

INSTRUCTIONS FOR THE GENERAL COLLECTION (Bring to first class)

A general collection will be required with specimens in good condition and properly prepared according to the following instructions. It is due the last laboratory period. You will be allowed to have the collection or at least part of the collection returned to you once they are graded. I reserve the right to retain any specimens that may be needed in the museum for research or teaching.

1. Identify all insects to family.
2. Each specimen should be labeled with the locality (state, county, city, specific site such as the distance in miles from a particular town or point, and longitude and latitude), date, collector's name, and whenever possible collecting method or plant or animal association.
3. Mount on points all specimens that should be pointed (see page 5).
4. Mount on pins other specimens (see pages 4-5). Make sure when mounting that characters needed to identify each order are visible.
5. Spread all Lepidoptera (see page 5).
6. Odonata should be spread for class use. Duplicates should be kept in paper envelopes with collection data written on the flap.
7. Families to be killed and preserved in alcohol are listed later in handout.
8. Sheets of labels for order and family can be supplied if needed to help you organize your collection.
9. No credit will be given for immatures (there is another class for that!). Duplicate specimens (up to 10) will be acceptable in rare (marked with an * in text) families or those needed for the collection.
10. Specimens from cultures reared in the laboratory are not acceptable.
11. Turn in a typed list of all orders, families, and number of specimens with your collection.

Grading plan: The collection will be worth 250 points.

Diplura, Embioptera, Protura, Strepsiptera, Zoraptera.....	3.0
All other Orders.....	2.0
Each Family.....	1.0
Each additional Species in a Family (up to 20).....	0.6
Any rare (marked with an * in text) Family or one needed for collection.....	2.0
Each duplicate specimen in above category (up to 10).....	1.0

Up to 250 points may be earned through accurate identification of your specimens. The quality of the collection will also be judged. You may earn up to an additional 15 points based on the quality of your specimens, and whether they were pinned and labeled properly. In general, we do not examine every specimen to document that all the legs, antennae, wings, etc. are present, and whether all the labels are done correctly. We will scan the collection, rating it for overall quality. In general, if all, or most all, of the specimens are in good condition, and are preserved correctly, you will receive a point total near the maximum of 15. If a specimen here or there is damaged, etc., you may lose a point or two. If there are a fair number of specimens in poor shape, or poorly prepared, you will receive fewer of the 15 points. Keep in mind, however, this is essentially bonus points, hopefully to encourage you to take the time to properly pin and label your specimens.

Examples of poor specimen condition that may result in point reductions:

- | | |
|--------------------|----------------------------|
| 1. no antennae | 5. wings crumpled severely |
| 2. no head | 6. very discolored |
| 3. no abdomen | 7. wings badly broken |
| 4. 4 or fewer legs | |

Examples of incorrect labels that may result in a loss of points:

- | | |
|------------------------------------|---------------------------------|
| 1. no collector's name | 5. label turned wrong direction |
| 2. name incomplete | 6. label pinned in wrong place |
| 3. date written wrong | 7. label too high or low |
| 4. data faded from labels in vials | 8. label too large |

Examples of poor specimen preservation that may result in point reductions:

1. Lepidoptera not spread properly
2. Preserved in alcohol when should be pinned or vice versa
3. Body shriveled (often teneral, or specimens that should have been preserved in alcohol)
4. Specimen turns on pin – a tiny drop of glue will cure this.
5. Pinned in wrong place or slanted on pin
6. Antennae, legs, wings, abdomen too far out or down
7. Specimen broken by oversized pin
8. Too high or low on pin
9. Point or right of pin
10. Specimen pinned when should have been pointed
11. Specimen incorrectly placed on top of point

ADULTS - Killing, Preserving, Mounting

Kill and preserve in 75% ethyl alcohol all of the following orders*

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|---------------------------|----------------------|
| 1. Collembola ** | 9. Psocoptera |
| 2. Diplura | 10. Pthiraptera |
| 3. Embiidina (Embioptera) | 11. Siphonaptera |
| 4. Ephemeroptera | 12. Strepsiptera |
| 5. Isoptera | 13. Thysanoptera *** |
| 6. Microcoryphia | 14. Thysanura |
| 7. Plecoptera | 15. Trichoptera |
| 8. Protura | 16. Zoraptera |

* The soft-bodied orders are usually stored in 80-85% alcohol, and some require additional additives, e.g., Ephemeroptera, preferably with 1% ionol added; Thysanura and Microcoryphia (alcohol Bouin's solution may be a better preservative).

** For identification, Collembola should actually be mounted in pairs on microscope slides. One specimen should be mounted laterally - head to the left, and one specimens should be mounted ventral surface up (Christianson & Bellinger, 1980).

*** This is the preferred method for Thysanoptera: kill in AGA solution (8 parts 95% alcohol, 5 parts distilled water, 1 part glycerin, and 1 part glacial acetic acid). After a few weeks transfer to 80% alcohol.

Kill in cyanide or ethyl acetate vapor; mount on pins, points the following orders:

17. Blattaria – pin through right tegmen in about the middle (from front to rear) of the body.
18. Coleoptera – pin through right elytron or point.
19. Dermaptera – pin with #1 pin through right tegmen or mount on top of flat point, making sure that the abdomen does not droop.
20. Diptera – mount on pins. Smaller specimens may be mounted using points (in the past, they were mounted on minutens through the thorax; tip of fine minuten may be touched to adhesive before piercing specimen); cyanide is the preferred killing agent as specimens are drier; minute forms (2 mm or less), except Psychodidae, should be preserved in alcohol. Once wet, Diptera wings usually do not dry out properly.
21. Hemiptera – pin larger specimens through scutellum; smaller, thinner ones through right hemelytron; most of those less than 10 mm long should be pointed. Also point very thin bodied Hemiptera.
22. Homoptera – pin large specimens through scutellum; smaller ones through right wing or point (small); EXCEPT Aleyrodidae, Aphididae, and Pseudococcidae, kill and preserve in alcohol; scale insects (several families) should be preserved dry on host plant material.
23. Hymenoptera – mount on pins through thorax or point. Kill and preserve minute forms (2 mm or less) in alcohol.
24. Lepidoptera – pin through thorax and spread wings. Microlepidoptera are double-mounted on minutens (See Jerry for advice). A good guide for the use of minutens over #0 insect pins is "fringe 1/2 or more width of wing." Lepidoptera of all sizes can be mounted on smooth styrofoam ventral side up as shown in McCabe

- & Post, 1977. Cyanide is the preferred killing agent as some workers feel ethyl acetate sets the muscles making them difficult to pin later. Pinch thorax sharply to stun them before putting them into killing jar.
25. Mantodea – pin through right tegmen in about the middle (from front to rear) of the body.
 26. Mecoptera – pin through thorax.
 27. Neuroptera – mount on pins or point dorsoventrally through thorax; put very small forms (Coniopterygidae) in alcohol.
 28. Odonata – pin, preferably sideways with left side uppermost (spread like Lepidoptera for teaching purposes), or place in envelopes.
 29. Orthoptera – pin or point.
 - Acrididae and Tetrigidae – pin through right side of pronotum (so pin passes through mesosternum).
 - Tettigoniidae and crickets – pin through right tegmen in about the middle (from front to rear) of the body.
 30. Phasmida – pin through metanotum between last two pairs of legs.

Specimens submitted for identification to the Systematic Entomology Laboratory, USDA, may require different treatment. Consult 1976 Bull. Entomol. Soc. Amer. 22(2):130 and museum personnel for the latest requirements.

KILLING BOTTLES

(see text, pp. 749-750)

Making a cyanide killing jar (make in well ventilated area):

1. Jars – pickle relish or jelly jars – convenient to hold in hand.
2. Spread 1 heaping tablespoon of potassium cyanide evenly over bottom of small jar.
3. Cover with layer of cellucotton 1/2" thick. Push down so have more space in killing jar.
4. Mix plaster of Paris with water to thick consistency and pour half inch layer over cellucotton.
5. When plaster of Paris is almost set, make holes in it with a probe the size of a small pencil lead.
6. The jar sweats as plaster hardens so leave lid slightly ajar or wipe out with absorbent tissue.

Precautions to observe with killing jars:

1. Label **POISON**. At bottom of label, write name of poison, e.g., potassium cyanide.
2. Tape bottom of jar to keep it from shattering if dropped.
3. Keep out of reach of children.
- 4. Do not smell to test strength!!**
5. A killing bottle used for Lepidoptera should not be used for other insects because they will become covered with scales.
6. Do not leave jar open longer than necessary.
7. Keep inside of bottle dry by wiping periodically or keep some paper towels inside bottle to absorb moisture and keep insects from getting tangled.

Other chemicals used in killing jars:

- | | |
|------------------------------------|--|
| 1. sodium cyanide | 4. carbon tetrachloride - renders many insects brittle |
| 2. calcium cyanide | 5. chloroform - degrades orange of nymphalids |
| 3. ethyl acetate - least dangerous | |

Liquid killing agents are poured on some sort of absorbent material in the bottom of a bottle. Liquids evaporate and bottles using them must be recharged.

Other methods of killing insects:

1. Insects to be stored in alcohol should be killed in alcohol.
2. Freezing (remove plant material)

HANDLING THE CATCH

(see text, p. 754)

It is advisable to pin specimens as soon as possible after killing them as dried insects are extremely brittle. Specimens which have been dried may become loose on the pin. Insects may be stored (dead or alive) in the refrigerator or frozen for longer periods. They will have to be relaxed after extended freezer storage. They may also be stored dry in pillboxes or paper envelopes containing an absorbent material and relaxed for pinning or pointing.

RELAXING INSECT SPECIMENS

(see text, p. 755)

Dried specimens may be pinned after 4-13+ hours in a relaxing chamber to which a few crystals of phenol (C_6H_5OH), naphthalene, paradichlorobenzene, or chlorocresol have been added to prevent mold. Time in chamber depends on length of time specimens have been dead and type of relaxing chamber.

CLEANING INSECT SPECIMENS

(see text, p. 756)

Mud, dung, and Lepidoptera scales may be removed by placing specimen in water to which a few drops of detergent have been added (if water doesn't harm specimen). Grease may be removed by xylene, acetone, or other cleaning fluid.

GENERAL PINNING INFORMATION

Insect pins:

* Sizes (thickness):

- a. Range from 00-7, the smaller the number the thinner the pin.
- b. All are approximately 37 mm long except #7 which are about 54 mm long.

* Types:

- a. Steel pins with black japanned finish and either nylon or brass wound heads. Nylon heads are preferred as brass wound heads tend to slip allowing pins to prick fingers.
- b. Stainless steel pins. They don't corrode or rust, but don't hold a point as well.

* Uses:

- a. #1 and #2 pins are the sizes usually used for pinning insects, although #1 pins, being thinner, are best used in pinning trays with foam bottoms.
- b. Insects which are too small for a #1 pin to pass through without injury to the parts are glued on points (or pinned on minutens). Generally, insects 6 mm or less should not be pinned.
- c. #3 pins are used with double mounts (points, cork blocks or polyporus strips) or for large insects such as sphingid moths or rhinoceros beetles.
- d. #7 pins are used for very large, very thick insects such as foreign goliath beetles (Scarabaeidae). Insects pinned on these longer pins require a deeper box for storage.

Mounting:

* Insects are usually pinned vertically through the body as shown and described on p. 756-760 of the text.

Dragonflies and damselflies are best pinned horizontally with the left side uppermost.

* Height on pin – the pin should project ~3/8" above the insect so it may be handled without the fingers touching the specimen. Flies and wasps with upward projecting wings may be placed 1/2" from the top of the pin. This height allows sufficient room beneath the specimen for a series of labels, and insects which are mailed may have the pins deeply inserted into the bottom of a shipping box without the danger of losing legs.

* Appendages – insects with legs, antennae or wings which extend too far anteriorly, laterally, dorsally or ventrally take up too much room in a collection, are more likely to be broken, and interfere with the placement of the labels. On the other hand, these structures do need to project out from the body slightly so they can be easily examined. Therefore insects with long legs and antennae or abdomens which might sag should be

pinned to a styrofoam block about 3/4" high until they are dry; other pins may be used to position the appendages close to the body and out of the way of the labels.

- * Hemiptera – Gerridae and Nepidae have very long middle and hind legs which should extend straight backward.
- * Orthoptera, Mantodea, Phasmida--The legs may reach to the tips of the wings or ovipositor if they don't extend too high; otherwise fold tibiae and tarsi beneath femur. Some suggestions on folding the legs of mantids and walkingsticks are shown in the pinning displays.

MOUNTING INSECTS ON POINTS

The advantage of mounting insects on points is that no part of the insect is destroyed. The specimen can be removed from the point with the appropriate solvent.

Points are punched from 2 ply Bristle Board (3 ply Bristle Board is better if tips are to be split). Punched points are stored in vials.

Points are mounted on #3 pins. Put point on magazine or protom board and start pin through middle of large end. Points are mounted 1/2" from top of pin by pushing pin point through the hole in the highest step of a 4 step pinning block. Take care not to bend the smallest points.

Use points for insects 6 mm or less in length. Use triangular point with tip straight for minute insects. Point tip is usually bent down with forceps to conform to rounded side of insect but may be left straight if insect is flattened ventrally. Tip of point may be split if more surface area is needed. Points are mounted on pins in advance of need, with tips straight or bent.

A drop of Elmer's glue (or colorless nail polish) is placed on the tip of the point which is applied to the right side of the thorax as the insect faces forward. Avoid getting legs in the glue. Hold for a few seconds, then lift. If insect tends to slide, put pin in cork so insect hangs parallel to table. It may also be necessary to let the glue dry a bit before touching the specimen. An insect flattened dorsally-ventrally may be laid on its back on a block of wood 3/4" to 1" high. Point is dipped in drop of glue, turned upside down and applied to thorax beside legs. When mounted the insect faces forward on the left side of the pin.

MOUNTING BUTTERFLIES AND MOTHS

Put insect pin through center of thorax of freshly killed butterfly or moth. If it has dried, relax specimen first (see text). Allow 3/8" of the pin to project above thorax. Specimen should not tilt from side to side or from front to back on pin.

Push pin straight down in center of slot of pinning board until outstretched wings are just level with surface of pinning board.

Insert insect pin lightly in each front wing near base of front margin and just behind a heavy wing vein. Move front wings forward gently until hind margins of front wings are in a straight line, at right angles to body.

With pin placed behind a heavy vein in the hind wing, move each hind wing forward until the gap between front wing and hind wing is closed to just a notch.

Cut narrow strips of paper (waxed paper works well) and lay them over wings. Pins holding paper strips in place should not go through wings but should be close to them to keep enough pressure on wings to prevent their slipping out of place. Remove other pins that are through wings. If abdomen tends to sag, it can be propped up with pins until it dries. Pins can also be used to keep antennae in place while specimen dries. Depending on the moisture in the air, specimens should remain on the board from four to eight days. As you become more proficient, you will learn not to puncture the wings with the pin.

MOUNTING WITH MINUTEN NADELN

This is really not done much anymore. We will be glad to let you try this if you wish.

Mounting pins:

- a. Sizes: 0.15 mm (thin) or 0.20 mm (thick) in diameter.
- b. Types: stainless steel or black japanned. Stainless steel minutens are preferred because they don't react with insect juices. The 0.15 mm minutens are best used with polyporus blocks.
- c. Insect pins: #3.

Cork or polyporus blocks:

- a. each large cork block has already been cut into four smaller ones with a single-edged razor blade. Polyporus strips are cut into blocks 4-5-mm long.

Preparing the double mount:

- a. push a #3 pin through one end of a cork (white side up) or polyporus block. The bottom of the block is set about 1/2" from top of pin by pushing the pin point through the hole in the highest step of a 4 step pinning block.
- b. Using forceps, push the sharp end of a minuten through the block at right angles to the large pin (for non-Lepidoptera) or parallel to large pin (for Lepidoptera). The blunt end of the pin should project a bit so the insect may be turned.

Pinning small Diptera:

- a. Place the insect on its left side and impale the specimen through the thorax. It is preferable to use the binocular scope and pin at or near the suture which separates the mesopleura and pteropleura.
- b. Press the insect gently against a thumb or finger until you feel the pin prick. The minuten, therefore, won't extend far enough out of the specimen to damage the left side. The insect faces forward on the left side of the pin. Generally insects 6 mm or less are mounted on minutens. (Taken from Sabrosky, C. W. 1937. On mounting micro-diptera. Entomol. News 48:102-107.)

Sometimes small insects (Neuroptera: Hemerobiidae, Sisyridae, small Chrysopidae and Mantispidae) are mounted as follows: using forceps, push the sharp end of a minuten through the insect from dorsum to venter leaving a little of the minuten protruding above the dorsum. Hold the minuten beneath the insect with the forceps and use your thumb to bend it at right angles. Push minuten into a cork mounted on a #3 pin.

Microlepidoptera, Hymenoptera or Neuroptera with wings spread are mounted on straight minutens which are pushed into elongate polyporus blocks with the head facing the large pin. Sometimes it is easier to make a starter hole in the polyporus block before inserting minuten.

PRESERVATION OF INSECTS IN FLUIDS

(Text, p. 761)

Types of fluid:

- a. The fluid generally used in 75% alcohol. Rubbing alcohol (drugstore grade of isopropyl alcohol) is satisfactory for temporary storage but often contains ingredients which cause changes in specimens and often is more dilute than 70%. Do not use methyl alcohol or formalin solutions. The alcohol should be changed after 24 hours because it becomes diluted by the body fluids of the specimens.
- b. Thysanoptera are killed in AGA solution and later transferred to 80% alcohol.
- c. Insect larvae are killed in Quinter's or KAAD solution and preserved in 95% ethyl alcohol. Some nymphs also need pretreatment.
- d. Thysanura and Microcoryphia are perhaps better preserved in alcoholic Bouin's solution.

Uses:

* Permanent storage:

- a. Soft-bodied insects (e.g., mayflies, stoneflies, termites) that would shrivel and become distorted if pinned and allowed to dry.
- b. Many very small insects that are best studied in detail when mounted on a microscope slide (e.g., lice, fleas, thrips, springtails).
- c. Insect larvae and nymphs.
- d. Arthropods other than insects

* Temporary storage: Insects which are to be pinned or pointed are preferably preserved dry. If you must store in alcohol, kill first.

1. Disadvantages of temporary storage in alcohol:
 - a. Body fluids which "glue" insect to pin are destroyed and insect turns on pin (not important for insects which are pointed).
 - b. Taxonomic characters are lost or damaged: colors fade or change; body hairs and bristles stick together; scales forming wing pattern of Lepidoptera are lost; insect wings crumple on removal from alcohol; insects with delicate integuments shrivel when dried.
 - c. Insects are not easily examined in alcohol; must be pinned or pointed to identify.
 - d. Insects dropped live in alcohol die with wings and legs in unnatural positions and are difficult to pin properly.
2. Advantages of temporary storage in alcohol:
 - a. Specimens are easy to dissect (e.g., genitalia)
 - b. Some structures (number of segments in tarsi or beak) are more easily seen in specimens preserved in alcohol
 - c. Useful for handling large lots of material. A few specimens are pinned for identification and the rest are stored in alcohol to be counted later.

Vials for storage of specimens preserved in alcohol--see Text, p. 761.

Labels:

- a. Paper--stiff, white, preferably with high rag content.
- b. About as long and wide as vial, but not long enough to interfere with stopper.
- c. Print legibly in capital letters with waterproof ink; let dry and place in vial.
- d. Label information--at least locality (state, parish, city, distance from a particular point, or township and range coordinates), date, and name of collector. A detailed label would also have the collecting method and plant or animal association, if known.
- e. Position in vial--left edge down; printed information to outside.

CHARACTERS USED IN THE IDENTIFICATION OF THE VARIOUS ORDERS

In the textbook each order is preceded by a section about the characters used in identification and followed by one dealing with collecting and preparing specimens. Some suggestions about the characters used in the following orders are given below. If you recognize the family to which a specimen belongs it will not be necessary to spread the wings (except Odonata and Lepidoptera), extend the legs, etc. Coleoptera and Diptera are probably the most difficult.

Coleoptera – Legs of small specimens should be down so tarsal segments can be counted and characters on ventral surface seen.

Diptera – Wing venation, including veins in anal area of wing; bristles on sides of thorax, so legs need to be down; legs: pads and bristles between tarsal claws; tibial spurs and bristles; femoral bristles; presence or absence of postscutellum; if wings are a little distance from middle of the body, this structure can be seen.

Homoptera – Hind tibiae and tarsi: presence or absence of spines on tibiae; number of tarsal segments; length of terminal beak segment in some Fulgoroidea.

Hymenoptera – Front wing venation of Ichneumonidae and Braconidae (antennae with 16+ segments). Bees (6 families, usually very hairy or fuzzy); mouthparts should be extended or wings on one or both sides (preferably right side) spread so anal area of hind wing may be seen.

Lepidoptera – if you need to clear the wings, there are a couple methods: A) Quick, crude method: insert an insect pin in the thorax and with your fingers strip as many scales as possible from the right wings. Place the specimen upside down on a pinning board (body is supported by groove) and remove remaining scales from underside of wings with a very fine paint brush with the bristles cut to a length of 2 mm. Reverse the specimen, clean the upper surface and spread. B) Better method: 1) Dip wings in alcohol; 2) immerse wings in bleach until clear; 3) dip wings in dilute acetic acid (water & vinegar); 4) dip wings in alcohol; 5) place specimen on mounting board on two glass slides, allow to dry. Note - with small and minute specimens, the wings are removed, run through the above clearing procedure and allowed to dry on glass

slides. Wings can then be made into a permanent slide mount or they can be mounted on white cards. Venation of large specimens can often be viewed by either: 1) Carefully wetting the wings with alcohol and backlighting the specimen; or 2) Place the specimen on an observation block (ventral surface up), and shine a light across the wing surface. Veins will show as a pattern of light ridges with shadowed borders.

LABELS

Standards for entomological labels:

- a. Size: no larger than 10 mm x 20 mm (3/8" x 3/4"); 3 or 4 lines can be handprinted in that area
- b. Legible: "handwritten" means using a fine pen point (Crow quill, Radiograph, etc.); print size on printed labels no less than 0.8 mm high.
- c. Permanent
 - paper – thinnest Bristol board or other fairly stiff white paper, preferably with high rag content so won't yellow with age
 - ink – permanent or India ink; ordinary writing inks may change unpredictably with age
 - Labels are printed in strips and may be purchased partly printed. Labels can also be done on the computer as long as the paper is the proper quality. Collectors' labels are often printed separately.

Information required on labels:

- a. Locality (indicates geographic distribution):
 - country – We will abbreviate, but the name should be written in full whenever possible because many countries have changed their names, boundaries, or both in the last 25 years. Specimens don't always remain in the country in which they were collected: people travel and collect in foreign countries, exchange specimens with friends overseas, or foreign specialists borrow specimens for taxonomic revisions.
 - state – ND. The post office's 2 letter abbreviations for states may be used, although it is preferable to spell out the name of the state.
 - county – (Co. can be used as abbreviations). Towns lose their population, then their post offices and their place on current maps or they may be incorporated into an adjacent city.
 - city, town, village, distance in miles from a particular point, or township and range coordinates. Be precise; too many people label specimens with the name of the town they are headquartered in when the actual collecting sites are 10-20 mi. away in varied surroundings. Be clear--name a place that can be recognized by other people. Smith's farm is fine for a temporary label but needs to be translated to a name that is on a map or in an atlas or gazetteer.
- b. Collecting date (indicates seasonal distribution):
 - Months are written in Roman numerals (I, II, III, etc.)
 - Day and year are written in arabic numerals (1, 2, 3 etc.); year is written out in full.
 - Preferred order is day-month-year: 24-II-1977, but month-day-year is acceptable.
Not 7-6-76 (July 6 or June 7?; 1876 or 1976?)
 - For reared specimens indicate date host or immature was collected.
- c. Name of Collector.
 - Gives credit.
 - May wish to communicate with collector for more data.
 - Sometimes indicates reliability of data--a student in the beginning entomology course collected all summer without recording a date; in the fall randomly assigned dates to his specimens; some good records were lost because the data was unreliable.
- d. Collecting method.
 - Tell how you collected the specimens so others can find them: e.g. sweeping, black light trap, pitfall trap. Some families may be collected only by sweeping; others may be collected in light traps (Bostrichidae and Platypodidae) which you would not expect from their common names or habits.

e. Plant or animal associations.

- This is as important as date and locality for identifying specimens and finding others like them.
Examples: beating pine, sweeping soybeans, reared from Nezara viridula (L.), armadillo carcass, rotting log.

How labels are pinned on specimens:

- * Labels should be parallel to and underneath the insect. The height of the pinned labels will vary for different species because some insects are thicker than others. In general they should be 1/4" below specimen and 1/4" apart. They should not be so close to the body that legs are broken off. Generally the insect sits at about the 4th level of the pinning block, the first label is at about the 3rd step, the second label at about the 2nd step and the third label at about the 1st step.
- * Insects on pins – the long axis of the label should coincide with the long axis of the specimen, and the left margin of the label should be toward the head of the specimen. When writing a label, plan a place for the pin hole so it won't obliterate words or numbers; it may go through dashes. For pinned insects this is through or slightly anterior to the middle of the label.
- * Insects on points or minuten – the long axis of the label should extend parallel to the point or minuten. The pin goes at about the middle of the label width and about 1/8" from the right edge.
- * Most people prefer that insect labels be read from the left. In collections, specimens on points which are placed with pinned specimens should have the points directed upward so all labels can be read from the same side and the specimens take up less space.

* References:

Arnett, R. H. 1967. Locality and data labels for insects. *Ann. Entomol. Soc. Amer.* 60(5):1111-1112.
Stuckenberg, B. R. and M. E. Irwin. 1973. Standards for entomological labels. *Bull. Entomol. Soc. Amer.* 19(3):164-168

PROBLEMS ASSOCIATED WITH STORAGE OF INSECT COLLECTIONS

- * Insects will last a long time if properly cared for. It is common to see insects collected in the 1800's and there are still quite a few collected in the 1700's still in existence.

Careless Handling:

- * Dried insects are brittle and easily broken. They are of little value if parts are lost. Pin properly and handle carefully.

Museum pests--text, p. 770:

- * Freshly pinned specimens may be attacked by ants or roaches. Dried specimens may be attacked by dermestids, cigarette beetles, etc.
 1. Store in pest proof boxes; keep lids closed when not in use.
 2. Use repellants.
 - a. naphthalene (flake of ball)--lasts longer.
 - b. Paradichlorobenzene--volatilizes more rapidly and must be renewed more frequently. I've used this as a fumigant on untreated collections with good results.
 3. Fumigate if necessary with Vapona strips.

Mold:

- * Mold is a problem in humid climates.
 - a. Store collection in dry place.
 - b. Don't leave in relaxing chamber too long.
 - c. A little carbolic acid (phenol) on a sponge in the storage box will prevent mold.

* Reference: Banks, 1909, U.S.N.M. Bull. 67, p.111; Oldroyd, 1958, p. 132.

Grease:

- * Grease oozing to the surface of a specimen often obscures the surface markings. It's a common problem with moths. Specimens with "good" patterns have recently emerged from the pupae and are therefore full of fat. Grease may also be a problem with other insects, e.g. Dermaptera, Lygaeidae, Scutelleridae, and Bruchidae.
 - a. May be removed by soaking in xylene or acetone or other cleaning fluid for about 24 hours.

* References: Oldroyd, 1958, p.132; C.D. Johnson, 1970, U. of CA Publ. in Entomol. 59:4.

Fading of colors:

- * Keep collections in dark. Comparison of newly collected specimens with old, faded ones in collection may cause misidentifications.

Verdigris:

- * Acid juices in bodies of certain insects have an affinity for pin metal, so that when these specimens are mounted on bright pins a green substance known as verdigris will accumulate about the pin, finally corroding it so it will easily break. Black japanned and silvered pins do not verdigris.

*Reference: Banks, 1909, U.S.N.M. Bull. 67, p.112.

PACKING AND SHIPPING INSECTS

(see text, pp 770-771)

Ref.: Sabrosky, C. W. 1971. Packing and shipping pinned insects. Bull. Entomol. Soc. Amer. 17(1):6-8.

Mailing pinned specimens:

1. Use a strong pinning box with a good bottom which is firmly glued in place.
2. Set pinned insects firmly in pinning box; use a pinning forceps if necessary.
3. Anchor large and heavy specimens with additional pins.
4. Anchor each microvial with pins at both sides and the free end.
5. Put cardboard over the top of the pins with a layer of cellucotton on top to hold it in place.
6. Wrap the pinning box in paper to keep out packing material debris.
7. Put address label on pinning box as well as on shipping carton.
8. Leave 2 to 3 inches of space on all sides between pinning box and shipping carton. Fill space with packing material, neither too tight or too loose.
9. Don't put a vial in a box of pinned insects.
10. Don't put paradichlorobenzene or naphthalene crystals loose in pinning box.
11. Don't reuse weak or damaged cartons.
12. Send a letter to the addressee notifying him/her of the shipment.

Shipping specimens preserved in fluid:

1. Fill vials completely with fluid removing the air bubble (p. 771). Small delicate specimens may be enclosed in a small vial within the larger vial which is capped with cotton and cushioned with similar material.
2. Wrap vials individually in cellucotton and pack in larger container.

PLACES TO COLLECT VARIOUS ORDERS

(text p. 745-746)

Collect from birds or mammals:

- a. Pthiraptera (Anoplura, Mallophaga)
- b. Siphonaptera

- * Lice seldom leave host except after death. Lay freshly killed bird or mammal on white sheet of paper; as body cools lice will leave it and may be picked up with moistened camel's hair brush. Or, (fleas and lice) place freshly killed host in plastic bag, tie shut. Or, (fleas) comb out or shake freshly slain mammals or their

skins over a basin of water. Or, (fleas) walk in area where abundant, such as dog yard, and collect from clothes.

Collect from vegetation or structures near aquatic habitats:

- | | |
|---------------------------------|----------------|
| a. Ephemeroptera | d. Plecoptera |
| b. Odonata | e. Trichoptera |
| c. Neuroptera (aquatic species) | |

Collect under bark:

- | | |
|---------------|-----------------|
| a. Collembola | f. Protura |
| b. Dermaptera | g. Psocoptera |
| c. Diplura | h. Thysanoptera |
| d. Coleoptera | i. Thysanura |
| e. Embidina | j. Zoraptera |

Collect from moist soil, humus, leaf mold, and leaf litter:

- | | |
|---------------|---|
| a. Protura | d. Diplura |
| b. Collembola | e. Thysanura |
| c. Dermaptera | f. Coleoptera (Staphylinidae, Lathridiidae) |

* Sift onto white surface and pick up the insects with moistened brush; sift over pan of alcohol (many insects such as Collembola float); use Berlese funnel.

Collect from dead or decaying stumps or wood or old boards:

- | | |
|----------------|----------------|
| a. Collembola. | e. Protura. |
| b. Diplura. | f. Thysanura. |
| c. Isoptera. | g. Zoraptera. |
| d. Phasmida. | h. Coleoptera. |

* Collect with moistened brush or knock infested wood onto paper.

Collect parasitized hosts (bees, wasps, leafhoppers, planthoppers) and rear out parasites:

- | | |
|-----------------|----------------|
| a. Diptera | c. Hymenoptera |
| b. Strepsiptera | |

Collect inside buildings insects attacking stored food, fabrics, wood products, humans or pets; some are incidental invaders:

- | | |
|---------------|--------------------------|
| a. Blattaria | f. Lepidoptera |
| b. Coleoptera | g. Orthoptera (crickets) |
| c. Dermaptera | h. Psocoptera |
| d. Diptera | i. Siphonaptera |
| e. Isoptera | j. Thysanura |

Collect on flowers:

- | | |
|----------------|---|
| a. Coleoptera. | d. Hymenoptera. |
| b. Diptera. | e. Lepidoptera. |
| c. Hemiptera. | f. Thysanoptera--collect flowers in bag, shake over light or dark surface |

Sweep or beat vegetation, including trees and shrubs:

- a. Coleoptera.
- b. Diptera.
- c. Hemiptera.
- d. Homoptera.
- e. Hymenoptera.
- f. Mantodea.
- g. Neuroptera.
- h. Orthoptera.
- i. Phasmida.
- j. Psocoptera (on tree bark).
- k. Thysanoptera.

Collect with aerial net:

- a. Diptera.
- b. Lepidoptera.
- c. Hymenoptera
- d. Mecoptera

Collect at lights (fewer during full moon):

- a. Coleoptera.
- b. Diptera (few).
- c. Ephemeroptera.
- d. Hemiptera.
- e. Homoptera.
- f. Hymenoptera (few).
- g. Lepidoptera.
- h. Neuroptera.
- i. Orthoptera.
- j. Plecoptera.
- k. Strepsiptera (males some spp.).
- l. Trichoptera.