BIBLIOGRAPHY

DEPOLIO, CRISTY W. APRIL 2011. Formulated Botanical Insecticides in Controling Aphids on Lettuce (*Lactuca sativa* L. var. Red Wave) under Controlled Environment. Benguet State University, La Trinidad, Benguet.

Adviser: Bonie S. Ligat Sr., MSc.

ABSTRACT

The study was conducted at the STVRDC greenhouse, La Trinidad, Benguet, from December 2010 to March 2011 to formulate botanical insecticides that can control the aphid population infesting lettuce plants, to compare the efficacy of formulated botanical insecticides with and without liquid soap and to observe the phytotoxicity of this formulated botanical insecticides to lettuce plants.

Two sets of experiments were conducted. Formulated botanical insecticides without soap (Experiment 1) were sprayed on lettuce plants one month after transplanting. Formulated botanical insecticides with soap was sprayed on lettuce plants two months after transplanting following the different treatments: Control, Lantana camara (Lantana) plant extract, Cymbopogon nardus (Lemon grass) plant extract, Oriental herb insecticide (OHI) using lantana, and Oriental herb insecticide (OHI) using lemon grass.

Formulated botanical insecticide using OHI lantana and OHI lemongrass without soap reduced the aphid population on lettuce plants.

Formulated botanical insecticide with soap using OHI with lantana and lemongrass reduced aphid population under controlled environment. There was no observed phytotoxicity of formulated botanical insecticides on lettuce plants.

TABLE OF CONTENTS

INTRODUCTION

Organic Agriculture in the country is fastly gaining its popularity since the former president Gloria Macapagal Arroyo approved the Executive Order 481 titled "Promotion and Development of Organic Agriculture in the Philippines" last December 2005. To strengthen the promotion of Organic Agriculture, In April 6, 2010 the former president Gloria Macapagal Arroyo has signed into law Republic Act (RA) 10068, the Organic Agriculture Act of 2010, which provides for the development and promotion of organic agriculture in the country through a comprehensive program to be executed by a newly created National Organic Agricultural Board (NOAB). The law is a state policy to promote, propagate and further develop the practice of organic farming in the Philippines which is expected to increase farm productivity; reduce environmental degradation and prevent the depletion of natural resources; further protect the health of farmers, consumers and the general public; and help cut expenses on imported farm inputs (PCARRD, 2006).

Benguet State University (BSU) being an Agriculture school was challenged to promote organic agriculture. BSU started shifting away from farm technologies that rely heavily on petro- chemicals and now making this possible by appealing to local agricultural stakeholders to review their production strategies and support the conversion of highland agriculture to organic farming.

Excessive use of chemicals not only causes environmental pollution but has led to development of resistance and adversely affected beneficial organisms. Pesticide of plant origin are being explored extensively as an alternative to chemicals as they are effective against target insect pests, safe to human and are easily biodegradable. Keeping in

view the economic importance of plant, the study aimed to know the efficacy of locally available plant species to find out possible ways to control insect pests using eco-friendly method. Wide range of botanical plants had been recorded to have insecticidal properties as a means of controlling pests used mostly by organic growers and some were known to be effective.

This study was conducted to formulate botanical insecticides that can control the aphid population infesting lettuce plants, to compare the efficacy of formulated botanical insecticides with and without liquid soap and to observe the phytotoxicity of this formulated botanical insecticides to lettuce plants.

The study was conducted at the STVRDC greenhouse, Benguet State University from November 2010 to March 2011.

REVIEW OF LITERATURE

Botanical pesticides are derived from naturally occurring plants which have been shown to have insecticidal properties. In their simplest form it maybe a crude preparations of plant parts ground to produce the concentrated extract or powder that maybe used full strength or distilled. Extracts of these plants is sprayed on the crop to either kill or repel insects. Botanical pesticides had been used for several centuries and were known in traditional cultures around the world. However, the discovery and increasing development of synthetic pesticides led to virtual abandonment of botanical pesticides (Rechcigl and Nancy, 2000). Saxena (1983) as cited by Felipe (1996) stated that plants are virtually nature's chemical factories, providing practically unlimited natural sources of botanical pesticides. Different societies in the world have continually employed plants to kill or repel insects since civilization began.

Toxicity of Botanical Plants

Lantana. Lantana camara (lantana) has several uses, mainly as an herbal medicine in some areas. A work conducted on the chemical constituents of lantana extract from the leaves showed that it exhibits antimicrobial, fungicidal, insecticidal, and nematicidal activity (Fuentebella and Morallo- Rejesus, 1980). In addition Prasad (2002) stated that extract of these plants is being used in controlling Plutella xylostella and aphids. Moreover (Grundy, 2010) stated that essential oils taken from the lantana plant have been shown to be effective in killing and repelling the maize grain weevil, a bug that infests stored corn. Furthermore (Grant, 1990) said that methanol and chloroform extracts

from lantana showed a high mortality in termite populations and can kill nematodes in just a 1 percent concentration of a four-component distillation derived from the plant.

Lemon grass Cymbopogon nardus (Lemon grass) species are used for the production of citronella oil, which is used in soaps, as an insect repellentin insect sprays and candles (Pedigo, 2002). A consistent of citronella oil, citral, was reported to have some juvenile hormone activity against the nymphs of some insects, other insects, such as leafhoppers, screw worms, pulse beetles, ants, mites and whiteflies are also affected by the oil of these plants (Sangatanan, 2000).

Oriental Herb Insecticide (OHI). Oriental Herbal Insecticide is one of the fermented products used in natural farming; it is a natural pest repellant in growing crops. It is also effective in strengthening the immune system of plants making the crop healthy and also used in enhancing the nutrients of livestock feed (Sarian, 2010).

MATERIALS AND METHODS

Two sets of experiments were conducted in the study. First experiment was a preliminary study in which the formulated botanical insecticides were tested in controlling aphids on lettuce plant. The second experiment was conducted when the sprayed formulated botanical insecticides showed no effect in controlling aphids in the first experiment.

Experiment 1

The different materials used in formulating different botanical insecticides were lemon grass leaves; lantana leaves, garlic, muscovado, jar and liquor (gin). Blender and meshed cloth were also used in extracting. Goggles like mask and gloves were used in spraying the formulated insecticides.

Formulation of Botanical Extract

The botanical extract was prepared using lantana and lemon grass. One half kg of fresh lantana leaves and ½ lemongrass were separately washed and chopped into small pieces. Both botanical plants were extracted individually with the use of blender. Water was poured while being blended following a 1:1 ratio (plant material: water). A clean cloth was used to extract the juice. The lantana and lemongrass were squeezed to obtain each extract. The extracts were immediately sprayed on the transplanted lettuce (two weeks after transplanting).

Formulation of Oriental
Herb Insecticide (OHI)

Preparation of Oriental Herb Insecticide (OHI) was in two formulations. These are from lantana and lemon grass leaves that were fermented individually.

Two kg crushed garlic, and 1/2 kg muscovado sugar or molasses were added to two kg plant leaves in two separate jars. The jars were covered and sealed to ferment. After three days, two liters of gin was added and resealed again leaving two inches space from the rim left unfilled. The liquid was decanted after 10 days of fermentation. After decanting, two liters of gin was added to the jar. This procedure was repeated three times. After the last decantation, two kg plant materials (lantana/ lemongrass) were added and again allowed tor 10 days, then again it was decanted. The extracted oriental herb insecticide was mixed and sprayed at a rate of two tbs/liter once a week to the lettuce plants.

Setting Up of Experimental Units

One month old lettuce was transplanted in a 50 polyethylene bags measuring 8x10x14 cm. The polyethylene bags were arranged following the Completely Randomized Design (CRD) with ten replications.

The treatments from the different botanical plants are as follows:

T_{1}- Control (Figure 1)

T_{2}- *Lantana camara* (Lantana) plant extract (Figure 2)

T_{3}-*Cymbopogon nardus* (Lemon grass) plant extract (Figure 3)

T_{4}- *Oriental herb insecticide* (OHI) using lantana (Figure 4)

T_{5}- *Oriental herb insecticide* (OHI) using lemon grass (Figure 5)

Figure 1. Control treatment

Figure 2. Lantana extract treated plant

Figure 3. Lemongrass extract treated plant

Figure 4. OHI lantana treated plant

Figure 5. OHI lemongrass treated plant

Application of different formulated insecticides was done on the second week of the transplanted lettuce plants.

Experiment 2

Observing no effect of the formulated botanical insecticides on aphids, another experiment was conducted. The same procedure done in the first experiment was followed except that liquid soap (joy calamansi) was added to every treatment prior to spaying. This was done on the second month of the lettuce plant from transplanting.

Degree of Injury
and Population

Monitoring the degree of injury caused by greenhouse insect pest such as leaf curling, stunting and stippling were determined through percentage by visual estimation of the whole plant using the following index (Cayetano, 1982). :

Rating Index	Qualitative Index	Description
1	No damage	No Injury
2	Slightly damaged	1-25 % damaged on crop
3	Moderately damaged	26-50 % damaged on crop
4	Severely damaged	51-75 % damaged on crop
5	Very severely damaged	76-100 % damaged on crop

Monitoring the population of insects was determined by counting leaf portions of the whole plant. Counting was done prior to spraying and after each spray of the different formulated botanical insecticides. Spraying was done once a week early in the early morning or late afternoon.

The data gathered were:

1. Population of insects. This was taken by recording the observed insect pest attacking the lettuce crop.

2. Phytotoxicity. This was taken by observing the presence of tip burning and spot drying.

3. Degree of injury. This was taken by observing the presence of leaf curling, stunting and stippling caused by the insects.

Data Analysis.

The data gathered were statistically analyzed using the ANOVA. The significance between treatment means was analyzed using the Duncan's Multiple Range Test (DMRT).

RESULTS AND DISCUSSION

Experiment 1

Aphid Population

The total number of aphids on lettuce one day after the application of botanical insecticides is shown in Table 1. Population of aphids did not differ from each other. Spraying of lantana leaves extract however, registered the highest mean of 292. 0 followed by lemongrass leaves extract with a mean of 272, Oriental Herb Insecticide with a mean of 210.70 and the least was OHI with lantana.

Aphid population on the lettuce plants is uniform which implies that the different formulated botanical insecticides sprayed are not effective.

Degree of Plant Injury

The degree of plant injury caused by aphids from different treatments is shown in Table 2. Statistically, application of formulated botanical insecticides did not differ from each other including the untreated plants. Lemongrass leaves extract treated plants had the highest mean of 10.53%, followed by lantana leaves extract with a mean of 10.48%, OHI lemongrass with a mean of 10.18% and the least was OHI lantana having a mean of 9.96%.

Results show that the higher population of aphids, the degree of injury was also higher and the lower population the lower also the degree of injury to lettuce plants. The result implies that aphid population has a significant relationship on the degree of injury.

Table 1. Aphid population on lettuce as affected by different botanical insecticides

FORMULATED BOTANICAL INSECTCIDES	MEAN
Control	249.40[a]
Lantana leaves extract	292.00[a]
Lemon grass leaves extract	272.70[a]
Oriental Herb Insecticide (lantana)	174.60[a]
Oriental Herb Insecticide (lemon grass)	210.70[a]

Means with the same letter are not significantly different at 5% DMRT

Table 2. Percent rate of plant injury caused by aphids

FORMULATED BOTANICAL INSECTCIDES	MEAN
Control	11.3[a]
Lantana leaves extract	10.48[a]
Lemon grass leaves extract	10.53[a]
Oriental Herb Insecticide (lantana)	9.96[a]
Oriental Herb Insecticide (lemon grass)	10.18[a]

Means with the same letter are not significantly different at 5% DMRT

Phytotoxicity of Formulated Botanical Insecticides

Table 3 shows the percent phytotoxicity of formulated botanical insecticides to lettuce plants. There were no signs of phytotoxicity symptom such as tip burning and spot drying on plants after application of the different treatments.

Table 3. Percent phytotoxicity of botanical insecticides to lettuce plants

FORMULATED BOTANICAL INSECTCIDES	MEAN
Control	0
Lantana leaves extract	0
Lemon grass leaves extract	0
Oriental Herb Insecticide (lantana)	0
Oriental Herb Insecticide (lemon grass)	0

Experiment 2

Aphid Population

Table 4 shows that there was a highly significant difference between the untreated and botanical insecticide treated plant. Aphid population was greatly affected by the different formulated botanical insecticides. The least mean insect counted was obtained from plants treated with OHI lantana having a mean of 25. 20, followed by plants treated with OHI lemongrass with a mean of 28.40. Lantana leaves extract had a mean of 76.30 lower than the control with a mean of 98.80. The highest count was obtained from plant sprayed with lemon grass extract with a mean of 109.40.

Data shows that OHI lantana and lemongrass were effective in controlling aphids when mixed with soap. This might be due to insecticidal constituents of botanical plants used or due to the added soap as a sticker. Farmers usually use soap as sticker in foliar sprays of insecticides.

Table 4. Aphid population of on lettuce as affected by different botanical insecticides

FORMULATED BOTANICAL INSECTCIDES	MEAN
Control	98.80[b]
Lantana leaves extract	76.30[c]
Lemon grass leaves extract	109.40[a]
Oriental Herb Insecticide (lantana)	25.20[d]
Oriental Herb Insecticide (lemon grass)	28.40[d]

Means with the same letter are not significantly different at 5% DMRT

Degree of Plant Injury

The degree of plant injury caused by aphids from different treatments is shown in Table 5. Statistically, application of formulated botanical insecticides did not differ from each other including the untreated plants. Lantana leaves extract treated plants had the highest mean of 9.89%, followed by lemongrass extract with a mean of 9.85%, OHI lemongrass with a mean of 9.77% and the least was OHI lantana having a mean of 9.73%.

Results show that the higher population of aphid, the degree of injury was also higher and the lower population the lower also is the degree of injury to lettuce plants. This means that population had a significant relationship on the degree of injury.

Phytotoxicity of Formulated
Botanical Insecticides

Table 6 shows the percent phytotoxicity of formulated botanical insecticides to lettuce plants. There was no observed phytotoxicity symptom such as tip burning and spot drying on plants after application of the different formulated botanical insecticides.

Table 5. Percent rate of plant injury caused by aphids

FORMULATED BOTANICAL INSECTCIDES	MEAN
Control	9.81[a]
Lantana leaves extract	9.89[a]
Lemon grass leaves extract	9.85[a]
Oriental Herb Insecticide (lantana)	9.73[a]
Oriental Herb Insecticide (lemon grass)	9.77[a]

Means with the same letter are not significantly different at 5% DMRT

Table 6. Percent phytotoxicity of botanical insecticides to lettuce plants

FORMULATED BOTANICAL INSECTCIDES	MEAN
Control	0
Lantana leaves extract	0
Lemon grass leaves extract	0
Oriental Herb Insecticide (lantana)	0
Oriental Herb Insecticide (lemon grass)	0

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary

The study was conducted at the STVRDC greenhouse, La Trinidad, Benguet, from December 2010 to March 2011 to formulate botanical insecticides that can control the aphid population infesting lettuce plants, to compare the efficacy of formulated botanical insecticides with and without liquid soap and to observe the phytotoxicity of this formulated botanical insecticides to lettuce plants.

The population of aphids on lettuce plants sprayed with different formulated botanical insecticides without soap (Experiment 1) was not significantly affected. Numerically, however, plants sprayed with lantana leaves extract registered the highest number of aphids and the least was on plants sprayed with Oriental Herb Insecticide (lantana).

Aphid population on lettuce plants treated with different formulated botanical insecticides with soap (Experiment 2) was significantly reduced. Plants sprayed with Oriental Herb Insecticide (lantana) registered the lowest aphid population. Conversely, the highest aphid population was noted from lemongrass leaves extract treated plant.

The degree of plant injury caused by aphids as affected by different formulated botanical insecticides was not significant with and without soap. This implies that degree of plant injury was not due to aphids but maybe attributed to other.

No phytotoxicity of formulated botanical insecticides to plants was observed like tip burning and spot drying from both experiments.

Conclusions

Formulated botanical insecticides without liquid soap evaluated did not significantly reduce aphid population. On the other hand formulated botanical insecticide using OHI (lantana) and OHI (lemongrass) with liquid soap significantly reduced the aphid population. Further, the aphids had no significant effect on plant injury but maybe due to other pests.

Recommendations

OHI with lantana or lemongrass can be used to control aphid. However further study is recommended to have more valuable and reliable results.

LITERATURE CITED

CAYETANO, O. C. 1982. The effect of insecticide application interval on the control of garden pea leaf miner. BS Thesis. Mountain State Agricultural College, La Trinidad,Benguet. P. 5.

FELIPE, S. W. 1996. Effect of plant extracts on the egg hatching of root knot cyst nematode. BS Thesis. Benguet State University, La Trinidad, Benguet. Pp.4-5

FUENTEBELLA, F. and B. MORALLO-REJESUS. 1980. The Insecticidal Activity of Fancy Buttons (Lantana camara L.) Flower Extracts to Several Insect Species. Youth Res. Apprentices hip Action Prog. Rep., Society for the Advancement of Research.P. 19.

GRANT, B. 1990. Lantana Plant as a Pesticide | Garden Guides. Retrieved 06 October 2010 from http://www.gardenguides.com/130457-lantana-plant pesticide.html#ixzz13hpsVkTL

GRUNDY, L. 2010. Lantana Plant as a Pesticide. Retrieved 06 October 2010 From: http //www.ehow.com/facts_5979107_lantana-plant- pesticide. html.

PHILIPPINE COUNCIL FOR AGRICULTURE, FORESTRY AND NATURAL RESOURCES RESEARCH AND DEVELOPMENT. 2006. Organic Farming. Retrieved 06 September 2010 from http://pcarrd.dost.gov.ph/phil-organic/about.htm.

PEDIGO, L. P. 2002. Entomology and Pest Management.4th edition. New Jersey, USA: Prentice Hall. P. 406

PRASAD, D. 2002. Sustainable Pest Management. Trinagar, Delhi. Daya Publishing House P.93.

RECHCIGL, E. J. and A. NANCY. 2000. Biological Control and Biotechnological Control of Insect Pest.Washington D.C. Lewis Publishers. Pp.102-112, 117.

SANGATANAN, P. 2000. Practical Guide to Organic Pesticides (How to Process Organic Pesticides). Pp. 15, 23.

SARIAN, Z. 2010.Make your own Oriental Herbal Nutrient (OHN). Retrieved 06 October 2010 fromhttp://www.gaiadiscovery.com/latest-planet/organic-botanical-pesticides-cheaper-effective-pest-control.html

APPENDICES

Appendix Table 1. Total mean population of aphids applied with botanical insecticides with liquid soap from January to February 2011

FORMULATED BOTANICAL INSECTICIDES	REPLICATION										TOTAL	MEAN
	I	II	III	IV	V	VI	VII	VIII	IX	X		
Control	83	239	272	117	440	123	269	292	279	380	2,494	249.40
Lantana leaves Extract	216	237	404	363	359	458	231	254	252	146	2,920	292.00
Lemon grass leaves extract	131	280	386	234	373	168	284	276	246	349	2,727	272.70
Oriental Herb Insecticide (lantana)	17	37	81	102	408	288	64	259	312	178	1,746	174.60
Oriental Herb Insecticide (lemon grass)	46	19	185	357	232	211	287	44	345	381	2,107	210.70

ANOVA TABLE

SOURCE OF VARIANCE	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULATED F 0.05	TABULATED F 0.01
TREATMENT	4	89972.28	22493.07	1.69^{ns}	2.58	3.77
ERROR	45	597375.00	13275			
TOTAL	49	687347				

$_{ns}$=Not significant CV=48.03%

Appendix table 2. Rate of injury caused by aphids on lettuce sprayed with botanical insecticide with liquid soap plant from January to February 2011

FORMULATED BOTANICAL INSECTICIDES	REPLICATION											
	I	II	III	IV	V	VI	VII	VIII	IX	X	TOTAL	MEAN
Control	8.34	16.67	15.39	15.18	8.33	7.14	10	14.28	7.69	10	113.02	11..30
Lantana leaves Extract	7.69	10	16.06	14.29	8.33	14.29	9.09	7.69	9.09	7.69	104.82	10.48
Lemon grass Leaves extract	14.29	8.33	14.29	7.69	9.09	10	9.09	9.09	14.29	9.09	105.25	10.53
Oriental Herb Insecticide (lantana)	7.14	8.33	.69	15.38	10	7.69	10	14.29	9.09	10	99.61	9.96
Oriental Herb Insecticide (lemon grass)	7.69	14.29	6.67	10	15.38	8.33	7.69	9.09	8.33	14.29	101.76	10.18

ANOVA TABLE

SOURCE OF VARIANCE	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULATED F 0.05	TABULATED F 0.01
TREATMENT	4	10.39	2.60	.262 ^{ns}	2.58	3.77
ERROR	45	445.77	9.91			
TOTAL	49	456.16				

$_{ns}$= not significant CV=30.0%

Appendix Table 3. Total percent phytotoxicity of botanical insecticides to lettuce plants from January to February 2011

FORMULATED BOTANICAL INSECTICIDES	REPLICATION											
	I	II	III	IV	V	VI	VII	VIII	IX	X	TOTAL	MEAN
Control	0	0	0	0	0	0	0	0	0	0	0	0
Lantana leaves extract	0	0	0	0	0	0	0	0	0	0	0	0
Lemon grass leaves extract	0	0	0	0	0	0	0	0	0	0	0	0
Oriental Herb Insecticide (lantana)	0	0	0	0	0	0	0	0	0	0	0	0
Oriental Herb Insecticide (lemon grass)	0	0	0	0	0	0	0	0	0	0	0	0

The data was not statistically analyzed because all of the treatments are zero.

Appendix Table 4. Total mean population of aphids applied with botanical insecticides with liquid soap from February to March 2011

FORMULATED BOTANICAL INSECTICIDES	REPLICATION											
	II	III	IV	V	VI	VII	VIII	IX	X	TOTAL	MEAN	
Control	104	90	69	32	127	36	114	145	146	125	988	98.80
Lantana leaves Extract	74	64	40	49	63	60	107	97	115	94	763	76.30
Lemon grass Leaves extract	127	74	48	56	114	99	94	140	174	168	1094	109.40
Oriental Herb Insecticide (lantana)	35	35	25	24	22	31	18	16	23	23	252	25.20
Oriental Herb Insecticide (lemon grass)	12	27	20	40	29	35	26	21	36	38	284	28.40

ANOVA TABLE

SOURCE OF VARIANCE	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULATED F 0.05	TABULATED F 0.01
TREATMENT	4	61307.68	15326.92	17.45 **	2.58	3.77
ERROR	45	39526.10	878.358			
TOTAL	49					

**=Highly significant CV=43.83%

Appendix table 5. Rate of injury caused by aphids on lettuce sprayed with botanical insecticide without liquid soap plant from February to March 2011

FORMULATED BOTANICAL INSECTICIDES	REPLICATION											
	I	II	III	IV	V	VI	VII	VIII	IX	X	TOTAL	MEAN
Control	l7.69	14.67	16.67	7.14	8.33	7.69	7.14	13.33	8.33	7.14	98.13	9.81
Lantana leaves extract	14.29	8.33	15.38	7.69	9.09	10	8.33	9.09	7.69	9.09	98.98	9.89
Lemon grass leaves extract	7.69	14.29	13.33	10	5.38	9.09	7.69	10	13.33	7.69	98.49	9.85
Oriental Herb Insecticide (lantana)	14.29	8.33	7.69	8.33	7.69	9.09	8.33	9.09	9.09	15.38	97.31	9.73
Oriental Herb Insecticide (lemon grass)	7.14	8.33	7.69	15.38	9.09	7.69	10	13.33	10	9.09	97.74	9.77

ANOVA TABLE

SOURCE OF VARIANCE	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULATED F 0.05	TABULATED F 0.01
TREATMENT	4	.1661	.0415	.047^{ns}	2.58	3.77
ERROR	45	393.32	8.74			
TOTAL	49	393.49				

$_{ns}$= Not significant CV=30.14%

Appendix Table 6. Total percent phytotoxicity of botanical insecticides to lettuce plants from February to March 2011

FORMULATED BOTANICAL INSECTICIDES	REPLICATION											
	I	II	III	IV	V	VI	VII	VIII	IX	X	TOTAL	MEAN
Control	0	0	0	0	0	0	0	0	0	0	0	0
Lantana leaves extract	0	0	0	0	0	0	0	0	0	0	0	0
Lemongrass leaves extract	0	0	0	0	0	0	0	0	0	0	0	0
Oriental Herb Insecticide (lantana)	0	0	0	0	0	0	0	0	0	0	0	0
Oriental Herb Insecticide (lemongrass)	0	0	0	0	0	0	0	0	0	0	0	0

The data was not statistically analyzed because all of the treatments are zero.