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Labeling Specimens

Proper labeling of specimens should be first and foremost in the minds of those creating insect collections. Professional entomologists usually welcome the opportunity to study the insects of a well-preserved and labeled collection, because such collections supply distribution and timing records, as well as other information of value to the profession. There is pride and satisfaction in a collection that includes important scientific value.

To be of scientific value, each specimen must be accompanied by information including the location (county and state) and date (day, month, year) of its capture and the name or initials of the collector. To avoid confusion, the month should be written in roman numerals and should always occur between the day and the year. These data are printed on a small label (Figure 22) placed on the pin beneath the specimen. A specimen in a collection for scientific purposes frequently has secondary labels on the pin indicating the host or habitat of the specimen or its identification (not required in beginning or 4-H club collections).

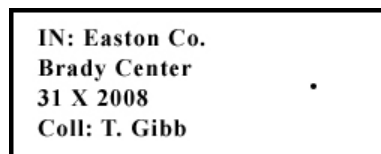


Figure 22

The maximum allowable size of pin labels in 4-H collections is not more than 7/8 inch long and 5/16 inch wide. Most professional entomologists use even smaller labels. Pre-sized labels are provided [here](#) and may be created by cutting directly from the page. Homemade labels are cut from stiff white paper, such as index card stock. Collectors find many advantages in cutting a large supply at one time for future use.

The most important label should be mounted closest to the insect. This label must have the name of the state and county where the insect was collected, as well as the date and the name of the collector. The label should be positioned in line with the length of the insect. Additional labels, indicating hosts and identification, may be placed lower on the pin and oriented as in Figure 23.

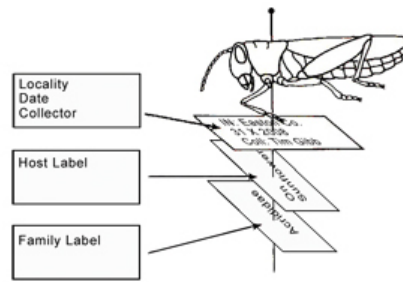


Figure 23

Cut all labels to the same size and from the same card stock to vastly improve the appearance of your collection. Carefully and neatly print information on the label to improve the appearance and the utility of the collection. Fine-point black pens are the best choices for attractive and legible labels. When you plan a large collecting effort in a single habitat or on a single day, use a computer to print partial labels in small type so that only the date and initials of the collector are filled in by hand to save time and effort.

Use a pinning block to place labels at a uniform height on the pins and always orient the labels so that all are read from the same side. These tips make for a very eye-catching display.

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Preserving Soft Body Insects

Preserve larval stages of insects and other soft-bodied specimens immediately by dropping them directly into a 70 to 90 percent ethyl or isopropyl alcohol solution. When collecting in the field, carry a few small vials of preservative fluid to store specimens.

An even better method of preserving caterpillars, grubs, and maggots, is to carry them home alive in separate plastic or glass containers, then submerge them for 1 to 2 minutes in boiling water. After this they can be immediately placed in the vials of alcohol. This process kills bacteria in the digestive tract and prevents discoloration. After a day or two, the liquid may become discolored. When this happens, transfer the specimens permanently to fresh alcohol solution.



Specimens in vials must be labeled exactly as described for pinned specimens with two exceptions. Labels must be written with a soft-lead pencil or with India ink so that the writing does not dissolve or run. Only one label should be used, thus append any information such as host and identification to the bottom of the label. Cut labels longer to allow for this. Labels must be included with the specimen inside the vial. Do not attach them to the outside as this has proven to be an unreliable method of labeling.

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How to Display Insects

After insects have been properly pinned and labeled, they are kept in specially designed insect boxes constructed with soft flooring into which pins can be inserted. Pinned insects cannot be stored in good condition for long unless they are placed in boxes to protect them from dust and damage. A standard display box is 18 x 24 inches (outside measurements) and 2 1/2 to 3 inches deep to allow insect pins to stand upright. It is protected on top with a glass or Plexiglas top. Figure 24 shows a box that is simple and easy to make. Standard display boxes also are available from entomological supply houses, or 4-H leaders may know of local suppliers. Use caution if Styrofoam is used for the bottom of display boxes, because the protectants described below may melt this material if contacted directly.

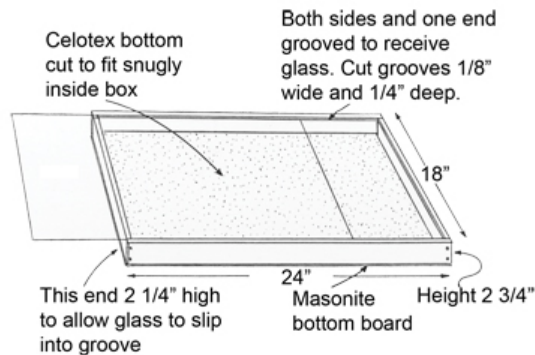


Figure 24



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Insect Display Box

Here's how to build an insect display box at home.

1. Cut a 1 to 4 inch board into two 24-inch pieces and two 16 1/2-inch pieces.
2. Cut a groove for the glass on all pieces (about 1/8-inch width and 1/4-inch deep), about 1/2 inch below the top edge.
3. Cut one 16 1/2-inch boards all the way through at the groove so the glass can slide in. Save the cut off piece of wood to secure the glass later.
4. Screw all the pieces together to form the box sides.
5. Attach masonite to the bottom of your box and trim if necessary. (Use nails, tacks, or screws dependent on materials chosen.)
6. Place polyfoam or Celotex in the bottom of the box. Other materials will also work if they allow pins to be pushed easily in and they hold the pins in an upright position.
7. Slide the glass or Plexiglas top in the grooved edge and reattach the piece you cut off (#3) to hold it in place.

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Precaution Against Collection-Damaging Pests

Store boxes in cool dry areas to prevent mold and mildew growth. Several types of small dermestid beetles, as well as other incidental pests such as rodents, readily feed upon and damage dry insect specimens. Naphthalene flakes, crystals, or mothballs (available as insect repellents in many retail stores), can protect against insect pests if exposed inside the box. These must be carefully secured in the box or they may shift and possibly damage specimens when the box is moved. Alternatively, you may securely attach small strips or squares cut from dichlorvos-impregnated resin strips (No-pest strips, Vaponite, Vapona strips, etc.) to the inside corners of boxes to kill any insect pest present. All insecticides should be handled very carefully and only used in accordance with label directions. Environmental Protection Agency (EPA) regulates mothball use, because some ingredients in mothballs may be carcinogenic. The active ingredients are very volatile and evaporate in a short time when exposed to air. Do not dispose of any surplus where there is any chance of these materials entering surface or groundwater supplies.

Always keep the lid tightly closed to exclude other pests, as well as to increase the longevity and effectiveness of the pest-protective materials.

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Placing Insects in Boxes

Specimens within an order are neatly grouped above the order label. Pinned specimens face towards the top of the box (Figure 25). Pointed specimens face to the viewer's right, but their labels are parallel to the labels of the pinned specimens. Although no specific size of the order label is mandated, most attractive labels are approximately 2 inches long and 5/16 inch wide. A series of these labels is available to cut and use in the collection [here](#). Pin them directly to the floor of the box, and arrange all specimens representing that order in neat rows in a rectangular area above the label. (Always arrange the insects across the length of the box.)

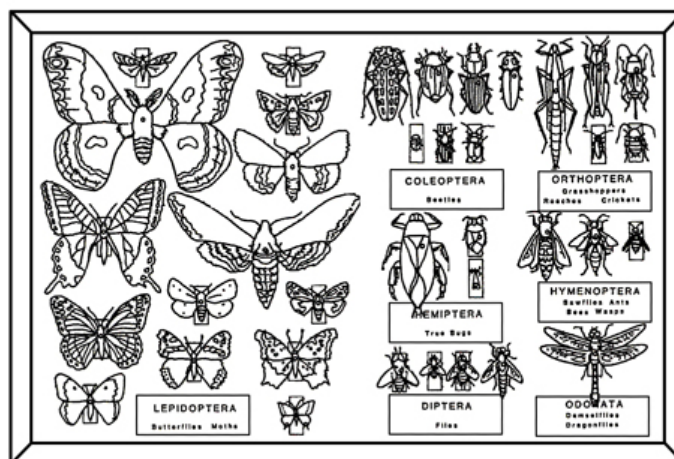
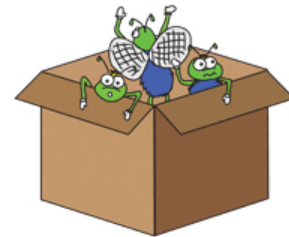


Figure 25

When secondary identification labels (common name, family, etc.) are used, they are smaller or a different color than order labels and also may be pinned to the floor of the box. Additional labels showing host or habitat may be placed on the pin on which the specimen is mounted, but below the primary label (see Figure 23).

Photos of actual insect display boxes are provided to illustrate what is expected in an insect collection. Objectively critiquing other displays can help improve your own.

Asking for advice and tips from others who have experience in insect collecting is also valuable. Above all, remember that practice is key. As old specimens are culled and replaced with newer and better mounts, the collection will improve. The best insect displays are usually a result of several years of persistent insect collecting, practice in mounting, and attention to detail in displaying the collection.



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Tips for Awesome Insect Collections

The most common comments and suggestions for improving insect collections as cited by entomology judges include the following:

Overall Appearance of Collection

Arrange specimens neatly and in an orderly way in the box. Top-to-bottom and left-to-right across the widest side of the box is best.

The box should be a standard size, clean, and well kept. Staining or waxing the box can improve the general appearance of the collection.

Group specimens under their correct order and family names. Rectangular groupings are most attractive. Line up specimens where possible. If multiples of a single species are included, always place them together.

Use a background color that shows off the collection nicely. White is usually the color of choice, however, light pastel shades of blue or green are also acceptable.

Order and family labels should be clear, neat, uniform, and attractively displayed.

Selection and Condition of Specimens

Wings on butterflies and moths must be properly spread. The first moths and butterflies spread usually are considered practice specimens and seldom improve the collection. With practice spreading will improve dramatically. Only display perfectly spread specimens.

Properly position antennae, legs, and other body parts when drying. Support the head and abdomen of large and less rigid specimens to prevent sagging. Create realistic or life-like positions of all specimens.

Do not display damaged or poorly mounted specimens. In most cases, it is better to display a well-mounted, ordinary specimen rather than a poorly mounted specimen, even if it is unusual.

Think carefully about displaying duplicate specimens. Judges look for as many varied insects as rules allow. Choose specimens from different orders, families,

and species rather than multiples of the same insect.

Pinning

Pin specimens so that insects are level, not tilted, on pins.

Place specimens at a uniform height on the pins.

Be sure to pin insects according to the pin placement guides for the various orders.

Labels

Make sure labels are uniform and neatly written, and contain all required data.

Position labels on the pins so they are level, straight, and oriented in the same direction.

Neatly cut all labels to a uniform size.

Use order labels (and family labels if required) to organize the placement of specimens within the box. These should be held by insect pins so that they lie flat against the bottom of the display box.

Specimen Identification

Be as accurate as possible in identifying insects. Order level is mandatory, common name and family name are required at some levels but always encouraged.

Do not re-label and use specimens from someone else's collection. Do not display insects purchased from supply houses. (Judges can usually detect such specimens and may disqualify the entire collection as a result.)

You may exhibit insects from another state only if you collect them yourself and label them correctly as to state, county, collector, and date.

Place insects in proper order groups.

Be sure that the mounting technique is appropriate for the specimen. Never pin immature insects. (Many insect collection rules stipulate adult insects only.) Use points, vials, and slides when necessary.

When using common names, be sure that they are "accepted common names."

Closely related insects (within an order) should be grouped together.

More precise identification (family and common names) is needed in advanced divisions.

Collect a variety of insects from as many different orders as possible. Do not allow one group of insects to dominate the collection and throw the variety of the specimens out of balance.

Specimen selection is more important in advanced collections. Selecting perfectly mounted unusual specimens is the goal.

Educational Display Boxes

Educational displays are designed to teach others something about insects. These displays use the same insect boxes as do the collections. Attractiveness, order, and accuracy are still key to making a winning display. However, much more creativity can be demonstrated in educational displays than in insect collections. Educational displays may teach nearly any subject dealing with insects and always feature real specimens as part of the box. Subjects often selected include comparisons of insect mouthparts, growth and development, camouflage, behavior, food resources, habitat, or any of a variety of other topics. Look for education box rules to determine what, if any, subject is required. Insects displayed are not held to the pinning, placement, labeling, or other rules common to collection displays. Tips for top-quality educational displays include:

Remember that the purpose of the educational box is to teach others.

Keep the message simple; do not try to teach multiple concepts with a single box.

Be sure the information presented is scientifically accurate.

Place a heading in the box that tells the viewer exactly and concisely what the display is.

Be sure that a “take-home message” is clear, concise, and accurate.

The display should tell its own story. The fewer the words the better, in most cases.

Appearance of, or “eye appeal” of the box is very important.

Displaying something you have personally seen or experiments you have conducted is usually best.

Try to be original within the confines of the rules.

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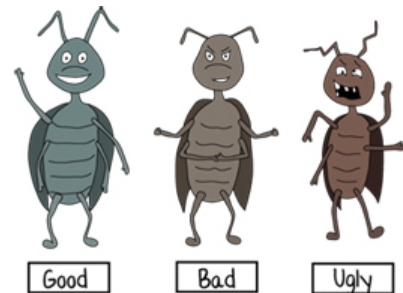
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How to Identify Insects to Order

Part of making an insect collection is learning how to correctly classify the specimens. This is a very challenging assignment, because there are so many insects and so many of them look alike. Do not be discouraged if there are specimens that cannot be identified. Remember that even professional insect taxonomists (entomologists who identify and classify insects) cannot identify every species of insect. Some must specialize in working with one group and others with another group.



Classification, the grouping and naming of insects, is an ever-changing science. Insect specialists separate and combine groups of insects based largely upon their morphological similarities, some having more influence in a decision than others. As such, this process is somewhat subjective and, thus, dynamic. A student of entomology may find slight differences in classification schemes depending upon which reference or which entomologist they consult, and these may change over time.

Not all orders of insects are the same size. For example, more than one-third of the named species of insects (300,000) are in one single order, the Coleoptera (beetles). The next largest orders are Lepidoptera (butterflies and moths), with 150,000 species; and Hymenoptera (wasps and bees), with 125,000 species. The order Diptera (flies) includes about 20,000 species. These four orders, Coleoptera, Lepidoptera, Hymenoptera, and Diptera, comprise more than 80 percent of the named species of insects.

Approximately 92,000 named species of insects occur in the United States and Canada. It is not known how many of these species occur in any one state or in even a small area within a state. A list of insects in New York, published in 1928, included more than 15,000 species, but hundreds of species have been discovered there since that time. States such as California, Arizona, Texas, and Florida probably far exceed the Midwest and Northern states in the total number of species of insects.

Estimates of the number of species for three representative states and also for all of USA and Canada are provided as an indication of the number of species that insect collectors may expect to find (Table 1). A collector who can find one or more representatives of

each of the 24 orders discussed in this book will have a very diverse collection, and in so doing will learn a great deal about insects and their habits.

Table 1. Estimated Number of Species					
Order	North Carolina	New York	Indiana	USA & Canada	World Wide
Collembola	169	200	200	314	9000
Thysanura	6	5	7	25	900
Ephemeroptera	121	61	120	690	3100
Odonata	148	159	150	425	5500
Dictyoptera	23	15	20	101	5800
Orthoptera	235	121	150	925	20000
Dermaptera	7	4	5	18	2000
Isoptera	5	1	5	41	2900
Plecoptera	94	59	85	408	2000
Psocoptera	37	38	30	150	4400
Mallophaga	164	53	90	318	4000
Anoplura	11	11	15	62	900
Thysanoptera	64	71	150	600	5000
Hemiptera	568	727	800	4600	40000
Homoptera	759	864	900	6700	50000
Neuroptera	68	61	65	338	6500
Megaloptera	9	10	15	61	300
Coleoptera	3336	4546	4424	30000	350000
Mecoptera	27	20	20	89	600
Trichoptera	161	174	210	980	11000
Lepidoptera	1428	2439	2000	10100	150000
Diptera	2595	3615	3600	17000	120000
Siphonaptera	14	26	28	250	2500
Hymenoptera	2463	2300	2800	17000	125000

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Naming Insects

With so many different insects, and with them occurring in so many different places, it is no wonder that assigning common names is difficult and sometimes confusing. For example, the common name “stink bug” may be given to one insect in one part of the country and to a completely different insect in another part of the country. To reduce this confusion, a list of accepted common names has been developed by the Entomological Association of America. This list (Common names of Insects and Related Organisms 1997) includes many, but not all, common names.

An average person seldom uses scientific names, but refers to insects by common names such as “beetle,” “blister beetle,” or even “black blister beetle.” In this example, the common name “beetle” may refer to any of thousands of insects belonging to the order Coleoptera. “Blister beetle,” on the other hand, is a common name for all members of the family Meloidae, a subset of the order Coleoptera. “Black blister beetle” is the common name for *Epicauta pennsylvanica*, a particular species of insect. So, even though common names are very important and widely used, not all of them refer to individual insects. That is why standardized scientific names are necessary, especially to professional entomologists and insect collectors.

All insects belong to the class INSECTA. Within this class many ORDERS of insects exist. This booklet describes how to classify the insects into one of 24 Orders. Within each order, many FAMILIES may exist. Within families, many GENERA occur and, likewise, within Genera, many SPECIES exist. A general understanding of the scientific nomenclature and rank order of associated names is important for collectors. For example, in the blister beetle illustration below, a collector should know that the basic nomenclature is as follows:

- Class = Insecta
- Order = Coleoptera
- Family = Meloidae
- Genus = *Epicauta*
- Species = *pennsylvanica*



All specimens in an insect collection should be identified at some level. Amateur collectors gain a good knowledge of insects by first classifying them according to their order name. An order is a name applied to a large group of insects having similar characteristics. For example, all butterflies and moths belong to the order Lepidoptera;

all beetles, regardless of size, shape, or color, belong to the order Coleoptera; all flies belong to the order Diptera, and so forth.

In this book we will discuss the 24 orders listed [here](#). Make a checklist of the insect orders you collect and display; it's a valuable organizing tool.

For professional entomologists and those who have sufficient interest, orders of insects can be further broken down. Orders are broken down into families, the families into genera, and the genera into species. Professional entomologists generally study insects at the genus and species level. The first word of an insect's scientific name is the genus to which it belongs, and the second word is the species name.

The Pictorial Key to the Order of Adult Insects included in this book should help you classify specimens to the order level. Similar keys exist for families, genera, and species separation, but are beyond the scope of this book. This book, as well as most field guides, also provides common names of the more frequently collected insects.

An insect collection check list is provided [here](#) for field collecting the insects required in this text.

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Classifying Orders of Insects

Color, size, and markings of an insect, together with written information as to where it was found (locality) and what it was doing (behavior) allow an experienced entomologist to identify insects quickly. However, it should be stressed that this is not always a clear-cut process. Beginning entomologists should become familiar with the use of the order keys to avoid misidentifying insects that look alike. In addition, expertise in working dichotomous keys is a foundation for more in-depth identification (to the family, genus, or species level). The following chart depicts the current most commonly recognized orders of insects. In this publication we describe 24 common orders of insects, most of which can readily be collected in every state. Additional orders such as Protura, Diplura, Zoraptera, and Embioptera are rare and seldom encountered even by the most experienced collectors.

A dichotomous key is a tool that allows the user to determine the identity of insects based primarily upon what the insect looks like (its morphology). A key consists of a series of choices that lead the user to the correct name of a given insect. "Dichotomous" means "divided into two parts." Therefore, dichotomous keys always give two choices in each step. In this book, we present a dichotomous key for the classification of adult insects into their proper orders.

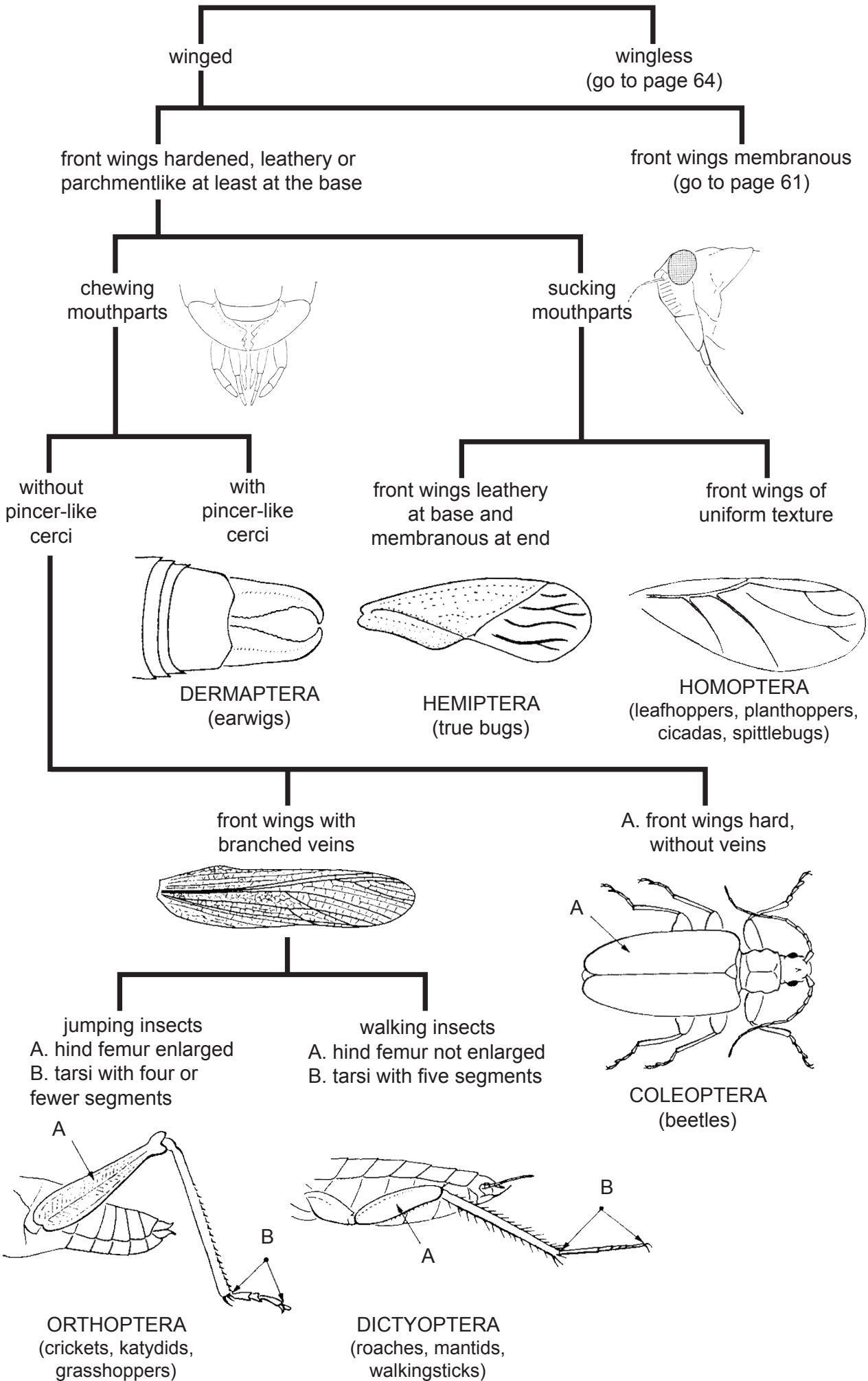
Start at the beginning of the key, and as you study the insect in question, you will be given a set of two mutually exclusive choices. Depending upon the answer to the question, you will either learn the proper order of the insect or you will be directed to another set of questions.

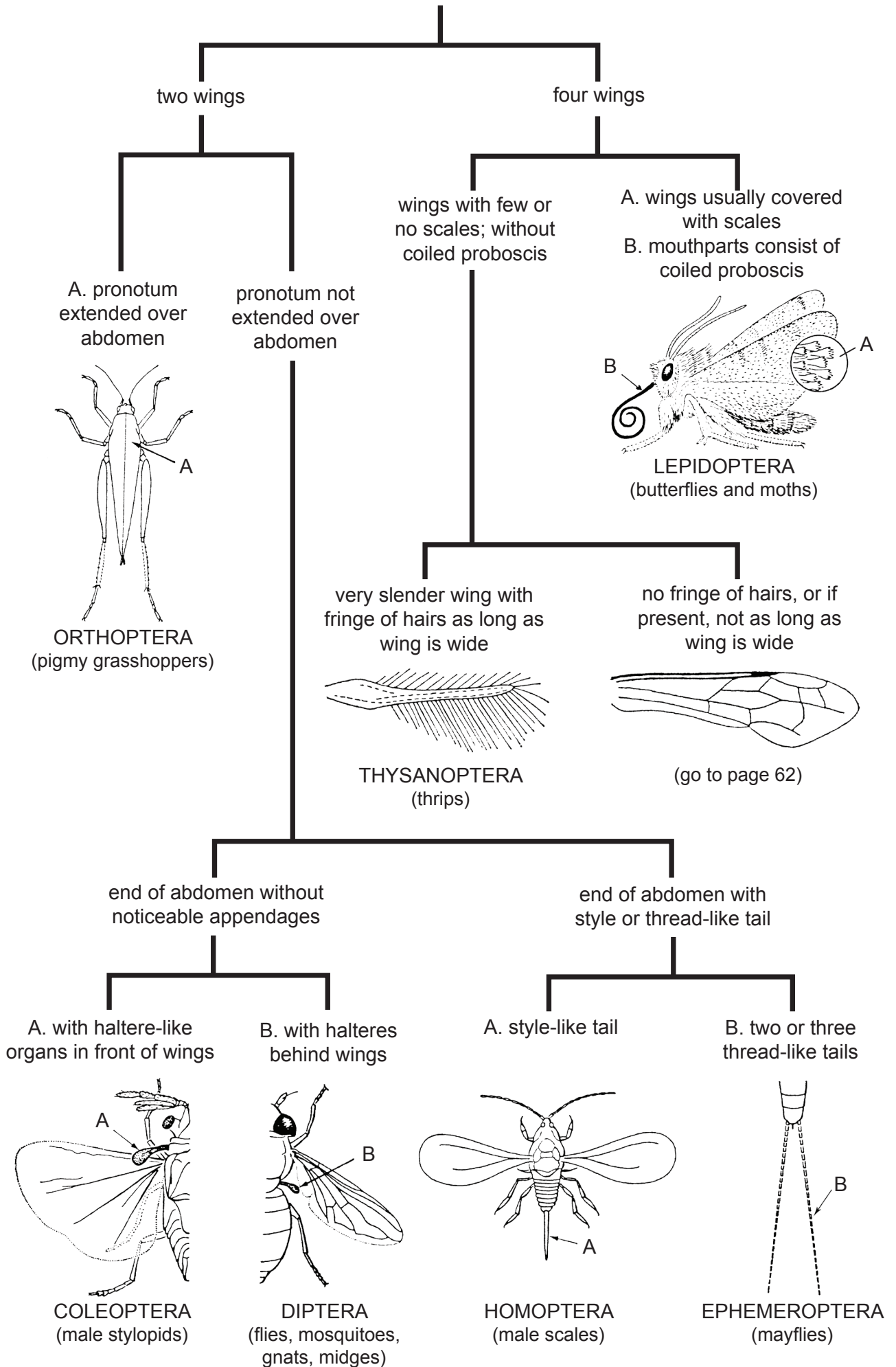
Eventually your choices will lead you to the name of the insect order. Once an insect is identified to order, you can assume that much of the biology, distribution, and key behaviors of the insect in question, are similar to other insects in the order.

Experience in working through the keys will help tremendously. Sometimes particular specimens are difficult to classify, even with the key. On occasion, a rare specimen may not easily key out. Do not be discouraged. Consult with a person who is well trained in classification, or contact a professional entomologist to assist. Remember that the following key is designed for adult specimens only. It will not work for immature insects.

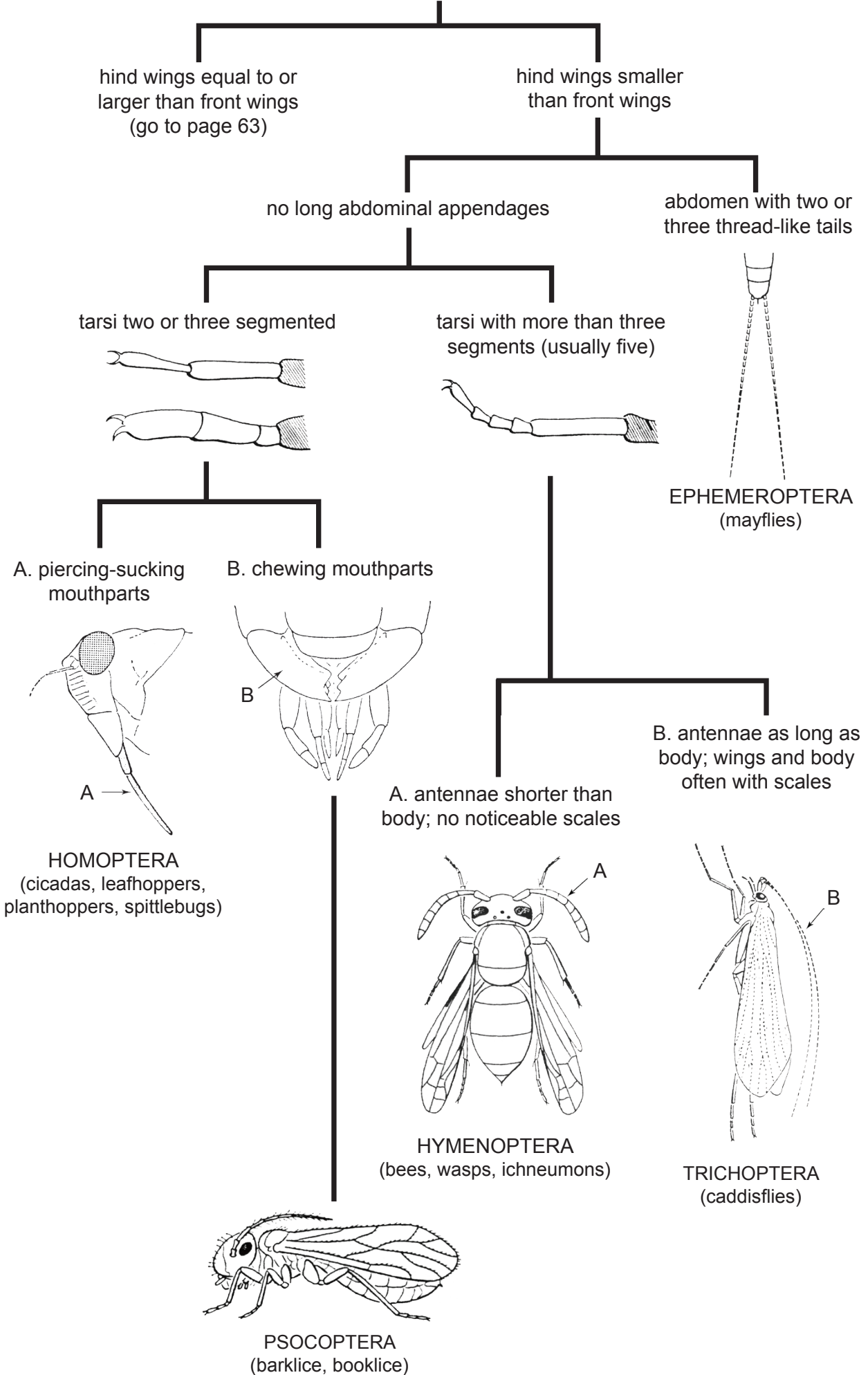
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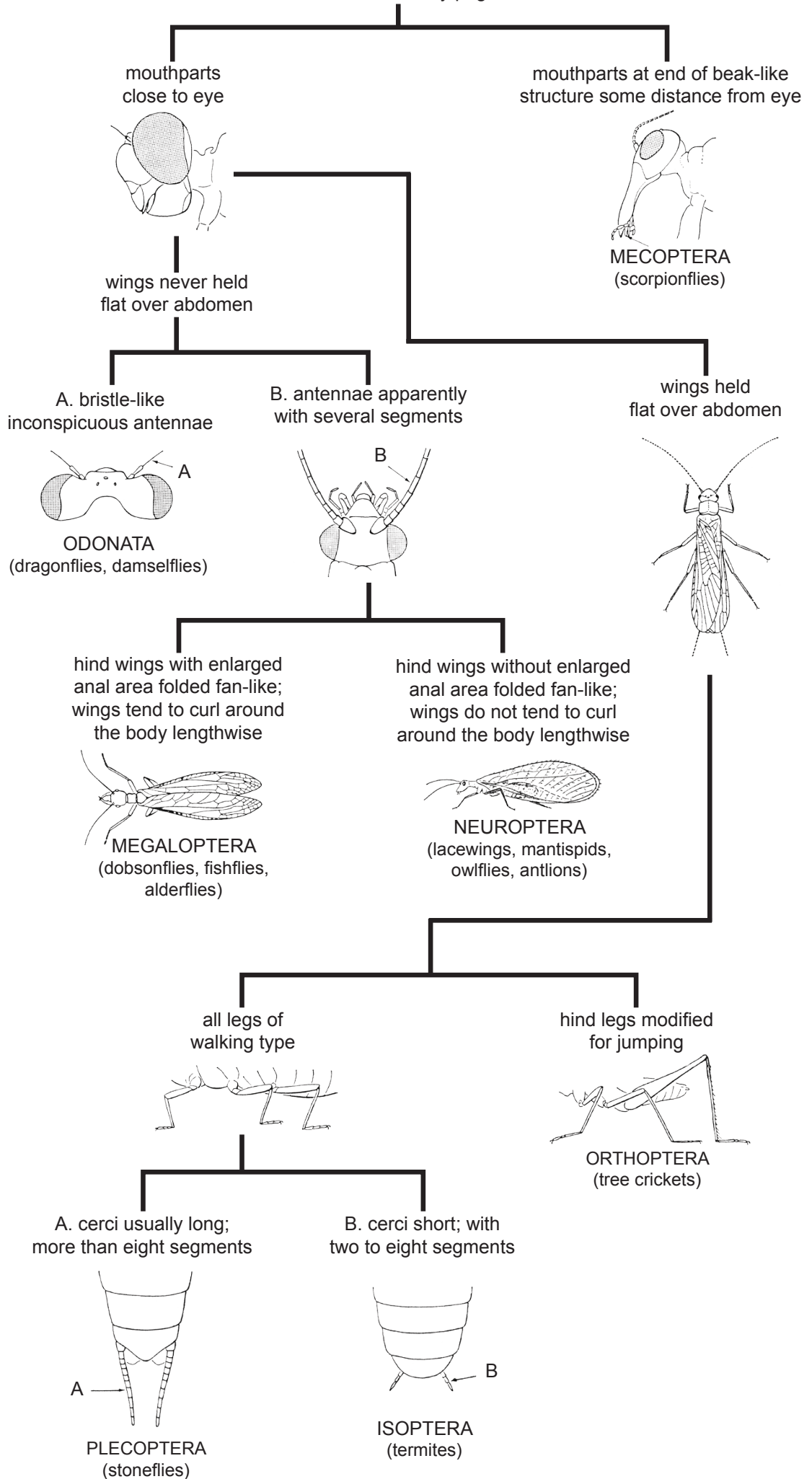
A Pictorial Key to the Order of Adult Insects



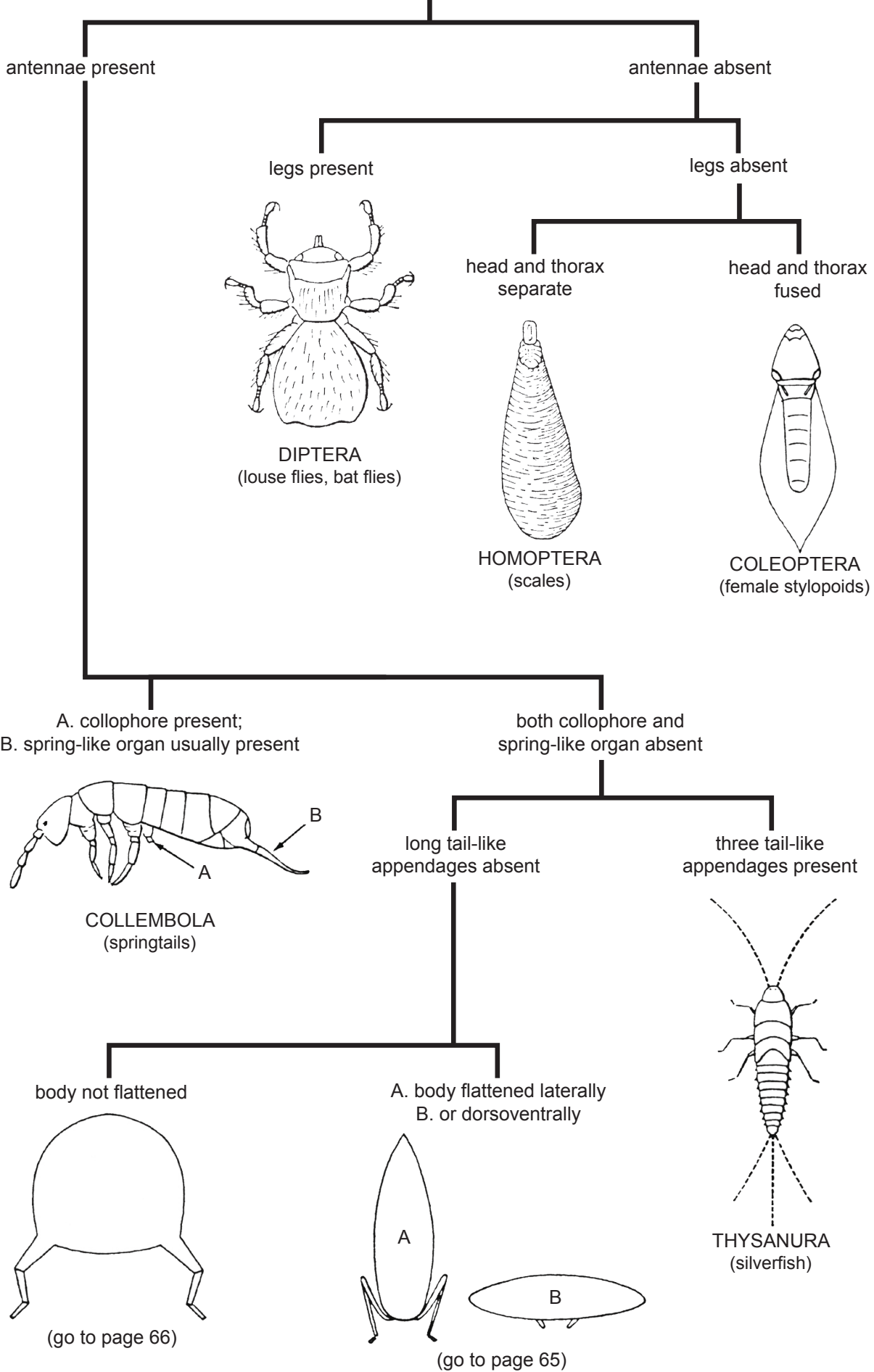


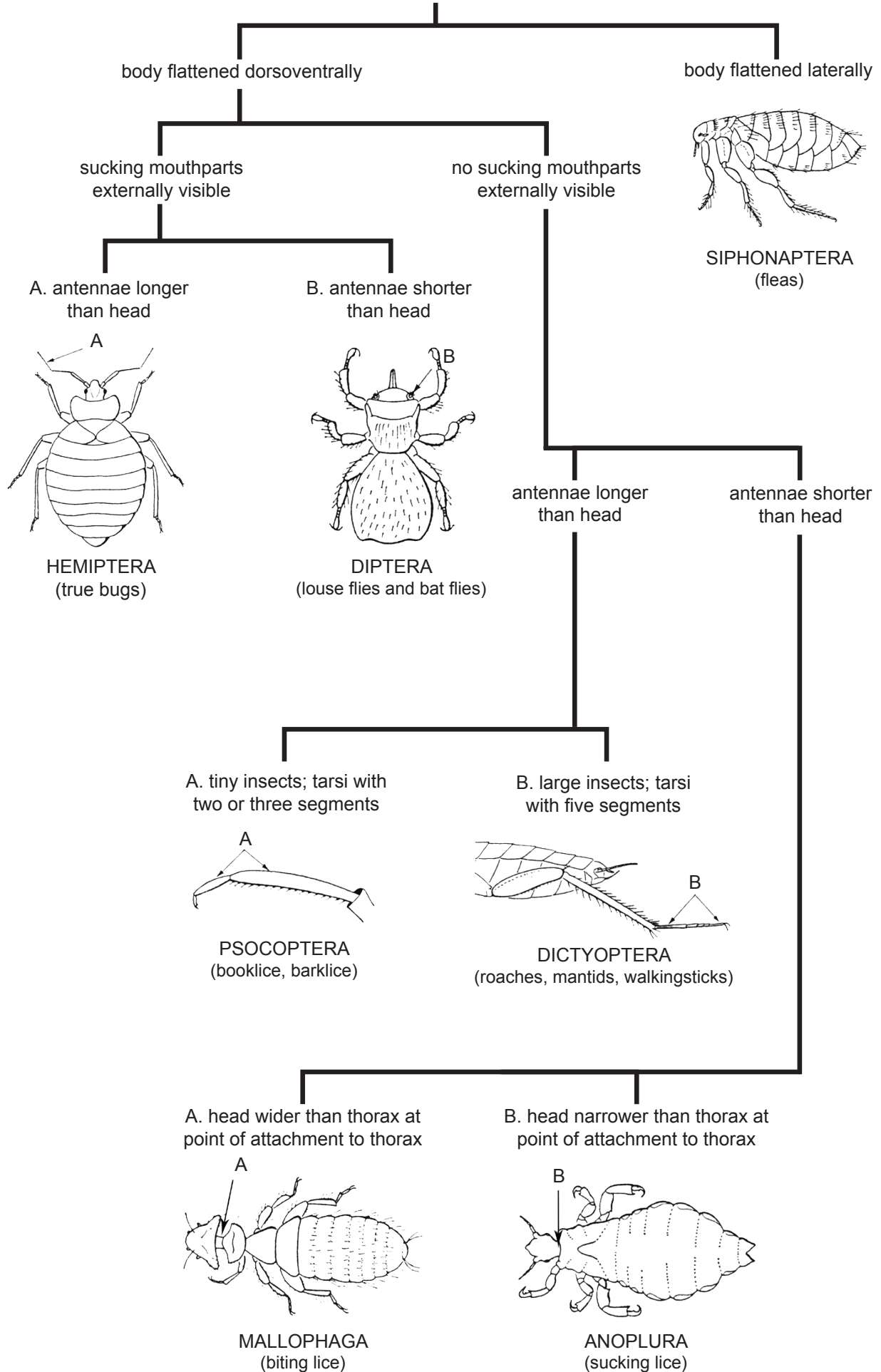
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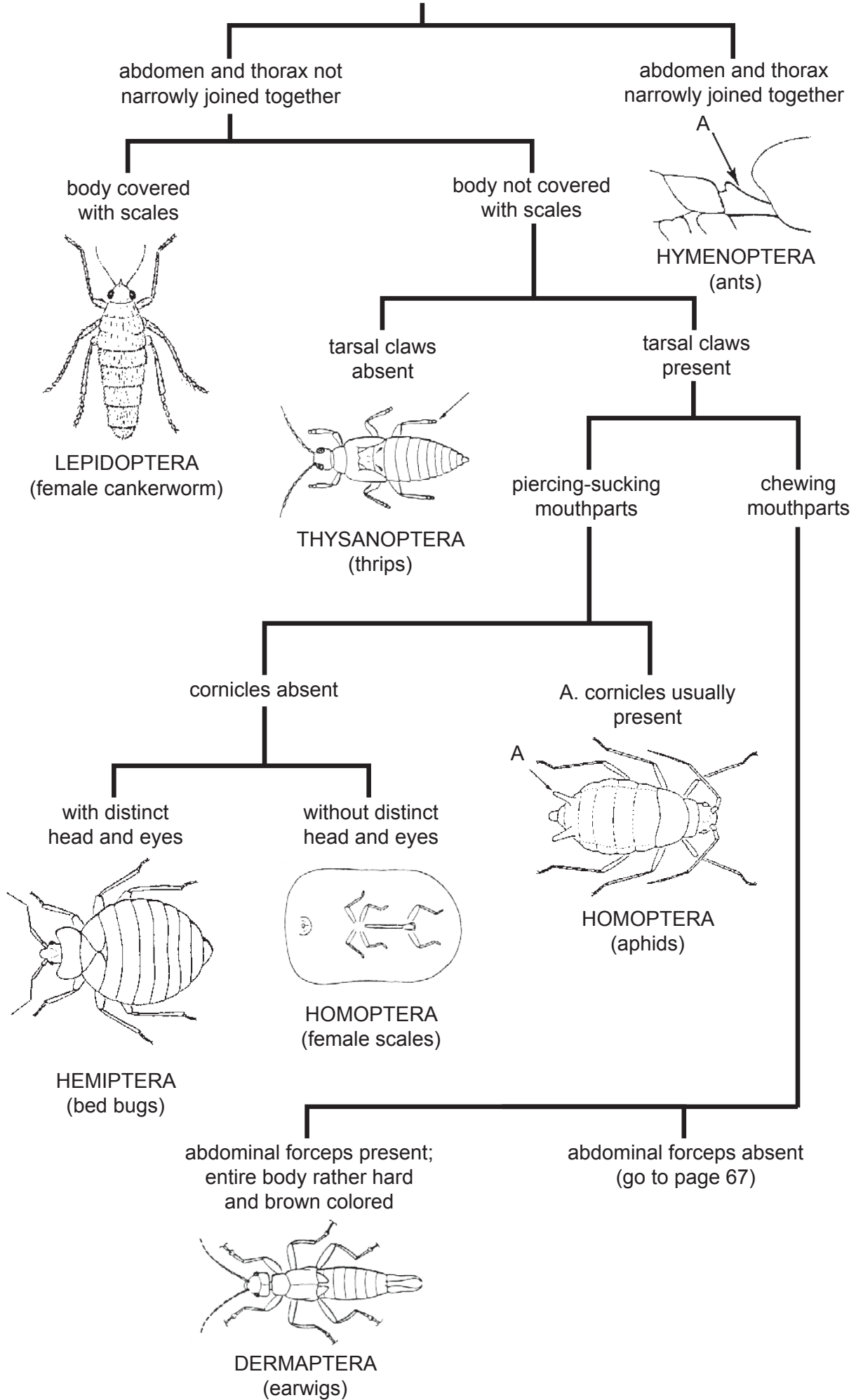




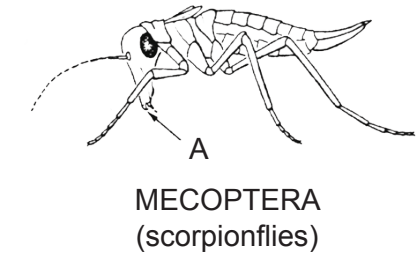
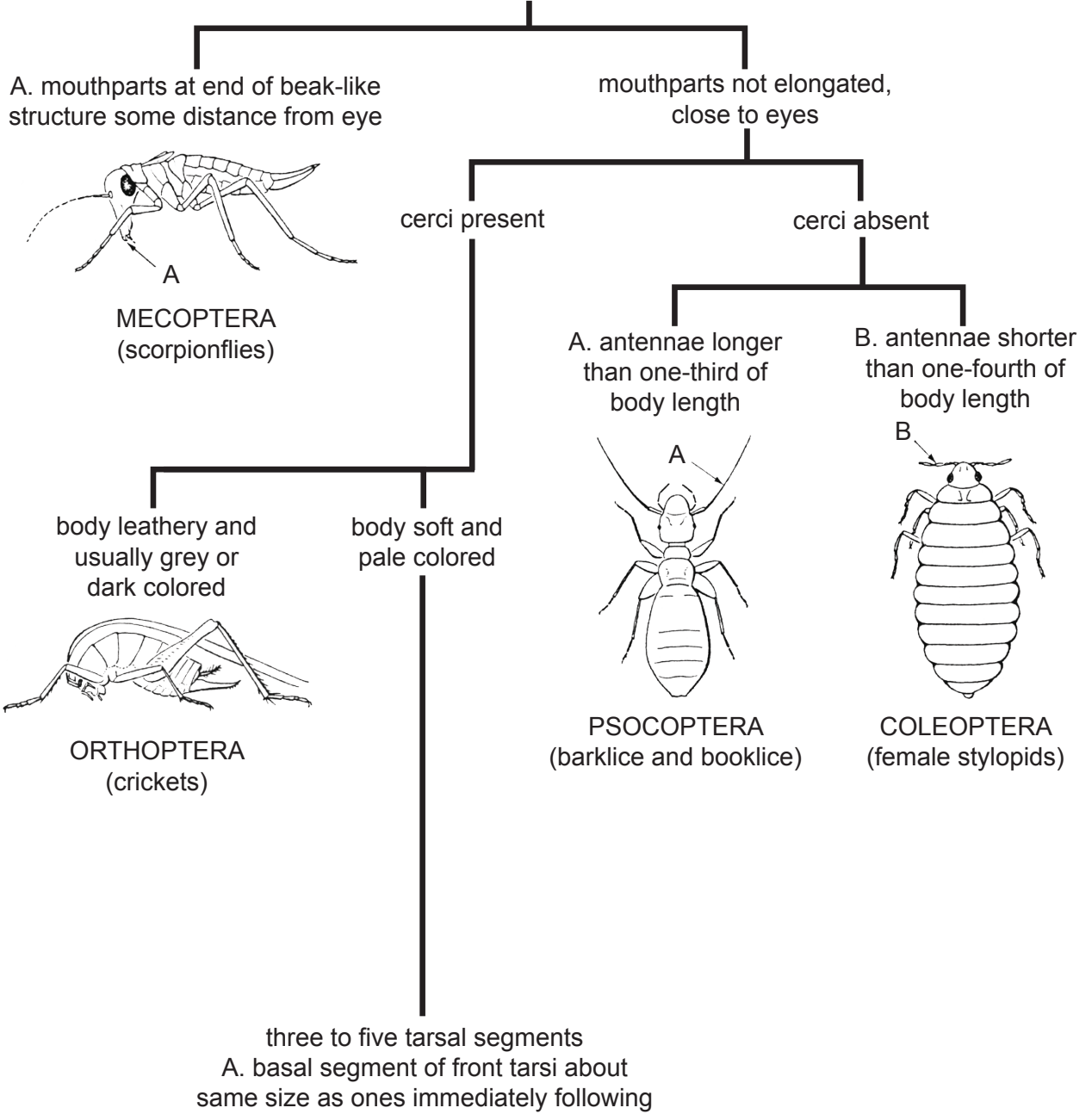
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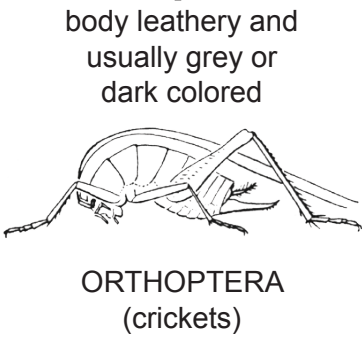




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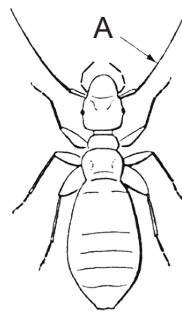


MECOPTERA
(scorpionflies)



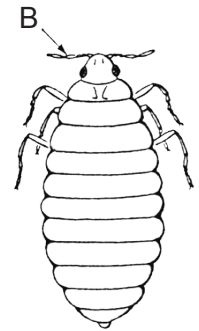
ORTHOPTERA
(crickets)

A. antennae longer than one-third of body length

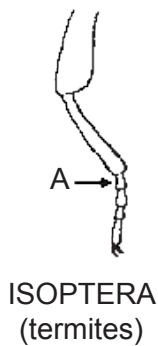


PSOCOPTERA
(barklice and booklice)

B. antennae shorter than one-fourth of body length



COLEOPTERA
(female stylopids)



ISOPTERA
(termites)

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Classifying Orders of Insects

 Color, size, and markings of an insect, together with written information as to where it was found (locality) and what it was doing (behavior) allow an experienced entomologist to identify insects quickly. However, it should be stressed that this is not always a clear-cut process. Beginning entomologists should become familiar with the use of the order keys to avoid misidentifying insects that look alike. In addition, expertise in working dichotomous keys is a foundation for more in-depth identification (to the family, genus, or species level). The following chart depicts the current most commonly recognized orders of insects. In this publication we describe 24 common orders of insects, most of which can readily be collected in every state. Additional orders such as Protura, Diplura, Zoraptera, and Embioptera are rare and seldom encountered even by the most experienced collectors.

A dichotomous key is a tool that allows the user to determine the identity of insects based primarily upon what the insect looks like (its morphology). A key consists of a series of choices that lead the user to the correct name of a given insect. "Dichotomous" means "divided into two parts." Therefore, dichotomous keys always give two choices in each step. In this book, we present a dichotomous key for the classification of adult insects into their proper orders.

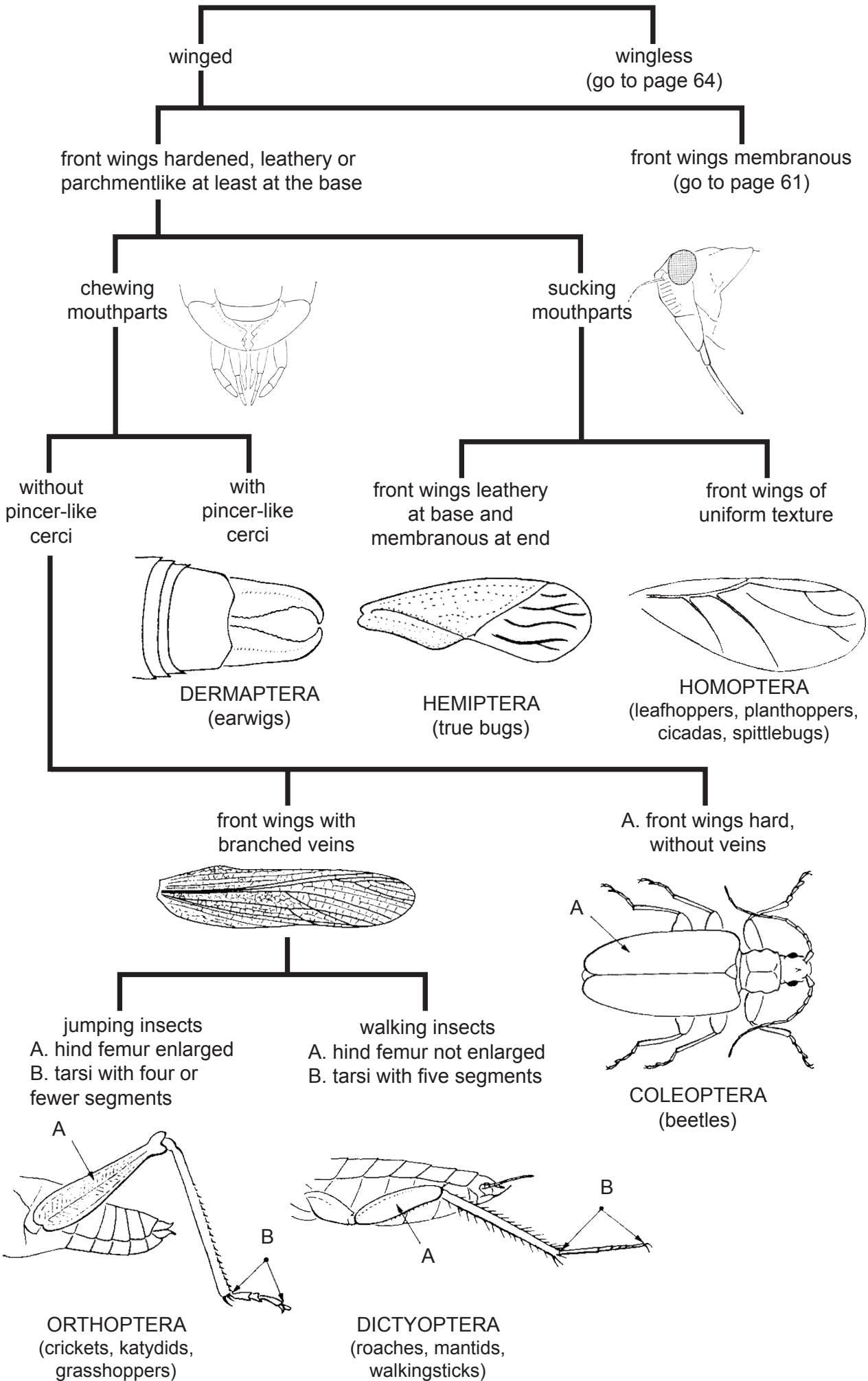
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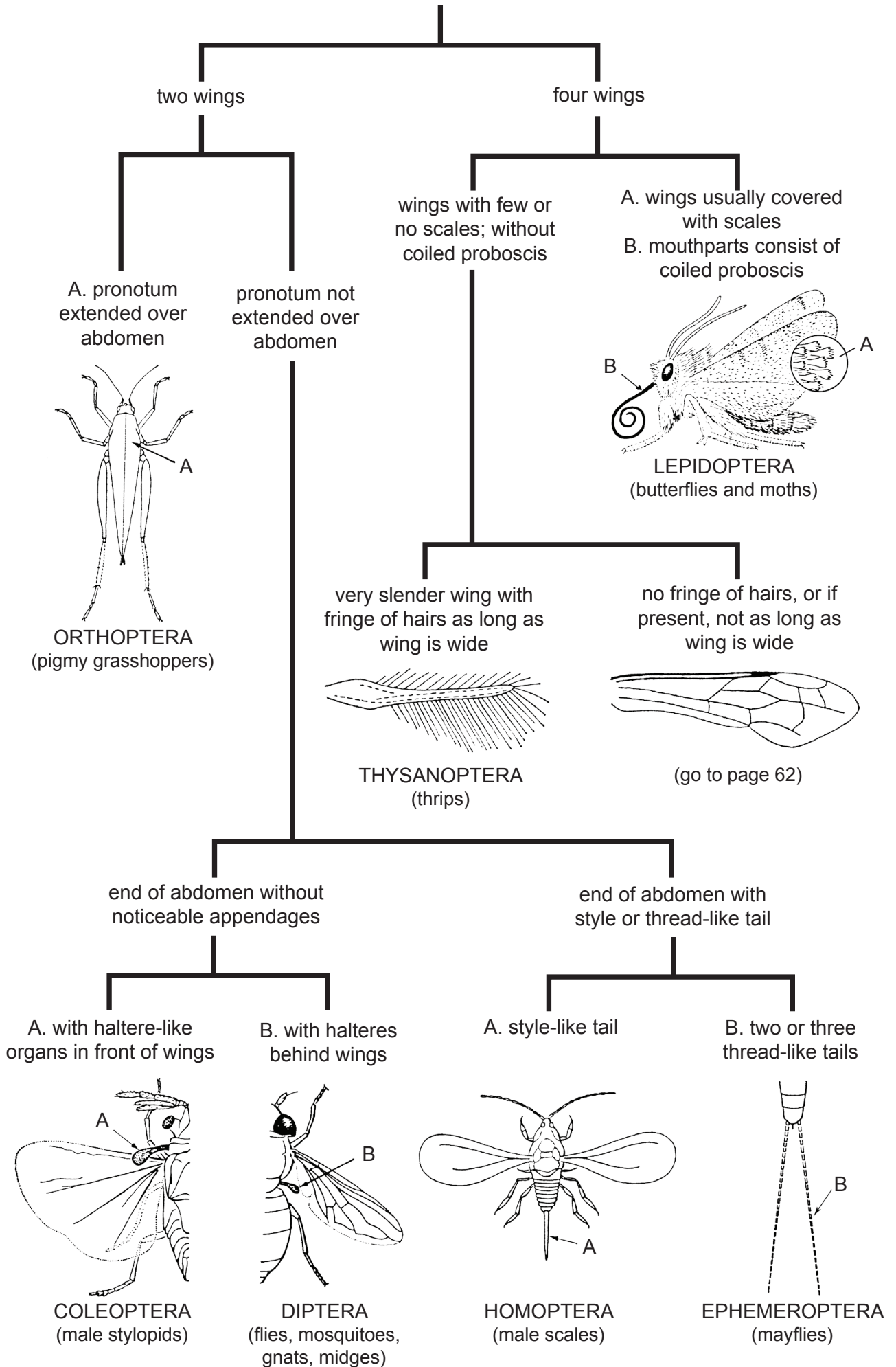
Eventually your choices will lead you to the name of the insect order. Once an insect is identified to order, you can assume that much of the biology, distribution, and key behaviors of the insect in question, are similar to other insects in the order.

Experience in working through the keys will help tremendously. Sometimes particular specimens are difficult to classify, even with the key. On occasion, a rare specimen may not easily key out. Do not be discouraged. Consult with a person who is well trained in classification, or contact a professional entomologist to assist. Remember that the following key is designed for adult specimens only. It will not work for immature insects.

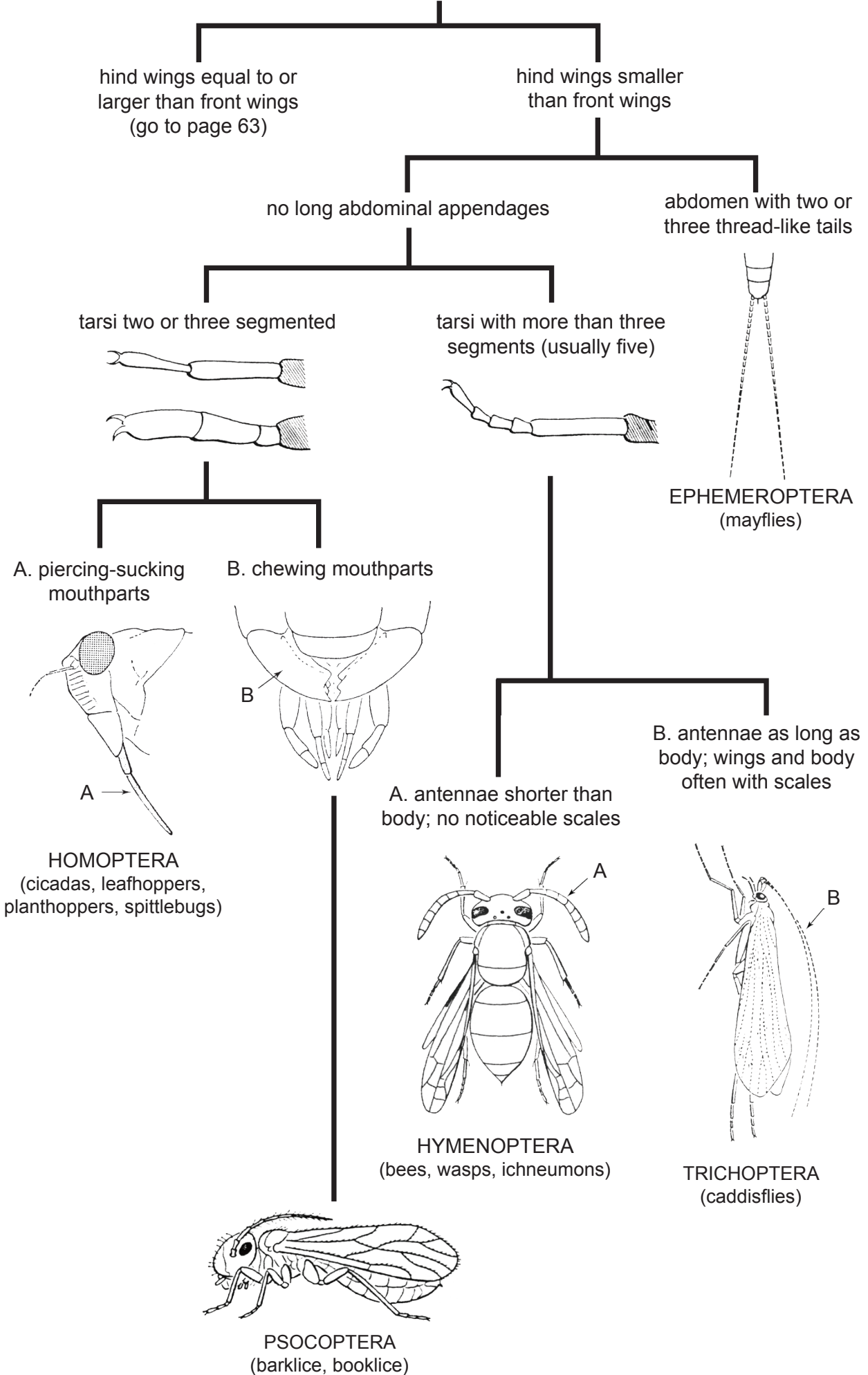
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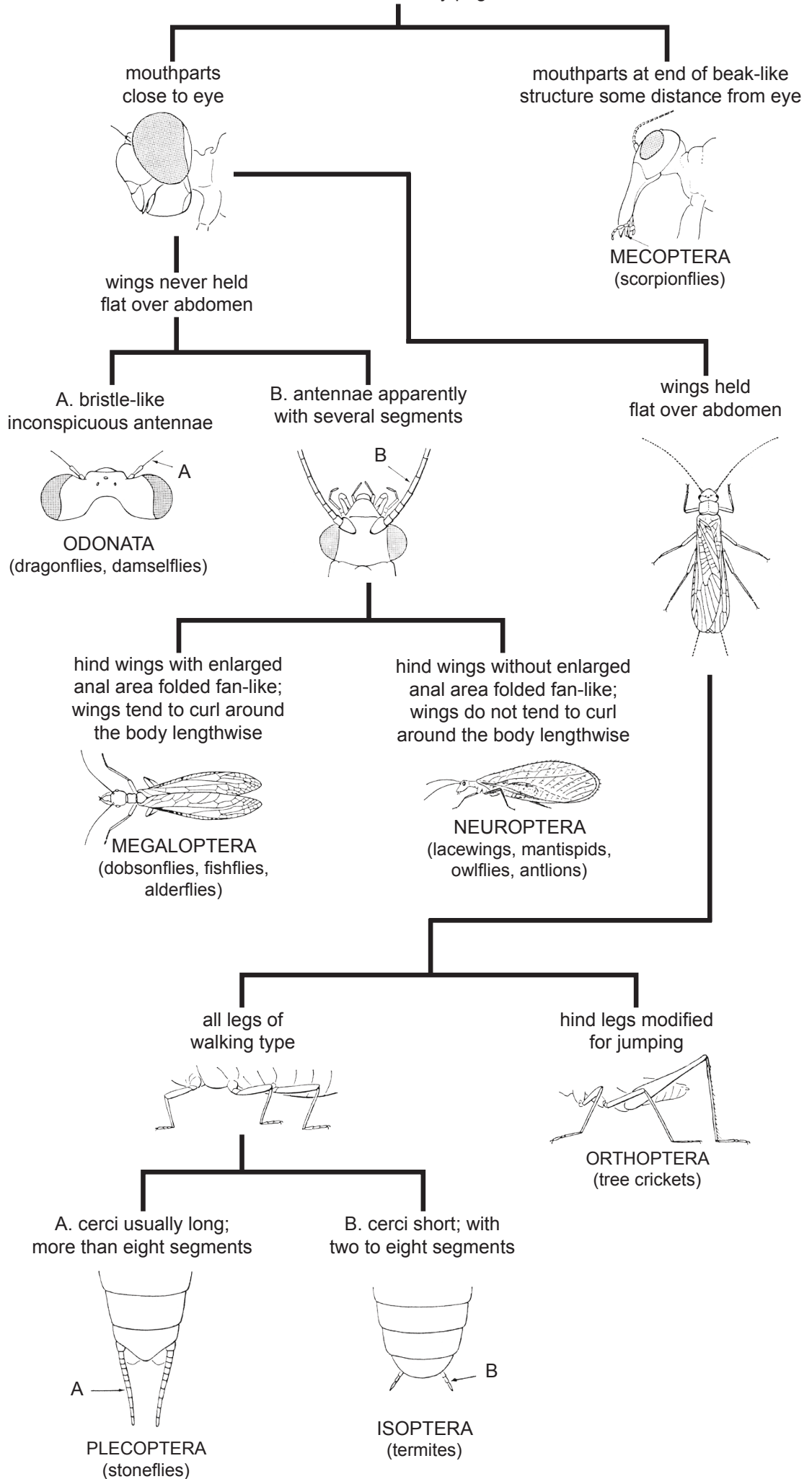
A Pictorial Key to the Order of Adult Insects



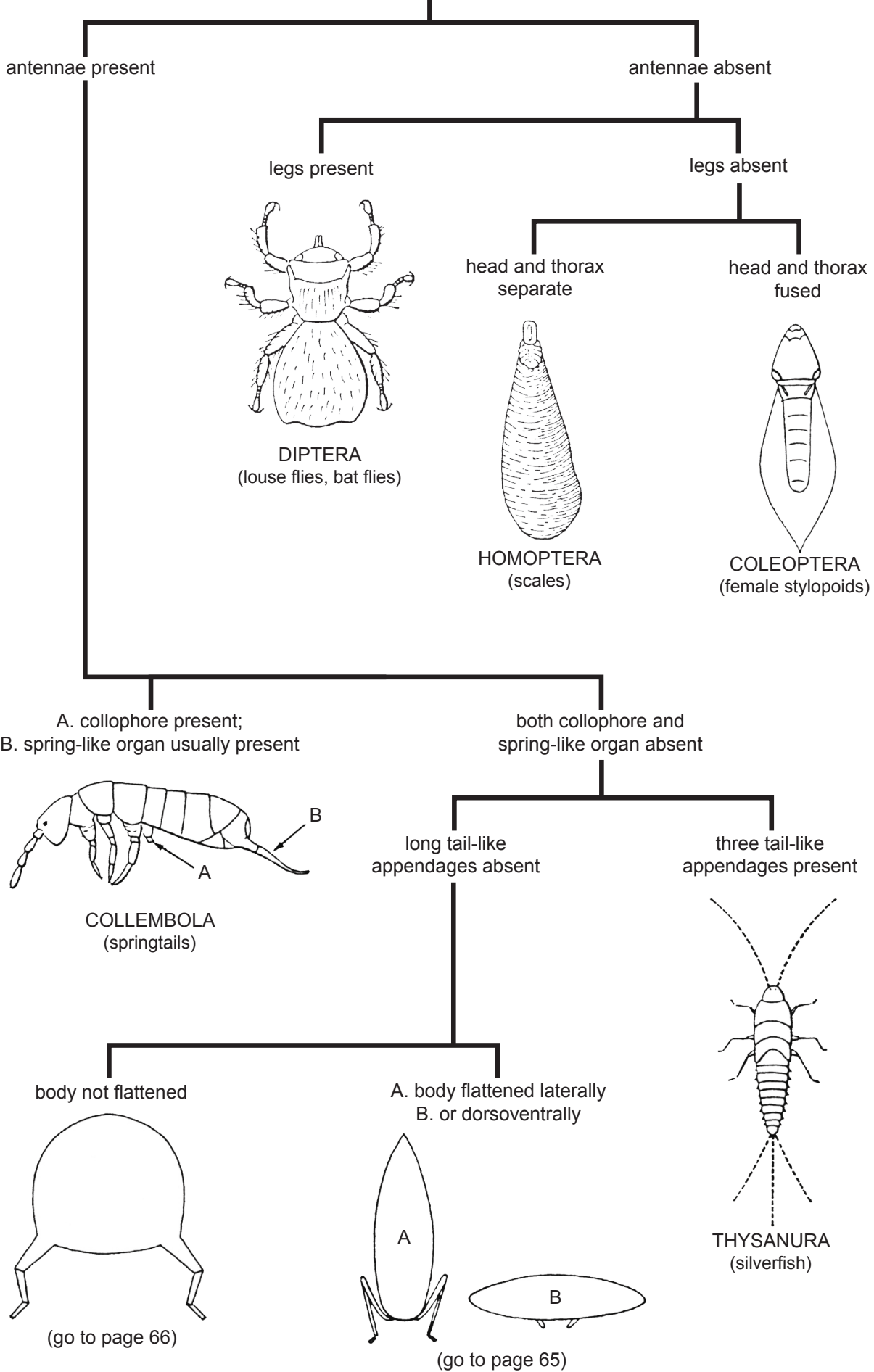


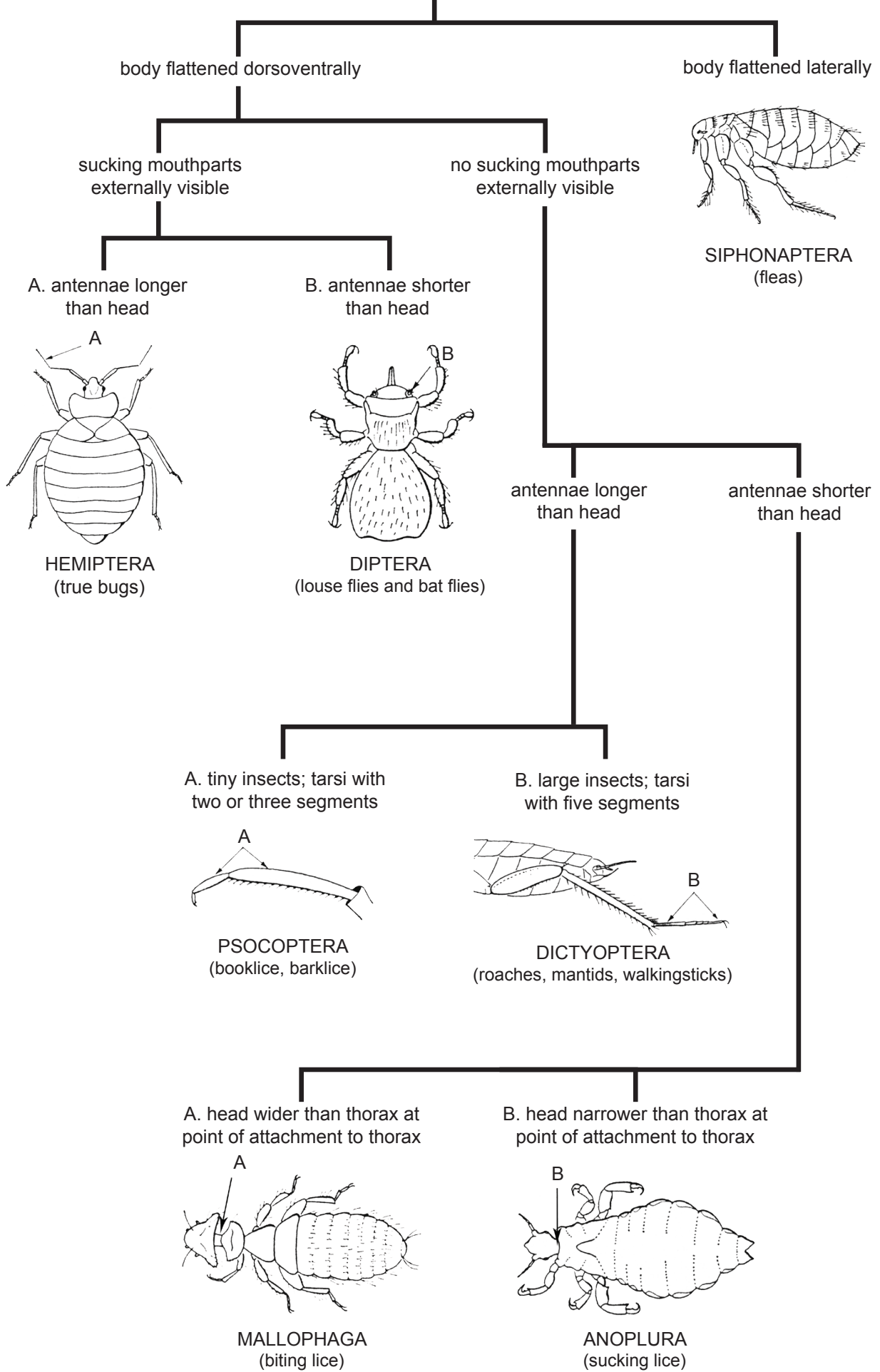
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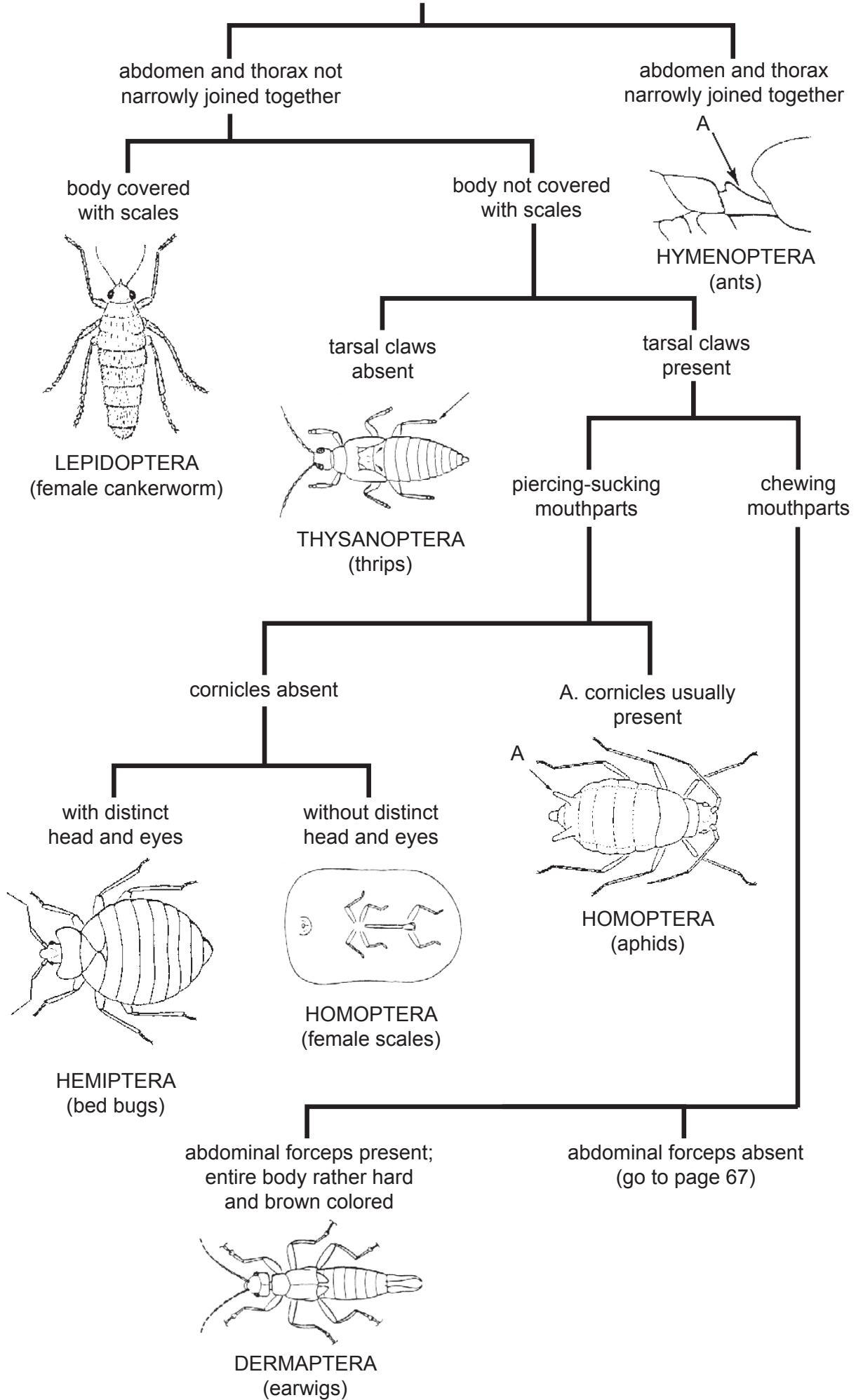




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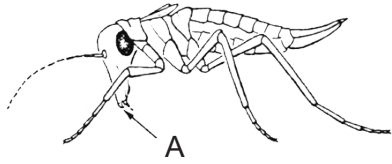






continued from key page 66

A. mouthparts at end of beak-like structure some distance from eye



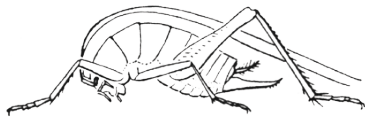
MECOPTERA
(scorpionflies)

mouthparts not elongated, close to eyes

cerci present

cerci absent

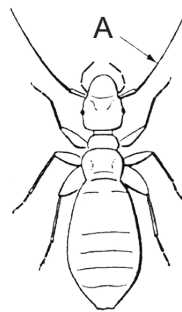
body leathery and usually grey or dark colored



ORTHOPTERA
(crickets)

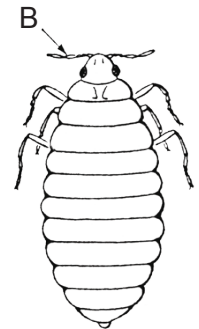
body soft and pale colored

A. antennae longer than one-third of body length



PSOCOPTERA
(barklice and booklice)

B. antennae shorter than one-fourth of body length



COLEOPTERA
(female stylopids)

three to five tarsal segments
A. basal segment of front tarsi about same size as ones immediately following



ISOPTERA
(termites)



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Common Insect Orders

Brief descriptions of the orders follow. Order names are usually derived from a Greek or Latin word that describes the group. Most of the orders can be separated based on differences in wing morphology, thus learning the origin of the order name is very instructive and helpful in learning about the insects belonging to that order. Name derivations are provided in parentheses next to the order name. Common name of the order is also provided as it often reveals additional information about the biology or morphology of the group.

Note: Line drawings of several insects from each order are provided as examples of the order. All measurements given in this section are based on average body length (front of head to end of abdomen) of the species shown with the exception of the Lepidoptera (where measurements indicate average length of the forewing). Color photographs of representative insects in their adult form are provided at the end of this book and also are available via the Internet. Photos make for excellent review or study, and while they may not be as valuable as real specimens, they make for a handy reference collection or series for insect judging contests.

[Collembola](#)
[Thysanura](#)
[Ephemeroptera](#)
[Odonata](#)
[Dictyoptera](#)
[Orthoptera](#)
[Dermaptera](#)
[Isoptera](#)
[Plecoptera](#)
[Psocoptera](#)
[Mallophaga](#)
[Anoplura](#)
[Thysanoptera](#)
[Hemiptera](#)
[Homoptera](#)
[Neuroptera](#)
[Megaloptera](#)
[Coleoptera](#)
[Mecoptera](#)

Trichoptera
Lepidoptera
Diptera
Siphonaptera
Hymenoptera

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Field Identification

The following photographs of insects are provided to assist students in basic insect identification. Be aware that dichotomous keys, similar to those used for order classification, also exist for separating insects into families and even further into genera and species. The use of such keys is beyond the scope of this book in most cases. However, in some instances, these may need to be referred to for the identification of less common insects. For the purposes of this text, once a student has correctly placed an insect into its proper order, comparison to color photographs or to other properly identified specimens (such as those in reference collections) can be a productive method of assigning common names to collected insects. In addition to the following color photographs, many field guides can assist in family and common name classification.

All 4-H and FFA students in Indiana are required to recognize order and common names for the following list of insects. To assist in identification, a color photo of each of these is provided together with a brief description of the insect, its biology, pest status, and life cycle.

Information regarding selected pest insects in their damaging stage, together with life history and control recommendations is provided in an accompanying text *How to Manage Radical Bugs*, ID 403.

[View the Flashcards](#)

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Insect pins, display cases, vials, forceps, killing jars, nets, and other supplies needed for collecting and preserving insects can be obtained from any one of several commercial outlets. 4-H leaders may have local sources for many of the supplies needed. Below are the names and addresses of a few additional supply houses.

BioQuip Products

2321 Gladwick Street
Rancho Dominguez, CA 90220
PH: (310) 667-8800 FAX: (310) 667-8808
<http://www.bioquip.com>

Carolina Biological Supply Co.

2700 York Rd.
Burlington, NC 27215-3398
PH: (800) 334-5551
<http://www.carolina.com>

NASCO Science Catalog

901 Janesville Ave.
Ft. Atkinson, WI 53538-0901
PH: (800) 563-2446 FAX: (920) 563-8296
<http://www.enasco.com>

Ward's Natural Science Establishment, LLC

5100 West Henrietta Rd.
P.O. Box 92912
Rochester, NY 14692-9012
PH: (800) 962-2660 FAX: (585) 334-6174
<http://wardsci.com/>

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Reference Books

A beginning entomologist soon learns the value of additional reference books. The next book recommended for most entomologists is: Gibb, T. J. and C. Y. Oseto. 2006. *Arthropod Collection and Identification—Laboratory and Field Techniques*. 311 pp. New York, Elsevier/Academic Press. This text builds upon the principles introduced in this book and goes into greater detail in collecting, labeling and preserving insects and mites.

An Introduction to the Study of Insects,

listed below, is recommended for family level identification. The other books referenced here are valuable companion field guides. Many other reference books are also available.

- Arnett, Ross H. and Richard L. Jacques, Jr.. 1981. *Guide to Insects*, 511 pp. New York, Simon and Schuster.
- Borror, D.J. and R.E. White. 1970. *A Field Guide to the Insects of America North of Mexico*, 404 pp. Boston, Houghton Mifflin Co.
- Borror, D.J., C.A. Triplehorn, and N. F. Johnson. 1989. *An Introduction to the Study of Insects*, 875 pp. Philadelphia, Sanders College Publishing.
- Fichter, G.S. and H.S. Zim. 1966. *Insect Pests*, 160 pp. New York, Golden Press.
- Gibb, T. J. and C. Y. Oseto. 2006. *Arthropod Collection and Identification—Laboratory and Field Techniques*. 311 pp. New York, Elsevier/Academic Press.
- Jacques, H.E. 1987. *How to Know Insects*, 205 pp. Dubuque, Iowa, William C. Brown Co.
- Mitchell, R.T. and H.S. Zim. 1964. *Butterflies and Moths*, 160 pp. New York, Golden Press.
- Shull, Ernest M.. 1972. *Butterflies of Indiana*, 262 pp. Indiana Academy of Science.
- Zim, H.S. and C. Cottam. 1956. *Insects*, 160 pp. New York, Golden Press.

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Appendix III - Insect Collection Checklist

Common Name — Order	Location/ Habitat	Collection (date)
1. Alfalfa weevil — Coleoptera		
2. American cockroach — Dictyoptera		
3. Angoumois grain moth — Lepidoptera		
4. Annual cicada — Homoptera		
5. Antlion — Neuroptera		
6. Aphid — Homoptera		
7. Apple maggot fly — Diptera		
8. Armyworm — Lepidoptera		
9. Asparagus beetle — Coleoptera		
10. Assassin bug — Hemiptera		
11. Bagworm — Lepidoptera		
12. Baldfaced hornet — Hymenoptera		
13. Bean leaf beetle — Coleoptera		
14. Bed bug — Hemiptera		
15. Bird louse — Mallophaga		
16. Black cutworm — Lepidoptera		
17. Blister beetle — Coleoptera		
18. Blow fly — Diptera		
19. Booklouse — Psocoptera		
20. Boxelder bug — Hemiptera		
21. Brownbanded cockroach — Dictyoptera		
22. Brown lacewing — Neuroptera		
23. Bumble bee — Hymenoptera		
24. Cabbage butterfly — Lepidoptera		
25. Cabbage looper — Lepidoptera		
26. Caddisfly — Trichoptera		

Common Name — Order	Location/ Habitat	Collection (date)
27. Camel cricket — Orthoptera		
28. Carolina grasshopper — Orthoptera		
29. Carpenter ant — Hymenoptera		
30. Carpenter bee — Hymenoptera		
31. Carrion beetle — Coleoptera		
32. Cecropia moth — Lepidoptera		
33. Chinch bug — Hemiptera		
34. Cicada killer wasp — Hymenoptera		
35. Click beetle — Coleoptera		
36. Clover leaf weevil — Coleoptera		
37. Cluster fly — Diptera		
38. Codling moth — Lepidoptera		
39. Colorado potato beetle — Coleoptera		
40. Common stalk borer — Lepidoptera		
41. Corn earworm — Lepidoptera		
42. Corn flea beetle — Coleoptera		
43. Cottony maple scale — Homoptera		
44. Crane fly — Diptera		
45. Damsel bug — Hemiptera		
46. Damselfly — Odonata		
47. Deer fly — Diptera		
48. Dermestid beetle — Coleoptera		
49. Differential grasshopper — Orthoptera		
50. Diving beetle — Coleoptera		
51. Dobsonfly — Megaloptera		
52. Dragonfly — Odonata		

Common Name — Order	Location/ Habitat	Collection (date)
53. Earwig — Dermaptera		
54. Elm leaf beetle — Coleoptera		
55. Emerald ash borer — Coleoptera		
56. European corn borer — Lepidoptera		
57. Field cricket — Orthoptera		
58. Firefly — Coleoptera		
59. Flea — Siphonaptera		
60. Fungus gnat — Diptera		
61. German cockroach — Dictyoptera		
62. Giant water bug — Hemiptera		
63. Green June beetle — Coleoptera		
64. Green lacewing — Neuroptera		
65. Ground beetle — Coleoptera		
66. Gypsy moth — Lepidoptera		
67. Hackberry psyllid — Homoptera		
68. Head louse — Anoplura		
69. Hessian fly — Diptera		
70. Honey bee — Hymenoptera		
71. Horntail — Hymenoptera		
72. Horse fly — Diptera		
73. House fly — Diptera		
74. Ichneumon wasp — Hymenoptera		
75. Indian meal moth — Lepidoptera		
76. Japanese beetle — Coleoptera		
77. June beetle — Coleoptera		
78. Katydid — Orthoptera		

Common Name — Order	Location/ Habitat	Collection (date)
79. Lace bug — Hemiptera		
80. Lady beetle — Coleoptera		
81. Locust leafminer — Coleoptera		
82. Longhorned beetle — Coleoptera		
83. Luna moth — Lepidoptera		
84. Mayfly — Ephemeroptera		
85. Mexican bean beetle — Coleoptera		
86. Midge (chironomid) — Diptera		
87. Mimosa webworm — Lepidoptera		
88. Mole cricket — Orthoptera		
89. Monarch butterfly — Lepidoptera		
90. Mosquito — Diptera		
91. Mud dauber wasp — Hymenoptera		
92. Northern corn rootworm — Coleoptera		
93. Oriental cockroach — Dictyoptera		
94. Oystershell scale — Homoptera		
95. Pavement ant — Hymenoptera		
96. Peachtree borer — Lepidoptera		
97. Periodical cicada — Homoptera		
98. Picnic beetle — Coleoptera		
99. Pine needle scale — Homoptera		
100. Plum curculio — Coleoptera		
101. Polistes paper wasp — Hymenoptera		
102. Potato leafhopper — Homoptera		
103. Praying mantid — Dictyoptera		
104. Redlegged grasshopper — Orthoptera		

Common Name — Order	Location/ Habitat	Collection (date)
105. Rice weevil — Coleoptera		
106. Robber fly — Diptera		
107. Rose chafer — Coleoptera		
108. Rove beetle — Coleoptera		
109. Satyr — Lepidoptera		
110. Sawfly — Hymenoptera		
111. Sawtoothed grain beetle — Coleoptera		
112. Scorpionfly — Mecoptera		
113. Seedcorn beetle — Coleoptera		
114. Silverfish — Thysanura		
115. Sod webworm — Lepidoptera		
116. Soldier beetle — Coleoptera		
117. Spittlebug — Homoptera		
118. Spotted cucumber beetle — Coleoptera		
119. Springtail — Collembola		
120. Squash bug — Hemiptera		
121. Squash vine borer — Lepidoptera		
122. Stable fly — Diptera		
123. Stag beetle — Coleoptera		
124. Stink bug — Hemiptera		
125. Stonefly — Plecoptera		
126. Strawberry root weevil — Coleoptera		
127. Striped cucumber beetle — Coleoptera		
128. Swallowtail butterfly — Lepidoptera		
129. Sweat bee — Hymenoptera		
130. Syrphid fly — Diptera		

Common Name — Order	Location/ Habitat	Collection (date)
131. Tarnished plant bug — Hemiptera		
132. Termite — Isoptera		
133. Thrips — Thysanoptera		
134. Tiger beetle — Coleoptera		
135. Tiger moth — Lepidoptera		
136. Tobacco hornworm — Lepidoptera		
137. Tomato hornworm — Lepidoptera		
138. Tortoise beetle — Coleoptera		
139. Treehopper — Homoptera		
140. Tulip tree scale — Homoptera		
141. Tussock moth — Lepidoptera		
142. Velvet ant — Hymenoptera		
143. Viceroy butterfly — Lepidoptera		
144. Vinegar fly — Diptera		
145. Walkingstick — Dictyoptera		
146. Water strider — Hemiptera		
147. Western corn rootworm — Coleoptera		
148. Whitefly — Homoptera		
149. Wood cockroach — Dictyoptera		
150. Yellowjacket — Hymenoptera		

Insect Card Points

Cut out pre-sized labels carefully. Dots indicate correct location of pin.

