



COLLECTING INSECTS

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Where and How to Collect Insects

Insects feed on the leaves, stems, roots, flowers and fruit of many horticultural plants, producing directly visible damage or symptoms. Examine plants closely. Look for holes in leaves or ragged leaves near the ends of branches. Turn leaves over to see for sure, especially if you spot any leaf discoloration or stippling patterns. Also check for ant activity – they often tend aphids or scale insects whose honeydew (sugary excrement) they love. Look for holes in stems – evidence of boring insect activity and insect frass (excrement). Plants damaged by soil insects or stem-borers may wilt in the heat of day and recover somewhat in the evening when the sun goes down. Pull damaged plants and closely examine root systems for signs of insect attack.

The best insect collecting is often in diverse habitats. A vegetable or flower garden or landscaped facility such as a park, arboretum or zoo will usually have multiple plantings of many different types of plants. But make sure that you have permission to collect first. Note that it is illegal to collect in a federally sponsored facility or national park without a collecting permit. Always be careful not to damage plants when collecting. You shouldn't cause more damage to the plantings than do the pests themselves. Be reasonable and don't hack off side branches, limbs of trees or entire shrubs or flowers unless they are not salvageable (dead or dying). When collecting insects, don't forget to dig in soil. Most plants have a characteristic group of "specialist" insects which feed on them. Other insects may be more general feeders, attacking a large group of plants. Chop into a dying tree or rotting log to discover some interesting specimens.

Insect Collecting Equipment

The basic equipment necessary for field collecting is an insect net, one or more storage boxes, insect nets, pins, pinning blocks, spreading boards, light and pitfall traps, killing jars, killing and preserving chemicals, several vials of assorted sizes, plastic bags and assorted containers. A collecting bag (roughly 14" x 18") made of canvas, muslin or other strong material is helpful to carry equipment, plant cuttings and in-

sects when out in the field. These supplies can be obtained by direct order from one or more biological supply houses such as BioQuip (310-667-8800 or www.bioquip.com).



The Killing Jar

Insects must be killed before pinning and mounting. Killing jars are used as a sort of "small scale fumigation" to kill collected insects as rapidly as possible, using a liquid fumigant or killing agent (ethyl acetate/nail polish remover) that produces a toxic atmosphere that the insect cannot breathe.

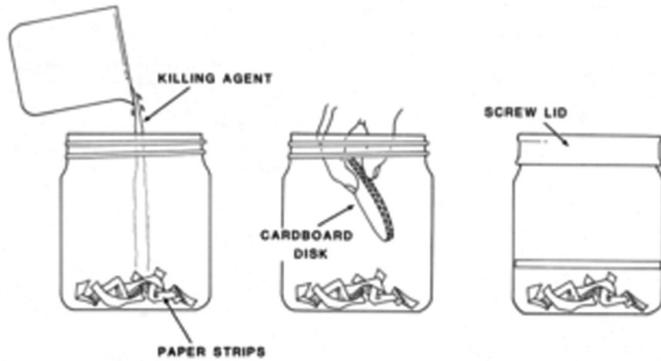
When placed in the killing jar, insects often close their spiracles, but eventually they must open them. The process may take several minutes for smaller insects or up to a half hour or more for larger specimens. Because large, hard-bodied insects such as beetles die slowly and may damage other insects placed in the same killing jar, you will need more than one jar. Also, you may break or lose one of your jars.

It is possible to make suitable killing jars with nearly any jar used for jam or jelly and baby food jars are especially handy. Do not use plastic containers, because the chemical killing agent may damage them. At least one large (i.e. pint or quart size) jar would be helpful for larger specimens.

In the bottom of each jar, place about 1 to 1-1/2 inches of absorbent material, such as cotton, shredded newspaper,

Know how. Know now.

Plaster of Paris or wood fiber (sawdust). If Plaster of Paris is used, pour it about 1 inch deep and allow it to dry for at least 48 hours before use. With paper- or fiber-filled jars, cut a cardboard circle just slightly larger than the inside diameter of the jar and push it into the opening against the plaster in the bottom. Wrap the outside bottom third of each jar with masking tape to prevent cuts in case the jar is broken. Attach a label that says POISON to each jar and store the jars out of reach of children (or irresponsible adults) until you are ready to go collecting.



The killing jar is now ready to charge with a killing agent. Pour enough ethyl acetate (a tablespoon or so) into the killing jar to thoroughly wet the dry, absorbent plaster. Use a bit more if the plaster will absorb it. Pour off any excess into the original container. Do not use too much or you may “wet” and damage insects that you collect. Turn the lid on tightly to prevent loss of fumes. As the killing jar is used, it will lose its strength so the killing agent must be replenished from time to time. Tear up some strips of paper, crumple them slightly and place them in each jar. This will help to prevent insects from damaging one another.

Pinching the thorax of large butterflies or moths before placing them in the killing jar will prevent them from flopping around and damaging the wings. Squeeze them for 20-30 seconds between thumb and index finger and put them in the killing jar. This procedure stuns the insects so they do not flutter once inside the jar. Remove butterflies and moths from the killing jar fairly soon so their wings do not become soaked with killing agent.



If a killing jar is not available, freezing is another way to kill insects. Simply place your specimens in a plastic bag (the Zip-Lock kind is nice) or small jar and put them in the freezer for an hour or two. Do not handle them again until they are thawed or legs and antennae may break. And don't forget them in the freezer. Insects, like food, left too long in the freezer for several days or weeks will desiccate and remain dry and stiff, even when thawed. If pinned when dry, these insects will break during handling and wings, especially of Lepidoptera, will be impossible to spread. Remember that specimen quality is an important consideration in grading insect collections.

Using the Relaxing Jar

We recognize that while insects should be pinned on the same day they were collected, this is not always possible. So before pinning these specimens left in the killing jar or freezer too long, to restore their flexibility, it is necessary to “relax” them. By placing them in a relaxing jar at high humidity for a few days we can restore their flexibility enough to allow pinning without damage to the specimens.

Relaxing is always a risky process and, if carelessly done, the specimens may be ruined.

A relaxing jar is easy to make. Simply use another baby food or larger jar as the relaxer. Place some absorbent material such as newspaper, sand or cotton in the bottom and cut a blotting paper disk to fit tightly inside. Moisten the material with water and add a drop or two of ethyl acetate, phenol, Lysol or laundry beach (*Hi-Lex, Purex, Clorox*) to prevent mold. Place insects on the paper, close the jar tightly and let it sit for about 2-3 days. Check the jar. If the insects are flexible, mount them immediately. If the specimens are still too stiff, keep them in the relaxer for a few more days, but watch them carefully. Insects will mold and decompose if held in the relaxer too long.



Using a Collecting Net

Aerial nets for collecting flying insects can be ordered or made at home from a 4-foot length of doweling, about 4 feet of heavy wire and a half yard or so of sheer nylon or orlon netting. Grooves are cut across one end of the handle, then a one-half inch deep hole is bored on one side of the handle (in the groove) three inches from the end. A second hole is bored one-half inch deep in the opposite groove four inches from the end. A four foot length of heavy wire is bent into a hoop and attached to the handle by a 4-inch aluminum slip collar, which holds the wire hoop in place.

The bag, once hemmed and attached to the hoop, is about one foot in diameter, two to three feet long and tapered to a point. The bag is slipped onto the wire hoop before it is



attached to the handle. A muslin or denim band is usually sewn over the hoop end of the bag to make the net last longer. Sweeping or beating nets are made like aerial nets. However, the net bag is constructed of strong muslin material instead of the lighter netting. These heavier duty nets are used to collect insects from grass, trees and shrubs by swinging the net through heavy foliage. Thus, these nets are sometimes referred to as “beating” or “sweeping” nets. The sweeping net is widely used to sample insect populations in standing field crops such as alfalfa, wheat and soybeans. As the surveyor walks through the crop, the net is swung in an arc a specified number of times – e.g. 10, 20, 50, 100, etc. Done at several locations over time in a field, and the results totaled, a reasonable assessment of the pest population can be made, compared with economic thresholds and management/control decisions made.

Other Collecting Equipment and How To Use It

Aspirator. The aspirator is a suction device for collecting small insects which are difficult (or hazardous) to capture with the fingers or with an insect net. Basically, it consists of a large glass or plastic vial, a length of flexible rubber tubing, some rigid plastic or metal tubing and a rubber stopper with 2 holes cut in it to receiving the tubing. A small piece of cheesecloth or fine metal screen serves to seal the suction tube on the inside so that insects are not sucked into the mouth. Bear in mind that if you collect ants, you may not suck the ants through the fine mesh, but their defensive secretion (formic acid) can give you a nasty mouthful, especially if the ants are large and numerous. This experience is guaranteed to clear your sinuses.

To make an aspirator, bend the two lengths of rigid tubing and fit the tubes into a rubber stopper. The long tube should extend down to within about one inch of the bottom of the vial when it is in proper position. Attach the small piece of cheesecloth or metal screen to the short piece of tubing with solder, glue or a rubber band. (This is to prevent you from sucking several bugs or bits of dirt into your mouth when you are using the aspirator.) Now attach the rubber tube to the short piece of rigid tubing.



To use the device, just place the long tube beside a small insect, put the rubber tube into your mouth and suck sharply. With a bit of practice, you will find that this is an excellent way to collect smaller insects with ease.

Light traps. Many types of insects are attracted to light and can be captured there by hand. A light trap offers the advantage that it will continue to trap specimens without being constantly watched by the collector. Insects are quite sensitive to different types of light; therefore, more of certain types can be captured with “black” (or ultraviolet) light as opposed to the regular “white” light given off by most standard light

bulbs. The difference in attractiveness of the two types of light is due to the wave lengths produced by the two kinds of bulbs. Black light consists mainly of the shorter wave lengths which are more attractive to night-flying moths, flies and beetles. White light bulbs (producing mostly longer wave lengths) attract some moths and other insects, but not as many as a black light. Simply turning your home entry lights on or standing under a street light or in your car headlights often produces many specimens, including many horticultural pest insects. Many of the night-flying cutworm moths can be captured when feeding on various flowers during evening hours.



All that is needed to make a simple light trap is a battery-operated lantern or an automobile trouble light with a 100-watt or larger bulb, a large metal funnel (you can also make one of plastic sheeting, but remember this is flammable) and a wide mouth jar or a large tin fruit juice can. Hang the light outdoors away from the buildings, in a sheltered place, near a power source, if needed and no more than 4 feet off the ground. Construct a wire framework to support the lantern or suspended bulb, funnel and trap can. Make sure that the end of the collecting funnel is large enough to allow larger insects to pass through. Place some crumpled newspaper in the bottom of the can (about 2 inches deep) and lightly wet it with killing solution. Start the trap at dusk and empty it in the morning. A simpler trap setup is to prop up a white sheet to serve as a reflecting surface, then to sit a lantern in front of it on a chair or stool. Collect the insects attracted to the sheet as they land on the surface. Blacklights are made in the same form as regular fluorescent tube lights and can be operated in similar types of fixtures. Do not look directly at the blacklight bulb, because ultraviolet light can damage eyes. Night-flying insects seem to be more often attracted to light traps placed in sheltered areas (i.e. protected from wind by trees) than those in more open areas.

Pitfall trap. A pitfall trap will catch many ground beetles and other insects that live on or in the soil. It consists of a trap can that is buried in the soil, level with the rim so that



insects attracted to it will fall in. Once inside, it is difficult for them to get out. An attractive bait in the bottom will increase the drawing power of the trap. Use pieces of spoiled fruit, vegetables, excrement or meat. Cover the trap with a board placed on small stones so insects can crawl under it and into the can. This arrangement will protect the trap from wind and rain, but allow access to the insects you want to catch. It will also help to hold insects inside the trap once they are caught. Remove the insects that you catch each morning.

PRESERVING INSECTS

Hard-Bodied Insects

Since insects have a hard shell or exoskeleton and all of the soft parts are on the inside, they tend to keep rather well after drying, even for long periods of time. Only a small amount of maintenance is necessary to keep them in good condition. Many specimens in museums today are over one hundred years old and look just as they did on the day they were collected. Certain types of insects may fade, but others hold their colors indefinitely. If you want to study insects in the winter, you must work with collections of dead insects or with living laboratory-reared material. Remember that dead, pinned insects are very brittle and delicate. They must be handled very carefully and never jarred, dropped or touched directly. Specimens whose legs, antennae and wings are broken and lost are essentially worthless. Also, damaged specimens will not be graded as highly in your insect collection.

Soft-Bodied Insects

Many types of insects, including aphids, springtails, thrips, mayflies or silverfish, are soft-bodied and cannot be pinned successfully. The same is true of many immature insects such as caterpillars, beetle and wasp larvae and others. If placed on pins, most soft-bodied insects will shrivel or decompose. Such insects must be preserved in liquids in rubber-stoppered glass vials. However, prior to preserving soft-bodied specimens for the long term, their color must be "fixed" or they may fade in some cases or blacken in others. The "fixing" process prevents, reduces or delays color change.



For the long term, insects are preserved in ethyl alcohol, usually of about 70 percent concentration (70% alcohol, 30% water). Isopropyl alcohol can also be used, but with less success. Over time, alcohol at lesser dilutions, i.e. stronger solutions can cause colors of specimens to darken and bodies to shrivel. Remember that alcohol is a dehydrator -- it removes water. These problems can be largely prevented in either of two ways. The best way is to "fix" the insect tissues and color by killing the specimens in boiling water. For smaller specimens, simply dip them in boiling water for about 30 seconds

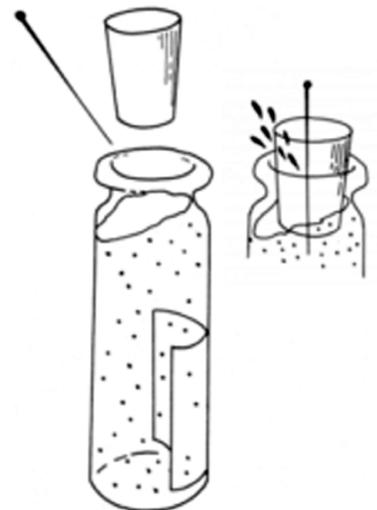
and then transfer them to 70 percent alcohol. Use more extended periods for large-bodied insects.

The most preferred method, often used for caterpillars and other soft-bodied larvae, is to kill the insects in a special fixing solution called K.A.A.D. mixture. This solution is made by mixing one part of refined kerosene, two parts of glacial acetic acid (a weak acid), ten parts of 95 percent alcohol and one part of dioxane. A good feature of the K.A.A.D. solution is that it causes soft-bodied larvae to uncurl, distend and swell, expanding the tissues and making them easier to examine and study. Leaving specimens in the solution too long can cause the bodies to burst, however, so watch them carefully. Small insects should not remain in the solution for more than 30 minutes while larger ones, such as a medium-sized caterpillar, might require 2 to 3 hours. After they are fixed in the solution, they should be transferred to 70 percent alcohol in tightly closed vials, with rubber stoppers.

Chemicals can be purchased directly from biological supply houses. Also, grain (ethyl) alcohol is sold in liquor stores in many states as "Everclear", a product that is 95% pure. Price will vary depending on the level of state and federal taxes. Vodka is another option, but it is usually sold at 40% strength. The 95% pure alcohol, or ethanol can be easily diluted to 70% strength by working in units to get the amount you need. To dilute 95% alcohol to 70%, use "about" (slightly less than/actually 2.8) 3 parts of 95% alcohol to 1 part distilled water.

Note that collection and specimen identification labels must accompany insect specimens in each vial (labeling will be discussed in detail later). With the insects in the solution, top off the liquid to within 1/4" of the top of the vial. Wipe off the excess alcohol, then place an insect pin against the interior of the vial, and push a rubber stopper deep into the vial opening as the pin is simultaneously withdrawn. This procedure "burps" the bottle, forcing surplus air out of the vial as a stream of tiny bubbles, thus helping to ensure an airtight fit.

Otherwise, the stopper may pop out -- especially if the stopper or inside vial rim were wetted by the alcohol. Because the body contents of a large specimen may dilute the preservative, it is best to replace or top off the original alcohol with fresh alcohol after a day or two. After this special treatment, colors should not fade much. Over time, the alcohol may evaporate, so it may be necessary to add a bit more from time to time.



PINNING, MOUNTING AND DISPLAYING INSECTS

Temporary Storage Boxes

You will need at least one, but more likely two “Schmidt Boxes”, a specially designed and constructed container for long term insect storage. The lid is tightly fitted to the box to help prevent entry of scavenger insects which feed on dead insect specimens, into the box. Cigar boxes make excellent containers for temporary storage of pinned insect specimens. Line the bottom of cigar boxes with styrofoam material, corkboard, balsa or cardboard to receive and hold the insect pins. While cigar boxes are fine for temporary storage, they are poor over long periods of time. For extended storage and for display, tighter containers are essential. Add naphthalene crystals, placing them into a small container in one corner of each display box to prevent damage to your specimens.

Insect Pins

Special pins are needed to pin insects. They come in several sizes from 00 through 7, the size of the pin increasing with each number. Number 3 insect pins are the best for most purposes. Insect pins are purchased from biological supply houses and can be found in some hobby stores. Never use common pins.



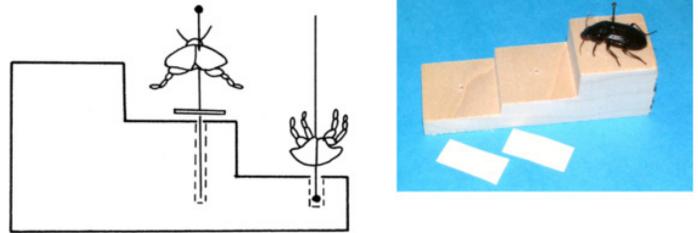
Pin Storage Rack

A 4-inch long section of 2" x 4" lumber with 6 one-half inch diameter drilled holes, each 3/4" deep, makes a handy pin storage rack.

Pinning Block

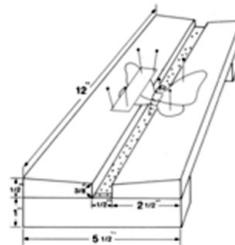
Larger insects should be mounted using a wooden pinning block, a simple piece of equipment. A very small hole is bored almost through the bottom in the middle of each step. A simpler pinning block can be made by drilling three holes—1, 3/4, and 1/2 inch deep—into a small wooden block. Proper use of a pinning block will result in an attractive col-

lection with the insect, collection and identification labels in uniform position. Note the dimensions of a pinning block in the drawing below.



Spreading Board

Mounting butterflies and moths is a special technique that requires a spreading board to do an attractive job. The spreading board is usually made of soft pine with a piece of balsa or cork underneath the center groove to receive insect pins. An acceptable spreading board can be made from balsa wood or cardboard strips, 2 heavy paper clasps, four corks and four common pins. Spreading boards can also be ordered from biological supply houses and hobby stores.



Pinning Insects

When working with your collection, be sure to follow these instructions precisely and routinely. Improperly pinned insects in your collection will be discounted. The rationale and main goal in developing and using proper procedures in pinning insects is to effectively expose and display critical details of insect structure -- the *taxonomic characters* which are used by insect classification experts (taxonomists) to key and identify insects.

The proper way to pin an insect depends on the type of insect that you have collected. Remember that soft-bodied insects such as caterpillars, mayflies, silverfish and some others cannot be pinned. The following diagram illustrates the proper way to pin various orders of insects. Note that the pin is usually just slightly to the right of the midline of the insect. Specimens should also be level and squarely mounted on the pin as shown. The use of a pinning block will help in obtaining proper height and positioning.

Pinning and Spreading Butterflies and Moths

These insects must be done correctly or else their appearance will detract from the overall quality of your collection. This is an area where many beginning entomology students get off on the wrong foot, because they collect the insects, but don't get them pinned right away. In some cases it may be necessary to store them temporarily until they can be pinned.

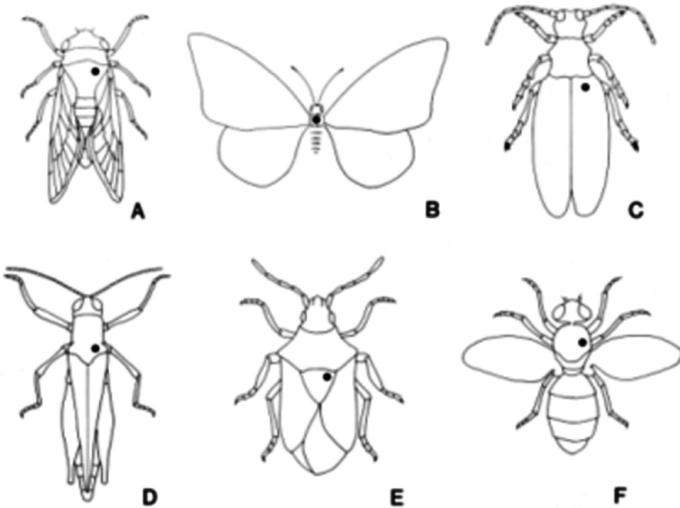
Insects with large wings, such as butterflies, moths and dragonflies, can be temporarily stored and dried in paper triangles until you have time to relax, pin and spread them. Write the collection data on the outside of the triangle so that you have when you are ready to mount and label the specimen. Then place the freshly collected, pinched and killed insect inside the triangle with the wings held together above the body. Store them like files in an insect storage box with a tight fitting lid and add naphthalene crystals if the specimens will be stored for an extended period. Working with fresh specimens is much easier. Before trying to pin them, the specimens must be relaxed, as described earlier.

When pinning and spreading a butterfly or moth, before you begin to work, cut several thin strips of paper about 1/4" wide and 8"-10" long. Once these are ready, pick up the insect by the thorax and carefully push a pin through the middle of the thorax. Adjust the position of the butterfly on the pin and make sure that it is level, both on the sides and in both front and back. Place the pin into the hole in the tallest step of the pinning block, being careful not to damage the fragile wings. Adjust the width of the groove in the spreading board to be just slightly wider than the body of the butterfly. Remove the pinned insect from the pinning block and push the pin into the slot of your spreading board until the bases of the wings are just level with the top of the two side pieces. On some spreading boards this may require the use of a pin pliers, a tool that allows you to place pressure on the lower part of the pin, so that it will more easily penetrate the cork or balsa wood strip. With the fingers this is difficult or in some cases not possible.

Slip a paper strip between the wings (if they are upright) and use it to force the wings on one side down into position. Pin the ends of the paper down to hold the wings loosely in place. Do the same with the wings on the other side, also pinning the ends of the paper down.

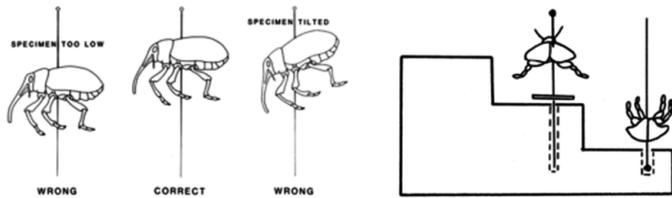
Now take another insect pin or needle and slip the point through the leading edge of the right forewing (there is a strong vein just at the front edge of each wing) near its attachment to the thorax. Be careful not to tear the wing. Loosen the forward end of the paper strip and gradually bring the forewing up into final position. Pin the wing down with a paper strip. Repeat this procedure with the forewing on the other side. Using the same technique bring both hindwings into proper position and fasten all four wings firmly with the paper strips.

Note carefully that the rear edge of the two forewings



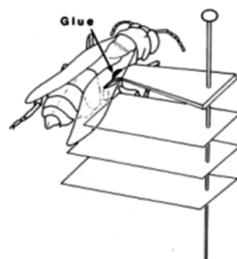
First, place the pin in the insect thorax in the proper position on the top step of the pinning block, pushing it in so that the top of the insect is quite close to the pin head. Then, remove the pin from the top step, reverse it and place the head of the pin in the lowest step of the pinning block. Push it down as far as it will go. This will result in positioning each insect about one-fourth inch from the pin head. The middle step on the block is to position the collection label. The lowest step is used to position the insect identification label.

Very small insects (less than 3/16 inch) should either be



pinned with *minuten nadeln* (German for "tiny needles"), or glued on their right sides to tiny paper triangles. The latter procedure is called *pointing*. When pointing, first push a regular insect pin (No. 2 or 3) through the butt end of the triangle. Level the triangle by pushing the pin through the hole in the highest step of your pinning block. Bend the tip of the paper triangle slightly downward with a forceps and touch it to a tiny drop of glue or clear fingernail polish. Pick up the small insect carefully with forceps and mount it by touching it on its thorax (right side) to the drop of glue. Adjust the insect so that it remains squarely in position, then allow the glue to dry.

When using *minuten*, be very careful because they stick to the fingers and can easily be transferred to the mouth, nose or eyes simply by rubbing. The figure below indicates how *minuten* are used and the final position of the insect specimen.

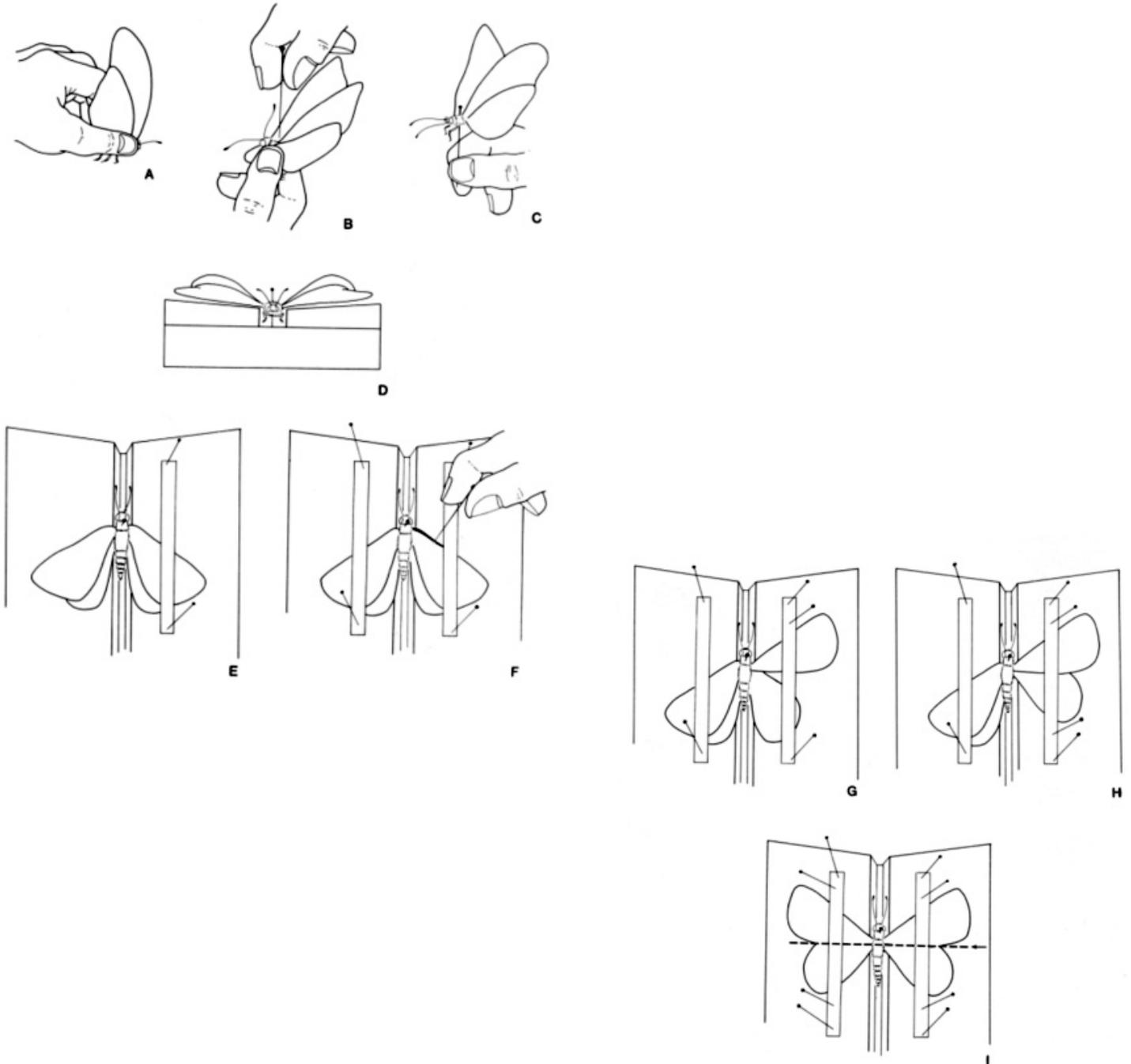


should make a perfectly straight line across the back. The hindwings should be pinned so that the rear edge is held just slightly away from the abdomen. Position antennae with pins and if the abdomen has drooped, prop it up with pins so that it dries in a natural position.

Allow specimens to dry for several days before you remove the pins. Drying “freezes” the wing muscles of the insect in position. Rushing the drying process somewhat by placing specimens in an oven at 125EF. for about an hour will work, but may result in the wingtips curling upward and spoiling

the insect’s appearance. Be very careful if you attempt this. Using wider (3/4 inch) paper strips to hold the wings down will help to prevent distortion. Please see the illustrations below and movie clips for further detail on pinning lepidopterans.

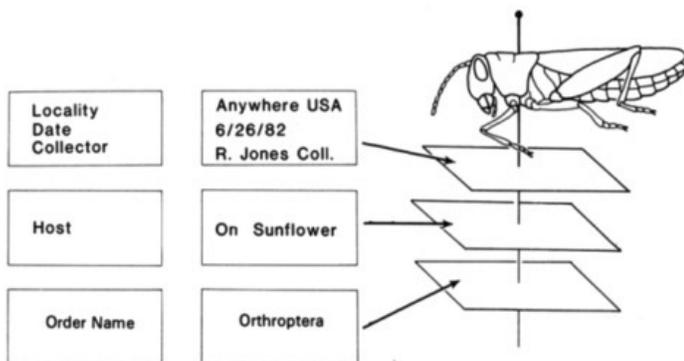
Large-bodied moths like *Cecropia* should be cut open on the underside of the abdomen and the contents removed with a cotton swab. The body cavity should be filled with cotton so that the specimen looks natural from above. If this is not done, the fatty material in the abdomen will decompose, releasing oils which may discolor and ruin the specimen.



Labeling Insects

A collection has little value unless each insect is properly and accurately labeled. Labeling must be done as soon as possible after collecting, pinning and mounting or vital information may be lost. Note that many insects in museums today stand as living documents of biological diversity. Their precise collection locations, habitats, and data on plants on which they were found is important documentation. Many of these habitats have been or are being altered and in some cases destroyed. Many plant and animal species, once common and together in biological ecosystems, are now endangered or in some cases are already gone. It is essential that the presence of insects, plants and other creatures be documented for future generations.

Make your labels with your computer and print them off. Trim labels with a sharp paper cutter so the edges make nice, clean, and flat rectangles. Two labels should be placed on the pin below each insect specimen. Both labels should be of the same size and lined up parallel to the length of the body of the insect (not cross-wise). The insect head should be at the left and the label should read from left to right. However, in the case of “pointed” specimens, the labels should be parallel to the length of the point. The top label should have the county and state in which the insect was collected, the collection date and the name of the collector. The lower label should show the Order name of the insect. Many entomologists place another label beneath the collection label which gives the host plant, habitat or other pertinent information, however, this label is not required for ENT116. Print the information on the labels as neatly as you can. Neatness, accuracy and quality are important.



Insect Label Data

Collection (First) Label:

Locality: Lincoln, NE

Date: 09/26/12

Collector: D. L. Keith, Coll.

The above label was reduced (below) to a font size of 6.

Lincoln, NE
09/26/12
D. L. Keith, Coll.

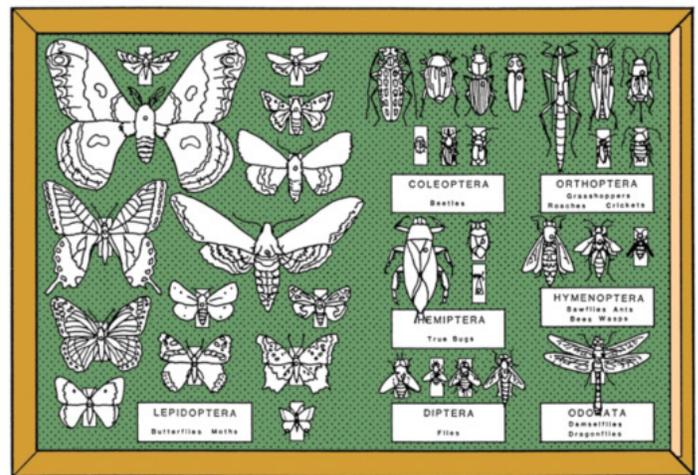
Second Label:

Order Name: Orthoptera

Family Name: Acrididae (10 specimens identified to family)

Organizing Your Insect Collection in Schmidt Boxes

Do not pin vials of insects in Schmidt boxes! These often come loose, roll around and damage insect specimens. Keep your vials in a plastic bag with some tissue or styrofoam “popcorn” to cushion them and prevent breakage. Otherwise, use strong rubber bands to hold vials together. Place only neatly pinned and labeled specimens in collection boxes. Organize them into sections by taxonomic grouping (i.e. Order) and position and space all labels neatly on the pin, so that the specimens are arranged in neat rows. Place a large label below and in the center of each order group. Order labels should be about 2” long, 1/2” wide and neatly printed with black lettering. Neatness in pinning, mounting and displaying insects is important.



Source: University of Nebraska–Lincoln course, “Entomology 116 – Insect Identification.”