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BIOEFFICACY LEVEL OF KAPPAPHYCUS DRIPPINGS AGAINST GOLDEN APPLE SNAIL (*Pomacea sp.*)

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Abstract

The study was conducted to determine whether Kappaphycus Drippings have its molluscicidal property, which will be used to arrest the life of golden apple snail. This was conducted under the vicinity of Southern Philippines Agri-business and Marine and Aquatic School of Technology, Matti, Digos City on February 2014. The study used the Completely Randomized Design with five treatments replicated three times. Treatment 1, treatment 2, treatment 3 and treatment 4 which vary in the amount of Kappaphycus Drippings but they all have the same volume (100ml). Treatment 5 contains the commercial molluscicide that is used to kill golden apple snails. Results of the study showed that the degree of Bioefficacy in terms of treatment 1 to 5 was extremely and very effective. The degree of Bioefficacy of KD concentration implies that pure Kappaphycus Drippings (100ml) without dilution is best in killing the snails. The data also shows that there is a significant difference between the degrees of treatments in killing snails. Furthermore result of the test implies that the second group contains the best treatment in killing the golden apple snail. Moreover, result of the study reveals that there is a significant effect on

the use of KD concentration and Niclosamide Ethanolamine Salt against golden apple snail. Future study will determine the chemical properties that enable the agent to arrest golden apple snail.

Keywords

Molluscicidal, Bioefficacy, Kappaphycus, Pomacea, Concentration, Drippings, Snail

1. Introduction

Most of the farmers today are experiencing many problems on how to have greater yields with their planted crops especially rice and corn. One of their problems is the infestation of different kinds of pests especially the snails. This soft-bodied mollusk are voracious eaters, capable of destroying crops in just a few minutes, which in turn leads to very low harvests and economic loss. Many techniques and strategies had been carried out already but none of them are proven to be effective in applying over a large scale area. Golden Apple Snail (*Pomacea* sp.) is one of the 100 world's worst invaders, according to the Global Invasive Species Database. It would earn the designation "highest priority" based on its large distribution in many countries, potential to destroy crops and harm people. Snails are large group of soft-bodied mollusk. They have a high rate of reproduction and extremely tough (Encyclopedia Americana, 1829). Over half (1.2 to 1.6 million hectares) of rice fields in the Philippines are infested with the golden apple snail. The damage and economic loss have been devastating (Ranee Enriquez, 2005). The main problem is to determine the bio-efficacy of Kappaphycus Drippings concentration against golden apple snail (*Pomacea* sp.) and the fatal effect of these drippings to the snails will be compared to the chemical pesticides used to kill snails. This study focuses mainly on the bio-efficacy of seaweed drippings (*Kappaphycus alvarezii*) concentration against snails. This study will be conducted from January – February 2014 in SPAMAST-CAS.

2. Definition of Terms

The following terms are defined operationally for better understanding:

Bioefficacy. This refers to a term which means Biological Effectiveness of an active ingredient (KD) which will be used against golden apple snail.

Golden Apple Snail. This refers to a mollusk that destroys major agricultural crops. They are the pests that will be used to determine the bio-efficacy of Kappaphycus drippings.

Kappaphycus Drippings. This refers to an extract from seaweeds usually fermented in a room temperature.

3. Conceptual Framework

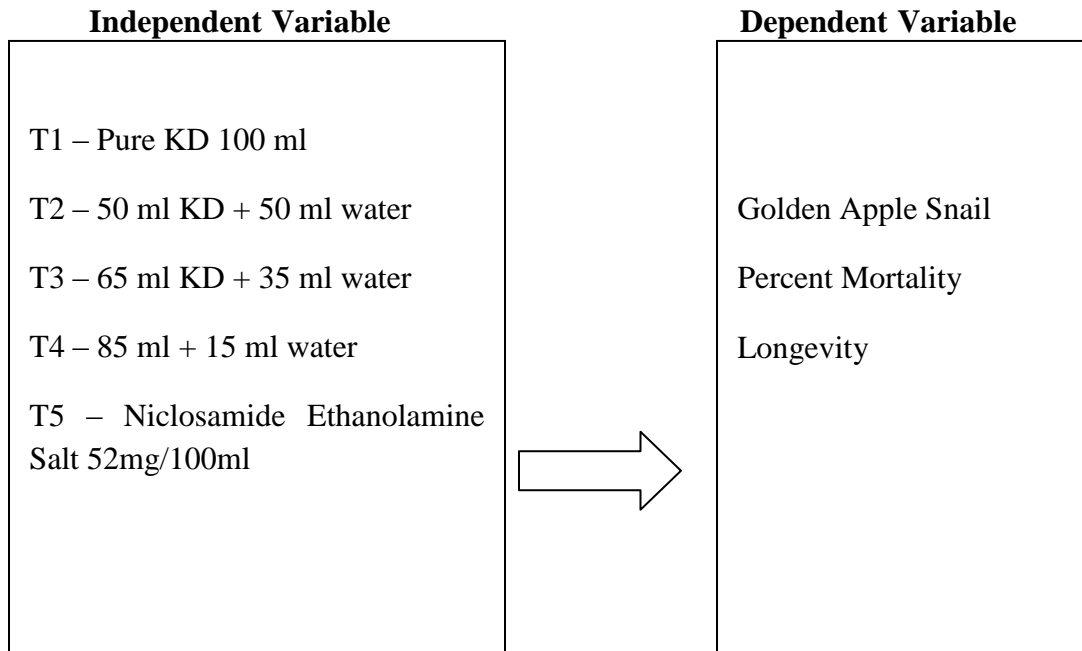


Figure 1: Paradigm showing the independent and dependent variables on the study “Bioefficacy of Kappaphycus Drippings Against Golden Apple Snail”.

4. Methodology

4.1 Research Locale

This study was conducted under ordinary room condition at Southern Philippines Agri-Business And Marine And Aquatic School Of Technology, College of Agricultural Sciences, Matti, Digos City, Province of Davao Del Sur in March 2014. SPAMAST-CAS has an average of more than 1,000 enrolled students coming from different municipalities in Davao del Sur, and few are outside the province. This is the only state college in Davao del Sur. It is an agricultural state college that most studies focus on an agricultural livelihood and production.

4.2 Research Design

This study was laid using Completely Randomized Design with five treatments replicated three times. The treatments were the following:

- Treatment 1 – 100 ml Pure Kappaphycus Drippings
- Treatment 2 – 50 ml Kappaphycus Drippings + 50 ml of water
- Treatment 3 – 65 ml Kappaphycus Drippings + 35 ml of water
- Treatment 4 – 85 ml Kappaphycus Drippings + 15 ml of water
- Treatment 5 – Niclosamide Ethanalamine salt 52mg/100ml

4.3 Experimental Lay-out

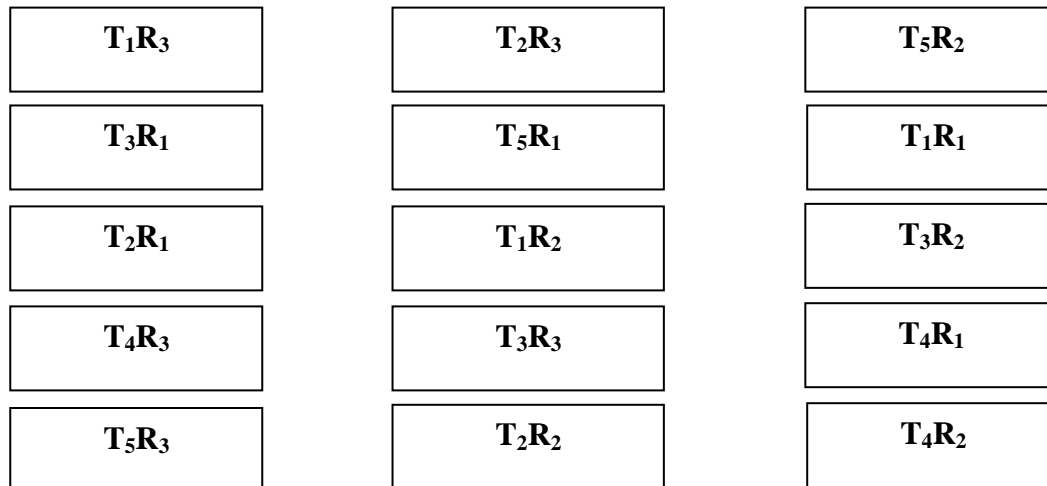


Figure 2: Distribution of Treatments with Replication in the Experiment using Completely Randomized Design in the study entitled “Bioefficacy of Kappaphycus Drippings Against Golden Apple Snail”.

4.4 Research Instruments

The study utilized the following materials. Record notebook, ballpen, ruler, graduated cylinder, plastic tray and container, Kappaphycus Drippings (3 liters), water (1 liter), molluscide, and 150 golden apple snails.

4.5 Data Gathering Procedure

4.5.1 General Procedure

Golden apple snails were placed inside the tray with paddy field soil and fresh vegetative plant at exactly 9:00 am in the morning. A total of 150 snails were evenly distributed in 15 trays. Every tray was sprayed with 5 different treatments. Samples were taken out of the tray, 24 hours after the application of each treatment. Each snail was colored with number individually for proper identification using a pentel pen permanent marker. They are monitored 24-hour time interval to determine if the snail is dead using a behavioral scale of the snail.

4.5.2 Preparation And Rearing Of Snails

More than 150 Golden Apple Snails (though 150 only needed in the experiment) with various age, sizes and sexes, were collected from water logged-rice fields and irrigation canals. They were all placed in a single 12" X 6" plastic container.

4.5.3 Snails Isolation

10 Golden Apple Snails (regardless of age, sizes and sexes) were placed on every tray. The snails are the subject of the experiment. 15 of 8" X 5" plastic trays were prepared and 0.5 inch of paddy field soil was placed in each tray. Small pieces of fresh vegetative plant were placed in the tray. Each tray was covered with plastic lid having 60 holes for proper ventilation. This cover also ensures that no snails might escaped during the experiment period.

4.5.4 Preparation Of Kappaphycus Drippings

Three liters of Kappaphycus Drippings are bought from the research office and stored at room temperature in the vicinity of Chemical Laboratory in SPAMAST-CAS.

4.5.5 Application Of KD And Molluscicide

With a constant volume of 100 ml, treatment one were sprayed with pure KD 100 ml, replicated three times. In treatment two, the tray was sprayed with 50 ml KD diluted with 50 ml of water, replicated three times. The third treatment was sprayed with 65 ml KD diluted with 35 ml water, replicated three times. The fourth treatment was sprayed 85 ml KD diluted with 15 ml water, replicated three times. The fifth treatment was sprayed with Niclosamide Ethanolamine salt 52mg/100ml, replicated three times.

4.5.6 Observation Period

After the application, golden apple snail was taken out of the tray. Each tray was cleaned and dried out. The snails were colored with number individually for proper identification using a pentel pen permanent marker. Each cleaned tray was filled with 400ml of clean water. The snails were then submerged after filling the tray with water. Each treatment was observed 24 hours right after placing the snails inside the tray. Each snail was rated according to behavioral scale of the snail.

4.5.7 Behavioral Scale

The behavioral scale was used to evaluate the behavior of snail 24 hours after placing in 400ml clean water inside the tray. The snail was assessed using the following behavioral scale:

1–immotile (dead), 2 – slightly motile (alive), 3 – motile (alive), 4 – very motile (alive), 5 – extremely motile

4.5.8 Mortality rate

The mortality rate was used to determine the percentage of dead snails and it was calculated using the equation,

$$\text{Mortality rate} = \frac{\text{Dead Snails}}{\text{Total Number of Snails}} \times 100$$

4.5.9 Degree of efficacy

The degree of efficacy was used to evaluate the effectiveness of each treatment. This scale is based on the mortality rate of each treatment. It was assessed using the following arbitrary scale;

Scale	Descriptive meaning	Descriptive rating
5	Mortality rate of 81-100%	Extremely Effective
4	Mortality rate of 61-80%	Very Effective
3	Mortality rate of 41-60%	Effective
2	Mortality rate of 21- 40%	Moderately Effective
1	Mortality rate of 20% below	Less Effective

4.6 Statistical Tools

The data was analyzed using Analysis of Variance (ANOVA) in Completely Randomized Design (CRD). Further, the Post hoc was used to determine the homogeneity of treatments.

5. Results And Discussions

5.1 Degree Of Bioefficacy Between Each Treatment

Table 1 shows the degree of bioefficacy between each Treatment. Treatment 5 has a mean of 10.0 or extremely effective. This means that the mortality rate of T5 range from 81-100. Treatment 1 has a mean of 9.7 or extremely effective. This means that the mortality rate of T1 range from 81-100. Treatment 4 has a mean of 9.0 or extremely effective. This means that the mortality rate of T4 range from 81-100. Treatment 3 has a mean of 7.7 or very effective. This means that the mortality rate of T3 range from 61-80. Treatment 2 has a mean of 6.7 or very effective. This means that the mortality rate of T2 range from 61-80.

The degree of Bioefficacy in terms of treatment 1 to 5 was all considered as extremely and very effective in arresting the life of golden apple snail.

Table 1: Degree of bioefficacy between each treatment against golden apple snail.SPAMAST-CAS, Matti, Digos City February 2014

Treatment	Replication			Total	Mean	DE
	I	II	III			
T ₁	10	9	10	29	9.7	Extremely Effective
T ₂	7	8	5	20	6.7	Very Effective
T ₃	7	9	7	23	7.7	Very Effective
T ₄	9	8	10	27	9.0	Extremely Effective
T ₅	10	10	10	10	10.0	Extremely Effective

5.2 Degree Of Bioefficacy Of KD Concentration

Table 2 shows the degree of bioefficacy of KD concentration against golden apple snail. It was found out that Treatment 2 (Pure KD 50ml + 50ml water) got the lowest mean of 6.7 followed by Treatment 3 (Pure KD 65ml + 35ml water) with a mean of 7.7, followed by Treatment 4 (Pure KD 85ml + 15ml water) with a mean of 9.0. The one that got the highest mean among the treatment that contains Kappaphycus Drippings is the Treatment 1 (Pure KD 100ml) with a mean of 9.7.

Treatment 1, Treatment 4, Treatment 3 and Treatment 2 with varying amount of Kappaphycus Drippings did eradicate the life of golden apple snail.

Thus the degree of Bioefficacy of KD concentration implies that pure Kappaphycus Drippings (100ml) without being diluted is best in killing the snails.

Table 2: Degree of Bioefficacy of KD concentration. SPAMAST-CAS, Matti, Digos City February 2014

Treatments	Replication			Total	Mean
	I	II	III		
T ₁	10	9	10	29	9.7
T ₂	7	8	50	20	6.7
T ₃	7	9	70	23	7.7
T ₄	9	8	10	27	9.0

5.3 Significant Difference Between The Degree Of Treatments In Killing Snails.

Statistical analysis revealed that the study is significant at 5% level. Table 3 shows the analysis of variance on the mortality rate of golden apple snails treated with varying amount of KD concentration but constant in volume and the control. Furthermore, the table shows the coefficient of variance which is 11.63% this means that the data is reliable.

Table 3: Analysis of variance on the mortality rate golden apple snails treated with varying amount of KD with constant volume and the control. SPAMAST-CAS, Matti, Digos City. February 2014.

Source of Variation	SS	df	MS	F	P-value	F crit	
						5%	1%
Between groups	23.6	4	5.9	5.900*	0.010536	3.478	5.994
Within groups	10	10	1				
Total	33.6	14					

CV= 11.63%

* mean significant at 5 % level

Since the result of the study is significant at 5% level, Post hoc test was administered using Scheffe, to determine the homogeneity of each treatment. Table 4 shows how each treatment differs from each other. The means for groups in homogenous subsets are displayed,

based on the observed means. The first group is significant at 0.054 and the other group is significant at 0.164.

Furthermore the data shows that there is a significant difference between the degree of treatments in killing snails.

The result of the test implies that the second group contains the best treatment in killing the golden apple snail.

Table 4: Post hoc test with the use of Scheffe to determine the homogeneity of each treatment that are used to kill snails. SPAMAST-CAS, Matti, Digos City. February 2014.

Replication				
	Treatment	N	Subset	
			1	2
Scheffe^{a,,b}	Treatment 2	3	6.6667	
	Treatment 3	3	7.6667	7.6667
	Treatment 4	3	9.0000	9.0000
	Treatment 1	3	9.6667	9.6667
	Treatment 5	3		10.0000
	Sig.			.054

5.4 Significant Effect on the Use of KD Concentration And Niclosamide Ethanolamine Salt Against Snails

Table 5 shows that the experiment is found to be significant, thus the hypothesis is rejected that there is no significant effect between the use of KD and the control against golden apple snail. The level of application between Kappaphycus Drippings and Niclosamide Ethanolamine Salt significantly differ from each other. Data showed remarkable result among each treatment.

Statistical analysis showed that T₅ (52mg/100ml) with a mortality mean of 10.0 was highly significant. This result was expected since commercial formulation of Niclosamide ethanolamine salt (commercial molluscicide) was primarily developed for the control of golden apple snails as major pests in the field.

6. Summary, Conclusion, Recommendation

6.1 Summary

The study was conducted at the vicinity of Southern Philippines Agri-Business and Marine and Aquatic School of Technology, Matti, Digos City on February 2014, under ambient

(room) condition to determine the Bioefficacy of Kappaphycus Drippings against golden apple snail.

A Completely Randomized Design (CRD) was used in the study with five treatments replicated three times. T1 (Pure KD 100ml), T2 (Pure KD 50ml + 50ml water), T3 (Pure KD 65ml + 35ml water), T4 (Pure KD 85ml + 15ml water), T5 (52mg/100ml of Niclosamide ethanalamine Salt).

Statistical analysis revealed that the study is significant at 5% level in varying amount of treatment. 24 hours after the application when the snail are taken out from the tray and observed 24 hours in a tray half full of water, the researchers used the behavioral scale of the snail to determine if the snail is dead. Then, it was found out that golden apple snail are killed by the varying amount of Kappaphycus Drippings and the Niclosamide ethanalamine Salt.

6.2 Conclusion

Based On The Result Of The Study, The Different Conclusions Are Derived:

1. The Degree Of Bioefficacy In Terms Of Treatment 1 To 5 Is Extremely And Very Effective.
2. Thus The Degree Of Bioefficacy Of Kd Concentration Implies That Pure Kappaphycus Drippings (100ml) Without Being Diluted Is Best In Killing The Snails.
3. Data Shows That There Is A Significant Difference Between The Degree Of Treatments In Killing Snails. Furthermore Result Of The Test Implies That The Second Group Contains The Best Treatment In Killing The Golden Apple Snail.
4. Result Of The Study Reveals That There Is A Significant Effect On The Use Of Kd Concentration And Niclosamide Ethanalamine Salt Against Golden Apple Snail.

6.3 Recommendation

Based on the findings of the study, the researcher established the following recommendations:

SPAMAST Research Office. They may allocate a budget in order to continue the study and that promotes its reliability and validity. Moreover, production of Kappaphycus Drippings will emerge if this study will be consistent enough to be applied over a large scale area.

Research Students. The data may be used to conduct another study using other variables. Since the golden apple snail that was gathered during the study varies in age, the researchers highly recommend to conduct another study using a cultured snail to determine its age and to confirm the validity of the result. Furthermore, biochemical study of Kappaphycus Drippings must be

administered in order to determine what chemical factors in Kappaphycus Drippings that they are able to arrest the life of the golden apple snails.

Farmers. They may use KD as an alternative measure than using a commercially sold pesticide. Since Kappaphycus Drippings is very economical, it could be a versatile product for raising farm outputs.

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