INSECTS ASSOCIATED WITH YACON (*Smallanthus sonchifolius* Poepp & Endl) PLANTS IN LA TRINIDAD, BENGUET

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ABSTRACT

This study was conducted to identify the different insects and other arthropods that were found on yacon (Smallanthus sonchifolius Poepp & Endl) plants; to classify these arthropods; and, to determine the degree of injury inflicted by the insects on the yield of the yacon plants.

There were twenty nine (29) species of insects, 2 species of spiders and 1 specie of mites that were found on yacon plants.

The species of arthropods were classified as potential insect pests, predators, parasitoids, and visitors.

The species of chewing insects had a sound (1) to slight (3) injury while the species of sucking insects had a sound or no injury on yacon plants. Both injuries were observed on the leaves of the yacon plants.

KEYWORDS: Yacon, insect pests, arthropod, predator and parasitoid.

INTRODUCTION

Yacon is an exotic plant which is becoming popular in Benguet because of its pleasant taste. Unlike in Nueva Viscaya, where people grow it as a main source of living, people here in Benguet grow it as a backyard crop. The roots of this crop are used as food and the leaves and stems, after air drying, could be used as tea. Moreover, even though medically unconfirmed, many grow it for medicinal purposes and people believe that its medicinal value could be gained if the crop is grown without the application of chemicals. This plant is resistant to insect pest and diseases and it can thrive on any types of soil (unconfirmed evidence). Recently, we observed some feeding advances of insect from our yacon plants indicating that this plant is vulnerable to insect attack and the increase of people growing this crop would invite insect species. Hence, documenting the arthropod pests present on this crop is timely so that people would be aware of the insects that would be detrimental to the plants. It will also give information on the functional response of yacon plants to the insect.

The objectives of the study were to look at the arthropods found on yacon (*Smallanthus sonchifolius* Poepp & Endl) plants; to classify the kinds of these arthropods; and, to determine the degree of injury inflicted by the insects to the yield of the yacon plants.

MATERIALS AND METHODS

Yacon rootstocks ('crown') were grown in a 300 square meter lot that was dug 30 cm deep. Twenty raised plots measuring 1.5 x 10 meters were prepared. Two rows of yacon were planted at a distance of 35 cm between row and 40 cm between hills.

Monitoring of arthropods started one month after planting with one hundred (100) plants as samples. These samples were marked and were observed throughout the study. Monitoring was done by scouting the whole plants and all arthropods encountered were collected and brought to the laboratory for proper identification. The identity of the specimens were known by subjecting the specimen to the steriozome microscope and compared to textbooks such as Baltazar and Salazar (1982), Ciba-

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Geigy (1988), and CSIRO (1991); compendiums (Colting et. al. 2003); and electronic references (Grau and Rea, 2006). Monitoring of the population of these arthropods was done weekly starting from one month age of the plants up to harvesting.

The degree of injury inflicted by the insects on each sample plants was taken by visual estimates using the rating scales. Five plants were chosen randomly per plot and these served as samples for the assessment of the degree of injury, the whole plant was observed. Assessments for chewing and piercing-sucking insects were separated.

The rating scales used for the degree of injury of chewing insects were as follows;

Scale	Index	Description
1	Sound	No injury
3	Slight	1 – 25% injury on plants
5	Moderate	26–50% injury on plants
7	Slightly severe	51–75% injury on plants
9	Severe	76–100% injury on plants

The insects that injured the plants by making holes or consuming the plant leaves, stems or roots were categorized as chewing.

The degree of injury caused by piercing–sucking arthropods were categorized into curling or distortion of leaves, yellowing or stippling on leaves, stunted growth and wilting of the whole plants. This was taken regardless of the population of arthropods in the plants. The arthropods that were categorized as piercing-sucking are the arthropods that suck the plant sap for their subsistence.

Chewing insects that inflict a degree of injury from 1–50% are considered as minor pests and those that had an injury from 51–100% are considered major pests. On the other hand, piercing-sucking insects and mites that had moderate injury were considered minor pests and those that inflict slightly severe to severe injuries are considered major pests.

The rating scale used for the degree of injury for piercing–sucking arthropods were as follows;

Scale	Index	Description
1	Sound	No injury
3	Slight	Curling or distorted of leaves
5	Moderate	Yellowing or stippling of leaves
7	Slightly severe	Stunted growth of plants
9	Severe	Wilting of plants

In the discussion of this paper, the growth stage of the yacon plants were categorized into early vegetative (1 to 2 months old), vegetative (3–4 months), flowering (5–6 months), and maturity stage (7–8 months).

The Data Gathered were as follows:

1. **Species.** These are the names of the arthropods that were encountered on the yacon plants
2. **Degree of injury.** The amount of plant parts eaten or deformed by the arthropods.
3. **Role of arthropods.** This is the category of the arthropods found on the yacon plants.

RESULTS AND DISCUSSION

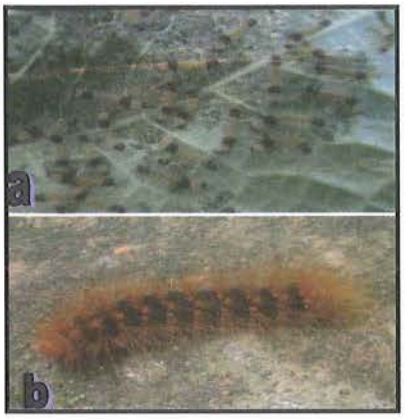
There were thirty two (32) species of arthropods found on yacon plants for the duration of the study. The species of arthropods were classified as potential insect pests, predators, parasitoids, and visitors. Of the 32 arthropod species, nineteen were classified as potential pests and were noted as chewing and piercing sucking; eleven were chewing insects; seven were piercing-sucking insects including mites. Five insects and two species of spider predators that were observed to be associated with the potential pests. Moreover, there were five insects that were classified as visitors of the yacon plants. The predators consumed the potential pest by sucking its body fluid that results to the shrinking of the body of the potential pest. Likewise, there is one parasitoid found associated with the potential pest of the yacon plants.

Potential Insect Pests

Chewing Insects

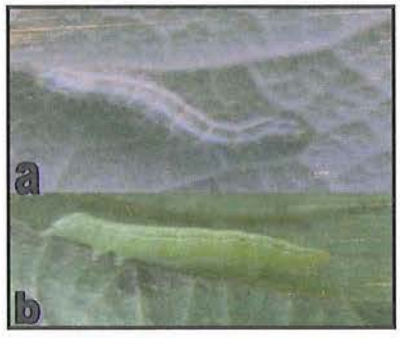
Looper (*Gymnoscelis* sp.). The looper larvae damage the plants by chewing the leaves (a). They create small holes on the leaves that soon increase in size as the leaves becomes mature.

They were usually found or feed on middle to top leaves. They appeared to be dried twigs (b), as their defense mechanisms when at rests and moved by looping (c). The insects were first observed on the early vegetative stage of the crop up to maturity.



Tiger Moth Caterpillar (*Phragmatobia* sp.). The 1st to 3rd instar larvae feed by chewing the lower flesh of the leaves leaving the upper epidermis (window like) of the plants as shown in plate a. Likewise, during the succeeding larval instar they consume the leaves starting at any portion of the leaves. They usually stay underside the leaves and they can be determined by the damaged incurred in the leaves due to feeding and presences of feces. This insect usually stays in groups in earlier larval stages (1st to 3rd instars) and dispersed as they reach 4th instars. The larvae can defoliate or skeletonized the whole plants in a day during the 3rd to 5th instar (b) if they will not disperse. This insect was present throughout the duration of the study.

Semi–looper (*Trichoplusia ni* Hubner). The larvae damaged by chewing the leaves creating irregular holes. The holes increase as the leaves matures. The larvae are commonly found on the middle to top leaves either feeding (a) or resting (b). However, it was observed that these larvae were usually attacked by parasitoids. The insect was present throughout the duration of the study.



Cutworm (*Spodoptera litura* Lin.) The larvae devour the leaves by chewing the middle, newly emerged leaves and chewing the stem of emerging yacon plants. The 1st and 2nd instar larvae stays in groups and feeds on the underside of leaves leaving the upper epidermis of the leaves showing window effect. Likewise, 2nd and 3rd instar larvae that were observed during the 4th month to maturity of the plants were infected with white and green fungi which maintained the population and degree of damage on the plants low. Likewise, this insect was present during the vegetative stage, flowering, and maturity stage of the yacon plants.

Chrysomelid beetles (*Educella* sp.). The adult make irregular holes on leaves that later increase in size as the leaves mature. The insect is observed feeding on the middle and top leaves. Likewise, the insect appears dead upon disturbance and to some extent they just drop to the soil or fly. This insect was observed attacking the yacon plants starting from the vegetative stage of the yacon plant up to maturity of the crop.

Flea beetle (*Phylotreta* sp). The adult feeds on the leaves by making small holes by chewing the leaves. They consumed the middle and top leaves. The adult jumps when disturbed or some possess the fringed death behavior. This insect was present from the vegetative up to maturity stage of the yacon plants.

Mole cricket (*Gryllotalpa africana* Pal de Beauvois). The mole cricket makes tunnels on yacon tubers that makes it unmarketable and results to early rotting of tubers due to entry of soil and

water on holes. The adult and immature stage makes tunnel on the soil and utilize the young yacon tubers as their niche. This insect was found associated to the tubers during the sampling and harvesting done on the maturity stage of the plants.

Piercing – sucking Insect Pests

Aphids (*Mysus percicae* Sulcer). The immature and adult aphids suck the plant sap of the yacon plants. This insect stays in groups or colonies. The aphids were found from the bottom to top leaves. They produce honeydew or "sugars" from their conicles thus ants are attracted to it. The ants protect the aphids from its predators while they collect the dew produced by the former. The aphids were the first insect present on the plants at the early vegetative stage of the yacon plants.

Whiteflies (*Bemisia tabaci* Gennadius). The immature and adult suck the sap of plants. Whiteflies were found underside of leaves and whitish adults fly when plants are disturbed. They are found either on the lower, middle and top underside of leaves. Likewise, this insect was present during the early vegetative of the yacon plants.

Lygus bug (*Lygus hesperus* Kelson). Lygus bugs were observed sucking the yacon plant's sap. They usually stay underside of the leaves and moves to the upper side when disturb. The lygus bug was present during the vegetative up to maturity stage of the crop.

Leafhopper (*Cofania* sp). The immature and adult suck plant fluids. The leafhoppers are usually found in the underside of leaves. The adult and immature move to the upper portion or any part of the leaves by moving sidewise when disturbed. The presence of these insect were observed starting from the flowering stage towards maturity of the crop.

Mealy bugs (*Phenacoccus* sp). The mealy bugs feed by sucking the sap of the stem and leaves. These insects stay in groups and are found on older leaves and on stems most especially when the leaves of yacon are dense. The mealy bugs produce honeydew that is being collected by the ants. The insect was present during the flowering stage up to maturity of the yacon plants.

Mirid bugs (*Nesidiocoris* sp). The adult and immature stages of these insect feed on leaves and stem of the yacon plants. The feeding causes small black dots on the leaves and stems that later turns into dark spots and yellowing of the whole leaf. They were found on the shoots of yacon plants and as they increase in number, they move to the middle leaves of the plants. This insect was present towards maturity of the plants.

Thrips (*Thrips tabaci* Lindeman). The thrips damage plants by rasping the leaves and sucking

the plant's sap. They were found on the underside of the middle leaves as shown in plate a. This insect was present from the vegetative stage to maturity of the yacon plants.

Potential Pest

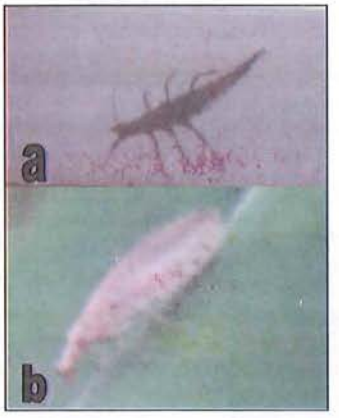
Mites (*Tetranychus* sp). Mites damage the crop by sucking the plant's sap. These were observed on the underside of older leaves and they stay in groups. This arachnidwas present during the early vegetative to flowering stage of the yacon plants.

Potential Predators

Coccinellid beetle (*Hippodamia* sp Lin). The Coccinellid beetle was found associated with aphids, and mealy bugs. They suck the body fluid of the aphids and mealy bugs. This predator was usually found on the lower leaves of the yacon plants. This insect was present during the vegetative stage of the yacon plants.

Spider (*Argiope* sp and *Tetragnatha* sp). They are commonly found on the top and middle leaves. Adult whiteflies were observed being trapped on the web constructed by the spiders. While these spiders are constructing their web, the leaves of the yacon plant are being curled (a) as their shelter. A high population of spider on plants reduced photosynthetic activity of the leaves. These arachnids (a and b) were found from the vegetative stage to maturity of the yacon plants.

Brown lacewings (*Micromus substanticus* Walker). Larva (a) and adult (b) of brown lacewings were found underside of the leaves predating on aphids. The larvae voraciously consume any stage of the aphids. This potential predator was present from vegetative up to maturity of the yacon plants.



Cecidomyiid (*Felteilla* sp). This insect was found associated on mites. The larvae suck the body fluid of the mites. The larvae consume any growth stages of mites. They become very visible due to their red color on the last stage probably due to the color of the mites they consumed. This insect was present when the population of mites was relatively high. This insect was present during the vegetative stage of the yacon plants up to the flowering stage of the yacon plants.

Rove beetle (*Paederus* sp). The adult beetle was found associated with mites, aphids, and mealy bugs. However, its presence was observed when the plants were already at flowering and maturity stage.

Big–eyed bug (*Geocoris* spp). This insect was observed when the yacon plants were at maturity stage and found associated with the immature stages of leafhoppers and lygus bugs. The adult stay at the lower leaves where most of its prey stays.

Potential Parasitoid

Tiny wasp (*Thripobius* sp.). The adult wasp was observed associated with whiteflies. The insect was also found on middle to top leaves. This parasitoid was present from emergence of the yacon plants up to maturity.

Visitors

Honeybee (*Apis mellifera* Lin). This insect was only found or seen during the flowering stage of the plants. They collect pollen from flowers.

Fruitfly (*Bactocera* sp.). Adult fruitfly were commonly observed sheltering on the underside of yacon leaves in the afternoon. This insect was observed during the flowering to maturity stage of the yacon plants.

Diamond Back Moth (DBM) (*Plutella xylostella* Lin). The adult DBM were found on the underside of leaves during rainy days. This was observed during the vegetative stage of the yacon plants.

Cabbage butterfly (*Peiris rapae* Lin). The adult alight during noon time and observed to be visiting the flowers of the yacon plants. Some larvae were observed to climb and pupate on the stems of yacon plants. This insect was found during the vegetative up to maturity of the yacon plants.

Ant (*Acropyga* sp). The ants (a) were observed associated with aphids and mealy bugs from the early vegetative to maturity stage of the yacon plants. The ants collect the honey dew emitted by the aphids.

The insects which damaged the plants by chewing are the following: looper, semi–looper, tiger moth caterpillar, cutworm, chrysomelid beetles, flea beetle and mole cricket. The Table 1 shows the degree of injury of chewing insects. Chewing insect had a sound (3.4) to slight (4.2) injury on the plants. The long duration and thick canopy of the yacon plant makes the plant tolerant to the injury of these insects. Likewise, farmers claim that the plants were resistant to insect attack was true.

Table 1. Degree of injury of chewing arthropods

PLANT SAMPLE	REP 1	REP 2	REP 3	REP 4	REP 5	TOTAL	AVE
1	3	3	5	3	3	17	3.4
2	3	3	5	3	3	17	3.4
3	3	3	5	3	3	17	3.4
4	3	3	5	3	5	19	3.8
5	3	3	5	3	3	17	3.4
6	3	5	5	3	5	21	4.2
7	3	5	5	3	5	21	4.2
8	3	5	5	3	5	21	4.2
9	3	5	5	3	5	21	4.2
10	3	5	5	3	5	21	4.2
11	3	5	5	3	5	21	4.2
12	3	5	5	3	3	19	3.8
13	3	5	5	3	3	19	3.8
14	3	5	5	3	3	19	3.8
15	3	5	5	3	5	21	4.2
16	3	5	5	3	5	21	4.2
17	3	5	5	3	5	21	4.2
18	3	5	5	3	5	21	4.2
19	3	5	5	3	5	21	4.2
20	3	5	5	3	5	21	4.2

Scale	Index	Description
1	Sound	No injury
3	Slight	1 – 25% injury on plants
5	Moderate	26–50% injury on plants
7	Slightly severe	51–75% injury on plants
9	Severe	76–100% injury on plants

The arthropods which damage the plants by piercing and sucking the plant's sap were aphids, whiteflies, lygus bugs, leafhoppers, mealy bugs, mirid bugs, thrips, and mites. The result shows (Table 2) that the average injury of piercing–sucking insects is under the scale 1 or no injury. The result further shows that the number or population of piercing–sucking insects on the plants did not affect the plant vigor.

Table 2. Degree of injury of piercing - sucking arthropods

PLANT SAMPLE	REP 1	REP 2	REP 3	REP 4	REP 5	TOTAL	AVE
1	3	1	1	1	3	9	1.8
2	1	1	1	1	1	5	1
3	1	1	1	1	1	5	1
4	1	1	1	1	1	5	1
5	3	1	1	1	1	7	1.4
6	1	1	1	1	1	5	1
7	1	1	1	1	1	5	1
8	1	1	1	1	1	5	1
9	1	1	1	1	1	5	1
10	1	1	1	1	1	5	1
11	1	1	1	1	1	5	19
12	1	1	1	1	3	7	1.4
13	1	1	1	1	1	5	1
14	1	1	1	1	1	5	1
15	1	1	1	1	1	5	1
16	1	1	1	1	1	5	1
17	1	1	1	1	1	5	1
18	1	1	1	1	1	7	1.4
19	1	1	1	1	1	5	1
20	1	1	1	1	1	5	1

Scale	Index	Description
1	Sound	No injury
3	Slight	Curling or distorted of leaves
5	Moderate	Yellowing or stripling of leaves
7	Slightly severe	Stunted growth of plants
9	Severe	Wilting of plants

SUMMARY, CONCLUSION AND RECOMMENDATION

This study was conducted to identify the different insects and other arthropods that were found on yacon (*Smallanthus sonchifolius* Poepp & Endl) plants; to classify the kinds of these arthropods; and, to determine the degree of injury inflicted by the insects on the yield of the yacon plants.

There were thirty two species of arthropods found on the yacon plants but they did not affect the growth and development of yacon.

The species of chewing insects had a sound (1) to slight (3) injury while the species of sucking insects had a sound (1) or no injury on yacon plants. Both injuries were observed on the leaves of the yacon plants.

It is therefore recommended that validation of the different arthropods identified will be done in different yacon growing areas most especially at Nueva Viscaya, which is known to be yacon producers.

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