

RECOMMENDED INSECT CLASSIFICATION FOR UGA ENTOMOLOGY CLASSES (2016)

In an effort to standardize the hexapod classification systems being taught to our students by our faculty in multiple courses across three UGA campuses, I recommend that the Entomology Department adopts the basic system presented in the following textbook:

Triplehorn, C.A. and N.F. Johnson. 2005. Borror and DeLong's
Introduction to the Study of Insects. 7th ed. Thomson Brooks/Cole,
Belmont CA, 864 pp.

This book was chosen for a variety of reasons. It is widely used in the U.S. as the textbook for Insect Taxonomy classes, including our class at UGA. It focuses on North American taxa. The authors were cautious, presenting changes only after they have been widely accepted by the taxonomic community.

Below is an annotated summary of the T&J (2005) classification. Some of the more familiar taxa above the ordinal level are given in caps. Some of the more important and familiar suborders and families are indented and listed beneath each order. Note that this is neither an exhaustive nor representative list of suborders and families. It was provided simply to clarify which taxa are impacted by some of more important classification changes. Please consult T&J (2005) for information about taxa that are not listed below.

Unfortunately, T&J (2005) is now outdated with respect to some significant, recent classification changes. Therefore, in the classification standard provided below, some well corroborated and broadly accepted updates have been made to their classification scheme.

Feel free to contact me if you have any questions about this classification. If you see an important omission that should be added, please let me know.

Thank you.

Sincerely,


Joseph V. McHugh

ANNOTATED CLASSIFICATION OF HEXAPODA

(submitted by Joe McHugh, 7/2016)

ENTOGNATHA

Protura

Collembola

Diplura

Campodeidae

Japygidae

INSECTA (=ECTOGNATHA)

*Note: Historically, the term **INSECTA** has been used to refer to more or less inclusive groupings of hexapods. It is occasionally used as a synonym for **PTERYGOTA** only. It is often used synonymously with **HEXAPODA**. The most widespread use of the term today, however, is as a synonym of **ECTOGNATHA**. As such, it would include all of the hexapods that have an ectognathous cranium.*

Microcoryphia

Machilidae

Thysanura

Lepismatidae

PTERYGOTA

*Note: While **PTERYGOTA** is considered to be a natural group by most systematists, **APTERYGOTA** is not. As such **APTERYGOTA** is no longer recognized in formal classifications.*

Ephemeroptera

Odonata

Suborder: **Anisoptera**

Aeshnidae

Corduliidae

Gomphidae

Libellulidae

Macromiidae

Suborder: **Zygoptera**

Calopterygidae

Coenagrionidae

Lestidae

NEOPTERA

*Note: The jury is still out on whether the higher-level group **PALEOPTERA** (Odonata + Ephemeroptera) is monophyletic and worthy of formal recognition in classification. The higher-level group **NEOPTERA**, which includes all of the taxa listed below, is broadly accepted as monophyletic and is recognized formally.*

Plecoptera

Phasmida

Pseudophasmatidae

Heteronemiidae

Mantophasmatodea

Note: This is the recently discovered order of insects from west Africa that was first reported in 2002. They are commonly referred to as “gladiator insects”.

Grylloblattodea (=Grylloblattaria)

Grylloblattidae

Notes:

1) In the past, **DICTYOPTERA** (Mantodea + Blattodea + Isoptera) was recognized as an order of insects. Today, it is still thought to be a natural (i.e., monophyletic) group, but it is recognized in classifications at the rank of superorder now.

2) **Blattodea** classification is undergoing dramatic revision currently. **Cryptocercidae** was removed from **Polyphagidae** and is now recognized as a separate family. For decades there was growing phylogenetic evidence from multiple sources that termites (**Isoptera**) arose from the middle of the roach clade (**Blattodea**). Today, termites are widely recognized as highly modified, social roaches and are classified as part of **Blattodea**. The exact rank for the termite group is still unsettled, but they are often recognized at or near the level of superfamily. Until the familial ranks of the roach clade stabilize more, I recommend that we recognize the **Isoptera** as the superfamily **Termitoidea** (of **Blattodea**).

Mantodea

Mantidae
Mantoididae

Blattodea

Blattidae
Blattellidae
Cryptocercidae
Rhinotermitidae
Kalotermitidae

Dermaptera

Carcinophoridae
Forficulidae
Labiduridae

Embiidina (=Embioptera)

Orthoptera

Suborder: **Caelifera**

Acrididae
Romaleidae
Tetrigidae
Tridactylidae

Suborder: **Ensifera**

Gryllacrididae
Gryllidae
Gryllotalpidae
Mogoplistidae
Tettigoniidae

Note: Historically many of the lower neopteran orders (Mantodea, Blattaria, Isoptera, Dermaptera, Phasmida, etc.) were considered to be families of a much more inclusive order Orthoptera. Today the order is restricted to the taxa in the suborders Caelifera and Ensifera (i.e., grasshoppers, crickets, katydids, etc.).

Zoraptera

Zorotypidae

Psocoptera

Phthiraptera

Pediculidae
Pthiridae

Notes:

1) The lice were traditionally divided into two orders **Mallophaga** and **Anoplura**. Phylogenetic studies show that Mallophaga is paraphyletic if Anoplura is not included in it. As a result, both chewing and sucking lice now are recognized as one order, **Phthiraptera**, with four suborders: *Ischnocera* (part of Mallophaga), *Amblycera* (part of Mallophaga), *Rhyncophtherina* (part of Mallophaga), and *Anoplura*.

2) To complicate matters, it is now clear that all of **Phthiraptera** falls within the **Psocoptera** clade. There are several ways that this phylogenetic information could be accurately reflected in the classification, but until there is some consensus, I recommend that we continue to recognize both current orders. At some point these taxa will be recognized as two redefined orders, one combined order, or three separate orders.

Thysanoptera

Hemiptera

Suborder: **Auchenorrhyncha**

Acanaloniidae
Cercopidae
Cicadellidae
Cicadidae
Delphacidae
Dictyopharidae
Flatidae
Fulgoridae
Issidae
Membracidae

Suborder: **Sternorrhyncha**

Aleyrodidae
Aphididae
Asterolecaniidae
Coccidae
Diaspididae
Eriococcidae
Eriosomatidae
Kermisidae
Margarodidae
Psyllidae

Suborder: **Heteroptera**

Alydidae
Anthocoridae
Aradidae
Belostomatidae
Berytidae

Blissidae
 Cimicidae
 Coreidae
 Corixidae
 Cydnidae
 Gelastocoridae
 Geocoridae
 Gerridae
 Hydrometridae
 Lygaeidae
 Miridae
 Naucoridae
 Nepidae
 Notonectidae
 Pachygronthidae
 Pentatomidae
 Plataspidae
 Pleidae
 Reduviidae
 Rhopalidae
 Rhyparochromatidae
 Scutelleridae
 Thyreocoridae
 Tingidae

Notes:

1) The old 2-order classification system for the true bugs (**Hemiptera & Homoptera**) was replaced. Homoptera is not monophyletic and is no longer formally recognized in classifications. Instead, the entire group of true bugs is considered one order, Hemiptera sensu lato. What was Homoptera is now represented by two suborders, (Sternorrhyncha & Auchenorrhyncha), within the new, more inclusive order Hemiptera. What was the old Hemiptera is now recognized as the suborder Heteroptera within the more inclusive order Hemiptera. A fourth suborder of true bugs, Coleorrhyncha, occurs only in austral regions of the world. It is evolutionarily intermediate between the Auchenorrhyncha and Heteroptera.

2) **Lygaeidae** was broken up into 10 separate families. Some of the new families are **Geocoridae**, **Blissidae**, **Cymidae**, **Rhyparochromidae**, and **Pachygronthidae**.

ENDOPTERYGOTA
(=HOLOMETABOLA)

Neuroptera

Suborder: **Planipennia**
 Ascalaphidae

Chrysopidae
 Coniopterygidae
 Hemerobiidae
 Mantispidae
 Myrmeleontidae

Suborder: **Megaloptera**

Corydalidae
 Sialidae

Suborder: **Raphidioptera**

Raphidiidae

*Note: Currently, the order **Neuroptera** is used in two different senses. In the broader sense it includes the familiar members, as well as **Megaloptera** and **Raphidioptera**. As a result, the three former orders (o.) are reduced to subordinal ranks (s.o.) within **Neuroptera sensu lato** as follows:*

o. Megaloptera = s.o. Megaloptera;

o. Raphidioptera = s.o. Raphidioidea;

o. Neuroptera = s.o. Planipennia.

Each of the three orders is thought to form a natural (i.e., monophyletic) group, so this is simply a ranking issue.

Coleoptera

Suborder: **Archostemata**

Cupedidae
 Micromalthidae

Suborder: **Adephaga**

Carabidae (incl. Cicindellidae,
 Rhysodidae, Paussidae)
 Dytiscidae
 Gyrinidae
 Halipidae
 Noteridae

Suborder: **Polyphaga**

Bostrichidae (incl. Lyctidae)
 Brentidae
 Buprestidae
 Cantharidae
 Chrysomelidae (incl. Bruchidae)
 Cerambycidae
 Cleridae
 Coccinellidae
 Cucujidae
 Curculionidae (incl. Scolytidae,
 Platypodidae)

Dermestidae
 Elateridae
 Elmidae
 Endomychidae
 Erotylidae (incl. Languriidae)
 Heteroceridae
 Histeridae
 Hydrophilidae
 Lampyridae
 Lucanidae
 Lycidae
 Meloidae
 Melyridae
 Mordellidae
 Nitidulidae
 Passalidae
 Phalacridae
 Phengodidae
 Ptilodactylidae
 Ptinidae (incl. Anobiidae)
 Ripiphoridae (=Rhipiphoridae)
 Scarabaeidae
 Scirtidae (=Helodidae)
 Silphidae
 Staphylinidae (incl. Pselaphidae,
 Scaphidiidae)
 Tenebrionidae (incl. Lagriidae,
 Alleculidae)

Notes:

The classification of Coleoptera has had much revision since T&J (2005). Many families were redefined by splitting or lumping to reflect phylogenetic relationships. Here are some of the more dramatic changes.

1) *Curculionidae* has been extensively redefined. *Platypodidae* and *Scolytidae* fall out as internal branches of the weevil evolutionary tree. They now are recognized as subfamilies (*Scolytinae* and *Platypodinae*) of *Curculionidae*. Other weevil groups were raised to familial-level status and removed from *Curculionidae*, including: *Nemonychidae* (pine flower weevils), *Belidae* (cycad weevils), *Anthribidae* (fungus weevils), *Attelabidae* (leaf rolling weevils), and *Brentidae* (straight snout weevils).

2) *Staphylinidae* now includes a few groups that were once recognized as separate families, including *Pselaphidae*, *Scaphidiidae*, *Micropeplidae*, and *Dasyceridae*.

3) *Scarabaeidae* has been divided into many new families, including *Bolboceratidae*, *Geotrupidae*, *Glaresidae*, *Hybosoridae*, *Pleocomidae*, and *Trogidae*. The most familiar scarab groups (*Scarabaeinae*, *Melolonthinae*, *Aphodiinae*, *Rutelinae*, *Dynastinae*, and *Cetoniinae*) remain in *Scarabaeidae* though.

Strepsiptera

Stylopidae

Note: Strepsiptera was once considered to be a family (Stylopidae) of Coleoptera. The phylogenetic placement of this order is controversial. It is currently recognized at the ordinal level as the sister taxon to Coleoptera.

Mecoptera

Bittacidae
 Meropeidae
 Panorpidae

Siphonaptera

Diptera

Suborder: **Nematocera**

Bibionidae
 Cecidomyiidae
 Ceratopogonidae
 Chironomidae
 Culicidae
 Mycetophilidae
 Psychodidae
 Ptychopteridae
 Simuliidae
 Tipulidae

Suborder: **Brachycera**

Asilidae
 Bombyliidae
 Calliphoridae
 Diopsidae
 Ephydriidae
 Hippoboscidae
 Muscidae
 Mydidae
 Phoridae
 Pyrgotidae
 Rhagionidae
 Sarcophagidae
 Sepsidae

Stratiomyidae
Syrphidae
Tabanidae
Tachinidae
Tephritidae

Trichoptera

Lepidoptera

Bombycidae
Cossidae
Crambidae
Drepanidae
Erebidae (incl. Arctiidae)
Geometridae
Hesperiidae
Lasiocampidae
Limacodidae
Lycaenidae
Noctuidae
Nymphalidae
Papilionidae
Pieridae
Psychidae
Pterophoridae
Pyrilidae
Saturniidae (incl. Citheroniidae)
Sesiidae
Sphingidae
Tortricidae
Yponomeutidae

Major family changes:

- 1) **Erebidae** now includes **Arctiidae** and **Ctenuchidae**.
- 2) **Crambidae** has been removed from **Pyrilidae** and is now recognized at the family level.
- 3) **Nymphalidae** now includes **Heliconidae**, **Morphidae**, **Danaidae**, **Satyridae**, and **Libytheidae**.

Hymenoptera

Suborder: **Symphyta**

Cepidae
Cimbicidae
Pamphiliidae
Siricidae
Tenthredinidae

Suborder: **Apocrita**

Andrenidae
Apidae (incl. Anthophoridae,
Xylocopidae, Bombidae)
Bethyidae
Braconidae
Chalcididae
Chrysididae
Colletidae
Cynipidae
Diapriidae
Dryinidae
Eucharitidae
Evaniidae
Figitidae
Formicidae
Gasteruptiidae
Halictidae
Ichneumonidae
Megachilidae
Mutillidae
Pelecinidae
Perilampidae
Pompilidae
Proctotrupidae
Rhopalosomatidae
Sapygidae
Scelionidae
Scoliidae
Sphecidae
Torymidae
Tiphidae
Vespidae

Major family changes:

- 1) **Apidae** now includes **Anthophoridae**, **Xylocopidae**, and **Bombidae**.