem extract (T_4) and 30% corot leaves extract (T_3) had a mean of 64.3 and 67.3 rice black bugs and rice bugs respectively while those untreated or control plants (T_1) obtained the highest number of rice black bugs and rice bugs with a mean of 79.0 (Table 1).

Table 1. Mean number of larval insect pests, flying insect pests, plant damaged by insect pests, insect pests' mortality, unfilled grains due to insect feeding and the plot yield in kilograms.

Treatment	Mean number of larval insect pests	Mean number of flying insect pests	Mean number of plant damaged by insect pests	Mean number of insect pests' mortality	Mean number of unfilled grains due to insect feeding	Plot yield in kilograms
T_1 - Control (No spray)	27.67 ^a	79.0 ^a	20.00 ^a	0 ^c	61.87 ^a	1.759 ^b
T_2 - 30% CTE + 70% tap water	13.67 ^b	51.7 ^b	16.87 ^a	12 ^b	28.67 ^{bc}	1.509 ^b
T_3 - 30% CLE + 70% tap water	24.33 ^a	67.3 ^{ab}	18.80 ^a	0 ^c	46.47 ^{ab}	1.508 ^b
T_4 - 30% CSE + 70% tap water	26.33 ^a	64.30 ^{ab}	17.33 ^a	0 ^c	51.47 ^a	1.515 ^b
T_5 -Commercial insecticides	12.00 ^b	42.3 ^b	9.40 ^b	22 ^a	22.73 ^c	2.232
F value (treatment)	22.35	8.374 ^{**}	21.24 ^{**}	53.14 ^{**}	17.65 ^{**}	16.46 ^{**}

Note: Means having the same letter superscript are not significantly different at 0.01 level based on DMRT.

ns - not significant

** - highly significant

ANOVA showed highly significant differences among the treatment means. Treatment 5 (commercial insecticide) and Treatment 2 (30%) corot tuber extract) are significantly lower than Treatment 1 (no spray). However, it did not differ significantly from Treatment 4 and Treatment 3. Likewise, Treatments 1, 3 and 4 did not differ significantly.

This implies that the use of the 30% corot tuber leaves and stem extract are comparable to the commercial insecticides in repelling rice black bugs and rice bugs from infesting the rice plants. This conforms with Hu and Yao (2001) and Su *et. al.* (2003) that *Dioscorea* has toxic content that kills cancer cell lines.

Mean number of plants damaged by insect pests

Rice plants treated with commercial insecticide (T_5) obtained the lowest number of rice plants damaged by insect pests with a mean of 9.40. Those treated with 30% corot tuber extract (T_2), 30% corot stem extract (T_4) and 30% corot leaves extract (T_3) and the untreated or control plants (T_1) obtained the mean insect pests damaged rice plants of 16.87, 17.33, 18.80, and 20.00, respectively (Table 1)

ANOVA showed highly significant differences among the treatments. DMRT revealed that rice plants treated with commercial insecticide had statistically lower number of plant damaged by insect pest than Treatments 1, 2, 3, and 4.

This implies that the different corot extracts were not as effective as the commercial insecticides in preventing insect pest from damaging the rice plants.

Mean number of insect pest's mortality

The highest number of insect pests mortality was observed on rice plants treated with commercial insecticide (T_5) with a mean of 22, followed by rice plants treated with 30% corot tuber extract (T_2) with a mean of 12. Plants treated with 30% corot leaves extract (T_3) and 30% corot stem extract (T_4) and the untreated or control plants (T_1) obtained zero insect pest mortality (Table 1).

ANOVA revealed highly significant differences among treatment means. Treatment 5 (commercial fertilizer) was significantly different from the rest of the treatments. Treatment 2 had significantly higher insect pests' mortality than Treatments 1, 4 and 3 but significantly lower than Treatment 5.

This implies that among the corot extracts, only the 30% corot tuber extract is effective in causing mortality to rice insect pests.

Mean number of unfilled grains due to insect feeding

The highest number of unfilled grains was obtained from the untreated or control plants (T_1) with a mean of 61.87. This is followed by those treated with 30% corot stem extract (T_4), 30% corot leaves extract (T_3) and 30% corot tuber extract (T_2) with mean unfilled grains of 51.47, 46.47 and 28.67 respectively. Those treated with commercial insecticide (T_5) got the lowest number of unfilled grains with a mean of 22.73 (Table 1).

ANOVA showed that differences among treatment means were highly significant. DMRT showed that commercial insecticide application is significantly lower than other treatments but comparable to plants sprayed with 30% corot tuber extract (T_2). Treatment 2 is comparable to Treatment 3 while Treatment 3 is comparable to Treatment 1.

This implies that 30% corot tuber extract and commercial insecticide are equally effective in repelling insect pests (rice black bugs and rice bugs) that feed on rice plant, hence, lesser unfilled grains were observed.

Plot yield

Rice plants treated with commercial insecticide (T_5) obtained the highest plot yield with a mean of 2.232 kgs, followed by the rice plants treated with 30% corot stem extract (T_4), 30% corot tuber extract (T_2), and 30% corot leaves extract (T_3) with the means of 1.515, 1.509 and 1.508 kgs, respectively. The untreated or control plants (T_1) obtained the lowest plot yield with a mean of 1.459 kgs (Table 1).

ANOVA showed that differences in plot yield among treatments are highly significant. DMRT showed that Treatment 5 (commercial insecticide) differed significantly from the rest of the treatments. On the other hand, Treatments 1, 2, 3 and 4 are statistically the same.

This implies that the different extracts of corot did not affect the plot yield of rice. Likewise, the result implies that the use of commercial insecticide reduced

the number of insect feeding on rice hence, better yield was obtained in this treatment compared to those rice plants treated with different corot extract.

Computed yield per hectare

Rice plants treated with commercial fertilizer (T_5) obtained the highest computed yield with a mean yield of 5.580 tons/ha, followed by those plants treated with 30% corot stem extract (T_4), 30% corot leaves extract (T_3) and 30% corot tuber extract (T_2) with means of 3.7875, 3.770, 3.7725 tons/ha, respectively. The lowest yield was obtained from the untreated or control plants (T_1) with an average yield of 3.6475 tons/ha (Table 2).

This implies that the use of commercial insecticides repel insect pests from infesting the plants, hence higher yield was obtained compared to the rest of the treated plants.

Table 2. Computed yield per hectare

Treatment	Average Yield/ha(tons)
T_1 - Control (No spray)	3.6475
T_2 - 30% corot tuber extract	3.7725
T_3 - 30% corot leaves extract	3.7700
T_4 - 30% corot stem extract	3.7875
T_5 - Commercial insecticide	5.5800

Conclusion

Based on the result of the study, it can be concluded that the application of 30% corot tuber extract is as effective as that of commercial insecticide in controlling and/or repelling rice insect pests.

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Varying Volume of Heated Wine with Gelatin as Clarifying Technique in Cashew Wine Processing

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ABSTRACT

The study was conducted to determine the effect of gelatin dissolved in varying volumes of heated wine on the quality and acceptability of cashew wine before and after clarification and after two months clarification. Twenty five (25) liters of eight month old cashew wine was equally distributed in 5 treatments with each treatment utilizing various volume of heated wine in clarifying wine. Ten selected panelists evaluated the quality and acceptability of wine in terms of color, aroma and clarity. Kruskal Wallis statistics method was used to test the differences of quality and acceptability among treatments.

Alcohol content ($^{\circ}$ R%) and sugar concentration ($^{\circ}$ Brix) were the same for all treatments after 2 months storage. Likewise, all treatments had statistically the same color, aroma and clarity of all treatments after two months storage. On the other hand, the specific gravity of the 5 treatments increased after 2 months storage.

Keywords: Gelatin, alcohol content, sugar concentration, specific gravity

INTRODUCTION

Cashew (*Anacardium occidentale* L.) is a crop whose potential was not utilized extensively and not fully appreciated because its benefits were not extensively publicized. It is the leading nut crop of the Philippines where 90% of cashew production comes from the province of Palawan. Cashew kernels are eaten in fried, roasted or brittle form and can be processed as whole or split. Young cashew leaves can be eaten fresh and its apples are eaten raw but can be processed into candies, jams, jellies, vinegar and wine.

Cashew apple like other fruits can be processed into wine. The process of cashew making is similar to other fruits where cashew apple's sugar will undergo fermentation in suitable conditions that enable the yeast to grow and produce ethyl alcohol or wine. After the fermentation, the new wine produced has cloudy

appearance due to the presence of yeast particles and other unwanted substances. The wine is clarified by removing the unwanted components and it can be further clarified with the addition of substances like gelatin. Gelatin is a well proven fining agent used in many wine producing areas in Europe. It enhances visual characteristics and impart delicate flavor of white wine and improves the palatability of red wine (Anonymous, 1983).

The Western Philippines University (WPU) is the only academic institution in Palawan that processed wine from cashew and holds the technology in cashew wine making. The common practice of technicians in WPU Food Processing Center is to heat 20 liters of cashew wine to clarify the wine. This practice tends to evaporate a large amount of the volatile alcohol thus making the wine clear but low in alcohol content. Hence, the researchers conducted this study to address this concern by determining a clarifying technique that utilizes lesser volume of wine and is more economical.

METHODOLOGY

Twenty five (25 liters) of eight months aged cashew wine from WPU Food Processing Center was equally distributed in 5 sterilized bottles and classified into 5 treatments (Treatment 1: 4 g unflavored dissolved gelatin + 1 liter 20°C heated wine + 4 liters unheated wine; Treatment 2: 4 g unflavored dissolved gelatin + 2 liters 40°C heated wine + 3 liters unheated wine; Treatment 3: 4 g unflavored dissolved gelatin + 3 liters 60°C heated wine + 2 liters unheated wine; Treatment 4: 4 g unflavored dissolved gelatin + 4 liters 80°C heated wine + 1 liter unheated wine; and Treatment 5: 4 g unflavored dissolved gelatin + 5 liters 100°C heated wine. The unflavored powdered gelatin used in all treatments was dissolved at 60-65°C temperature. The sediments in all present in all treatments were allowed to settle for two weeks or until the wine is visibly clarified.

Sensory evaluation of unclarified and clarified wine samples in terms of color, aroma and quality tests were determined subjectively by 10 selected panelists (5 WPU faculty/staff and 5 students). For unclarified wine samples, each panelist was provided with 10 ml wine for evaluation of sensory attributes. Likewise, the ten panelists were given 10 ml coded clarified wine samples for each treatment for evaluation of color, aroma and quality. Each treatment sample was evaluated one at a time with panelists rinsing their mouth with water after each test. The panelists recorded their responses on the score sheets cards.

The same wine tasting procedure was followed for treated wine stored for another 2 months.

The data gathered were the acceptability rate of unclarified and clarified wine samples, alcohol content before and after clarifying, and after 2 months of storage, and percent alcohol content of clarified wine. Alcohol content was determined by recording the degree Brix ($^{\circ}$ Brix) reading of one to two drops of wine in a refractometer. Percent alcohol content ($\%^{\circ}$ R) was computed by dividing the rate of sugar in brix ($^{\circ}$ Brix) to 80° Fr, the constant rate of yeast extract activity in fermentation.

Kruskal Wallis was employed to test the differences in color, aroma and quality of the sample treatments.

RESULTS AND DISCUSSION

The frequency scores of panelists on the color, aroma and clarity of cashew wine clarified with gelatin dissolved in varying percentage volume of wine before clarification, after clarification, and after two months of storage are presented in Table 1. In terms of color, the unclarified wine was perceived to be light brown. After clarification, the sample clarified with 60% by volume of heated wine was also perceived as light brown by majority of the panelists (80%) but after two months of storage, the color of the same cashew wine was perceived by the same number of panelists to have changed to brown. After clarification, sample clarified with 80% by volume of heated wine was perceived by 50% of the panelists to be light brown. The same number likewise perceived that the same wine turned dark brown after two months of storage. The same observation was noted for sample wherein 100% of wine was heated.

As to the aroma, unclarified wine was given a rating of slight to moderate alcohol flavor by 98% of the panelists. After clarification, sample with 20% by volume of heated wine was perceived to have slight alcohol flavor without changed in aroma after two months of storage. On the other hand, sample with 40%, 60% and 80% by volume of heated wine, have reduced their alcohol aroma as perceived by the panelists. Improvement of aroma was perceived by the panelists for treatment where 100% of wine was heated. This sample was perceived to have improved from moderate to extreme alcohol flavor after two months of storage.

In terms of wine clarity, 75 percent of the panelists adjudged the unclarified wine with slight to moderate clarity. After clarifying process, the

sample clarified with 80% heated wine was preferred by 70% of the panelists over the other treatments with a rating of moderate to extreme clarity. After 2 months storage, the treatments where gelatin was dissolved in 40%, 80% and 100% heated wine were given a rating of moderate clarity as judged by 70% of the panelists (Table 1). The above data indicate that heating wine at a lower volume of 40% is equally effective in wine clarified by 80% and 100% heated wine.

Table 1. Percentage scores on the color, aroma and clarity of cashew wine clarified with gelatin dissolved in varying percentage volume of wine before clarification (BC), after clarification (AC) and after two months storage (ATMS).

Two months storage (ATMS).											
Attributes	Treatments										
			20%		40%		60%		80%		100%
	BC	AC	ATMS	AC	ATMS	AC	ATMS	AC	ATMS	AC	ATMS
Color:											
Yellow	32			20	50	80	20	50	10		
Light brown	48	30	40	30	50	10	80	10	40	70	30
Brown	4	10	40	20		10		30	50		50
Dark Brown	16	60	20	30						30	20
Flavor:											
Extreme alcohol	4	10		30	10	10	20	20	20	30	40
Moderate alcohol	52	20	20	30	30	50	40	50	30	60	30
Slight alcohol	46	60	80	30	60	30	40	20	50	10	30
No alcohol flavor	2	10		10		10		10			
Clarity:											
Extreme clarity	2			10	20		20	10	30		10
Moderate clarity	36	30	20	50	70	50	50	60	70	50	70
Slight clarity	38	60	60	40	10	40	10	30		50	10
Turbid	24		20				20				10

The degree brix ($^{\circ}\text{Bx}$), alcohol content($^{\circ}\text{R}\%$) and specific gravity of the untreated and the treated wine is shown in Table 2. The unclarified 8 month old wine has sugar concentration of 5° Brix and alcohol content of 7.5. After clarification, the sugar concentration and alcohol content of wine clarified with 40%, 60% and 80% heated wine did not change while samples with 20% and 100% heated wine exhibited reduction in sugar concentration (6° to 5° Brix) and alcohol content (7.5 to 6.25). After 2 months storage, all treatments had equal sugar concentration (5° Bx) and alcohol content (6.25).

Table 2. Degree of brix ($^{\circ}$ Brix), alcohol content (R %) and specific gravity of cashew wine clarified with gelatin which was dissolved in varying volume percentage of heated wine.

Treatments	Before Clarification			After Clarification			After 2 months storage		
	$^{\circ}$ Brix	$^{\circ}$ R%	Specific gravity	$^{\circ}$ Brix	$^{\circ}$ R%	Specific gravity	$^{\circ}$ Brix	$^{\circ}$ R%	Specific gravity
Unclearified wine	6	7.5	998						
20%				5	6.25	999	5	6.25	1.001
40%				6	7.5	998	5	6.25	1.000
60%				6	7.5	999	5	6.25	1.000
80%				6	7.5	999	5	6.25	1.000
100%				5	6.25	999	5	6.25	1.001

After 2 months storage, the specific gravity of cashew wine increased. These can be attributed to the demijohn wherein the wine were stocked for two weeks before they were transferred in individual bottle. The alcohol present in the wine may have evaporated from the vacant space in the demijohn. The slight reduction in alcohol content of wine samples may also be due to the heating process.

The acceptability ranking scores on the color, aroma and clarity of cashew wine clarified with varying percentage volume of heated wine is shown in Table 3. In terms of color, there was a significant difference in ranking among the treatments after clarification. However, after 2 months storage, no significant difference in ranking was observed among treatments. This implies that a lower volume of wine can be effective enough in maintaining the color of the cashew wine. Heating in a reduced volume of wine also has economical implications on wine processing.

On the other hand, Kruskal Wallis test revealed that the aroma of unclarified wine was significantly different from the aroma of clarified wine samples regardless of the technique used and the length of storage. This implies that the reduction in the alcoholic aroma of clarified wine maybe due to the evaporation of the alcohol during the heating and clarifying procedure.

Moreover, the rankings of the treatments in terms of aroma after clarification and after two months storage were not significantly different. This implies that aroma of all treatments were comparable after clarification and after 2 months storage.

Table 3. Acceptability ranking scores on the color, aroma and clarity of cashew clarified with gelatin dissolved in varying percentage volume of heated wine before clarification (BC), after clarification (AC) and after two months storage (ATMS).

Treatment	Attributes								
	Color			Aroma			Clarity		
	BC	AC	ATMS	BC	AC	ATMS	BC	AC	ATMS
Unclarified Wine	2.8			2.78			11.28		
20%		3.2	2.3		2.7	2.1		4.3	2.4
40%		4.0	2.4		2.3	2.5		3.3	1.7
60%		3.2	2.5		2.6	2.3		2.8	2.8
80%		2.6	2.3		3.2	2.5		1.8	2.6
100%		2.7	2.7		2.4	3.3		1.9	2.3
Kruskal Wallis Statistics	1.128 ⁿ _s	0.660 [*]	4.952 ^{ns}	1.430 [*]	7.021 ⁿ _s	9.029 ^{ns}	3.349 ⁿ _s	0.612 [*]	4.189 ^{ns}

ns - not significant

* - significant

As to the clarity of wine, the clarity of unclarified wine was significantly different from the clarity of all treatments after clarification, and after 2 months storage. Nevertheless, all treatments had significantly the same clarity after clarification and after 2 months of storage.

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***Sargassum filipendula* Extract as Bio-Fertilizer to Lowland Rice (*Oryza sativa* Linn.)**

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ABSTRACT

This study aimed to evaluate the effects of varying concentration of *Sargassum filipendula* (seaweed) extract on the growth and yield of lowland rice and to identify the level of seaweeds extract that best promotes growth and yield of lowland rice. Results revealed that *Sargassum filipendula* extract had highly significant effect on the average number of days from transplanting to maturity of rice plants. Plants applied with 100% seaweeds extract (T₅) obtained the earliest maturity of 83.0 days. Likewise, the rice plants applied with seaweeds extract were significantly different from the control plants in terms number of grains per panicle. However, the average weekly height increments, average number of tillers per plant, final height, and plot yield in kilograms were not significantly affected by the application of the extract.

Keywords: seaweeds, Sargassum filipendula, lowland rice, Oryza sativa

INTRODUCTION

Rice (*Oryza sativa* Linn.) is an annual crop and mainly produced in the Philippines as staple food and considered as lifeblood of the Filipino. It is a good source of carbohydrates and its by-products such as rice bran are commonly used as animal feeds.

Farmers today rely mostly in chemical fertilizer to provide the essential elements required by the plant. Commercial fertilizers are very costly which make it difficult for low income farmers to acquire and use. Aside from being expensive, these fertilizers have negative effect to the soil, to the environment and to human health.

Organic sources like extracts from seaweeds are suitable for growing different crops. It contains more than 60 minerals. It has fair amount of nitrogen

and potash but little phosphorous. It is particularly rich in micronutrients such as iron, copper, zinc, boron, and manganese. Seaweed species such as *Sargassum* seaweed improves soil quality by increasing the organic matter and by adding nutrients essential for plant growth. Different nutrients are present in *Sargassum* but the concentration vary with species. But in general, these seaweed species have near neutral to slightly alkaline pH, with a nutrient value of 1.5% Nitrogen, 0.1% Phosphorous, and 1.3% Potassium. In addition, it contains 5% Calcium and 1.3% Magnesium, plus it is a great source of essential micronutrients (Wallace, 1966). Hence, this study was conducted to evaluate *Sargassum* as an alternative fertilizer for use in lowland rice production.

METHODOLOGY

The study used Randomized Complete Block Design with five (5) treatments and three (3) replications. The treatments were: T₁ – tap water; T₂ – 25% seaweeds extracts (SE) + 75% tap water (TW); T₃ – 50% SE + 50% TW; T₄ – 75% SE + 25% TW; and T₅ – 100% SE. Five (5) sample plants per plot were randomly selected as basis of observation.

Land preparation. An area of 72 square meters (8m x 9m) was plowed and harrowed thoroughly using carabao drawn-implements. The area was divided into three blocks and further subdivided into five (5) equal plots of 1 x 2 m per block with one meter leeway between plots and blocks.

Seedbed preparation. An area of 2m x 5 m seedbed was plowed and harrowed. The plot bed was raised to 5-6 cm high to facilitate water management.

Soaking and incubating of seeds. The cleaned seeds were placed in a clean sack and soaked in clean running water for 24 hours. It was incubated for 36 hours before broadcasting in the prepared seedbed.

Uprooting and transplanting of seedlings. Seedlings were uprooted 20 days after sowing and transplanted at a distance of 25 x 25 cm apart at an average of three seedlings per hill.

Care and management. The area was properly irrigated and drained to control golden kuhol (snails). Weeds were hand pulled during the early vegetative growth stage of the rice plants.

Collection of seaweeds and preparation of extract. Kulafu seaweeds gathered from the shore of Port Barton, San Vicente, Palawan were washed with tap water and then grounded using mortar and pestle. The grounded kulafu was squeezed to separate extracts from pulp. The extracts were cleaned using a cheese cloth strainer.

Application of seaweed extracts. The seaweed extracts were applied using a hand sprayer. Application was done a day after transplanting and every two (2) weeks thereafter.

Harvesting. Sample plants were harvested first to get the data on per sample basis. Harvesting was done when rice grains attained approximately 80% physiological maturity. The "gapas" method was used in harvesting.

Threshing. "Giik" method was used in threshing. This involves spreading the stalks of paddy rice on hard surface or mat and applying a combination impact-friction force of the feet to the rice panicles by trampling until the grains are loosed and detached from the panicle.

Drying and cleaning. The harvested grains were sundried to reduce the moisture content of the grains. The grains were cleaned by winnowing.

The data collected were average weekly height increment, average number of tiller per plant, average number of days from transplanting to maturity, number of days from transplanting to 80% physiological maturity, final height, average number of grains per panicle, plot yield in kilogram and computed yield per hectare.

The data gathered were analyzed using Analysis of Variance (ANOVA) and Duncan's Multiple Range Test (DMRT).

RESULTS AND DISCUSSION

Average weekly height increment

The plants sprayed with 25% seaweed extract (T_2) had the highest average height increment of 7.14 cm per week. This was followed by control plants (T_1) and plants sprayed with 75 percent (T_4), 100 percent (T_5) and 50 percent seaweeds extracts with average weekly height increments of 7.09 cm, 7.06 cm, 7.03 cm and 6.83 cm, respectively.

ANOVA showed no significant differences among treatment means. This finding implies that the application of seaweeds extract to lowland rice has no effect on the weekly height increment.

Table 1 Average weekly height increment, average number of tillers per plant, average number of days from transplanting to maturity, final height, average number of grains per panicle and plot yield of sample rice plants.

Treatment	Average weekly height increment (cm)	Average number of tillers per plant	Average number of days from transplanting to maturity	Final height	Average number of grains per panicle	Plot yield (kg)
T ₁ - Control	7.09	6.373	85.00 ^a	97.11	108.600	1.009
T ₂ - 25% KSE	7.14	6.483	84.00 ^b	99.27	129.133	1.086
T ₃ - 50% KSE	7.03	6.420	84.00 ^b	98.34	133.533	1.120
T ₄ - 75% KSE	7.06	7.463	83.33 ^b	98.84	131.467	1.077
T ₅ - 100% KSE	6.83	7.247	83.00 ^c	95.50	143.933	1.138
F-value (Treatments)	0.523 ^{ns}	2.95 ^{ns}	26.487 ^{**}	1.944 ^{ns}	6.108 [*]	0.250 ^{ns}

Note: Means having the same letter superscript are not significantly different at 0.01 level based on DMRT

ns = not significant

* - significant

** - highly significant

Average number of tillers per plant

The control plants (T₁) produced an average of 6.373 tillers per plant followed by the plants sprayed with 50 % (T₃), 25 % (T₂), 100 % (T₅) and 75 % (T₄) seaweeds extract with average tillers of 6.420, 6.483, 7.247 and 7.463 per plant, respectively. ANOVA revealed no significant differences among the treatment means. The plants applied with varying levels of seaweeds extracts and the untreated plants are comparable in terms of average number of tillers per plant. This finding implies that the application of seaweeds extracts as foliar fertilizer has no effect on the tillering formation of lowland rice plant.

Average number of days from transplanting to maturity

On the average, plants treated with 100% seaweed extract (T_5) had the shortest period of 83 days from transplanting to maturity, followed by plants treated with 75% seaweed extract (T_4) with 83.3 days from transplanting to maturity. On the other hand, plants treated with 25% and 50% (T_2 and T_3) seaweed extract had an average of 83.33 days from transplanting to maturity while control plants (T_1) obtained the longest period of 85 days from transplanting to maturity.

ANOVA revealed that treatment means showed highly significant differences. The application of 25% to 100% seaweed extract had significantly shorter period from transplanting to maturity than control plants. Furthermore, the application of 100% kulafu seaweeds extract had significantly lesser days between transplanting and maturity than the application of 25%, 50% and 75% seaweed extract. This implies that the application of seaweeds extracts to the rice plants promotes faster maturity. Seaweed foliar spray promotes faster, stronger stem, and leaf growth, earlier blooming and fruit set when sprayed on leaves and flower buds (Smitte, 1991). Furthermore, seaweed extract stimulate and enhance flowering of some plant species Schmidt (1990).

Final Height

The plants sprayed with 25% seaweeds extract (T_2) had the highest final height of 99.27 cm. On the other hand, the plants sprayed with 75% (T_4) and 50% (T_3) seaweeds extract and control plants (T_1) have final height of 98.84 cm., 98.34 cm and 97.11 cm, respectively. Furthermore, the plants sprayed with 100% seaweeds extract (T_5) had the lowest final height of 95.5 cm. ANOVA showed no significant differences among treatment means in terms of final height of rice plants. This finding implies that the plants applied with kulafu seaweeds extract are comparable to the control plants in terms of final height of lowland rice.

Average number of grains per panicle

Plants treated with 100% seaweed extract (T_5) had the highest average grains per panicle of 143.933 while plants treated with 50% (T_3), 75% (T_4) and 100% (T_5) seaweeds had average grains per panicle of 133.533, 131.467 and 129.33. On the other hand, the control plants (T_1) had the least average grains per panicle of 108.600.

ANOVA showed significant differences among the treatment means on the number of grains per panicle. This implies that application of 25% to 100% seaweeds extract produced significantly greater number of grains per panicle than the control thus, it can be said that application of *Sargassum filipendula* extract promotes grain development to the rice plants.

The significant effect could be attributed to the presence of iron in seaweeds extract which gave special benefits to plants when supplied (Nabati, 1994). Furthermore, *Sargassum filipendula* contain more than 60 minerals. It has fair amount of nitrogen and potash but little phosphorous. It is particularly rich in micronutrients such as iron, copper, zinc, boron and manganese. (Wallace, 1966).

Plot yield

The plants sprayed with 100% seaweeds extract (T₅) had the highest average yield of 1.138 kilograms per plot, followed by the plants with 50% seaweeds extract (T₃) with an average yield of 1.120 kg per plot. On the other hand, the plants sprayed with 25% and 75% seaweeds extract (T₂ and T₄) had an average yield of 1.086 kg and 1.077 kg per plot while control plants (T₁) obtained the lowest average yield of 1.009 kg per plot. ANOVA revealed no significant difference between the treatment means which implies that the plants applied with kulafu seaweeds extract are comparable to the control in terms of plot yield.

Computed yield per hectare

The plants sprayed with 100% seaweeds extract (T₅) obtained the highest average yield of 5,685 kgs per hectare, followed by the plants sprayed with 50% seaweeds extract (T₃) with an average yield of 5,601.5 kgs per hectare. The plants sprayed with 25% and 75% seaweeds extract (T₂ and T₄) had average yield of 5,430 kgs and 5,385 kgs per hectare whereas control plants (T₁) had the lowest average yield of 5,045 kilograms per hectare. ANOVA revealed no significant difference between the treatment means with regards to rice yield per hectare.

Table 2. Computed average yield per hectare in kilograms.

Treatment	Average Yield
T ₁ - Control	5045.0
T ₂ - 25% seaweeds extract	5430.0
T ₃ - 50% seaweeds extract	5601.5
T ₄ - 75% seaweeds extract	5385.0
T ₅ - 100% seaweeds extract	5685.0

Conclusion

Based on the results of the study, the application of 100% application *Sargassum filipendula* extract best promotes the maturity of rice plants among the treatments. Moreover, the application of varying concentration (25%, 50%, 75% and 100%) of *Sargassum filipendula* extract increase the average number of grains per panicle compared to the control however, it did not significantly affect height increment, number of tillers, final height and plot yield of rice plants.

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Prevalence of Liverfluke in Slaughtered Ruminants (Cattle and Goat) at the Abattoir of Narra, Palawan

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ABSTRACT

This study was conducted to determine if liverfluke is present in the slaughtered ruminants at Narra, Palawan abattoir; determine the species of liverfluke, the degree of infestation, and the percentage ruminants slaughtered that are affected by liverfluke; and identify possible areas in Narra, Palawan that are affected by liverfluke.

All ruminants held at the holding area of Narra, Palawan abattoir from July 23 to August 25, 2007 were subjected to ante-mortem inspection and the liver of these animals were subjected to post-mortem inspection.

Results of the study revealed that liverfluke was not present in the ruminants (cattle and goats) slaughtered in Narra, Palawan abattoir.

Keywords: liverfluke, ruminants, ante-mortem inspection, post-mortem inspection

INTRODUCTION

Liverfluke disease (fascioliasis) is an important disease found worldwide affecting sheep, goats, cattle and buffalo as well as other domestic animals. The common causative agents are *Fasciola hepatica* and *Fasciola gigantica* which requires various species of *Lymnea*, a fresh water snail, as their intermediate host. The epidemiology of the disease and its prevalence in the Philippines is mentioned in Agricultural Journal. The disease causes considerable impact in the economy of the livestock industry which consists of cost of antihelmenthic, drench, labor, liver condemnation, meat inspection, and reduction in growth rate, fertility and draft power.

This study aimed to: 1) determine if liverfluke is present in the slaughtered ruminants of Narra, Palawan abattoir; 2) determine the species of liverfluke that infest the affected ruminants; 3) determine the degree of infestation of the affected

ruminants; 4) determine the percentage of the ruminants slaughtered that are affected by liverfluke in Narra, Palawan and 5) identify the possible areas in Narra, Palawan that are affected by liverfluke.

METHODOLOGY

The samples in the study were 29 slaughtered ruminants at Narra abattoir from July 23 to August 25, 2007. Fifteen of these were cattle while 14 were goats.

Permission protocol. A formal written request asking permission for the conduct of the study to the Municipal Mayor, Municipal Agriculturist, Market Superintendent and Meat Inspector of Narra, Palawan was facilitated prior to the conduct of the study.

Physical examination of goat and cattle prior to slaughter. All cattle and goats at the holding pen of Narra abattoir that are scheduled for slaughter were physically examined by checking if animals are stressed and lame, and by checking for physical disorder while the animal is in motion. The body condition, health, age, weight and breed of the animals were also determined.

Determination of area of origin of slaughtered goat and cattle. The animal owners were asked about the place where the animals were bought. The researcher sought permission to the owner or the record keeper to look into the animal credentials for additional information.

Examination of the appearance of the liver. The weight, color, texture and presence of abnormalities/spots of the livers of the slaughtered cattle and goats were considered in the examination.

Post-mortem examination of the liver for the presence of liverfluke. The livers of the slaughtered cattle and goats were sliced at hepatic vein and bile duct area. The sliced parts were squeezed to extrude adult liverfluke if it is present.

Identification of liverfluke species. The morphology of the shoulders of the liverfluke served as point of comparison to determine the species of the liverfluke that infested the ruminants. *Fasciola hepatica* are pale brown in color and its shoulder vary up to 12 mm in width when mature while *Fasciola gigantica* are grayish in color and its shoulder vary up to 8 mm in width when mature.

The data gathered were: 1) age, weight, breed, place of origin of animals; 2) health status of the animals (animal body conditions whether healthy or emaciated); 3) livers' color, texture, shape, weight and presence of spots; 4) presence of liverfluke; and 5) degree of liverfluke infestation and percent of animals affected with liverfluke (number of animals positive for liverfluke divided by the number of slaughtered animal).

The degree of infestation was assessed using the following scale:

Degree of infestation	Number of liverfluke seen
-	0
+	1-3
++	4-6
+++	7 and more

RESULTS AND DISCUSSION

Information about the ruminants slaughtered

Sixty percent of the cattle slaughtered falls at the age range of 4 years old and up while the rest (40%) falls at the age range of 1-2 years old. Majority (71.42%) of the goats slaughtered falls at the age range of 1-3 years while the rest belong to the age range of 0 to 1 year old (14.29%), 3-4 years old (7.14%) and 4 years old and above (7.14%).

About 67 percent of the cattle are male and the rest are female (33.33%). Likewise, there are more male goats (57.14%) than female goats (42.85%). The average weight of the cattle is 201.3 kg while the goats' average is 22.66 kg. The cattle are hybrid (20%), native (13.13%) or purebred (66.67%). In goats, majority of them are native (85.71%) and the remaining are hybrid (14.25%).

One third (33.33%) of the cattle slaughtered came from Barangay. Panacan; 20 percent from Barangay. Antipuluan; and around seven percent (6.67%) from Barangay. Malinao. Only one cattle each from Barangays. Tinagong Dagat, Taritein and Abo-abo, Sofronio Espanola was slaughtered. About 43 percent of the goats came from Barangay. Aramaywan. Some of the goats came from Barangay. Panitian, Sofronio, Espanola (21.43%), Barangay. Antipuluan and Barangay. Panacan (14.29% each) and Barangay. Maranan (7.14%).

Table 1. Information about the slaughtered animals.

	CATTLE		GOATS	
	Frequency n=15	Percentage (%)	Frequency n=14	Percentage (%)
Age				
0-1			2	14.29
1-2	6	40.0	5	35.71
2-3			5	35.71
3-4			1	7.14
4 up	9	60.0	1	7.14
Mean age	5 years old		1.9 years old	
Sex				
Male	10	66.67	8	57.14
Female	5	33.33	6	28.85
Weight (kg)				
11-20			8	57.14
21-30			5	35.71
31-40			1	7.14
51-100	1	6.67		
101-150	4	26.67		
151-200	6	40		
201-250				
251-300	2	13.33		
301-350	2	13.33		
Average weight	201.33 kg		22.36 kg	
Breed				
Purebreed	10	66.67		
Hybrid	3	20	2	14.28
Native	2	13.33	12	85.71

One of the 15 cattle slaughtered was emaciated due to poor management of the owner. The rest of the cattle slaughtered were relatively healthy. All goats were in good condition which appears to be healthy.

Appearance of the liver

The description of slaughtered ruminants' liver is shown in Table 2. One of the 15 livers of the slaughtered cattle was rough, pale with milk spots. This came from animal number 14 which has relatively healthy body condition. Even though there were milk spots evident in the liver, no adult liverfluke were observed upon inspection. All other livers had no milk spots, pinkish in color and appeared to be apparently normal. These healthy livers include the liver of the cattle

diagnosed to be emaciated during ante-mortem inspection. On the other hand, all goats' liver had no milk spots, reddish in color, smooth in texture and also appears to be relatively normal.

Table 2. Appearance of the liver.

Appearance	CATTLE		GOATS	
	Frequency	Percentage	Frequency	Percentage
	n=15	(15%)	n=14	(%)
Color				
Pinkish/Reddish (Normal)	14	93.33	14	100
Pale (Abnormal)	1	6.67		
Texture				
Smooth	14	93.33	14	100
Rough	1	6.67		
Presence of abnormalities/ milk spots				
Negative for milk spots	14	93.33	14	100
Positive for milk spots	1	6.67		

Presence of liverfluke

Incisions were made at the liver tissues, hepatic vein and at the bile duct to check for adult liverfluke. All livers of cattle and goat were found to be negative of liverfluke. This indicates that liverfluke was not present in slaughtered ruminants in Narra abattoir from July 23 to August 25, 2007.

Table 3. Presence of liverfluke.

	CATTLE		GOATS	
	Frequency	Percentage	Frequency	Percentage
	n=15	(%)	n=15	(%)
Positive				
Negative	15	100%	14	100

Possible Factors Affecting the Absence of Liverfluke in Slaughtered Cattle and Goats at Narra Abattoir

1. *Selection of animals for slaughter.* The middlemen who brought the animals to the abattoir for slaughter are very careful in selecting the animals they bought. According to these middlemen, they only buy animals that are relatively healthy to avoid condemnation of the carcass.

Emaciated animals are possible suspect for diseases such as liverfluke that are harmful for public health and may be condemned upon inspection.

2. *Regular deworming of animals by owners.* Some animal farmers in Narra, Palawan are aware of the different parasites that infest their livestock. These farmers have regular year-round deworming to control possible infestation of parasites such as liverfluke. Also, the Municipal Agriculture Office of Narra, Palawan has a regular health program in the municipality including deworming of ruminants. Most often, this is done in the month of October in line with their Farm Family Month or the Anihan Festival (now Palay Festival). Barangay schedules for the visit and monitoring of the animal technician of the said office are also conducted.
3. *Few areas with stagnant water.* The middlemen-owner of the ruminants also assumes that one of the reasons for the absence of liverfluke is the negligible source of stagnant water in Narra, Palawan. Although Hall (1997) mentioned that the Philippines is very much prone to the presence of liverfluke due to several areas badly drained water sources, this might not be true for Narra, Palawan.
4. *Rice farm practices.* Most farmers in Narra, Palawan use molluscicide to control snail (from genus *Lymnea*) infestation in the rice paddies. Georgi (1980) said that aquatic snails as an intermediate host of fascioliasis can be controlled by broadcasting molluscicides. This will, in a way, prevent or control liverfluke infestation to ruminants.

Conclusion

In conclusion, liverfluke was not present in the ruminants slaughtered (cattle and goats) in Narra, Palawan abattoir from July 23 to August 25, 2007.

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Biology of Diamondback Moth (*Plutella xylostella* Linn) Reared on Cabbage Treated with Ginseng and Mint Extract

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ABSTRACT

The study compared the biology of diamondback moth reared on cabbage treated with ginseng and mint leaves extracts and compared the effect of different concentrations of ginseng and mint leaves extracts on the biology of diamondback moth. There were seven treatments and three replications used in the study: T₁- control ; T₂ - 30% ginseng extract; T₃ - 60% ginseng extract; T₄ - 100% ginseng extract; T₅ -30% mint extract; T₆ - 60% mint extract and T₇-100% mint extract.

Results of the study showed significant differences among the treatment means on the pupal duration, adult longevity, total lifespan, number of eggs laid per female adult, duration of egg laying, larval mortality, growth inhibitory effect (percentage pupal and adult survival) and antifeedant effect of ginseng and mint leaves extracts based on the percentage leaf disc eaten by the diamondback moth larvae 24 hours after introduction in the choice and no choice test. However, the differences on the incubation period, larval duration, total lifespan, % hatchability and repellent effect based on the number of larvae that visited the treated and untreated cabbage leaf discs in the choice and no choice test were insignificant.

Keywords: biology, diamondback moth, Plutella xylostella, antifeedant

INTRODUCTION

Diamondback moth (DBM) or "tarsan", *Plutella xylostella* L. is the most destructive pest of crucifer crops in the Philippines. The DBM larvae feed on and destroys the foliage of the plant from seedling stage until it is ready for harvest. About 100% yield loss is incurred if DBM infestation will not be controlled (AVNET, 1991).

Mint (*Mentha*) is a very aromatic perennial plant from prostrate rootstocks. Leaves are ovate to oblong-ovate. The flowers are small, arranged in whorls in the

axillary and terminal spikes, the calyx which are five-toothed are companulate or tubular. The corolla is subsequently four-lobed. Stamens are equal and erect. The nutlets are smooth to reticulate (Merill, 1984). According to Sangatanan and Sangatanan (2000), this plant is effective against all chewing insect pests attacking cashew plants in combination with green onion and hot pepper.

Ginseng (*Panax ginseng*) is erect, branching, perennial plants ranging from 2 to 3 feet tall with square, purplish-green stems. Leaves are opposite, serrate, oblanceolate with acuminate apex and base with a length of 2 to 5 inches, flowers are small, irregular and unsymmetrical, manuevers are clustered, 6 flowers per cluster, arranged in terminal. The calyx is green, gamosepalous, corolla is whitish violet, gamopetalous; stamens are polyandrous (4 to 5 stamens per flower), white, 1 to 2 inches filament and violet, oval shaped anther. The pistil is wanting (absent). This plant was reported to have many medicinal uses. Some people use it to boost resistance to viral infection as well as ii prevents human disease (Web MD, 1995).

To control DBM infestation, the farmers commonly use strong chemicals. However, the high dosage and continuous applications of insecticides do not totally control DBM, rather, make DBM resistance to practically all insecticides used. The costly insecticide adds up the cost of production and further aggravates hazards to human health and the environment. It is with this premise that the researchers pursued this study to search for biodegradable and environment friendly alternatives to insecticide in controlling diamondback moth. Specifically this study aims to compare the biology of diamondback moth reared in cabbage treated with ginseng and mint leaves extract, and the effect of varying concentration of ginseng and mint leaves extract on the biology of diamondback moth.

METHODOLOGY

The study was laid out in Completely Randomized Design (CRD) with seven treatments, three replications and 30 samples per treatment. The treatments used were: Treatment 1 – control (untreated); Treatment 2-30% ginseng extract (30ml plant extract +70 ml water); Treatment 3- 60% ginseng extract (60 ml plant extract + 40 ml water); Treatment 4- 100% ginseng extract (100 ml plant extract); Treatment 5-30% mint extract (30 ml plant extract + 70 ml water); Treatment 6-60% mint extract (60 ml plant extract + 40 ml water) and Treatment 7-100% mint extract (100 ml plant extract).

Raising Host Plant

Cabbage seeds were sown in a seedbox (40 cm x 30 cm x 10 cm) containing sterilized mixtures of sand, compost and garden soil (1:1:1 ratio). Emerged seedlings (first three leaves begin to appear) were pricked using plastic cups to provide ample room for development. After two weeks, the seedlings were transplanted in 50(8" x 11") polyethylene bags filled with soil and compost or animal manure. The plants were watered daily to avoid wilting. Ten one month old bagged cabbage plants were allowed to be infested with diamondback moth while the rest were protected with net to avoid insect infestation of cabbage intended for rearing the insect.

Rearing Test Insect

Last instar larvae and pupae of diamondback moth collected from the infested cabbage were placed inside the insect cage (oviposition cage) with a dimension of 2" x 2" x 4". These were allowed to become adults. White polypropylene sheets were hanged inside the oviposition cage and were sprayed with 20% honey solution which served as food for DBM adults. Four bagged cabbage plants were placed inside the cage for overnight oviposition. Ovipositioned cabbage plants were transferred in a rearing cage (1.5" x 2" x 2") after 24 hours and were replaced with another unovipositioned plant as source of stock.

Extraction of Ginseng and Mint Leaves Juice

Ginseng (500 g) and mint (500 g) leaves were harvested and pounded with mortar and pestle. Pounded leaves were squeezed using a piece of cheesecloth to extract the juice.

Life cycle study

Two hundred ten (210) first instar larvae that hatched at the same time were placed individually in a Petri plate and were fed with excised cabbage leaf treated with the different concentrations of ginseng and mint leaves extracts. Food was changed daily until the larvae pupate. Change in the larvae appearance, their development stages and mortality cases were recorded.

Newly emerged adults were collected, sexed and paired (female and male per pair). Two pairs per replication were used in the observation of fecundity and longevity of adults. Each pair was placed in an insect cage and fed with 20%

honey sprayed in hanged white polypropylene sheet. One and one half months old cabbage plants were placed inside the cage for oviposition where each pair was reared until they die. Cabbage plants laid with eggs were excised or cut and placed in Petri plates with moist tissue paper. Incubation period and percentage hatchability were noted. The hatched larvae were used in the second generation test.

Bioassay

A total of 210 first instar diamondback moth larvae were used in studying the growth inhibitory effects of diamondback moth larvae. Twenty one (21) Petri dishes were lined with moistened tissue paper. Cabbage leaf discs were cut according to the size of the Petri dish, dipped for 10 minutes to the different concentrations of crude extract of ginseng and mint and air dried for 4 hours. After air drying, it was placed inside the Petri dishes. Ten first instar larvae were introduced into each Petri dish with three replications. Pupae and adult survival percentages and abnormalities in each stage were recorded.

Repellant and Antifeedant Effects

This was studied using choice and no choice test. Cubed cabbage leaf treated with varying concentrations of ginseng and mint extract was arranged in a circular fashion inside a circular container or pan. For the choice test, third instar larvae were released at the center of the pan. This was done in 3 replications with 20 insects per replication for treated and control (untreated) cabbage leaf discs.

For the no choice test, the larvae were placed directly on the surface of the cabbage leaf discs. Only treated leaf discs were exposed to the test insects.

The number of insects that visited each disc was observed for two days at different time intervals (30 minutes, one hour and two hours after introduction and every two hours thereafter, up to the twelve hours and 24 hours). Each portion of the leaf discs were used as evidence for the repellant and antifeedant effects of the different treatments.

The data gathered were diamondback moths' biology (incubation period, larval and pupal duration, adult longevity, total life cycle and lifespan, fecundity (number of laid eggs per female adult), percentage hatchability, mortality, growth inhibitory effects (developmental abnormalities of the different stages), and treatments' repellant and antifeedant effects (number of insect visiting and initially

feeding on the diet at different time intervals in the choice and no choice test and % eaten/damage portion of the leaf disc).

Data collected were analyzed using Analysis of Variance (ANOVA) and Duncan's Multiple Range Test (DMRT).

RESULT AND DISCUSSIONS

Biology of Diamondback Moth Reared on Cabbage Treated with Ginseng and Mint Leaves Extract

The biology of diamondback moth reared on cabbage applied with varying concentrations of ginseng and mint extract is shown in Table 1. The incubation period of the cabbage reared DBM treated with 30% mint extract (T_5) obtained a mean of 2.30 days, followed by those reared on cabbage treated with 60% (T_6) and 100% (T_7) with the same means of 2.27 days. Incubation period of DBM reared on cabbage treated with 30 % (T_2), 60 % (T_3) and 100% (T_4) ginseng extracts had the same means of 2.23 days while the untreated or control incubated for 2.20 days.

Table 1. The mean incubation period, larval duration, pupal duration, adult longevity, total life cycle and life cycle of diamondback moth reared on cabbage treated with varying concentrations of ginseng and mint extract.

Treatment	Mean incubation period (days)	Mean larval duration (days)	Mean pupal duration (days)	Mean adult longevity (days)	Mean total life cycle (days)	Mean total life-span (days)
T_1 -control	2.20	12.00	4.83 ^{ab}	9.73 ^c	19.03	28.77 ^{abc}
T_2 -30% ginseng extract	2.23	14.17	5.57 ^c	8.30 ^{bc}	21.97	30.03 ^{bc}
T_3 -60% ginseng extract	2.23	12.40	5.27 ^{ab}	9.10 ^{bc}	19.90	29.00 ^{bc}
T_4 -100% ginseng extract	2.23	14.23	4.67 ^a	9.80 ^c	21.13	30.93 ^c
T_5 -30% mint extract	2.30	12.33	5.47 ^{bc}	7.90 ^{ab}	20.10	28.00 ^{ab}
T_6 -60% mint extract	2.27	12.43	5.50 ^{bc}	6.67 ^a	20.20	26.87 ^a
T_7 -100% mint extract	2.27	13.23	5.17 ^{abc}	6.60 ^a	20.67	27.27 ^a
F-value	0.833 ^{ns}	2.31 ^{ns}	2.928*	8.640**	1.816 ^{ns}	3.114*

Note: Means having the same letter as superscript are not significantly different at 0.1 level based on DMRT.

ns - not significant

* - significant

** - highly significant

ANOVA revealed insignificant differences among the treatment means. This implies that the incubation period of diamondback moth was not affected by the varying concentrations of mint and ginseng leaves extracts thus, all treatments had statistically the same incubation period.

The larval duration of DBM reared on cabbage treated with 100% ginseng extract (T_4) obtained a mean of 14.23 days, followed by those reared on cabbage treated with 30% ginseng extract (T_2) with a mean of 14.17 days. Those reared on cabbage treated with 100% mint leaves extract (T_7) had a mean larval duration of 13.23 days while those reared on 60% mint extract (T_6), 60% ginseng extract (T_3), 30% mint extract (T_5) and the untreated or control (T_1) had mean larval durations of 12.43, 12.40, 12.33 and 12.00 days, respectively. ANOVA revealed that there were no significant differences among the treatment means which implies that feeding the DBM with varying concentrations of mint and ginseng extract did not affect their larval duration. In comparison to the larval duration reported in literature cited, the result is higher than the larval duration of 3 to 4 days (HYPP Zoology Homepage) and 5 to 11 days (AVNET, 1991) but lower than the larval duration of 9 to 30 days (Waterhouse and Norris, 1987).

The longest pupal duration of DBM was obtained from T_2 (30% ginseng extract) with a mean of 5.57 days, followed by T_6 (60% mint extract) and T_5 (30% mint extract) with means of 5.50 and 5.47, respectively. On the other hand, T_3 (60% ginseng extract), T_7 (100% mint extract) and T_1 (untreated or control) had mean pupal durations of 5.27, 5.17 and 4.83 days, respectively. Treatment 4 (30% mint extract) had the shortest DBM pupal duration with a mean of 4.67 days. ANOVA revealed significant differences among the treatment means. DMRT showed that cabbage treated with 30% ginseng extract (T_2) had significantly longer pupal duration than those reared on cabbage treated with 60% and 100% ginseng extract (T_3 and T_4) and the untreated or control (T_1). However, it did not significantly differ from the rest of the treatments (T_5 to T_7). Moreover, all treatments are comparable to control except T_2 . This implies that 30% ginseng extract can affect the life cycle of DBM by prolonging the pupal duration.

The longest DBM adult longevity was obtained in T_4 (100% ginseng extract) with a mean of 9.80 days followed by Treatment 1 (control or untreated) with a mean of 9.73 days. Those reared in T_3 (60% ginseng extract), T_2 (30% ginseng extract), T_5 (30% mint extract) and T_6 (60% mint extract) had mean adult longevity days of 9.10, 8.30 and 7.90, respectively. The shortest DBM adult longevity was obtained in T_7 (100% mint extract) with a mean of 6.60 days. ANOVA showed highly significant differences among treatment means. DMRT

revealed that T₆ (60% mint extract) and T₇ (100% mint extract) were highly significant over T₄ (100% ginseng extract), T₁ (control), T₃ (60% ginseng extract) and T₂ (30% ginseng extract). However, it is not significantly different from T₅ (30% mint extract). This implies that the use of mint extract shortens the longevity of adult DBM. Furthermore, as mint extract concentration increases, the higher the toxicity of the substance thus, DBM adult longevity decreases. The substance toxic to diamondback moth but not to human could be the menthol that is present in the plant (Lewis, 1998).

The total life cycle of DBM reared on 30% ginseng extract (T₂) obtained a mean of 21.97 days, followed by the 100% ginseng extract (T₄) with a mean of 21.13 days. Those reared on 100 % (T₇), 60% (T₆) and 30% (T₅) mint extracts had mean life cycles of 20.67, 20.20 and 20.10 days, respectively. The control or untreated DBM obtained a mean life cycle of 19.03 days. ANOVA showed insignificant differences among the treatment means. This implies that rearing DBM in cabbage plants treated with different concentrations of ginseng and mint extracts had no effect on their total life cycle of DBM.

Treatment 6 (60% mint extract) obtained the shortest total lifespan of DBM with a mean of 26.87 days, followed by T₇ (100% mint extract) with a mean of 27.27 days. Treatment 5 (30% mint extract), T₁ (control), T₃ (60% ginseng extract) and T₂ (30% ginseng extract) obtained the means of 28.00, 28.77, 29.00 and 30.03 days, respectively. The longest total lifespan of DBM was obtained from T₄ (100% ginseng extract) with a mean of 30.93 days. ANOVA revealed significant differences among treatment means. DMRT showed that T₆ and T₇ were significantly different from T₂ and T₄. However, it is not significantly different from T₅, T₁ and T₃. This implies that although T₆ and T₇ significantly differed from T₂ and T₄, the use of mint and ginseng extracts has no effect on the total lifespan of DBM since it was not significant different from the control (T₁).

Fecundity

Fecundity of diamondback moth reared on cabbage leaf discs treated with various levels of ginseng and mint extracts is shown in Table 2. In terms of the number of eggs laid per female adult DBM. Treatment 6 (60% mint extract) obtained the lowest number of eggs laid per female adult DBM with a mean of 82.67 eggs. This was followed by T₅ (30% mint extract), T₇ (100% mint extract), T₃ (60% ginseng extract), T₂ (30% ginseng extract) and T₄ (30% mint extract) with mean eggs of 85.67, 86.33, 96.67, 99.33 and 99.67 eggs, respectively. Treatment 1 (control and untreated) obtained the highest number of eggs laid with a mean of 110.00 eggs. ANOVA revealed highly significant differences among treatment

means. DMRT showed that T₆ (60% mint extract) was significantly lower than T₃ (60% ginseng extract), T₂ (30% ginseng extract), T₄ (100% ginseng extract), T₇ (100% min extract) and T₁ (control). However, it is not significantly different from T₅ (30% mint extract). This implies that 30 % and 60 % mint can reduce the oviposition capacity of female adult DBM thus, it may pose anti ovipository material against diamondback moth or this could be attributed to the shorter adult longevity of diamondback moth.

Table 2. The mean number of eggs laid, egg laying duration and percent hatchability of eggs of adult female DBM.

Treatment	Mean number of eggs laid	Mean egg laying duration(days)	Percent hatchability of eggs
T ₁ -control	110.00 ^d	10.00 ^c	100
T ₂ -30% ginseng extract	99.33 ^{cd}	8.67 ^b	100
T ₃ -60% ginseng extract	96.67 ^{bcd}	8.67 ^b	100
T ₄ -100% ginseng extract	99.67 ^{cd}	8.67 ^b	100
T ₅ -30% mint extract	85.67 ^{ab}	8.50 ^b	100
T ₆ -60% mint extract	82.67 ^a	7.50 ^a	100
T ₇ -100% mint extract	86.33 ^b	8.50 ^b	100
F-value	3.396*	8.933**	

Note: Means having the same letter as superscript are not significantly different at 0.1 level based on DMRT.

** - highly significant

The shortest duration of egg laying was obtained by the DBM reared on 60% mint extract (T₆) with a mean of 7.50 days, followed by those female reared in 30% (T₅) and 100%(T₇) mint extracts with the same mean egg laying durations of 8.50 days. Those female reared on 30 % (T₂), 60% (T₃) and 100% (T₄) of ginseng extracts also had the same mean durations of egg laying of 8.67 days. The longest egg laying duration was obtained by female adult DBM reared on untreated cabbage (T₁) with a mean of 10 days. ANOVA showed highly significant differences among treatment means. DMRT revealed that duration of adult female DBM reared on 60% mint extract (T₆) differed significantly from those reared on all treatments. This implies that 60% mint extract can shorten the duration of egg laying of DBM. Moreover, the result was lower than the result cited by Poelking (1991) wherein a female DBM can lay eggs for 12 days.

On the percent hatchability of DBM eggs. All treatments had 100% DBM eggs hatchability which implies that the hatching of DBM eggs was not affected by the various concentrations of ginseng and mint extracts.

Mortality

The highest number of dead DBM larvae was obtained by T₆ (60% mint extract) with a mean of 7.33 larvae, followed by T₅ (30% mint extract) and T₇ (100% mint extract) with the same means of 6.00 larvae mortalities. Likewise, T₄ (100% ginseng extract) and T₃ (60% ginseng extract) had the same mean mortalities of 3.33 larvae. Treatment 1 obtained zero mortality (Table 3). ANOVA showed significant differences among treatment means. DMRT revealed that T₆ differed significantly over T₁, T₂ and T₃. However, it did not differ significantly from T₄, T₅ and T₇. This implies that 100% ginseng extract and 30%, 60% and 100% mint extract are deterrent to DBM larvae thus, greater DBM larval mortality was observed on these treatments.

Table 3. Mean number of dead DBM larvae and mean percentages of DBM pupal and adult survival.

Treatment	Mean number of dead DBM larvae	Mean percentage DBM pupal survival	Mean percentage DBM adult survival
T ₁ -control	0 ^a	100.00 ^a	100.00 ^a
T ₂ -30% ginseng extract	3.33 ^{ab}	66.67 ^{ab}	66.67 ^{ab}
T ₃ -60% ginseng extract	3.33 ^{ab}	73.33 ^{ab}	73.33 ^{ab}
T ₄ -100% ginseng extract	5.33 ^{bc}	66.67 ^{ab}	33.33 ^c
T ₅ -30% mint extract	6.00 ^{bc}	60.00 ^{ab}	53.33 ^{bc}
T ₆ -60% mint extract	7.33 ^c	40.00 ^b	20.00 ^c
T ₇ -100% mint extract	6.00 ^{bc}	60.00 ^{ab}	30.00 ^c
F-value	4.318*	28.35**	41.49**

Note: Means having the same letter as superscript are not significantly different at 0.1 level based on DMRT.

** - highly significant

Growth inhibitory effects

Larvae reared on cabbage treated with varying concentrations of ginseng and mint leaves extracts showed developmental abnormalities on the larval, pupal and adult stages. Some larvae survived to meet the next instar showed no apparent increase in size and body shrinkage after sometime, larvae survived to pupae are smaller compared to those reared on untreated plants. Pupae that survived resulted to smaller adults with deformed wings compared to DBM reared in untreated cabbage. This indicates that ginseng and mint extracts had growth inhibitory effect to diamondback moth.

In terms of percent pupal survival. Diamondback moth reared in untreated cabbage leaf disc (T₁) got the highest percentage of pupal survival with a mean of

100%, followed by those reared on cabbage leaf discs treated with 60% ginseng extract (T_3) with a mean of 73.33%. Those reared on 30% ginseng extract (T_2) and 100% ginseng extract (T_4) had equal mean pupal survival of 66.67%. Likewise, diamondback moth in T_5 (30% mint extract) and T_7 (100% mint extract) had the same mean survival of pupae of 60%. The lowest percentage of pupal survival was obtained on the cabbage leaf discs treated with 60% mint extract with a mean of 40% (Table 3). ANOVA revealed highly significant differences among the treatment means. Mean of T_6 (60% mint extract) differed significantly from the mean of T_1 (untreated) but it was not significantly from the rest of the treatment means. Furthermore, the rest of the treatments except T_6 was comparable to T_1 (control or untreated). This implies that 60% mint extract seem to possess insecticidal property that hinders or inhibits the DBM pupae from surviving into adults. It further implies that with greater larval mortality on the said treatment, the lesser pupae survive.

Diamondback moth reared on the untreated cabbage leaf disc (T_1) had the highest percentage adult survival with a mean of 100%. This was followed by those reared on cabbage leaf discs treated with 60% ginseng extract (T_3), 30% ginseng extract (T_2), 30% mint extract (T_5), 100% ginseng (T_4) and 100% mint extract (T_7) with a mean adult survival of 73.33, 66.67, 53.33% and 33.33%, respectively. DBM reared on 60% mint extract (T_6) got the lowest percentage adult survival with a mean of 20% (Table 3). ANOVA revealed significant differences among treatment means. Treatment 6 is significantly the same with T_7 (100% mint extract), T_4 (100% ginseng extract) and T_5 (30% mint extract) in terms of DBM adult survival but all these treatments were significantly lower than T_1 (control or untreated). The result implies that 100% ginseng extract and 30%, 60% and 100% mint extracts seem to possess insecticidal property that further inhibit adult DBM from surviving. It further implies that with greater larval mortality and lesser number that have pupated on these treatments, the lesser number of adults that survive.

Repellent and antifeedant effects

The choice test indicated that there were no significant differences among the treatment means in all time intervals. This implies that the varying concentrations of ginseng and mint extract have no repellent effect on diamondback larvae thus, the larvae in the untreated and treated cabbage leaf disc were statistically the same (Table 4a).

Likewise, no significant differences were observed among treatment means in all time intervals under the no choice test which imply that the different

concentrations of ginseng and mint extracts have no repellent effect on diamondback larvae (Table 4b).

Table 4a. Mean number of diamondback moth larvae that visited cabbage leaf discs treated with ginseng and mint extracts at different time intervals (Choice test).

Time Interval	Treatments						
	T ₁	T ₂	T ₃	T ₄	T ₅	T ₆	T ₇
30 min ^{ns}	4.33	2.00	3.33	2.33	2.33	2.00	2.67
1 hr ^{ns}	5.00	2.33	2.67	2.67	2.33	2.67	2.33
2 hrs ^{ns}	5.00	2.33	2.67	2.33	3.67	2.33	3.33
4 hrs ^{ns}	4.33	2.33	4.00	2.67	3.00	3.33	3.67
6 hrs ^{ns}	4.00	2.67	3.00	3.33	3.67	3.67	3.67
8 hrs ^{ns}	5.67	2.33	3.00	4.67	3.67	4.00	3.00
10 hrs ^{ns}	4.67	3.67	2.67	3.00	3.00	4.33	2.67
12 hrs ^{ns}	4.00	3.00	3.00	3.67	2.67	3.67	3.33
24 hrs ^{ns}	3.33	1.33	3.33	2.67	1.67	1.00	2.67

ns - not significant

Table 4b. Mean number of diamondback moth larvae that visited cabbage leaf discs treated with ginseng and mint extracts at different time intervals (No choice test).

Time Interval	Treatments					
	T ₂	T ₃	T ₄	T ₅	T ₆	T ₇
30 min ^{ns}	1.33	1.33	1.67	2.33	1.67	2.33
1 hr ^{ns}	1.67	2.33	1.33	2.67	1.67	2.00
2 hrs ^{ns}	2.33	3.67	1.00	3.67	3.00	3.00
4 hrs ^{ns}	1.67	2.67	1.33	3.00	3.00	2.67
6 hrs ^{ns}	2.33	1.67	2.67	1.67	2.67	2.33
8 hrs ^{ns}	3.33	2.33	2.33	3.33	2.67	2.33
10 hrs ^{ns}	2.33	1.67	2.33	2.33	2.33	2.67
12 hrs ^{ns}	1.33	4.00	2.67	2.67	2.33	1.00
24 hrs ^{ns}	3.33	3.67	2.33	2.67	2.33	2.00

Conclusion

On the basis of the result of the study, it can be concluded that 30% ginseng extract prolongs pupal duration of diamondback moth while 60% mint extract was effective in reducing the egg laying capacity and inhibiting the growth of diamondback moth. Moreover, 100% ginseng extract and 30%, 60% and 100% mint extracts have deterrent and antifeedant effect on diamondback moth. However, the varying concentrations of mint and ginseng extracts have no effect

on diamondback moths' incubation period, larval duration, total life cycle and on the hatchability of adult female eggs.

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The Palawan Scientist is the official publication of the Western Philippines University. It documents researches in agriculture, fisheries, environment, education and related fields. While the faculty and staff of WPU provide the bulk of the papers, contribution from other institutions and individual researchers are most welcome.

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