



4-H Entomology Projects:

LEADER'S GUIDE

*Prepared by R.A. Scheibner, State 4-H Entomologist
Revised by Stephanie Bailey, State 4-H Entomologist
Direct questions to Lana Unger, Extension Entomologist, (606) 257-5107*

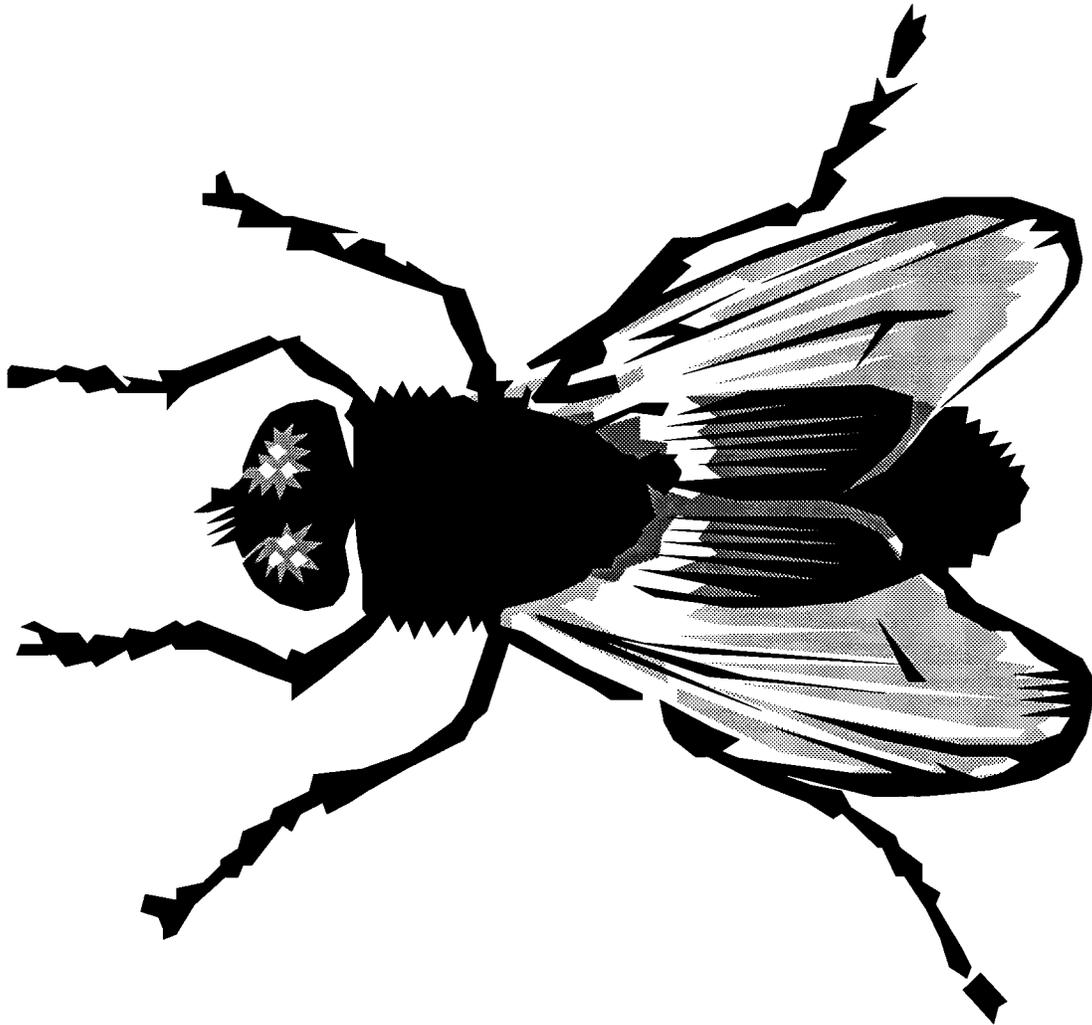


TABLE OF CONTENTS

Welcome to 4-H Entomology	2
Introduction	3
Objectives of 4-H Entomology	3
Program Aids	3
Suggested Resource Personnel	3
How to Begin Your Entomology Project	4
Suggested Programs for Club Meetings	4
Other Ideas for 4-H Entomology Meetings	4
References	5
Entomology Organizations	5
Teaching Methods and Aids	6
Questions for Leading Discussions, Quizzes or Independent Investigation	6
Suggestions for Demonstrations and Illustrated Talks	6
Field Trips or Collecting Tours	6
Experiments	7
Experiments and Studies for Members in Advanced Units	7
Games and Contests	7
Collections and Exhibits	9
Special Collections and Exhibits	9
4-H Entomology Collection Score Sheet (1st-4th Year)	9
5th Year Judging Criteria	10

Welcome To 4-H Entomology

As a volunteer leader, you are accepting one of the most important responsibilities in our world today—leading young people toward the goal of better citizenship and a better life. Extension entomologists are happy to share this experience and opportunity with you.

Although the 4-H Entomology project helps youngsters study and identify insects and related forms of life, it goes far beyond this. It provides the opportunity to learn the relationship of insects to man and the environment, and their economic impact on the community. This project presents a study of the biological sciences and deals with both domestic and wild forms of life. You will find that the 4-H Entomology project lends itself well to both urban and rural 4-H members.

Introduction

This Leader's Guide was written for you as a leader of 4-H members who are involved in entomology activities. Local leaders like you have done an excellent job encouraging 4-H'ers to learn about insects. The entomology project offers an opportunity to study this important and fascinating group in the animal kingdom. The great variety of insects and different kinds of life habits they possess afford endless opportunities for exploration.

Collecting, preserving, mounting, and assembling insects in collection boxes are activities that appeal to children and adults. As a leader in entomology, you can assist club members in making and displaying collections and mounts of insects showing life stages and damage they cause. You can help with demonstrations, illustrated talks, and research projects. An entomology project not only develops entomologists, but helps develop citizens with a greater appreciation for insects and their importance to people. (For information on careers in entomology, contact the State 4-H Entomologist, Agricultural Science Building North, Lexington, KY 40546-0091.)

You are a key person in your local 4-H club. The success or failure of your entomology program depends on your interest and initiative, but the whole load should not rest on your shoulders. Your job is to help your club members plan and carry out a program based on their needs, interests and abilities. This manual can help you be a better entomology leader.

There are many sources of help for your entomology program. Your local Extension agent can provide literature, training aids and other assistance as needed. Many friends of 4-H in commercial concerns and other organizations work in entomology through Extension agents. There might be trained entomologists in your community. Libraries, magazines, newspapers, radio, and television are also sources of information. However, your greatest asset is your own ingenuity. You are not expected to know it all. Help is available if you seek it. As a local leader, you will be able to do these things for 4-H members:

1. Help members and parents select the appropriate study area within entomology.
2. See that meetings are carried out. Arrange for group meetings and notify members in advance.
3. Assist individual members with their demonstrations.
4. Involve older members as junior and teen leaders.
5. Help members keep necessary records.
6. Assist members with their records of achievement, and help them analyze their records to see what awards programs they should enter.
7. Visit members to advise and encourage them in their work and recognize their accomplishments.
8. Encourage members' parents to become interested and involved and support the 4-H member.
9. Coordinate entomology group activities with the organization leader and other subject-matter leaders. The organization

leader and each subject-matter leader is responsible for a part of the 4-H program and each should supplement the other's work.

10. Help 4-H members develop demonstrations in subject matter to present at 4-H meetings, school assemblies, civic clubs, television programs, and other community affairs.
11. Submit information to county Extension agents about meeting plans, number in attendance, and needed training so the entire county entomology program can be coordinated.
12. Attend subject-matter leader training meetings.

Objectives of 4-H Entomology

1. To help 4-H members develop leadership talents, build character, and work toward effective citizenship
2. To help 4-H members learn about the science of entomology and to encourage scientific training in the biological sciences
3. To provide an opportunity for young people to develop precise work habits, skill in techniques, and the ability to see a project through to completion
4. To help 4-H members meet the goals set for them in the individual units of the 4-H Entomology project
5. To promote project experiences that will increase 4-H members' awareness and appreciation of natural phenomena

Program Aids

The material in this booklet contains resource information to help leaders plan, prepare, and conduct programs in entomology. Most of the information is in the way of suggestions and not requirements that must be strictly adhered to or accomplished. The information you use will depend on the nature of the group you are leading.

Suggested Resource Personnel

- *Adult entomology hobbyists*
- *Entomologists at local universities, colleges, experiment stations, or government offices*
- *Entomology or agricultural consultants*
- *Nursery personnel and arborists*
- *Conservationists*
- *Foresters*
- *Fish and wildlife personnel*
- *Beekeepers*
- *Public health officials*
- *Successful farmers*
- *Biology teachers*
- *Insect pest management scouts*
- *Librarians*
- *Former 4-H members*
- *Pest control operators*
- *Other adults, not necessarily familiar with entomology but willing to help with other aspects of the program*

How to Begin Your Entomology Project

If a 4-H club is already organized in your community, meet with the club and take a few minutes to explain the entomology project. Or you could meet with other assembled youths such as Boy or Girl Scouts, school classes, church-affiliated groups, etc. Make a list of those who indicate an interest in studying entomology and plan an entomology meeting.

Parents of interested members could be invited to the first meeting so they will understand what is being planned and the objectives of the program.

At the beginning of the first meeting:

1. Explain and discuss objectives with members and parents.
2. Explain what members can do in entomology.
3. Give each 4-H'er a member's manual and discuss its use.
4. Tell members to take the manual home and look through it for content. Notice there are minimum requirements for completing each project unit.
5. Explain what materials and equipment are needed in the project. Some, like pins, need to be purchased, but most other equipment can be made.
6. Set time and place for next meeting.

Suggested Programs for Club Meetings

The following outlines are suggestions and should be modified to fit the needs of the club.

FIRST MEETING

1. Open the meeting and take care of the items suggested for beginning the first meeting given under "How To Begin Your Entomology Project."
2. Have members turn to Unit one, page four, while you read "What is an insect?" to them. Some of the vocabulary and ideas will be new to the group, so allow time for questions, discussion, or further explanation about what was said. How do they affect humans and the environment? If questions are asked that don't pertain to the subject matter on page 4, you may want to defer the questions to a later meeting for discussion.
3. After the group seems to have the concept of what an insect is, have them do the exercise on page five.
4. Tell members what the topics of the next meeting will be.
5. Tell them to bring to the next meeting materials for making a killing jar, some live insects, and insect pins.
6. Tell them to have the exercise on page six done by the next meeting.

SECOND MEETING

1. Open the meeting with a demonstration on how to make a killing jar.
2. Have members make killing jars from materials they have brought.
3. Have members kill some of the live insects they brought by

using the killing jar or some other method suggested in Project Unit one, page seven. Compare and discuss the advantages or disadvantages of different killing methods.

4. Have them pin and put date-locality labels on their insects.
5. Have the members do the exercise on page six and see if they can locate insect parts on the specimens they brought. Discuss how variable insects can be although they have the same basic body plan.
6. Announce the subject of the next meeting. Tell members to bring materials for making some piece of equipment. Encourage members to give a demonstration on making or using equipment.

THIRD MEETING

1. Open the meeting by having members answer roll call by naming an insect part or telling how insects differ from their relatives.
2. Have a demonstration on how a piece of equipment is made and/or used.
3. Have a contest quiz or game activity.
4. Have members identify insects they have collected and mounted using 4-H literature or other resource literature.
5. Teach members to identify the order to which their insects belong by using the key in Key to the Order of Insects.

FOURTH AND SUBSEQUENT MEETINGS

1. Cover topics selected from "Other Ideas for 4-H Entomology Meetings." The topics should be appropriate to the group's level of progress in the project or special interests members have developed.
2. Some of the topics can be review of previously covered material to be presented by club members.

Other Ideas for 4-H Entomology Meetings

1. Have demonstrations on how to make and use special equipment or how to perform some technique. See the section "Suggestions for Demonstrations and Illustrated Talks" on page five for examples. Where possible, have members give the demonstrations.
2. Plan to have a talk on insects by an experienced person selected from the resource personnel listed on page two.
3. Integrate entomological activities with other projects (e.g., insects and photography, first aid, insect-themed crafts, etc.)
4. Show a film on entomology, such as the *Hellstrom Chronicles*, videotape the Discovery channel during "Bugweek" or show popular movies with bug themes like *Arachnophobia*, *Honey*, *I Shrank the Kids*, etc.
5. Build an electric light board for a changeable "insect quiz." Instructions are available from the Entomology Department.
6. Have members bring insects to meetings and give interesting information about them, such as how hard they were to find and catch, their unusual habitats or behaviors or their

benefits or injuries to human welfare.

7. Study some insect thoroughly and report on its life cycle, its economic importance, how it is controlled or used to benefit humans (e.g., Colorado potato beetle, clothes moths, praying mantis, silkworm, fleas, etc.).

8. Collect cartoons, verses, jokes, or postage stamps about insects and show them to members.

9. Collect and/or research insect houses (e.g., hives, galls, etc.).

10. Have an insect identification contest.

11. Have an exchange meeting where club members trade insects with each other or visiting clubs.

12. Take members on a field trip or collecting tour.

13. Play a game or have a contest about entomology. See the section "Games and Contests."

14. Have a demonstration of insects as a food source. Consult the library for references such as *Why Not Eat Insects?* by Holt and *Entertaining With Insects* by Taylor and Carter.

15. Visit an insect collection of an individual, local university, or state agricultural office.

16. Visit a beekeeper to observe working with bees.

17. Have a general discussion meeting on careers in entomology.

18. Plan how the club can lead or participate in a campaign to deal with some insect problem.

19. Discuss ways insects protect themselves from their enemies; give examples (run, fly, hide, bite, sting, smell or taste bad, camouflage, mimicry, etc.).

References

4-H Entomology literature includes: project books for Units I, II and III, Key to the Order of Insects, Handbook of the Insect World, and Beginning Beekeeping for Kentuckians. Your county and state Extension offices also have entomology informational leaflets that may be used to supplement 4-H projects.

Your public or school library has catalogue references to help you locate books containing entomology information. Look for key words such as entomology, insects, arthropods, biology, zoology, spiders, ants, bees, beetles, etc. The librarian will be happy to help you if you have difficulty finding suitable books.

Local bookstores often have field guides and other books about insects. If they do not have a particular book you are looking for, they may order it for you if it is still in print. A few of the field books popular with 4-H'ers include:

- *Insects* by Zim and Cottam; Golden Press
- *Butterflies and Moths* by Mitchell and Zim; Golden Press
- *Insect Pests* by Fichter and Zim; Golden Press
- *A Field Guide to Insects* by Borror and White; Houghton Mifflin Co.
- *A Field Guide to Moths of Eastern US.* by CoveII; Houghton Mifflin Co.

- *Peterson Field Guides*; Houghton Mifflin Co.
- *Eastern Butterflies* by Opler and Malikul
- *Beetles* by White

Magazines, newspapers, radio and, television are also sources of reference. Be alert for articles about other subjects that include insects in the discussion—for instance, gardening articles that include information about insect pests. Advertisements depicting insects can be clipped out for making visual aids.

Entomology Organizations

Kentucky Beekeepers Association—KBA is open to professional and hobby beekeepers as well as anyone else interested in honey bees. KBA has many local chapters that hold their own meetings. Most youths in KBA are included in family memberships, but individual youth membership is accepted. Youth activities sponsored or promoted by the association include selection of state honey queen and participation in local and state honey shows. For information on joining KBA, write to Tom Webster, Kentucky State University, Frankfort, KY 40601.

Kentucky Lepidopterists' Society—KLS is open to youths and adults interested in collecting and studying moths and butterflies.* For information on KLS activities and enrollment, write to Dr. Charles Coveli, Department of Biology, University of Louisville, Louisville, KY 40292.

Xerces Society—Named for an extinct blue butterfly from California, the Xerces Society was formed for the protection and conservation of butterflies as well as other insects and arthropods. For more information, contact Xerces Society, 10 Southwest Ash Street, Portland, OR 97204.

Young Entomologist's Society—YES is a reorganization of Teen International Entomology Group (TIEG) under new sponsorship. YES publishes a quarterly magazine that includes articles of special interest to young entomologists. Most of the articles are submitted by YES youth members. Members may submit "advertisements" for correspondence or specimen trading in their special areas of interest. For information on joining YES, write to Young Entomologist's Society, c/o Department of Entomology, Michigan State University, East Lansing, MI 48824-1115.

* Every July, they take a survey of butterflies present in Kentucky.

Teaching Methods and Aids

Ways to open and direct discussions include leading questions, controversial issues, personal experiences of the members, role playing, slides or films and listing facts or statistics. See that the atmosphere allows for reasonable freedom of expression, but set up self-imposed discipline.

Demonstrations or illustrated talks are useful learning experiences, especially for the person making the presentation. Besides learning the subject matter thoroughly enough to

make the presentation, the demonstrator develops poise, confidence, and practice in public speaking.

A demonstration shows and tells how to do something. It necessarily involves using props and other visual aids. An illustrated talk, such as “What Is an Insect?” does not show how to do something, but uses visual aids to help communicate the verbalized concepts.

How to prepare and give a demonstration is covered in other 4-H literature such as: *Speak Up* (4KA-O1PO), *Would You Like to Do a 4-H Project Demonstration?* (4KA-O2PA) and *Posters* (4KB-O1PA)

Questions for Leading Discussions, Quizzes, or Independent Investigation

1. What is an insect? How do insects differ from their close relatives?
2. What is the name of the group of animals that contains insects and their relatives?
3. What are insects' three body regions? To what region are the legs and wings attached?
4. Where is an insect's skeleton? What function does it serve?
5. How do insects grow? Do they all grow in the same way? What is the word for the changing in form as an insect grows? What are the life stages of an insect with complete metamorphosis?
6. What is entomology? What does the study include? What are some occupations for which a knowledge of entomology is useful? What are some areas of specialization in entomology?
7. Insecticides are often used to control insects. What are some important things to know about insecticides? What are some other methods for controlling insect pests?
8. What are some ways in which insects are pests?
9. How are insects beneficial?
10. Insects use camouflage and mimicry to protect themselves from enemies. What is the difference between these two terms?
11. What are some other ways insects protect themselves from their enemies? What animals are enemies of insects?
12. Are insects warm-blooded or cold-blooded (technical terms: homeothermic and poikilothermic)? What happens to insects in winter? Where do they come from the following summer? What do some insects do when the weather is too hot for them?
13. What is the difference between hibernation and aestivation? How do these habits help the survival of insects?

Suggestions for Demonstrations and Illustrated Talks

1. How to make and use a piece of equipment, such as: killing jar, insect net, storage box, display box, spreading board, re-

laxing jar, pinning block, etc.

2. How to prepare and arrange a 4-H insect display collection
3. How to process honey
4. How and what to look for when examining a beehive
5. How bees communicate—the honey dance
6. How, when, and why bees swarm
7. How a hive is organized—the caste system
8. How to mount insects in plastic
9. How insects are injurious or beneficial
10. First aid for bites and stings
11. How to recognize different insect orders
12. How to distinguish moths, butterflies, and skippers
13. How to use insecticides safely
14. How insects eat—mouthpart types and methods for getting food
15. How insects breathe
16. How insects grow and change form—metamorphosis
17. How to rear insects for fish bait or food for aquarium fish (Mealworms, crickets, and wax moths are often reared for fish bait. Earthworm rearing would be an acceptable topic too, although they are not insects.)
18. How to organize and assemble your 4-H records book
19. Special techniques for collecting and mounting small insects (for example: thrips, collembola, aphids and lice)
20. How to spread butterfly wings

Field Trips or Collecting Tours

The duration of a field trip is not important, except that it should be long enough to give each member adequate time to collect in various available habitats. Organizing into groups of two, three, or four members helps promote orderliness and safety consciousness. A leader can check with the captain of each group occasionally to see that everyone is present. Parents and other interested adults, youth leaders, or entomology hobbyists can add much to a trip or tour.

The afternoon of a warm sunny day is an excellent time to collect insects. Moths and other insects that hide during the day can be collected best at night around lights.

Nearby parks, farms, fields, ponds, and streams are good places to visit for collecting if there is a variety of habitats. See Unit I project booklet, page eight, for types of insect habitats. City parks are usually too small or too well kept for collecting many insects.

Before the groups disperse for collecting, older members can demonstrate how to use the collecting net, other ways to collect, and where to collect. Encourage members to look for insects in the different available habitats. Tell them to make a mental note of the habitat in which they find the different insects they collect. Have a contest among the groups to see which one finds the greatest variety of insects and habitats.

At the next club meeting, have members report what they

saw and learned on the field trip. Such discussions help members retain information about the many kinds of insects observed and make the results of the trip more valuable and memorable.

Experiments

Experimentation with living things demands your attention to attitudes toward life, science, and the scientific method. To contribute to an understanding of animal behavior, the leader and 4-H members must tamper with, harm and, in some cases, kill test animals. Few people object to killing insects because they are a low order of life and the well-being of humans makes it necessary to control pest insects. One should not convey an attitude of pleasure or, conversely, an attitude of disgust if the insect is harmed by the experiment. The experiment is a logical means to an end and should have moral purpose. It should be both humbling and exhilarating to unfold and understand some of the mysteries of life.

The following experiments or observations may be performed by members or conducted as demonstrations by leaders or junior leaders. Results of some experiments will depend on what kind of insect is used. Therefore, the observer must be alert for detecting and interpreting results. Remember, every experiment should have a control, or unrelated units of the experiment as a reference point.

1. Collect a large fly and remove one of its halteres. Release the fly in a closed room and observe the fly's flight control. Recapture the fly and remove the other haltere. How was the fly's flight affected each time? Are halteres important to flight? Is a fly's flight affected if its legs are removed but its halteres left on?
2. Catch a butterfly and clip the wings together with a paper clip. Suspend the butterfly on a string attached to the paper clip and let the butterfly quiet down. Now touch the tongue of the butterfly with a small watercolor brush that has been dipped in sugar water. What happens? Next touch the front tarsus with the brush. What happens to the tongue this time? Touch the antennae and other parts of the butterfly with the brush and notice what happens to the tongue each time. How does the butterfly respond to taste? (by uncoiling its tongue)
3. Catch several large insects of the same kind and notice how they move and the position they take when resting. With a dark colored paint or dark fingernail polish, cover one eye of one of the insects. Does this change the insect's behavior in any way? Cover the top part of each eye of another insect and notice its behavior. Try covering the bottom of each eye of another insect, and all of both eyes of another insect to see the effects.
4. Cut the front wings from a grasshopper, June beetle, or any other beetle that is a good flier. Does the absence of these parts affect the flight of these insects? If so, how?

5. Place several crawling insects of any kind at the center of a 10-inch circle, and determine the average length of time it takes them to crawl out of the circle. Place the same insects in a jar, refrigerate them for 15 minutes, and time them again in the circle. After 15 minutes, time them again. Next warm them gently with an electric light, and time them again. What effect does temperature have on the activity of these insects?

6. Catch a cricket of the chirping variety and keep it in a cage you can move around. Place the cage in different areas with different temperatures, and record how many chirps it makes per minute at different temperatures. Use a thermometer to determine the temperature. Make a graph of your data. Put degrees on one scale and number of chirps per minute on the other scale. At some later time when the cricket is chirping, count the number of chirps per minute and see if you can predict what the temperature is.

Experiments and Studies for Members in Advanced Units

The following experimental studies may require too much time or apparatus to be conducted as demonstrations. However, they are within the realm of advanced members to conduct as special projects. Outline guides for the topics marked with an asterisk(*) are available from the 4-H Entomology State Specialist.

1. Insect survey of a particular plant—An observational study to show the diversity and change in insect populations on a plant over a period of time.*
2. Light trap survey of the sod webworm—Light trapping can provide information for timing the application of insecticide controls. Information will vary depending on the geographic area.
3. The effects of diet on insects—For instance, rear cecropia moths on different host plants to observe differences in size and/or color of the caterpillars and moths. Does host plant affect the number and/or viability of eggs laid by the moths? Is the life cycle shorter or longer when the insect is reared on different plants, etc.?
4. Genetics—*Drosophila* flies and instructions are available from biological supply houses for genetic experimentation and study.

Games and Contests

Games, contests, and tricks add spice to the entomology project. Those used in other activities can often be adapted for entomology use. Other state project books may include representative games, contests, or diversions. Playlets can be for entertainment or to express some idea for later discussion. Pantomime or charade performances can also be used in this

way. The following is an example of a playlet for 4-H'ers to modify and build on.

WATCH OUT! THERE'S A SNAFU IN THE GARDEN

Act I

Characters: A man and his two children. Fred is the older child, and Cindy is the younger.

Scene: The man and his children are standing in their garden looking at the condition of things.

Man: Look at all the bugs crawling, hopping, and flying around here. I'll bet they blew over from the Smiths' yard. The wind is strong enough today.

Cindy: What kind of bugs are they Daddy?

Man: I don't know exactly. All I know is that I hate 'em.

Fred: Those going from blossom to blossom are honeybees. Those in a colony on that stem are aphids. Some ladybird beetles are eating some of them. There are some leaf beetles, and...

Man (interrupting Fred): Never mind all that. Let's get rid of them. If you want to look at bugs, go over to Smith's garden. As far as I'm concerned there are only two kinds of bugs, live ones and dead ones. And dead ones are the best kind.

Cindy: How are you going to make them dead, Daddy?

Man: Well there are too many just to stomp on, so I guess we'll poison them.

Cindy: How?

Man: Let's see. Didn't Mom have some bug spray left over when she sprayed her lilacs a couple of years ago?

Cindy: Oh yes, it's under the sink in the kitchen. I was playing with it yesterday.

Fred: Is that what's in that jug? The label was all smudged and hard to read. Cindy, you shouldn't have been playing with that. Besides it's pretty old, and it should be...

Man: Fred, don't be such a fuss-budget. Anyway, we're going to use it all up today.

Cindy: Should I get the hand sprayer Mom used?

Man: OK. No wait a minute. That will be too slow for this job. Mom has a spray attachment for her vacuum cleaner. We'll use that.

Fred: You better read the "Cautions" on the insecticide label before you do anything.

Man: Are you trying to throw a monkey wrench in the works to get out of helping us? If that stuff is so dangerous they wouldn't be allowed to sell it to the public. In fact, I'm going to make a big strong batch of the stuff and kill those bugs once and for all.

Cindy: What are you going to mix it in?

Man: We'll need something big. The pickle crock is about the right size. We can wash it out good when we're done. Well, let's get everything together.

CURTAIN

Act II

Act II is left for your club members to write. But before you do Act II, discuss all the things you saw in Act I that were wrong. Fred expects some problems and dangers with the spray program as it is. Can you help him solve the problems when you write Act II. Modify the script or subject of Act I any way you would like.

INSECT IDENTIFICATION CONTEST

This is good for learning the identity of common insects. The leader should collect 25 or more common insects and label them with a common name. Allow the 4-H'ers time to study the collection for a while. For the contest replace the common name labels with number tags. Have each member number a sheet of paper and write the name of each insect after the number that corresponds with the insect's tag number. If each insect is put in an individual box, the insects can be distributed to the group and passed from one member to the next until everyone has seen all the quiz insects. This will solve the problem of the group crowding around a collection trying to see it at the same time. Reward the person who identifies the most insects with a small prize or some other sort of recognition.

GUESSING AND QUIZ GAMES

Quizzes can be more fun if they are made into games like TV game shows. For instance, a series of dashes, where each dash represents a letter in an insect name, can be written on a blackboard. Players take turns guessing letters in the name. Each time a letter that appears in the name is guessed, the letter is placed above the appropriate dash or dashes on the blackboard. The person guessing a correct letter gets one point. At some point, enough letters will be filled in so that a player is ready to guess the insect's name. If the guess is correct, 10 points are awarded. If the guess is wrong, the guesser is eliminated from further guessing until the next game.

"Bug Baseball" is a team game that requires a set of file cards prepared with quiz questions. The pitcher of one team selects a card from the stack and asks the question of the person at bat on the other team. If the at-bat person answers correctly he/she has a hit and advances to first base. If the person can't answer or answers incorrectly, the pitcher attempts to answer. If the pitcher also misses the question, the batter has a strike against the pitcher. The game proceeds according to the general rules of baseball. An umpire, who has a list of all the questions with correct answers, rules on whether questions are answered satisfactorily or not.

Flash cards prepared by pasting insect pictures on file cards can be used in various ways to train or quiz members in insect identification. Flash cards can be used in lieu of written questions, for instance, in the "Bug Baseball" game.

Certain kinds of puzzles also develop or reinforce learning. The following are available from the State 4-H Entomologist. "Elmer Fudd's Garden" is a word-search puzzle that includes quiz questions. "Riddle Bug Hunt" is a set of 29 riddles. It can be used at meetings as a quiz or as an insect list for a collecting contest during a collection field trip.

Collections and Exhibits

Collections help members learn the names of insects and provide excellent exhibit material. General insect collections usually consist of the adult forms of insects. Immature insects often require special preserving and storing techniques, so their inclusion is not encouraged in beginning display collections. Immature forms of insects may be an important part of an exhibit in the more advanced units, after the 4-H'er has developed more knowledge and skills.

When collections are used for exhibits in store windows or visual aids in illustrated talks, they can be prepared and arranged in any fashion that suits the purpose. However, display collections entered in 4-H competition at local and state fairs must be prepared according to regulations. A checklist for preparing competition collections is given in Unit II project booklet on page eight. An illustration of an example exhibit is shown on page 18, and an example of a collection catalogue to accompany the collection is shown on page 12. An example of a collection score sheet is given on page 8 of this booklet. The requirement of number and variety of insects in competition collections for Units I to V is as follows:

Unit I

One or two boxes with 25 to 50 insects representing at least four orders. Identification beyond order is not necessary, but every specimen needs a date-locality label.

Unit II

One or two boxes with 50 to 100 insects representing at least eight orders. Half the insects should be identified with a common name.

Unit III

Two boxes with 100 to 150 insects representing 10 or more orders.

Project IV

Three boxes with two of the boxes displaying 150 or more insects representing 12 or more orders. The third box should have an example of insect damage, the stage of the insect causing the damage, and any other life stage that heII, III as resource material and 4LD-02RA, Kentucky 4-H Project or Activity Form, as a record sheet.)

Project V

Any type of display that pertains to experiences beyond those of previous projects. Examples are special collections of native and/or exotic butterflies, beetles or other insect order, larvae, etc., or charts, photographs, models or other visual aids to illustrate the work done in a special study or experiment.

(There is presently no project manual for this project level. Members may use Units I, II, III as resource material and 4LD-02RA, Kentucky 4-H Project or Activity Form, as a record sheet.)

Special Collections and Exhibits

Special collections that are not restricted by the requirement rules can be made to display certain adaptation or habits of insects. The collection may be made for promotional displays, for illustrated talks, or as the subject for the fifth level of the 4-H Entomology project. Examples are:

1. A collection of insects that are vegetable pests or household pests, etc.
2. A collection and/or charts showing the different kinds of insect mouthparts, wings, or leg adaptations
3. A collection of insects displaying examples of mimicry and camouflage among insects
4. A collection of insects displaying examples of mature and Immature insects to show the different kinds of metamorphosis
5. A collection of structures made by insects (nests, galls, termite mud tubes, cocoons, etc.)
6. A collection of insects embedded in plastic
7. Insects and/or charts to illustrate how some insects make sounds (crickets, katydids, cicadas, etc.)
8. Charts showing seasonal abundance of particular insects

4-H Entomology Collection Score Sheet (1st - 4th Year)

1. Orders _____
2. Species _____
3. Common names _____
4. Labels _____
5. Condition of specimens _____
6. Overall appearance _____
7. Life cycle representation _____
8. Catalogue of specimens _____
9. Total _____

Name _____

Address _____

Club _____

County _____

1. 10 points for each order or other arthropod class represented.
2. Two points for each species represented. Opposite sex of the same species counted by no extra points for the excess specimens beyond two of a species.
3. One point for each correct or acceptable common name below the rank of order. For example, a specimen under Diptera correctly labeled “house fly” receives one point, but if it is only labeled “fly” it gets no point because all Diptera are flies. The common name “ant” under Hymenoptera would receive one point, although there are many kinds of ants, because Hymenoptera includes bees, wasps and sawflies as well as ants.
4. 100 possible points; average collection 50 points.
Considerations:
 - a. labels neat and accurate
 - b. labels straight and of uniform height on pin
 - c. labels placed on pins according to 4-H project book directions
5. 200 possible points; average collection 100 points.
Considerations:
 - a. correct pinning
 - b. Lepidoptera properly spread
 - c. specimens not broken or tattered
6. 100 possible points; average collection 50 points.
Considerations:
 - a. a variety of insect types, not primarily a butterfly collection with a minimum of other insects
 - b. specimens in neat columns
 - c. all insects of the same order placed in a single grouping (e.g., not some beetles, then some flies, then more beetles)
 - d. spacing and distinction of order groups and specimens within a group
 - e. pinning bottom condition not stained or peppered with old pin holes
7. 100 possible points; average collection 50 points.
Considerations:
 - a. completeness of the cycle stages
 - b. examples of damage, nest, or other material that explain the interest in or importance of the insect
 - c. adequate titles and text to explain the life cycle display
 - d. neatness and accuracy
8. 20 points for including an Insect Collection Catalogue.

5th Year Judging Criteria

1. Inclusion of an Insect Collection Catalogue—20 points.

2. Labels—100 possible points.
3. Condition of specimens—200 possible points; average collection 100 points. Considerations:
 - a. correct pinning
 - b. butterfly/moth wings properly spread (if applicable, not counted against if none in fifth year project)
 - c. specimens not broken or tattered
4. Overall appearance—100 possible points; average collection 50 points. Considerations:
 - a. Specimens neatly displayed and pinning bottom condition not stained or peppered with holes
 - b. Specimens don’t have to be in columns but they must be organized (e.g., if specimens are in a “lifelike” habitat, they should be placed where they belong)
 - c. Pinning bottom doesn’t have to be a solid color like the other years but should not be stained; it should have a neat appearance
5. Development of the theme—200 possible points.
There should be a title and a few paragraphs explaining the box: why the theme was chosen, description of the theme as if to someone who knows nothing about it (or even about insects), and the importance of the theme. The display box should contain the title, but the short statement can be in the box or in the catalogue.
6. Score for the collection—last 500 points depend on what type of special collection has been created. Score breakdown may include:
 - a. One-order collection (e.g., all beetles), maximum 40 specimens—12.5 possible points/specimen. ½ point for correct order, fourth points for correct common name, fourth points for family name, fourth points for special information (e.g., pest of __, larvae protect themselves with stinging hairs, etc.)
 - b. Multi-order collection (e.g., camouflage, aquatic insects, insects in a particular crop such as soybeans, soil insects, beneficial insects, pollinators, etc.), maximum 25 specimens—*construction of habitat*: 100 possible points (include pressed plants or draw plants in bottom of box or draw or construct other type of habitat such as soil, aquatic, etc.); *specimen identification*: two points for order, four points for common name, 10 points for how insect survives in the habitat
 - c. Life cycle (social insects like wasps, bees, ants, termites or solitary insects—125 points for number and length of instars: 25 points—tell whether gradual, complete metamorphosis; 25 points for how they live—singly, groups, or colonial; 75 points for generations per year, why/how over winter; 75 points for natural enemies; 50 points for food sources and 25 bonus points for any other information (besides correctness). Total points will only be granted if 4-H'er uses actual specimens (pictures will not count as much).
 - d. Insect/human interactions or cultural entomology (e.g., insect products we use; insecticides; careers in entomology; insect influence in art, jewelry, history,

medicine, Bible, etc.; new techniques such as embedding insects; insect photography). This type of display will be somewhat subjective. Use as many actual specimens as possible. Do new techniques yourself. In the case of a literature search (e.g., historical), sum up and make captions; don't just paste copied captions (but use reference). Points will be assigned according to creativity, quality of box, and amount of time and effort involved in project.

4-H Entomology Collection Score Sheet (5th Year)

Extra points will not be awarded for specimens above the numbers listed in the project manual.

Year _____ Class No. _____
Entry No. _____ Ribbon _____

Name _____

County _____

Identification of Exhibit _____

- 1. Catalogue of specimens (20 points) _____
- 2. Labels (100 points) _____
- 3. Condition of specimens (200 points possible; 100 points average) _____
- 4. Overall appearance (100 points possible; 50 points average) _____
- 5. Development of the theme (200 points possible) _____
- 6. Core points (500 points possible) _____

TOTAL POINTS (1,120 points possible)

Judges' comments:

Educational programs of the Kentucky Cooperative Extension Service serve all people regardless of race, color, age, sex, religion, disability, or national origin. Issued in furtherance of Cooperative Extension work, Acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture, C. Oran Little, Director of Cooperative Extension Service, University of Kentucky College of Agriculture, Lexington, and Kentucky State University, Frankfort. Copyright © 1999 for materials developed by the University of Kentucky Cooperative Extension Service. This publication may be reproduced in portions or its entirety for educational or nonprofit purposes only. Permitted users shall give credit to the author(s) and include this copyright notice. Publications are also available on the World Wide Web at: <http://www.ca.uky.edu>. Issued 6-1985, Revised 3-1996, Last printed 12-1997, 500 copies, 10900 copies to date.