

BIBLIOGRAPHY

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ABSTRACT

The study was conducted in three Strawberry farms in La Trinidad, Benguet from August to October 2008. Improvised pitfall traps and quadrant metal were used to collect insects once a week. The specimens were counted, identified and recorded. The study aimed to identify the species of Ground Beetles and Earwigs present in the farm, to assess the population of Ground Beetles and Earwigs and to document the insects with the use of Digital Camera.

Three (3) species of Carabid Beetles were collected: *Chlaenius tricolor*, *Bembidioni versicolor*, and *the Patrobus longicornis*. There were also three species of Earwigs: the *Anisolabis maritima*, *Euborellia annulipes*, and *Forficula auricularia*.

The population of carabid beetles in three months ranged from 12 to 46 while the Earwigs ranged from 47 to 53.

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INTRODUCTION

The growing hazards that go along with the heavy use of chemicals to produce man's food and other basic commodities has enlightened the enthusiasm of many institutions and workers to develop alternative measures to minimize the use of chemicals in agricultural and industry. One of their objectives is to minimize the pollution of our environment and its resultant effect on human health. The Philippine Council for Agriculture, Forestry and Natural Resources Research and Development through its Agricultural Resources Management Research Division, has already taken significant strides.

President Gloria Macapagal Arroyo declared Executive Order 481, a state's policy to promote and develop Organic Agriculture in the country. on July 27, 2005 which is called the Organic Agriculture (OA) including all agricultural systems that promote environmentally, socially, and economically sound production of food and fibers. It sprang from the need to produce safe food as an alternative to alleviate over exploitation and degradation of natural resources. Since then the policy was executed, Benguet State University is now spearhead the Province of Benguet in promoting Organic Agriculture especially in the Vegetable Industry.

In support to the institution's program, research on different Organic practices have been started and this including the use of biological control against pest such as insect predators, parasitoids, and pathogens.

Beneficial insects like Carabid beetles and Earwigs/ predatory that feed on immature pests. Carabidae is a large family with more than 40,000 species worldwide. Most species are carnivorous, and some run swiftly to catch their prey. Although there is



a variation on their body shape and coloring, most are shiny, black, and have rigid elytra. Gourd beetles in the genus *Brachinus* are commonly known as bombardier beetles; ground beetles in the family *Cicindelidae* are known as tiger beetles. Unlike most species of Carabidae, which are nocturnal, tiger beetles are active diurnal hunters, and often brightly colored. All species except the primitive *Paussinae*, have a groove on their front tibia bearing a comb hairs, for cleaning their antennae, common habitats are under the bark of trees, under logs, or amongst rocks or sand by the edge of ponds and rivers (Drees et al., 1999).

The earwig is one of the important insect because most earwigs feed on decaying plant matter and some species are predatory and feed on a variety of other insects. They can be easily identified by their forceps-like pincers (cerci), which they use for defense. Many species are wingless and live in the soil or in enclosed spaces. Predatory earwig will enter plant stems of stem boring and they are usually hide during daytime and become active at night.

Once Organic Farming becomes fully implemented in the country, Carabid beetles, earwigs and other important insects will be conserved and reared in mass for biological control against insect pests. It will also observe if the ground beetles (Carabidae and Earwigs) are present in strawberry farms. Furthermore, it will provide a benchmark data for future researchers who wish to study more on the different ground insects in strawberry farms.

The study was conducted to Asses the population of ground beetles and earwigs on strawberry farms in La Trinidad, Benguet; identify species of ground beetles and



earwigs and record other ground insects caught in the trap and encountered in the Quadrant Metal.

The research concentrated on the occurrence of ground beetles and earwigs on strawberry farms. This is because these insects are important predators that could be used as biological control. The study was conducted in three areas of La Trinidad: Longlong, Swamp area, and at the Entomology field located at Balili. The study was conducted from August to October 2008.



REVIEW OF LITERATURE

Carabid Beetles

Some soil coleopterans are predators of other soil animals, others are Phytophagous. Include in the latter group are the well known larvae of scarabs and chaffers which feed upon plant roots (Richards, 1974).

Biology

Larvae of some species are considered to mainly carnivorous and wide-ranging, feeding on some soft-bodied insects. *Euborellia annulipes* (Lucas), the ring-legged earwig has been recorded from beneath stones, debris or litter of various kinds in compost heaps or dung in which it may be numerous, or in fruits, among vegetation, or in houses (Stehr, 1987).

The ground beetles are predaceous, the prey consisting mainly of insects but including also earthworms, snails, etc., though a few species are questionably phytophagous and others at times partake of plant food in addition to insect diet. The insect feeders attack lepidopterous larvae and naked pupae more generally than they do the immature stages of other orders, though a number of species are recorded are feeding extensively upon scarabeid grubs in the soil. The adults are predominantly ground dwellers, and they carry their activities mainly at night. They may can be found also in various protected locations, such as under stones and debris and the loose bark of trees, or they may inhabit distinct burrows (Stehr, 1987).

The feeding habits of the adult beetles vary considerably from those of the larvae. Thus, a number of species of *Carabus*, *Craspedonotus*, and other genera have



been recorded as attacking and feeding upon adult beetles, snails, etc. *Calosoma inquisitor* L. of Europe is particularly abundant in areas bearing broad-leaved trees, upon the foliage of which it searches for caterpillars. The variety of food consumed by the adults is appreciably greater than that consumed by the larvae, partly owing to their greater agility, enabling them to capture insects that can escape from the larvae. Feeding may be very rapid, consisting of the biting or tearing away of portions of the tissue of the victim after the integument has been broken, or it may solely by the ingestion of liquid materials, resulting from the preoral digestion of the host tissues, in addition to the body fluid (Clausen, 1962).

Carabid ground beetles go through egg, larval, and pupal stages of development before reaching adulthood. Development from the egg to the adult stage generally takes about a year. The adults of some species lay their eggs in specially constructed mud or twig cells, while others lay their eggs in debris. Some adults may live 2 to 3 years (Carey, 2005).

The Sidewalk Carabid a ground beetle has almost 2200 species in the United States and throughout the world. The Sidewalk Carabid was chosen to represent the family simply because it is the most commonly encountered species in residential areas. These are good bugs. They feed on any kind of ground-inhabiting larvae and insect eggs. They live in ground covers and in compost piles. In the garden they prefer to eat cut worms, so gardeners love to see these beetles take up residence. Ground beetles range in size from about 2 mm to 25 mm (1/8 inch to 1 inch). Most tend to be black, but there are a wide variety of colors represented in the various species. Some are dark brown and sometimes have a bronze or green metallic



sheen. Sidewalk Carabid is shiny black and about 15 mm long. These are robust beetles with proportionately large powerful jaws. Ground beetles are found everywhere in the United States, Canada, and throughout the world. The Sidewalk Carabid is largely restricted to the larger towns and cities, but has been gradually working its way into the countryside. It is an introduced species, originally coming from Europe (Maddison, 2006).

Ecology

Most carabids are omnivorous (feeding on both plants and animals) and polyphagous (being able to use a wide range of foods), feeding on live prey, carrion and plant material. Some species however are specialist feeders, i.e. *Harpalus rufipes* (the Strawberry Seed Beetle) on seeds, *Loricera pilicornis* (the Springtail Beetle) on Collembola and *Abax parallelopedus* and *Cychrus caraboides* on slugs and snails. *Offonus* species feed exclusively on the seeds of Umbellifers, this is known as spermophagy. The larvae are always carnivorous if the adults are. Many Carabids find their food by random foraging, but specialist feeders tend to use chemical cues. *Pterostichus cupreus* has a two dimensional search pattern until it finds an aphid at the base of a plant. Finding the aphid stimulates it to a three dimensional search pattern, i.e. it climbs the plant looking for more aphids. Most species of Ground beetles are cannibalistic given the opportunity. *Abax parallelopedus* is unusual in that it is not cannibalistic it can often be found under rotten logs in woodlands (Anonymous, 2006).

Predacious ground beetles also referred to as carabids, belong to a large family of beneficial beetles called the Carabidae. There are several thousand species



of these beetles in North America alone. The adult beetles range from 1/8-inch to 1¼ inches long. Variable in shape, they are usually elongate, heavy bodied, and slightly or distinctly tapered at the head end while generally dark in color (dark brown to black), some beetles are an attractive purple or metallic green, or are multi-colored, as some case of some tropical species. Ground beetles are fast-moving insects, which generally have prominent, long legs and fairly threadlike antennae. Most native species to the area are found in the wetter regions (or around waterways). Larval ground beetles are elongate and wormlike in appearance; most live in burrows in the soil or in leaf litter or other debris. Both larval and adult ground beetles have powerful and prominent mandibles. This is an adaptation for their predacious life style. Most ground beetles in this area feed on a varied diet of insects and insect-like creatures, many of which are garden or house pests, such as cutworms or house fly maggots. One specific group of ground beetles feeds on snails and slugs. Some occasionally feed on earthworms, but their beneficial feeding habits, in general, far outweigh any detrimental effects they may have on local earthworm populations. A few species will even feed on pollen or seeds. When carabids are disturbed they often demonstrate some form of defensive behavior. Many northwestern native species secrete chemicals that have a bad odor. This behavior is thought to be a deterrent to animals which might eat them (Carey, 2005).

Dermaptera-Earwigs

According to Alford (1999), Earwigs are polyphagous and are beneficial and will destroy large numbers of Aphids and other pests. They are nocturnal insects, and



usually hide during the daytime amongst curled leaves, under loose bark and in other sheltered situations.

Earwigs are medium-sized insects that superficially resemble certain types of beetles. They are elongate insects with a pair of pincer-like cerci at the tip of the abdomen. These insects may or may not have wings. Those with wings have front wings that form short, leathery coverings for the large membranous hind wings. Earwigs have chewing mouthparts and three-segmented tarsi and show little change in body form during growth (Gradual metamorphosis). Some species with gland and openings on the gland that emit a foul-smelling liquid believe to serve as protection from enemies (Pedigo and Rice, 1989).

Earwigs are active at night and hide during the day. They feed mostly on decaying organic matter, but few occasionally feed on plants, and others are predaceous.

Earwigs as Pest Control

Earwigs can be considered in some ways as beneficial insect and part of the garden, especially when they prey on other insects, but they can become a nuisance because of their habit of positioning themselves within leaves and feeding on soft plant tissues. They prefer cool, moist places, and a rolled up damp newspaper placed where earwig activity is suspected can be effective in collecting them. The newspaper can then either be discarded or shaken out. Placing diatomaceous earth in key spots around the home (bathroom, baseboards, window frames) can be a long-term repellent (Rankin and Palmer, 2003).



Hundreds of thousands of these beneficial predators are now being produced and released in corn farms infested with asian corn borer, cutworm, corn earworm, armyworm, grasshoppers, and semi-looper (Fernandez, 2008).

Cotton Development Authority (CODA) also developed a technology on the use of earwigs against the flower weevil on cotton. The earwigs both the nymph and adult feed on the larva and pupa of flower weevils. Their life span ranges from 82-104 days. These predators are mass-reared and are released in the field when flower weevils are present. Initial population of the predator can be collected from the soil and shed young bolls. It can be mass-produced in the laboratory using larva of *Tribolium sp.* or its hosts. Three-week old earwig nymphs and adults at 9,000 to 11,000 per hectare can be released at 68, 82 and 89 days after planting (DAP) or on the first occurrence of flower weevil. The first release should coincide with the hatching of the first generation of flower weevil eggs. The predation efficiency of earwigs ranges from 20.44 to 23.15 percent. Using earwigs, seedcotton yield is expected to increase by 19.15 to 22.18 percent (Anonymous, 2008).



MATERIALS AND METHODS

Materials

The materials used were; improvised pitfall traps (75 pieces) made of plastic bottles with measuring about 8 cm diameter with 11 cm tall with plastic shade, 1 kilogram detergent tide powder, forceps, microwavable plastic container, camera, microscope, and one quadrant metal trap made up of tin can (27 X 27 X17 cm), and improvised sieve.

Methodology

Location. The study was conducted in th three strawberry farms in La Trinidad, Benguet measuring 500 sq m each particularly at the Entomology field located at Balili (Figure 1), Longlong (Figure 2), an Swamp area (Figure 3). The Strawberry plants in Balili are at their senescence stage, at Longlong the strawberry were bearing fruits while at Swamp the strawberry are on their vegetative stage.

Pit trap. An improvised pitfall trap was prepared using empty C2 plastic bottle and used as shown in figure 4ab. The plastic trap was half-filled with water mixed with tide detergent. The detergent was used as a repellent. Twenty five traps at each farm site were arranged in transect (Figure 5). Each trap was put in a dug as shown in Figure 6. it filled with water and the tip was elevated at least ½ inch above the ground. The traps were provided with plastic shade against rain (Figure 4a) with 1 ½ distance from the ground. The introduced pitfall traps were carefully observed one after it was introduced and every week thereafter for 12 weeks. The water-detergent container was replenished when necessary to keep the trapped insects in place prior to collection period. In collecting the insects, the traps were decanted and sieved (Figure 8c).





Figure 1. The site at Balili with dry cogon grass as mulch



Figure 2. The site at Swamp with Polyethylene mulch





Figure 3. The site at Longlong with polyethylene as mulch



Figure 4. Improved Pitfall trap cover. a.) Top view and b.) Side view



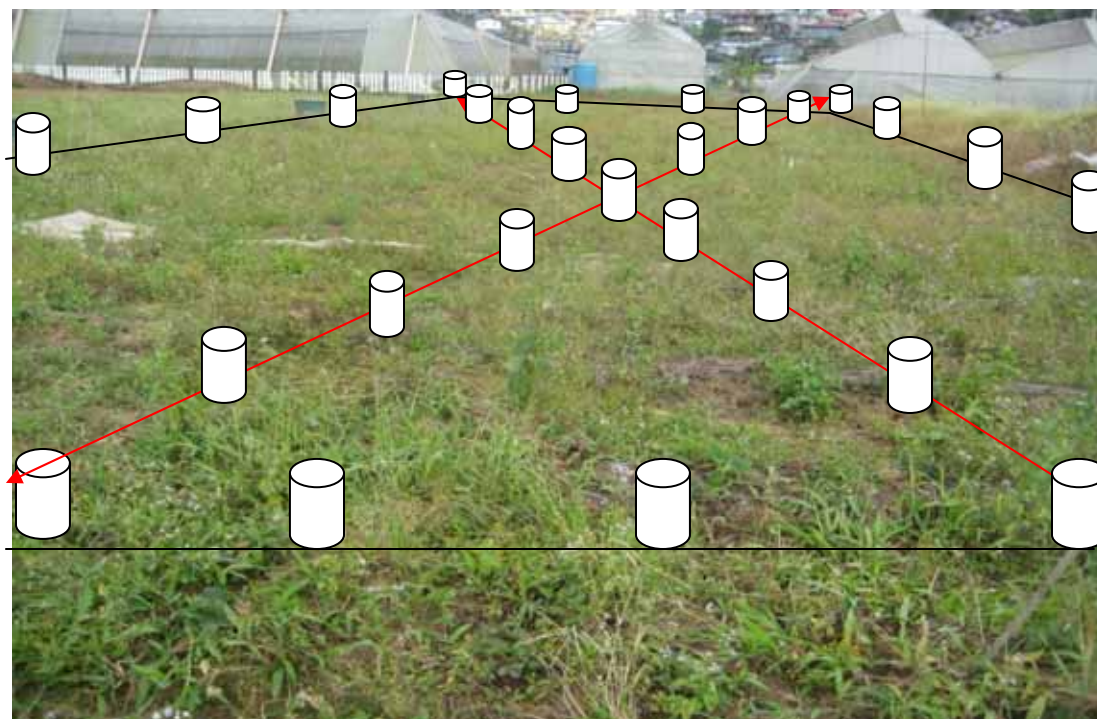


Figure 5. The Transect Method



Figure 6. Top view of a Pitfall trap set up beside a Strawberry plant

Quadrant metal trap. Insects tend to hide during the day and they may forage in the weeds outside the area. The quadrant metal was used to determine insects also outside the experimental area. Hence, a quadrant metal trap (Figure 7) was improvised and used. The quadrant metal trap was set up by pressing the side surface in areas outside the strawberry fields where there are grasses. The area inside the trap was cleaned by uprooting all the grasses. Samples of insects present inside the trap were gathered and recorded. After which the grasses were removed and exposed the earwigs and Carabid beetles that are usually soil-bone.

The insects were gathered using forceps (Figure 8) and through an improvised sieve. Insects were documented using Digital Camera with a white Background through a microscope (Figure 9 & 10). Identification book and microscope were used to identify the insects at the Mite Predators Rearing House (Figure 11).



Figure 7. Quadrant metal trap. a.) Side view b.) top view



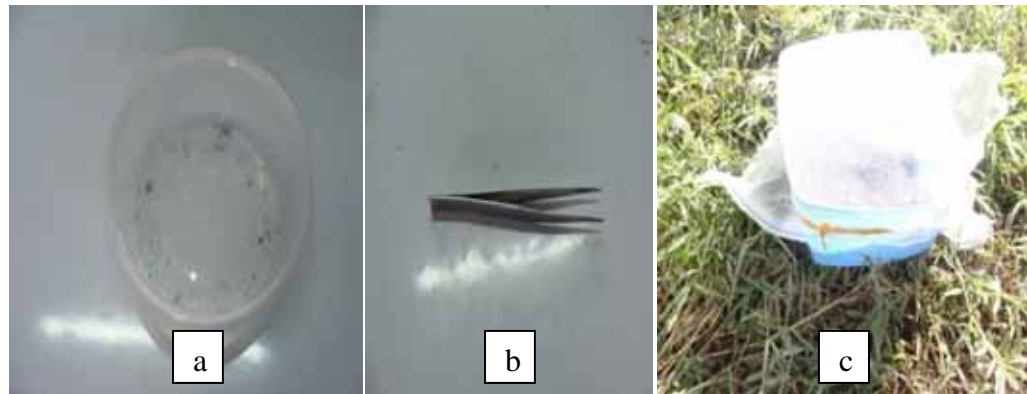


Figure 8. Materials used in the collection of specimens. a.) microwavable plastic, b.) forceps, and c.) improvised sieve.

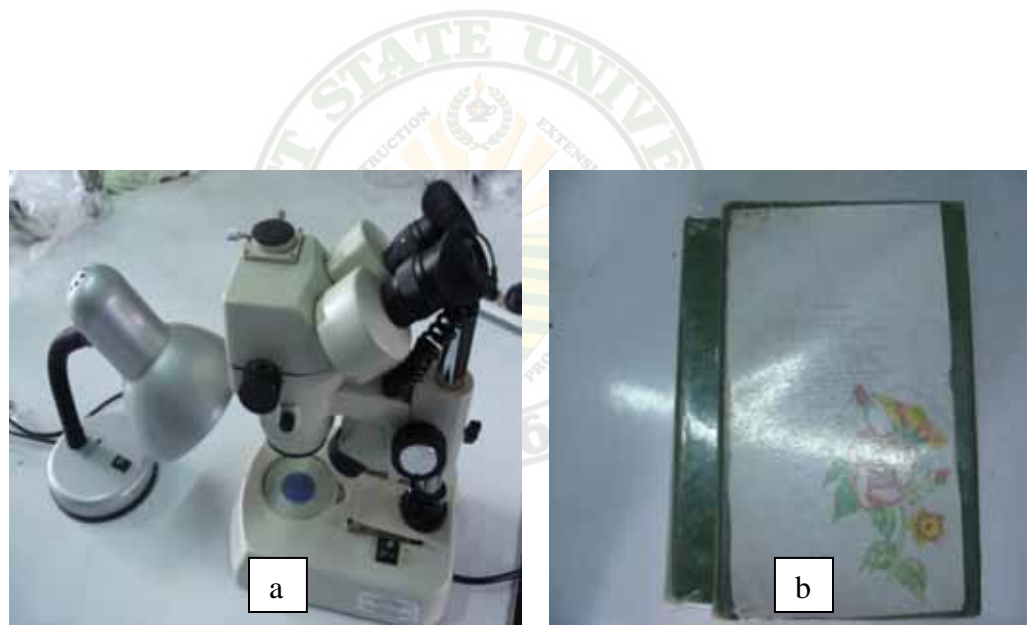


Figure 9. Materials used in identifying the specimens. a) Microscope, and b) identification book





Figure 10. The researcher identifying the collected insects.



Figure 11. The mite predator rearing house



The data gathered were:

1. Number of adult carabid beetles and earwigs. This is to determine the species and the population of these insects in the three sampling sites.
3. Photographs of insects collected. These were that were caught in the trap.



RESULTS AND DISCUSSION

Carabid Beetles

Pit trap

Species. The monitored species of Carabid beetles that were collected are presented in Table 1. There are three species as follows: *Chlaenius tricolor* (Figure 12), *Bembidioni versicolor* (Figure 13), and *Patrobus longicornis* (Figure 14).

Population. There were eight adults of *Chlaenius tricolor*, four were collected from Balili and also four from Swamp while it was absent in Longlong. Only one *Bembidioni versicolor* was collected from Balili while it was absent from the two sites. In terms *Patrobus longicornis*, one was collected from Balili, two from Longlong, and was absent at the Swamp area.

Bembidioni versicolor was the least in number while *Chlaenius tricolor* has the highest in number. The difference could be due to the observation that *Bembidioni versicolor* stay at the side of the strawberry plots where the polyethylene mulch ends. Thus, these were not caught at the pitfall traps that were situated at the strawberry plots.

Chlaenius tricolor on the other hand, was absent in Longlong. According to Murray (2007), their habitat is usually moist areas, some and some are semiaquatic and the site at Longlong was a little bit dry and elevated.





Figure 14. *Chlaenius tricolor* (Murray)

Chlaenius tricolor. It measures 8-23 mm in Size. Medium sized to large ground beetles. They are Attractive, often with vivid metallic coloration of head. Pronotum has distinctive indentations. Head, pronotum, and elytra have fine hairs (“setose”setae). front tarsomeres 1-3 of male are dilated, have spongy underside presumably used in mating. The covered with hairs that lie flat.



Figure 15. *Bembidioni versicolor* (Murray)

Bembidioni versicolor. This has some distinguishing characteristics that include elytra; pronotum with relatively dull luster and lateral margins parallel toward base.



Figure 16. *Patrobus longicornis* (Eaton)

Patrobus longicornis. It is the almost the same with Bembidioni, the difference is the long antennae and the color pure black color of its body.



Table 1. Total population of carabid beetles species collected from the pitfall trap from August to October 2009

SPECIES	POPULATION			
	BALILI	LONGLONG	SWAMP	TOTAL
<i>Chlaenius tricolor</i>	4	0	4	8
<i>Bembidioni versicolor</i>	1	0	0	1
<i>Patrobus longicornis</i>	1	2	0	3
TOTAL	6	2	4	12

Quadrant Metal Trap

Species. In this trap the species collected were similar to those trapped from the pitfall.

There were Forty six (46) individuals of Carabid beetles from the three (3) species. The highest in number was the *Bembidioni versicolor* which was gathered from Longlong and Swamp while this was absent at Balili. *Patrobus longicornis* has seventeen and it was gathered from the three sites. *Chlaenius tricolor* was not present neither from the three sites.

There was no collected *Chlaenius tricolor* from the three sites. They may be present in the side areas of the sites but the Quadrant Metal Method was done only once in a month having the tendency that they were not encountered. *Bembidioni versicolor* is absent in Balili this could be because the side areas was being disturbed by the neighboring Garden prior to the removal of the grasses. On the other hand, they were abundant in Swamp because the sides of the area were filled with different waste that attracted other insects including larvae. These insects served as food for the *Bembidioni versicolor*. *Patrobus longicornis* was encountered in the three sites



Table 2. Total population of carabid beetles encountered from the quadrant metal from August to October 2009

SPECIES	POPULATION			
	BALILI	LONGLONG	SWAMP	TOTAL
<i>Chlaenius tricolor</i>	0	0	0	0
<i>Bembidioni versicolor</i>	0	6	23	29
<i>Patrobus longicornis</i>	2	2	13	17
TOTAL	2	8	36	46



Earwigs

Pitfall trap

Species. The collected species of Earwigs were the following: *Anisolabis maritima* (Figure 15) *Euborellia annulipes* (Figure 16), and *Forficula auricularia* (Figure 17).

Population. In Balili, there were thirteen earwigs collected from the pitfall trap. There were four *Euborellia annulipes*, nine *Forficula auricularia* and no *Anisolabis maritima* were collected. There were also nineteen Earwigs collected in longlong, three were *Anisolabis maritima* species, three *Euborellia annulipes*, and thirteen *Forficula auricularia*. The three species were also present in Longlong, three *Anisolabis maritima*, six *Euborellia annulipes* and six *Forficula auricularia* were collected. To sum it up there were forty seven Earwigs collected from the whole duration of the implementation as of August to October, 2008.

There were no caught *Anisolabis maritima* in the improvised pitfall trap from the whole duration of the study in Balili. The reason could be the senescence stage of the strawberry plant that affected the absence of the species. There were at least thirteen collected *Euborellia annulipes* species from the three sites. *Forficularia auricularia* on the other hand is also present in the three sites. They were abundant in Longlong maybe because the place is suited them.





Figure 15. *Euborellia annulipes* (Eaton)

Euborellia annulipes. Its size is 12-18 mm. They are medium-sized dark-brown earwig with dark areas on the light-yellow legs ("black armbands"). The species is wingless. Adults have antennae with 14-16 the third and fourth segments, (sometimes the fifth) from the end being white or pale.



Figure 16. *Forficularia auricularia* (Murray)

Forficula auricularia. Body length ranges from 12 to 15 mm. Male forceps 4 to 8 mm (Figs. 1-2); female forceps 3 mm, tegmina 2 mm. Male forceps vary from about half as long to longer than the abdomen, broadened basally, with crenulate teeth basally and on beginning of curvature of inner margin. Antennae have 14 or 15 segments. The adult is rich reddish-brown, with wing covers and legs dull yellow brown, and the wings completely developed.





Figure 17. *Anisolabis maritime* (Eaton)

Anisolabis maritime. Wingless form earwig with a medium-sized body. Antenna with no white antenna segment.

Table 3. Total population of earwig species collected from the pitfall trap from August to October 2008

SPECIES	POPULATION			
	BALILI	LONGLONG	SWAMP	TOTAL
<i>Chlaenius tricolor</i>	0	3	3	6
<i>Bembidioni versicolor</i>	4	3	6	13
<i>Patrobus longicornis</i>	9	13	6	28
TOTAL	13	19	15	47

Quadrant Metal

Species. the species that were collected in this trap were similar to the species collected from the pitfall trap. They were the *Anisolabis maritima*, *Euborellia annulipes* and *Forficula auricularia*

Population. Three Earwigs were collected from Balili, there is no *Anisolabis maritime*, one *Euborellia annulipes* and two *Forficula auricularia*. fifteen individuals were also collected from Longlong three *Anisolabis maritime*, four were *Euborellia*



annulipes and eight were *Forficula auricularia*.in. Swamp Area, there were thirty five earwigs collected as follows: six *Anisolabis maritima*, six *Euborellia annulipes* and twenty three *Forficula auricularia*. The Collected Earwigs has a total number of fifty three of all the species collected, *Forficula auricularia* has the highest in number, having a total number of thirty three, while there eleven and nine individuals for the *Anisolabis maritima* and *Euborellia annulipes* respectively.

The same in the Pitfall trap, there were no encountered species of *Anisolabis maritima* at Balili the reason could be they are absent in the area. *Euborellia annulipes* and *Forficula auricularia* were also present in the three sites. In terms of the collected individuals of the species, Balili got the lowest count. This could be affected by the situation of the area wherein there were no grasses found at the side of the farm.

Table 4.Total population of earwigs species collected from the quadrant metal from August to October 2008

SPECIES	POPULATION			
	BALILI	LONGLONG	SWAMP	TOTAL
<i>Chlaenius tricolor</i>	0	3	6	9
<i>Bembidioni versicolor</i>	1	4	6	11
<i>Patrobus longicornis</i>	2	8	23	33
TOTAL	3	15	35	53



Other Collected insects

Aside from the Earwigs and the Ground Beetles there were other collected insects through the two methods from the three sites. These were the Ants, thrips, Cockroach, Cricket, Dung Beetle, Housefly, Katydid, Lady Bug Beetle, Rove Beetle, and Snout Beetle. Lady Bug Beetles and Rove beetles were known as insect predators/Beneficial insects that were found. Lady Bug Beetles was collected from Balili while the Rove Beetles were collected from from Longlong.



SUMMARY, CONCLUSION AND RECOMMENDATION

Summary

The study was conducted at La Trinidad, Benguet from August to October, 2008 to assess the population of Ground Beetles and Earwigs, identify their species and record other ground insects within the strawberry farms in La Trinidad, Benguet.

Three farms in La Trinidad, Benguet were established as collection sites. Improvised pitfall trap and Quadrant Metal were used to collect insects. After collecting species of insects, it was recorded and quantified. Gatherings of Samples was done weekly for the pitfall trap and once in a month for the Quadrant metal.

There were three species of carabid beetles collected from the three sites, the *Claenius tricolor*, *Bembidioni versicolor*, and the *Patrobus longicornis*. There were also three species of earwigs, the *Anisolabis maritima*, *Euborellia annulipes*, and *Forficula auricularia*. Other insects also that were recorded were as follows: Ants, Thrips, Cockroach, Cricket, Dung Beetle, Housefly, Katydid, Lady Bug Beetle, Rove Beetle, and Snout Beetle. There were five insects belonging to the Order Coleoptera, two insects belong to the Order Orthoptera, one insect also belong to Order Hymenoptera one and one also from the order Blattodea.

Lady Bug Beetles and Rove beetles were known as insect predators/Beneficial insects that were found. Lady Bug Beetles was collected from Balili while the Rove Beetles were collected from Longlong.

Conclusion

There were Carabid Beetles and Earwigs in Strawberry farms in La Trinidad, Benguet. There were three species of Carabid beetles (*Claenius tricolor*, *Bembidioni*



versicolor and, *Patrobis longicornis*). Earwigs were also present in the areas, there were three species found from the three areas namely: *Forficularia auricularia*, *Annisolabis maritima* and *Euborellia annulipes*.

The Ecological Society of America (ESA) concluded that the larval diets of carabid beetles are carnivorous in general, and are divided into three types: insect larva feeder (feed on lepidopteran and dipteran larvae), snail feeder and earthworm feeder. Adult beetles of these three types tend to be omnivorous. While Hadley (2008) mentioned that the earwig's diet is highly variable. European earwigs feed at night on the foliage of various flowers and garden plants. Most species prey on other insects and supplement their diet with decaying organic matter found in soil or garbage. In addition to consuming aphids, beetle larvae, and maggots.

With the presence of these important predators, the researcher concluded that the three sites at Balili, Longlong and Swamp area are still good. We should conserve these insects, as they are important that will help us control the insect pest in our farms.

Recommendation

It is recommended that further study more on Carabid Beetles and Earwigs should be done for 1 year to know their activities, during summer, when there is typhoon or heavy rain.



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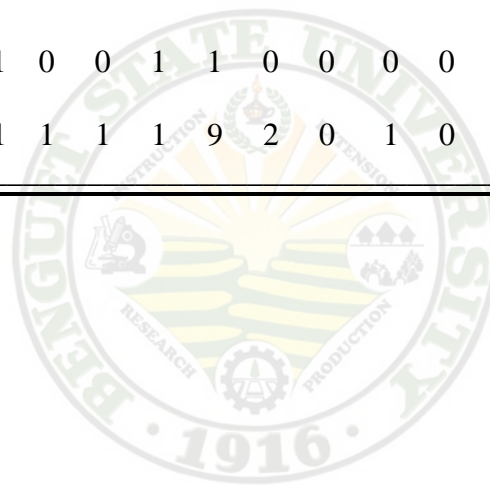
APPENDICES

Appendix Table 1. The total number of carabid beetles collected from the pitfall trap from August to October 2009

FARMS	TRAP NUMBER																									TOTAL
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	
Balili	0	0	0	0	0	0	0	0	0	0	0	0	1	3	1	1	0	0	0	0	0	0	0	0	0	6
Longlong	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	2
Swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1	4
TOTAL	0	0	0	0	0	1	0	0	0	0	0	0	1	3	2	1	0	0	0	0	0	0	0	3	1	12

Appendix Table 2. The total number of earwigs collected from the pitfall trap from August to October 2009

FARMS	TRAP NUMBER																									TOTAL
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	
Balili	0	0	0	0	0	0	0	0	0	1	1	0	8	2	0	1	0	0	0	0	0	0	0	0	0	13
Longlong	0	2	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	9
Swamp	0	4	1	1	0	5	0	0	1	0	0	1	1	0	0	0	0	0	0	0	0	0	1	0	0	15
TOTAL	0	6	1	1	0	9	0	0	1	1	1	1	9	2	0	1	0	0	0	0	0	0	1	2	1	37



Appendix Table 3. Total number of carabid beetles collected from the quadrant metal trap from August to October 2009

FARMS	TRAP NUMBER						TOTAL
	1	2	3	4	5	6	
BALILI	0	0	0	0	1	1	2
LONGLONG	0	0	0	3	5	0	8
SWAMP	2	13	10	1	3	7	36
TOTAL	2	13	10	4	9	8	46

Appendix Table 4. Total number of earwigs collected from the quadrant metal trap from August to October 2009

FARMS	TRAP NUMBER						TOTAL
	1	2	3	4	5	6	
BALILI	0	0	1	2	0	0	3
LONGLONG	6	0	2	1	5	1	15
SWAMP	3	13	12	5	2	1	36
TOTAL	9	13	15	8	7	2	54