IDENTIFIKASI SERANGGA

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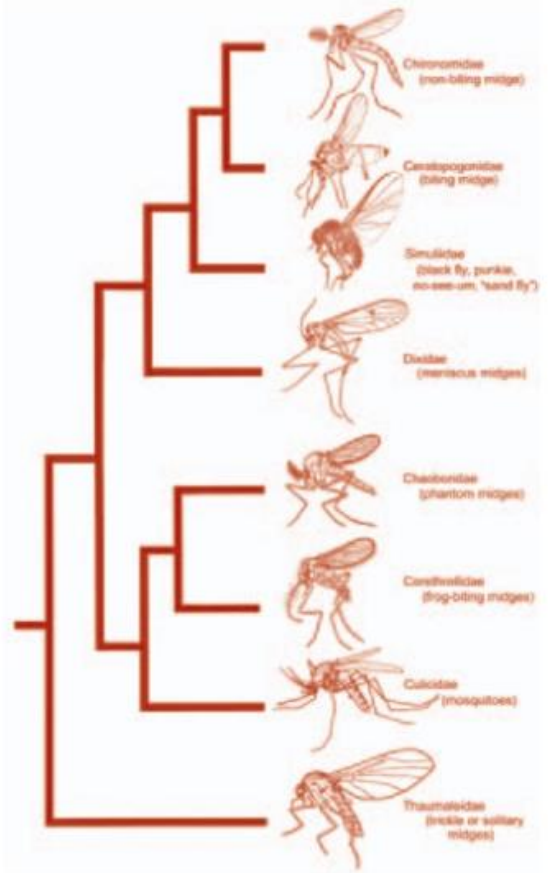
ENTOMOLOGI PERTEMUAN 9 -IDENTIFIKASI SERANGGA-

Penamaan dan Klasifikasi Serangga

INSECT SYSTEMATICS: PHYLOGENY AND CLASSIFICATION



Tree showing proposed relationships between mosquitoes, midges, and their relatives. (After various sources.)

SPESIASI

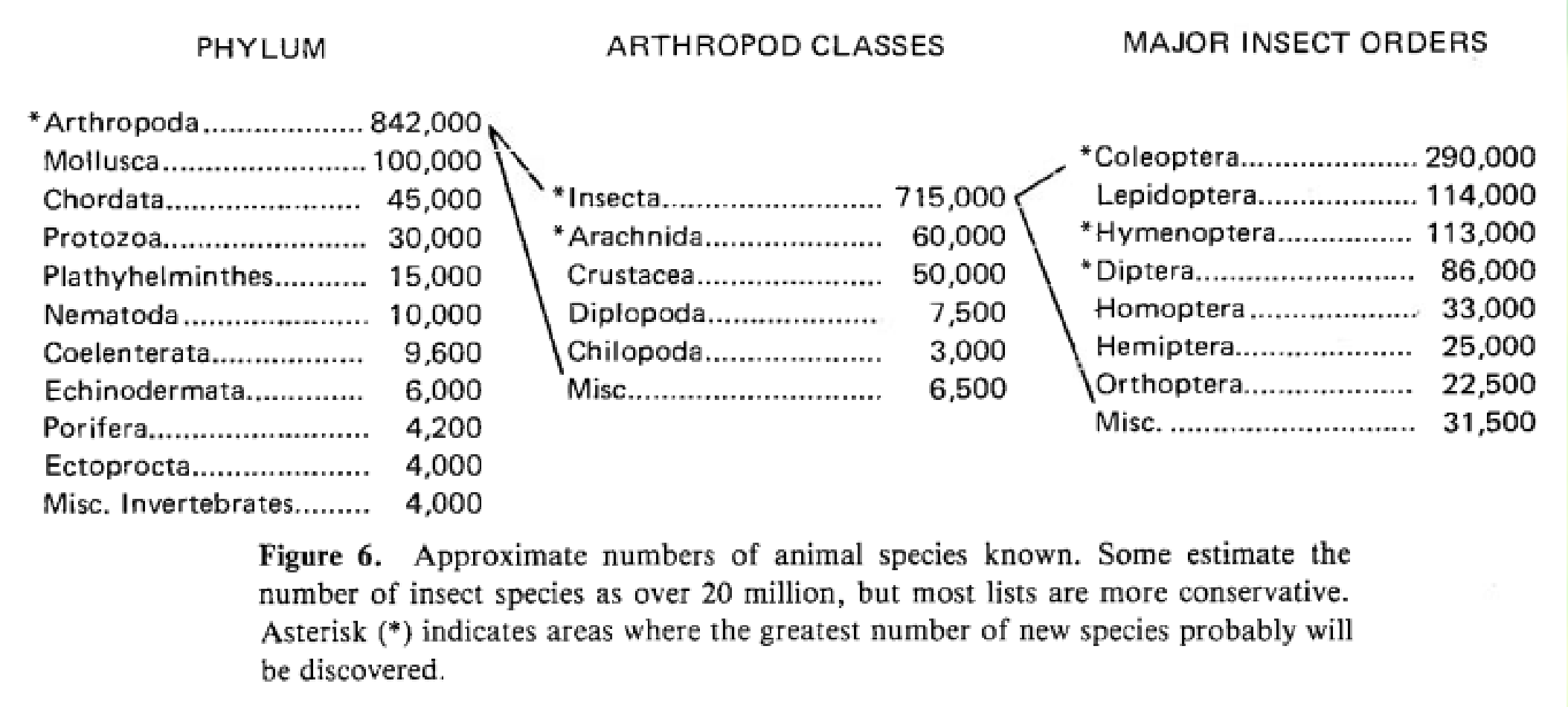


Figure 6. Approximate numbers of animal species known. Some estimate the number of insect species as over 20 million, but most lists are more conservative. Asterisk (*) indicates areas where the greatest number of new species probably will be discovered.

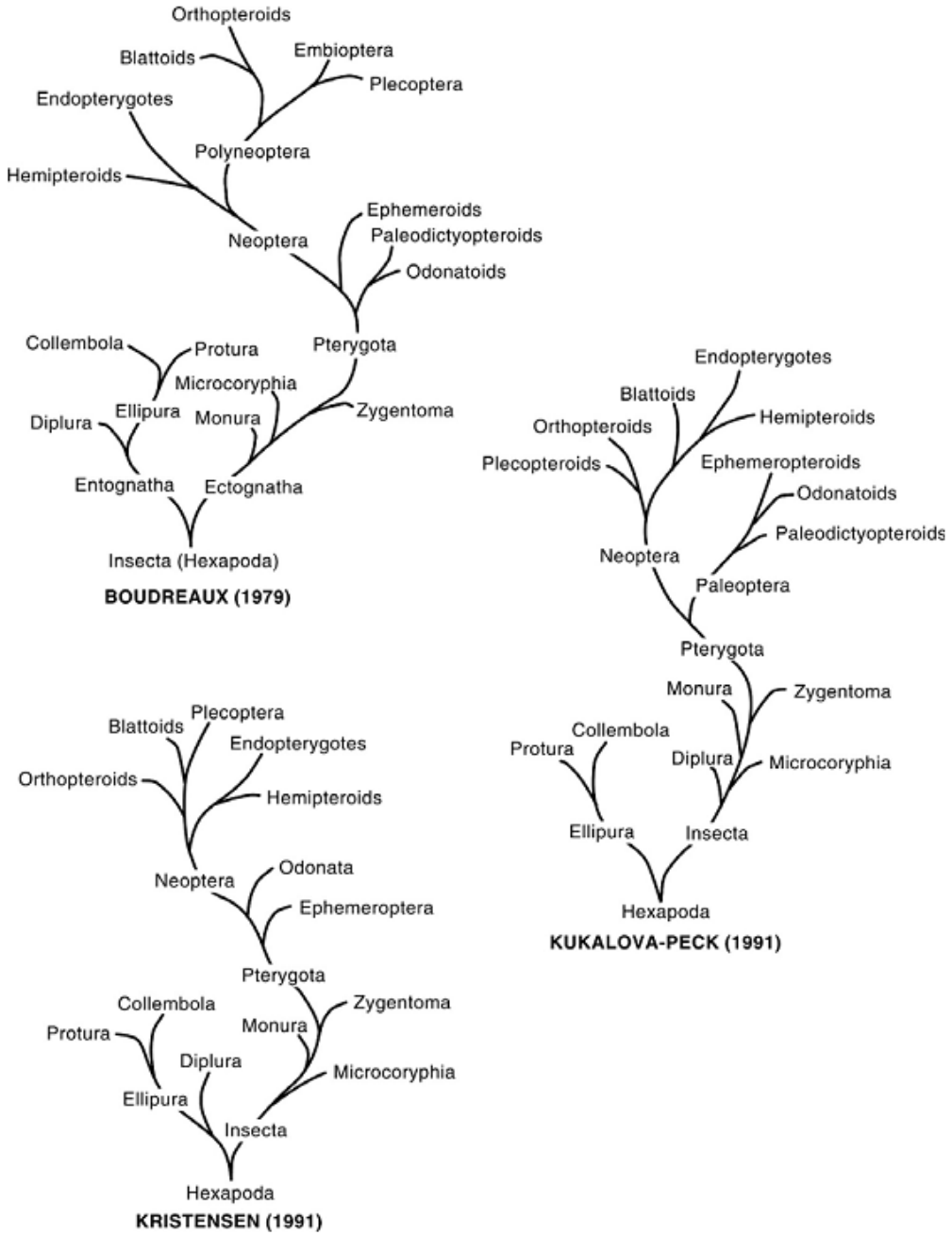


FIGURE 1.9. Schemes for the possible relationships of the hexapod groups as envisaged by Boudreaux (1979), Kristensen (1991), and Kukalová-Peck (1991).

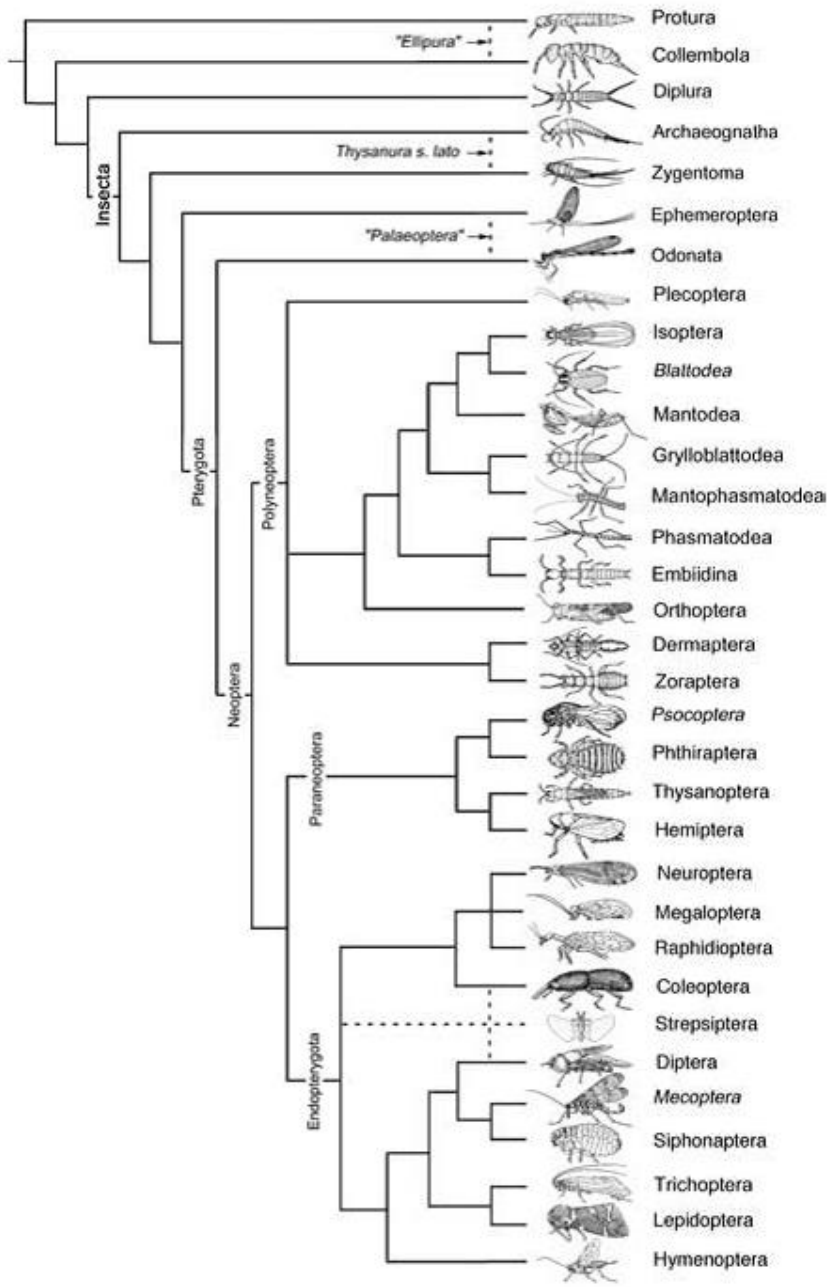
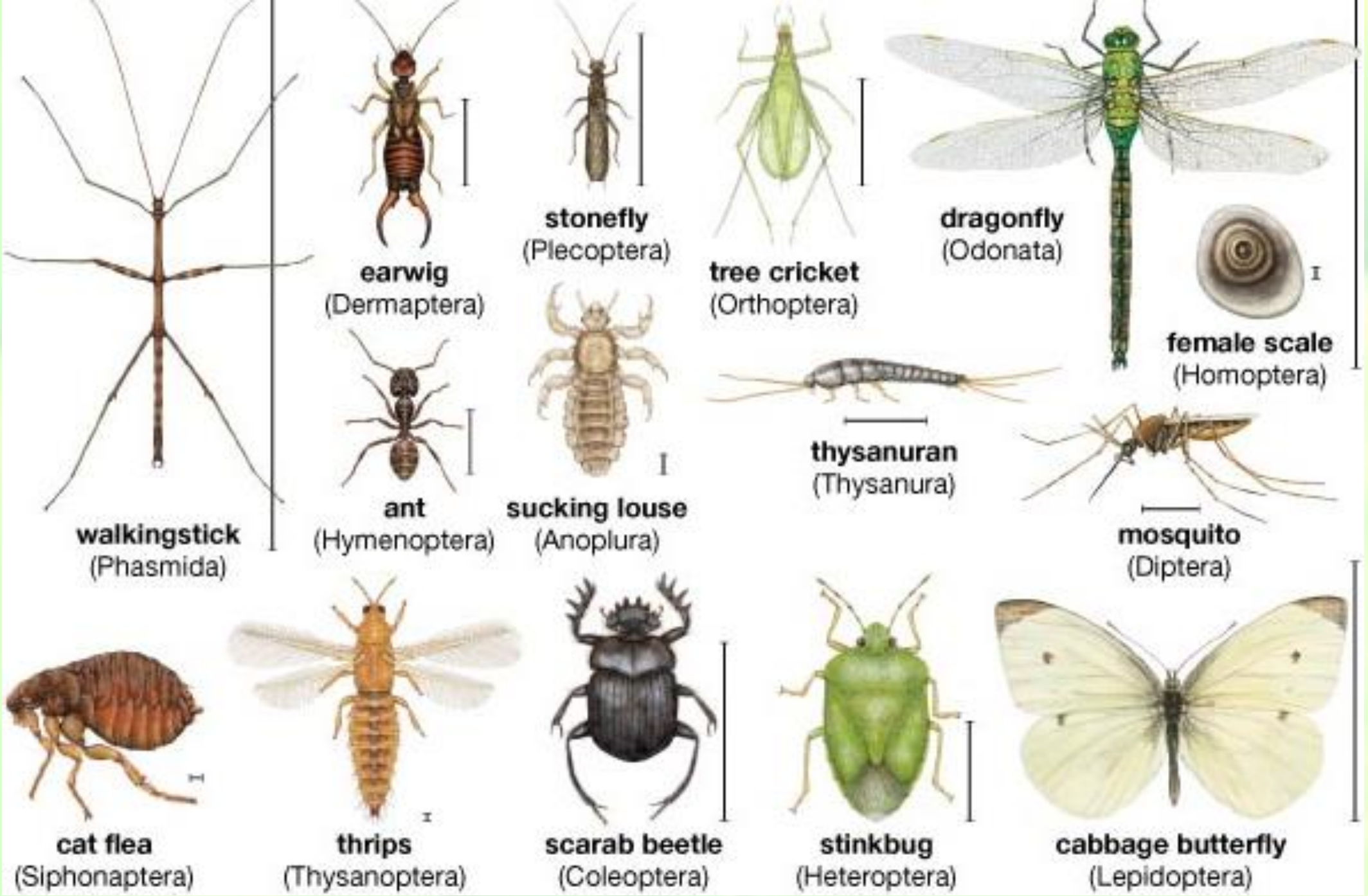


Fig. 7.2 Cladogram of postulated relationships of extant hexapods, based on combined morphological and nucleotide sequence data. Italicized names indicate paraphyletic taxa. Broken lines indicate uncertain relationships. Thysanura *sensu lato* refers to Thysanura in the broad sense. (Data from several sources.)


walkingstick
(Phasmida)
earwig
(Dermaptera)
stonefly
(Plecoptera)
tree cricket
(Orthoptera)
dragonfly
(Odonata)
female scale
(Homoptera)
ant
(Hymenoptera)
sucking louse
(Anoplura)
thysanuran
(Thysanura)
mosquito
(Diptera)
cat flea
(Siphonaptera)
thrips
(Thysanoptera)
scarab beetle
(Coleoptera)
stinkbug
(Heteroptera)
cabbage butterfly
(Lepidoptera)

Sistematika dan Taksonomi

1. Pendahuluan

- Sistematika dapat diartikan sebagai studi tentang jenis dan keragaman organisme serta hubungan antar organisme.
- Taksonomi, teori dan praktik mengidentifikasi, mendeskripsikan, menamai, dan mengklasifikasikan organisme, merupakan bagian integral dari sistematika.
- Klasifikasi adalah susunan organisme menjadi kelompok (taksa, singulartakson) atas dasar hubungan mereka.
- Identifikasi dapat terjadi setelah klasifikasi telah ditetapkan.
- Taksonomi sering kali digunakan sebagai sinonim dari sistematika, sedangkan klasifikasi kadang lebih digunakan secara longgar/sinonim dari identifikasi.

Lanjutan…

Taksonomi serangga

- Seperti kebanyakan kelompok organisme hidup lainnya, didasarkan terutama pada struktur luar, data fisiologis, perkembangan, perilaku, dan sitogenetik.
- Pada beberapa dekade ini, analisis biologi molekuler dalam sistematika serangga mengalami peningkatan. Analisis ini, pada prinsipnya menggunakan urutan mtDNA, pada prinsipnya berfokus pada penyelesaian hubungan pada tingkat taksonomi yang lebih rendah, misalnya, antara subspesies, spesies dan kelompok spesies. Studi filogenetik molekuler dari taksa serangga tinggi (misalnya, hubungan antar ordo).

2. Penamaan dan Penggambaran Serangga

- Untuk menghindari kemungkinan kebingungan, setiap spesies serangga, seperti semua organisme lain, diberi nama binomial (dua bagian) dalam bahasa latin, merupakan sebuah sistem yang diperkenalkan oleh Linnaeus di awal 1700-an.
- Nama ilmiah/*scientific name:*
  - Dicetak miring
  - Kata pertama menunjukkan genus, kata kedua untuk spesies (ex. *Musca domestica* (lalat rumah). Jarang, nama memiliki tiga bagian, bagian ketiga menunjukkan subspesies.
- Nama yang diberikan untuk spesies baru harus mengikuti aturan dan sistem tata nama universal yang ditetapkan oleh Komisi Internasional untuk Nomenklatur Zoologi (diterbitkan dalam Kode Internasional Nomenklatur Zoologi). Ex. pada capung *Hemicordulia flava* (dari bahasa Latin "flavus" yang berarti kuning, mengacu pada warna kuning yang luas pada tubuh), atau mungkin bisa nama orang atau tempat, Ex. pada lalat *Neosticta fraseri*, dinamai dari ahli odonatologi Australia, FC Fraser.

3. Klasifikasi

- Sistem klasifikasi biologi bersifat hierarki, yaitu taksa terbesar dibagi lagi menjadi taksa yang lebih kecil berturut-turut.
- Setiap takson memiliki tingkatan (pangkat) tertentu di dalam sistem. Kelompok dengan peringkat yang sama dikatakan termasuk dalam kategori taksonomi yang sama yang diberi nama tertentu.
- Beberapa dari kategori ini bersifat wajib (huruf kapital pada contoh di bawah), sementara yang lainnya bersifat opsional.untuk memperkenalkan nama-nama dari berbagai kategori,
- Kita ambil contoh klasifikasi lebah madu, *Apis mellifera*:

KINGDOM	Animalia
PHYLUM	Uniramia
Subphylum	Hexapoda
CLASS	Insecta
Subclass	Pterygota
Infraclass	Neoptera
Division	Oligoneoptera
ORDER	Hymenoptera
Suborder	Apocrita
Superfamily	Apoidea
FAMILY	Apidae
Subfamily	Apinae
Tribe	Apini
Subtribe	—
GENUS	*Apis*
Subgenus	—
SPECIES	*Apis mellifera*
Subspecies	

Lanjutan…

Klasifikasi Serangga

Superclass Hexapoda.

1. CLASS. Collembola
   ORDERS. Arthropleona, Neelipleona, and Symphypleona
2. CLASS AND ORDER. Protura
3. CLASS AND ORDER. Diplura
4. CLASS. Insecta
   - I. SUBCLASS. Apterygota
     ORDERS. Microcoryphia and Zygentoma
   - II. SUBCLASS. Pterygota
     - A. INFRACLASS. Paleoptera
       ORDERS. Ephemeroptera and Odonata
     - B. INFRACLASS. Neoptera
       - a. DIVISION. Polyneoptera (orthopteroid orders)
         ORDERS. Orthoptera, Grylloblattodea, Dermaptera, Plecoptera, Embioptera. Dictyoptera, Isoptera, Phasmida, Mantophasmatodea, and Zoraptera
       - b. DIVISION. Paraneoptera (hemipteroid orders)
         ORDERS. Psocoptera, Phthiraptera, Hemiptera, and Thysanoptera
       - c. DIVISION. Oligoneoptera (endopterygote orders)
         ORDERS. Mecoptera, Lepidoptera, Trichoptera, Diptera. Siphonaptera, Neuroptera, Megaloptera, Raphidioptera, Coleoptera, Strepsiptera, and Hymenoptera

4. Identifikasi

Pada prinsipnya, identifikasi serangga sama dengan yang dilakukan pada hewan lain. Dalam praktiknya lebih sulit, karena dua alasan utama. Pertama, banyaknya spesies yang muncul berarti bahwa seringkali perbedaan yang sangat kecil dalam struktur harus digunakan untuk membedakan bentuknya. Kedua, ukuran kecil dari sebagian besar serangga mengakibatkan identifikasinya tidak mudah dilihat.

Ada berbagai metode untuk mengidentifikasi organisme:

(1) spesimen dikirim ke ahlinya,

(2) dibandingkan dengan spesimen dalam koleksi berlabel,

(3) dibandingkan dengan gambar atau deskripsi, atau

(4) diidentifikasi dengan menggunakan kunci. Terdapat kunci bergambar, mencakup materi cetak dan sistem interaktif berbasis komputer yang mudah digunakan seperti yang dikembangkan oleh Bishop *et al*. (1989), Lawrence *et al*. (1993), dan Weeks *et al*. (1999). Namun, yang paling sering digunakan, kunci tertulis konvensional. Identifikasi dengan menggunakan kunci harus dilakukan dengan membandingkan karakter spesimen dengan diagnosis atau deskripsi spesies.

Lanjutan…

Identifikasi menggunakan Kunci

Key to the Orders of Insecta

1. Wings developed.....2
   Wingless, or with vestigial wings, or with rudimentary wings not suitable for flight (wingless adults and immature stages).....31
2. Fore wings horny, leathery, or parchmentlike, at least at base; hind wings membranous (occasionally absent). Prothorax large and not fused with mesothorax (except in Strepsiptera).....3
   Fore wings membranous.....11
3. Fore wings containing veins, or at least hind wings not folded crossways when hidden under fore wings.....4
   Fore wings veinless, of uniform horny consistency; hind wings, when present, folded crossways as well as lengthwise when at rest and hidden beneath fore wings; mouthparts mandibulate.....10
4. Mouthparts forming a jointed beak, fitted for piercing and sucking. Bugs.....HEMIPTERA (Page 210)
   Mouthparts with mandibles fitted for chewing and moving laterally.....5
5. Hind wings not folded, similar to fore wings; thickened basal part of wings very short, separated from rest of wing by a preformed transverse suture; social species, living in colonies. Termites..... ISOPTERA (Page 163)
   Hind wings folding, fanlike, broader than fore wings.....6
6. Usually rather large or moderately large species; antennae usually lengthened and threadlike; prothorax large and free from mesothorax; cerci present; fore wings rarely minute, usually long.....7
   Very small active species; antennae short with few joints, at least one joint bearing a long lateral process; no cerci; fore wings minute; prothorax small. Rare, short-lived insects, parasites of other insects, usually wasps and bees.....Males of STREPSIPTERA* (Page 326)

7. Hind femora not larger than fore femora; body more or less flattened with wings superposed when at rest; tergites and sternites subequal.....8
Hind femora almost always much larger than fore femora, jumping species, if not (Gryllotalpidae) front legs broadened for burrowing; species usually capable of chirping or making a creaking noise; body more or less cylindrical, wings held sloping against sides of the body when at rest, tergites usually larger than sternites. Grasshoppers, katydids, crickets ..... ORTHOPTERA (Page 184)
8. Body elongate; head free, not concealed from above by the prothorax; deliberate movers.....9
Body oval, much flattened; head nearly concealed beneath the oval pronotum; legs identical, coxae large and tibiae noticeably spiny or bristly..... Cockroaches..... DICTYOPTERA, Suborder BLATTODEA (Page 160)
9. Prothorax much longer than mesothorax; front legs almost always heavily spined, formed for seizing prey; cerci usually with several joints. Mantids..... DICTYOPTERA, Suborder MANTODEA (Page 161)
Prothorax short; legs similar, formed for walking; cerci unjointed. Stick and leaf insects..... PHASMIDA (Page 179)
10. Abdomen terminated by movable, almost always heavily chitinized forceps; antennae long and slender; fore wings short, leaving most of abdomen uncovered, hind wings nearly circular, delicate, radially folded from near the center; elongate insects. Earwigs..... DERMAPTERA (Page 175)
Abdomen not terminated by forceps; antennae of various forms but usually with 11 subdivisions; fore wings usually completely sheathing the abdomen; generally hard-bodied species. Beetles..... COLEOPTERA (Page 305)
11. With four wings.....12
With only mesothoracic wings, usually outspread when at rest.....29
12. Wings long, very narrow, the margins fringed with long hairs, almost veinless; tarsi 1- or 2-jointed, with swollen tips; mouthparts asymmetrical without biting mandibles, fitted for lacerating and sucking plant tissues; no cerci; minute species. Thrips..... THYSANOPTERA (Page 233)
Wings broader and most often with veins; if wings rarely somewhat linear, tarsi have more than two joints and last tarsal joint is not swollen.....13
13. Wings, legs, and body covered, at least in part, with elongate flattened scales (often intermixed with hairs) that nearly always form a color pattern on the wings; mouthparts (rarely vestigial) forming a coiled tongue composed of the maxillae; biting mandibles present only in Micropterigidae. Moths and butterflies..... LEPIDOPTERA (Page 276)
Wings, legs, and body not covered with scales, although sometimes hairy and having a few scales intermixed; sometimes covered with bristles, especially on legs, or rarely with wax flakes or dust; color pattern when present extending to wing membrane..... 14
14. Hind wings with anal area separated, folded fanlike when at rest, nearly always wider and noticeably larger than fore wings; antennae prominent; wing veins usually numerous..... 15
Hind wings without a separated anal area, not folded and not larger than fore wings..... 17
15. Tarsi five-jointed; cerci not pronounced.....16
Tarsi three-jointed; cerci well developed, usually long and many jointed; prothorax large, free; species of moderate to large size. Stoneflies..... PLECOPTERA (Page 147)
16. Wings with a number of subcostal crossveins; prothorax rather large; species of moderate to large size. Alderflies..... MEGALOPTERA (Page 297)
Wings without subcostal crossveins, with surface hairy; pro thorax small; species of small to moderate size. Caddisflies..... TRICHOPTERA (Page 268)
17. Antennae short and inconspicuous; wings netveined with numerous crossveins; mouthparts mandibulate.....18
Antennae large; if antennae small, wings have few crossveins or mouthparts form a jointed sucking beak.....19
18. Hind wings much smaller than fore wings; abdomen ending in long threadlike processes; tarsi normally four- or five-jointed; sluggish fliers. Mayflies..... EPHEMEROPTERA (Page 127)
Hind wings nearly like fore wings; no caudal setae; tarsi three-jointed; vigorous, active fliers, often of large size. Dragonflies, damselflies..... ODONATA (Page 136)
19. Head elongated ventrally forming a rostrum, at tip of which are mandibulate mouthparts; hind wings not folded; wings usually with color pattern, crossveins numerous; male genitalia usually greatly swollen, forming a reflexed bulb. Scorpionflies..... MECOPTERA (Page 239)
Head not drawn out as a mandibulate rostrum; male abdomen not forcipate.....20
20. Mouthparts modified for sucking (occasionally reduced or absent); mandibles absent or in form of long bristles; no cerci; crossveins few.....21
Mouthparts for biting [occasionally for sucking (higher Hymenoptera)]; mandibles always present and having typical biting form.....22
21. Wings not covered with scales, not outspread when at rest; prothorax large; antennae with few subdivisions; mouthparts forming a jointed piercing beak. Bugs..... HEMIPTERA (Page 210)
Wings and body covered with colored scales that form a definite pattern on wings; antennae greatly subdivided; mouthparts when present forming a coiled tongue. Moths and butterflies..... LEPIDOPTERA (Page 276)
22. Tarsi five-jointed; if rarely three- or four-jointed, hind wings are smaller than front ones and wings lie flat over body; no cerci.....23
Tarsi two-, three-, or four-jointed; veins and crossveins not numerous..... 26

23. Prothorax small or only moderately long. (In Mantispidae prothorax is very long, but front legs are strongly raptorial.) 24
Prothorax very long and cylindrical, much longer than head; front legs normal; antennae with more than 11 subdivisions; crossveins numerous. Snakeflies ..... RAPHIDIOPTERA (Page 299)

24. Wings similar, with many veins and crossveins; prothorax more or less free 25
Wings with relatively few angular cells, costal cell without crossveins; hind wings smaller than fore pair; prothorax fused with mesothorax; abdomen frequently constricted at base and ending in a sting or specialized ovipositor. Ants, wasps, bees, etc. ..... HYMENOPTERA (Page 330)

25. Costal cell, at least in fore wing, almost always with many crossveins. Lacewings, antlions ..... NEUROPTERA (Page 301)
Costal cell without crossveins. Scorpionflies ..... MECOPTERA (Page 239)

26. Wings equal in size, or rarely hind wings larger, held superposed on top of abdomen when at rest; media fused with radial sector for a short distance near middle of wing; tarsi three-, four-, or five-jointed 27
Hind wings smaller than fore wings; wings held at rest folded back against abdomen; radius and media not fusing; tarsi two- or three-jointed 28

27. Tarsi apparently four-jointed; cerci usually minute; wings with a transverse preformed suture near the base; social species, living in colonies. Termites ..... ISOPTERA (Page 163)
Tarsi three-jointed, front metatarsi swollen; cerci conspicuous; usually solitary species. Webspinners ..... EMBIOPTERA* (Page 153)

28. Cerci absent; tarsi two- or three-jointed; wings remaining attached throughout life; radial sector and media branched, except when fore wings are much thickened. Book lice ..... PSOCOPTERA (Page 199)
Cerci present; tarsi two-jointed; wings shed at maturity, venation greatly reduced; radial sector and media simple, unbranched ..... ZORAPTERA* (Page 195)

29. Mouthparts not functional; abdomen with a pair of caudal filaments 30
Mouthparts forming a proboscis, only exceptionally vestigial; abdomen without caudal filaments; hind wings replaced by knobbed halteres. True flies ..... DIPTERA (Page 243)

30. No halteres; antennae inconspicuous; cross veins abundant. A few rare mayflies ..... EPHEMEROPTERA (Page 127)
Hind wings represented by minute hooklike halteres; antennae evident; venation reduced to a forked vein; crossveins lacking; minute delicate insects. Males of scale insects ..... HEMIPTERA (Page 210)

31. Body with more or less distinct head, thorax and abdomen, and jointed legs; capable of locomotion 32
Without distinct body parts or without jointed legs, or incapable of locomotion 75

32. Terrestrial, breathing through spiracles; rarely without special respiratory organs 33
Aquatic, usually gill-breathing, larval forms 62

Parasites on warm-blooded animals 70

3. Mouthparts retracted into head and scarcely or not at all visible; underside of abdomen with styles or other appendages; less than three joints on maxillary palps if antennae present; delicate, small or minute insects 34
Mouthparts conspicuously visible externally; if mouthparts mandibulate, maxillary palps more than two-jointed; antennae always present; underside of abdomen rarely with styles 36

4. Antennae absent; no long cerci, pincers, springing apparatus, or anterior ventral sucker on abdomen; head pear-shaped ..... PROTURA (Page 118)
Antennae conspicuous; pincers, long cerci, or basal ventral sucker present on abdomen 35

5. Abdomen consisting of six segments or less, with a forked sucker at base of abdomen below; no terminal pincers or long cerci; usually with conspicuous springing apparatus near end of abdomen. Springtails ..... COLLEMBOLA (Page 114)
Abdomen consisting of more than eight visible segments, with long multi-jointed cerci or strong pincers at the end; eyes and ocelli absent ..... DIPLURA (Page 120)

6. Mouthparts mandibulate, formed for chewing 37
Mouthparts haustellate, formed for sucking 59

7. Body usually covered with scales; abdomen with three prominent caudal filaments and bearing at least two pairs of ventral styles 38
Body never covered with scales; never with three caudal filaments; ventral styles absent on abdomen 39

8. Head with large compound eyes and ocelli; legs with three tarsal segments; paired styli present on each abdominal segment. Bristletails ..... MICROCORYPHIA (Page 122)
Compound eyes small or absent; legs with two to four tarsal segments; paired styli on abdominal segments 7–9 (rarely 2–9). Silverfish, firebrats ..... ZYGENTOMA (Page 123)

9. Underside of abdomen entirely without legs 40
Abdomen bearing false legs beneath, which differ from those of thorax; body caterpillarlike, cylindrical; thorax and abdomen not distinctly separated; larval forms 57

0. Antennae long and distinct 41
Antennae short, not pronounced; larval forms 54

1. Abdomen terminated by strong movable forceps; prothorax free. Earwigs ..... DERMAPTERA (Page 175)
Abdomen not ending in forceps 42

2 Abdomen strongly constricted at base; prothorax fused with mesothorax. Ants, etc. ..... HYMENOPTERA (Page 330)
Abdomen not strongly constricted at base; broadly joined to thorax 43

3. Head not elongated ventrally 44
Head elongated ventrally forming a rostrum, at tip of which are mandibulate mouthparts. Scorpionflies ..... MECOPTERA (Page 239)

4. Very small species; body soft and weakly sclerotized; tarsi two- or three-jointed 45

Usually much larger species; tarsi usually with more than three joints, or, if not, body is hard and heavily sclerotized and cerci are absent 46

45. Cerci absent. Book lice ..... PSOCOPTERA (Page 199)
Cerci unjointed, prominent ..... ZORAPTERA* (Page 195)

46. Hind femora enlarged; wing pads of larva when present in inverse position, that is, metathoracic overlapping mesothoracic ..... ORTHOPTERA (Page 184)
Hind legs not enlarged for jumping; wing pads, if present, in normal position 47

47. Prothorax much longer than mesothorax; front legs fitted for grasping prey. Mantids DICTYOPTERA, Suborder MANTODEA (Page 161)
Prothorax not greatly lengthened 48

48. Cerci present; antennae usually with more than 15 subdivisions, often multiply subdivided. 49
No cerci; body often hard-shelled; antennae usually with 11 subdivisions. Beetles ..... COLEOPTERA (Page 305)

49. Cerci with more than three joints 50
Cerci short, with one to three joints 52

50. Body flattened and oval; head inflexed; prothorax oval. Cockroaches ..... DICTYOPTERA, Suborder BLATTODEA (Page 160)
Body elongate; head nearly horizontal 51

51. Cerci long; ovipositor rigid and exserted; tarsi five-jointed ..... GRYLLOBLATTODEA* (Page 173)
Cerci short; no ovipositor; tarsi four-jointed; social forms, living in colonies. Termites ..... ISOPTERA (Page 163)

52. Tarsi five-jointed; body usually very slender and long. Stick insects ..... PHASMIDA (Page 179)
Tarsi two- or three-jointed; body not elongate 53

53. Front tarsi with first joint swollen, containing a silk-spinning gland, producing a web in which the insects live; body long and slender. Webspinners ..... EMBIOPTERA* (Page 153)
Front tarsi not swollen, without silk-spinning gland; body much stouter; social species. Termites ..... ISOPTERA (Page 163)

54. Body cylindrical, caterpillarlike 55
Body more or less depressed, not caterpillarlike 56

55. Head with six ocelli on each side; labium with spinnerets; antennae inserted in membranous area at base of mandibles ..... Larvae of some LEPIDOPTERA (Page 276)
Head with more than six ocelli on each side; metathoracic legs distinctly larger than prothoracic legs ..... Larvae of Boreidae (MECOPTERA) (Page 239)

56. Mandibles united with corresponding maxillae to form sucking organs ..... Larvae of NEUROPTERA (Page 301)
Mandibles almost always separate from maxillae ..... Larvae of COLEOPTERA (Page 305); RAPHIDIOPTERA (Page 299); STREPSIPTERA * (Page 326); DIPTERA ..... (Page 243)

57. False legs (prolegs) numbering five pairs or fewer, located on various abdominal segments, but not on first, second, or seventh; false legs tipped with many minute hooks (hookless prolegs rarely on second and seventh segments) ..... Larvae of most LEPIDOPTERA (Page 276)
False legs numbering from six to ten pairs, one pair of which occurs on second abdominal segment; prolegs not tipped with minute hooks 58

58. Head with a single ocellus on each side ..... Larvae of some HYMENOPTERA (Page 330)
Head with several ocelli on each side ..... Larvae of MECOPTERA (Page 239)

59. Body bare or with few scattered hairs, or with waxy coating 60
Body densely covered with hair or scales; proboscis if present coiled under head. Moths ..... LEPIDOPTERA (Page 276)

60. Last tarsal joint swollen; mouth consisting of a triangular unjointed beak; minute species. Thrips ..... THYSANOPTERA (Page 233)
Tarsi not bladderlike at tip, and with distinct claws 61

61. Prothorax distinct. Bugs ..... HEMIPTERA (Page 210)
Prothorax small, hidden when viewed from above. True flies ..... DIPTERA (Page 243)

62. Mouthparts mandibulate 63
Mouthparts suctorial, forming a strong pointed inflexed beak ..... Larvae of HEMIPTERA (Page 210)

63. Mandibles exserted straight forward and united with the corresponding maxillae to form piercing jaws ..... Larvae of NEUROPTERA (Page 301)
Mandibles normal, moving laterally to function as biting jaws 64

64. Body not encased in a shell made of sand, pebbles, leaves, etc. 65
Case-bearing forms; tracheal gills usually present ..... Larvae of TRICHOPTERA (Page 268)

65. Abdomen furnished with external lateral gills of respiratory processes (a few Coleoptera and Trichoptera larvae here also) 66
Abdomen without external gills 67

66. Abdomen terminated by two or three long caudal filaments ..... Larvae of EPHEMEROPTERA (Page 127)
Abdomen with short end processes .... Larvae of MEGALOPTERA (Page 297)

67. Labium strong, extensible, and furnished with a pair of opposable hooks ..... Larvae of ODONATA (Page 136)
Labium not capable of being thrust forward and not hooked 68

68. Abdomen without false legs 69
Abdomen bearing paired false legs on several segments ..... A few larvae of LEPIDOPTERA (Page 276)

69. The three divisions of thorax loosely united; antennae and caudal filaments long and slender ..... Larvae of PLECOPTERA (Page 147)
Thoracic divisions not constricted; antennae and caudal filaments short (also some aquatic larvae of Diptera and a few Trichoptera here) ..... Larvae of COLEOPTERA (Page 305)

70. Body flattened (or larval maggots) 71
Body strongly compressed; mouth formed as a sharp inflexed beak; jumping species. Fleas ..... SIPHONAPTERA (Page 264)

71. Mandibulate mouthparts 72
Mouthparts formed for piercing and sucking 73
72. Mouth inferior; cerci long; ectoparasites of bats or rodents ..... Rare DERMAPTERA* (Page 175)
Mouth anterior; no cerci; generally elongate-oval insects with somewhat triangular head; ectoparasites of birds (occasionally mammals). Chewing lice..... PHTHIRAPTERA, in part (Page 203)
73. Antennae exserted, visible, though rather short..... 74
Antennae inserted in pits, not visible from above (also larval maggots, without antennae)..... Pupiparous DIPTERA (Page 243)
74. Beak (mouthparts) unjointed; tarsi formed as a hook for grasping hairs of the host (Figure 3.24C); permanent parasites. Sucking lice ..... PHTHIRAPTERA, in part (Page 203)
Beak jointed; tarsi not hooked; temporary parasites..... Some HEMIPTERA (Page 210)
75. Legless grubs, maggots or borers; locomotion effected by a squirming motion ..... Larvae of STREPSIPTERA* (Page 326); SIPHONAPTERA (Page 264); and of some COLEOPTERA (Page 305) (see also couplet 56); DIPTERA (Page 243); LEPIDOPTERA (Page 276); and HYMENOPTERA (Page 330). (If living in body of wasps and bees, with flattened head exposed, compare females of STREPSIPTERA* (Page 326); if aquatic wrigglers, see larvae and pupae of mosquitoes, etc.) Sedentary forms, incapable of locomotion 76
76. Small degraded forms bearing little superficial resemblance to insects, with long slender beak, and usually covered with a waxy scale, powder, or cottony tufts; living on various plants. Scale insects ..... HEMIPTERA (Page 210)
Body quiescent, but able to bend from side to side; not capable of feeding, enclosed in a skin which is tightly drawn over all appendages, or which leaves limbs free but folded against body; sometimes free; sometimes enclosed in cocoon or in shell formed from dried larval skins..... 77
77. Skin encasing legs, wings, etc., holding appendages tightly against body; prothorax small; proboscis showing 78
Legs, wings, etc., more or less free from body; biting mouthparts showing 79
78. Proboscis usually long, rarely absent; four wing cases; sometimes in cocoon..... Pupae of LEPIDOPTERA (Page 276)
Proboscis short; two wing cases, pupa often enclosed in oval shell (puparium) formed of hardened larval skin..... Pupae of DIPTERA (Page 243)
79. Prothorax small, fused into one piece with mesothorax; sometimes enclosed in loose cocoon..... Pupae of HYMENOPTERA (Page 330)
Prothorax larger and not closely fused with mesothorax..... 80
80. Wing cases with few or no veins..... Pupae of COLEOPTERA (Page 305)
Wing cases with several branched veins ..... Pupae of NEUROPTERA (Page 301)

METHODS IN ENTOMOLOGY: COLLECTING, PRESERVATION, CURATION, AND IDENTIFICATION

Alfred Russel Wallace collecting butterflies. (After various sources, especially van Oosterzee 1997; Gardiner 1998.)

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