

Subject	Insect Taxonomy- Diploma
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Taxonomy: More than one million species of animal and half a million of plant have already been described and estimates on the number of them still undescribed living species range from 3 to 10 million, each species may exist in numerous different forms (sex , age , classes , seasonal forms , morphs).It would be impossible to deal with this enormous diversity if it were not ordered and classified.

Taxonomy is the naming of organisms, a science which has developed over hundreds of years and which is still undergoing dramatic changes. As an Entomologists it is important to understand the fundamentals of taxonomy – much can be told of an organism’s physiology, behavior and ecological role simply by knowing which major group it belongs to. Taxonomy provides a means with which to recognize species, this is a simple but very important concept, how can biodiversity be protected if the species themselves cannot be identified? Considerable changes have occurred within the field of taxonomy over the last century, most notably with respect to the techniques employed by scientists to discern species as well as the various approaches to classification, at times this has led to confusion within the scientific community. The vast majority of species on Earth are in fact invertebrates (95% of known species).

Definition of Taxonomy, Systematics

-Taxonomy: The theory and practice of classifying organisms.

The term taxonomy is derived from the Greek **word taxis, arrangement** and **nomos, law** and was first proposed in its French form by de Candolle (1813) for theory of plant classification.

-Systematics: The science dealing with the diversity of organism.

The term systematic stem from the Latinized Greek word systema, as applied to systems of classification developed by the early naturalists, notably Linnaeus (*Systema nature* , 1st ed , 1735).

The Purpose of Taxonomy:

1. Naming: Give the scientific name to all living things.
2. Description: Describe the species of living organism in a detail, and use the diagnostic characters for the identification.
3. Classification: Arrangement all taxa in its grouped.
4. Mention of the morphological variation which helps the researchers to diagnosis between specie and genera.

Levels of taxonomy:

1. Alpha taxonomy: The level of taxonomy concerned with the characterization and naming of species.
2. Beta taxonomy: The level of taxonomy concerned with the arrangement of species into a natural system of lower and higher taxa.
3. Gamma taxonomy: The level of taxonomy dealing with the various biological aspects of taxa.

The Periods of Taxonomy

First Period – The study of local faunas

For time immemorial mankind has striven to name many animals and plants. Early names for species would have evolved quite naturally with the spoken and written language. Several early Greek scholar , Notably Hipocrates (460 – 377 B.C.) enumerated kinds of animals .

The first well recorded attempt at biological classification of into distinct groups occurred many centuries ago with the Greek philosopher Aristotle (384 – 322 B.c.) was father of biological classification.

The main works of philosopher Aristotle:

1-who devised the Scala Naturae or "Ladder of Life", which split animals into “those with blood” and “those without blood”. Animals with blood were further divided into those that bore live offspring (mammals) and those that laid eggs (non-mammalian species).

2-Aristotle went further by placing creatures into an order of hierarchy based on observations and their “soul types” i.e. vegetative, sensitive and/or rational.

3-The philosopher made some striking observations with respect to marine fauna, most notably that whales and dolphins are not fish but mammals, and that male octopods have a modified arm (the hectocotylus) which is used for sperm packet transfer to the female.

4-Aristotle so divided insects to two groups a. Mandibulata and haustellata, so he divided the insects to Winged and wingless.

5- Aristotle used some terms such as Coleoptera and Diptera, these recently uses in our studies.

6-The important publication of Aristotle is (Historia animalium), in this book , Aristotle try to Classifieds the animals depending on its way of living, habits , actions and bodies parts.

Many centuries later the classification of animals and plants took a great leap forward with particular interest in the naming of herbs and plants via polynomial Latin which literally described morphological features (observable traits). Soon after the practice of ascribing polynomial Latin to species was introduced the Swedish botanist and medical doctor Carolus Linnaeus introduced the binomial system which involved assigning only two Latin adjectives to a species. This method was highly successful within the scientific community and was adopted as the primary means with which to name species, it is still used today, with the first word being the genus or generic name and the second being the species or specific name. Linnaeus produced the *Systema Naturae* or ladder of life which attempted to classify animals and plants into a logical framework. The 10th edition of the book contained some 4,400 species of animal and 7,700 species of plant.

The main works of Linnaeus are:

1. The first proposed the binomial nomenclature of the organisms

Any organism with scientific name composite of two words (term), First the genus which beginning by Capital symbol and species beginning by small.

2. The famous published is *Systema Naturae* 10 ed. 1758.

3. Linnaeus mention seven Categories of any taxa these are (Kingdom , Phylum , Class , Order , Family , Genus and species)

4. Linnaeus mention seven orders of Insects, these are: Coleoptera, Lepidoptera , Diptera , Hymenoptera , Neuroptera , Orthoptera and Aptera.

Second Period – The acceptance of evolution

Over time it became apparent that it was not simply enough to name species but to try and understand the relationships between them. With this in mind Charles Darwin, as well as other reputable scientists, began researching into these relationships – the theory of evolution was put forward. The theory of evolution, the subtle change of species over time through natural selection, was one of great importance and generated massive intellectual debate within the scientific community. Darwin composed a simple tree in a notebook showing the possible divergence of species from a common ancestor (speciation - the formation of new species). From this stage onward taxonomists began to realize that the naming of species should reflect the position of the organism in relation to close relatives. One such scientist was the German biologist Ernst Haeckel who was fundamental in the advancement of taxonomy, coining the terms phylogeny, phylum, ecology and the kingdom protista.

The characteristics of this period:

1-A survey to collecting the samples in all regions of the world, this caused to publishing Monographic treatment

Monographs: In taxonomy, an exhaustive treatment of a higher taxon usually involving full systematic treatment of comparative, biology, ecology, and detailed distribution analysis of all taxa.

2-Darwin published 1859 (The origin of species) which decided on of the famous publication in history of biology

3-The most working in this period was about the Phylogeny

Phylogeny: The study of the history of the line of evolution in a group of organisms

4-New record of many genera and species and Families

5-Changing of some categories, for deleting of Heterogeneous groups (Polyphyletic groups)

Polyphyletic: A term applied to a composite taxon derived from two or more ancestral source.

Monophyletic: A term applied to a composite taxon derived from one ancestral source.

Third Period – The Study of Population

The characteristics of this period

1. A study of the development of the species

The Concept of Typology is changing to the polytypic concept (The species contain Polytypic species), which includes many subspecies.

Polytypic: A taxon containing two or more taxa in the immediately subordinate category, as a genus with several species or a species with several subspecies.

2. A study of variation in the population.

3. The identification of the species depends on more characteristics (not only morphological) such as Physiological characteristics, comparative analysis genetics, geographical distribution, Ecological, habitat ...etc.)

The current period:

The current period is characterized by three development

1-Renewed examination of the whole theory of taxonomy, as indicated by the publication of (Henning , 1950 ; Simpson , 1961 ; Mayer , 1965)

2-The use of electronic computers.

3-The use of biochemical techniques and, more importantly, a growing among molecular biologists of the importance of understanding the phylogeny of organism

Contributions to taxonomy:

1- The taxonomy shares in Applied Sciences such as medicine, health, agriculture

2-Science has proved that the key to solving problems in economic entomology.

3-Is the basis for operations in quarantine by the correct diagnosis to prevent entry into the country?

4-The correct diagnosis is important in the development of programs for

biological control of pests.

5- Taxonomy as a career worker is considered as a source to receive a large salary from the State.

6- Taxonomy is considered a hobby that is enjoyed by many people.

Classification of Insects:

Classification: It is the ordering of organisms into a hierarchy of categories.

The categories:

Domain: The broadest and most recently added taxonomy group, it divides organisms into Bacteria, Archaea, and Eukaryotic

Kingdom: The second most broad level of classification, it divides living things into the groups Animalia, Plantae, Fungi, Protista, Archaea, and Bacteria. However, this classification group is the source of much debate and revision as it's often considered inaccurate.

Phylum: The third broadest taxonomical group which further divides organisms based on their morphological characteristics or evolutionary relatedness.

Class: This is the fourth broadest taxonomical group which divides organisms based on a shared feature. This was the broadest category proposed by Linnaeus, but it is not often used by botanists due to modern findings rendering it less accurate.

Order: Order is the fifth taxonomical group and further subdivides organisms, there is no agreed rationale for placing organisms into different orders.

Family: This is the sixth taxonomical group where organisms are further subdivided, it again is decided at the taxonomist's discretion.

Genus: This is the seventh taxonomical group and is a specific collection of organisms and the first part of an organism's scientific name.

Species: This is the eighth and final taxonomical group, it is the most specific of the taxonomical classifications.