

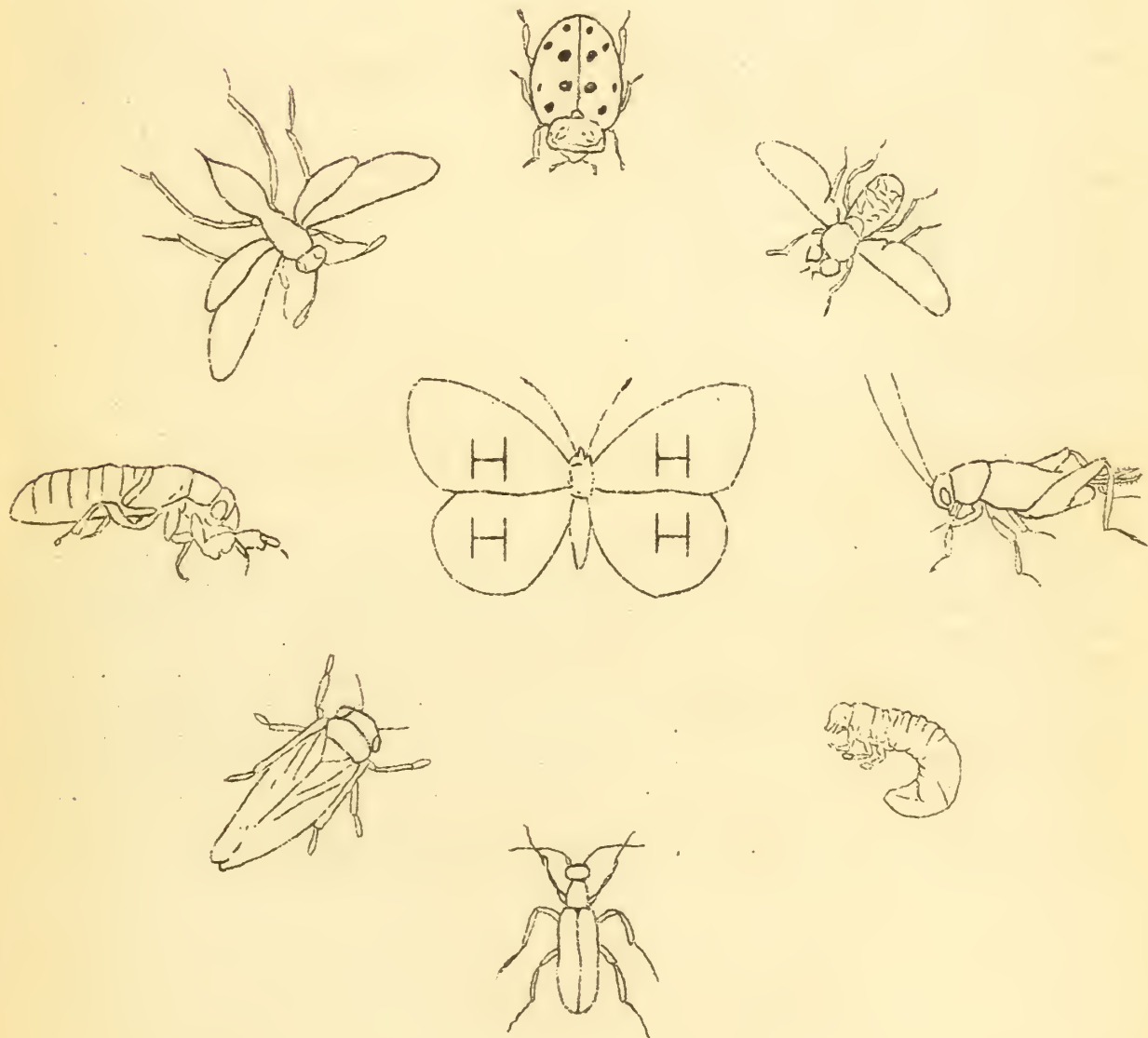
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# 4-H INSECT-CLUB MANUAL

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CONTENTS

	Page
Introduction .....	3
Activity chart for 4 years of insect work .....	4
Why study insects? .....	5
Part I.--About the insect. (Introduction to first-year work) .....	6
Activity chart - first year .....	8
Collection and identification .....	9
Outline of work .....	10
Part II.--Rearing insects. (Introduction to second-year work) .....	15
How insects grow .....	15
Activity chart - second year .....	16
Collection and identification .....	17
Outline of work .....	18
Things to know about insects .....	22
Questionnaire .....	23
List of common insects .....	24
Answers to questionnaire .....	27
Part III.--Control of insects. (Introduction to third-year work) .....	29
Activity chart - third year .....	30
Collection and identification .....	31
Outline of work .....	32
Sample spray-record sheet .....	36
Sample narrative report .....	37
Part IV.--Teaching devices .....	39
Activity chart - fourth year .....	40
Collection and identification .....	41
Playlets .....	42
Demonstrations .....	61
Exhibits .....	65
Surveys .....	66
Names of insects .....	67

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DISTRIBUTION.--A copy of this circular has been sent to each extension director, State and assistant State leader in 4-H club work, extension entomologist, land-grant college library, and experiment-station library.

## INTRODUCTION

This manual was prepared primarily for the use of 4-H club members, but it also may be useful to other groups of young people. Its purpose is to give a better understanding of the lives of insects and the principles underlying insect control.

In industrial sections of the country where use of leisure time is becoming a problem, the study of insects and the making of insect collections affords an excellent pastime. The cost of equipment is small, and the insect supply is almost unlimited. In some places, county-fair boards and local chambers of commerce have provided money to be given as awards to individuals making commendable showings of insect collections.

Although some insect collections have sold for large sums of money, such collections represent the lifetime jobs of the individuals making them. The collector should not be misled by advertisements of certain companies to purchase insects, especially when he is obligated to buy a book of instructions before the company will buy the insects.

Insect collecting should be started as a hobby, just as stamps and other objects are collected, and not as a means of making money. The value of the collection to scientific institutions will depend on the number of rare species it contains and the preciseness with which the specimens are mounted and labeled.

The public in general is becoming more conscious of the damage caused by insects and the need for more information on insect control. Members of 4-H clubs who participate in the activities outlined in this manual will learn many things that will always be of value to them.

To get the most out of the insect study, one should follow the 4-year program as outlined. This will allow time not only for the acquirement of experience, which is the best teacher, but for a review of literature on insects.

All people cannot become entomologists, but they may acquire knowledge that will enable them better to understand the language of the entomologists.

This manual is so outlined that 4-H club members can carry on insect work for 1, 2, 3, or 4 years. To help the members to get the most out of the study of insects, the following chart outlines an activity for each meeting period. In case of less than 12 meeting periods per year, two or more of these activities can be combined into one meeting period.

ACTIVITY CHART FOR 4 YEARS OF INSECT WORK

Meetings	Acquaintance with insects and collections	Page	Rearing insects, surveys, and collections	Page	Control of insects and collections	Page	Teaching devices and collections	Page
First February	Organization		Organization		Organization		Organization	
Second March	Outline work		Outline work		Outline work		Outline work	
Third April	Make collecting net		Make rearing cages		Select control project		Playlets	
Fourth May	Make killing jars		Select insects to be reared		Mix insecticide		Playlets	
Fifth June	Make collection box		Make preservative for immature insects		Apply insecticide		Demonstrations	
Sixth July	Pin insect		Make Riker mounts		Visit control projects		Demonstrations	
Seventh August	Spread butterfly		Exhibit reared insects		Check results and exhibits		Exhibits	
Eighth September	Collecting trip		Field trip		Fall clean-up and exhibits			
Ninth October	Identify insects		Hibernation cages		Fall plowing		Fall surveys	
Tenth November	Exhibit collections		Locate insects in winter quarters		Judging contests			
Eleventh December	Individual reports		Make permanent exhibits for school or county agent's office		Fill out record sheet forms		Playlets	
Twelfth January	Literature reports		Discussion on life cycle of insects		Insecticide exhibit for school or county agent			



## WHY STUDY INSECTS?

There are many people who have trudged through life finding little enjoyment in the beauties of Nature or knowing very little about them. If we learn to know more of our natural surroundings, we shall be building toward a fuller life. The human race makes up only a very small part of the living creatures here on earth. Man feels that he has about reached the top of the social ladder, but in reality he still has a long way to go.

### History of insects.

People could profit much by turning to some of Nature's other children who have been struggling along life's pathways for millions of years, possibly long before man came into existence. The lowly insects, as we think of them, were living on the earth more than forty million years ago. In fossils and in amber, we find preserved insects almost identical with those we can find in our own back yard today. Scientists have found no trace of man that dates back to anywhere near those geological ages.

What is it about the insect that has permitted it to withstand all these centuries while many other forms of animal life have appeared on the earth and, after a relatively few years, passed out of existence? We see pictures of large prehistoric animals and wonder, with all the strength they must have possessed, why they did not dominate the earth. This process of elimination is still going on, and every few years some form of animal life passes out of existence. Our naturalists today are working very hard to perpetuate the lives of certain kinds of birds and animals that are almost extinct.

### Importance of insects.

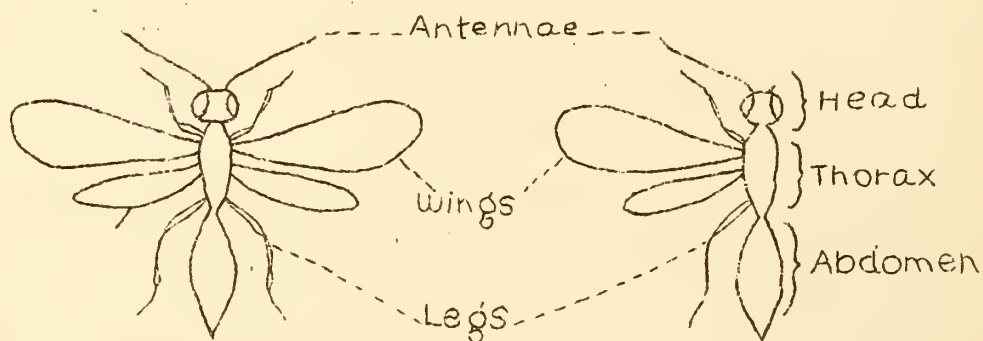
Insects, however, live on, and today they are man's greatest competitor in his struggle for existence. Insects destroy our crops, they kill our animals, they crumple our buildings, and they actually feed on man himself. In addition, they spread disease germs that threaten our plants and animals. Some of the diseases carried only by insects have killed more people than have been killed in all wars. It would be unfair to give the impression that all insects are pests, because most of them are of little or no importance and many are actually beneficial. Many of the ground beetles, lady beetles, wasps, and flies are beneficial because they feed on insect pests. The honeybee makes honey and beeswax, the silkworm makes silk, and many insects pollinate plants. Insects also provide food for birds and fishes.

This manual is prepared so that youth may have a better understanding of the lives and habits of many of the insects and why they have been able to exist for so many centuries. It must be remembered that every creeping thing is just as much entitled to a living as we are. We must, however, be able to protect ourselves against their taking too much of the material we claim. The more of us there are who know our friends and foes in the insect world, the better we shall be equipped to stand our ground against the ravages of our greatest rivals, the insect pests.

# PART I - ABOUT THE INSECT

(Introduction to first-year work)

What is this creature we call an insect, and how does it differ from other forms of animal life? Insects are animals that in the adult stage have an external skeleton and three definite body regions: Head, thorax, and abdomen. They have three pairs of legs and only one pair of antennae (feelers). They usually have compound eyes and one or two pairs of wings.



Insects are adapted to a wide range of conditions. Some live in the air and soil, some in plants or animals or their products, and some live in the water. Those that live out of the water breathe through small openings along the sides of their bodies, and some of those that live in the water are equipped with gills which enable them to get their air from the water.

There are more kinds of insects than of all other forms of animal life put together. In fact, an entomologist found more than 1,000 different kinds in his small back yard in a suburb of New York City. When we consider that there are about 700,000 different kinds of insects known to exist, the need for some form of classification becomes apparent. The entomologists separate them into orders, families, genera, and species. (Each of these classifications further divides the one preceding.) In this manual we can do no more than to help acquaint the reader with the more common orders.

A scientific name, in addition to helping to classify an insect or show its relationship to other insects, aids in designating more clearly the particular insect referred to. For instance, there are several insects which have the same common name. The potato beetle is an example - a name which may refer to the Colorado potato beetle, the black blister beetle (old-fashioned potato bug), or the tiny flea beetle; but if we say Leptinotarsa decimlineata it doesn't matter whether we are in the United States, England,

or China, the entomologist knows which beetle we are referring to. Let us analyze Leptinotarsa decimlineata and see what the words mean:

Leptinotarsa: From leptos, meaning small, and tarsa, meaning "part of insect leg."

decimlineata: From deca, meaning ten, and linea, meaning line.

Thus we have Leptinotarsa decimlineata, an insect with small tarsi and 10 lines on its head.

It should be noted that the technical name of an insect often refers to some part of the insect, or to the plant or animal upon which the insect feeds.

Insects may have different common names. Take the corn earworm, for instance. In places where tomatoes are grown extensively, this worm is called the tomato fruit worm; in the cotton sections it is called the cotton bollworm, and people growing corn refer to it as the corn earworm. But if we say Heliothis obsoleta, the entomologist anywhere will know the insect referred to.

No doubt many boys and girls will want to refer to the scientific names of some insects. For this reason, on pages 67 through 74 are the common name, and the order, family, genus, and species names of several of our common insects. It must be remembered that in referring to the scientific name, only the genus and species names are given.

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Song on Insect Control  
(Tune: Wait for the Wagon)

1. Though some insects are harmless, some others cause distress.  
They bring us much annoyance, and make the crops grow less.  
They eat the corn and beans and spuds and make the farmer cuss.  
The moths bite holes in Sunday clothes, and fleas bite holes  
in us.

Chorus:

We'll put up a scrap, boys! We'll put up a scrap, boys!  
We will not give up our crops without a fight.

2. Against the garden beetles we'll use calci'm arsenate,  
And plant lice through our nicotine will meet their proper fate.  
We'll bait cutworms and hoppers too, and spray our fruit trees  
well,  
And make clean-up and rotations against field-crop pests tell.

Chorus:

We'll put up a scrap - - - etc.

ACTIVITY CHART - FIRST YEAR

Meetings	Acquaintance with insects and collections	Page
First February	Organization.	
Second March	Outline work.	
Third April	Make collecting net.	
Fourth May	Make killing jars.	
Fifth June	Make collection box.	
Sixth July	Pin insect, spread butterfly.	
Seventh August	Collecting trip.	
Eighth September	Identify insects.	
Ninth October	Exhibit collections.	
Tenth November	Individual reports.	
Eleventh December	Literature reports.	
Twelfth January	Discussion on life cycle of insects.	



## COLLECTION AND IDENTIFICATION

It is hoped that club members will make an insect collection, and that after a few years each member will have representative specimens of the more important orders of insects and note sheets giving a complete description of each. Beginners should endeavor to have by the end of the first year insects representative of the following six orders:



### ORTHOPTERA.--Orthos (straight); pteron (wing).

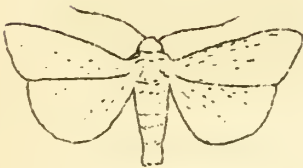
Four wings when present; front wings leathery, straight; hind wings fold fanlike under them. Chewing mouth parts, gradual life change (metamorphosis). Antennae usually long, legs usually long. Grasshoppers, crickets, katydids, cockroaches, walking sticks.



HEMIPTERA.--Hemi (half); pteron (wing). Four wings when present; front wings leathery at base forming an X on back when wings are folded. Piercing and sucking mouth parts folded under body. Odor sometimes sickening. Stinkbugs, bedbugs, chinch bugs, squash bugs, assassin bugs, leaf bugs, plant bugs.



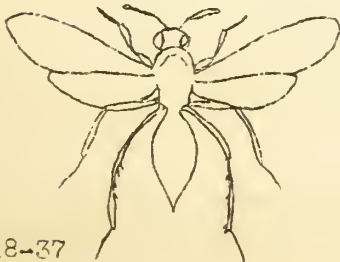
COLEOPTERA.--Koleos (a sheath); pteron (wing). Front wings all leathery, fitted over body like a case, meet in straight line along center of back; hind wings clear, jointed in middle, folded under front wings when at rest. Mouth parts formed for chewing. Life changes (metamorphosis) complete. Potato beetle, lady beetles, leaf beetle, carpet beetles.



LEPIDOPTERA.--Lepido (scale); pteron (wing). Four similar wings when present; membranous, but covered with overlapping scales. Mouth parts for sucking. Complete life change (metamorphosis). Butterflies, moths, skippers.



DIPTERA.--Dis (two); pteron (wing). Two clear wings, knobs in place of hind wings. Three distinct body regions. Mouth parts tubular for sucking, piercing, or lapping. Complete life change (metamorphosis). Flies, mosquitoes, gnats.



HYMENOPTERA.--Hymen (membrane); pteron (wing). Four clear wings when present, few veins; hind wings smaller, often hooked to front wings. Mouth parts, chewing. Abdomen often with slender waist, some females have stingers. Complete life stages. Bees, wasps, ants, sawflies.

The following outline breaks down the activity chart. It lists some of the equipment necessary and suggests a few steps in procedure for carrying out the work each meeting or each month. When entire clubs are working on insects, the work for each meeting can be illustrated by team demonstrations.

The introduction and summary for each demonstration will be about the same. In the introduction the demonstrators should tell first, what is being demonstrated, and second, what it will be used for. In the summary they should summarize the main points in the demonstration to be remembered, and ask for questions.

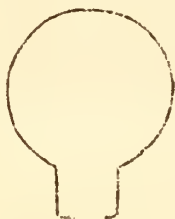
Because the equipment and procedure will vary with each meeting, the following outline will set up the equipment necessary and a few points on procedure for each meeting.

### OUTLINE OF WORK

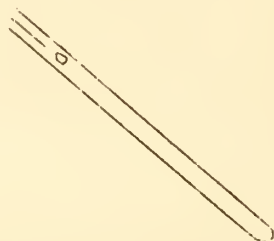
President of club, club agent or entomologist outlines the work for the year and has club members make survey of insect situation before next meeting. Read through work for year.

### Collecting Net

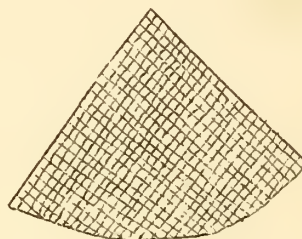
Equipment:



Wire



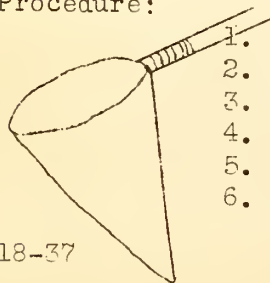
wood Handle



Cloth Pattern

1. Small wood handle about 3 feet long (broom handle).
2. Five feet of heavy stiff wire (barrel hoops or telephone wire).
3. Piece cloth 3 by 5 feet (mosquito netting or better-grade material).
4. Pattern from which to cut cloth.
5. Saw, hammer, brace, small bit, narrow wood chisel.
6. Cord for wrapping wire onto handle.

Procedure:



1. Bend wire into shape.
2. Bore hole and cut grooves into broom handle.
3. Cut cloth and sew it together (mention grades of cloth).
4. Slip bag on wire.
5. Attach wire to handle.
6. Reference: U. S. Department of Agriculture. Farmers' Bulletin 1601, Collection and Preservation of Insects.

### Demonstrate Making Killing Jars

#### Equipment:



1. 1-pint fruit jar (tight lid).
2. Piece of cardboard (double-faced, corrugated preferred).
3. Small bottle of gasoline or calcium cyanide.
4. POISON label for Calcium cyanide.

#### Procedure:

Cut cardboard to fit tightly inside jar.

#### For gasoline killing jar--



1. Place several small scraps of cardboard in bottom of jar.
2. Saturate scraps with gasoline.
3. Cover with cardboard disk.
4. Place lid on tight.

#### For calcium-cyanide killing jar--

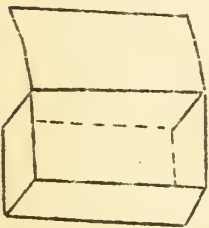
(Dangerous: handle with caution)



1. Place calcium cyanide (G grade) about half an inch deep in bottom of jar.
2. Cover with cardboard.
3. Place lid on tight.
4. Place POISON label on jar.

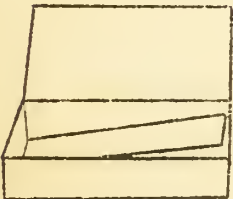
### Make Collection Box

#### Equipment:



1. Cigar box, 2 by 6 by 8 inches preferred.
2. Piece of double-faced, corrugated cardboard or soft fiber board.
3. Glue.
4. Moth ball.
5. Common pins.
6. Box or folder of matches.

#### Procedure:



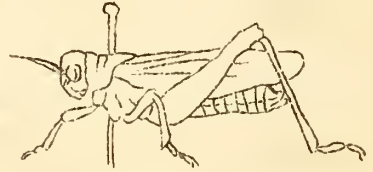
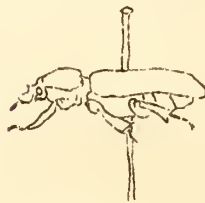
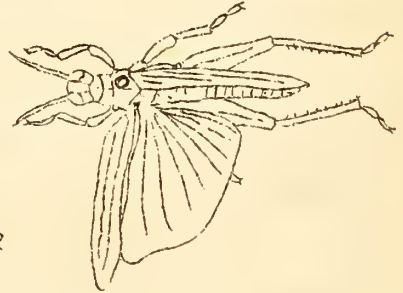
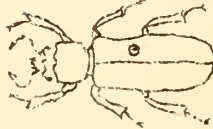
1. Cut cardboard to fit bottom of box.
2. Smear glue in bottom of box and insert cardboard.
3. Box may be lined with white paper.
4. Heat head of pin from lighted match.
5. Insert hot head of pin in moth ball and cool.
6. Stick moth ball, on pin, in corner of box.

### Pin Insects

#### Equipment:

1. Pins. No. 3 insect pins preferred. Common pins may be used.
2. A few freshly killed insects representing each of the five major groups, namely: beetle, stinkbug, grasshopper, bee or fly, butterfly.
3. Spreading board.

#### Procedure:



Bug

Beetle

Bee

Grasshopper

1. Pin insects, Farmers' Bulletin 1601, pages 6 and 7, according to figures 5, 6, 7, 8.
2. Spread butterfly, Farmers' Bulletin 1601, pages 6 and 7, according to figure 11.
3. Making of spreading board may be demonstrated.

### Collecting Trip

#### Equipment:

1. Killing jar or bottle.
2. Collecting net.
3. Extra bottle or box for young or soft-bodied forms.

#### Procedure:



1. Collect economic insects from gardens, orchards, or field crops.
2. Observe plant on which insect is feeding.
3. Kill adult forms only, in killing jars.
4. Keep lid on killing jar tight except when inserting or removing insects.
5. Immature insects may be pickled in alcohol or formaldehyde.

### Identify Insects

#### Equipment:

1. State or Government farmers' bulletins on insects.
2. Textbook on insects.
3. Small labels from stiff paper  $\frac{1}{2}$  by 1 inch.



Procedure:

1. Compare insects with pictures and descriptions in bulletins and books.
2. Prepare labels (to be placed on pin with insect).
3. On one or more labels have:



- a. Name of insect.
- b. Place collection.
- c. Date collection.
- d. Name of collector.

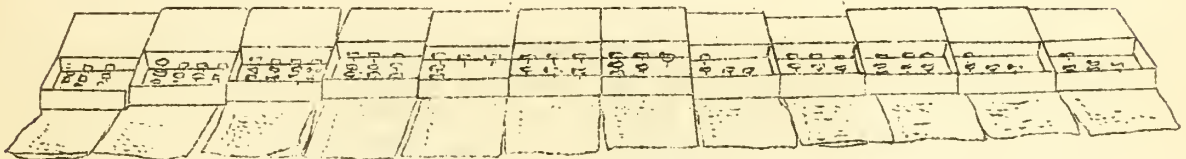
Exhibits

Equipment:

1. Insect collections and any notes on insects.
2. Insects should be well labeled.
3. Insects should be neatly arranged in rows, heads toward lid of box.

Procedure:

1. Place all insects from a given club in neat order.



Individual Reports

Equipment:

1. Collection and any notes that member may have.

Procedure:

1. Each insect club member tells name of each insect in collection.
2. Tells what he or she knows about each insect in collection.
3. Names book or bulletin where information was obtained.

Literature Report

Equipment:

1. Book, farm paper, newspaper, or bulletin carrying some unusual or interesting story about an insect.

Procedure:

1. Each tells in his own words the interesting story about insects, and his source of information.

## Life Cycle of Insects

### Equipment:

1. Book, bulletin, or paper giving life history of some one insect.

### Procedure:

1. Each member reports on life of some insect.
  - a. Its name.
  - b. The plant or animal it feeds on.
  - c. How it feeds (chews or sucks).
  - d. Kind of life cycle, complete or incomplete.
  - e. Where insect spends the winter.

---

### The Prayer of Agassiz

On the isle of Penikese,  
Ringed about by sapphire seas,  
Fanned by breezes salt and cool,  
Stood the Master with his school.  
\*\*\*

Said the Master to the youth;  
"We have come in search of truth,  
Trying with uncertain key  
Door by door of mystery;  
\*\*\*

As with fingers of the blind,  
We are groping here to find  
What the hieroglyphics mean  
Of the Unseen in the seen,  
What the Thought which underlies  
Nature's masking and disguise,  
What it is that hides beneath  
Blight and bloom and birth and death."

- - - Whittier.

---

## PART II - REARING INSECTS

(Introduction to Second-Year Work)

### HOW INSECTS GROW

Once the insect becomes an adult it never grows any larger. A gnat will always be a gnat; it is not a baby fly. Insects make all their growth while in the immature stages. There are, however, two types of growth. Some insects, like the grasshopper, develop gradually, and each time they shed their skin, the newly emerged young more closely resemble the adult. We call this incomplete metamorphosis.



In the case of the butterflies and beetles, the young or larva does not resemble the adult, and when the larva has completed its growth, it goes into a pupa stage where the complete change takes place. We call this complete metamorphosis.



ACTIVITY CHART - SECOND YEAR

Meetings	Rearing insects, surveys, and collections	Page
First February	Organization.	
Second March	Outline work.	
Third April	Make rearing cages.	
Fourth May	Select insects to be reared.	
Fifth June	Make preservative for immature insects.	
Sixth July	Make Riker mounts.	
Seventh August	Exhibit reared insects.	
Eighth September	Field trip.	
Ninth October	Hibernation cages.	
Tenth November	Locate insects in winter quarters.	
Eleventh December	Make permanent exhibits for school or county agent's office.	
Twelfth January	Make permanent exhibits for school or county agent's office.	

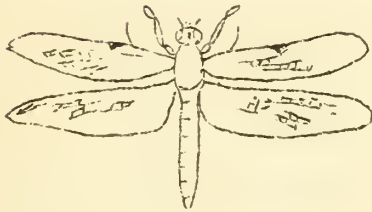


COLLECTION AND IDENTIFICATION

In addition to rearing insects, members of this group are to continue with their collections and should expand them to include six more orders of insects. Some of these insects are too small to be pinned, but they can be preserved in alcohol or formaldehyde.



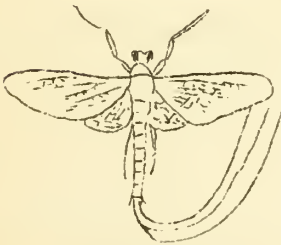
HOMOPTERA.--Homos (same); pteron (wing). Winged forms have four wings; front pair clear or leathery and longer and narrower than hind wings; wings fold rooflike over back. Mouth parts piercing and sucking. Gradual life change (metamorphosis). Aphids, cicadas, leaf hoppers, tree hoppers, and scale insects.



ODONATA.--Odons (a tooth). Four long, rather narrow wings, finely netted, may be clear or banded, equal size. Large eyes, head loosely joined to long narrow body. Antenna short. Wings notched along front side appear to be broken. Chewing mouthparts. Larva live in water. Dragonflies, damsel flies.



NEUROPTERA.--Neuron (nerve); ptera (wing). Four large leaflike wings, nearly equal size, usually finely netted; wings not notched, held rooflike over back when at rest. Antenna long. Chewing mouth parts. Complete life change (metamorphosis). Larva of some live in water. Dobson flies, aphid lions, and lions (doodlebugs).



EPHEMERIDA.--Epheron (a may-fly). Four netted, veined wings folded vertically over back when at rest; hind pair much smaller. Mouth parts chewing. Antenna short. Three long tails on tip of abdomen. Gradual metamorphosis. Body rather frail, molt once in adult stage; very short lived. Nymphs live in water. May flies, lake flies, or shad flies.



TRICHOPTERA.--Trichos (the hair); pteron (wing). Four similar membranous wings; hind pair shorter and broader. Mouth parts modified for chewing. Antenna long, legs long. Complete metamorphosis. Larva live in water. Caddis flies.

THYSANURA.--Thysanos (a tassel); oura (the tail). Small grey wingless insects. Long antenna and long bristlelike tails. Chewing mouth parts. No metamorphosis. Body somewhat carrot shaped. Found in dark places and feed on starchy substances such as book binding. Silverfish, bristletails, or fish moths.



## OUTLINE OF WORK

President of club, club agent, or entomologist outlines the work for the year and has club members make survey of insect situation before next meeting. Read through work for year.

### Equipment:

1. Bulletins or books showing rearing cages.

### Procedure:

1. Have president of club or entomologist outline the work for year.
2. Mention some insects that can be reared.

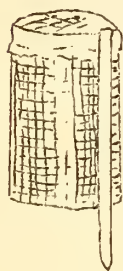
## Make Rearing Cages

### Equipment:



1. Glass container with both bottom and top open, such as lamp chimney, fruit can with bottom out.
2. Piece cheesecloth.
3. Flowerpot or can in which to grow plant.
4. Screen wire.
5. Sticks of wood (small to support screen cage).
6. Carpet tacks.

### Procedure:



1. Glass cage.
  - a. Place globe over plant and firm it in soil.
  - b. Fasten cheesecloth over top.
2. Screen cage.
  - a. Roll screen to make cylinder of desired size.
  - b. Tack stick to fold in screen (leaving stick 2 or 3 inches longer than screen).
  - c. Fasten cloth or screen over top.
  - d. Insert point of stick in soil, firm soil around base of wire.

## Select Insect to be Reared

### Equipment:

1. Each member should have list of common insects about the farm or home.

### Procedure:

1. From life cycle presented in books or bulletins decide which insects can be reared during summer.
2. As far as possible have each member select a different insect to rear.
3. Outline procedure for rearing insects.

### Make Preservative for Immature Insects

#### Equipment:



1. Small bottles with stoppers, size of man's thumb.  
(1 dram short Home) can be obtained at drug store.
2. 1 pint formaldehyde.

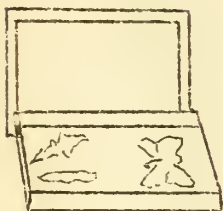
#### Procedure:



1. Dilute formaldehyde to 5-percent solution.
2. Distribute in vials.
3. Keep reserve supply with club stock.
4. Preserve immature life stages of insects. Select these insects from those to be reared.

### Make Riker Mounts

#### Equipment:



1. Piece glass about 6 by 8 inches (windowpane glass).
2. Shallow box (1 inch deep).
3. Cotton.
4. Insect and its damage to be mounted.
5. Paper for labels.
6. Tools: Hammer, saw, pincers, chisel, etc.

#### Procedure:



1. Fit lid for box, using glass for top.
2. Place cotton in box.
3. Arrange insect and damaged leaves, cloth, etc.
4. Fasten lid on box.

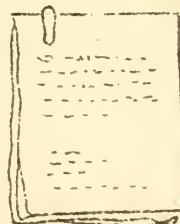
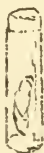
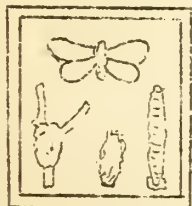
### Exhibit Reared Insect

#### Equipment (for each club member):

1. Riker mount.
2. Preserved specimens immature insects.
3. Potted plant showing insect and damage.

#### Procedure:

1. Arrange exhibit showing each club member's mounts, preserved insects, and potted plant; also any notes available.



## Field Trip

### Equipment:

1. Collecting net.
2. Killing bottle.
3. Vials for immature forms.
4. Container for insect galls and other things of interest.

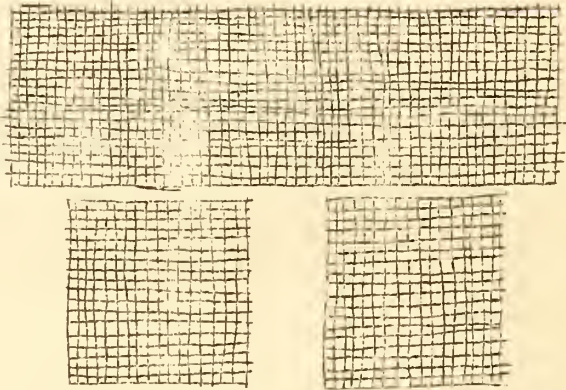
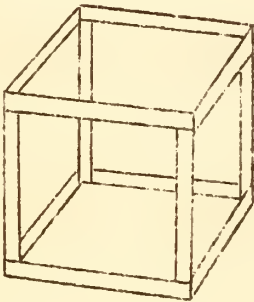
### Procedure:

1. Locate as many life stages of each insect as possible.
2. Collect as many life stages of each insect as possible.

### Hibernation Cages

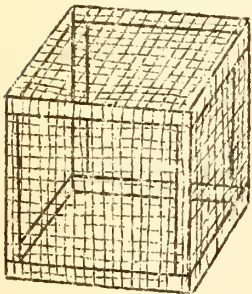
(Each Club Member, or One for Whole Club)

### Equipment:



1. Two pieces of screen about 24 inches square and 1 piece 24 inches wide and 6 feet long (or enough to cover five sides of a 24-inch cube).
2. Wood strips to make frame for cage (eight 1 by 1 by 20 inch and four 1 by 1 by 22 inch strips).
3. Nails and carpet tacks.

### Procedure:



1. Nail frame together.
2. Cover with screen.
3. Tack very tightly to prevent insects' escape.
4. If possible, fit door into one side.
5. Allow the four longer corner strips to extend below wire.
6. Sink longer legs in soil.
7. Place leaves, sticks, etc., in cage.
8. Place several hundred beetles or bugs inside.
9. Examine occasionally to see that cage has not been molested.
10. Examine and count bugs that come out alive in spring.



### Locate Insects in Winter Quarters

Equipment:

1. Paper and pencil.

Procedure:

1. Examine weeds along fence rows and ditchbanks; record findings.
2. Look carefully under loose bark of dead and fallen trees, and record findings.
3. From books and bulletins find other places where insects spend the winter and look for them there.

### Permanent Exhibit (For Club, School, or County Agent)

Equipment:

1. Collections.
2. Riker mounts.
3. Preserved immature forms.

Procedure:

1. Select from each member's collection the best prepared specimens.
2. In permanent exhibit have representatives of the more important insects in the community.
3. Arrange insects in neat order in large exhibit tray or case.

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### Chasing Insects (Tune: I'm Forever Blowing Bubbles.)

We're forever chasing insects,  
Pesky insects everywhere,  
They're small and shy;  
How they hate to die;  
But we will get them by and by.  
Though they're always hiding,  
We'll look everywhere,  
We're forever chasing insects,  
Pesky insects everywhere.

- - Courtesy of Oklahoma Extension  
Service. (4-H Club Insect Manual

## THINGS TO KNOW ABOUT INSECTS

Club members should know something about the habits of the insects in their collections, and control of the pests. If a paragraph were written on each insect, this manual would be too large to be practical for the purpose for which it is intended. The key appearing on pages 27 and 28 prove helpful in aiding members to obtain the information they need regarding each common insect listed.

On page 23 is a questionnaire, to be filled out, which contains questions indicated by 10 Roman numerals. A list of insects, arranged in alphabetical order appears on pages 24, 25, and 26; at the top of the page appear the Roman numerals corresponding to the numbers of the questions in the questionnaire. Following each insect name is a series of numbers arranged in columns under the Roman numerals. These numbers refer to like numbers on pages 22 through 27, which give the answers to the questions. For example, if an alfalfa caterpillar is the insect concerned, and we want to fill out the questionnaire, we turn to page 24, and find alfalfa caterpillar, then look for Roman numeral I, which represents the question, "What are the food plants, animals, or their products?" Opposite alfalfa caterpillar, under number I, we find the figure 2. If we turn to page 27, under Roman numeral I, we find that figure 2 refers to alfalfa and clover, which are the food of the caterpillar. By the same procedure all the questions for each insect may be answered. In some cases the mouthparts, controls, or other factors may be different for the adults and larvae, in which case the top row of figures refers to the adult and the bottom row refers to the larvae. In the case of the codling moth, the reference indicates that control is directed to the larvae and all control practices and materials refer to the larvae.

---

Learn from the birds what food the thickets yield;  
Learn from the beast the physic of the field;  
The art of building from the bee receive;  
Learn of the mole to plough, the worm to weave.

- - - Pope.

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Questionnaire  
Things to Know About Insects

Name of insect \_\_\_\_\_  
(common)

Name of collector \_\_\_\_\_

(Genus) \_\_\_\_\_  
(species)

Date collected: \_\_\_\_\_

Place collected: \_\_\_\_\_

(Day) \_\_\_\_\_  
(month) \_\_\_\_\_  
(year) \_\_\_\_\_

Town \_\_\_\_\_  
State \_\_\_\_\_

I. What are the food plants, animals, or their products?  
\_\_\_\_\_  
\_\_\_\_\_

II. What part of the food plant or animal is infested?  
\_\_\_\_\_  
\_\_\_\_\_

III. In what stage does insect spend the winter?  
\_\_\_\_\_  
\_\_\_\_\_

IV. Where does the insect spend the winter?  
\_\_\_\_\_  
\_\_\_\_\_

V. What kind of mouth parts has this insect?  
\_\_\_\_\_  
\_\_\_\_\_

VI. Of what economic importance is this insect?  
\_\_\_\_\_  
\_\_\_\_\_

VII. What is injurious stage of insect?  
\_\_\_\_\_  
\_\_\_\_\_

VIII. Control is directed toward what stage of this insect?  
\_\_\_\_\_  
\_\_\_\_\_

IX. What control measures are recommended?  
\_\_\_\_\_  
\_\_\_\_\_

X. What insecticide would be used?  
\_\_\_\_\_  
\_\_\_\_\_

List of Common Insects

Insect	Stage	I	II	III	IV	V	VI	VII	VIII	IX	X
Alfalfa caterpillar	adult larva	2	32	43, 50	60	66 62	67	73	73	80, 86	112
Angoumois grain moth	adult larva	21	34, 35 31 32, 34	50	60	66 62	67	73	76	83, 90	106
Apple aphid		3		46	53	64	67	73, 75	76	97	117, 113, 115
Armyworm	adult larva	7, 21	32	47, 50	57, 60	66 62	67	73	73	77	119, 123
Bagworm	adult larva	23	32	46	60	66 62	67	73	73	86, 89, 97 88	105, 112
Bean weevil		4	34, 35	50	60	62	67	73, 75	76	90, 98	106
Beetbug		14, 1	40	50	54, 60	64	67	73, 75	73	97	108, 111
Blister beetle	adult larva	18 15	32, 33 44	47	57	62 62	67 68	75	75	88, 90 86, 97	101
Boll weevil		8	31, 32 33, 34	49	56	62	67	73, 75	73	83, 80 86, 96	105
Bollworm	adult larva	13	33 32, 34	48	57	66 62	67	73	73	80, 86	105
Brown chicken louse		20	40	50	60	62	67	73, 75	76	84, 86	125
Cabbage aphid		6	32	46, 50	60	64	67	73, 75	76	85, 97	115
Cabbage looper	adult larva	6, 13	32	48	55	66 62	67	73	73	86, 97	100
Cankerworm	adult larva	3, 23	32	48	57	66 62	67	73	73	78 86, 97	126 112
Carpet beetles (Buffalo bug, etc.)		11, 15 25	39, 42 40	50	60	62	67	73, 75	76	88, 90 96, 98	106, 108
Cat and dog flea		1		50	60	66	67	75	76	84, 86 97	107, 127
Chinch bug	adult nymph	7, 21 7, 21	23, 32 23, 32	49	56	64 64	67 67	73 75	75	83, 100 78	127
Cicada	adult nymph	23	26	47	57, 60	64 64	67 67	75	75	82	



List of Common Insects (Continued)

Insect	Stage	I	II	III	IV	V	VI	VII	VIII	IX	X
Cattle grub	.	Cattle	40	47	60	65	67	73	73	86, 89 91	109
Clothes moth/ <u>1</u>	adult larva	11, 25	42	50	60	66 62	67	73	75 73	88, 90 96, 98	106, 108 116, 118
Cockroach		12	55	50	60	62	67	73, 75	73, 75	77, 86 96, 97	109, 124
Codling moth/ <u>2</u>	adult larva	3	34	47	56	66 62	67	73	73	78, 80 83, 97	112
Colorado potato beetle		19	32	49	57	62	67	73, 75	73, 75	86, 97	112, 119
Corn earworm	adult larva	18	32, 34 28, 29 30, 31	48	57	66 62	67	73	73	92, 86	105
Cotton flea hopper		8, 18	46	46	52	64	67	73, 75	76	80, 86	119, 129
Cotton leaf worm	adult larva	3, 10, 16 3	33, 34 32 43	47	57, 56	62	67	73	73	86, 97	105, 112, 119
Cricket (field)		15, 18	32, 36	46, 47	57, 56	62	71	73, 75	73, 75	77	105, 119, 123
Cutworm	adult larva	18	26, 28	47	57	62	67	73	73	77	119, 123
Dragonfly	adult nymph	15 15		47	59	62 62	68 68				
Firefly		18	26, 36	47	57	62	71				
Granary weevil		7, 21	34, 35	50	60	62	67	73, 75	76	88, 90 96	106, 108
Grasshopper		18	31, 32 33, 34	46	57	62	67	73, 75	76	77, 80 97	119, 123
Harlequin bug		6	32	49	60	64	67	73, 75	73	83, 89	109
Hessian fly		21	28	47	60	65	67	73	76	80, 82	
Honey bee		10	33	50	Hive		68				
Horse botfly		13	40	47	60	65	67	73	73, 72	91	106

1.-Numbers in IX and X apply to both adult and larva.

2.-Numbers in IX and X apply to larva only.

List of Common Insects (Continued)

Insect	Stage	I	II	III	IV	V	VI	VII	VIII	IX	X
Housefly		1	39	47	57	65	67	75			
House ant		12,14		50	54,57	62	67	75	76	77	106,123
Housefly	adult	12,14		50	54	65,66	67	75	75	88,96	121,126
	larva		36						73	97,99	
Imported cabbageworm	adult	6	32	48,50	55	66	67	73	73	86,97	109,121
	larva	18	32,34			62	67	73	75	97	
Japanese beetle	adult	21	26	47	57	62	67	75	73	80	128
	larva	15	44,45	49	56	62	68				
Ladybeetle		15	44,45	46	53	62	68				
Mantis		15	44,45	46	53	62	68				
Melon aphid		8,9	31								
		18	32,33	45,50	52	64	67	73,75	73,75	86,97	115
Mexican bean beetle		4	32,33	49	56	62	67	73,75	73,75	86,97	107,109
			34				67	73,75	73,75	84,91,97	128
	animal	1	40	50	51,54	64	67	73,75	76	97	113,117,128
	flower )	3,13	27,31	46,50	60	64	67	73,75	76	97	113,117
	vegetable)		32,34						73	85,96	
Mites	trees )	23	32	46	53	64	67	73,75	75	97	121
	shrubs)		33,34								
Mosquito		1	40	50	51	64	67	73,75	76	97	109,115
		13	32	49	55	65	67	73,75	76	97	109
Onion thrips			33,34								
		2,17	31	46,49	60	64,66	67	73,75	73,75	86,97	109
Pea aphid			32,34								
	adult	16	28	47	60	66	67	73	73	88	118
	larva										
Peach tree borer	adult	18	28	47	55,60	62	67	73	73	83,93	
	larva										
Stalk borer	adult	18	28	47	55,60	62	67	73	73	83,93	
	larva										
Wireworms (click beetles)		18	26,27	47	57,60	62	67	73	73		

Answers to Questionnaire

- I. Food, plants, animals, or their products:
1. Animals, many kinds.
  2. Alfalfa or clovers.
  3. Apples and pears.
  4. Beans.
  5. Books and papers.
  6. Cabbage and related crops.
  7. Corn.
  8. Cotton.
  9. Cucumbers, melons, and squash.
  10. Flowers.
  11. Furs.
  12. Food products.
  13. Horses and mules.
  14. Annoyance.
  15. Other insects.
  16. Peaches.
  17. Peas.
  18. Plants, many kinds.
  19. Potatoes (Irish).
  20. Poultry and birds.
  21. Small grains and grasses.
  22. Tomato and tobacco.
  23. Trees in general.
  24. Wood and wood products.
  25. Woolens.
- II. Part of host infested:
26. Roots.
  27. Bulbs or tubers.
  28. Main stem or trunk.
  29. Bark.
  30. Branches.
  31. Buds or "squares."
  32. Leaves.
  33. Blossoms.
  34. Fruits or grains.
  35. Stored plant products.
  36. Decaying vegetation.
  37. Paste, glue, starch.
  38. Lumber.
  39. Hide or leather.
  40. Flesh or blood.
  41. In intestines.
  42. Dried hair and feathers.
  43. Decaying animal matter.
  44. Eggs (insect).
  45. Young and adults (insect).
- III. Stage in which insect spends the winter:
46. Egg.
  47. Immature stages.
  48. Pupa.
  49. Adult.
  50. All stages (in South or in heated buildings).
- IV. Where insect spends the winter:
51. Animals.
  52. Alternate host.
  53. Branches of trees.
  54. Buildings.
  55. Crop refuse.
  56. Protected places in general.
  57. Soil.
  58. Stored products.
  59. Water.
  60. Where it fed.
  61. Woody portion of plants.
- V. Mouth parts:
62. Chewing.
  63. Lapping.
  64. Piercing and sucking.
  65. Rasping.
  66. Sucking.
- VI. Economic importance.
67. Pest.
  68. Beneficial.
  69. Larva beneficial.
  70. Adult beneficial.
  71. Questionable importance.
- VII. Injurious stage:  
(Same numbers as VIII.)
- VIII. Control directed towards:
72. Egg.
  73. Immature stage.
  74. Pupa.
  75. Adult.
  76. All stages.

IX. Control measures:

77. Baits.
78. Banding or barriers.
79. Burning.
80. Culture.
81. Date of harvesting.
82. Date of planting.
83. Destroy hibernating quarters.
84. Dipping.
85. Drainage.
86. Dusting.
87. Hot-water treatment.
88. Fumigation.
89. Hand picking or squeezing.
90. Heating.
91. Medication.
92. None satisfactory.
93. Parasite.
94. Pruning.
95. Rotation.
96. Sanitation or crop refuse destruction.
97. Spraying.
98. Store in tight container or bin.
99. Trapping.
100. Varieties (resistant).

X. Insecticide to use:

101. Barium fluosilicate.
102. Benzol.
103. Beta-naphthol.
104. Bordeaux mixture.
105. Calcium arsenate.
106. Carbon disulphide.
107. Cryolite.
108. Cyanide.
109. Rotenone (derris or cube).
110. Hellebore.
111. Kerosene.
112. Lead arsenate.
113. Lime sulphur.
115. Nicotine.
116. Naphthalene.
117. Oil emulsion.
118. Paradichlorobenzene.
119. Paris green.
120. Pine tar oil.
121. Pyrethrum.
122. Soaps.
123. Sodium arsenite.
124. Sodium fluoride.
125. Sodium fluosilicate.
126. Tanglefoot.
127. Creosote.
128. Rather complicated.  
See a bulletin on the subject.

---

In the first place, it has been estimated by a conservative natural-ist of world-wide reputation that more than half of the animal matter of the land surfaces of the globe is locked up in the bodies of insects. That is to say, if all the elephants and lions and buffaloes and horses and cattle and hogs and birds and snakes and lizards of the earth were put into one pan of a gigantic balance, and all its insects into the other, the insect collection would be found to outweigh all these other land animals taken together.

- - Stephen A. Forbes.



# PART III- CONTROL OF INSECTS

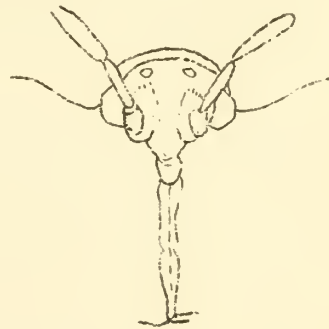
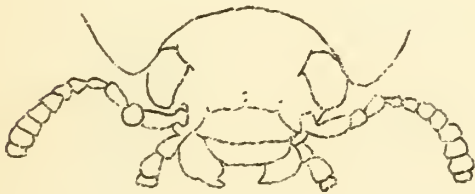
(Introduction to Third-Year Work)

Many years ago very little was done about insect damage, and it was only occasionally that an outbreak occurred which caused serious damage. Since then many changes have taken place, and we have an entirely different problem today.

Through commerce man has upset Nature's balance and many insects have been accidentally introduced, and their natural enemies have been left behind. Many plants have been introduced which provide better food for native insects than native plants provide, thus stimulating the rapid reproduction of those favored insects. Certain plant breeding has made plants more susceptible to insect attack. Then, also, one phase of our agricultural system - the planting of large acreages of one kind of crop in a concentrated area - has made it possible for damaging numbers of insects to build up in destructive numbers.

In recent years quarantines have been set up which regulate the shipments of plants and animals. Plant breeders are working toward greater resistance in plants to insects and diseases. Much parasite work is being done to help nature reestablish her balance. All these factors are helping, but more immediate or drastic control measures are necessary, and chemicals poisonous to insects must be used.

In the earlier days, a blanket recommendation was made - stomach poisons for chewing insects and contact sprays for sucking insects.



An effort is being made to use less and less of the metallic poisons. The organic or plant product sprays have been found to be much more specific, and the old rule doesn't always apply. A person must know much more about insects and insecticides (spray materials) than was formerly necessary if he hopes to control insects adequately.

This control phase of the project is better to acquaint the club member with the insect habits and effect of different control measures.

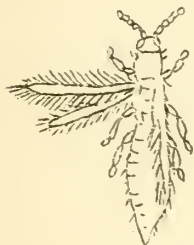


ACTIVITY CHART - THIRD YEAR

Meetings	Control of insects and collections	Page
First February	Organization.	
Second March	Outline work.	
Third April	Select control project.	
Fourth May	Mix insecticide.	
Fifth June	Apply insecticide.	
Sixth July	Visit control projects.	
Seventh August	Check results and exhibits.	
Eighth September	Fall clean-up and exhibits.	
Ninth October	Fall plowing.	
Tenth November	Judging contests.	
Eleventh December	Fill out record sheet forms.	
Twelfth January	Insecticide exhibit for school or county agent.	

COLLECTION AND IDENTIFICATION

In addition to the study of insect control, this group of club members should endeavor to collect and prepare notes on six other orders of insects. The six listed below contain many small insects and should be mounted on small cardboard points or preserved in alcohol or formaldehyde.



THYSANOPTERA.--Thysanos (fringed); pteron (wing). Mostly wingless when wings present; four, long, narrow fringed with hairs, folded over back when at rest. Body much elongated. Mouth parts rasping. Gradual metamorphosis. Thrips.



ISOPTERA.--Isos (equal); pteron (wing). Most forms wingless; kings and queens have four wings at mating time; wings equal in size, long, narrow, and folded over back when at rest. Somewhat resemble ants, but are pale in color and no slender waist in abdomen. Termites (white ants).



SIPHONAPTERA.--Siphon (a tube); aptera (without wings). Small wingless body, laterally compressed (flattened from side to side). Hind legs long, stout, fitted for jumping. Mouth parts piercing and sucking. Complete metamorphosis. Fleas.



MALLOPHAGA.--Mallos (wool); phagein (to eat). Small, wingless, flattened insects. Large brood heads, rounded in front. Eyes degenerate. Mouth parts chewing. Metamorphosis gradual. Mostly parasitic on birds, some on mammals. Chewing lice or bird lice.



ANOPLURA.--Anoplas (unarmed); oura (tail). Small wingless, flattened parasites of mammals. Mouth parts piercing and sucking. Head narrow and pointed in front. Eyes wanting or degenerate. Metamorphosis simple. Blood-sucking lice.



CORRODENTIA.--Corrodens (gnawing). Minute insects, wingless or with four membranous wings with few prominent veins; when wings present, are folded rooflike over body. Mouth parts chewing. Metamorphosis simple. Book lice, dust lice, bark lice, deathwatches.

## OUTLINE OF WORK

President of club, club agent, or entomologist outlines the work for the year and has club members make survey of insect situation before next meeting. Read through work for year.

### Select Control Project

#### Equipment:

1. List of crops or animals at home.
2. List of insects causing damage.

#### Procedure:

1. Select most troublesome insect pests in community.
2. Assign each club member a different insect to control.
3. Work out control measures to be followed by each club member.

### Mix Insecticides

#### Equipment:



1. Samples of all insecticides to be used by each club member.
2. Necessary vessels for mixing.
3. Bulletins and books on insect control.

#### Procedure:

1. Each member or team to demonstrate mixing of each kind of insecticide to be used.
2. Tell story of need for thorough mixture cautions, etc.

### Apply Insecticides (In Field if Possible)

#### Equipment:

1. Small quantity of each kind of insecticide.
2. Dusters and sprayers.

#### Procedure:

1. Each club member demonstrates how his insecticide is applied.
2. Each club member demonstrates where insecticide is applied and why.  
(Under leaves, in buds, mopping, scattering poison, tops of closets, etc.)
3. Leave few plants unsprayed as check.
4. Outline method for filling out spray record sheet, page 36.

### Visit Control Project

#### Equipment:

1. Notebook and pencil.
2. Thorough knowledge of your control problem.

#### Procedure:

1. Visit several members' insect control plots.
2. Host member tells how many sprays are applied.
3. Tell of number of bugs.
4. Discuss record forms to be filled out.

### Check Results

#### Equipment:

1. Paper and pencil.
2. Record forms.

#### Procedure:

1. Check leaves damaged on treated and check plot, or amount of lice on poultry, etc.
2. Count insects present.
3. Compare yields.

### Exhibit

#### Equipment:

1. Insects controlled.
2. Potted plants showing control.
3. Riker mounts showing control.
4. Insecticides used.
5. Dusters or sprayers used.
6. Notes on control.
7. Any pictures taken.

#### Procedure:

1. Set up exhibit at school or community fair.
2. Have member present to discuss exhibit.

(This exhibit may be omitted until the ensuing month.)

### Fall Clean-up (In Field)

#### Equipment:

1. Crop refuse harboring insects.
2. Plow or spade.

Procedure:

1. Examine crop refuse and weeds for hibernating insects.
2. Plow or spade under infested crop.
3. Plow under or burn trash and crop refuse.
4. Seed to some cover crop.

Fall Plowing

Equipment:

1. Farmer plowing late in fall.

Procedure:

1. See how many bugs can be found which have been exposed to the birds and weather.

Judging Contests

Judging contests may be used better to acquaint individuals with insects and insect injury to the host, as well as with control measures. Contests may be between individuals within a club or between members of different clubs. Each club member may fill out a form for 10 insects as indicated in the form below.

Equipment:

1. Twelve samples of injury caused by insects, each carrying a number.
2. Twelve specimens of economic insects, each having a number.
3. Twelve samples of insecticides, each carrying a number.
4. Series of placards, each carrying a number, and the name of a particular control practice such as spraying, dusting, fumigation.
5. Forms to be filled out by contestants.

Injury sample	Insect	Insecticide	Control practice
Potato	Colorado potato beetle	Arsenate of lead	Dusting or spraying

Procedure:

1. Contestants work separately.
2. Identify insect which caused injury and write name (or number) in space.
3. Pick out insecticide used to control, and write its number in space.
4. Pick out control-practice placard and write its number in space.



### Fill out Record Forms

Equipment:

1. Record forms, page 36.
2. Notes taken during season.

Procedure:

1. Copy very neatly onto record forms information called for.
2. Write narrative report of season's work according to outline page 37.
3. Fill out questionnaire page 23, for each insect collected this year.

### Insecticide Exhibit

Equipment:

1. Collection of as many kinds of insecticides as possible.

Procedure:

1. Make list of all insects each insecticide is used to control.
2. Where possible, make case to hold insecticides and notes on their use.

---

The careful insect 'midst his works I view  
Now from the flowers exhaust the fragrant dew,  
With golden treasures load his little thighs,  
And steer his distant journey through the skies.

- - - Gay.

---

(Sample)

Name \_\_\_\_\_  
(Club member)

Insect-Control Experiment

Spray Record Sheet

Name of plant: Cabbage  
Name of insect to be controlled: Cabbage worm  
Does this insect have chewing or sucking mouthparts? Chewing  
What spray or dust material used? Davis  
Strength of dust material: 75 percent Potash

Spray Calendar

Applications	Date	Size of plant <u>Inches high</u>	State of development of plant
First	<u>May 15</u>	<u>8</u>	<u>Well leafed out</u>
Second	<u>May 25</u>	<u>10</u>	<u>Heads beginning to form</u>
Third	<u>June 10</u>	<u>12</u>	<u>Heads well formed</u>

## Narrative Report of the Cabbage Worm

The common white butterfly, or the common cabbage worm, is undoubtedly the worst pest of cabbage. This pest was imported from Europe in 1865 and gradually spread as far as the chief States by 1880.

The butterflies are among the first to emerge in the early spring. They are white, marked with black near the tips of the forewing. The female has two spots on each forewing, and the male has one.

The butterflies lay yellowish, oval eggs on the foliage. They hatch in from 4 to 8 days. The larvae grow very rapidly and gorge themselves on the foliage. They become full grown in from 10 days to 2 weeks. The mature worm is velvety and of a green color, very similar to that of the foliage, with a faint yellow stripe down its back and yellow spots on each side.

Luckily, some parasites were imported when the pest became established in the United States. One parasite purposely imported from Europe is a wasplike fly, which is known to have killed practically every worm at Washington D. C., in 1904.

Since the pupae winter in the old cabbage refuse, it is necessary that such remnants be destroyed. Various methods of control are known, but the most satisfactory means is spraying or dusting with rotenone or pyrethrum.

---

Little bugs have other bugs  
Upon their backs to bite 'em,  
And these in turn have other bugs,  
And so ad infinitum.

---

## PART IV - TEACHING DEVICES

(Introduction to Fourth-Year Work)

In addition to continuing with insect collecting, the members in this group will be in a position to carry to other club members and to adults information that they have gained from their experience with insects. Through plays, demonstrations, exhibits, and surveys, they can help entomologists and extension workers to get correct control information into the hands of many people who would not otherwise be reached. Because of the great number of insects and the wide variety of insect control practices, there is no limit to the amount of work club members can do in this respect.

---

O, yet we trust that somehow good  
Will be the final goal of ill,  
To pangs of nature, sins of will,  
Defects of doubt and taints of blood;

That nothing walks with aimless feet;  
That not one life shall be destroyed,  
Or cast as rubbish to the void,  
When God hath made the pile complete;

That not a worm is cloven in vain,  
That not a moth with vain desire  
Is shriveled in a fruitless fire,  
Or but subserves another's gain.

- - Tennyson.

---



ACTIVITY CHART - FOURTH YEAR

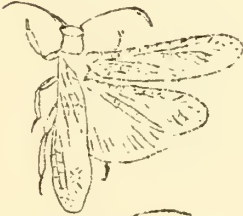
Meetings	Teaching devices and collections	Page
First February	Organization.	
Second March	Outline work.	
Third April	Playlets.	
Fourth May	Playlets.	
Fifth June	Demonstrations.	
Sixth July	Demonstrations.	
Seventh August	Exhibits.	
Eighth September	Exhibits.	
Ninth October	Fall surveys.	
Tenth November	Fall surveys.	
Eleventh December	Playlets.	
Twelfth January	Playlets.	

COLLECTION AND IDENTIFICATION

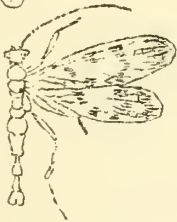
There is a difference of opinion as to the total number of orders of insects, but it is about 25. Representatives of some orders are very rare and would seldom be picked up in collections. However, there are 5 more orders listed here, and specimens of some of them can be located with sufficient effort.



DERMAPTERA.--Derma (skin); ptera (a wing). Front wings beetlelike (leathery), but much shorter than abdomen. Hind wing earshaped, veins radiating from middle forward margin. Often wingless. Cerci (forceplike) structures on tip of abdomen. Chewing mouth parts, gradual metamorphosis.



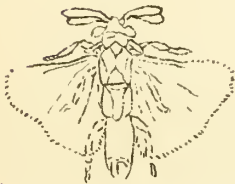
PLECOPTERA.--Plecos (plaited); pteron (a wing). Four netted, veined wings, front pair narrow, hind pair very broad and folding like a fan. Folded flat on abdomen when at rest. Chewing mouth parts. Gradual metamorphosis. Stone flies.



MECOPTERA.--Mecos (length); pteron (a wing). Four long, rather narrow wings, numerous cross veins; mouth parts elongated into a snout three times as long as width across the eyes. At end of snout are chewing mouth parts; metamorphosis complete. Scorpion flies.



COLLEMBOLA.--Colla (glue); embolon (a bolt or bar). Tiny, primitive wingless insects, mouth parts chewing, sunken into head. Never more than six abdominal segments. First segment has a forked adhesive organ or ventral tube. The fourth segment is with forked spring; by use of spring insect flips itself along; no metamorphosis. Spring tails.



STREPSIPTERA.--Strepsis (twisted); pteron (a wing). Four wings, front pair reduced to mere clubs, hind pair triangular. Eyes stalked, degenerate; chewing mouth parts. Females without legs, wings, eyes, or antenna; mouth parts, vestiges; wormlike, and living in the interior of insects throughout life. Twisted wing parasites.

PLAYLETS

There is no question but that through plays many people can be shown the light to better insect control. Plays must be true to life. Sufficient wit and humor should be worked in to lighten the serious thought back of the play and to keep the audience interested.

In portraying the parts, proceed as one would normally. Don't make actions too mechanical.

In speaking, speak freely; practice to impersonate the person you are to represent.

The following playlets may serve as suggestions, and it is hoped that more original ones will be worked out.

Striped Cucumber Beetle Control

A Playlet in Three Scenes

Characters

County agent  
Johnny, farmer boy  
Grandpa Wortle  
Matilda Hicks  
Johnny's father  
Neighbor Jones

Scene I.--Melon patch.

(To typify melon patch, seed can be planted in shallow trays a few weeks before the meeting, and these trays can be placed around on the stage to give the appearance of a melon patch. As the scene opens we find Johnny seated on a stone with his face in his hands as Neighbor Jones walks in.)

Neighbor Jones: What's the matter Johnny?

Johnny: Last year I tried so hard to grow a few melons, but they all died before I got any to eat. This year the bugs were here before the plant got through the ground.

Neighbor Jones: (Stoops down and examines vine.)  
Why don't you try placing moth balls around the hills?  
I hear they will keep the bugs away.

Johnny: These bugs are not moths, but if you think moth balls will work I'll give them a trial.

Neighbor Jones: Look who's coming now--that old busybody, Matilda Hicks. I wonder what news she has today. I'll bet she has some good remedy for these bugs.

Johnny: (Rises as Jones begins to speak, then sits down again.)  
I wouldn't doubt it, she has the answer for most everything.

(Matilda Hicks, a tall, thin woman with pointed face and very sharp features, enters, talking very fast.)

Matilda: Bless my soul! What are you two doing here? I would think you could find something more important to do than loafing.

Neighbor Jones: Well, Johnny was just telling me about these bugs and I started --- (Matilda interrupts.)

Matilda: Huh! Those bugs. Well, if you will just go down the road there and get some dust out of the covered bridges and sprinkle it over the melon hills you won't have any more trouble. I'll tell you it's good for the bugs.

Johnny: (Rises and stoops over vines. Looks up to speak.)  
I don't want anything that is good for the bugs, I want something that will get rid of them. But next time I come through the bridge I'll get some dust and give it a trial.

Neighbor Jones: The covered bridges are about all gone, and how will we control the bugs then?  
(Takes out his knife and starts to whittle.)

Matilda: Well, the dust from other bridges will do, but it isn't as good as that from covered bridges. In fact I hear that just plain road dust will help some.

Neighbor Jones: Well son, your troubles will soon be over. Here comes Grandpa Wortle.

(All speaking at once.)

Johnny: Hello, Grandpa!

Matilda: How are you feeling today?

Neighbor Jones: Howdy, neighbor.

Grandpa: Oh, right pert - except from the way my rheumatiz feels I think we'll have a change in the weather, probably rain tonight or tomorrow. It's been nigh on to 2 weeks since we've had a good shower.  
(Leans, both hands on his stick.)

Matilda: Johnny here's been frettin' about these little striped bugs on his melons.

Grandpa: (Pokes vines with his stick.)  
Ah, shucks! Them critters are easy to handle. When I was a boy we used to get a pail of real fresh cow manure and make a good paddle then smear a little manure around the vines. It won't hurt if you get some on the vines and in addition to keeping the bugs away the manure makes the melons grow better.

Johnny's Father: Well, Johnny, I just came out to tell you supper is ready, but it seems as though you are having quite a conversation here. What's it all about?

Johnny: (Rather startled.)  
Hello Dad. Wya' these folks been telling me how to get rid of these beetles.

Johnny's Father: Why don't you put salt on their tails then you can catch 'em? That's the way they catch birds.

All Except  
Johnny: A grand laugh.

End of Scene I.

Scene II.--Next day, same place.

Johnny: (Talking to himself, holds several small packages in his hands.)  
Let's see, now that I have all these things, what will I do with them, put a little of each around all the plants? No! that won't do, cause I won't know which was best. I think I'll make a little experiment. (Stoops and works.) I'll put moth balls around these two or three hills (moves along), road dust around these two, and (moves again, stooping) try Grandpa's wonder remedy on these two. Pa said he once heard of using soot, so I think I'll try using a little of that too. (Here he rises and looks toward the road.) I wonder who that fellow is and what he wants.



County Agent: (Enters.)  
Hello there, son. How are you? I am County Agent Smith from over at Dublin. I just happened to be passing by, and when I saw all those packages I wondered what you were doing.

Johnny: Well, I've been trying to grow some melons, but seems as though it can't be done. The bugs don't wait until the plants come up before they start eating on them. Last year some vines kept growing until the melons were almost ripe, then they withered and died. I guess it must have been the weather.

County Agent: The weather may have done part of the damage, but I imagine the beetles did the most of it.

Johnny: There were not many bugs around when the vines wilted, just before harvest.

County Agent: That's probably true. There is an interesting story in that connection. The beetles damage your melons and cucumbers the same way. You probably know they eat the plants.

Johnny: They sure do. They can almost clean up a patch over night.

County Agent: (County agent takes a small leaflet from his pocket and hands it to the boy.)  
Here is a bulletin that tells all about the beetles. These beetles also lay eggs on or near the vines, and the little larvae or worms that hatch bore into the stems, and sometimes kill the plants.

Johnny: (Interrupts and reads.)  
It says here that the third and possibly most important is that these little striped beetles carry a bacterial disease which they transmit to the plants and cause the plants to wilt and die just before harvest. So far as ent-to-molo-gists - I guess that means bugologists - know the disease can only live overwinter in the stomach of these beetles. After one plant is diseased there are several insects that can carry the disease to healthy plants. To prevent the disease it is necessary to kill the beetles before they get you.

County Agent: (Has been looking over Johnny's shoulder. Johnny turns to face him.)  
Well, son, you can see why the melons died just before harvest. They got the disease from the bugs last spring, but the disease didn't kill the vines until just before the melons got ripe.

Johnny: Is that the only thing that would make the plants wilt and die?

County Agent: Oh, no! In some places there is a different kind of wilt disease that lives and spreads, independent of the beetles. Then often there are small green lice which suck the juice from the leaves and cause them to curl up. Quite often they are curled so much they might as well be dead.

Johnny: But what can we do to kill these striped bugs?

County Agent: If you will look at the bulletin it tells you what to use. (Again looks on with Johnny.)

Johnny: Oh yes, it says here to use calcium arsenate and land plaster or gypsum. What is calcium arsenate?

County Agent: Oh, that's a poison, a sort of white powder. By the way, I have some already mixed with gypsum out in my car. Just wait and I'll go out and get it. (Johnny continues to look at bulletin. County agent returns.)

Johnny: I've had several suggestions from people around here about different things I can use to control the bugs, and I'm making a test of some of these. Will you sell me enough of this to dust a few hills?

County Agent: No, I won't sell you any, but if you'll dust about a dozen hills thoroughly each week until the runners are rather large, I'll give you the dust, and I believe I have a little duster in the car which you can use to apply it. All I'll ask of you is to let me know, sometime this fall, what kind of results you have. We'll go see about the poison.

End of Scene II.

Scene III.--County agent's office.

(Johnny comes strolling in carrying a large melon - if off season one can be made up - his face beaming, followed by his father, mother, and Matilda.)

(County agent is seated writing, but looks up as they enter.)

County Agent: Hello, there, where did you buy that one?

Johnny: I didn't buy it, you gave it to me.

County Agent: I didn't give it to you, because I haven't seen you since last spring.

- Johnny:            Anyway, I brought this to you from your melon patch. (Hands melon to agent.)
- County Agent:     Thanks a lot, but I don't have a melon patch.
- Johnny's Mother:   Johnny has called his patch yours all season because you saved it from the bugs.
- County Agent:     Well. And what happened to the melons when you used moth balls, soot, dust, and Grandpa's remedy?
- Johnny:            They're out of sight.
- County Agent:     You mean they are the nicest vines you have?
- Johnny:            No, they're dead and gone.
- Matilda:          (Who has been poking around.)  
I came along to see if I could get one of those books.
- County Agent:     Sure you may. I'll get you one. (Goes to file and picks one out and hands it to Matilda.)
- Matilda:          Grandpa Wortle asked if I could get one for him.
- County Agent:     Sure, that's what they're printed for. (Walks toward files.)  
Come on over, all of you, maybe there are some other bulletins you will find useful. (All follow agent and start looking over the file.)
- Johnny's Mother:   (Picking up a bulletin and looking through it.)  
Here is one on clothes moths and their control. I'd like to have it.
- Johnny's Father:   (Picks up bulletin, fumbles for his specks, and reads.)  
This boll-weevil bulletin looks good to me. (An insect common to your particular community may be submitted.)
- Matilda:          My word! I didn't know there was any one place where a person could get so much information. Won't I have lots to tell the folks when I go to prayer meeting Wednesday night! I'll bet all the folks will be wanting more information when I get through telling them what I've learned.
- (All gradually walking toward the door. Each one bids Mr. Smith good-bye.)
- Johnny's Father:   Come out to see us whenever you can. We'll need your help a lot.

County Agent: All right, Mr. Brown. Thanks again for the melon Johnny. What are you going to feed the bugs next year? (Follows them to the door.)

Johnny: (Others have left the stage, as Johnny leaves he repeats:) Calcium arsenate and land plaster; and hereafter when I want advice I know where I'll come. Good-bye.

The End.

---

4-H Insect Song

Oh where have you been, Billy boy, Billy boy?  
Oh where have you been, charming Billy?  
I've been learning insect lore that I never knew before,  
And I'm making a start in insect study.

Did you learn the different kinds, Billy boy, Billy boy?  
Can you tell me some of them, charming Billy?  
I know many different kinds, cannot keep them all in mind,  
For a hundred kinds are just outside my doorway.

Have you a collection made, Billy boy, Billy boy?  
Have you pinned some in a box, charming Billy?  
I have started to collect, but don't know what to reject,  
It is hard to find boxes for so many.

Have you watched the ways they live, Billy boy, Billy boy?  
Do you know their habits all, charming Billy?  
I have watched them in the field, and seen some secrets yield,  
But there's much more that I should learn about them.

Do some kinds eat up your plants, Billy boy, Billy boy?  
Can you drive them from the crops, charming Billy?  
I can put up quite a fight, if I have my methods right,  
I can make them wish they had not left their mummies.

- - - Wadley.

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BUYING INSECTICIDES

A Playlet in Three Scenes

Characters

Robert Jones.....Club president  
 Charley Myers.....Club secretary  
 Herman Ford.....Druggist  
 Willie Durant.....Drug clerk  
 Mrs. Smith.....Mary's and John's mother  
 Mary Smith )  
 John Smith )  
 Dave Clark )  
 Sam Reed ).....Club members  
 Jane Johnson)  
 James Miller)  
 Mabel )  
 8 other club members

List of crops and number of rows in each crop (to be written on blackboard before play starts).

<u>Crop</u>	<u>Rows</u>	<u>Crop</u>	<u>Rows</u>
Potatoes.....	16	Onions.....	1
Corn.....	10	Lettuce.....	1
Beans.....	4	Spinach.....	
Peas.....	4	Radishes.....	
Cabbage.....	4	Carrots.....	1
Cauliflower.....	2	Melons.....	1
Tomatoes.....	1	Cucumbers.....	1
Beets.....	1	Squash.....	1
Turnips.....	1		

Scene I.

Home of Mary and John, club members.  
 Mary and John are seated at the table.

Mary: Well, John, last night we made plans for our garden next summer. Tonight we arranged to figure on poisons to kill the bugs that are almost sure to come.

John: Do you have that list of crops we plan to plant, and the number of rows in each crop?



- Mary: Yes, they are still written on the blackboard--the one we used the other night when the club met here.
- John: I will go get it. (Leaves the room.)
- Mary: (While John is out.) I'll look over the bulletin to see what bugs we are likely to have.
- John: (Returns after a few minutes.) Here it is, and the names of the vegetables are still there.
- Mary: According to this bulletin, we are in for a lot of trouble with the bugs.
- John: Well, you remember the trouble Dad and mother had with potato beetles and the little yellow striped beetles on melons and cucumbers.
- Mary: That's right, and the little green worms just about ate all of Sallie Green's cabbage last year.
- John: You remember all the neighbors were talking about how bad the cutworms were last year.
- Mary: And the little green lice were on almost everything. Let's check the names of the vegetables that are often damaged by the lice.
- John: (Goes to board and checks crops as he calls the names of those that are likely to have plant lice.) We usually have lice on cabbage (pause), cauliflower (pause), turnips (pause), beans (pause), peas (pause), melons and cucumbers.
- Mary: What about the spinach?
- John: Ah! let the bugs have it. The more they eat the less I will have to, and we will save that much nicotine.
- (Mary interrupts.)
- Mary: You can get used to eating the spinach as well as the bugs can, and it will be good for you, too.
- John: This bulletin says to control aphids - I guess aphids are plant lice - use nicotine and let's see how much we will need.
- Mary: How big is our garden?
- John: As I remember, our garden is about 50 by 125 feet, which is about one-seventh of an acre. We will run our rows the short way across the garden, which will make them about 50 feet long.

Mary: Well, how much nicotine will it take to protect our crops?

John: (Picks up bulletin and quotes.) It says here to use a 3-percent nicotine at the rate of about 40 pounds per acre for one application.

Mary: How many times will we have to use it?

John: We may get by with two, but I think we better count on applying it three times because some crops may need several treatments.

Mary: That means if we had an acre which needed to be protected we would have to have about 120 pounds of nicotine dust. Then how much nicotine will we need to buy?

John: (Looking in bulletin, quotes.) It says for a 3-percent dust use  $3\frac{3}{4}$  pounds of nicotine to a 50-pound sack of lime or 1 ounce per pound. It says also that nicotine sulphate alone does not deteriorate with age, but when it is mixed with lime it must be used soon after it is mixed or kept sealed very tight.

Mary: Let's get back to see how much nicotine we need.

John: It will be easier to work out if we figure it on the basis of 1 ounce of nicotine to 1 pound of lime.

Mary: What part of an acre do we have in crops that are likely to be bothered with aphids?

John: (Goes to board and counts the rows in crops he had previously checked.)  
There are 12 rows which we plan to plant,  $2\frac{1}{2}$  feet apart, and the melons and cucumbers will be 5 feet apart. Now, if these are 50 feet long, what part of an acre have we? You like to figure better than I do, Mary, you can work it out.

Mary: (Goes to blackboard and works out problem her own way.)  
All right.  
12 rows  $2\frac{1}{2}$  feet apart = 30 feet, width of this part of garden.  
2 rows 5 feet apart = 10 feet, width of melon and cucumber patch.  
40 feet, total width.  
That's a strip 40 feet wide, and if it is 50 feet long we have  
 $50 \times 40 = 2,000$  square feet. There are 43,560 square feet in an acre, so  $43,560 \div 2,000 = 21.78$ , or one-twenty-first of an acre. To make it easy, let's say one-twentieth of an acre. Now, if 120 pounds is the right amount per acre, for three applications, we will need  $120 \div 20$ , or about 6 pounds of dust. At 1 ounce of nicotine to 1 pound of lime, that would mean 6 ounces of nicotine.

John: Well, that is pretty good, Mary. I could have figured it out just as easily, but I wanted to see if you could.

- Mother: (Rather loud from outside the room.)  
Mary. John. It's time to go to bed. You can finish that tomorrow night.
- Mary: All right, mother.
- John: Well, tomorrow we can get an idea of how much of the other kinds of insecticides we need. Then the next time we go to town we will shop around for prices.

Scene II.

About 1 week later, in the corner drugstore.

(To represent a drug store, provide the shelves and a counter on which can be placed a number of bottles and packages. Empty cartons can be used. They can be saved up at home, or perhaps the drug store can provide some.)

- Drug Clerk: (Young and quite sure of himself, and let's everybody know it. He is busy with some bottles as Mary and John enter.)  
Hello, Mary. Hello, John. What will you have today?
- John: Well, Mary and I are going to plant a garden next summer, and we have been shopping all town to get prices on poisons to kill the bugs.
- Drug Clerk: (Speaks rather loudly and cockily.) Oh! So you are going to be bugologists, are you? (Laughs.)
- Mary: Call us bugologists if you like, but we know how much damage bugs can cause, and we want to be prepared.
- Drug Clerk: (Speaks rather loudly and cockily.) What it takes to kill bugs, we've got plenty of! Just name your poison!
- Mary: (Takes out list.) We will need about 6 ounces of nicotine.
- Drug Clerk: (Pulls package off the shelf and shows it.) Yep, we have \_\_\_\_\_ (Get \_\_\_\_\_). That's nicotine sulphate con-  
trade name from local dealer)  
taining 40 percent nicotine, and done up in 1-ounce bottles. It sells for 35 cents per bottle.
- Mary: There it is again, \$2.10 just for nicotine.
- Drug Clerk: Well, that's what she sells for. (Places nicotine package on counter.)

- Mary: What is the price of Paris green?
- Drug Clerk: Fifty cents per pound, and we have plenty of it, either in package or in bulk.
- Mary: The bulletin we had said Bordeaux was good to use on potatoes. How much does it cost?
- Drug Clerk: Bordeaux! Where do you think you are, in France? (Looks around under the counter and on the shelves.) Sure, we have it, without arsenate of lead 30 cents per pound, and 40 cents per pound with arsenate of lead already mixed in. Better buy it with the lead, and it will take care of the potato bugs as well as leafhoppers. We also have copper lime dust, with or without the poison, and although it isn't quite as good as Bordeaux, it can be applied in a dust form.
- Mary: Which kind do you think is better, John?
- John: Take the prices of all and we can figure out later which we want. (Mary gets prices from clerk and writes them down.)
- Drug Clerk: What else you got on your mind?
- John: The bulletin said cryolite could be substituted for control of some bugs. What is it worth?
- Drug Clerk: Cryolite? (Looks blank and stammers.) Wa-wa-wa-well, cryolite. You mean cryolite. (Goes to shelves again and looks around.)
- John: (Allows clerk to hunt awhile, then nudges Mary and smiles.) Apparently you don't have cryolite, or don't even know what it is, so just forget it.
- Drug Clerk: Oh, what do you want to fool around with so many poisons for? (Reaches to shelf and pulls down a container.) Now, here is a cure-all which the salesman said would kill any bug that crawls. It may be a little more expensive, but if it kills all bugs, it's worth the difference.
- Mary: My mother always said that a medicine that was good for everything wasn't good for anything, and I am afraid the same would be true of insecticides.
- Drug Clerk: (Puts that package back and gets out another.) Well, now, here is another one. You can read right here on the label that it's good for cabbage worms, bean beetles, cucumber beetles, potato bugs. (Any number of bugs common to a given locality can be substituted.)

- John: (Interrupts.) I am afraid that's the trouble, it's too good for the bugs. That we want is something bad for the bugs. Mary is right. We will stick to the recommendations in our bulletin. What else do you have listed Mary?
- Mary: How about the rotenone-bearing compounds?
- Drug Clerk: Now what are you doing, trying to kid me?
- Mary: No. (Shows the clerk her list.) Here is the name just as I copied it from the bulletin.
- Drug Clerk: You must have copied it wrong.
- John: No she didn't, because we talked about it at home.
- Drug Clerk: Well, then, it must be a misprint.
- Druggist: (Enters while clerk is still talking, and just as clerk stops talking druggist remarks rather jokingly:)  
What's all the commotion?
- Drug Clerk: John and Mary are trying to find out what I know about bug control, and I don't know whether or not they are trying to kid me.
- Druggist: What seems to be the difficulty?
- John: Well, we just asked about a rotenone-bearing compound.
- Druggist: Oh yes! Rotenone--that's a product that comes from both the derris and cube plants, and there are several products manufactured under different trade names. They sell for different prices, depending on the amount of rotenone they contain. The trade names of some of these are: Cubor, Derridust, Derrispray, Derox, Dustall, Kubatox, Rotofume, Serrid, and I don't know how many others.
- Mary: Why do they recommend rotenone?
- Druggist: Apparently some people don't wash their vegetables thoroughly enough, and there is danger of people getting poisoned by using arsenate of lead on any portion of vegetables which are to be eaten. So, they are using rotenone, which is safer.
- Mary: You have about scared us out. When we consider the high cost it seems as though we may as well take a chance with the bugs.
- Druggist: Oh, I don't think so. I believe we can figure some way out. Why are you interested in insect control at this time of the year?



Mary: You see, the members in our club are planning gardens next summer, and John and I are making plans early and are getting prices on insecticides.

Druggist: Oh, I see. Well, you know the smaller the package, the more expensive the product, because it cost about as much to pack an ounce as it does to pack a pound, or even 5 pounds.

John: (Rather surprised.) Say, I have an idea. Why can't all we club members pool our orders and buy larger amounts, then divide the material according to our needs.

Mary: That will be a good idea. Let's bring this up at the next club meeting.

Druggist: (As Mary and John start for the door.) All right, when you find out how much you need, I will be glad to have your business, and if I don't have in stock the materials you need, I'll be happy to get just what you want.

Mary and  
John: (Leaving the place.) Thank you, and we will see you again.

### Scene III.

Club room two weeks later.

(The club officers and a few members are in the room when the curtain rises. Other members continue to enter and all exchange greetings.)

Club

President: (Looks at his watch.) It is 8 o'clock and time to start our meeting. All members be seated.

President: (Rises to start the meeting, when an awful commotion takes place outside and Pete comes rushing in.)  
What's the matter, Pete? Did you have a flat tire, run out of gas, or couldn't you give your baby brother the slip?

Pete: Oh! I thought I was ready to come, and Mom made me take a bath and change clothes. I guess next time I'd better do it without being told.

President: (Calls meeting to order.) Leads members in repeating national 4-H club pledge; roll call; reading of minutes, unfinished business (all conducted in the usual manner).

President: We have changed our program a little for tonight. Mary and John have something in mind in which you will all be interested.

Will one of you come up to the front and tell the rest of the club your plan? (Mary punches John, and John urges Mary to go. Finally Mary goes to a place by the table and related the story.)

Mary: Mr. President.

President: Miss Smith.

Mary: The other night John and I were making plans for our garden, and after we decided on the crops we want to plant, we got to thinking of how bad the bugs were on the gardens last summer, so we began figuring on poisons to kill the bugs. After we decided how much it would take, we went to town and shopped around for prices. We found that to buy the small quantities we would need, the sprays would be too expensive. The druggist told us it would be much cheaper to buy in larger quantities. We just wondered how many of the club members would be interested in pooling their orders with ours, then we could take advantage of a cheaper price.

Sam: Mr. President.

President: Mr. Reed.

Sam: I certainly will. Last summer I picked so many bugs, I dreamed about them at night.

Mary: How big is your garden, Sam?

Sam: I figure about a tenth of an acre.

Mary: What are you going to plant?

Sam: Cabbage, potatoes, corn, tomatoes, lettuce, beans, peas, melons.

Mary: That's just about what we had in mind.

President: How many more of you are planning for about the same size gardens and about the same crops? (All members raise their hands.)

President: How many of you would be interested in buying bug poisons according to Mary's and John's plan?

Jane: Mr. President.

President: Miss Johnson.

Jane: How much will the poisons cost?

John: Mr. President.

President: Mr. Smith.

John: Well, that depends on how much we buy. I imagine about a dollar or a dollar and a half apiece.

James: Mr. President.

President: Mr. Miller.

James: Where will we get that much money for poisons to kill bugs?

Jane: Mr. President.

President: Miss Johnson.

Jane: Can't we put on a play and raise some money?

Sam: Mr. President.

President: Mr. Reed.

Sam: Maybe we can get someone to advance us a few dollars until we can sell some of our first vegetables.

President: I believe the money part can be worked out, and if it can, how many of you would be interested in cooperating?

(All raise their hands and the secretary makes the count.)

Secretary: There were 18 raised their hands, but I believe Martha and Dave will be working together. How about you, Mabel and Janet?

Mabel: Mr. President.

President: Miss Brown.

Mabel: Yes, we will have only one garden.

Secretary: Then with John and Mary having the same garden, we will have 15 gardens.

President: That means if we buy 15 times as many poisons as Mary and John planned for, we should have enough. I think there ought to be a committee appointed to arrange to get the poisons, and to study the possibilities of putting on a play.

Sam: Mr. President.

President: Mr. Reed.

Sam: I would like to suggest that you, Mr. President, Mary, and John, serve on that committee.

James: Mr. President.

President: Mr. Miller.

James: I think that the secretary should also be on that committee, then all records will be kept together.

President: I feel that a committee of three is sufficient, and I will gladly withdraw from the committee. Are there any other remarks about this committee?

Jane: Mr. President.

President: Miss Johnson.

Jane: I move that the selection of this committee be left with the president.

Sam: Mr. President.

President: Mr. Reed.

Sam: I second the motion.

President: You have all heard the motion. Are there any further remarks? (Pause.) If not, will all those in favor let it be known by saying Aye. (All members "Aye.")

President: All opposed, No.

President: On this committee I will appoint Mary, John, and Secretary Myers. I know they will keep us informed of any developments. When the poisons are bought, we can have a special meeting and divide them.

President: Are there any further questions or remarks relative to insect control?

Dave: Mr. President.

President: Mr. Clark.

Dave: I have been wondering how we will apply these insect poisons when we get them.

President: That's a very good point. Does anyone have a suggestion on how this can be handled?

John: Mr. President.

President: Mr. Smith.

John: In our shopping around we have found that poisons can be obtained to apply either in the dust form or as a liquid spray. The bulletin we were studying said that in many cases the liquid spray was better than the dust, but that for small garden use, the dust should prove quite satisfactory.

Dave: Mr. President.

President: Mr. Clark.

Dave: I saw in a catalog from the hardware store that they have both the hand and knapsack types of dusters and sprayers listed. Apparently you can buy them at almost any price.

John: Mr. President.

President: Mr. Smith.

John: I have been wondering which would be more satisfactory--to pool our orders and each member get a small plunger type of duster, or to buy one or two compressed-air sprayers cooperatively.

Jane: Mr. President.

President: Miss Johnson.

Jane: I am afraid that if we get only one sprayer we will never have it when we need it, and by the time I could get over to John's or Sam's after the sprayer, the bugs would cause too much damage.

President: This is a pretty important question, and I think that each of us should give some thought to the matter. We can bring it up for discussion again at our next meeting.

Mary: Mr. President.

President: Miss Smith.

Mary: I think that is a very good idea, and in the meantime, I will try to see the county agent to see what he thinks best.

President: That concludes this part of the program. Is there any other business to be brought before the club? If not, will someone make a motion to adjourn?

Sam: (Rising.) Mr. President.



President: Mr. Reed.

Sam: I move we adjourn.

Jane: I second the motion.

President: It has been moved and seconded that we adjourn. All in favor say, Aye; opposed, No. (If there is no opposition the President says the meeting stands adjourned.)

The End.

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The Chigger Song  
(Tune: Polly-Wolly Doodle.)

Oh, there was a little chigger,  
And he wasn't any bigger  
Than the point of a very small pin;  
But the lump that he raises  
Just itches like the blazes,  
And that's where the rub comes in.

Comes in, comes in,  
Oh, that's where the rub comes in.  
The lump that he raises,  
Just itches like the blazes,  
And that's where the rub comes in.

- - Courtesy of Oklahoma Extension  
Service. (4-H Club Insect Manual

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## DEMONSTRATIONS

Demonstrations provide club members with the opportunity actively to study the details and technicalities of insect control, especially in relation to the insects that are prevalent in their own communities. Club members themselves not only become well informed but are thereby better prepared to pass their information on to others.

The damage done by an insect, how it lives (life cycle), its feeding habits, and methods of control, constitute major points which should be well developed in any 4-H team demonstration dealing with insect control. These points are outlined a little more in detail in the following sample outline which the members of a club may use as a guide in planning a team demonstration on the control of any insect or insects found in their community, as for example, Controlling Insects on Yard Flowers, or Peach-Borer Control.

A club tour or a survey of the various kinds of insects found around their homes and in their communities will not only aid club members in the selection of a demonstration subject having much practical value and worthy of being demonstrated, but will furnish them also with very helpful, important data for the development of their demonstration. (Note points listed under introduction in outline.)

The insect, the host, and some evidence of the damage caused by the insect should be shown in the introduction. A chart or poster presenting important data on the insect or demonstration subject, resulting possibly from a club survey, makes the introduction more convincing by emphasizing the need for good control methods.

In presenting the demonstration all equipment, materials, and processes should be well shown. Diagrams or charts will, no doubt, be needed to show and explain adequately the habits and the feeding and sucking mouth parts of the insect. Important points throughout the demonstration will be emphasized, and minute processes made much clearer by the use of charts and posters.

To have their demonstration fundamentally sound and complete, club members should exhaust all the subject-matter material possible relating to their demonstration. In addition to using material in this manual, club members may consult such well-informed persons as the county agricultural agent, club agent, or extension specialist, and obtain bulletins from them on the particular subject that is being demonstrated.

Note: The host of the insect is the plant or animal or products of these which the insect feeds on; such as cabbage for the cabbage worm or furs and woollens for the clothes' moth.

Sample Outline for Team Demonstration on Insect Control

Demonstrator's Name: \_\_\_\_\_

Demonstrator's Name: \_\_\_\_\_

I. Introduction (talking and showing).

- Reasons for giving demonstration.
- Kinds of insects prevalent in community.
- Damage done by these insects.
- Most important insect in community.
- Host of this insect.
- Nature of damage by this insect.
- Economic or esthetic value of host.

(No talking.)

- Assists teammate with work.
- Furnishes teammate with equipment and supplies as needed.

First part of demonstration  
(talking and working).

- Habits of the insects.
  - a. Time of year and place of the different life stages (eggs, larva or nymph, pupa, and adult) are found.
- Relation of habits to control.
  - a. Feeding.
    - Chewing.
    - Sucking.  
(Under cover or out in open.)
  - b. Where insects spend the winter.
  - c. Migration (check by barriers)
  - d. Others.

Second part of demonstration  
(talking and working).

- Control methods.
  - A. Insecticidal.
    - 1. Kind.
      - a. Name of poison.
      - b. Contact or stomach poison.
    - 2. Cost.
    - 3. Method of mixing insecticide.
      - a. Dilution.
      - b. Procedure.

(No talking.)

- Assists teammate with work.
- Furnishes teammate with equipment and supplies as needed.

4. Methods of application.
    - a. Dusting, spraying, fumigation, or medication.
    - b. Place to apply poison.
  5. Time of application.
  6. Number of applications.
  7. Length of effectiveness.
  8. Length of time to kill insect.
- B. Other control methods.
1. Hand picking.
  2. Cultural practices.
  3. Management practices.
  4. Sanitary measures.
  5. Natural control.
    - Parasites.
    - Predators.

(No talking.)

Assists teammate with charts, posters, and all equipment necessary for summarizing all important points of demonstration.

Summary (talking and showing).

A review of all important points considered in demonstration. Use charts, posters and any type of illustrative material necessary.

There is almost no limit to the number of insect control practices which lend themselves to team demonstrations. Below are listed a few suggestive topics which may be developed according to the sample outline given. The sub-heads under each topic are control methods which should be demonstrated.

Controlling the clothes moth and carpet beetle.

- a. Fumigation.
- b. Brushing.
- c. Sunning and airing.
- d. Cleaning and storing.

Controlling stored-grain insects.

- a. Cleaning bins.
- b. Fumigation.

Controlling ox warble.

- a. Squeezing.
- b. Ointment.
- c. Wash.

Controlling screwworm on animals.

- a. Medication.

Controlling lice on animals.

- a. Dipping.
- b. Medication.

Controlling peach borer with paradichlorobenzene.

Controlling vegetable-garden insect pests.

Controlling yard-flower insect pests.

Controlling houseflies.

- a. Sanitation.
- b. Traps.
- c. Screens.

Mixing poison bait for grasshopper and cutworm control.

Mixing poison sirup for house-ant control.

In addition to the team demonstrations on insect control, there are many other phases of the work with insects which can be presented by individual demonstrations. They are simple processes which may become a part of a team demonstration. The following may offer a few suggestions:

Preparing insects to be sent away for identification.

Making a collection net.

Making a jar for killing insects.

Pinning insects.

Making of a spreading board.

Spreading butterflies.

Mounting butterflies for ornaments.



## EXHIBITS

The primary object of an exhibit is to create interest. It is often difficult to tell an entire story by an exhibit, and quite frequently when people go where exhibits are shown, they do not take time to make a complete study of the whole exhibit. For this reason, exhibits must be simple and so built that they will suggest the story without the use of too many legends.

Exhibits should create enough interest so that the next time the observer sees an article or bulletin on the subject, he will want to read it and know more of the details on the particular subject. If an attempt is made to show insect damage to a plant or animal, living specimens should be used, whenever possible, and arranged in their natural position and surroundings.

In displaying control measures, the major steps in procedure may be shown. For instance, in peach-borer control, use three trees or stumps. Around one have the ground leveled off and free of stones and trash. Around another show the position of the chemical, and arrange the third tree to show the job completed with the soil mounded up around the tree.

Whenever possible, have the life stages of the insect and the material to be used in control in a conspicuous place, where those who wish to examine them more closely can do so.

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The butterfly, seeming careless and free,  
The armored beetle, and humming bee,  
The dragon-fly darting through summer airs,  
All busily work at their strange affairs.

- - - Wadley.

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## SURVEYS

Through surveys it is possible to locate areas of heavy insect populations and arrange to apply control measures before damage occurs. In cases where certain control measures are to start with given populations of the insect, surveys are very important. Entomologists make surveys every year, but conditions do not permit them to cover every farm or even every county. Reports of surveys made by local people will often help the entomologist to locate threatening numbers of insects that might otherwise be overlooked until after damage occurred. There are many insect pests for which information on their abundance would be valuable, but surveys for only a few insects will be mentioned here.

Large quantities of grasshoppers in a given area during late summer and early fall might indicate that numerous eggs were being laid there. County agents or entomologists could be notified to this effect and an egg-bed count could be made. These areas could be watched closely the following spring, and when young "hoppers" appear in dangerous quantities, poison bait can be applied to these areas. If this were done, the hoppers would be killed before they spread over the fields which would necessitate poisoning larger areas at a much greater cost.

With reference to the cotton boll weevil, the information gained from the surveys would be very important. The early spring survey to be made about the time cotton is chopped would be an indicator of the number of weevils emerging from hibernation. When 40 or more weevils per acre are present on any given field, it is likely that control measures will be necessary on that field and arrangements for applying control measures should be made.

The square infestation survey when the cotton begins to fruit should be made on each field to determine when 10 percent of the squares are infested. If cloudy rainy weather, which is favorable to boll-weevil development, prevails, dusting with calcium arsenate should be started.

The occurrence of scale insects increases and decreases from year to year. Too often damaging infestations are not located until the trees or shrubs are in foliage. Control measures for scale insects are applied while trees are in the dormant period. If the public could be taught to be on the lookout for these pests and to notify entomologists, control measures could be started during the dormant period and before damage to the trees occurs.

Possibly one of the best examples of the effectiveness of surveys is the Hessian-fly survey. Through surveys entomologists have found that if no young growing wheat, barley, or rye is present when the adult flies are in flight, these crops will receive no eggs and no subsequent damage. Each year these surveys are made by entomologists, and safe seeding dates are announced. Club members in Hessian-fly territory could, by familiarizing themselves with the survey, do much to assist entomologists, as well as to educate farmers regarding the value of withholding planting until after the safe seeding date.

# NAMES OF INSECTS

For the benefit of the boy or girl who may want to know more about the technical names of insects or the relationship of one insect to another, there is attached a list of some important economic insects. The insects are listed in alphabetical order by crops and by common names. Following the common name is the family, order, genus, and species, to which the insect belongs. Keep in mind that in referring to the scientific name of an insect, only the genus and species names are used. The order and family names are for classification. As an example the apple aphid is Aphis pomi.

Below is a chart to show how the technical name of an insect is used in classification. In this chart are only the Homoptera, considered in the list of some important economic insects, appearing in this manual. Just remember that in the Homoptera there are many more families, genera, and species than are shown here. In the family aphididae (plant lice) there are listed here five genera, each of which has certain characteristics in common. Upon closer examination one finds that in each of the genera are individuals which differ in character, so these are placed under species, as we see under aphis.

		(gossypii
		(maidi-radici
	(Aphis .....	(pomi
	(	(rumicis
	(	
(Aphididae .....	{ Anuraphis	roseus
(	{ Brevicoryne	brassicae
(	{ Erisoma	lanigerum
(	{ Myzus	cerasi
(		
(	(Aspidiotus	perniciosus
(	(Chionaspis	furfura
(Coccidae .....	(Lepidosaphes	ulmi
(	(Pulvinaria	vitis
(		
Homoptera .....	(Cicadidae .....	Magiccicada septendecim
(		
(		
(	(Empoasca	maligna
(Cicadellidae .....	(Erythroneura	comes
(		
(	(Membracidae .....	Ceresa bubalus
(		

SOME IMPORTANT ECONOMIC INSECTS

Common name	Order	Family	Genus	Species
<b>APPLE AND PEAR.</b>				
<b>Aphids:</b>				
Apple aphid	Homoptera	Aphididae	Aphis	pomi
Rosy apple aphid	Homoptera	Aphididae	Anuraphis	roseis
Woolly apple aphid	Homoptera	Aphididae	Eriosoma	lanigerum
Buffalo treehopper	Homoptera	Membracidae	Ceresa	bubalus
canker worm, Spring	Lepidoptera	Geometridae	Paleacrita	vernata
Codling moth	Lepidoptera	Olethreutidae	Carpocapsa	pomonella
curculio, Apple	Coleoptera	Curculionidae	Tachypterellus	quadrigibbus
curculio, Plum	Coleoptera	Curculionidae	Conotrachelus	neuphar
<b>Fall webworm</b>	Lepidoptera	Arctiidae	Hypantria	cunea
Flat-headed apple tree borer	Coleoptera	Buprestidae	Chrysobothris	remorata
leafhopper, Apple	Homoptera	Cicadellidae	Empoasca	maligna
Oriental fruit moth	Lepidoptera	Olethreutidae	Grapholitha	molesta
Oyster-shell scale	Homoptera	Coccidae	Lepidosaphes	ulmi
Pear slug	Hymenoptera	Tenthredinidae	Eriocampoides	limacina
Periodical cicada	Homoptera	Cicadidae	Magdicada	septendecim
Round-headed apple tree borer	Coleoptera	Cerambycidae	Saperda	candida
San Jose scale	Homoptera	Coccidae	Aspidiotus	perniciosus
Scurfy scale	Homoptera	Coccidae	Chionaspis	furfura
Shot-hole borer	Coleoptera	Scolytidae	Scolytus	rugulosus
Snowy tree cricket	Orthoptera	Gryllidae	Cecanthus	niveus
tent caterpillar, Eastern	Lepidoptera	Lasiocampidae	Malacosoma	americana
<b>BEAN.</b>				
Bean-aphid	Homoptera	Aphididae	Aphis	rumicis
Bean leaf beetle	Coleoptera	Chrysomelidae	Cerotoma	trifurcata
Bean weevil	Coleoptera	Mylabridae	Acanthoscelides	obtectus
Mexican bean beetle	Coleoptera	Coccinellidae	Epilachna	varivestis
<b>CABBAGE.</b>				
Cabbage aphid	Homoptera	Aphididae	Brevicoryne	brassicae
Cabbage looper	Lepidoptera	Noctuidae	Autographa	brassicae
Cabbage maggot	Diptera	Anthomyiidae	Hylemyia	brassicae

SOME IMPORTANT ECONOMIC INSECTS - (Continued)

Common name	Order	Family	Genus	Species
<u>CABBAGE. (Conta.)</u>				
Imported cabbage worm	Lepidoptera	Pieridae	Ascia	rapae
Harlequin bug	Hemiptera	Pentatomidae	Murgantia	histrionica
<u>CHERRY.</u>				
Black cherry aphid	Homoptera	Aphididae	Myzus	cerasi
Cherry fruit fly	Diptera	Trypetidae	Rhagoletis	cingulata
Pear slug	Hymenoptera	Tenthredinidae	Eriocampoides	limacina
<u>CORN.</u>				
Chinch bug	Hemiptera	Lygaeidae	Blissus	leucopterus
Corn earworm	Lepidoptera	Noctuidae	Heliothis	obsoleta
Corn root aphid	Homoptera	Aphididae	Anuraphis	maidi-radicis
Corn rootworm	Coleoptera	Chrysomelidae	Diabrotica	duodecimpunctata
Corn wireworm	Coleoptera	Elateridae	Melanotus	communis
Cutworms:				
Bronzed	Lepidoptera	Noctuidae	Nephelodes	emmedonia
Glassy	Lepidoptera	Noctuidae	Sidemia	devastatrix
Black	Lepidoptera	Noctuidae	Agrotis	ypsilon
Variegated	Lepidoptera	Noctuidae	Lycophotia	margaritosa
Stalk borer	Lepidoptera	Noctuidae	Papaipema	nebris nitela
White grubs	Coleoptera	Scarabaeidae	Lachnosterna	spp.
<u>COTTON.</u>				
Boll weevil	Coleoptera	Curculionidae	Anthonomus	grandis
Cotton leaf worm	Lepidoptera	Noctuidae	Alabama	argillacea
Cotton fleahopper	Hemiptera	Miridae	Psallus	seriatus
Cotton aphid	Homoptera	Aphididae	Aphis	gossypii
<u>CUCUMBER.</u>				
Melon aphid	Homoptera	Aphididae	Aphis	gossypii
Spotted cucumber beetle	Coleoptera	Chrysomelidae	Diabrotica	duodecimpunctata
Squash beetle	Coleoptera	Coccinellidae	Epilachna	borealis
Striped cucumber beetle	Coleoptera	Chrysomelidae	Diabrotica	vittata



SOME IMPORTANT ECONOMIC INSECTS - (Continued)

Common name	Order	Family	Genus	Species
<u>FORAGE CROPS.</u>				
Alfalfa caterpillar	Lepidoptera	Pieridae	Colias	eurytheme
Clover leaf-weevil	Coleoptera	Curculionidae	Eyera	punctata
Clover root curculio	Coleoptera	Curculionidae	Sitona	nispidula
Clover seed chalcid	Hymenoptera	Chalcididae	Bruchophagus	gibbus
Field cricket	Orthoptera	Gryllidae	Gryllus	assimilis
Green clover worm	Lepidoptera	Noctuidae	Plathyrena	scabra
Soil webworms	Lepidoptera	Crambidae	Crambus	trisectus, et al
Stalk borer	Lepidoptera	Noctuidae	Papaipema	nebris nitela
Wireworm, corn	Coleoptera	Elateridae	Melanotus	communis
<u>FOREST AND SHADE TREES.</u>				
Bagworm	Lepidoptera	Psychidae	Thyridopteryx	eohemeraciformis
Catalpa sphinx	Lepidoptera	Spangidae	Ceratonia	catalpae
Cecropia moth	Lepidoptera	Saturniidae	Samia	cecropia
Chestnut weevil	Coleoptera	Curculionidae	Curculio	rectus
Common meadow grasshopper	Orthoptera	Tettigoniidae	Orchelimum	vulgare
Cottony maple scale	Homoptera	Coccidae	Pulvinaria	vitis
Elm leaf beetle	Coleoptera	Chrysomelidae	Galerucella	xanthomeleena
Hickory borer	Coleoptera	Cerambycidae	Cyllene	caryae
Katydid	Orthoptera	Tettigoniidae	Amblycorypha	oblongifolia
Locust borer	Coleoptera	Cerambycidae	Cyllene	robiniae
Locust leaf miner	Coleoptera	Chrysomelidae	Chalepus	dorsalis
Tent caterpillar	Lepidoptera	Lasiocampidae	Malacosoma	americana
Walnut caterpillar	Lepidoptera	Notodontidae	Datana	intererrima
White-marked tussock moth	Lepidoptera	Liparidae	Hemerocampa	leucostigma
<u>GARDEN.</u>				
Asparagus beetle	Coleoptera	Chrysomelidae	Crioceris	asparagi
Blister beetles:				
Ash-gray	Coleoptera	Meloidae	Macrobasis	unicolor
Black	Coleoptera	Meloidae	Epicauta	pennsylvanica
Gray	Coleoptera	Meloidae	Epicauta	cinerea
Striped	Coleoptera	Meloidae	Epicauta	vittata
Horseradish flea beetle	Coleoptera	Chrysomelidae	Phyllotreta	armoraciae

Common name	Order	Family	Genus	Species
<u>GARDEN. (Contd.)</u>				
Onion thrips	Thysanoptera	Thripidae	Thrips	tabaci
Tarnished plant bug	Hemiptera	Miridae	Lygus	pratensis
Zebra caterpillar	Lepidoptera	Noctuidae	Ceramica	picta
<u>GENERAL FEEDERS.</u>				
Blister beetles	See GARDEN			
Cutworms	See CORN			
Carolina grasshopper	Orthoptera	Acrididae	Dissosteira	carolina
Differential grasshopper	Orthoptera	Acrididae	Melanoplus	differentialis
American grasshopper	Orthoptera	Acrididae	Schistocerca	americana
Red-legged grasshopper	Orthoptera	Acrididae	Melanoplus	fulvum-rubrum
Spotted cucumber beetle	Coleoptera	Chrysomelidae	Diabrotica	duodecimpunctata
Tarnished plant bug	Hemiptera	Miridae	Lygus	pratensis
Wireworms	See CORN, WHEAT, and FORAGE			
<u>GRAPE.</u>				
Grape berry moth	Lepidoptera	Olethreutidae	Polychrosis	viteana
Grape leafhopper	Homoptera	Cicadellidae	Erythroneura	comes
Grape rootworm	Coleoptera	Chrysomelidae	Eidia	viticida
Imported currant worm	Hymenoptera	Tenthredinidae	Pteronidea	ribesii
<u>HOUSEHOLD.</u>				
Bedbug	Hemiptera	Cimicidae	Cimex	lectularius
Cat flea	Siphonaptera	Pulicidae	Stenocephalides	felis
Case-bearing clothes moth	Lepidoptera	Tineidae	Tinea	pellionella
Webbing clothes moth	Lepidoptera	Tineidae	Tineola	biselliella
Dog flea	Siphonaptera	Pulicidae	Ctenocephalides	canis
German cockroach	Orthoptera	Blattidae	Blattella	germanica
American cockroach	Orthoptera	Blattidae	Periplaneta	americana
Housefly	Diptera	Muscidae	Musca	domestica
Indian-meal moth	Lepidoptera	Pyralidae	Plodia	interpunctella
Meal moth	Lepidoptera	Pyralidae	Pyralis	farinalis
Mosquitoes	Diptera	Culicidae	Culex	pipiens, et al
Oriental cockroach	Orthoptera	Blattidae	Blatta	orientalis

SOME IMPORTANT ECONOMIC INSECTS - (Continued)

Common name	Order	Family	Genus	Species
<u>HOUSEHOLD. (Contd.)</u>				
Silverfish	Thysanura	Lepismatidae	Lepisma	saccharina
Stablefly	Diptera	Muscidae	Stomoxys	calcitrans
Termites	Isoptera	Rhinotermitidae	Reticulitermes	flavipes, et al
Pharaoh's ant	Hymenoptera	Formicidae	Monomorium	pharaonis
Little black ant	Hymenoptera	Formicidae	Monomorium	minimum
<u>LIVESTOCK.</u>				
Cat flea	Siphonaptera	Pulicidae	Ctenocephalides	felis
Chicken louse	Mallophaga	Menoponidae	Menopon	biseriatum
Dog flea	Siphonaptera	Pulicidae	Ctenocephalides	canis
Hog louse	Anoplura	Haematopiniidae	Haematopinus	suis
Black horsefly	Diptera	Tabanidae	Tabanus	atratus
Sheep tick	Diptera	Hippoboscidae	Melophagus	ovinus
Stablefly	Diptera	Muscidae	Stomoxys	calcitrans
<u>MELON.</u>				
Melon aphid	Homoptera	Aphididae	Appis	gossypii
Spotted cucumber beetle	Coleoptera	Chrysomelidae	Diabrotica	duodecimpunctata
Striped cucumber beetle	Coleoptera	Chrysomelidae	Diabrotica	vittata
<u>PEACH AND PLUM.</u>				
Oriental fruit moth	Lepidoptera	Clethreutidae	Grapholitha	moesta
Oystershell scale	Homoptera	Coccidae	Lepidosaphes	ulmi
Peach borer	Lepidoptera	Aegeriidae	Conopia	exitiosa
Plum curculio	Coleoptera	Curculionidae	Conotrachelus	nenuphar
San Jose scale	Homoptera	Coccidae	Aspidiotus	perniciosus
<u>POTATO.</u>				
Blisters beetles	See GARDEN.			
Colorado potato beetle	Coleoptera	Chrysomelidae	Leptinotarsa	decemlineata
Potato aphid	Homoptera	Aphididae	Illinoia	solanifolii
Potato flea beetle	Coleoptera	Chrysomelidae	Epitrix	cucumeris
Potato leafhopper	Homoptera	Cicadellidae	Empoasca	fabae
Sweetpotato flea beetle	Coleoptera	Chrysomelidae	Chaetocnema	confinis

SOME IMPORTANT ECONOMIC INSECTS - (Continued)

Common name	Order	Family	Genus	Species
<u>SHRUBS.</u>				
Oystershell scale	Homoptera	Coccidae	Lepidosaphes	ulmi
Rose aphid	Homoptera	Aphididae	Macrosiphum	rosae
Rose chafer	Coleoptera	Scarabaeidae	Macrodactylus	subspinosus
Rose sawfly	Hymenoptera	Tenthredinidae	Caliroa	aetnlops
Scurfy scale	Homoptera	Coccidae	Chionaspis	furfura
Spirea aphid	Homoptera	Aphididae	Apiis	spiraecola
<u>SQUASH.</u>				
Squash bug	Hemiptera	Coreidae	Anasa	tristis
Squash beetle	Coleoptera	Coccinellidae	Epilachna	borealis
Squash borer	Lepidoptera	Aggeriidae	Melittia	satyriniformis
<u>STORED GRAINS.</u>				
Angoumois grain moth	Lepidoptera	Gelechiidae	Sitotroga	cerealella
Saw-toothed grain beetle	Coleoptera	Cucujidae	Oryzaephilus	surinamensis
<u>TOBACCO AND TOMATO.</u>				
Tobacco worm	Lepidoptera	Sphingidae	Protoparce	quinquemaculata
Tomato fruit worm	Lepidoptera	Noctuidae	Heliothis	obsoleta
Tomato worm	Lepidoptera	Sphingidae	Protoparce	sexta
<u>WHEAT.</u>				
Grainch bug	Hemiptera	Lygaeidae	Blissus	leucopterus
Hessian fly	Diptera	Cecidomyiidae	Phytophaga	destructor
Wheat jointworm	Hymenoptera	Chalcididae	Harmolita	tritici
European wheat midge	Diptera	Cecidomyiidae	Thecodiplosis	mosellana
Wheat wireworm	Coleoptera	Elatерidae	Agriotes	mancus
<u>PARASITIC INSECTS.</u>				
Braconid wasps	Hymenoptera	Braconidae	Aphidius	spp.
Braconid wasps	Hymenoptera	Braconidae	Microgaster	spp.
Ichneumonid wasp	Hymenoptera	Ichneumonidae	Megarhyssa	lunator, et al
Tachinid flies	Diptera	Tachinidae	Phorocera	claripennis, et al

SOME IMPORTANT ECONOMIC INSECTS - (Continued)

Common name	Order	Family	Genus	Species
<u>PREDACEOUS INSECTS.</u>				
Aphis lion	Neuroptera	Chrysopidae		
Fiery hunter	Coleoptera	Carabidae	Calosoma	calidum
Ground beetle	Coleoptera	Carabidae	Calosoma	scrutator
Ground beetle	Coleoptera	Carabidae	Harpalus	caliginosus
Ground beetle	Coleoptera	Carabidae	Lebia	grandis
Ground beetle	Coleoptera	Carabidae	Foecilus	lucublandus
Convergent ladybeetle	Coleoptera	Coccinellidae	Hippodamia	convergens
Nine-spotted ladybeetle	Coleoptera	Coccinellidae	Coccinella	novemnotata
Ladybird beetle	Coleoptera	Coccinellidae	Ceratomygilla	maculata
Spined soldier bug	Hemiptera	Pentatomidae	Podisus	maculiventris
Syrphid fly	Diptera	Syrphidae	Syrphus	americanus





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