Introduction to Classification and Nomenclature

Naming and classification of Insects

The formal naming of insects follows the rules of nomenclature developed for all animals (plants have a slightly different system). Formal scientific names are required for unambiguous communication between all scientists, no matter what their native language. Vernacular (common) names do not fulfill this need: the same insects even may have different vernacular names amongst peoples that speak the same language. For instance, the British refer to "ladybirds", whereas the same coccinellid beetles are "ladybugs" to many people in the USA. Many insects have no vernacular name, or one common name is given to many species as if only one is involved. These difficulties are addressed by the Linnaean system, which provides every described species with two given names (a binomen). The first is the generic (genus) name, used for a usually broader grouping than the second name, which is the specific (species) name. These Latinized names are always used together and are italicized. The combination of genus and species names provides each organism with a unique name. Thus, the name *Aedes aegypti* is recognized by any medical entomologist, anywhere, whatever the local name (and there are many) for this disease-transmitting mosquito. Ideally, all taxa should have such a Latinized binomen, but in practice some alternatives may be used prior to naming formally.

In scientific publications, the species name often is followed by the name of the original describer of the species and perhaps the year in which the name first was published legally. In publications, after the first citation of the combination of genus and species names in the text, it is common practice in subsequent citations to abbreviate the genus to the initial letter only (e.g. *A. aegypti*). However, where this might be ambiguous, such as for the two mosquito genera *Aedes* and *Anopheles*, the initial two letters *Ae.* and *An.* are used.

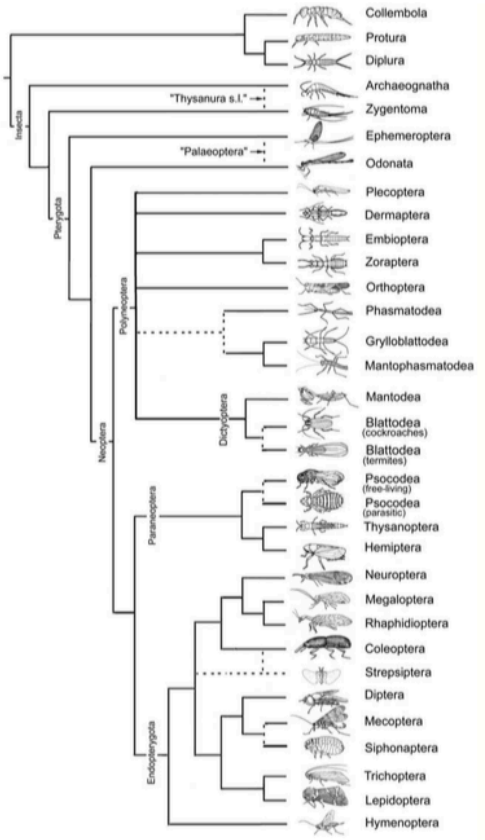
Various taxonomically defined groups, also called **taxa** (singular **taxon**), are recognized amongst the insects. As for all other organisms, the basic biological taxon, lying above the individual and population, is the species, which is both the fundamental nomenclatural unit in taxonomy and, arguably, a unit of evolution. Multi-species studies allow recognition of **genera**, which are discrete higher groups. In a similar manner, genera can be grouped into **tribes**, tribes into **subfamilies**, and **subfamilies** into **families**. The families of insects are placed in relatively large but easily recognized groups called **orders**. This hierarchy of ranks (or categories) thus extends from the species level through a series of "higher" levels of greater and greater inclusivity until all true insects are included in one class, the Insecta. There are standard suffixes for certain ranks in the taxonomic hierarchy, so that the rank of some group names can be recognized by inspection of the ending.

Table: Taxonomic categories (Obligatory categories are shown in **bold**)

Taxon category	**Standard suffix**	**Example**
Order		Hymenoptera
Suborder		Apocrita
Superfamily	-oidea	Apoidea
Family	-idae	Apidae

Subfamily	-inae	Apinae
Tribe	-ini	Apini
Genus		*Apis*
Subgenus		
Species		*A. mellifera*
Subspecies		*A. m. mellifera*

Depending on the classification system used, some 25 to 30 orders of Insecta may be recognized. Differences arise principally because there are no fixed rules for deciding the taxonomic ranks referred to above; only general agreement that groups should be monophyletic, comprising all the descendants of a common ancestor. Orders have been recognized rather haphazardly in the past two centuries, and the most that can be said is that presently constituted orders contain similar insects differentiated from other insect groups. Over time, a relatively stable classification system has developed but differences of opinion remain as to the boundaries around groups, with "splitters" recognizing a greater number of groups and "lumpers" favoring broader categories. For example, some North American taxonomists group ("lump") the alderflies, dobsonflies, snakeflies, and lacewings into one order, the Neuroptera, whereas others, including ourselves, "split" the group and recognize three separate (but clearly closely related) orders, Megaloptera, Raphidioptera, and a more narrowly defined Neuroptera.



The order Hemiptera sometimes was divided into two orders, Homoptera and Heteroptera, but the homopteran grouping is invalid (non-monophyletic). New data and methods of analysis are further causes of instability in the recognition of insect orders.

Recognition. Grouping things into broad categories (i.e. birds, butterflies, spiders, bugs). Recognition is not sufficient for most scientific purpose.

Identification. Attaching a name to something which has not been previously named.

Systematics. The study of diversity of organisms and their relationships. It is linked to taxonomy because any scheme of classification that is developed for a group of insects will be affected by the characters used, the relative weight they are given, and how they are analyzed.

Species is the fundamental unit of systematics. Species designations in the literature and labelled in insect collections may or may not be "good species''. One goal of taxonomists is to name "good species' 'based on the best information that is available. If we cannot directly test species concept, how do we recognize different species? Scientists study phenotypic and genotypic differences and available knowledge of variability in related populations, various characters are evaluated and then related to knowledge of species biology. We see insects that exists today. How do we determine how insects evolved.?

All available data (i.e. anatomical, physiological, ecological, genetic, behavioral, fossil record) can be used to infer relationships and evolutionary history.

In many cases, species within a group look similar because they share certain characteristics. However, "good species" look alike (sibling species) making it very difficult to identify each species based only on morphological characteristics.
Example: *Diabrotica longicornis* (Say)

INSECT NAMES

Common names:

Many insects have common names. The Entomological Society of America formally approves common names used in United States. There are other common names used in other parts of world. Many insect species have more than one common names. Common names are regionalized and can occur at various taxonomic levels. The term **fly,** within Diptera word (e.g. black fly, horse fly, blow fly) outside of Diptera fly is written together with the descriptive word (e.g. dragonfly, butterfly, sawfly). The term **bug** within Hemiptera is a separate word (e.g. stink bug, lace bug) while outside of Hemiptera, bug is written together with the descriptive word (e.g. ladybug, Junebug, mealybug).

Scientific Nomenclature:

To avoid potential confusion from many common insect names that may be in use for the same species, scientific nomenclature is used to formally assign a scientific name to each species. The international Code of Zoological Nomenclature (ICZN 1999) must be followed to formally describe a scientific name. Scientific names are determined by rules laid down by the International Code of Zoological Nomenclature; the binomial system of classification (generic name-specific name) has been used since Linnaeus "System Naturae" was published in 1758.

Majority of the scientific names are Greek or Latin which generally show some characteristic of that insect. However, it may also be derived from other languages, or from names of people or places. When we assign a scientific name to a species, it is binomial that includes genus name and species name. In case of subspecies, it is then called as trinomial. Scientific names are typed italicized. In cases where species and subspecies are added with author name. Author's name is not italicized. When the name of author is written in parentheses, it shows the species or subspecies was earlier placed in some other genus than the recent genus. For example, *Papilio glaucus* Linnaeus (the tiger swallowtail butterfly) shows that species *glaucus* was placed in genus *Papilio* by Linnaeus. While, Colorado potato beetle, *Leptinotarsa decemlineata* (Say) where species *decemlineata* was described by Say in the genus *Doryphora* and after that it was transferred to genus *Leptinotarsa.*

***sp. vs* spp:** When a species is simply referred but not named is simply denoted by “sp.” Like “*Gomphus* sp.” reflects a species of *Gomphus.* However, when it is written as “*Gomphus* spp.” it shows more than one species of *Gomphus*. The abbreviation "spp" means "**species plural**" and indicates the discussion of multiple species within one genus

Law of priority: The valid name of a genus or species is one that was published the earliest and followed the accepted binary nomenclature rules. Law of priority has been in effect since Linnaeus “System Naturae”. Every species must be unique.

Synonym: two different names given to the same species (two independent workers unaware of each other’s work, color variants, in older literature.

Homonym: Same scientific name given to the different species *Nactua variegata* (bird vs. moth). Discoveries of old valid names sometimes cause problems (literature reviews are more difficult, custom must change). over 200 type nomenclature terms are in use by taxonomists.