# COLLECTING AND PRESERVING INSECTS AND MITES: TECHNIQUES AND TOOLS.

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## BASIC TOOLS AND GENERAL TECHNIQUES

### Reasons for Collecting Insects and Mites

Insects and related groups such as spiders and mites make up a very large proportion of the diversity of animal life on the planet. Not only are there more kinds or species of insects than of all other animals combined, but insects their relatives can be found in almost every conceivable environment. Their habits vary from parasitic to free-living and from beneficial to highly destructive. The destructive forms can cause enormous losses in terms of diseases and damage to food, clothing, and other materials of value to humans and can injure people or transmit disease to them directly.

Because of the potential harm that some species of insects and mites can cause, better knowledge of these organisms has the potential to save lives and money. Correct identification of a newly detected pest or disease vector is of the utmost importance, because the scientific name is the key to all known information about the insect, its habits, its behavior, and its potential threat or benefit to human welfare.

Insects and mites can and should be observed in their natural environments, but most of them, especially the many small ones, must be collected and properly preserved before they can be identified. Because correct identification seldom is easy, it is important that specimens be preserved in the best condition possible. The identification of a particular insect or mite usually requires examination of minute details of its anatomy with the aid of a hand lens or microscope. Some specimens may require dissection or even study with the electron microscope. If these details on a specimen are concealed, missing, or destroyed because of improper handling or preservation, identification is impossible, and information about the species to which it belongs cannot be made available. Therefore, adequate preservation and proper labeling of specimens are essential to their identification.

The methods used and when and where to collect depend on the purpose of the collecting. Insects and mites may be collected to obtain general study material, as for a school course or for personal interests (hobby); to survey for the presence or abundance (relative or absolute numbers) of pests; to acquire material for biological, physiological, ecological, and other types of studies; or to obtain specimens for other purposes that may demand various special collecting methods.

This manual is an updated and modified version of the USDA Misc. Publication no. 1443 published by the Agricultural Reserach service in 1986 and Edited by George C. Steyskal, William L. Murphy, and Edna M. Hoover. It has been limited to cover only collection and preservation techniques.

## What to Collect

Because of their incredible diversity, insects, mites, and other related groups vary widely as to their proper collecting requirements and methods. In the following sections, we will explore some of the many recommended techniques and look at the varied equipment used by collectors. The emphasis will be on insects and mites, but much of what is included here will also pertain to other related groups.

What specimens to collect depends on the purpose for which the material is intended. When important pest insects and mites need to be identified, they should be collected in large numbers if at all feasible. A sample of 20 specimens should be considered the minimum, and even larger numbers may be desirable. If adults and immatures are present, specimens should be collected of all life stages. Excess specimens can be discarded or exchanged, but it is not always possible to collect additional specimens when needed. Frequently insects and mites cannot be identified accurately from immature stages, and it is then necessary to rear them to the adult stage to obtain a precise identification. Photographers should collect the specimens they photograph if positive identification is desired; minute, critical diagnostic characters often are not depicted in photographs. If specimens are destined for display cases, it may be important to collect a sample of the host plant for the display. When collecting gall-producing insects and mites, it is essential to obtain the gall as well.

Many persons starting a collection attempt to collect every specimen they find. Biology students in high school and college are often required to collect specimens from as many orders or groups as possible. The experience and knowledge gained in making a general collection are of value in helping the collector decide on a specialty. However, with so many different kinds of insects from which to choose—over 80,000 described species in North America alone—most persons find that concentrating eventually on 1 or 2 of the major insect or mite groups is desirable. Specimens other than those in a chosen group may still be collected for exchange with other collectors.

References: 265, 380.2

See list of Selected References.

## Equipment and Collecting Methods

Collecting methods may be divided into two broad categories. In the first the collector actively searches out the insects, using nets, aspirators, beating sheets, or whatever apparatus suits his or her particular needs. In the second, the collector participates passively and permits traps to do the work. Both approaches may be used simultaneously, and both are discussed in the following pages. To obtain as many specimens as possible, use as many different collecting methods as possible, especially when briefly visiting an interesting area.

The simplest method of collecting is to pick up specimens by hand. For many reasons, however, such as difficulties in capturing insects and injury or discomfort that the insects may cause the collector, various kinds of equipment and special methods are needed. Those described here have general application; it is expected that the collector will make some adaptations to fit his or her own purposes and resources. For additional information, especially concerning the use of specialized techniques, consult the list of references.

References (general): 9, 13, 15, 16, 43, 46, 53, 69, 70, 80, 113, 132, 238, 240-242, 261, 266, 284, 285, 330, 334, 335, 345, 381, 394, 399, 431-433, 436.

The equipment used to assemble a general insect or mite collection need not be elaborate or expensive. In

many instances, a collecting net (see p. 5) and several killing bottles (see p. 7) will suffice; however, additional

items will permit more effective sampling of a particular fauna. Many collectors carry a bag or wear a vest in which they store equipment. The following items usually are included in the general collector's bag:

(1) Forceps. Fine, lightweight forceps are recommended; if sharp-pointed forceps are used, care must be taken not to puncture specimens. If possible, grasp specimens with the part of the forceps slightly behind the points.

(2) Vials containing alcohol or other preservatives (see p. 21).

(3) Killing bottles of various sizes.

(4) Small boxes or containers for storing specimens after their removal from killing bottles. These may be made of cardboard, plastic, or metal and should be partly filled with soft tissue or cloth to keep specimens from rolling about. Do not use cotton because specimens become entangled in the fibers and may become virtually impossible to extricate without damage.

(5) Small envelopes for temporary storage of delicate specimens.

(6) One or more aspirators (see p. 8).

(7) Absorbent tissue for use in killing bottles and aspirators.

(8) Notebook and writing equipment for jotting down notes and label data.

(9) A strong knife for opening galls, seed pods, twigs, etc.

(10) A small, fine brush (camel's hair is best) for picking up minute specimens. Moisten the tip; tiny specimens will adhere to it and may be transferred to a killing bottle or vial.

(11) Bags for storing plant material, rearing material, or Berlese samples (see p. 10). For collecting much plant material, a botanist's vasculum or tin box is advisable.

(12) A hand lens.

This list may be modified according to the special kinds of insects or mites to be collected. A small digging tool or trowel may be useful for collecting insects from soil or for gathering Berlese samples and a heavy knife or small hatchet for searching under bark or in decaying logs. A plant press should be available to prepare plant specimens for determination or as voucher specimens, especially when leaf-mining insects are being studied. When collecting at night, have a flashlight or headlamp; the latter is especially useful because it leaves the hands free.

Much of the equipment may be obtained from ordinary sources, but equipment especially designed for insect collecting often must be bought from special supply houses. Their addresses may be found in the yellow pages of telephone directories under "Biological Laboratory Supplies" or "Laboratory Equipment and Supplies." Inquiry to biology departments of high schools and universities may also be helpful, and biological and entomological journals often carry advertisements of equipment suppliers. Inasmuch as these firms are located in many parts of the country and change names and addresses fairly often, it is not practical to list them here. The faculty members of the local university's biology or entomology department are usually willing and in the best position to recommend a supplier in their area.

## Collecting Nets

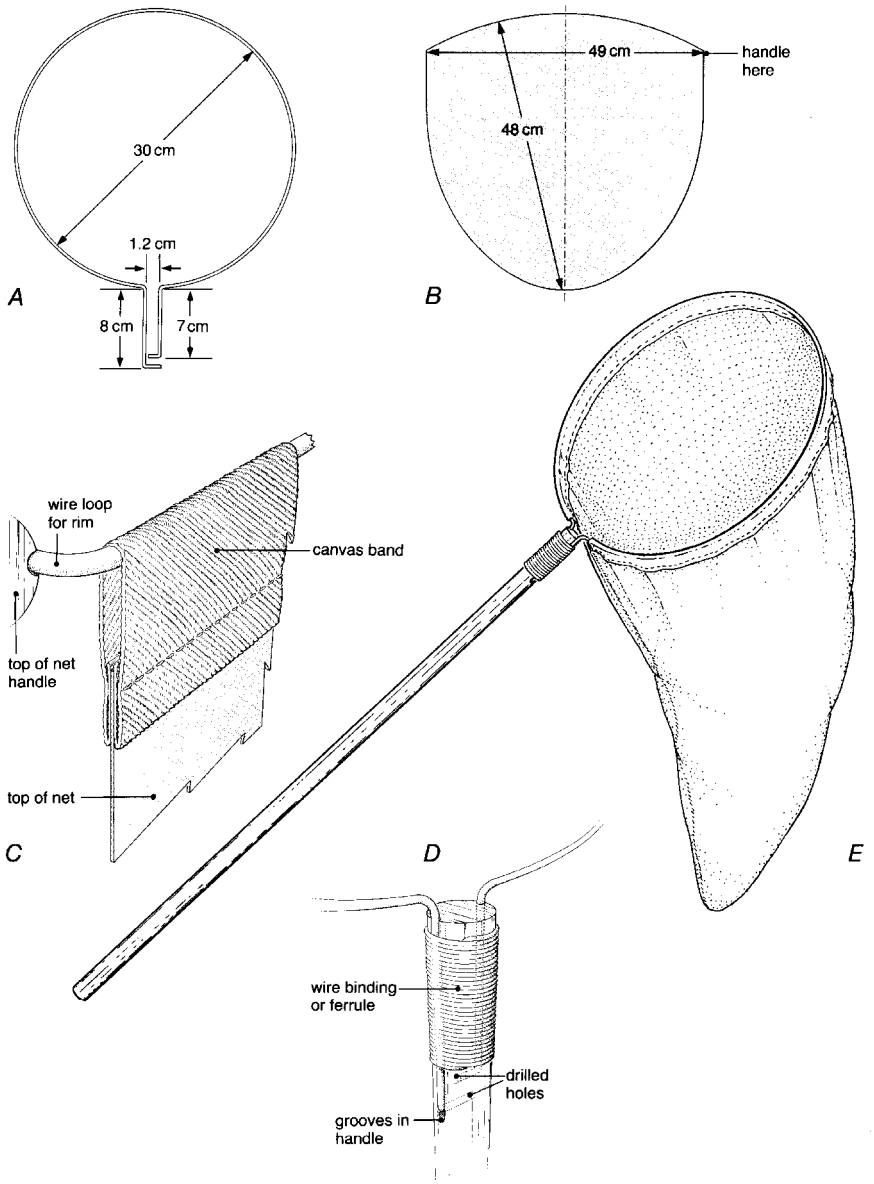
Collecting nets come in three basic forms: Aerial, sweeping, and aquatic. The first is designed especially for collecting butterflies and other flying insects. Both the bag and handle are relatively lightweight. The sweeping net is similar to the aerial net but is stronger and has a more durable bag to withstand being dragged through dense vegetation. Aquatic nets are used for gathering insects from water and are usually made of metal screening or heavy scrim with a canvas band affixed to a metal rim. A metal handle is advisable because wooden ones may develop slivers after repeated wetting. The net you choose depends on the kind of insects or mites you wish to collect.

Several kinds of nets, including collapsible models with interchangeable bags, are available from biological supply houses, but anyone with a little mechanical ability can make a useful net. The advantage of a homemade net is that the size and shape can be adapted to the needs of the user, to the kind of collecting intended, and to the material available, which need not be expensive. These materials include—

(1) Piece of heavy (8-gage) steel wire for the rim, bent to form a ring 30-38 cm in diameter (fig. 1, A). Small nets 15 cm or so in diameter sometimes are useful, but nets larger than 38 cm are too cumbersome for most collecting.

(2) Dacron or other strong, light fabric through which air can flow freely. Brussels netting is best but may be difficult to obtain; otherwise nylon netting, marquisette, or good quality cheesecloth can be used, but the last snags easily and is not durable. The material should be folded double and should be 1.5-1.75 times the rim diameter in length (fig. 1, B). The edges should be double-stitched (French seams).

(3) Strip of muslin, light canvas, or other tightly




woven cloth long enough to encircle the rim. The open top of the net bag is sewn between the folded edges of this band to form a tube through which the wire rim is inserted (fig. 1, C).

(4) Straight hardwood dowel about 19 mm in diameter and 105-140 cm long (to suit the collector). For attachment of the rim to the handle, a pair of holes of the same diameter as the wire are drilled opposite each other to receive the bent tips of the wire, and a pair of grooves as deep and as wide as the wire are cut from each hole to the end of the dowel to receive the straight part of the wire (fig. 1, D).

(5) Tape or wire to lash the ends of the rims tightly into the grooves in the end of the handle. This may be electrician's plastic tape or fiber strapping tape commonly used for packaging. If wire is used, the ends should be bound with tape to secure them and to keep them from snagging. A close-fitting metal sleeve (ferrule) may be slipped over the rim ends and held in place with a small roundheaded screw instead of tape or wire lashing.

After the net has been placed on the rim, the ends of the band should be sewn together and the rim ends fastened to the handle. The other end of the handle should be filed to remove sharp edges. The net is then ready for use (fig. 1, E).

Efficient use of a net is gained only with experience. Collection of specimens in flight calls for the basic stroke—swing the net rapidly to capture the specimen, then follow through to force the insect into the very bottom of the bag. Twist the wrist as you follow through so the bottom of the bag hangs over the rim (fig. 2); this will entrap the specimen. If the insect alights on the ground or other surface, it may be easier to use a downward stroke, quickly swinging down on top of the insect. With the rim of the net in contact with the ground to prevent the specimen from escaping, hold the tip of the bag up with one hand. Most insects will fly or crawl upward into the tip of the bag, which can then be flipped over the rim to entrap the specimen.

Sweeping the net through vegetation, along the sand and seaweed on beaches, or up and down tree trunks will catch many kinds of insects and mites. The aerial net may be used in this way,

but the more durable sweeping net is recommended for such rough usage. After sweeping with the net, a strong swing will bring anything in the bag to the bottom, and then by immediately grasping the middle of the net with the free hand, the catch will be confined to a small part of the bag. Only the most rugged sweeping net may be used through thistles or brambles. Even some kinds of grasses, such as sawgrass, can quickly ruin a net. Burs and sticky seeds are also a serious problem.

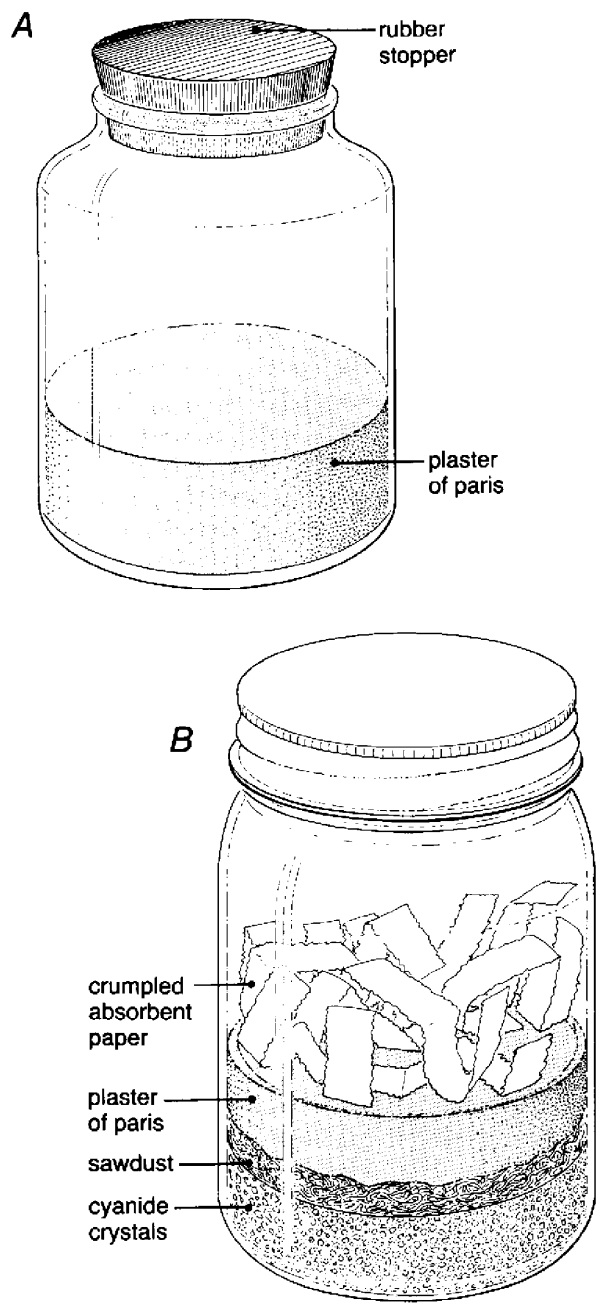
The catch may be transferred from the bag to a killing jar in one of several ways. Single specimens are transferred most easily by lightly holding them in a fold of the net with one hand while inserting the open killing jar into the net with the other. While the jar is still in the net, cover the opening until the specimen is stupefied; otherwise, it may escape before the jar can be removed from the net and closed. To prevent a butterfly from damaging its wings by fluttering in the net, squeeze the thorax gently through the netting when the butterfly's wings are closed. Experience will teach you how much pressure to exert; obviously, pinching small specimens of any kind is not recommended. When numerous specimens are in the net after prolonged sweeping, it may be desirable to put the entire tip of the bag into a large killing jar for a few minutes to stun the insects. They may then be removed and desired specimens placed separately into a killing jar, or the entire mass may be dumped into a killing jar for later sorting. These methods of mass collecting are especially adapted to obtaining small insects not readily recognizable until the catch is sorted under a microscope.

Removal of stinging insects from a net may be a problem. They will often crawl toward the rim of the bag and may be made to enter a killing jar held at the point where they crawl over the rim. However, many insects will fly as soon as they reach the rim, and a desired specimen may be lost. A useful method is to trap the insect in a fold of the net, carefully keeping a sufficient amount of netting between fingers and insect to avoid being stung. This fold of the net can then be inserted into the killing jar to stun the insect. After a few moments, it should be safe to remove the insect from the net and transfer it to a killing jar. If the stunned insect clings to the net and does not fall readily into the jar, use forceps or pry the insect loose with the jar lid or a small stick—not with your fingers.

Aerial nets made of dacron or nylon may be used to sweep insects from water if an aquatic net is not at hand. The netting will dry quickly if swept strongly through the air a few times; however, it should not be used again until thoroughly dry, or other specimens, especially butterflies, may be ruined. A number of special modifications are necessary to adapt a net for aquatic collecting.

For specialized collecting, nets can be attached to the ends of beams that are rotated about their midlength by a motor drive. Nets also can be adapted to be towed by or mounted on vehicles.

References: 108, 226, 366, 371, 413, 455; vehicle-mounted net: 6, 19, 170, 188, 196, 208, 248, 254, 284, 371, 425, 426.

**Killing Jars or Bottles**

Any heavy, wide-mouthed glass jar or bottle with a tight-fitting stopper or metal screw top may be used as a killing container. Olives frequently are sold in bottles that make convenient killing containers. Tops that may be