BIBLIOGRAPHY

BIG-ASAN, JEMALYN U. APRIL 2011. Evaluation of Natural Attractants in Trapping Insects Associated with Strawberry. Benguet State University, Balili, La Trinidad Benguet.

Adviser: Maria Ana C. Tanyag, MSc.

ABSTRACT

This study was conducted from November 2010 to March 2011 at Benguet State University Experimental Station, Balili, La Trinidad, Benguet, to identify formulated natural attractants that were effective in trapping strawberry insects, identify families of insects associated with strawberry that were attracted to the attractants, categorize trapped insects according to economic importance, to determine the total number of insects attracted to the formulated attractants and to know the duration of the efficacy of attractants.

All the different formulations of FPJ and VJ which were the following, 250 ml: 1000 ml, 350 ml: 1000 ml, 500 ml: 1000 ml, 1000 ml: 1000 ml, 1500 ml: 1000 ml, 2000 ml: 1000 ml and 2500 ml: 1000 ml were effective attractant. The highest number of attracted insects was observed from 2000 ml formulated plant juice: 1000 ml vinegar juice formulation.

Insects observed associated with strawberry were from the families of Chrysomelidae, Noctuidae, Coccinelidae and Scatopsidae.

There were six families identified as insect pests such as Chrysomelidae, Nitidulidae, Noctuidae, Scarabaeidae, Sphingidae and Tephritidae. Seven as beneficial insects, they were from the families of Apidae, Braconidae, Carabidae, Coccinelidae, Scatopsidae, Sepsidae and Tachinidae and eight visiting insects attracted to the trap set from Calliphoridae, Chironomidae, Drosophilidae, Micropezidae, Muscidae, Plutillidae, Sarcophagidae and Tipulidae families.

The total number of insects trapped on the different attractant formulations were 3, 694. Family Noctuidae had the highest number of insect pests trapped by all of the formulated attractants.

The efficacy of all the formulated attractants lasted for eleven days with 5^{th} day as the peak day and declining up to 11^{th} day.

TABLE OF CONTENTS

INTRODUCTION

Progress in pest control technologies has contributed to the improvement of yield and quality of food, fiber, and ornamental crops. However, the development and widespread adoption of some pest-control technologies did not occur without environmental impacts and societal concerns about food safety. The strawberry which is a wholesome and delicious fruit and ranks foremost as a table delicacy among the vegetables and fruits grown in Baguio city and vicinity is of no exception. While it is very much in demand among vacationists and tourist in the Mountain Provinces the strawberry is still costly (Coronel, 1983) due to limited supply. Some of the pressing problems are of which is the lack of high yielding variety and the existence of insect pest that affect the yield of the plant.

Insect traps and natural attractants are now being used as an alternative solution in controlling insect pests. Various trapping devices, viz. light, bait color traps, chemical attractants (pheromone), plant-based attractants are being used to attract insects. Yellow sticky or pan water trap is used in daytime to catch aphids on various fruit crops. Traps baited with some attractive material namely fermented sugar, molasses, etc. and poisoned with chemicals have also been found effective in capturing fruit fly adults. Likewise, freshly chopped pseudostems of banana when spread in the banana orchard during night are found to be an effective practice of catching the adult weevils (Prasad, 2007).

Health and well-being are highly valued in societies around the world, resulting in demands for a safe, wholesome food supply that is produced without harm to the environment or hazards to those who work in agriculture as well as the consumers. Pesticides have provided the primary means for limiting pest populations. However, the

use of pesticides is the most critical hazard to a food supply. Clearly, employing formulated attractant in strawberry plantation is one way to meet the demand of people in the community for a safe and nutritious strawberry fruit supply. Also, it helps farmers decrease their increasing farm inputs for agrochemicals.

The study was conducted to identify formulated natural attractants that are effective in trapping strawberry insects, identify families of insects associated with strawberry that are attracted to the attractants, categorize trapped insects as pest, beneficial and visiting insects , to determine the total number of insects attracted to the formulated attractants and to know the duration of the efficacy.

The study was conducted at Benguet State University, Balili, Experimental Station, Balili, La Trinidad Benguet from November 2010 to March 2011.

REVIEW OF LITERATURE

Kinds of Attractant

Chemical attractant. Insects use many different semio chemicals that convey message between organisms. Chemicals that acts as attractants or carry other message are volatile (quick to evaporate) compounds when release in the air the component can be detected by certain insects a few inches to hundreds of yards away. Chemicals that carry messages over a considerable distance are most often used in the pest management. Pheromones are semio- chemicals that are produced and received by members of the same species, this has a great influenced on the behavior and biological processes of insects. Pheromones are produced synthetically and are used in different ways. It can be used as a lure in traps used to monitor pest populations. Pheromones also disrupt mating (Birch and Haynes, 1982).

Visual lures. Visual lures used in insect management fall into three categories, (1) light, that attracts insects from dark or dimly light surroundings, (2) colored that are attractive because of their specific reflectance and (3) shape of silhouettes that stands out against the contracting background (Weinzer and Koehler, 1997).

Using light to attract insects. A light trap is used to survey night-flying insects. Most light traps use ultraviolet lamps and capture a wide range of moths, beetles, and other insects. Placing outdoor lights several feet away from doors of homes and apartments also concentrates insect activity away from the sites where they cause the most annoyance. In addition, yellow light bulbs attract fewer insects than white incandescent lights or fluorescent bulbs (Gilbert, 1984).

Using colored objects to attract insects. Specific colors are attractive to some day-flying insects. For example, yellow objects attract many insects and are often used in traps designed to capture winged aphids and adult whiteflies. Red spheres and yellow cards attract apple maggot flies. Like other attractants, colored objects can be used in traps for monitoring or mass trapping (Prasad, 2007).

Plant- based attractant. These are attractants which generally introduced to plants. These hybrid plants can attract and kill insect pest that are attacking them. One example is the attractin, a patented environmentally friendly, non-toxic, plant-based attractant which effectively attracts fruit flies including olive and orange fruit fly pest, attractin does not affect honeybees. attractin was developed by Natural- Agro in 2001. Scientist in Beltsville, Maryland has now also identified and synthesized attractant is emitted as volatile from potato plants. The chemical attracts not only the pest but also the predators that attack the pest (Birch and Haynes, 1982).

Plant attractants. Plant can also be used as an attractant for insect and can be even used to attract beneficial insects that predate the pest. American hoverfly (Metasyrphus Americana) and toxomerous Hoverflies which feeds on aphids are attracted on sweet asylum, baby blue eyes, morning glory, cosmos, coreopsis, oleander, candy tuff and white yarrow. They also love the flowers of the Silver lace vine (Polygonoum aurbertii). Also soldier beetles that wage war on grasshopper's eggs, caterpillars, cucumber flea and other small beetles and spider mites are attracted to Hydrangea, milkweed and golden rod (Delfosse, 1999).

Natural insect attractant. Instead of pesticide, Natural farming uses various natural insect attractants (fermented plant juice mixed with raw rice wine) to get rid of insects.

Insect's keen sense of smell and taste is utilized to lure and catch insects into insect attractant-containing plastic bottles with open side windows (Anonymous, 1985).

Duration of efficacy of the attractants. Regardless of the concentration of the attractant, there was a decreasing number of insect caught with respect to time (Sumingwa, 2004).

Strawberry plant. The strawberry (*Fragaria chiloensis* Duch.) is a wholesome and delicious fruit and ranks foremost as a table delicacy among the vegetables and fruits grown in Baguio City and vicinity. It is highly esteemed as a fresh fruit or as a preserve. Today, commercial strawberry production is confined to Baguio and Benguet where the crop is highly adapted and where the fruit is in great demand during the vacation season in March to May (Coronel, 1983).

Insects of strawberry. The strawberry is attacked by many pests. Among those observed in Baguio and surrounding areas are white grubs, mites, thrips, weevil, leaf rollers, aphids and grasshoppers (Coronel, 1983).

MATERIALS AND METHODS

Materials

The materials used in the study were chopping knives, three pails, manila paper, rubber bands. Triple beam balance, graduated cylinder, beaker, clean containers, pot, electric stove, grab hoe, digital camera, scooping tool, clean cloth, scientific calculator, record notebook, pencil and pen.

Methodology

Fermented Plant Juice (FPJ). Two kilos of banana trunk (cardava variety) were chopped and mixed with 1 kilo muscovado sugar and were placed in pails. The pails were covered with manila paper and tied with rubber bands. The pails were stored in a cool place for fermentation for 7 days. The fermented juice were extracted and transferred to clean containers.

Vinegar Juice (VJ). A gallon of crude vinegar was mixed with ½ kilo muscovado sugar. The mixture was heated until it reach boiling point. The mixture was set aside to cool and was used in preparing the attractants.

Preparation of Mixture. Two hundred fifty millimeters of the fermented plant juice was measured and added to the cooled vinegar juice. The mixture was set aside for testing.

Testing . Ten plots measuring 1mX5m was prepared and planted with strawberry. The attractant, which were contained on 32 containers, were introduced on the area. A volume of 300 ml was used for the attractant. Water was introduced in the area as

control. The attractant was replicated 4 times. The introduced attractant was observed daily to determine the number of attracted insects. The different ratio of FPJ and VJ used to serve as treatments (Figures 1 and 2) were the following:

Treatments	FPJ	VJ
T_1	Water	
T_2	250ml:	1000ml
T_3	350ml:	1000ml
T_4	500ml:	1000ml
T_5	1000ml:	1000ml
T_6	1500ml:	1000ml
T_7	2000ml:	1000ml
T_8	2500ml:	1000ml

Randomized Complete Block Design (RCBD) was used in the statistical analysis of the treatments. Figures 3 and 4 show the experimental set-up.

Figure 1. A 500 ml Beaker used for measuring the different ratio

Figure 2. A 1.5 liter container used to show level of formulation

Figure 3. Trap set approximately 6" above the ground

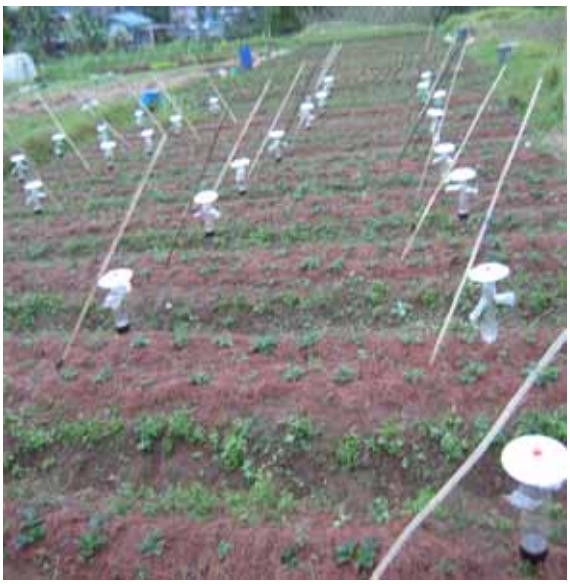

Figure 4. RCBD lay-out of field traps

Identification of the Effective Formulated Attractants

The eight different ratios of the natural attractants were replicated 4 times and were observed daily. The insect trapped were collected with a wire scoop and counted.

Identification of Strawberry Insects Attracted to the Attractant

The collected trapped insects were identified visually. Minute and unidentified insects were brought to the laboratory for further identification.

Determining the Most Attracted Insects

Using the data of the recorded insects of strawberry attracted to the formulated attractant, the population was summed up using scientific calculator. The insect having the highest population was then identified.

Identification of Strawberry Insects

Eight strawberry plants per block were randomly selected to represent each replication. The observation was done daily within five days. The observed insects were recorded.

Population of Trapped Adult Insects

With the aid of the previous data on the insect trapped, the population was summed up regardless of its kind.

Kinds of Insects Trapped on the Attractant

Having a closer view on the insect trapped, the insects were identified and recorded whether the insects trapped were insect pests, beneficial or visiting insects.

Insects Trapped on the Attractant

The trapped insects were identified to what family do they belong and by their scientific and common name.

Duration of the Efficacy of the Attractants

The duration of 300 ml volume of attractant placed in the designed container for the set up was monitored daily until the formulated attractants were capable to trap.

Data Gathered.

1. Population of trapped adult insects The number of adult trapped was collected and counted.
2. Strawberry insects trapped on the attractant The insects of strawberry were

identified and recorded.

3. Kinds of insects trapped on the attractant This insects was group into pest insects, beneficial and visiting insects.

4. Duration of the efficacy of the attractants The number of days in which the attractants ceased on trapping.

RESULTS AND DISCUSSION

Identification of Effective Ratios
of formulated Natural Attractant

It was presented in Table 1 that the treatment with a ratio of 2000 ml:1000 ml trapped the highest number of insects having a total mean of 167.50 followed by 2500 ml:1000 ml ratio having a mean of 163.50 and 500 ml:1000 ml ratio have a total mean of 134.50. Likewise, 1500 ml: 1000 ml ratio trapped a total mean of 128.50; 1000 ml: 1000 ml had 127.50 mean insects trapped, respectively.

It was apparently shown in the table that all the formulated attractants were effective in trapping insects of strawberry. Numerically, treatment 7 with a ratio of 2000 ml: 1000 ml trapped the highest number of insects having a total number of 670. Nevertheless, statistical analysis revealed that all the formulated ratios were not significantly different with each other except treatment 3 and the control treatment.

Table 1. Total number of trapped insects by the different formulations

RATIO OF FORMULATIONS	TOTAL NUMBER OF TRAPPED INSECTS	MEAN NUMBER OF TRAPPED INSECTS
T_1 Water	5	1.25^{c}
T_2 250 ml: 1000 ml	493	123.25^{ab}
T_3 350 ml: 1000 ml	405	101.25^{b}
T_4 500 ml: 1000 ml	538	134.50^{ab}
T_5 1000 ml: 1000 ml	509	127.25^{ab}
T_6 1500 ml: 1000 ml	514	128.50^{ab}
T_7 2000 ml:1000 ml	670	167.50^{a}
T_8 2500 ml: 1000 ml	654	163.50^{a}
CV		25.43

Means with the same letter is not significantly different at 5% level of significance (DMRT)

Identification of Strawberry Insects and Other Arthropods Associated with Strawberry

At about five days scouting on the strawberry plant, the insects observed were from the families of Aphididae (aphids), Aleyrodidae (whitefly), Chrysomelidae (elm leaf beetle, flea beetle), Cicadellidae (plant hopper), Coccinelidae (lady bug beetle) Formicidae (ants), Noctuidae (cutworm larvae), Scatopsidae (black minute scavenger fly), and spiders and mites. With the given list of insects by Coronel (1983) only aphids and mites were observed in the study.

On the other hand, insects associated with strawberry trapped on the attractant as presented in Table 2 were from the family chrysomelidae and family noctuidae specifically cutworm larvae. Moreover, the minute black scavenger fly, and lady bug beetle categorized as beneficial insects were also observed on the attractant.

Table 2. Insects trapped on the attractants formulation

FAMILIES OF INSECTS TRAPPED	COMMON NAME	SCIENTIFIC NAME
Apidae	Honeybee	*Apis mellifera*
Braconidae	Braconid wasp	*Diachasmimorpha longicaudata*
Calliphoridae	Blowfly	*Calliphora sp.*
Carabidae	Carabid beetle	*Calleida decora* F.
Chironomidae	Midges	*C. plumosus* L
Chrysomelidae	Elm leaf beetle and Flea beetle	*Pyrralta luteola* M. *Phyllotreta striolata*
Coccinelidae	Lady bug beetle	*Hippodamia convergens*
Drosophilidae	Vinegar fly	*Drosophila melanogaster*
Micropezidae	Stilt-legged flies	*Badisis ambulans*
Muscidae	Housefly	*Musca domestica*
Nitidulidae	Sap beetle	*Carpophilus sp.*
Noctuidae	Cutworm	*Heliothis spp.*
Plutellidae	Diamond Back Moth	*Plutella xylostella*
Sarcophagidae	Flesh fly	*Sarcophaga spp*
Scarabaeidae	June beetle	*Phyllophaga sp.*
Scatopsidae	Minute black scavenger fly	*Scatopse notata* L.

Table 2. Continued …

FAMILIES OF INSECTS TRAPPED	COMMON NAME	SCIENTIFIC NAME
Sepsidae	Black scavenger fly	*Sepsis fulgens*
Sphingidae	Hawk moth	*Hyles lineata*
Tachinidae	Tachinid fly	*Lixophaga sp*
Tephritidae	Fruit fly	*Bactrocera sp.*
Tipulidae	Crane fly	*Tipula spp.*

Categorized Families of Insects Trapped

The identification of the kinds of insects trapped by the different formulated attractant was shown in Table 3. The insects trapped were categorized into three, insect pests, beneficial and visiting insects.

The insect pests observed were under the family Chrysomelidae, Drosophilidae, Nitidulidae, Noctuidae, Plutillidae, Scarabaeidae, Sphingidae and Tephritidae. On the other hand, the beneficial insects trapped on the attractant were from the family Apidae, Braconidae, Carabidae, Coccinelidae, Scatopsidae, Sepsidae and Tachinidae. Moreover, the visiting insects observed from the attractant were Calliphoridae, Chironomidae, Micropezidae, Muscidae, Sarcophagidae, and Tipulidae.

Table 3. Families of insect trapped on the attractants formulation

PESTS	BENEFICIAL	VISITING
Chrysomelidae	Apidae	Calliphoridae
Nitidulidae	Braconidae	Chironomidae
Noctuidae	Carabidae	Drosophilidae
Scarabaeidae	Coccinelidae	Micropezidae
Sphingidae	Scatopsidae	Muscidae
Tephritidae	Sepsidae	Plutellidae
	Tachinidae	Sarcophagidae
		Tipulidae

It was apparent in the table that insect pests were the least number of insects collected. It could be that insects associated with strawberries were ground dwelling insects. Moreover, flying beneficial and visiting insects were attracted on the attractant.

Insect pests. The population of trapped adult insect pests was presented in Table 4. All the treatments were not significantly different on the statistical analysis.

Though there were trapped Chrysomelidae (Figures 5 and 6) and Nitidulidae (Figure 7) on the different formulations, the statistical result was not significant. Moreover, treatment 8 trapping noctuidae family with a mean of 30.75 resulted highly significant compared to the other ratios.

Based on the statistical analysis, the different formulations were not significantly different in trapping Scarabaeidae, Sphingidae, and Tephritidae (Figure 8) though there were numbers of the trapped insects, there were no significant differences observed which indicates that they're not common pest of strawberry plants.

Table 4. Mean population of trapped adult insect pests on the different attractants formulation

RATIO OF ATTRACTANTS	FAMILIES OF INSECTS					
	CHRYSOMELIDAE	NITIDULIDAE	NOCTUIDAE	SCARABAEIDAE	SPHINGIDAE	TEPHRITIDAE
T_1 water	0^a	0^a	0^d	0^a	0^a	0^a
$T_{2\ 250:1000\ ml}$	0.75^a	1.75^a	5.25^{cd}	0^a	0.25^a	0.25^a
$T_{3\ 350:1000\ ml}$	0.25^a	1.75^a	5.25^c	0^a	0.25^a	0.25^a
$T_{4\ 500:1000\ ml}$	1.00^a	2.5^a	9^c	0^a	0.25^a	0^a
$T_{5\ 1000:1000ml}$	0.75^a	2.5^a	11.5^c	0.25^a	0.5^a	0.25^a
$T_{6\ 1500:1000ml}$	0.5^a	1.5^a	17.5^b	0^a	0.25^a	0.75^a
$T_{7\ 2000:1000ml}$	1.5^a	1.75^a	22.25^b	0.5^a	0.75^a	0.75^a
$T_{8\ 2500:1000ml}$	0^a	1.75^a	30.75^a	1.5^a	0.50^a	0^a
CV	126.2	69.19	30.86	246.25	208.03	214.69

Means with the same letter is not significantly different at 5% level of significance (DMRT)

Figure 5.Family Chrysomelidae
(Elm leaf beetle)

Figure 6. Family Chrysomelidae
(Flea beetle)

Figure 7. Family Nitidulidae (Sap beetle)

Figure 8. Family Tephritidae (Fruit fly)

Beneficial insects. Statistical analysis revealed that, Apidae, Braconidae (Figure 9), Carabidae, Coccinelidae (Figure 10), Sepsidae and Tachinidae families regardless of the different rates yielded not significant result, indicative that the attractant was not a threat on the population of these beneficial insects as shown in Table 5. However, Scatopsidae family was observed to be highly significant best at 250 ml: 1000 ml ratio having a total mean of 53.5 followed by treatment with ratio of 500 ml: 1000 ml with a total mean of 50.5 respectively.

Table 5. Mean population of trapped adult beneficial insects on the different attractants formulation

RATIO OF ATTRACTANTS	FAMILIES OF INSECTS						
	APIDAE	BRACONIDAE	CARABIDAE	COCCINELIDAE	SCATOPSIDAE	SEPSIDAE	TACHINIDAE
T_1 water	0^a	0^a	0^a	0.25^a	1.25^c	0^a	0^a
$T_{2\ 250:1000\ ml}$	0.25^a	0^a	0.50^a	0.25^a	53.5^a	2.00^a	0.75^a
$T_{3\ 350:1000\ ml}$	0^a	1.00^a	0.25^a	0.25^a	34.75^{ab}	1.25^a	0.25^a
$T_{4\ 500:1000\ ml}$	0.50^a	0.50^a	0.50^a	0.50^a	50.5^a	2.00^a	0.25^a
$T_{5\ 1000:1000ml}$	0^a	0.50^a	0.25^a	0.25^a	38.75^{ab}	0.75^a	0.50^a
$T_{6\ 1500:1000ml}$	0^a	0^a	0.75^a	0^a	36.25^{ab}	1.00^a	0.50^a
$T_{72000:1000ml}$	0.50^a	0^a	0.75^a	0.25^a	29^b	0.75^a	0.75^a
$T_{82500:1000ml}$	0^a	0^a	0.25^a	0.50^a	32.25^{ab}	0.75^a	1.00^a
CV	301.06	308.06	153.41	176.18	33.70	132.11	141.42

Means with the same letter is not significantly different at 5% level of significance (DMRT)

Figure 9. Family Braconidae (Braconid wasp)

Figure 10. Family Coccinelidae (Lady bug beetle)

Visiting insects. Among the group of insects trapped, visiting insects were observed to be highly significant except Micropezidae family (Figure 11). On the other

hand, the Calliphoridae family was highly significant at treatments with a ratio of 2500ml: 1000 ml and 2000 ml: 1000 ml comparable to the other treatments. Moreover, the different treatments were able to trap Chironomidae family and yielded highly significant result regardless of the rates except the control treatment. Also, the number of Drosophilidae attracted on the different formulations has no significant difference at all. However the trapping effectiveness of 250 ml: 1000 ml up to 2500ml: 1000ml was observed significant on the statistical analysis. Muscidae population was significantly high at treatments with ratios of 2000ml: 1000ml, 2500ml: 1000ml, 1500ml: 1000ml, and 1000ml: 1000ml comparable to the other treatments that followed. Also, Sarcophagidae was observed significantly high at treatments with ratios of 2500ml: 1000ml and 2000ml: 1000ml. Then, Tipulidae family (Figure 12) was trapped significantly on the different formulations except at the control treatment however; the mean number of attracted Tipulidae has no significant difference statistically.

Figure 11. FamilyMicropezidae (Stilt-legged fly)

Figure 12. Family Tipulidae (Cranefly)

Figure 13. Family Drosohilidae
(Vinegar fly)

Table 6. Mean population of trapped adult visiting insects on the attractants formulation

RATIO OF ATTRACTANTS	FAMILIES OF INSECTS							
	CALLIPHORIDAE	CHIRONOMIDAE	DROSOPHILIDAE	MICROPEZIDAE	MUSCIDAE	PLUTILLIDAE	SARCOPHAGIDAE	TIPULIDAE
T_1 water	0^{c}	0^{b}	0^{b}	0.25^{a}	0.25^{d}	0^{a}	0.25^{d}	0^{b}
T_2 250:1000ml	9.00^{b}	8^{a}	16^{a}	0.50^{a}	6.25^{cd}	0^{a}	14.5^{c}	1.75^{a} b
T_3 350:1000ml	5.25^{bc}	11.50^{a}	10^{ab}	0^{a}	7.50^{c}	0.5^{a}	12.75^{c}	1.75^{a} b
T_4 500:1000ml	7.50^{bc}	8.50^{a}	18^{a}	0^{a}	$9..50^{bc}$	0^{a}	16.25^{bc}	2.50^{a} b
T_5 1000:1000ml	8.00^{bc}	9.50^{a}	21.75^{a}	0^{a}	11.25^{a} bc	0^{a}	12.00^{c}	$3.75.^{a}$
T_6 1500:1000ml	12.00^{b}	8.50^{a}	11.5^{ab}	0.50^{a}	12.75^{a} bc	0.25^{a}	16.50^{bc}	4.00^{a}
T_7 2000:1000ml	28.50^{a}	6.25^{a}	19.25^{a}	0.25^{a}	17.75^{a}	0.25^{a}	25.25^{ab}	4.50^{a}
T_8 2500:1000ml	23.00^{a}	5.75^{a}	16.5^{a}	0^{a}	15^{ab}	0^{a}	28.5^{a}	1.75^{a} b
CV	46.99	48.18	54.34	236.37	43.77	261.25	38.02	68.08

Means with the same letter is not significantly different at 5% level of significance (DMRT)

Total Population of the Different Kinds
of Insects Trapped on the Attractant

Numerically, Scatopsidae family categorized as beneficial insect showed the highest number of insect trapped having a total number of 1117 and a mean of 34.30 and Drosophilidae from the visiting insects had a mean of 14.12 then Noctuidae family with a mean of 12.84 from the insect pests as shown in Table 7.

Table 7. Mean population of the different kinds of attracted insects on the attractants formulation

KINDS OF ATTRACTED INSECTS	TOTAL	MEAN
A. Pests Family		
Chrysomelidae	20	3.62
Nitidulidae	54	1.62
Noctuidae	411	12.84
Scarabaeidae	15	0.46
Sphingidae	10	0.31
Tephritidae	9	0.28
B. Beneficial Insects Family		
Apidae	5	0.15
Braconidae	8	0.25
Carabidae	14	0.43
Coccinelidae	9	0.28
Scatopsidae	1117	34.30
Sepsidae	34	1.06
Tachinidae	16	0.50
C. Visiting Insects Family		
Calliphoridae	373	11.65
Chironomidae	232	7.25
Drosophilidae	452	14.12
Micropezidae	6	0.18
Muscidae	321	10.03
Plutellidae	4	0.12
Sarcophagidae	504	15.75
Tipulidae	80	2.50
TOTAL	3694	

It was apparently shown in the tables that mean number of Scatopsidae family highly differed from the mean numbers of other insect trapped. It could be that these insects were abundant in the area because of the decomposing over ripe fruits.

Duration of Efficacy of the Attractant

The duration of effectiveness of formulated natural attractant was presented in Table 8. Regardless of the concentration of the attractant, there was a decreasing number of insect caught with respect to time except from day 1 to 4. The highest number trapped was recorded at day 5, this served as the peak day then the advancing time of assessment showed that the recorded insects decreases relative to the diminishing effectiveness of the attractant that differed from Sumingwa (2004) in which day 1 trapped the highest number and decreases chronologically until the last day.

Table 8. Duration (days) of efficacy of the different ratios of formulated attractants in catching adult insects

DAYS OF COLLECTION	NUMBER OF INSECTS TRAPPED								TOTAL	MEAN
	WATER	250:1000 ML	350:1000 ML	500:1000 ML	1000:1000 ML	1500:1000 ML	2000:1000 ML	2500:1000 ML		
1	2	44	46	58	70	60	97	63	440	55
2	2	60	54	76	82	65	84	79	502	62.75
3	1	52	63	68	65	62	92	91	494	61.75
4	4	48	32	38	44	50	54	73	343	42.87
5	1	74	50	69	55	65	89	87	490	61.25
6	0	59	40	48	46	63	88	76	420	52.5
7	0	42	31	43	36	38	59	56	305	38.12
8	0	36	25	47	38	35	36	46	263	32.87
9	0	32	18	37	27	31	28	33	206	25.75
10	0	26	32	30	26	33	24	30	201	25.12
11	5	20	14	24	20	12	19	15	124	15.5

SUMMARY, CONCLUSION AND RECOMMENDATION

Summary

The study was conducted at Benguet State University, Balili Experimental Station, Balili, La Trinidad Benguet from November 2010 to March 2011.

The study aimed to identify formulated natural attractants that are effective in trapping strawberry insects, identify insects associated with strawberry that are attracted to the natural attractants, categorized trapped insects as pest, beneficial and visiting insects, to determine the total number of insects attracted to the formulated attractants and to know the duration of the efficacy of attractants.

All the formulations were significantly effective in trapping strawberry insects except treatment 3 and the control treatment based on statistical analysis. Numerically, highest number of insects was from the rate of 2000 ml: 1000 ml formulation of attractant. Generally, the population of the counted insects' decreases relative to decreasing rates of formulated natural attractant.

Insects associated with strawberry trapped on the attractant were from the family chrysomelidae and family noctuidae specifically cutworm larvae. Moreover, the minute black scavenger fly, and lady bug beetle categorized as beneficial insects were also observed on the attractant.

There were three groups of insects observed from the formulated natural attractants. These were insect pests, beneficial insects and visiting insects. The insect pests were from the family Chrysomelidae, Nitidulidae, Noctuidae, Scarabaeidae, Sphingidae and Tephritidae. The trapped beneficial insects were from Apidae, Braconidae, Carabidae, Coccinelidae, Scatopsidae, Sepsidae and Tachinidae families.

The trap visiting insects were Calliphoridae, Chironomidae, Drosohilidae, Micropezidae, Muscidae, Plutillidae, Sarcophagidae and Tipulidae.

The total number of insects trapped on the different attractants formulation were 3, 694 respectively. Among the insect pests trapped, family noctuidae had the highest number of insect pests trapped by all of the formulated attractants.

The duration of efficacy of formulated natural attractant lasted 11 days. The fifth day of collection yields the highest number of trapped insects. The numbers of trapped insects decreases relative to the advancing time of assessment.

Conclusion and Recommendation

All the rates of formulated natural attractant evaluated were effective in trapping strawberry insect pests and not a threat on beneficial insect population. The formulated natural attractant was proven to be effective attractant of adult strawberry insect pests such as Noctuidae and Chrysomelidae.; however the rate of 2000 ml: 1000 ml is recommended being the most effective.

A follow up study could be done by increasing the amount of fermented plant juice mixed with vinegar juice and setting them as pitfall and aerial trap.

LITERATURE CITED

ANONYMOUS. 1985. Gardening and Natural Farming. Retrieved September 10, 2010 from http://www.naturalfarming.org/.

BIRCH. M.C. and K.F. HAYNES.1982. Insect Pheromones. London. The Institute of Biology's Studies in Biology. Pp. 87-100.

CORONEL, R.E. 1983. Promising Fruits of the Philippines. University of the Philippines at Los Banos College of Agriculture, College, Laguna, Philippines. Pp. 437-445.

DELFOSSE, A. 1999. Crop Protection and Quarantine, National Annual Report. Beltsville. National Program Staff. Pp. 50-55.

GILBERT, D. 1984. Insect Electrecutors and Light Traps. St. Paul Minnesota. American Association of Cereal Chemist. Pp. 87-108.

PRASAD, D. 2007. Sustainable Pest Management. Daya Delhi. Publishing House. Pp. 90-91.

SUMINGWA, S. 2004. Evaluation of formulated attractants against insects associated with white potato and cabbage. BS thesis. Beguet State University, La Trinidad, Beguet.

WEINZER, R., T. HENN and P.G. KOEHLER.1997. Insect Attractant and Traps. University of Florida, Gainesville. Cooperative Extension Services. Pp. 190-210.

APPENDICES

Appendix Table 1. Total population of the adult insects trapped

RATIO OF FORMULATIONS	REPLICATION 1	11	111	1V	TOTAL	MEAN
Water	2	1	0	2	5	1.25[c]
250:1000ml	93	87	155	152	487	123.25[ab]
350:1000ml	84	90	87	94	353	88.25[b]
500:1000ml	138	124	131	145	538	134.50[ab]
1000:1000ml	141	151	98	101	491	122.75[ab]
1500:1000ml	118	126	129	121	494	123.50[ab]
2000:1000ml	153	109	201	207	670	167.50[a]
2500:1000ml	197	203	111	143	654	163.50[a]
SUB-TOTAL	931	923	933	1001	3694	

ANALYSIS OF VARIANCE

SOURCE OF VALUE	DF	SUM OF SQUARES	MEAN SQUARES	F VALUE	TABULATED F 0.05	0.01
TREATMENT	7	75704.5	10814.93	11.93**	2.49	3.64
REPLICATION	3	493.0	164.33			
ERROR	21	19030.0	906.19			
TOTAL	31	95227.5				

**- Highly significant CV 25.43%

Appendix Table 2. Total population of trapped Apidae on the traps

RATIO OF FORMULATIONS	REPLICATION 1	11	111	1V	TOTAL	MEAN
Water	0	0	0	0	0	0
250:1000ml	0	1	0	0	1	0.25
350:1000ml	0	0	0	0	0	0
500:1000ml	2	0	0	0	2	0.5
1000:1000ml	0	0	0	0	0	0
1500:1000ml	0	0	0	0	0	0
2000:1000ml	0	0	1	1	2	0.5
2500:1000ml	0	0	0	0	0	0
SUB-TOTAL	2	1	1	1	5	

ANALYSIS OF VARIANCE

SOURCE OF VALUE	DF	SUM OF SQUARES	MEAN SQUARES	F VALUE	TABULATED F 0.05	0.01
TREATMENT	7	1.4688	0.2098	0.95^{ns}	2.49	3.65
REPLICATION	3	0.0938	0.0313			
ERROR	21	4.6563	0.2217			
TOTAL	31					

^{ns} -Not significant CV 301.36%

Appendix Table 3. Total population of trapped Braconidae on the traps

RATIO OF FORMULATIONS	REPLICATION 1	11	111	1V	TOTAL	MEAN
Water	0	0	0	0	0	0
250:1000ml	0	0	0	0	0	0
350:1000ml	4	0	0	0	4	1
500:1000ml	2	0	0	0	2	0.5
1000:1000ml	0	2	0	0	2	0.5
1500:1000ml	0	0	0	0	0	0
2000:1000ml	0	0	0	0	0	0
2500:1000ml	0	0	0	0	0	0
SUB-TOTAL	6	2	0	0	8	

ANALYSIS OF VARIANCE

SOURCE OF VALUE	DF	SUM OF SQUARES	MEAN SQUARES	F VALUE	TABULATED F 0.05	0.01
TREATMENT	7	4.0000	0.5714	0.80^{ns}	2.49	3.65
REPLICATION	3	3.0000	1.0000			
ERROR	21	15.0000	0.7143			
TOTAL	31	22.0000				

^{ns}-Not significant CV 338.06%

Appendix Table 4. Total population of trapped Calliphoridae on the traps

RATIO OF FORMULATIONS	REPLICATION 1	11	111	1V	TOTAL	MEAN
Water	0	0	0	0	0	0^{c}
250:1000ml	9	2	23	2	36	9^{b}
350:1000ml	10	7	3	1	21	5.25^{bc}
500:1000ml	13	5	6	6	30	7.5^{bc}
1000:1000ml	15	8	4	5	32	8^{bc}
1500:1000ml	14	9	18	7	48	12^{b}
2000:1000ml	33	33	31	17	114	28.5^{a}
2500:1000ml	26	34	18	14	92	23^{a}
SUB-TOTAL	120	98	103	52	373	

ANALYSIS OF VARIANCE

SOURCE OF VALUE	DF	SUM OF SQUARES	MEAN SQUARES	F VALUE	TABULATED F 0.05	0.01
TREATMENT	7	2508.4687	358.3527	11.95^{**}	2.49	3.65
REPLICATION	3	316.8437	105.6146			
ERROR	21	629.9062	29.9955			
TOTAL	31	3455.2186				

**- Highly significant CV 46.99%

Appendix Table 5. Total population of trapped Carabidae on the traps

RATIO OF FORMULATIONS	REPLICATION 1	11	111	1V	TOTAL	MEAN
Water	0	0	0	0	0	0
250:1000ml	1	1	0	0	2	0.5
350:1000ml	0	1	0	0	1	0.25
500:1000ml	0	1	0	1	2	0.5
1000:1000ml	0	1	0	0	1	0.25
1500:1000ml	0	0	2	1	3	0.75
2000:1000ml	0	1	0	2	3	0.75
2500:1000ml	0	0	0	1	1	0.25
SUB-TOTAL	1	6	2	5	14	

ANALYSIS OF VARIANCE

SOURCE OF VALUE	DF	SUM OF SQUARES	MEAN SQUARES	F VALUE	TABULATED F 0.05	0.01
TREATMENT	7	1.9688	0.2813	0.72^{ns}	2.49	3.65
REPLICATION	3	1.5938	0.5313			
ERROR	21	8.1562	0.3884			
TOTAL	31	11.7188				

^{ns}-Not significant CV 153.41%

Appendix Table 6. Total population of trapped Chironomidae on the traps

RATIO OF FORMULATIONS	REPLICATION 1	11	111	1V	TOTAL	MEAN
Water	0	0	0	0	0	0[b]
250:1000ml	4	8	9	11	32	8[a]
350:1000ml	17	10	9	10	46	11.5[a]
500:1000ml	2	11	10	11	34	8.5[a]
1000:1000ml	4	14	15	5	38	9.5[a]
1500:1000ml	8	9	6	11	34	8.5[a]
2000:1000ml	9	6	3	7	25	6.25[a]
2500:1000ml	8	5	4	6	23	5.75[a]
SUB-TOTAL	52	63	56	61	232	

ANALYSIS OF VARIANCE

SOURCE OF VALUE	DF	SUM OF SQUARES	MEAN SQUARES	F VALUE	TABULATED F 0.05	0.01
TREATMENT	7	330.5000	47.2143	3.87**	2.49	3.65
REPLICATION	3	9.2500	3.0833			
ERROR	21	256.2500	12.2024			
TOTAL	31	596.0000				

**- Highly significant CV 48.18%

Appendix Table 7. Total population of trapped Chrysomelidae on the traps

RATIO OF FORMULATIONS	REPLICATION 1	11	111	1V	TOTAL	MEAN
Water	0	0	0	0	0	0
250:1000ml	1	0	2	0	3	0.75
350:1000ml	1	0	0	0	1	0.25
500:1000ml	2	0	1	1	4	1
1000:1000ml	1	1	0	1	3	0.75
1500:1000ml	0	0	1	1	2	0.5
2000:1000ml	2	3	0	1	6	1.50
2500:1000ml	0	0	0	2	2	0.5
SUB-TOTAL	7	4	3	6	20	

ANALYSIS OF VARIANCE

SOURCE OF VALUE	DF	SUM OF SQUARES	MEAN SQUARES	F VALUE	TABULATED F 0.05	0.01
TREATMENT	7	5.9688	0.8527	1.24^{ns}	2.49	3.65
REPLICATION	3	0.8438	0.2813			
ERROR	21	14.4062	0.6860			
TOTAL	31	21.2188				

^{ns}-Not significant CV 126.21%

Appendix Table 8. Total population of trapped Coccinelidae on the traps

RATIO OF FORMULATIONS	REPLICATION 1	11	111	1V	TOTAL	MEAN
Water	0	1	0	0	1	0.25
250:1000ml	0	1	0	0	1	0.25
350:1000ml	0	1	0	0	1	0.25
500:1000ml	0	0	1	1	2	0.5
1000:1000ml	0	1	0	0	1	0.25
1500:1000ml	0	0	0	0	0	0
2000:1000ml	0	0	0	1	1	0.25
2500:1000ml	0	2	0	0	2	0.5
SUB-TOTAL	0	6	1	2	9	

ANALYSIS OF VARIANCE

SOURCE OF VALUE	DF	SUM OF SQUARES	MEAN SQUARES	F VALUE	TABULATED F 0.05	0.01
TREATMENT	7	0.7188	0.1027	0.42^{ns}	2.49	3.65
REPLICATION	3	2.5938	0.8646			
ERROR	21	5.1563	0.2455			
TOTAL	31	8.4687				

^{ns}- Not significant CV 176.18%

Appendix Table 9. Total population of trapped Drosophilidae on the traps

RATIO OF FORMULATIONS	REPLICATION 1	11	111	1V	TOTAL	MEAN
Water	0	0	0	0	0	0[b]
250:1000ml	11	15	26	12	64	16[a]
350:1000ml	10	7	14	9	40	10[ab]
500:1000ml	10	10	21	31	72	18[a]
1000:1000ml	13	12	42	20	87	21.75[a]
1500:1000ml	8	11	11	16	46	11.5[ab]
2000:1000ml	10	10	14	43	77	19.25[a]
2500:1000ml	10	13	20	23	66	16.5[a]
SUB-TOTAL	72	78	148	154	452	

ANALYSIS OF VARIANCE

SOURCE OF VALUE	DF	SUM OF SQUARES	MEAN SQUARES	F VALUE	TABULATED F 0.05	0.01
TREATMENT	7	1328.0000	189.7143	3.22*	2.49	3.65
REPLICATION	3	726.5000	242.1667			
ERROR	21	1237.0000	58.9048			
TOTAL	31	3291.5000				

*- Significant CV 54.34%

Appendix Table 10. Total to population of trapped Micropezidae on the traps

RATIO OF FORMULATIONS	REPLICATION 1	11	111	1V	TOTAL	MEAN
Water	1	0	0	0	1	0.25
250:1000ml	2	0	0	0	2	0.5
350:1000ml	0	0	0	0	0	0
500:1000ml	0	0	0	0	0	0
1000:1000ml	0	0	0	0	0	0
1500:1000ml	2	0	0	0	2	0.5
2000:1000ml	1	0	0	0	1	0.25
2500:1000ml	0	0	0	0	0	0
SUB-TOTAL	6	0	0	0	6	

ANALYSIS OF VARIANCE

SOURCE OF VALUE	DF	SUM OF SQUARES	MEAN SQUARES	F VALUE	TABULATED F 0.05	0.01
TREATMENT	7	1.3750	0.1964	1.00^{ns}	2.49	3.65
REPLICATION	3	3.3750	1.1250			
ERROR	21	4.1250	0.1964			
TOTAL	31	8.8750				

^{ns}-Not significant CV 236.37%

Appendix Table 11. Total population of trapped Muscidae on the traps

RATIO OF FORMULATIONS	REPLICATION 1	11	111	1V	TOTAL	MEAN
Water	0	0	0	1	1	0.25[d]
250:1000ml	16	5	1	3	25	6.25[cd]
350:1000ml	14	5	7	4	30	7.5[c]
500:1000ml	14	10	7	7	38	9.5[bc]
1000:1000ml	20	12	7	6	45	11.25[abc]
1500:1000ml	21	7	14	9	51	12.75[abc]
2000:1000ml	18	20	27	6	71	17.75[a]
2500:1000ml	19	14	20	7	60	15[ab]
SUB-TOTAL	122	73	83	43	321	

ANALYSIS OF VARIANCE

SOURCE OF VALUE	DF	SUM OF SQUARES	MEAN SQUARES	F VALUE	TABULATED F 0.05	0.01
TREATMENT	7	839.2187	119.8884	6.22**	2.49	2.49
REPLICATION	3	398.8437	132.9479			
ERROR	21	404.9062	19.2812			
TOTAL	31	1642.9687				

**- Highly significant CV 43.77%

Appendix Table 12. Total population of trapped Nitidulidae on the traps

RATIO OF FORMULATIONS	REPLICATION 1	11	111	1V	TOTAL	MEAN
Water	0	0	0	0	0	0
250:1000ml	2	3	0	2	7	1.75
350:1000ml	3	3	0	1	7	1.75
500:1000ml	5	2	2	1	10	2.5
1000:1000ml	1	3	3	3	10	2.5
1500:1000ml	2	2	1	1	6	1.5
2000:1000ml	2	1	0	4	7	1.75
2500:1000ml	2	1	1	3	7	1.75
SUB-TOTAL	17	15	7	15	54	

ANALYSIS OF VARIANCE

SOURCE OF VALUE	DF	SUM OF SQUARES	MEAN SQUARES	F VALUE	TABULATED F 0.05	0.01
TREATMENT	7	16.8750	2.4107	1.77^{ns}	2.49	3.65
REPLICATION	3	7.3750	2.4583			
ERROR	21	28.6250	1.3631			
TOTAL	31	52.8750				

^{ns}- Not significant CV 69.19%

Appendix Table 13. Total population of trapped Noctuidae on the traps

RATIO OF FORMULATIONS	REPLICATION 1	11	111	1V	TOTAL	MEAN
Water	0	0	0	0	0	0^{d}
250:1000ml	4	5	9	3	21	5.25^{cd}
350:1000ml	7	8	9	2	26	6.5^{c}
500:1000ml	10	8	9	9	36	9^{c}
1000:1000ml	17	13	3	13	46	11.5^{c}
1500:1000ml	20	12	21	17	70	17.5^{b}
2000:1000ml	25	30	20	14	89	22.25^{b}
2500:1000ml	33	30	27	33	123	30.75^{a}
SUB-TOTAL	116	106	98	91	411	

ANALYSIS OF VARIANCE

SOURCE OF VALUE	DF	SUM OF SQUARES	MEAN SQUARES	F VALUE	TABULATED F 0.05	0.01
TREATMENT	7	2840.9687	405.8527	25.83^{ns}	2.49	3.65
REPLICATION	3	43.3438	14.4479			
ERROR	21	329.9062	15.7098			
TOTAL	31	3214.2187				

**- Highly significant CV 30.86%

Appendix Table 14. Total population of trapped Plutellidae on the traps

RATIO OF FORMULATIONS	REPLICATION 1	11	111	1V	TOTAL	MEAN
Water	0	0	0	0	0	0
250:1000ml	0	0	0	0	0	0
350:1000ml	1	1	0	0	2	0.5
500:1000ml	0	0	0	0	0	0
1000:1000ml	0	0	0	0	0	0
1500:1000ml	0	0	1	0	1	0.25
2000:1000ml	1	0	0	0	1	0.25
2500:1000ml	0	0	0	0	0	0
SUB-TOTAL	2	1	1	0	4	

ANALYSIS OF VARIANCE

SOURCE OF VALUE	DF	SUM OF SQUARES	MEAN SQUARES	F VALUE	TABULATED F 0.05	0.01
TREATMENT	7	1.0000	0.1429	1.33^{ns}	2.49	3.65
REPLICATION	3	0.2500	0.0833			
ERROR	21	2.2500	0.1071			
TOTAL	31	3.5000				

^{ns}- Not significant CV 261.86%

Appendix Table 15. Total population of trapped Sarcophagidae on the traps

RATIO OF FORMULATIONS	REPLICATION 1	11	111	1V	TOTAL	MEAN
Water	0	0	0	1	1	0.25[d]
250:1000ml	19	14	13	12	58	14.5[c]
350:1000ml	10	21	10	10	51	12.75[c]
500:1000ml	19	18	10	18	65	16.25[bc]
1000:1000ml	4	25	6	13	48	12[c]
1500:1000ml	25	17	11	13	66	16.5[bc]
2000:1000ml	15	35	24	27	101	25.25[ab]
2500:1000ml	22	40	34	18	114	28.5[a]
SUB-TOTAL	114	170	108	112	504	

ANALYSIS OF VARIANCE

SOURCE OF VALUE	DF	SUM OF SQUARES	MEAN SQUARES	F VALUE	TABULATED F 0.05	0.01
TREATMENT	7	2074.0000	296.2857	8.26**	2.49	3.65
REPLICATION	3	325.0000	108.3333			
ERROR	21	753.0000	35.8571			
TOTAL	31	3152.0000				

**- Highly significant CV 38.02%

Appendix Table 16. Total population of trapped Scarabaeidae on the traps

RATIO OF FORMULATIONS	REPLICATION 1	11	111	1V	TOTAL	MEAN
Water	0	0	0	0	0	0
250:1000ml	0	0	0	0	0	0
350:1000ml	0	0	0	5	5	1.25
500:1000ml	0	0	0	0	0	0
1000:1000ml	0	0	0	1	1	0.25
1500:1000ml	0	0	0	0	0	0
2000:1000ml	0	1	0	1	2	0.50
2500:1000ml	1	4	0	1	6	1.5
SUB-TOTAL	1	5	0	8	15	

ANALYSIS OF VARIANCE

SOURCE OF VALUE	DF	SUM OF SQUARES	MEAN SQUARES	F VALUE	TABULATED F 0.05	0.01
TREATMENT	7	10.3750	1.4821	1.28^{ns}	2.49	3.65
REPLICATION	3	5.1250	1.7083			
ERROR	21	24.3750	1.1607			
TOTAL	31	39.8750				

^{ns}- Not significant CV 246.25%

Appendix Table 17. Total population of trapped Scatopsidae on the traps

RATIO OF FORMULATIONS	REPLICATION 1	11	111	1V	TOTAL	MEAN
Water	0	5	0	0	5	1.25[c]
250:1000ml	82	31	56	45	214	53.5[a]
350:1000ml	33	42	37	27	139	34.75[ab]
500:1000ml	44	43	45	70	202	50.5[a]
1000:1000ml	39	51	29	36	155	38.75[ab]
1500:1000ml	49	25	26	45	145	36.25[ab]
2000:1000ml	22	39	19	36	116	29b
2500:1000ml	32	43	31	35	141	35.25[ab]
SUB-TOTAL	301	279	243	294	1117	

ANALYSIS OF VARIANCE

SOURCE OF VALUE	DF	SUM OF SQUARES	MEAN SQUARES	F VALUE	TABULATED F 0.05	0.01
TREATMENT	7	7092.9687	1031.2812	7.32**	2.49	3.65
REPLICATION	3	250.5937	83.5312			
ERROR	21	2905.1562	138.3408			
TOTAL	31	10248.7186				

**- Highly significant CV 33.70%

Appendix Table 18. Total population of trapped Sepsidae on the traps

RATIO OF FORMULATIONS	REPLICATION 1	11	111	1V	TOTAL	MEAN
Water	0	0	0	0	0	0
250:1000ml	0	2	4	2	8	2
350:1000ml	2	0	3	0	5	1.25
500:1000ml	6	1	0	1	8	2
1000:1000ml	2	0	0	1	3	0.75
1500:1000ml	2	0	1	1	4	1
2000:1000ml	2	1	0	0	3	0.75
2500:1000ml	0	1	0	2	3	0.75
SUB-TOTAL	14	5	8	7	34	

ANALYSIS OF VARIANCE

SOURCE OF VALUE	DF	SUM OF SQUARES	MEAN SQUARES	F VALUE	TABULATED F 0.05	0.01
TREATMENT	7	12.8750	1.8393	0.93^{ns}	2.49	3.65
REPLICATION	3	5.6250	1.8750			
ERROR	21	41.3750	1.9702			
TOTAL	31	59.8750				

^{ns}- Not significant CV 132.11%

Appendix Table 19. Total population of trapped Sphingidae on the traps

RATIO OF FORMULATIONS	REPLICATION 1	11	111	1V	TOTAL	MEAN
Water	0	0	0	0	0	0
250:1000ml	0	1	0	0	1	0.25
350:1000ml	0	0	0	0	0	0
500:1000ml	1	0	0	0	1	0.25
1000:1000ml	2	0	0	0	2	0.5
1500:1000ml	0	1	0	0	3	0.75
2000:1000ml	0	0	2	1	2	0.5
2500:1000ml	0	0	1	1	1	0.25
SUB-TOTAL	3	2	3	2	10	

ANALYSIS OF VARIANCE

SOURCE OF VALUE	DF	SUM OF SQUARES	MEAN SQUARES	F VALUE	TABULATED F 0.05	0.01
TREATMENT	7	1.8750	0.2679	0.63^{ns}	2.49	3.65
REPLICATION	3	0.1250	0.0417			
ERROR	21	8.8750	0.4226			
TOTAL	31	10.8750				

^{ns}- Not significant CV 208.03%

Appendix Table 20. Total population of trapped Tachinidae on the traps

RATIO OF FORMULATIONS	REPLICATION 1	11	111	1V	TOTAL	MEAN
Water	0	0	0	0	0	0
250:1000ml	0	1	0	2	3	0.75
350:1000ml	1	0	0	0	1	0.25
500:1000ml	0	0	1	0	1	0.25
1000:1000ml	0	1	1	0	2	0.5
1500:1000ml	1	0	0	1	2	0.5
2000:1000ml	0	2	1	0	3	0.75
2500:1000ml	1	1	0	2	4	1
SUB-TOTAL	3	5	3	5	16	

ANALYSIS OF VARIANCE

SOURCE OF VALUE	DF	SUM OF SQUARES	MEAN SQUARES	F VALUE	TABULATED F 0.05	0.01
TREATMENT	7	3.0000	0.4286	0.86^{ns}	2.49	3.65
REPLICATION	3	0.5000	0.1667			
ERROR	21	10.5000	0.5000			
TOTAL	31	14.0000				

^{ns}- Not significant CV 141.42%

Appendix Table 21. Total population of trapped Tephritidae on the traps

RATIO OF FORMULATIONS	REPLICATION 1	11	111	1V	TOTAL	MEAN
Water	0	0	0	0	0	0
250:1000ml	1	0	0	0	1	0.25
350:1000ml	0	0	1	0	1	0.25
500:1000ml	0	0	0	0	0	0
1000:1000ml	1	0	0	0	1	0.25
1500:1000ml	0	0	1	2	3	0.75
2000:1000ml	1	2	0	0	3	0.75
2500:1000ml	0	0	0	0	0	0
SUB-TOTAL	3	2	2	2	9	

ANALYSIS OF VARIANCE

SOURCE OF VALUE	DF	SUM OF SQUARES	MEAN SQUARES	F VALUE	TABULATED F 0.05	0.01
TREATMENT	7	2.7188	0.3884	1.07^{ns}	2.49	3.65
REPLICATION	3	0.0938	0.0313			
ERROR	21	7.6563	0.3646			
TOTAL	31	10.4688				

^{ns}- Not significant CV 214.69%

Appendix Table 22. Total population of trapped Tipulidae on the traps

RATIO OF FORMULATIONS	REPLICATION 1	11	111	1V	TOTAL	MEAN
Water	0	0	0	0	0	0
250:1000ml	2	1	1	3	7	1.75
350:1000ml	0	3	4	0	7	1.75
500:1000ml	3	3	1	3	10	2.5
1000:1000ml	4	3	1	7	15	0.25
1500:1000ml	3	2	8	3	16	3.75
2000:1000ml	5	3	4	6	18	4.5
2500:1000ml	2	1	2	2	7	1.75
SUB-TOTAL	19	16	21	24	80	

ANALYSIS OF VARIANCE

SOURCE OF VALUE	DF	SUM OF SQUARES	MEAN SQUARES	F VALUE	TABULATED F 0.05	0.01
TREATMENT	7	63.0000	9.0000	3.11*	2.49	3.65
REPLICATION	3	4.2500	1.4167			
ERROR	21	60.7500	2.8929			
TOTAL	31	128.0000				

*-Significant CV 68.00%