

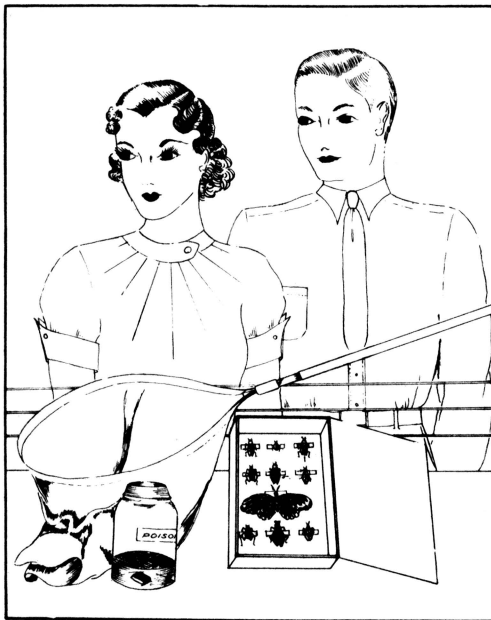
# 4-H ENTOMOLOGY CLUB

## I—STUDY OF INSECTS

4-H CLUB CIRCULAR 50 *a*

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### COOPERATIVE EXTENSION WORK IN AGRICULTURE AND HOME ECONOMICS

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THE 4-H ENTOMOLOGY CLUB PROJECT I - STUDY OF INSECTS\*

INTRODUCTION - ENTOMOLOGY AND ITS IMPORTANCE

Entomology, the study of insects, is a type of work which has been going on since the dawn of civilization. In fact, historians say that the struggle between man and insects for supremacy began long before the dawn of civilization. The Bible contains many chapters in which insect plagues are mentioned. This fight, no doubt, will continue as long as the human race endures. It has been said that man is but a child of nature and that he can profit from a study of the laws of life in general.

The struggle between man and insects is caused by both men and certain insects constantly wanting the same things. The fight is sometimes a bitter one and man does not always win out. This is, perhaps, due to the fact that insects undoubtedly were upon the earth long before man and were adapted to it when civilization began. Sometimes we forget ourselves and think that man has become lord and master over nature, but as a rule, experience teaches us differently. This is true with insects. If grasshoppers want our crops, they help themselves. If others, such as certain flies, want the blood of our livestock, they will not hesitate to help themselves before our very eyes. Should certain ones choose to live with us, they usually succeed in doing so. Even our health may be seriously affected by them, for house flies and mosquitoes are known to carry certain dreaded diseases. The struggle between man and insects is not limited just to the United States alone, but all humanity on the earth is involved.

Not all insects are destructive in habits. In fact, less than one per cent of the known forms are harmful. The remainder are either beneficial or neutral in habits. Many insects feed upon other insects. The lady bird beetle is a common example.

From this, we see that it behooves us as young people and as constant workers with nature to familiarize ourselves with a study of life that so affects our every day affairs.

\*This circular was prepared by George D. Jones, Extension Specialist in Entomology, in collaboration with T. T. Martin, State Club Agent.

Acknowledgement is hereby made for use of illustrative material taken from the following sources:

U. S. Department of Agriculture.

Farmers' Bulletin No. 1601: Figures 55, 56, 57, 58, 59, 60, 61, and 62.

Elementary Entomology - Sanderson-Jackson: Figures 7, 8, 9, 10, 11, 12, 13, 17, 18, 21, 22, 23, 24, 25, 27, 28, 29, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 48, 49, 50, 51, 52, 53, and 54.

Destructive and Useful Insects - Metcalf-Flint: Figures 1, 2, 4, 6, 12, 14, 15, 16, 19, 20, 26, 30, and 47.

Handbook of Nature Study - A. B. Comstock: Figure 5.

4-H Insect Club Manual - M. P. Jones, U. S. Dept. of Agriculture.

## PROJECT REQUIREMENTS

Object.- The object of the 4-H Entomology Club Project I - Study of Insects is to familiarize rural boys and girls with a group of animal life that affects their living; to teach them something about insect development in order that they can better understand control efforts; to help them to know more about their surroundings; and to demonstrate to them and to the community the importance of knowing more about insect life; and to train the members in leadership.

Work Required.- Each member is required:

1. To study the parts of an insect, such as grasshoppers; to know the difference between a complete and incomplete life cycle; and to know the two types of mouthparts that insects have.
2. To learn to separate insects into certain groups or orders, such as beetles, flies, etc.
3. To learn how and to make a killing jar, a collection box, labels and perhaps a net and spreading board.
4. To collect, pin and label properly 25 common insects and have at least five of the important groups or orders represented.
5. To observe control operations against insects and to make a study of the ways in which insects affect crop and animal production, the home buildings, forests and health.

Records Required. - Each member is required to keep an accurate account of this project, and to write a story on the report blank provided by the Extension Service of the Missouri College of Agriculture. Additional records are to be kept in a scrap book.

Ownership Required. - No expense will be required, except probably to provide materials for making a catching net and a killing jar and possibly a spreading board. It is suggested that the local leader secure as many of the different materials as possible and distribute the cost among the club members. Much of the necessary equipment can be furnished by the individual members. The cost of additional materials should not be over 25 or 30 cents per member.

Time Required. - Time necessary to do the following:

For attendance at six or more club meetings, field trips, tours, etc.

For necessary work on the project.

For attendance at a public achievement program at the close of the year's club work.

Organization.-These clubs should be organized in February, March, April or May; and should be completed by October.

## ORGANIZATION

### The Standard 4-H Club

A standard 4-H club is composed of a group of five or more boys and/or girls from the same community between the ages of 10 and 21 years, who are working upon the same club project under the direction of a local club leader.

Each standard club usually is sponsored by a community organization of some kind, or by a small committee of interested persons, who are selected to speak and act for the community in cooperation with the county club leader in the conduct of 4-H club work.

Standard 4-H clubs are required to hold at least six regular meetings during the club year. These meetings may be conducted as often as the local club leader and members desire, however, the meetings usually are conducted once each month.

Below are suggested problems for a number of club meetings. It may be necessary to devote two or more meetings to the same subject and to change the order of some of the meetings as an adjustment to the seasons of the year. Local club leaders and members are expected to adapt these subjects to local community conditions.

### Optional Activities

The members of each club also will have an opportunity to study some optional activity in addition to the regular insect study if desired, such as Everyday Courtesies, Wild Flowers of Missouri, etc.

#### SUGGESTED SUBJECTS FOR THE STUDY OF INSECTS

1. Organization of the Club. - The local club leader in charge. (Reference: The Club Secretary's Record Book or the Leader's Manual.)
  1. Explanation of the duties and responsibilities of club officers and members.
  2. Election of club officers from the membership of the club. (President, Vice-President, Secretary- Treasurer, Song-Leader, and Reporter.)
  3. Selection of a name for the club. (So as to identify the club's community and this project.)
  4. Selection of a time and place for regular club meetings.
5. Instructions. - The local club leader in charge.
  - (1) Distribution of the club literature and explanation of its use.
  - (2) Explanation of the Entomology I - Study of Insects project requirements and the standard 4-H club requirements.
  - (3) Adoption of the constitution and by-laws, as amended

to suit local conditions. (The members may indicate their desire to carry out this project by signing their names as a pledge on blanks below the constitution and by-laws in the Club Secretary's Record Book.)

(4) Setting Entomology Club Goals, as:

- a. Every member will carry out or help carry out on his or his neighbor's farm at least one insect control recommendation.
- b. Every member will teach at least one other person something about insect developments and the two kinds of mouth parts.
- c. Every member will identify at least two beneficial insects.
- d. Every member will attend each club meeting.

(It is suggested that the club set up its own goals or adopt one or more of the above, and write them out on blanks provided in the Club Secretary's Record Book.)

(5) Discussion of the main club activities for the year and setting up of a local club calendar of events for the club, including community and county-wide events in which the members desire to take part. (See blanks in the Club Secretary's Record Book.)

(6) Assignment of work for the next club meetings, as:

- a. Assignment of the national 4-H club pledge to be learned by all members before the next meeting. (See suggested outline of Meeting II.)
- b. Bringing or report blanks for use in the club meeting.
- c. Reference: The Study of Insects and a Few Facts About Them, Chapter II, page 14 (See Meeting II, page 7, for detailed assignment).
- d. Assignment of one or more topics to be used in response to roll call at the next meeting, as:
  - (a) Give a standard 4-H club requirement.
  - (b) Name at least two ways an insect differs from a dog.
  - (c) Name one way in which one can always identify an insect.
  - (d). Tell how insects breathe.
  - (e) In order to make the regular club meetings more interesting, it is suggested that the local leader encourage the members to appoint a program committee at the next club

meeting to feature some special number at each club meeting, such as: a reading, dialogue, musical selection, story, debate, or talk by an invited guest, and possibly a one-act, home talent play for some program during the year.

(7) The Social Hour. - (Recreation and games.)

II. The Study of Insects and a Few Facts About Them. - (Probably in April.)

1. The Business Meeting. - The Club officers in charge. (Reference: The Club Secretary's Record Book.)

(1) Meeting called to order by the president who leads the members in repeating the national 4-H club pledge, as follows:

"I pledge my head to clearer thinking, my heart to greater loyalty, my hands to larger service, and my health to better living, for my club, my community and my country."

(2) Roll call by the secretary, the members responding by reporting upon the previously assigned topics.

(3) Reading of the minutes of the last club meeting by the secretary, which should be adopted as a permanent record by the club when approved.

(4) Unfinished business.

a. Business from the last meeting or previous meetings.

b. Committee reports.

(5) New Business:

a. Appointment of a program committee to plan for special activities at future club meetings.

b. Appointment of a social committee.

c. Anything for the benefit of the club, such as a picnic, club tour, special meeting, club dramatics, etc.

(6) Songs, led by the song leader.

(7) Adjournment of the business meeting for work.

2. Instructions. - The local club leader in charge.

(1) Discussion: The Study of Insects and a Few Facts About Them, Chapter II, Page 14.

a. What is Entomology?

b. What per cent of all insects are harmful?

c. How many legs do insects have?

- d. Do all insects have wings?
  - e. Do all insects have four different stages in their life cycle? Can you name one common insect that does have all four stages?
  - f. Do all insects have three different stages in their life cycle? Can you name one common one that has three stages in its life cycle?
  - g. Do insects have eyes? Can they be moved around?
- (2) Demonstration: Take a grasshopper and name and locate as many parts of body as possible.
- (3) Assignment of work for the next club meeting, as:
- a. References, Kinds of Insects, Chapter III, page 20, (See Meeting III, page 8 for detailed assignment.)
  - b. Bringing of report blanks for use in the club meeting.
  - c. Assignment of one or more topics to be used in response to roll call at the next meeting, as:
    - (a) Name a standard 4-H club requirement.
    - (b) Tell how many different kinds of insects have been named.
    - (c) Tell why it is important that each particular kind of an insect be named.
    - (d) Name the number of large groups or orders into which the various kinds of insects are divided.
    - (e) Name the eight groups or orders that will be studied.

3. The Social Hour. - (Recreation and games.)

III. The Kind of Insects. - (Probably in May.)

- 1. The Business Meeting. - The club officers in charge. (Follow order of business as suggested for Meeting II.)
- 2. Instructions.- The local club leader in charge.
  - (1) Discussion: The Kinds of Insects, Chapter III, page 20.
    - a. How many insects have been named to date?
    - b. Why is it important that each particular kind be named?
    - c. Why are scientific names in Latin?



- d. Into how many groups or orders are insects divided?
- e. Can you name the eight groups that will be studied?
- f. Do all insects in each group have the same kind of mouthparts? The same kind of life cycle?

(2) **Demonstration:** Collect three different kinds of insects; and by the use of the information describing each group or order, place each insect into the group it belongs.

(3) **Assignment of work for the next meeting, as:**

- a. **Reference:** Preparation of Equipment for Collection and Preservation of Insects, Chapter IV, page 40 (See Meeting IV, page 9, for detailed assignment.)
- b. Bringing of report blanks for use in the club meeting.
- c. Assignment of one or more topics for roll call, as:
  - (a) Name a standard club requirement.
  - (b) Name materials needed to make a **collection** box.
  - (c) Name material needed to make a killing jar.

3. The Social Hour. - (Recreation and games.)

IV. Preparation of Equipment for Collection and Preservation of Insects. - (Early summer, probably not later than June.)

1. The Business Meeting. - The Club officers in charge. (Follow order of business suggested for Meeting II.)

2. Instructions. - The local club leader in charge.

(1) **Discussion:** Preparation of Equipment for Collection and Preservation of Insects, Chapter IV, page 40.

- a. What materials are used to kill the insects in the killing jar?
- b. Why is it important that a poison label be placed on the killing jar?
- c. What would be done if a killing jar should be accidently broken?
- d. Why is a piece of cardboard used in the bottom of the collection box?
- e. Why is a moth ball put in the collection box? Does it ever need to be replaced?

- (2) Demonstration: Each member should make a killing jar. Each club member should make a collection box with a moth ball firmly stuck in place.
- (3) Assignment of work for the next club meeting, as:
- a. Reference: Collection and Pinning of Insects, Chapter V, page 42. (See Meeting V, page 10, for detailed assignment.)
  - b. Bringing of report blanks for use in the club meeting.
  - c. Assignment of one or more topics for roll call, as:
    - (a) Name a standard club requirement.
    - (b) Give one reason why it is important to have a collection of insects.
    - (c) Name materials needed to properly pin an insect.
    - (d) Name three facts that should be put on each label.
3. The Social Hour. - (Recreation and games.)
- V. Collection and Pinning of Insects. - (Early summer, probably not later than June or July.)
1. The Business Meeting. - The club officers in charge. (Follow order of business suggested for Meeting II.)
  2. Instructions. - The local club leader in charge.
    - (1) Discussion: Collection and Pinning of Insects, Chapter V, page 42.
      - a. Of what value is an insect collection?
      - b. Why should insects be taken out of the killing jar after one or two hours?
      - c. Why should all insects be pinned after the collection trip, even if time does not permit for proper labelling?
      - d. What information should be put on each label?
      - e. Why is it important to properly pin insects?
    - (2) Demonstration: Each club member should collect at least three specimens, pin, label and place them in a box.
    - (3) Assignment of work for the next club meeting, as:
      - a. Reference: Field Trip for Collection of Insects (To garden, hay field or pasture), Chapter VI, page 44 (See Meeting VI, page 11, for detailed

assignment.)

- b. Bringing of report blanks for use in the club meeting.
- c. Assignment of one or more topics for roll call, as:
  - (a) Name a standard club requirement.
  - (b) Name kinds of equipment needed for the field trip.
  - (c) Name materials needed for pinning and labeling after the field trip.

3. The Social Hour. - (Recreation and games.)

VI. Field Trip for Collection of Insects. - (Summer, probably in July.)

- 1. The Business Meeting. - The club officers in charge.  
(Follow order of business as suggested for Meeting II.)
- 2. Instructions. - The local club leader in charge.
  - (1) Discussion: Field Trip for Collection of Insects (To garden, hayfield or pasture.) Chapter VI, page 44.
    - a. What equipment is needed for the field trip?
    - b. What materials are needed for pinning specimen after the field trip is over?
    - c. Why is it important to use care in opening and closing the killing jar?
    - d. How would you collect an insect which may sting?
  - (2) Demonstration: Individual team demonstration on how to open and close a killing jar, using an insect which may sting.
  - (3) Assignment of work for the next meeting, as:
    - a. Reference: Field Trip for Collection of Insects. (To woods, stream, crops or pasture.) Chapter VII, page 45. (See Meeting VII, page 12, for detailed assignment.)
    - b. Bringing of report blanks for use in the club meeting.
    - c. Assignment of one or more topics for roll call, as:
      - (a) Name a standard club requirement.
      - (b) Name the groups or orders of insects found on the field trip.
      - (c) Name beneficial kinds of insects found.

(d) Name insects observed to be causing damage.

(e) Name one water insect that may be seen on the next field trip.

3. The Social Hour. - (Recreation, games, etc.)

VII. Field Trip for Collection of Insects. - (For summer work in August.)

1. The Business Meeting. - The club officers in charge. (Follow order of business as suggested for Meeting II.)

2. Instructions. -

(1) Discussion:

- a. How many different groups or orders of insects were found on the last field trip?
- b. Which beneficial kinds were found?
- c. What harmful kinds were found?
- d. What neutral or non-harmful kinds were seen?
- e. Were both chewing and sucking kinds observed?

(2) Demonstration: Individual or team demonstration on how to spread a butterfly.

(3) Assignment of work for the next club meeting, as:

- a. Reference: Tour of Study Control of Certain Insects, Chapter VIII, page 46 (See Meeting VIII, page 12, for detailed assignment.)
- b. Assignment of individual demonstrations to be given at next meeting as try-out to make the club demonstration team.
- c. Bringing of report blanks for use in the club meeting.
- d. Assignment of one or more topics for roll call, as:
  - (a) Name materials needed for tours.
  - (b) Name the two general types of insects that may be seen.
  - (c) Name insects seen which have incomplete life cycle.

3. The Social Hour. - (Recreation, games, etc.)

VIII. Tour to Study Control of Certain Insects. - (For summer work, July, August or September.)

1. The Business Meeting. - The club officers in charge. (Follow order of business suggested for Meeting II.)

## 2. Instructions. -

- (1) Discussion: Tour to Study Control of Certain Insects, Chapter VIII, page 46.
  - a. What two types of mouthparts do insects have?
  - b. What are the names of the stages in the incomplete life cycle?
  - c. What are the names of the stages in a complete life cycle?
  - d. Are some insects harmful in both nymph and adult stages? Give an example.
  - e. Are some insects harmful in both the caterpillar and adult stages? Give an example.
  - f. Are some insects harmful only in the caterpillar stage?
- (2) Demonstrations: Individual demonstrations by all members as try-outs to be one of the club demonstration team.
- (3) Assignment of work for the next club meeting, as:
  - a. Reference: The 4-H Entomology Club Achievement Program. (See Meeting IX, page 13, for detailed assignment.) (See page 47 for exhibits)
  - b. Bringing of completed report blanks to give to the leader before the achievement club program is held.
  - c. Appointment of committees to help prepare for the achievement club program and conduct it, as:
    - (a) Committee on arrangements, place, equipment, etc.
    - (b) Committee on decorations, if desired.
    - (c) Courtesy committee to welcome visitors and to act as ushers, if needed.

## 3. The Social Hour. - (Recreation and games.)

- ### IX. A Suggested 4-H Entomology Club Achievement Program. - (To be held when the club work is completed.)
1. A regular 4-H club meeting, with the club officers in charge.
  2. An exhibit of all the club members' collections and the scrap books.
  3. Story of life history of one common insect, giving:
    - (1) Name.

- (2) Where it feeds, plant or animal.
  - (3) How it feeds, chews or sucks.
  - (4) Kind of life cycle, complete or incomplete, number of generations.
  - (5) How it spends the winter.
  - (6) Describe habits. (Give methods of control, if harmful insect is being discussed.)
4. Report on work of year, giving name of each insect in collection and other general information.
  5. A team demonstration of an approved entomology practice.
  6. An insect identification contest.
  7. Talk by the local club leader, a representative of the sponsoring organization or parent, on the value of entomology club work.
  8. Plans for next year.
  9. Presentation of club achievement pins, if awarded, by the extension agent or a representative of the local sponsoring organization.
  10. A 4-H club play or dramatic presentation of some kind.
  11. Adjournment. -

Suggestions: - Only club members who make a complete report or have their records up-to-date should be eligible to take part in county or state contests, club camps, etc.

## II. THE STUDY OF INSECTS AND A FEW FACTS ABOUT THEM

What is Entomology? Entomology or the study of insects is a very interesting science. It deals with the study of a group of animals that have been on earth a long time and that are capable of adapting themselves to almost any condition. Some live in water, others in the soil, some in cold climates, while others

thrive best under warm conditions. Certain insects may attack only some one particular crop, while others prefer different crops, animals, or many other things.

### General Information

Less than one per cent of all the known forms are harmful. The other 99 per cent are either neutral or beneficial in habits. Of all the known different kinds of animals on the globe, the various kinds of insects make up about 75 per cent of them all. Something like 700,000 different kinds have been discovered, properly named and described. Many new ones are being discovered each season in different parts of the world. Some workers estimate that there are probably over 2,000,000 different forms of insects. It is indeed interesting to learn that less than one per cent of all the known forms are classed as harmful. This small percentage of insects is estimated to cause over one billion and a half dollars (\$1,500,000,000) of damage each year in the United States alone. Some workers show that approximately ten per cent of every crop grown each year, taking the country as a whole, is destroyed by insects. Insects frequently play an important part in the development of farming practices.

So much is said about insects and their destructive habits that one may forget that there are many insects which are beneficial. Countless numbers are of value to man. Some destroy other insects. The common lady beetle is a well known example. Without the help of these beneficial insects, man could not control many of the harmful ones. A large proportion of the food of many of our fishes is made up of insect life. Many fish depend almost entirely on certain forms found in water. Many fur bearing animals and birds live almost entirely on various insects. The honey bee performs a great service to mankind in pollination work. No doubt, many apple crops and certain clover seed crops are due to the work of various bees. The production of figs is dependent almost entirely on the presence of a very tiny wasp which pollinates the flowers.

### How Insects Compare With Other Animals

Insects have certain definite things about them which

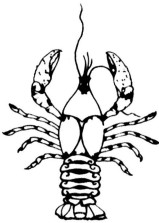


Fig. 1 Crab Fish



Fig. 2 Spider



Fig. 3 Centipede



Fig. 4 Tick

distinguish them from other animals. Examine one carefully. The possession of three pairs of legs, wings and three body regions distinguish them from their closest relatives in the animal world. What are the names of some of their closest relatives? The thousand legged worms, crayfish, ticks and spiders are very common animals which are closely related to insects. They are not true insects, according to the above definition. However, entomologists usually deal with them.

Size.—Most insects are rather small in size. Many are so small that a magnifying glass is necessary to study them. Some of the worst enemies of man, such as the mosquito, are not large. No doubt, one of the greatest factors in the success of insects is their small size. This makes it possible for them to retreat into small places and find protection.

Skeleton.—Insects have no bones, but are covered over the outside with a hard shell-like material. This covering usually is not heavy, and is lighter and stronger than bone. As a protective armor, it cannot be improved upon. This outer covering protects the muscles, nerves and other internal organs. Insects have their skeleton on the outside of their bodies.

See how many ways you can think of that an insect differs from a dog and a chicken. The dog's skeleton is on the inside of its body and has four feet. The chicken has feathers and has only two feet.

### Divisions of Body

We usually say that insects have three body regions, the head, thorax and abdomen. The thorax or middle section always bears the jointed legs and wings, if they are present. A very characteristic thing about adult insects is the presence of three pairs of jointed legs. In regard to wings, we find a variation of conditions. The grasshopper, most beetles and butterflies have two pairs. No insect has more than four wings or two pairs, which is the typical number. Some have only one pair, such as the house fly. A good many are wingless throughout life. Insects never have wings until they are full grown or in the adult stage.

Insects have body parts that perform the same functions which are common to all animals. The smallest insects are as

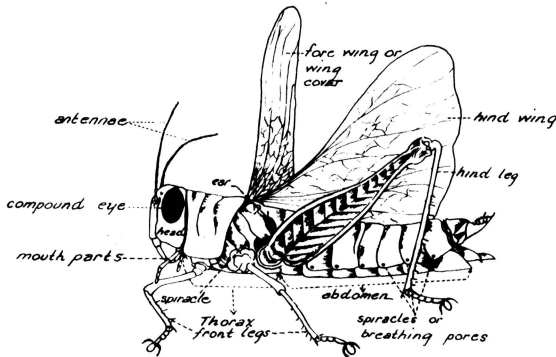


Fig. 5 Diagram Showing Body Region and Parts of Grasshopper

perfectly formed as the largest. They are just as perfect in development as the cat or the elephant. Naturally, the organization is complex in such a small body.

Feelers.—Insects have a pair of feelers or horns on their heads. The proper name is antennae and none of the other animals,



except the close relatives of the insects, have anything to compare with these organs. These "feelers" are very sensitive and it is with these organs that many insects locate their food, detect danger and in various ways sound out their environment.

Eyes.—The vision of most adult insects is considered rather poor. Their eyes are very complicated. Most typical insects have two large compound eyes and three simple eyes. The compound eye does not have an eyelid like our eyes do. It is made up of many parts, all of which are stationary and do not move. With many insects the simple eyes are difficult to find.

### How Insects Get Their Food

Insects feed in two general ways. They either tear or pinch off or chew up a plant, or they pierce the plant or animal with their needle-like mouthparts and suck out the plant juices or blood. Practically all insects can be grouped in a general way into these two groups.

#### Diagrams Showing Chewing and Sucking Mouth Parts



Grasshopper (chewing)



Mosquito (sucking)

In deciding how an insect injures a plant or animal, one may ask the question, "Does it eat holes in the plant or does the plant appear wilted?" After the food is swallowed, it undergoes digestion just like in other animals. Insects have a heart that pumps blood, but no blood vessels so the blood simply bathes all parts of the body. They can digest many things which the human system cannot digest, such as wood and wool. Some live on tobacco and other substances which would be dangerous for us to eat.

### How Insects Breathe

Insects have neither nostrils nor lungs. They have a series of holes along each side of the body which are called spiracles. (See illustration.) Most of these paired openings are located on the abdomen. The spiracles are connected with all organs of the body by means of a series of very small tubes. The living cells in the various parts of the body withdraw the oxygen from the air in these tiny tubes. They also give off waste gases in this same manner.

### How Insects Hear

Insects do not have ears on the sides of the head. However, some of them have organs which serve as ears. The antennae of the male mosquito is thought to pick up sound waves from the female mosquito.

In crickets, the hearing organ is found on each front leg; and in grasshoppers, it is thought to be located on the first segment of the abdomen. (See illustration.)

## Muscular Activity

Insects have a large number of muscles and all are perfect in working together. They are capable of tremendous work and remarkable endurance. Many beetles fly great distances. Honey bees make a large number of trips to collect nectar. Their wings move so fast that we cannot see them move.

## The Life Cycle of an Insect

What about the life of an insect? From where do the full grown or adults come? This is the most interesting part about insects. Generally speaking, all insects develop from eggs. To most of us, this makes us think of birds and chickens. With insects, the eggs hatch and the larva emerge from the shells. These may be called caterpillars or worms (larva of butterfly and moth), or may be maggots (larva of flies), or grubs (larva of beetles), or nymphs (immature stages before wings develop).

The larval or immature stage is the only stage in which growth takes place. This is the period when most feeding is done. Since the outer covering of insects is so hard and firm, insects can grow only by shedding their skins and growing a new one. The new skin at first is soft and elastic, but soon it becomes hardened like the old one. The shedding of the skin is called moulting. Some insects shed their skins four or five times during the growing period. Others may moult twenty or more times.

## Complete Life Cycle

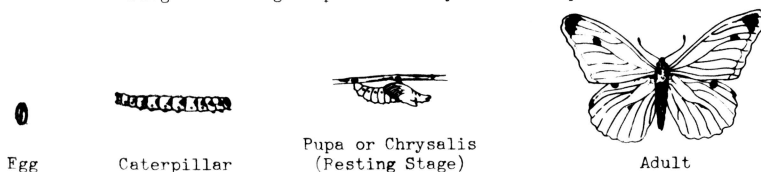
With the insects having the complete life cycle of four distinct stages in development, egg, larva, pupa and adult, the larva when full grown changes its skin and its form and becomes a pupa. (See illustration.)

This may be known as the transformation stage in which very wonderful changes take place within the body itself. The larva during the pupal stage changes into the adult stage. Usually, the pupa has no power of moving around, although it may squirm if disturbed. The pupa of the mosquito is an exception. This stage in the mosquito is called the "tumbler". Some of the larvae make small cavities in the soil in which the pupas rest during the transformation period. Many larvae of the moths spin about themselves a silk covering which is called a cocoon. Much of our finest silk is made from the cocoons of the silk worm. The covering or cocoon is very tough and will protect them from the weather and enemies. Each cocoon is composed of a single, continuous thread. There are about 1,000 feet of thread in each silk worm cocoon. The larvae of butterflies do not make a silk cocoon. The pupa which is without a covering may be found suspended to some object by a silk thread. The pupa of a butterfly is called a chrysalis.

After a period of time, varying from a few days to several months, depending on the insect and the climate, the pupa skin (or chrysalis) bursts open and from it emerges the adult insect with its complex body structure as already discussed. After an insect reaches this adult stage, it never grows any more, hence a small fly never becomes a larger fly, a small beetle, a larger beetle. Some insects feed very little in the adult stage. Others, like the grasshopper, feed heavily. It seems that nature intends that the purpose of the adult stage is to lay eggs and

thus continue its kind. Insects, having the four distinct stages

Diagram Showing Complete Life Cycle Metamorphosis.



in their growth, egg, larva, pupa and adult, are said to undergo a complete change or metamorphosis.

### Incomplete Life Cycle

Not all insects pass through the inactive stage known as the pupa stage. With some, the young resemble the adult form as soon as they hatch from the egg. The grasshopper is a well known example. These insects have to shed their skins just like the others in order to accommodate growth in size. Insects which do not go through all four stages, such as the egg, the larva, the pupa, the adult, are said to have incomplete or gradual metamorphosis.

Diagram Showing Incomplete Life Cycle or Metamorphosis



What are the young, undeveloped forms called? The young of these insects are called nymphs instead of larvae. There are only three stages in the life cycle of these insects, the egg, the nymph and the adult. Among other common insects, besides the grasshopper, having the incomplete life cycle are the squash bug, the cricket, the katydid, the aphid, the roaches and the chinch bug.

### Can Insects Think?

Do insects have a brain and do they have the power to think? Insects do have a brain, but they lack both reason and judgement. However, they seem to know instinctively that they have a purpose and as long as life persists within them, they continue to get a living for themselves and prepare for the next generation. The behavior of a mosquito when one is trying to sleep is a good example of this fact.

Insects have the ability to quickly adapt themselves to new surroundings. Certain insects within a few years have been known to adapt themselves to new host plants. The common Colorado potato beetle is an example of this. For years they fed only upon the sand bur and bull nettles in Colorado, but after the potato crop was introduced they began feeding on it and today have spread to practically all parts of the United States. Unless killed by poisons, they can soon ruin a potato crop.

## Reproduction

Insects reproduce very rapidly. This may be due to the fact that each female lays a large number of eggs and that there may be more than one generation each year. An insect goes through one generation when it completes its life cycle from the adult stage through the egg stage to the adult again. Some insects have only one generation each year, while others may have 5 or 6 or even more during the season. There are both males and females among insects. Males and females are about equally divided in numbers.

### III. KINDS OF INSECTS

It has been mentioned before that there are some 700,000 different kinds of insects in the world today which have been identified, named and classified. There are, no doubt, twice or three times this number which have not been identified. So, in order to keep all the insects identified properly, certain scientific names are applied to them. If this were not done and if no specific name were applied to a given insect, there would be considerable confusion and we would not always be able to know just which insect we are talking about. The scientific names are written in Latin, which is considered the foundation of all languages, and are accepted by all scientists in all countries. If we say that a potato beetle is eating our potato vines, it could be that anyone of at least three different beetles would be causing the damage, but if the scientific name by which it is known were given, then any entomologist, whether he be in the United States, Germany, Japan, or any other country, would know exactly which insect was causing the damage.

If we attempted to study and identify all the 700,000 different kinds of insects, we would have a very large task. Some would have wings, while others would not have wings. Some would get their food by eating plant foliage, while others would get theirs by sucking out the plant juices or animal blood. There would be many variations. We find, however, that all of the some 700,000 various kinds of insects can be sub-divided into a few large groups, just as we might divide all four-footed animals into such groups as horses, cows, elephants and so on. The insects in each group have several common characteristics. There are some twenty of these large groups. The insects in some of the groups are not as common as in others. Only eight of the most common groups or orders, as they are called, will be studied.

#### Study of Eight Common Groups or Orders

Eight large groups are outlined below. A few characters are given for each group. With a little practice one will be able to place many common insects in the groups to which they belong. The groups listed do not cover lice, fleas and a large number of other insects, but many of the common insects readily available can be classified in the group each represents. In using the following so-called key, take the insect that is to be studied and note number of wings, if any, and the wing characteristics. Study the wing characters of the eight groups and see which one of the groups it most closely resembles. If one is still not sure, check the specimen with the list of common insects found on pages 24-25. Only full grown or adult insects should be used for identification work. Detailed identification keys which would enable one to identify a great number of insects

are not included because of the space required and the need for magnifying equipment to enable one to study the small body characters which often have to be examined before exact identification can be made. The work in this project is arranged only for the elementary study of insects and for getting acquainted with only a few of the most common ones. Insofar as possible, it will, no doubt, be best if the members confine their study to the common insects listed.

GROUP I - Grasshoppers, Crickets, Roaches

(Order - Orthoptera)

Number of wings - two pairs; front pair leathery; rear pair folds under them.

Size - usually large

Length of legs - usually long

Antennae - usually long

Kind of mouthparts - chewing

Kind of life cycle - gradual or incomplete



GROUP II - True bugs, such as Squash Bug, Chinch Bug, Harlequin Cabbage Bug, Water Strider

(Order - Hemiptera)

Number of wings - two pairs (when present); front pair only half leathery; rear pair folds beneath front pair.

Size - May vary considerably but as a whole medium sized

Length of legs - Medium to short

Kind of mouthparts - Adapted for both piercing and sucking, folds under head and body.

Kind of life cycle - Gradual or incomplete



GROUP III - Beetles, such as Colorado Potato Beetle, Blister Beetle, Lady (bug) Beetle, Tumble (bug) Beetle

(Order - Coleoptera)

Number of wings - two pairs, front pair horny throughout; rear pair clear and folded beneath front pair. Wings usually long enough to cover entire body.

Size - May vary considerably

Length of legs - Medium to short

Antennae - Varies from short to long

Kind of mouthparts - Chewing



Kind of life cycle - Complete

GROUP IV - Butterflies and Moths, such as Monarch Butterfly, Cabbage Butterfly, Army Worm Moth, Cut Worm Moth.

(Order - Lepidoptera)

Number of wings - Two pairs, when present: wings veined and are covered with overlapping scales (dust-like particles).



Size - Varies considerably with both moths and butterflies.

Length of legs - Medium length in comparison to remainder of body.

Antennae - Varies both in size and shape, depending on kind of insect.

Kind of mouthparts - Adapted for both lapping and sucking.

Kind of life cycle - Complete.

GROUP V - Flies, such as House Fly, Mosquito, Gnats, Sheep Tick.

(Order - Diptera)

Number of wings - One pair, transparent, a pair of small knobs represent the rear pair.



Size - Usually considered small.

Length of legs - Medium to short.

Antennae - Varies from short to medium.

Kinds of mouthparts - Adapted for sucking, piercing or lapping.

Kind of life cycle - Complete.

GROUP VI - Bees, Ants, and Wasps, such as Bumble Bee, Honey Bee, Ants, Mud-dauber, Wasp and Yellow Jacket Wasp.

(Order - Hymenoptera)

Number of wings - Two pairs, when present, transparent, rear pair usually smaller than front pair.



Size - Usually considered medium to large.

Length of legs - Medium to short.

Antennae - Short.

Kind of mouthparts - Adapted for chewing, lapping or sucking.

Kind of life cycle - Complete.

GROUP VII -(Closely related to True Bug Group) Scale insects, Cicada (jar fly), Aphids.

(Order - Homoptera)

Number of wings- Two pairs, when present; front pair leathery or clear; rear pair smaller than front pair.



Size - Very small as with scales and aphids to large as with Cicada.

Length of legs - Medium to short.

Antennae - Short.

Kind of mouthparts - Adapted for piercing and sucking.

Kind of life cycle - Gradual or incomplete.

GROUP VIII - The Dragon Fly (snake doctor) and Damsel Fly.

(Order - Odonata)

Number of wings - Two pairs, wings rather long and narrow. Usually clear or banded or finely netted and of about equal size.



Size - Considered large.

Length of legs - Medium.

Antennae - Rather short.

Head - Loosely jointed to body.

Kind of mouthparts - Chewing.

Kind of life cycle - Considered gradual. Larvae live in water.

See page 24, for a list of some common insects in Missouri. Some are harmful ones and others may be classed as either beneficial or harmless. They are arranged according to their scientific classification. A brief discussion is given on each insect which will enable a person to study and identify many specimens. Insofar as possible, club members should collect only representatives found in the list.

Several Common Insects in the State

<u>Common Name</u>	<u>Genus</u>	<u>Species</u>	<u>Family</u>	<u>Order</u>
Large yellow or differential grasshopper	Melanoplus	differentialis Thomas	Locustidae	Orthoptera
Red legged grasshopper	"	femur - rubrum De Greer	"	"
Common black cricket	Gryllus	assimilis	Gryllidae	"
Roach (small tan)	Blattella	germanica	Blattidae	"
Roach (large brownish)	Periplaneta	americana	"	"
Green Katydid (angular winged)	Microcentrum	laurifolium	Tettigoniidae	"
Devil's darning needle or walking stick	- - -	- - -	Phasmidae	"
Chinch bug	Blissus	leucopterus	Lygaeidae	Hemiptera
Squash bug	Anasa	tristis De Greer	Coreidae	"
Box Elder Bug	Leptocoris	trivittatus Say	"	"
Harlequin Cabbage Bug	Murgantia	histrionica	Pentatomidae	"
Water Strider	Several different species		Gerridae	"
Colorado Potato Beetle	Leptinotarsa	decemlineata	Chrysomelidae	Coleoptera
Spotted Cucumber Beetle	Diabrotica	duodecimpunctata	"	"
Striped Cucumber Beetle		vittata	"	"
Blister Beetle (brown and striped)	Epicauta	"	Meloidae	"
Blister Beetle (Black, ash gray)	Macobasis	unicolor	"	"
Ground Beetle (black)	Many kinds		Carabidae	
Lady bird Beetle		Many species	Coccinellidae	Coleoptera
May beetle	Phyllophaga	" "	Scarabaeidae	"
Green June Beetle	Cotinus	nitida	"	"
Tumble Beetle	Aphodius	several species	"	"
Click Beetle	Many kinds		Elateridae	"
Firefly Beetle	" "		Lampyridae	"
White Cabbage Butterfly	Pontia	rapae	Piceridae	Lepidoptera
Monarch Butterfly	Danaus	archippus	Nymphalidae	"
Common Ear Worm Moth	Heliothis	obsoleta	Noctuidae	"



<u>Common Name</u>	<u>Genus</u>	<u>Species</u>	<u>Family</u>	<u>Order</u>
Cotton Leaf Worm Moth	Alabama	argillacea	Noctuidae	Lepidoptera
Swallow-tail Butterfly	Many kinds		Papilioninae	"
Luna Moth	Tropaea	luna	Saturniidae	"
Sphinx or Hawk Moth	Many kinds		Sphingidae	"
Tiger Moths	" "		Arctiidae	"
House Fly	Musca	domestica	Muscidae	Diptera
Stable Fly	Stomoxys	calcitrans	"	"
Black horse fly	Tabanus	atratus	Tabanidae	"
Sheep Tick	Melophagus	ovinus	Hippoboscidae	"
Mosquitoes	Many kinds		Culicidae	"
Robber Flies	" "		Asilidae	"
Bot Flies	" "		Oestridae	"
Honey Bees	Apis	mellifica	Apidae	Hymenoptera
Bumble Bee	Bombus	Many kinds	Bombidae	"
Wasps (mud dauber yellow jacket)	Several kinds		Several	"
Ants	" "		"	"
Damsel Flies	" "		"	Odonata
Dragon Flies	" "		"	"
Aphids	Many kinds		Aphididae	Homoptera
Cicada	" "		Cicadidae	"
Leaf Hoppers	" "		Cicadellidae	"
Scale Insects	" "		Coccidae	"

GRASSHOPPERS, ROACHES, CRICKETS  
AND OTHERS.  
(Order-Orthoptera)

Large Yellow or Differential Grasshopper. - The large yellow or differential grasshopper is one of the most common grasshoppers in the State. It is one of the largest grasshoppers, being when full grown about one and one-half inches in length. Its color is yellowish green. It is



Fig. 6 Differential Grasshopper

most generally found in corn and hay fields. It is considered to be one of the most destructive grasshoppers in the State. It passes the winter in the egg stage. From 30 to 100 eggs are in a pod and they are deposited in the soil.

Red Legged Grasshopper. - The red legged grasshopper is a medium sized kind and very common in all sections of the State. It is about one inch long when full grown and of a general brownish-red color. The hind legs are



Fig. 7 Red Legged Grasshopper

red in color with black spines. It is generally found in hay, clover, alfalfa and corn fields and pastures. It often is one of our most destructive grasshoppers in the State. This grasshopper, too, passes the winter in the egg stage in the soil.

Common Black Cricket. - The common black cricket is very familiar to most everyone. It is known best perhaps for its familiar chirp. It is about one inch long when fully developed and the color may vary from black to brown. The wings lie flat on the back when at rest,

instead of meeting edge fashion as with the grasshopper. The crickets are generally distributed and may be found usually under objects in hay fields, pastures, meadows and in grain fields. Sometimes on rare occasions they harm crops. Crick-

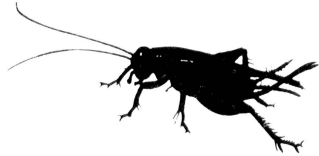


Fig. 8 Common Black Cricket

ets spend the winter in the egg-stage in the soil.

Roach (small tan). - The small tan roach, called the German roach, is about one-half inch long when full grown. Like all the other roaches, this roach is active mainly at night and in dark places. They feed



Fig. 9 German Roach

on many kinds of material such as paper, foods, garbage and the like. They are very objectionable because of their foul odor and filthy habits. They hide in cracks and crevices during the day time and their abundance is usually under-rated.

Roach (large brownish). - Another common roach is the large brownish one which is about one and one-half inches long when fully developed. This roach has habits similar to the one described above. The life cycles of roaches are the same. The eggs are laid in a pod-like capsule. The eggs hatch and the small roaches look like the adult one, except they do not

have wings. Development is

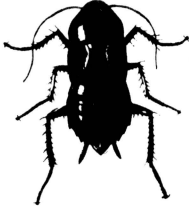


Fig. 10 American Roach

rather slow and continuous.

Katydid. - This large green insect is very similar to the grasshopper. It can be distinguished from the grasshopper by the long antennae or "feelers".



Fig. 11 Green Katydid

They may be found in most grassy areas. It passes the winter in the egg stage. The eggs are cemented to small branches and are placed in rows. They are not considered harmful.

Walking stick or Devil's Darning Needle. - These insects are extremely elongated, wingless, with long legs and long antennae.



Fig. 12 Walking Stick

They are often found feeding on foliage or resting on various objects. They appear to move

very little. The eggs are laid in mid-air and they drop to the ground where they hatch, early the following summer. It is not often that they damage foliage in the process of feeding. They spend the winter in the egg stage.

#### THE BUG GROUP (Order - Hemiptera)

Chinch Bug. - The chinch bug is a small insect, being only about one-sixth inch in length when full grown. The body color is black. They give off a vile but distinctive odor when crushed. One will always remember it



Fig. 13 Chinch Bug

if he ever smells the odor. They winter over as adults in most any kind of shelter during the winter. They can be found, as a rule, in most every clump of grass or grasses along the south side of roads and fence rows. They fly to small grain fields in the spring where eggs are laid and the spring brood of small red bugs develop. Another brood develops in corn fields in late summer from which they migrate to protected places for the winter. They are considered one of the worst crop pests.

Squash Bug. - The squash bug is well known to every gardener. It is a sap sucking insect, like all of the members in the true bug family. The adult bugs are brownish-black in color and about 2/3 inch long when mature. The adult bugs may be seen beneath the lower leaves of squashes and melons and other members of this group of plants. Sometimes they are hidden beneath clods or dead leaves. Their

brownish eggs are laid in groups of 15 or 20 on the leaves and



Fig. 14 Squash Bug

then hatch to small greenish-black-legged nymphs which are easily seen when present. They are one of the worst pests that the gardener has to contend with. There are probably two generations each year. The winter is spent in the adult stage beneath trash and debris about the garden and in other places.

Box Elder Bug. - The box elder bug is mentioned because it is a rather common bug. It causes practically no injury to the box elder tree but is an annoyance during fall and winter months because of its habit of crawling about on warm days.



Fig. 15 Box Elder Bug

They often enter houses, crawl over walls, sidewalks, etc. They are a bright red and black bug about one-half inch in length when full grown. The wings are dark bordered with red. They suck the sap from the new growth of box elder and ash. The nymphs develop from eggs laid in the spring. There is probably only one generation each year.

Calico Bug or Harlequin Cabbage Bug. - This bug in the southern half of the State and

throughout the South is to cabbage and related crops what the squash bug is to squashes. They are sap sucking bugs about  $3/8$  inch long with gaudy red and black spots. They appear rather



Fig. 16 Harlequin Cabbage Bug

flat and shield shaped. The bugs lay clusters of eggs which look like tiny kegs on the leaves and these hatch into nymphs which are somewhat similar in appearance to the adult bugs. The bugs winter over in trash. There is only one generation each year.

Water Strider. - This bug is a water insect. Most boys and girls are familiar with this bug. It is brownish-black in color with a rather elongated body about one-half inch long, with

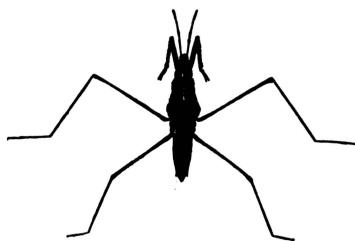


Fig. 17 Water Strider

long legs, and its head is shorter than the thorax (middle section of the body). It runs about on the surface of water very freely. It can bite and feeds by sucking the blood from other insects which may fall into the water. Its life cycle is not very well known.

BEE TL ES  
(Order - Coleoptera)

Colorado Potato Beetle.- This yellow and black striped "potato bug" beetle is perhaps the best known and most common and injurious beetle in the State. It is the very hard shelled striped beetle about  $\frac{3}{8}$  inch long with its black-red, black spotted,



Fig. 18 Colorado Potato Beetle

soft bodied young or grubs found devouring the potato plants. They are a pest practically every year. This beetle used to feed on weeds until the potato was grown on a large scale. It began feeding on potatoes and soon spread over most of the United States. It passes the winter in the adult stage in the soil and when spring comes emerges and lays its yellowish eggs in masses on the under sides of the potato vines. There are probably two complete broods in Missouri each year.

Striped Cucumber Beetle.-This beetle is a very serious pest of cucumbers and melons and other related crops. The beetles are familiar to most every grower. They are about  $\frac{1}{5}$  inch long, black and yellow in color, with three black stripes running lengthwise up and down the back. They winter over beneath leaves and trash about gardens and other places. In the spring, they feed

on pollen of certain trees and shrubs and fly to the melons and



Fig. 19 Striped Cucumber Beetle

other crops about the time they come up. Yellowish eggs are laid about the base of the plants and larvae find their way to the roots of the plants into which they may tunnel. They are a very serious pest. There is only one complete generation each year. They are known to carry diseases from plant to plant.

Spotted Cucumber Beetle. - This beetle is about the same size as the striped cucumber beetle but it is yellowish-green and has spots on the wing covers

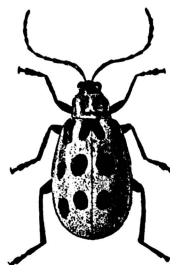


Fig. 20 Spotted Cucumber Beetle

instead of stripes. There are 12 spots on its back and it is about  $\frac{1}{5}$  inch long. It hibernates beneath grass and trash. It is more of a corn pest, but is a general feeder. The larva often damages corn roots to a very serious extent. There are probably two generations each year in Missouri.

Blister Beetles (Brown Striped). - The brown striped blister beetles, along with the other

blister beetles, are perhaps best known as the "old fashioned potato bugs". They were pests in the eastern part of the

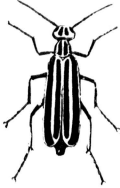


Fig. 21 Brown Striped Blister Beetle

United States before the Colorado potato beetle began its attack on potatoes. These beetles are about 1/2 to 3/4 inch long with rather prominent heads. They are about four times as long as wide and rather soft bodied. The adult stage is harmful. The larval or grub stage stays in the soil and is known to feed upon grasshopper eggs. The bodies of the adults contain a blistering agency if crushed on the skin. There is probably only one generation each year. The beetles feed upon a wide variety of plants in the garden and field.

Ash Gray Blister Beetle. - The ash gray blister beetle resembles the above beetles in every respect, except for its color.

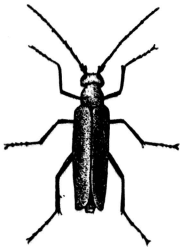


Fig. 22 Ash Gray Blister Beetle

This one is a very common species.

Ground Beetle (Black). - The black ground beetle is a common beetle. There are many different kinds of ground beetles. The black ground beetle is about 3/4

inch long and black over its entire body. The exact food habits are not well known, but they feed mostly on other insects and are considered bene-



Fig. 23 Ground Beetle

ficial. The black ground beetle may be found in grassy areas and beneath boards. They hunt chiefly at night. The larval stage with most species is also classed as beneficial. Not a great deal is known about its life habits.

Lady Beetle - (Lady Bird Beetle). - Most everybody will recognize these beneficial beetles. Many people, however, think they are harmful. The

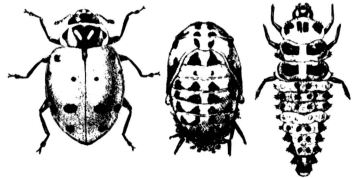


Fig. 24 Lady (Bird) Beetle

beetles, as well as the larvae, feed upon other insects such as aphids and scale and may be found on plants infested with aphids. They are about 1/8 inch long, rather roundish, usually red, brown or yellow with black spots. The eggs are laid in groups of about 25. They are yellowish in color and may be found on the leaves. There are usually several generations each year.

May Beetle. - This beetle is brown to blackish brown and about 3/8 inch long. It is short bodied and thick. It is

the adult stage of the common white grub seen in the soil

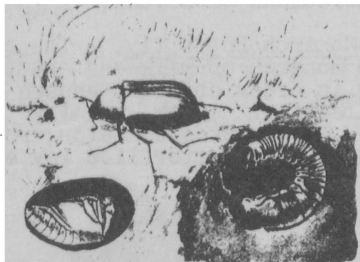


Fig. 25 May Beetle

under sod or when plowing. The white grubs are white with curved bodies and about one-half to one inch long when fully mature. The grubs cause injury to crops following sod. The adult beetle is a strong flier and flies about at night. Eggs are laid in the soil. The winter is passed in the adult and grub stage in the soil. It takes, as a rule, three years to complete the life cycle.

Green June Beetle. - This beetle is larger than the one just described, being about one inch long with the margins of the body bronze to yellow and



Fig. 26 Green June Beetle

the rest of the body green in color. The adult beetle feeds on peach foliage as well as crops, and the grubs feed on grass, roots and other vegetation in the soil. The grubs or larvae of the beetle are larger than the common white grub. They always crawl along on their backs.

Click Beetle. - These beetles are sometimes called "snapping" beetles because of the "snap" or "click" noise they make when they fall or are placed on their backs. The beetles are "hard shelled", usually brownish, grayish or nearly black in color. Eggs are laid in the soil beneath grasses. The eggs hatch



Fig. 27 Click or Snapping Beetle

into larvae which feed upon corn and other crops. The larva is usually hard shelled, smooth, wire-like and dark brown in color and is called the wireworm. Their damage is often severe in corn planted following sod.

Tumble Beetle (or bug). - This beetle is one that is very common. It was worshipped by the ancient Egyptians, because they thought the ball was a symbol of



Fig. 28 Tumble Beetle

the earth. Every boy and girl has seen this brownish black beetle with its mate rolling a ball of manure along the road side. The ball, which contains a single egg, is finally buried. The grub feeds within the ball until it is ready to pupate. These insects are considered beneficial.

Fire Fly Beetle. - To most people, these insects are called fire flies. Their twinkle in the dusk of a warm summer evening is a familiar sight. Their



Fig. 29 Fire Fly Beetle

bodies and wing covers are softer than those of most beetles. Most fireflies are medium sized beetles about half-an-inch long and of a dull color. The mid-body region or thorax is extended so as to cover the head. They fly only at night. The "glow" or light is produced by light organs in the abdominal segments. The larvae feed on other insects. There is usually one generation each season.

BUTTERFLIES  
(Order - Lepidoptera)

Imported Cabbage Butterfly. - Early in the spring, a white butterfly with small black blotches or spots on the wing may be seen flying about the



Fig. 30 Importea Cabbage Butte.fly

gardens. They may be observed to alight frequently on cabbage plants. The butterfly glues its yellowish eggs on the underside of a leaf. The eggs in a few days hatch into a velvet green caterpillar, which is also very familiar to most boys and girls. Then full grown they fasten themselves by the tail end to a leaf or other support and go into the pupa stage. This is called a chrysalis or pupa case and may be seen suspended from some part of the plant or other

object. This is the stage that the insect passes the winter in. There are probably three to five generations each year.

Monarch Butterfly. - The common monarch or milkweed butterfly is often abundant enough for collection. They usually are seen in pastures and along roadsides. The butterflies lay eggs



Fig. 31 Monarch Butterfly

on the foliage of the milkweed plant and the eggs hatch into dark green, black ringed caterpillars which feed upon the foliage. After the caterpillars become full grown they go into the chrysalis stage (pupa), which may be seen attached to a portion of the plant. This butterfly is known to migrate south in great numbers as the birds each fall and then return in the spring.

Swallow Tail Butterfly. -- There are several different kinds of swallow tail butterflies. The black and yellow,



Fig. 32 Swallow Tail Butterfly

the jet black and the blue are a few of the most common. These butterflies are rather large and may be found in grassy fields, pastures and the like. They all



have the tail-like projection on the hind wings. There are usually two or more generations each year.

Small Blue or Copper Colored Butterflies. - These butterflies are small in size, the largest with probably not over 3/4 inch



Fig. 33 Small Blue or Copper Colored Butterflies

wing spread. These may be seen as they flit along the roadside. Some are blackish with thread-like tails extending from the hind wings and others are blue or copper colored.

#### MOTHS

(Order - Lepidoptera)

A discussion of only a few moths will be given because it is very difficult to discuss moths briefly in such a way that proper identification can be made. There are so many forms that club members will have to confine their collections to only a few, otherwise they will simply have to be identified as moths.

Luna Moth. - The Luna moth is a rather common representative of the group of our largest



Fig. 34 Luna Moth

moths. In this group is found

the silkworm moth, the cecropia and many others. The Luna moth which has about a four inch wing spread is a brilliant green moth with long tails projecting from the hind wings. It is frequently attracted to lights on warm evenings in early summer. Each wing bears a small eye spot and the fore part of the front wings is purplish in color. It may be bred from cocoons found attached to twigs of maple and other trees.

Hawk Moths. - This group of moths is sometimes called humming bird moths because some of the various kinds are larger than humming birds. They resemble the humming bird in flight



Fig. 35 Tobacco Worm Moth

and quite frequently may be seen flying about petunias and similar flowers on warm summer evenings. The tobacco and tomato worm moth are of this type. These lay the eggs which hatch into small caterpillars and they in turn develop into the large greenish horn-worms which devour tobacco and tomato plants. The moths are recognized from their long, spindle-shaped bodies, strong, narrow wings and thick antennae which often are curved at the top. The moths are entirely harmless and cannot bite people, and the worms cannot sting with their spine.

The Owlet (or night flying) Moths. - This group of moths is made up of a large number of different kinds of moths. They are not readily distinguished one from the other. Color variations and markings are similar and only an expert can identify them. The caterpillar stages

are known by many people for many in this group are the worst pests that farmers have to contend with. This group will make up the majority of the moths as a rule that a collector will



Fig. 36 Corn Ear Worm Moth

catch. They are attracted to lights and are sometimes called "millers". The moths, speaking generally, are grayish or brown, with a wing expanse of from about one or one and one-half inches to three inches. They usually have stout bodies. The forewings are rather narrow, short and stout, and crossed with wavy lines and often with spots on them. The hind wings are usually plain but often with bright colors. Various cutworms, the corn ear worm, army worm, fall army worm, cotton leaf worm and others make up this group.

#### FLIES (Order - Diptera)

House Fly. - Because of its disease carrying habits, the house fly is perhaps one of the worst enemies of man. Most boys and girls will be able to recognize it because of its wide distribution and the fact that it



Fig. 37 House Fly

is the commonest fly found in the home. It passes through its life cycle from egg to maggot

(larva) to pupa to adult fly in a very few days when conditions are favorable. One fly probably lays as many as 500 eggs on the average. They may winter over as adults as well as pupa or larvae. The house fly cannot bite since the mouth parts are not adapted for taking in food in this manner. They lap and suck up their food.

Stable Fly. - The stable fly closely resembles the house fly but is found especially on the animals' legs; and around animals, it usually is more common than the house fly. They do



Fig. 38 Stable Fly

not frequent dairy barns as much as the house fly but they may be carried into the barn on cattle in large numbers. However, in stormy weather the stable fly may come into houses and bite people about the ankles. They are active during the day in the stable or in the field. They may pass the winter as larvae and pupa in manure or wet, decayed straw. Such materials are ideal for them to breed in during the summer. There are several generations each season.

Black or Brown Horse Flies. - The large black or brown heavy



Fig. 39 Horse Fly

bodied flies attacking animals are familiar to most boys and

girls. They probably are worse in low places or swampy areas. The flies develop in swampy or wet places. The larval stage lives in water or in the mud about lakes, streams or wet areas of land and the insect usually passes the winter in this stage. There may be more than one generation each season.

Bot Flies. - Most boys and girls are familiar with the bum-



Fig. 40 Bot Fly (Horse)

ble-bee like flies that buzz around horses' legs and throats during the summer months and glue yellowish eggs to the hairs. These insects are flies and are very bad pests. The eggs hatch when moistened by licking or biting and the young maggot or grub thus gets into the mouth and eventually into the stomach and intestines where it attaches itself to the lining of the walls of the digestive tract. By spring, the young "bots" are full fed and pass to the ground where they transform to adult flies.

Sheep Ticks. - The sheep "tick" is one of the most remarkable insects known. It is not a tick, like the dog tick for instance, but a louse-like fly that has lost its wings. It spends its entire life on the sheep. The adults and immature forms or "nits" may be found during any season of the year on the animals. The adult tick is wingless, six-legged, brownish in color, with a sac-like abdomen. The "nits" or eggs are not eggs. The adult tick does not

lay eggs but gives birth to the full grown maggot, which is glued to the wool. The outer covering of the maggot soon



Fig. 41 Sheep Tick

changes to a dark color and inside this the maggot or larva goes into the pupa stage and from this the adult tick or "louse-like" fly emerges. There may be several generations each year.

Mosquitoes. - These insects are well known to all boys and girls. Only the female mosquitoes bite. It has been proven that mosquitoes carry certain diseases, such as malaria and yellow fever. In some countries



Fig. 42 Common Mosquito

civilization has been greatly retarded by these diseases which are carried from person to person only through the bites of mosquitoes. The common mosquitoes found around rain barrels and in such places in this State do not carry either of these dreaded diseases. The French failed in building the Panama Canal largely because of yellow fever. After 1900 when American army surgeons discovered that the disease was spread by a certain kind of mosquito, conditions have improved immensely. There are probably more than 350 different kinds of mosquitoes in

North America. Their life cycles are very similar and they breed in stagnant water and damp places. Eggs are laid in such areas and soon hatch into "wrigglers" which transform to active pupae called "tumblers". From these the adult mosquitoes emerge. The "wrigglers" and "tumblers" can only get air by coming to the surface of water. Their entire life cycle can be observed in any rain barrel where water is permitted to accumulate. There are usually several generations each year.

Robber Flies. - These are well named flies, being large, heavy and ferocious looking. They are strong and swift fliers. They may be found around shrubs, in pastures and among trees. They are grayish in color, sometimes marked with white, yellow or black. They have a long tapering abdomen, long, narrow wings and large eyes. Robber flies catch other insects on wing and their larvae feed mostly on other insects or other small creatures in the ground or in rubbish. The adult flies may



Fig. 43 Robber Fly

be seen to dart out from a bush and buzz about after an insect. They suck out the blood of their prey. There is only one generation each season in most cases.

#### BEES, WASPS AND ANTS (Order-Hymenoptera)

Honey Bees. - Probably no other insect has been so closely associated with man as has the honey bee. Until the development of cane sugar, honey was the most common sweet and it was a rare treat in any home. The

keeping of bees is a well developed art and much ancient as well as modern literature on the subject is available. The honey bee was brought to America by early colonists and the so-called wild bees are descendants from these. There are three forms in every colony, the queen, the workers and the drones. The queen lays all the eggs in the colony and is properly called the mother of the colony. The eggs are laid in cells and each develops into a bee. The workers are the forms seen at work. The drones are fewer in number and are larger than the workers,



Fig. 44 Honey Bee (Worker)

more blunt and broader in shape. The drones do not have a stinger. There are several kinds of honey bees and they all go through the egg, larvae, pupa and adult stages to development. Honey bees are very helpful in pollination work of many fruits and other crops.

Bumble Bees. - Bumble bees are very common and every farm boy and girl is familiar with them. They are very beneficial and much of the seed crop of red clover is dependent on the work of these bees. There are three forms among bumble bees just like with honey bees. The



Fig. 45 Bumble Bee (Queen)

queens are larger than the workers or drones and are the only ones that carry over the winter. In the spring, the queens find

an abandoned mouse nest or other shelter and in it place a small ball of pollen and honey with her eggs. These hatch into larvae which feed on the pollen, and life in the colony continues very much like that of the honey bee. Additional broods or generations follow and all live in the same nest. When fall comes, the queens fly away and select a protected place in which to hibernate until spring.

Wasps (mud-dauber). - Of the many different kinds of wasps, only two will be described. The mud-dauber wasps may be recognized by the very long thread-like petiole or "connection between the thorax and abdomen".



Fig. 46 Mud-dauber Wasp

They are the common mud-daubers that make their nests from mud and place them under the eaves of buildings and in other protected places. The nests are made up of several tubes placed side by side, each of which contains an egg and some spiders which will serve as food for the larva when it hatches from the egg. The spiders are paralyzed by the sting of the adult female wasps and they may live for several days until the wasp larva hatches from the eggs and eats them. Only female wasps can sting.

Yellow Jacket. - There are several different kinds of the so-called yellow jackets, wasps or hornets. All of them have developed habits similar to many bees. They build their nests in the ground or in buildings and often attach them to trees or

bushes. The nests are made from bits of wood chewed up and



Fig. 47 Yellow-Jacket Wasp

formed into a paste, which later dries forming a paper-like material. Man, no doubt, discovered the process of making paper from wasps. The adults feed the young developing forms in the nest on chewed up insects and fruit juices. The life cycles of these wasps are all the same and similar to bees.

Ants. - A long discussion could very easily be devoted to the many kinds of ants. We have heard much or perhaps read about these well known insects. They, in general, display remarkable intelligence and represent a highly developed organization or society. Most boys and girls will recognize many ants. Only

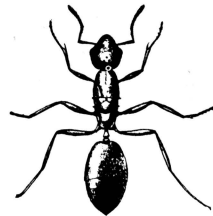


Fig. 48 Common Ant

one will be mentioned because its size will enable one to pin it, should it be collected. Ants, as a whole, are very fond of animal substances, dead insects and sweets of all kinds. Many species take care of plant lice which give off a sweetish honey dew of which they are fond. The ants are known to transport the aphids from plant to plant and otherwise care for them, even building shelters for them

as dairymen build barns for their cows. The corn root aphid is cared for by a small brown field ant and farmers have to be on the watch at times for damage. Some ants are slave holders, capturing the ants in other colonies and maintaining them in servitude. The life cycle of the ant includes all four stages of development and in many ways are organized in the colony like honey bees. The large black carpenter ant tunnels out dead or dying trees, logs and timbers and may be found about these objects quite abundantly.

**DRAGON AND DAMSEL FLY**  
(Order - Odonata)

Dragon Fly (Snake Feeder or Snake Doctor). - This insect is a very common one and many believe they are harmful. They are not harmful and are not poisonous in any way. The adults as well as the immature stages feed upon other insects. The larvae or nymphs live in water. The adults which usually are dark colored with blue, green or



Fig. 49 Dragon Fly

metallic luster have long, narrow, powerful wings of about equal size. They hold their wings horizontally when at rest. The adults usually are most abundant around and near streams and are important enemies of mosquitoes.

Damsel Fly. - This insect is very closely related to the dragon fly and both the adult and immature stages are predacious on other insects. The adults are somewhat smaller but look very much like the adult dragon flies. Damsel flies, however, can be distinguished easily from

dragon flies. They hold their



Fig. 50 Damsel Fly

wings vertically over the back when at rest, like a butterfly. The larvae or nymphs live in water.

**APHIDS, SCALE AND OTHERS**  
(Order - Homoptera)

This group of insects is rather closely related to the True Bug Group. It is made up of a large number of insects. Only a few representatives will be described.

Plant Lice or Aphids. - Plant lice are, perhaps, not large enough to pin, but they are very abundant and most plants are subject to attack by one or more



Fig. 51 Plant Lice or Aphids

kinds. Some refer to them as green flies. They are not over 1/10 inch long and the wingless forms are somewhat pear shaped with long legs and antennae. Aphids give off a sweetish substance called honey-dew, of which ants are very fond. Some forms of ants care for them and collect this substance, moving the aphids as the food supply becomes exhausted. Aphids can reproduce very rapidly and the vast amount of injury usually is due to this fact. They are sap

sucking insects. During the summer months, the females give birth to young and these in turn are all females and capable of reproduction in a few days. Many kinds pass the winter in the egg stage.

Scale Insects. - Some of the worst insect pests of the fruit orchard belong to this group. Another, the mealy bug, is common to greenhouses. There are many kinds but one can usually find scale insects on trees, shrubs or greenhouse plants. Their life cycle is somewhat



Fig. 52 Scale (Terrapin)

complicated. The female scale insects lay the eggs and these hatch into young immature forms. They are very small. They are sap sucking insects, hence they soon insert their beak and remain in place. The scale-like covering is secreted from their bodies and it serves as a protective coat. Hundreds of the scale insects may be present on one limb or branch.

Leaf Hoppers. - These insects are very common in dead leaves beneath orchard trees in the winter time. They may be found



Fig. 53 Leaf Hopper (from Grass)

on the underneath side of leaves in vineyards, orchards and in most grasses in most seasons. They usually are not over 1/4 inch long. They hop or jump off suddenly when disturbed and have

sap sucking mouthparts. One usually can collect several kinds if he sweeps his net back and forth in any meadow. Some have many colors, ranging from green to yellowish and black and red. Some forms winter over as adults, while others pass through the winter in the egg stage.

Cicada (Jar Fly). - The common "dog day" harvest fly is a well known representative of this group. It is a large insect, about one and one-half inches long, black and green in



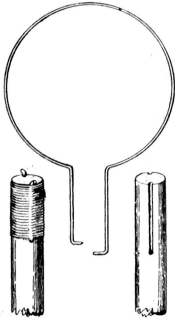
Fig. 54 Common Cicada

color and somewhat grayish underneath. The seventeen year Cicada (or Locust) is familiar to most people because of its habit of appearing every seventeen years. There are forms that occur every thirteen years and one brood or generation of these is expected in Missouri in May and June in 1937. The adults lay their eggs in twigs. The eggs soon hatch into nymphs and drop to the ground, and then begin their subterranean life of 13 or 17 years. The nymphs take food by sucking sap from the roots of plants and trees. They have only three life stages, egg, nymph and adult. Most of the common ones seen every summer require two years to complete their life cycle.

#### IV. PREPARATION OF EQUIPMENT FOR COLLECTION AND PRESERVATION OF INSECTS

A few articles are needed for collecting insects. However, most boys and girls will be able to get along with only a net, a killing jar and an empty bottle in which to place the insects after taking them from the killing jar. The net is not always essential for collecting many forms, but in collecting flying insects, it will be helpful and each member, if possible, should make one. If two or more members can work together, perhaps they can use the same net and killing jar. One will need a small box in which to place the insects after they have been studied and mounted. It is essential that every boy and girl have a box in which to keep the collection.

##### How to Make a Net



##### Materials Needed:

1. Five feet of heavy, stiff wire. This should be about the size of clothes line wire.
2. Small wood handle about three feet long. An old broom handle will be satisfactory, but something smaller will be all right.

##### Procedure:

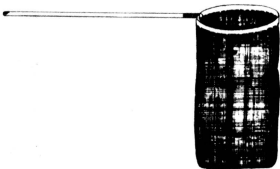
1. Bore or burn hole the size of wire about two inches from end of handle.
2. Cut groove with knife or chisel from opening of hole to end of stick (see illustration).

One should cut the shallow grooves and bore the holes in the handle at home. The grooves can be made with a wood chisel or knife. The holes should be bored about 1/8 inch deep. (Should one care to bore the hole all the way through the stick and put the ends of the wire through it, it would be all right.)

3. Piece of cloth 3 feet by 5 feet (mosquito netting or better grade of material). One may use a 50 pound sugar sack or two 25 pound sacks and sew a half-inch hem in the top. Sewing along the sides of the sack will give the net a pointed end, which is desirable. The sides may be closely trimmed. This work also may be done at home.

4. Strong cord for wrapping wire onto handle.

##### Procedure for putting together:



1. Measure wire for hoop and bend into shape.
2. Slip bag on wire.
3. Attach wire to handle and wrap securely with strong cord.

4. Reference: U. S. Department of Agriculture, Bulletin 1601, Collection and Preservation of Insects.

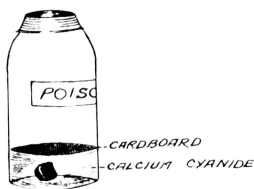
Diagram Showing Net  
Made from Flour Sack



### How to Make a Killing Jar\*

#### Materials Needed:

1. One "wide mouth" jar (about one pint size with rubber and tight lid). May use pint fruit jar.
2. Piece of cardboard (double faced corrugated preferred).
3. Small can calcium cyanide (granular kind preferred. (The local leader should secure enough calcium cyanide for all the club members.)
4. Small piece of cloth about 10 inches square.
5. "Poison" label for outside of killing jar.



#### Procedure:

1. Cut cardboard to fit tightly inside of jar. For Cyanide Jar - Place two or three tablespoons of the granular cyanide (preferred) on the piece of cloth and tightly fold into a small package and tie with string. Drop into bottom of jar. Cover with cardboard. (Disc may have to be bent in middle to get into jar. Two or three cardboard discs may have to be used.) Be sure cardboard fits tightly and holds package in place. Place lid on tight. Place poison label on outside. (It may be best to get the county extension agent to demonstrate to the leader how to use material.)

(Caution: The small amount of cyanide used will not be injurious to persons handling it, if care is used in not breathing too much of it. Do not breathe directly over poison at any time. Keep the jar closed at all times, except when opening the jar to put in or take out insects. Handle the material out in the open at all times, if possible. When one has to open the jar in a room, be sure there is plenty of fresh air at all times. If a jar gets broken, bury all pieces of the glass and the residue. Do not permit the cyanide to get in an open wound as it may cause serious results. It is not likely that the killing jar will become so weak during the collection period that it will not kill insects readily; however, if it does, one can supply the cloth - the jar with fresh material. Wash the hands carefully with soap and water after handling the material.)

### How to Make a Collection Box

#### Materials Needed:

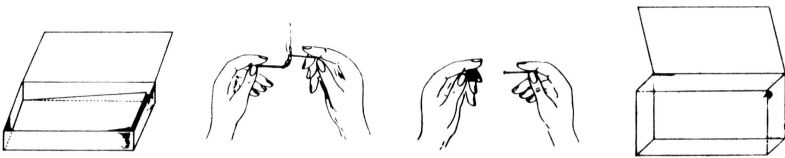
1. Cigar box about 2" x 6" x 8" or smaller box, wood preferred.
2. Piece of double-faced corrugated cardboard or soft fiber board.
3. Glue. (The local leader may purchase a sufficient quantity for the entire club.)
4. Moth ball.
5. Two or three common pins.
6. A few matches.

\* See also discussion Farmers' Bulletin 1601, pages 6 and 7.

The piece of double-faced corrugated cardboard or other board is glued into the bottom of the collection box. This material is easier than the bottom of the box to stick pinned specimens into. It also gives the box and pins added support. The moth ball will keep out other insect pests which often destroy dried specimens. The moth ball will have to be replaced about every month because it soon evaporates.

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 paper, white preferred.
4. Heat head of pin with lighted match.
5. Insert hot head of pin in moth ball and let cool.
6. Stick pinned moth ball in corner of box.



## V. COLLECTION AND PINNING OF INSECTS

The collection of insects can be made the basis of a great deal of useful instruction and information in connection with the subject of agriculture. Many teachers of agriculture, county extension agents, science instructors, as well as individual farmers, will find that a collection of the injurious as well as the beneficial forms will be interesting as well as useful in making proper identifications of insects. Exhibits of pinned specimens along with recommendations can be used for display purposes in local windows of banks, stores and in other places where people can see them.

In collecting and pinning insects, one should not leave insects in the killing bottle over one or two hours. They should be pinned immediately after each collection trip and placed in the collection box, even if time does not permit for proper labelling. They should be taken out, because if left in the jar too long, the poisonous gas may tend to darken the color of the insects. They should be pinned immediately because they soon become dry. After an insect dries out, it becomes brittle and then when one tries to pin it he may break off legs or other parts which will be essential in detailed identification work.

### How to Pin Insects Properly

Material Needed:

1. Pins. - Common stick pins may be used. One should secure the longest common pins available. For special work, regular insect pins should be used. A No. 3 insect pin will be found to be a good size for most work.
2. Insect Specimens. - For this work, club members may bring grasshopper, a bee, a beetle and a bug to the meeting, or

these may be secured during time of meeting after the business session. All specimens should be freshly killed and soft.

Note: A spreading board is not essential but if one wishes to carefully prepare butterflies or moths, a spreading board will be helpful. A wooden one is described in U. S. D. A. bulletin 1601. One may make one out of cardboard by cutting out a flat piece of



Fig. 56. Butterflies and Moths



Fig. 57 Bee

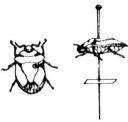


Fig. 58 Bug



Fig. 59 Beetle

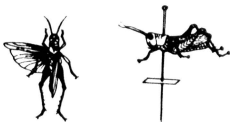


Fig. 60 Grasshopper

cardboard about 4 by 6 inches. On top of this, one may fasten with thumb tacks or pins one-inch strips of cardboard on top of each other about one-half inch apart. By using, perhaps 4 strips on each side, one can build up enough height to accommodate the depth of most any of the large insects.

#### Procedure to Follow in Pinning Insects:

1. See illustrations for place on insect's body to insert pin. With beetles, the pin goes through the wing; with others, it goes through the portion just back of the head.
2. Take insect up and hold between thumb and forefinger.
3. Start pin into the body from the top side. After the pin is through the insect's body, one can push the pin with the insect on it through a single thickness of paper and thus locate the insect on the pin near the top. All insects should be about the same distance from the head of the pin. The collection will look uneven if some are located at the base of the pin and others against the head of the pin.

#### To Spread Butterfly:

1. Insert the pin properly, then pull the wings out and around away from the body where they are folded until they are about at a 90 degree angle with reference to the body. By means of long, narrow strips of paper one can pin them in place. See illustration. After two or three days of drying on the spreading board, they may be removed, labelled and put in the collection box.

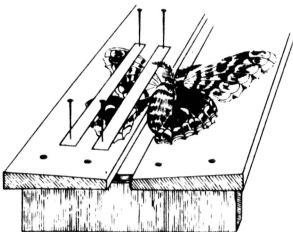


Fig. 61 Spreading Board

2. See U. S. D. A. Bulletin 1601 for reference.

Equipment Needed for Labelling:

1. Stiff white paper,  $\frac{1}{2}$ " by 1" long.

Procedure:

1. After the insects have been pinned, take the label and write or print in small letters on the lower left hand corner: (a)

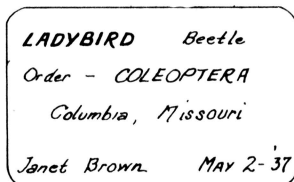
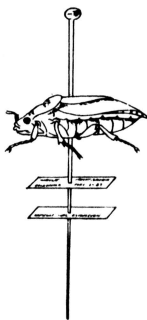


Fig. 62 Insect Pinned and Labelled

your name, (b) location and (c) date of collection. Across the top of the label, write the common name and order of the insect. Place the label just below the insect on the pin. Sometimes two labels may be used.

2. Place pinned insects, properly labelled, in box. One should be able to read the lettering on the labels when the box is examined.
3. Arrange insects in box according to groups or orders. (See part III as reference for this work.)

## VI. FIELD TRIP FOR COLLECTION OF INSECTS - MAKE TRIP TO NEARBY GARDEN, HAY FIELD OR PASTURE

In making a collection of a few common insects, one should try to get a few harmful forms as well as a few beneficial ones. The local club leader will have to be depended upon to know about which common insects are available before the field trip is taken. It would be well for the leader to make a survey of material before the meeting is held. This would help greatly in organizing the trip. Naturally, many forms will be encountered which will be difficult to identify. Perhaps they can be identified as far as the specific group or order. The fifty common insects as listed on pages 24 to 25 will be of help in the organization of this work.

Insofar as possible, the club members should take brief notes while on the collection trip and should note especially the kind of mouthparts of the insect caught, the eggs and young immature stages, if present. Notes may be taken about the amount of damage the insect has done and the effectiveness of control measures, if such are being tried. (See page 48 for space for keeping record of notes about each insect collected and placed in collection box.)

The club work in this project should stress the getting acquainted with several different kinds of insects and insofar as possible the collection of different kinds of insects. (See club requirements for the total number of insects required in collection.)

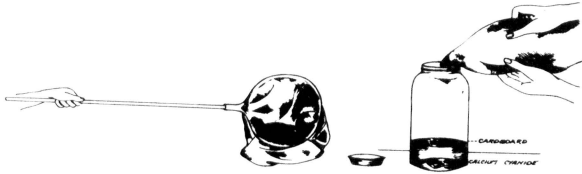
### Materials Needed for Collecting Trip:

1. Killing bottle (Review how to handle killing jar on page 41 ).
2. Collecting net.
3. Extra bottle for carrying insects taken from killing jar.

### Procedure:

Plan trip in order that some time will be left for pinning insects on return from trip.

1. Collect common insects found on trip to gardens, field crops and pastures. When collecting flying insects, one should,



after catching the insect in the net, quickly turn the hoop of the net so the side of the net will hang against the hoop (see illustration). When this is done, the insects cannot escape from the net. Catch the insect in the folds of the net with the hands, then reach inside the net and take it out carefully. When collecting an insect which stings, follow the same procedure except place the portion of the net and insect when caught with the hands in the killing jar for a few minutes. (Fasten lid as tight as possible.) After a few minutes the insects will be inactive and can be taken from the net and placed in the killing jar.

2. Collect adult forms only. (Do not collect larvae.)
3. Keep lid tight on killing jar, except when inserting or removing insects.
4. When field trip is completed, pin insects, label and place in box before club meeting is over.

### VII. FIELD TRIP FOR COLLECTION OF INSECTS - TO WOODS, STREAMS, CROPS AND PASTURES

#### Equipment Needed:

Same as in previous meeting.

#### Procedure:

Follow same procedure as in previous instructions for field trip. Some water insects may be seen on this trip.

The club members will probably collect all 25 different insect specimens during the field trip periods. Of course, if any club

member should like to make a larger collection, it will be alright.

### VIII. TOUR TO STUDY CONTROL OF CERTAIN INSECTS

In making observations on insect control work, several things should be kept in mind. It is important that one know as much about the particular insect as possible. The type of damage done and the kind of mouthparts are important. The nature of injury to the foliage is also important. Are the plants showing holes in the leaves or are they curled and wilted? What type of life cycle do the insects causing the damage have? Do they have a complete life cycle, four stages (egg, larvae, pupa, adult), or the incomplete with only the egg, nymph and adult? Where and in which stage of life cycle do they spend the winter? Is the adult or larval stage causing the damage? What is the method of control? Is the control work directed at the larvae or adult, or both? What materials are being used? How are they mixed and are they effective? How expensive is the control treatment? Is it practical? Are there more than one kind of the particular insect causing damage? These are facts that one should obtain when he studies control operations.

#### Equipment Needed for Tour:

1. Notebook and pencil.
2. Transportation.

#### Procedure:

1. Leader should arrange prior to the meeting for location of stops during the tour. Several insects and their control may be studied during one tour.
2. Try to arrange to see control measures being applied, or else study results of treatment with land owner showing how work was done.
3. Make notes about control work.
4. Some suggested work to be seen:
  - (1) Spraying for codling moth control.
  - (2) Grasshopper bait work.
  - (3) Chinch bug barrier.
  - (4) Wheat field seeded on "safe seeding date" in Hessian fly control.
  - (5) Spraying or dusting for Colorado potato beetle.
  - (6) Spraying or dusting for cotton leaf worm.
  - (7) Spraying or dusting for aphid control.
  - (8) Spraying or dusting for cabbage worm control.
  - (9) Dusting for roaches in the home.

- (10) Disposal of waste and use of screens and sprays in fly control.
- (11) Removal of stagnant water in mosquito control.
- (12) Oiling hogs to keep down lice and mange.

#### METHODS

1. Records and Reports. - Each 4-H Entomology Club member will keep a record of his project work throughout the year on the report blank provided, and submit it to the local club leader for approval when the club work is completed in the fall but before the achievement club program is held.

The local leader will include the reports of each member in his report to the county extension agent. When both the local club leader and the county extension agent approve a member's report, that member is eligible to receive an achievement club pin, if awarded in the county.

2. Preparation of Material for Displays and Exhibit.-Displays or exhibits showing insects, either the beneficial or harmful forms, can be used for various purposes. Many county agents use exhibits in their office windows. Local dealers often use them to an advantage in garden and household work. Prizes may be offered at county and state fairs for good exhibits or displays. County extension agents and teachers may want collections for their own use.

A few important essentials for preparation of an individual box or several boxes are given as follows:

1. Specimens should be pinned and labelled properly.
2. They should be arranged in rows with heads toward lid of box.
3. Several orders should be represented.
4. The box should be neat, yet simple.
5. The moth ball which is used to keep out pests should be securely located.

If a window display is developed to show control efforts of a certain pest, the following things should be stressed:

1. Show name of insect and life cycle stages and stage when most damage is caused. Show yearly activity and the number of generations during season.
2. Show type of mouth parts.
3. Display materials used in control work.
4. Give methods of preparation and rate of application of materials used to destroy the insects.
5. Show cost of treatment.
6. Give practical value of treatment.







3. Demonstrations.- Insofar as possible, all club members should be instructed in regular club meetings by the demonstration method. As a usual thing one or more members of each club can begin doing before the club useful phases of the work program soon after the processes have been demonstrated to the club by the club leader.

After two or three months of practical experience in handling real things, mature club members should be able to give public team demonstrations. The scope of the team demonstration usually should be limited to the essential processes of some practical phase of the club work of the current year on one subject. A team of two of the best demonstrators should be selected from the membership of one club, either by mutual consent, by designation of a committee, or by vote of the members, after making individual try-outs in competition. All teams should have an opportunity to demonstrate before the local club group and the people of the home community, and the championship team should represent the local club at the county achievement program or round-up, if one is held.

#### Suggested Problems for Team Demonstration:

1. Spreading of butterfly on spreading board.
  2. Pinning and labelling a beetle.
  3. Proper way to use killing jar.
- (Typical Outline of a Problem for a Team Demonstration.)

#### The Essential Steps in Collecting and Preserving Insects.

Reference: U. S. D. A. Bulletin 1601, Collection and Preservation of Insects and information in this bulletin.

Equipment and Materials: A live black ground beetle in empty glass jar. One killing jar. Insect pins, paper labels filled out properly, collection box, one moth ball, pencil and a table on which to display materials. (Stand behind table for demonstration.)

#### Procedure

##### "A" speaks and demonstrates -

"A" leads in giving a spirited club song or in repeating the national 4-H club pledge; gives brief history of the club; introduces his teammate and himself; and then explains importance of the problem.

##### 1. Collecting and Preserving Insects.

- (1) States how a collection of insects may be used and makes a statement about the importance of being able to identify several different insects, the harmful as well as the beneficial.

- (2) Methods - Killing jar, live

##### "B" assists -

"B" stands at attention until introduced, then assists "A".

Hands glass jar with

beetle in jar.

- a. Explains what the killing jar is and how it is made. Discusses other types of killing jars.

2. Procedure with killing jar. -

Explains and demonstrates the following points:

- (1) Way to open the killing jar and care to use in avoiding breathing poison fumes.
- (2) Remove beetle with "B's" assistance from an empty jar.
- (3) Drops beetle in killing jar.
- (4) Gives name of insect and where found. Tells how it breathes.
- (5) Explains length of time required to kill beetle.
- (6) Explains length of time to leave insects in killing jar, and why they should be removed.

"\_\_\_\_\_ will continue the demonstration by showing how to pin an insect properly."

live beetle and killing jar to "A" as needed.

Holds glass jar while "A" catches the beetle. Opens the killing jar (holds opening away from "A's" face) and holds it while "A" drops the beetle into the jar. Puts lid quickly on jar.

"A" assists -

Assist "B" by taking dead beetle when it is dead, from killing jar, - then closes the jar up tightly. Hands beetle to "B" when he is ready.

Hands other insect specimens to "B" as needed.

Hands lable to "B" when it is needed.

"B" speaks and demonstrates -

3. Explains and demonstrates how to proceed with pinning and labelling of insects.

- (1) Explains why it is important to pin insects while soft.
- (2) Explains kind of pins used.
- (3) Takes dead beetle from "A" and explains where pin will be inserted. Discusses briefly where the pin is inserted in other insects. (May have one or two other specimens available).
- (4) Explains why insect is located near the top of

Hands collection box to "B" when needed.

Strike match and heats head of pin, with lighted match.

Insert pin in moth ball as "B" holds it.

the pin.

- (5) Explains importance of label and necessary information on it.
  - (6) Places label on pinned specimen and places in collection box.
  - (7) Picks up moth ball and explains why it is necessary to use in protecting a collection of insects.
  - (8) Places pin with moth ball in corner of box.
- "\_\_\_\_\_ will summarize the demonstration."

"A" speaks -

Summarizes by explaining points demonstrated, about as follows:

- 1. Importance of studying insects and having a collection for identification and reference work.
- 2. Why insects should be labelled properly.
- 3. Explains how to go about identifying unknown insects.
- 4. Explains about how often moth ball has to be replaced.

Asks for questions

Answers questions or refers to teammate.

Concludes by thanking the audience for its attention.

"B" assists -

Quietly cleans up the table and puts things in order.

Stands at attention.

Answers questions referred to him.

Both clean up the table and stage

GENERAL REFERENCES

Leaders and members can secure one or more of the following publications, as available for distribution from their county extension agent:

Experiment Station Bulletins, Missouri College of Agriculture:

- B170 - Insect Pests of Field Crops
- B254 - Controlling Horn and Stable Flies on Cattle
- B305 - Bee Keeping in Missouri
- B356 - Insect Pests of the Household
- B342 - Greenhouse Pests and Their Control
- B373 - Controlling Borers of Fruit, Forest and Shade  
Trees
- C160 - The European Corn Borer
- C168 - Strawberry Insect Pests
- C169 - The Codling Moth and Its Control
- C192 - Hessian Fly Control
- E275 - Summer Chinch Bug Control

From the U. S. Department of Agriculture, Office of Information:

(Price 5¢) - Farmers' Bulletin 1601, Collection and Preservation of Insects.

Note: Most county agent offices will have a text book on Entomology which probably can be borrowed for reference use upon request.