A Key to the Principal Orders and Families of Insects

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PREFACE

What is it?—Having found an unknown insect, whether a beautiful butterfly or a freakish and formidable thing in the woods, a disconcerting moth or weevil in the pantry, granary, or clothes press, or a caterpillar, bug or beetle devouring vegetables, field crops, flowers or trees—the universal question that flashes in the mind and to the lips is “What is it?”

This little booklet is an attempt to answer the question in a fundamental and scientific way, or at least to start the tyro on his way toward the correct answer; for the complete answer to even so simple a question may involve considerable work. Even with the most extensive entomological library at hand, the beginner or the professional, would be well-nigh helpless to determine his insect unless he first knew the order and family to which it belongs. The number of insect kinds is so great and the literature dealing with them so vast that it is necessary to approach the subject in a systematic way in order to make any profitable use of the many books, monographs and bulletins on the subject. The first logical step is to determine the order and family. This booklet has been written with the hope of guiding you to that end.

The student in biology, zoology, ecology or kindred fields, who is not technically trained in entomology, will find this key indispensable. With it he can place an insect in the proper family and then can send his material to the proper specialist for identification to species.

Scope.—This key attempts to cover only the true insects; and only adult insects. True insects may be recognized as those small creatures that possess six legs (arranged in three pairs) and a body made up of three divisions; (a) the head, with eyes, a pair of feelers or antenna, and the mouthparts; (b) a thorax, bearing the three pairs of legs and often one or two pairs of wings; and (c) an abdomen, which has no appendages except at the tip, where claspers, ovipositor and other feeler-like organs may sometimes be found. The reader will therefore not expect to determine the names of spiders, ticks, centipedes, scorpions, harvestmen, true worms, slugs or snails with this key, because they are not insects; nor the names of caterpillars, “worms,” nymphs, pupae, chrysalids or cocoons, because they are not adult stages of the insect.

It should also be understood that this key makes no pretense of being complete or exhaustive. The idea has been to make the simplest possible analysis of the families of North American insects which should include perhaps 95 to 99 percent of the specimens found in the average student’s collection. To have included the other 1 to 5 percent it would have been necessary to make it so complex and technical that the beginning student could not use it at all. For the more uncommon specimens, not covered by this key, the student is referred to the many special books on entomology, some of which are listed below.

To a considerable degree insects of the same order and to a very large degree those of the same family, have similar habits, habitats, life-cycles and economic importance. So, for the amateur to be able to place an insect in its order, and especially in the correct family, is a genuine accomplishment. This is of fundamental importance to everyone who makes any claim to being a nature student, biologist, zoologist or entomologist. At the same time the student will recognize that such a key as this is only a beginning for his study of insects. Having determined the order and family he will be interested in finding out more about his specimens, especially the common name, habits, and control. Some of the following books he will want to consult as his knowledge grows.

Lutz, Field Book of Insects, G. P. Putnam’s Sons, 1921.
Comstock, Introduction to Entomology, Comstock Publishing Co., 1924.
Lochhead, Economic Entomology, F. Blakiston’s Sons and Co., 1919.
Herms, Medical and Veterinary Entomology, The MacMillan Co., 1926.
Sanderson and Pears, Insect Pests of Farm, Garden and Orchard, John Wiley and Sons, 1921.
How to Use This Key.—The pages that follow may be likened to a system of highways in which every turn involves a choice between two forks of the road and in which no two roads lead to the same end. From the very first number the correct choice must be made every time or the final destination cannot be correct.

The characters given are arranged in couplets bearing the same number but different letters as 1a, 1b; or 123a, 123b. The two parts of any couplet are opposing or partly opposing characters. No insect can fit both; every insect should fit one or the other.

With a given insect in hand you should read both parts of the first couplet—“1a, Wingless Insects—1b, Winged Insects.” If this particular specimen has wings, read next, couplet 37; if it does not have wings read next, couplet 2, as directed by the figure at the end of that line whose description best fits the specimen. If it has two wings (37a) go next to couplet 58, if four wings (37b) go next to couplet 76. Continuing in this way to select the alternative which best agrees with the specimen in hand, you should come presently to a couplet which ends in a name, preceded by “Order” as couplet 39a “Order DIPTERA.” This should be the order name of the specimen being keyed. Following the order name is another number (for example 46, in the case cited) leading eventually to the family name of the insect being keyed. Continue until a name without a following number is reached.

The Figures.—Wherever a star (*) appears in the couplet, one or more figures will be found at the top of the page bearing the same number as the couplet. The figures should make plain to anyone the nature of the character described. Often there are several figures illustrating the same point and bearing the same number. Or two different points in the same couplet may be illustrated, in which case very different figures will bear that same number. Figures and descriptions should be used together. If a point is reached where neither alternative fits the specimen, you should retrace your steps to the couplet where you had most doubt about your choice and try the other alternative from that point. If that does not eventually fit, either (a) you have made an earlier mistake in choice or (b) the specimen belongs to one of the more unusual species that is not included in this key.

To Teachers.—Most students are interested in the names of insects. This is a good place to begin in entomology, biology or nature study. Teachers of these subjects in high school or college will find the devotion of a considerable amount of time to insects, a valuable feature of their courses. No better training for the logical mind, the seeing eye and the skillful fingers can be found than the preparation and determination of a good collection of insects. Perhaps the best way to learn the morphology of insects (so often a dry and uninteresting, though very essential part, of a course) is to attempt to “key the insects down,” which is morphology with a purpose.

Acknowledgments.—The earlier editions of this key have been widely used in high schools, summer camps, biological stations, colleges and universities, and the authors are indebted to numerous colleagues for helpful suggestion. The key characters used have been drawn from so wide a variety of technical works that it is impossible to credit them specifically. Among the figures redrawn for this work the authors are glad to credit the following, of which the original source is known: Fig. 3a from Lubbeck; 5b from Howard; 39a from Tower; 49a from Johannsen; 41a and 78b from Folsom; 131a from Hopkins; 148b, 149a, 152a and 157b from Comstock; 195a, 196b, and 198b from Imms; 193a from Riley; and 200a from Packard. A number of figures were redrawn from the published or unpublished works of the senior author. The remainder were prepared especially for this work by Miss E. Haban, for whose pains-taking and enthusiastic work the authors are greatly indebted.

It is hoped that these few pages will make simple and easy a path that is too often formidable to the beginner, and open to the nature lover a wonderful world, whose marvels continually increase, the more man exposes them to common knowledge. Corrections and criticisms of the key will be gratefully received by

THE AUTHORS.

October, 1928
A KEY TO THE PRINCIPAL ORDERS AND FAMILIES OF INSECTS

1a *Wingless insects (See also figures 2b, 18a, 25a, etc.) .......................................................... 2
1b Winged insects (See figures 5a, 7a, 8a, 9a, 3a, 6a, 10a, 11a, 12a, 13a, 14a, 15a, 16a, 17a) ............ 31

WINGLESS INSECTS

2a *Abdomen provided with a spring, segments often fused, not more than six abdominal segments visible. Order COLLEMBOLA, 3
2b *Abdomen not provided with a spring, with more than six segments visible in the abdomen. 5

Order Collembola

3a *Abdominal segments fused, body globose ................................................. Family Sminthuridae
3b *Abdominal segments not fused, body longer than broad ........................................ 4
4a *Antennae short, scarcely as long at the head ............................................... Family Poduridae
4b Antennae longer, usually as long as the head and thorax combined ................ Family Entomobryidae

5a *Abdomen with three terminal, antennal-like appendages ...................................... Order THYSANURA, Family Lepismatidae
5b *Abdomen without antennal-like appendages ......................................................... 6
6a Mouth parts fitted for chewing (See figures 7a, 10a, 13a, 15a, 17a) ...................... 7
6b Mouth parts fitted for piercing, lapping or sucking, sometimes concealed (See figures 31b, 41a, 47b, 58a, 89b, 138a, 169a, 208a, 208a) .................................................. 23
7a *Louse-like insects (See also figures 10b, 20b, 31a) .................................................. 8
7b Insects of various forms, not louse-like ................................................................. 12
8a *Antennae with five segments or fewer than five segments ........................ Order MALLOPHAGA, 9
8b *Antennae with more than five segments ......................................................... Order CORRODENTIA (in part), Family Atropidae

Order Mallophaga

9a *Antennae plainly visible, three- or five-segmented ........................................ 10
9b *Antennae more or less concealed, four-segmented ........................................... 11
10a *Tarsi with one claw (See also figure 11a). *Antennae three-segmented. Infesting mammals .......................................................... Family Trichodectidae
10b *Tarsi with two claws (See also figure 11b). *Antennae five-segmented. Infesting birds .......................................................... Family Philopteridae
11a *Tarsi with one claw. Infesting mammals ........................................................... Family Gyropidae
11b *Tarsi with two claws. Infesting birds ............................................................... Family Liotheidae
12a *Abdomen with cerci (i.e., feeler-like appendages at the posterior end).........................Order ORTHOPTERA (in part), 13
12b *Abdomen without cerci______________________________________________________________16

Order Orthoptera
13a *Tarsi five-segmented .................................................................................................14
13b Tarsi three- or four-segmented (See figures 24b, 90b, 98a, 99a, 133b, 136a)..............15
14a *Body oval, flattened .................................................................................................Family Blattidae (in part)
14b *Body elongate, not flattened......................................................................................Family Phasmidae
15a Tarsi three-segmented .................................................................................................Family Gryllidae (in part)
15b Tarsi four-segmented .................................................................................................Family Tettigoniidae (Also called Locustidae) (in part)
16a Hind legs fitted for leaping (See figures 136a, 136b); hind femora much thickened
........................................................................................................................................Order ORTHOPTERA, 17
16b Legs not fitted for leaping; hind femora not much thickened. (See figures 13a, 18a)....18
17a *Base of abdomen constricted, much narrower than the thorax, Order HYMENOPTERA (in part), 19
17b Tarsi three-segmented .................................................................................................Family Gryllidae (in part)
17c Tarsi four-segmented .................................................................................................Family Tettigoniidae (Also called Locustidae) (in part)

Order Hymenoptera
19a *Peduncle of abdomen with a nodus or swelling. Body nearly bare ..........Family Formicidae
19b *Peduncle of abdomen without a nodus. Bright-colored, very hairy species ........Family Mutillidae (Females)

20a *Body very slender, linear.................................................................Order ORTHOPTERA (in part), Family Phasmidae
20b *Body broader, not linear.........................................................................................1

21a *Body ant-like in form, but base of abdomen not constricted
.................................................................................................................................Order ISOPTERA (in part), Family Termitidae (in part)
21b *Body not ant-like in form.......................................................................................22

22a *End of abdomen provided with forceps. (See also figure 101a).................................Order DERMAPTERA (Also called EUPLEXOPTERA), Family Forficulidae (in part)
22b End of abdomen without forceps .................................................................................Order COLEOPTERA, Family Lampyridae (in part)

23a *Small, scale-like insects, usually without legs, eyes or antennae and usually covered with a
scale beneath which the insect lives. Sometimes legs and antennae are present, the scale
wanting, and the insect covered with a mealy powder.............................................Order HOMOPTERA, Family Coccidae (in part)
23b Insect not scale-like or sedentary. Legs and antennae always present..........24
24a *Tarsi with five segments
24b *Tarsi with fewer than five segments
25a *Body compressed; flattened from side to side. Not covered with scales.
   Order SIPHONAPTERA, 26
25b *Body not compressed; wider than its depth.

Order Siphonaptera
26a Thorax longer than the first abdominal segment
26b Thorax shorter than the first abdominal segment
   Family Echidnophagidae (Also called Sarcopsyllidae)

27a *Abdomen indistinctly segmented, covered with hairs. The sheep "tick" and related forms.
   Order DIPTERA, Family Hippoboscidae
27b *Abdomen distinctly segmented, covered with scales, Order LEPIDOPTERA (Females, in part), 28
28a *Adult female not in a case
28b *Adult female remaining within the larval case
29a *Adult clothed with fine, hair-like scales
29b *Adult clothed with broad, flat scales
   Family Psyllidae (in part)
30a *With one or two claws on the last tarsal segment. Mouth parts enclosed in a beak or withdrawn into the head
30b *Without claws on the last tarsal segment. Mouth parts not enclosed in a beak
   Order THYSANOPTERA (in part), Family Thripidae
31a *Beak not evident; mouth styles completely withdrawn into head. Louse-like in form. External parasites on various mammals
   Order ANOPLURA (Also called SIPHUNCULATA and PARASITA), 32
31b *Beak evident and segmented

Order Anoplura
32a *Eyes present, evident. Parasitic lice on man
32b Eyes wanting or inconspicuous. Parasitic lice on domestic animals
   Family Pediculidae
33a *Beak (labium) arising from the fore part of the head
33b *Beak (labium) arising from the hinder part of the head between the front coxae
   Order HEMIPTERA (s.s., in part), 34
34a Middle and hind legs much longer than body and very slender
   Family Gerridae
34b Legs not extremely long
35a *Beak (labium) apparently three-segmented. *Body greatly depressed (flattened)
35b *Beak (labium) apparently four-segmented. Body not greatly depressed
   Family Cimicidae
36a *Front legs fitted for grasping prey
36b Front legs not fitted for grasping
   Family Nabidae (in part)
37a *With two wings (See also figures 56b, 59b) .............................................................. 38
37b With four wings evident (See figures 184b, 188b, 191a, 198b, 214b), or the presence or absence of the second pair concealed by the thickness of the first pair.

Note: When the front wings are thick and horny and meet in a straight line down the back (as in figures 100a, 104a, 112b, 118b, 122b, 135b) or thick and horny at the base with membranous, overlapping tips (as in figures 77a, 95a, 99b, 9a), a second pair of wings may be taken for granted in dry pinned specimens where the wings cannot be spread without breaking them .................................................. 76
38a *Wings membranous, i. e., thin and transparent like glass ........................................ 39
38b Wings horny or leathery; not membranous ................................................................. 73
39a *With few or no cross-veins (See also figures 12b, 56b, 61a, 66a) .............................. Order DIPTERA, 40
39b With many cross-veins (As in figures 181a, 192b, 159a, 165b) .............................. Order EPHEMERIDA (Also called EPHEMEROPTERA) (in part), Family Ephemeridae

Order Diptera
40a *Right and left legs attached close together, often touching at base. Segmentation of abdomen showing ................................................................. 41
40b *Distance between coxae about equal to the size of either coxa to the lateral margin. Abdomen does not show distinct segments .............................. Family Hippoboscidae
41a *Antennae of more than five segments, usually as long as head and thorax together. *Palpi elongate. *First anal (or anal) cell seldom closed or narrowed before the wing margin. *
*First mediolateral (or discal) cell generally wanting. (See also figure 49a) .................. 42
41b Antennae with usually not more than four segments. (See figures 50b, 52b, 62a, 71b). Palpi not elongate. First anal (or anal) cell closed or much narrowed before the wing margin. (See figures 55a, 55b). *First mediolateral (or discal) cell present. (See also figures 57a, 57b) .................. 49
42a Moth-like flies. Wings very hairy, without cross-veins. Wings held roof-like when at rest ................................................................. 58
42b *Not moth-like in form. *Wings with cross-veins ................................................................. 43
43a *The thorax with a distinct, V-shaped suture dorsally ............................................. Family Tipulidae
43b No V-shaped suture on the thorax. (See figures 50b, 55b) ............................................. 44
44a *Veins of the wing fringed with scales ........................................................................... Family Culicidae
44b *Veins of the wing not scaled ......................................................................................... 45
45a *Wings usually with three or less, never with more than five longitudinal veins. Tibiae without spurs .............................................................................. Family Cecidomyiidae (Also called Itonididae)
45b *Wings with more than three, usually the normal number of longitudinal veins. *Tibiae generally with spurs .............................................................................. 46
46a *Antenna longer than the thorax ....................................................................................... 48
46b *Antenna shorter than the thorax ....................................................................................... 47
47a *Ocelli present; slender flies with slender abdomen ....................................................... Family Bibionidae
47b *Ocelli absent; thick-set, hunch-backed flies, with heavy abdomen ............................... Family Simulidae
48a Ocelli present. *Coxae elongate ....................................................................................... 49
48b Ocelli absent. Coxae not especially elongate ................................................................. Family Chironomidae
49a *Antenna consisting of a single globular segment with a bristle. *No closed cells in the wing; two heavy veins near the costal margin and several lighter ones running obliquely backward. -----------------------------Family Phoridae

49b *Antenna of more than two segments; though the basal one may be very small (See also figures 62, 63, 71).-------------------------------------------------------------50

50a *Antennae of five or more segments; or if three-segmented the third segment is composed of several, closely applied, segment-like rings; and often with a triangular or thumb-like expansion at base of third segment.-----------------------------------------------51

50b *Antennae three- or four-segmented, the third segment not ringed.-------------------------------------------------------------52

51a *First medial two (or discal) cell small, hardly longer than broad, or rounded. *Tibiae without spurs at tip. *Tegulae (or squamae) small. -----------------------------Family Stratiomyidae

51b *First medial two (or discal) cell several times as long as broad. *Middle tibiae with two spurs at tip. *Tegulae (or squamae) large. -----------------------------Family Tabanidae

52a *Antennae of four segments, clavate. *Medius 1 + 2 (fourth vein) of wing curves forward to wing margin before the tip of wing. Large flies. -----------------------------Family Mydidae

52b *Antennae three-segmented; the third segment usually with a dorsal or terminal bristle.-----------------------------------------------53

53a *Radial vein four-branched (third vein forked)-----------------------------------------------54

53b *Radial vein three-branched (third vein not forked or branched)-----------------------------------------------55

54a *Vertex of the head distinctly hollowed out between the eyes. Large, bristly flies. -----------------------------Family Asilidae

54b *Vertex of the head not hollowed out.-----------------------------------------------55

55a *First anal (or anal) cell closed remote from the border of the wing.-----------------------------------------------Family Empididae

55b *First anal (or anal) cell narrowly open, or closed close to the border of the wing. Often hairy flies with pictured wings.-----------------------------Family Bombyliidae

56a *A false vein between radius 4 + 5 (third vein) and medius 1 + 2 (fourth vein) bisecting the radio-medial (anterior) cross-vein. Flies often banded with black and yellow, resembling bees or wasps.-----------------------------Family Syrphidae

56b *Without a false vein.-----------------------------------------------57

57a *First medial 2 (or discal) and medial (or second basal) cells not separated, the first medial 2 (or discal) cell open to the base of the wing. Small, brilliantly-colored flies.-----------------------------Family Dolichopodidae

57b *First medial 2 (or discal) cell complete and separated from base of wing by a cross-vein. Usually medium to large size flies; if small, not brilliantly-colored.-----------------------------58

58a *Head with a curving suture (the frontal suture), usually beginning on the face, running around above the antennae and down on the other side.-----------------------------59

58b Head without such suture (See figures 54a).-----------------------------Family Bombyliidae
59a *Tegulae (squamae) large.................................................................60
59b *Tegulae (squamae) small or wanting........................................66

60 *Oral opening small. Mouth parts small. Palpi wanting, Family Estridae, including Gastrophilidae

61a *Fifth radial (or first posterior) cell narrowed in the border of the wing........................................62
61b *Fifth radial (or first posterior) cell not narrowed in the border of the wing...Family Anthomyiidae

62a *Antennal bristle (arista) bare or short plumose..........................Family Tachinidae
62b *Antennal bristle (arista) plumose for part of its length at least........63

63a Base of abdomen with conspicuous bristles. Legs unusually long........Family Dexilidae
63b Base of abdomen without large bristles........................................64

64a Color metallic blue or green......................................................Family Calliphoridae
64b Color grayish or grayish white. Antennal bristle (arista) plumose (As in figure 62b)......................65

65a *Base of antennal bristle (arista) plumose; tip bare......................Family Sarcophagidae
65b *Antennal bristle (arista) plumose to the tip.................................Family Muscidae

66a *Subcostal (or auxiliary) vein present, distinct.............................67
66b *Subcostal (or auxiliary) vein absent or incomplete (See also figures 70a, 70b)........................70

67a *Oral vibrissae present, i.e., a distinct large bristle on each side of the face near oral margin......69
67b *Oral vibrissae absent.............................................................68

68a *Fifth radial (or first posterior) cell narrowed (As in figure 61a) or closed (As in figure 69a), toward the border of the wing. *Abdomen often narrowed toward the base........................................Family Conopidae
68b *Fifth radial (or first posterior) cell no narrowed toward the border of the wing. Wings usually pictured......................................Family Oritilidae
69a *Middle tibiae without strong bristles. 
69b *Middle tibiae with strong bristles. 
Families: Sepsidae and Piophilidae
Family: Cordylyridae
70a *First anal (or anal) cell absent. 
70b *First anal (or anal) cell present, often small. 
Family: Osmiridae
71a *Antennal bristle (arista) long, plumose. 
71b *Antennal bristle (arista) bars or short plumose. 
Family: Drosophilidae
72a *Wings pictured or spotted (See also figures 86b, 86b). 
72b *Wings not pictured. 
Family: Trypetidae
Family: Agromyzidae
73a *Mouth parts fitted for piercing (See also figures 81b and 89b). Order: HEMIPTERA, a.s., or Order HOMOPTERA (a few short-winged adults from various families). 
73b *Mouth parts fitted for chewing. 
Order: COLEOPTERA, Family: Meloidae (in part)
74a Front wings horny without veins (As in figures 10a, 10a, 11b, 11b, etc.). Legs not fitted for leaping. 
Order: COLEOPTERA, Family: Meloidae (in part)
74b Front wings leathery with many veins (As in figures 186a, 186b). Hind legs fitted for leaping (As in figure 188b). Order: ORTHOPTERA (in part), 75a Tarsi three-segmented. (As in figure 188b). Order: Gryllidae (in part)
75b Tarsi four-segmented. Family: Tetrigonidae (Also called Lygaeidae) (in part)
76a The two pairs of wings unlike in structure, i.e., with fore wings usually much thicker or less transparent than hind wings or the front wings only slightly thicker and the hind wings folded like a fan.
Note: When the front wings are thick and horny and meet in a straight line down the middle of the back (As in figures 10a, 10a, 11b, 11b, 12b, 13b, 13b) or thick and horny at the base with thinner, overlapping tips (As in figures 71a, 90a, 90b, 93b), it may be taken for granted that the kind pair of wings are transparent or membranous, in dry, pinned specimens where the wings cannot be spread without breaking them... 
76b The two pairs of wings similar in structure, i.e., with the two pairs of wings of the same degree of thickness or transparency.
Note: If the front wings are only slightly thicker and the hind wings are folded like a fan, see couplet 77; if prothorax very long and front legs large and grasping, see couplet 137. 
77a *Front wings thick at base, thinner and overlapping at tip (See also figures 90b, 93a). Mouth parts fitted for piercing, the beak arising from the front part of the head (See figures 31b, 73a). Order: HEMIPTERA, a.s., 77b Front wing of same texture throughout. (If legs very long and slender and beak attached to front of head, see couplet 89). Order: HEMIPTERA, a.s., 142
78a *Antennae short, usually concealed. 
78b Antennae longer, usually not concealed. 
79a *Hind tarsi with claws. 
79b Hind tarsi without claws. 
80a With two ocelli (As in figures 92b and 172b). Legs slender. 
Family: Gelastocoridae (Also called Gelgulidae)
80b *Without ocelli. 
81a *Body broadly oval in outline. 
81b *Body slender, linear in outline, with long appendages at tip of abdomen. 
Family: Nepidae
82a *Hind legs slender. Our species small, about one-third inch long. 
Family: Nauconidae
82b *Hind legs flattened. Our species larger. 
Family: Belostomatidae
83a Fore tarsi flattened and without claws. 
Family: Corixidae
83b *Fore tarsi not flattened, with claws. 
Family: Netomecidae
84a Front legs comparatively short and slender, less than one-half as long as middle and hind legs, which are very long and slender
84b Front legs not remarkably shorter than other legs; or, if so, thick and modified for grasping. Tarsi not split

85a Body elongate. Beak (labium) four-segmented
85b Body oval. Beak (labium) three-segmented

86a Membrane of the wing without closed cells or veins
86b Membrane with either closed cells or veins, or both

87a Membrane with one or two large closed cells, without additional longitudinal veins
87b Membrane with longitudinal veins (See also figure 94b). Closed cells usually small or wanting

88a Wings with a cuneus. Beak (labium) apparently four-segmented
88b Wings without a cuneus. Beak (labium) apparently three-segmented

89a Antennae three- or four-segmented
89b Antennae five-segmented

90a Fore wings resembling a net-work
90b Fore wings not resembling a net-work

91a Beak (labium) apparently four-segmented
91b Beak (labium) apparently three-segmented

92a Without ocelli (See figure 80b)
92b With ocelli

93a Body very slender. Antennae longer than the body
93b Body not slender. Antennae shorter than the body

94a Membrane with many branching veins
94b Membrane with a few, usually five, unbranched veins

Family Miridae (Also called Capsidae)
Family Tingitidae
Family Pyrrhocoridae
Family Lygaeidae
95a *Femora of fore legs nearly as wide as long* .............................................. Family Phymatidae
95b Femora of fore legs sometimes thickened, but never more than half as wide as long .......................... 96
96a Tarsi two-segmented .................................................................................................................. Family Aradidae
96b Tarsi three-segmented .................................................................................................................. Family Saldidae
97a *Fore legs fitted for grasping (with strong spines between femur and tibia)* ............................... Family Nabidae
97b Fore legs not fitted for grasping ..................................................................................................... Family Coreidae
98a *Scutellum flattened and usually narrowed behind* ................................................................. Family Pentatomidae
98b Scutellum very large and convex, covering almost the entire abdomen ................................. 99
99a *Tibiae with strong spines. Corium (the cell of the wing nearest below the figures 88b and 90b* on page 12) narrow and pointed ............... Family Cydnidae (Also called Tyroceridae)
99b Tibiae without strong spines. Corium broad and obtuse at tip ................................................ Family Scutelleridae

100a *Front wings horny, without veins. (Note: The regular, parallel ridges on the front wings of beetles are not veins)* ........................................... 101
100b Front wings leathery or opaque, with veins (*As in figure 138b*) ................................................ 133
101a *Abdomen provided with forceps at posterior end ......................................................................... Order DERMAPTERA (Also called EUPLEXOPTERA), Family Forficulidae
101b *Abdomen without forceps ........................................................................................................ Order COLEOPTERA, 102

Order COLEOPTERA

102a *Mouth parts reduced. *Front of head usually prolonged into a slender snout often longer than the rest of the head. Gular sutures (on under side of head) fused into one. Prosternal sutures wanting. Snout beetles ................................. 130
102b *Mouth parts not reduced. Front of head not prolonged into a slender, cylindrical snout. Gular sutures two. Prosternal sutures present. Typical beetles ........................................................................................................ 103
103a *Hind tarsi with the same number of segments as the fore tarsi (*See also figures 127a, 127b, 132b*) ................................................................. 104
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104b All the tarsi apparently four- or three-segmented (*See figures 125a, 127a*) ................................. 125
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121a Elytra (front wings) truncate, exposing one or two abdominal segments (As in figure 115b) Family Nitidulidae
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124b Front coxae conical, prominent. *Antennae capitate or clavate ........................................... Family Dermestidae
125a *All the tarsi apparently four-segmented ................................................................................ 126
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126b Front not prolonged. Tip of abdomen not usually exposed ................................................... 127
127a *Antennae usually as long as, or longer than, the head and thorax; their insertion usually
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eyes .................................................................................. Family Chrysomelidae
128a *Front coxal cavities closed behind. *Head narrower than the prothorax, without distinct
neck .......................................................................................... 129
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 ........................................................................................................... Family Meloidae
129a *Abdomen prolonged in a pointed style behind the elytra (front wings)........Family Mordellidae
129b *Abdomen not prolonged in a pointed style (See also figure 105b)........ Family Tenebrionidae
130a *Antennae straight, not clubbed ........................................................................... Family Brevitidae
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131a *Tibia serrate. Beak usually wanting ................................................................. Family Scolytidae
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132a Antennae not elbowed (As in figure 130a). A raised line on base of thorax... Family Anthribidae
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* 133a Mouth parts fitted for piercing, the beak (labium) arising from the ventral posterior part
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133b Mouth parts fitted for chewing (As in figure 73b) ........................................ Order ORTHOPTERA, 136
### Order Homoptera

134a *Antennae below the eyes at side of head* .................................................. Family Fulgoridae
134b *Antennae in front of and between the eyes* ................................................. 135
135a *Hind tibia with two rows of spines* ......................................................... Family Cicadellidae (Also called Jassidae)
135b *Hind tibia with a circlet of spines at apex* ............................................... Family Cercopidae

### Order Orthoptera

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137a Body oval, depressed. *As in figure 16a* .................................................... Family Blattidae
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138a Tarsi four-segmented. Antennae usually longer than body ............................... Family Tetrigidae (Also called Locustidae)
138b Tarsi three-segmented .................................................................................. 139
139a *Antennae short, usually not over half the length of the body* ......................... 140
139b Antennae long. Ovipositor long. Front wings flat above, bent abruptly down at sides .................................. Family Gryllidae
140a *Fore legs much widened, rake-like, fitted for burrowing* ....................... Family Gryllotalpidae
140b *Fore legs not fitted for burrowing* ............................................................... 141
141a *Fore wings reduced. Prothorax extending to near the tip of the abdomen* .............. Family Acrididae (Also called Tetrigidae)
141b *Fore wings not reduced. Prothorax not extending over more than the base of the abdomen* ................. Family Locustidae (Also called Acrididae)

### Order Lepidoptera

142a Last segment of tarsi without claws. *See figure 30b* .................................. Order THYSANOPTERA
142b Last segment of tarsi with claws. *See figure 167b* ......................................... 143
143a *Wings in part, at least, covered with scales* ........................................... Order LEPIDOPTERA, 144
143b Wings not scaled. *See figures 170a, 182, 195* ............................................. 149

### Order Lepidoptera

144a *Antennae thickened or enlarged toward the tip* ........................................... 165
144b *Antennae of various forms, not thickened toward the tip* ............................... 145
145a Wings split lengthwise, the borders of the clefts fringed with long hair-like scales .................................. Family Pterophoridae
145b *Wings not split lengthwise* ........................................................................... 146
146a *Hind wings usually lanceolate in shape, with a long fringe* ....................... Family Tineidae
146b Hind wings not lanceolate. *See figures 150a, 150b, 154a, 154b*. Fringe short 147
147a Fore wings narrow, more than four times as long as broad. Hind wings and sometimes fore wings in large part devoid of scales and therefore transparent
________________________________________________________________________Family Egeriidae (Also called Sesidiidae)
147b Fore wings not especially narrow. Hind wings usually covered with scales
________________________________________________________________________148
148a *Anal veins of fore wing two, of hind wing three
________________________________________________________________________149
148b *Anal veins of fore wing one, of hind wing usually two, rarely three or one
________________________________________________________________________154
149a *Medius 2 and medius 3 joined to cubitus, so that cubitus of fore wing appears four-branched...
________________________________________________________________________150
149b *Cubitus of fore and hind wings apparently three-branched
________________________________________________________________________Family Bombycidae
150a *Cubitus of fore and hind wings apparently four-branched
________________________________________________________________________151
150b *Cubitus of fore wing apparently four-branched, of hind wing three-branched ...Family Euclidiidae
151a *Radius 1 arising before the middle of the discal cell
________________________________________________________________________152
151b *Radius 1 arising near the apex of the discal cell
________________________________________________________________________153
152a Large moths. *Stem of medius distinct, dividing the discal cell
________________________________________________________________________Family Cossidae
152b Small moths. *Stem of medius not distinct (As in figures 147b, 155b). Discal cell not divided
________________________________________________________________________Family Tortricidae
153a *Small blackish moths with narrow elongate wings
________________________________________________________________________Family Pyromorphidae
153b *Medium brownish moths with broad wings
________________________________________________________________________Family Megalopygidae
154a *Anal veins of hind wing three
________________________________________________________________________Family Pyralidae
154b *Anal veins of hind wing two, rarely one
________________________________________________________________________155
155a *Accessory cells present in fore and hind wings
________________________________________________________________________Family Psychidae
155b *Accessory cells absent
________________________________________________________________________156
156a *Cubitus of fore and hind wings apparently four-branched, i.e., with medius 2 and 3 more closely joined to cubitus than to radius.
________________________________________________________________________157
156b Cubitus of both fore and hind wings not appearing four-branched
________________________________________________________________________159
157a *Premax present. Humeral angles (base of front margin) of hind wing not greatly expanded
________________________________________________________________________158
157b *Premax absent. *Humeral angles of hind wing greatly expanded
________________________________________________________________________Family Lasioadidae
158a *Subcosta of hind wing united to radius for a considerable distance
________________________________________________________________________Family Arctiidae
158b *Subcosta of hind wing united to radius for a short distance only
________________________________________________________________________Family Lymantriidae (Also called Liphistidae)
159a *Cubitus of fore wing apparently four-branched, of hind wing three-branched ..................160
159b *Cubitus of both wings apparently three-branched ..................................................161

160a Moths with strongly contrasted colors .................................................................Family Agaristidae
160b Colors of front wings dull grays and browns, not strongly contrasted ...........Family Noctuidae

161a *Frenulum present. Humeral angles (base of front margin) of hind wings not greatly expanded ..................................................163
161b *Frenulum absent. *Humeral angles of hind wings expanded ......................162

162a *Hind wings with two anal veins .................................................................Family Citheroniidae (Also called Ceratocampidae)
162b *Hind wings with one anal vein .................................................................Family Saturniidae

163a *Subcosta and radius of hind wing united by a strong cross vein ......................Family Sphingidae
163b *Subcosta and radius of hind wing not united by a strong cross vein ............164

164a *Subcosta of hind wing not bent sharply into the humeral angle. Stout bodied, narrow winged moths .........................................Family Notodontidae
164b *Subcosta of hind wing bent sharply into humeral angle. Slender-bodied, broad, delicate-winged moths ...........................................Family Geometridae (Also called Super-family Geometroidea)

165a *Antennae usually recurved or hooked at tip ..................................................Family Hesperiidae
165b *Antennae distinctly knobbed at tip, not recurved (See also figure 144a) ..............166

166a *Cubitus of fore wing apparently four-branched. *Hind wing with a tail-like projection along medius 3 ............................................Family Papilionidae
166b *Cubitus of fore wing apparently three-branched. *Usually no tail-like projection along medius 3 of hind wing .....................167

167a Fore legs well developed ..................................................................................168
167b *Fore legs reduced, the tarsi incomplete .........................................................Family Nymphalidae

168a Colors yellow, white or orange, usually marked with black ....................Family Pieridae
168b Not colored as above. Usually coppery, blue or brown ..........................Family Lycaenidae
Order HOMOPTERA, 170

169a *Mouth parts fitted for piercing.  
169b Mouth parts not fitted for piercing; usually for chewing, sometimes for sucking or lapping; sometimes greatly reduced.  

Order Homoptera

170a *Tarsi three-segmented.  *Beak present, evidently arising from the head.  *Antennae small, not prominent.  
170b *Tarsi one- or two-segmented.  Beak present or absent; when present *apparently arising from between the front coxae.  *Antennae usually prominent.  

171a *Antennae arising below the eyes, on sides of head.  Family Fulgoridae  
171b *Antennae arising in front of or between the eyes.  

172a *With three ocelli.  Prothorax not reaching tip of abdomen.  Family Cicadidae  
172b *With two ocelli or none (See also figure 92b).  Family Cicadellidae  

173a *Prothorax greatly enlarged upward and backward, often grotesquely shaped, usually reaching tip of abdomen.  Family Membracidae  
173b *Prothorax not enlarged or prolonged.  Family Cicadellidae (Also called Jassidae)  

174a Hind legs with femora thickened, fitted for leaping.  Family Chermidae (Also called Psyllidae)  
174b Hind legs not fitted for leaping, the femora slender.  

175a *Legs long.  Wings membranous.  Family Aphididae  
175b Legs short, wings opaque whitish.  Family Aleurodidae  

176a *Wings with many cross-veins and usually many veins (See also figure 184a).  
176b Wings with few cross-veins and usually not many veins (See figures 188b, 196, etc.).  Head never prolonged downward into a beak.  

177a *Tip of abdomen with long, anal filaments.  

Order Ephemeraida (Also called Ephemeroptera), Family Ephemeraidae  
177b *Abdomen without long anal filaments.  

178a *Hind tarsi with fewer than five segments.  
178b Hind tarsi with five segments.  

179a *Antennae short and slender, inconspicuous.  
179b Antennae conspicuous (See figures 184b, 188b).  

Order Odonata

180a *Front and hind wings dissimilar in outline, hind wings wider at base.  
180b *Front and hind wings similar in outline, distinctly narrower at base.  

181a *Wings with not fewer than five antenodal cross-veins, usually many.  Family Aeshnidae  
181b *Wings with not more than three antenodal cross-veins, usually two.  Family Coenagrionidae  
182a *Antenodals of first and second row usually meeting each other.  Family Libellulidae  
182b *Antenodals of first and second row not meeting each other.  Family Aeshnidae
183a Tarsi three-segmented (As in figure 187a). Hind wings as large as or larger than fore wings. Order PLECOPTERA, Family Perlidae

183b Tarsi four-segmented. Fore and hind wings of equal area. Order ISOPTERA, Family Termitidae

184a *Head prolonged into a beak with chewing mouth parts at its tip. Order MECOPTERA, Family Panorpidae

184b *Head not prolonged into a beak. Order NEUROPTERA, 185

Order Neuroptera

185a *Anal area of hind wings broad. Family Sialidae

185b *Anal area of hind wings narrow. Family Myrmeleontidae

186a *Antennae usually enlarged toward the tip. *Abdomen longer than the wings. Family Chrysopidae

186b *Antennae slender, not enlarged toward the tip. *Abdomen shorter than the wings.

Order Orthoptera

187a *Tarsi two- or three-segmented. 188

187b *Tarsi four- or five-segmented. 189

188a Hind wings folded like a fan (See figure 144a). Tarsi three-segmented (As in figure 188b). Order ORTHOPTERA, Family Gryllidae (in part)

188b *Hind wings not folded like a fan. Tarsi two-segmented (See figure 187a). Order CORRODENTIA, Family Psocidae

189a Fore wings larger than hind wings (See figures 191a, 191b, 195a, 198b, etc.). Mandibles well developed. Order HYMENOPTERA, 190

189b *Hind wings as large as, or larger than, fore wings. Mandibles inconspicuous. Order TRICHOPTERA
Order Hymenoptera

190a *Posterior trochanters consisting of two segments; that is, three small segments between the hind femur and the thorax. .................................................. 191
190b Posterior trochanters consisting of a single segment; only two small segments between the hind femur and the thorax (As in figures 191a, 191b) .................................................. 199

191a *Abdomen broadly joined to thorax. ............................................. 192
191b *Abdomen joined to thorax by a slender petiole or waist. .................... 195

192a *Tibia of fore leg with two terminal spurs. Ovipositor saw-like. .............. 193
192b *Tibia of fore legs with one terminal spur. Ovipositor not saw-like. ........... 194

193a *Antennae clubbed. .............................................................................. Family Cimbicidae
193b Antennae not clubbed. ........................................................................... Family Tenthredinidae

194a Ovipositor exerted nearly half as long as abdomen. Antennae not clubbed. Family Siricidae
194b *Ovipositor barely exerted; never half as long as abdomen. *Antennae clubbed. Family Cephidae

195a *Fore wings without closed cells. Minute insects .................................. 196
195b *Fore wings with at least one, sometimes several, closed cells .............. 197

196a *Pronotum extending to the tegula. (See also figure 214b) ..................... Family Proctotrupidae
196b *Pronotum not extending to the tegula. (See also figure 214a) ................. Family Chalcididae

197a *Fore wings with a stigma. .................................................................. 198
197b *Fore wings without a stigma. The body flea-like. .................................. Family Cynipidae

198a *Cell first medius 2 (third discoidal) present. ......................................... Family Ichneumonidae
198b *Cell first medius 2 (third discoidal) absent. .......................................... Family Braconidae

199a *Hind wing with no closed cells. ......................................................... 200
199b *Hind wing with at least one closed cell. .............................................. 201

200a *Abdomen in female extremely long and slender. *Antennae long and filiform. .................................................. 202

201a *Petiole of abdomen with a node or swelling (See also figure 198a). Ants .... Family Formicidae
201b Petiole without a node (As in figures 191b and 215a) ................................. 202
202a *First segment of tarsus of hind leg nearly naked and usually cylindrical. Hairs on the thorax simple. Wasp.................................................................................. 214
202b *First segment of tarsus of hind leg with many hairs; sometimes flattened. Hairs on the thorax plumose. Bees.................................................................................. 203
203a *Cheeks broad, eyes remote from the base of the mandibles. *Basal joint of the hind tarsus flattened.................................................................................................................. 204
203b *Cheeks narrow, eyes approaching the base of the mandibles. *Basal joint of the hind tarsus frequently not much flattened.................................................................................................................. 205
204a Eyes bare. *Hind tibiae with apical spurs.................................................................................. Family Bombidae
204b Eyes hairy. *Hind tibiae without apical spurs........................................................................ Family Apidae
205a *Fore wings with three submarginal cells.................................................................................. 206
205b *Fore wings with two submarginal cells.................................................................................. 211
206a Wasp-like bees with bright colors and not much hair. No pollen-collecting apparatus.........................................................Family Nomadidae
206b Not wasp-like in appearance.................................................................................................. 207
207a *Tibia of hind leg shorter than the basal segment of tarsus. Large species resembling bumble bees .......................................................................................................................... Family Xylocopidae
207b *Tibia of hind leg as long as the basal segment of the tarsus. Medium-sized species.................. 208
208a *Labrum conspicuous, about twice as broad as long................................................................. 209
208b *Labrum inconspicuous, several times as broad as long............................................................ 210
209a Small metallic bees, not covered with hairs.......................................................................... Family Ceratinidae
209b Medium to large size bees. Head and thorax densely pubescent.............................................. Family Anthophoridae
210a *Tongue short, obtuse at apex.................................................................................................. Family Colletidae
210b Tongue longer, acute at apex (As in figures 203b and 204b).................................................. Family Andrenidae
211a *Face of males densely pubescent. *Females with a dense brush of hairs on the ventral side of the abdomen.............................................................................................................. Family Megachilidae
211b *Face bare or nearly bare. Females without a brush of hairs on the ventral side of abdomen ................................................................................................................................. 212
212a Labrum evident, though sometimes small.................................................................................. 213
212b *Labrum concealed by the clypeus.......................................................................................... Family Stelidae
213a Legs clothed with long hairs................................................................................................. Family Panurgidae
213b Legs bare or clothed with short hairs.................................................................................. Family Hyleidae (Also called Prosopidae)
214a *Pronotum not touching the tegulae (See also figure 186b) ........................................... 215
214b *Pronotum touching tegulae (See also figure 196a) ...................................................... 222

215a *Pettiole long and slender ................................................. Family Sphexidae
215b Abdomen sessile or very short-petioled (As in figures 191a or 224a) ......................... 216

216a Middle tibia with one apical spur (As in figure 214a) ............................................... 218
216b Middle tibia with two apical spurs (As in figure 222a) ........................................... 217

217a Labrum concealed by the clypeus (As in figure 218b) ............................................... Family Nystontidae
217b *Labrum free, exposed beyond the clypeus ................................................................. Family Stizidae

218a *Labrum free, exposed beyond the clypeus ................................................................. Family Bembecidae
218b *Labrum concealed by the clypeus ............................................................................. 219

219a *Fore wings with two radial cells .............................................................. Family Crabronidae
219b *Fore wings with three or four radial cells ......................................................... 220

220a Abdomen constricted between first and second segments (As in figure 224a) ........... 221
220b Abdomen not constricted between first and second segments (As in figure 224b) .... 221

................................................................. Family Larridae

221a *Eyes deeply emarginate. Clypeus not lobed ......................................................... Family Trypanosomaeidae
221b *Eyes not emarginate. *Clypeus with a median lobe .............................................. Family Philanthidae

222a *With two terminal spurs on middle tibia ......................................................... 223
222b With one terminal spur on middle tibia (As in figure 214a) .......................... 225

223a *Eyes emarginate ............................................................................... Family Vespidae
223b *Eyes not emarginate ........................................................................... 224

224a *First abdominal segment constricted from second ventrally. *Body densely covered with hairs ........................................................................... Family Mutilidae (Males)
224b *First and second segments of abdomen not so separated ....................................................... Family Psammocharidae (Also called Pompilidae)

225a *Hind tibiae bare or with short hairs. *Each claw with a tooth ................................ Family Eumenidae
225b *Hind tibiae with spines and long hairs. *Claws not toothed ................................ Family Scoliidae