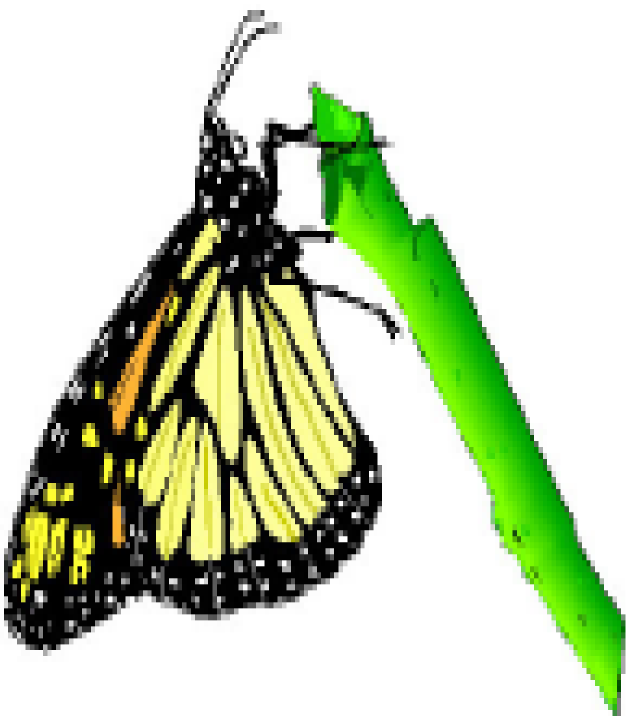
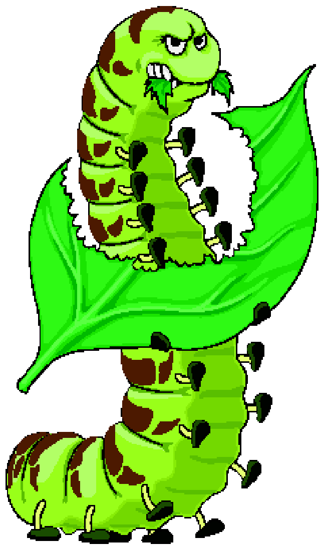
CHAPTER 3
WHAT IS IT?



Carl von Linne, (1707-1778) better known as Carolus Linneaus - Swedish naturalist and physician introduced a two-word system of naming organisms in 1753; since then about 1.7 million species have been named and catalogued: 344,000 plants, 42,000 vertebrates, 1,000,000 insects and 263,000 species of other invertebrates (arthropods) and microorganisms. More than half the known species are insects. Recent measurements suggest 1/3 of the entire animal biomass of the Amazon Rain Forest is composed of ants. Insects live virtually everywhere but in the ocean. About 8,000 species are discovered each year. Approximately 5% of all insects spend all or part of their life cycles in water - mostly fresh water, but a few species live in brackish water and intertidal zones. Several orders of insects have aquatic stages: (1) mayflies, (2) dragonflies and damselflies, (3) stoneflies and caddisflies. The total number of species on earth is unknown, even to an order of magnitude; as the destruction of poorly studied ecosystems continues, many species will become extinct before they are even discovered and identified. We know every 10 seconds a person dies of malaria. A single large swarm of locusts can outnumber the human population of the earth several times over, yet only about 1,000 species of insects are considered to be pests; the rest are beneficial and are necessary for the world to survive.
http://en.wikipedia.org/wiki/Carolus_Linnaeus

"Si Hoc Legere Scis Nimium Eruditionis Habes."



Most living things are divided into two big groups or KINGDOMS: the plant kingdom and the animal kingdom. In general, plants are generally incapable of moving from place to place and generally utilize inorganic materials as food; animals are more or less mobile organisms that consume organic materials as food.

The animal kingdom is divided into a dozen or so major groups called PHYLA (singular phylum) with the members of each phylum having certain structural characters in common.

Insects, spiders, mites, ticks, scorpions, centipedes, millipedes, crabs, shrimps, lobsters, sow bugs and many others belong in the phylum Arthropoda, which means jointed foot or appendage. Arthropods compromise the largest group in the animal kingdom, making up almost 90 percent of all known animal species. A close look at any of these common animals will show the following visible characteristics which distinguish the Arthropoda from all other animals.

1. Body segmented (jointed) with segments usually grouped or fused together into two or three more or less distinct regions.

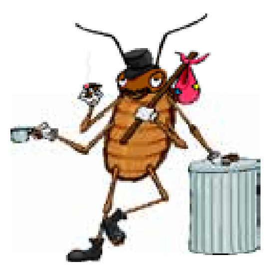
2. Paired, segmented or jointed appendages such as legs, wings and antennae.

3. An exoskeleton or a hard or tough or horny external skeleton or covering which is shed and renewed periodically as the arthropod grows in a process called molting.

4. Bilateral symmetry, that is the right and left sides of the arthropod are alike.

The classification of animals does not stop with phyla; each phylum is further subdivided into groups called CLASSES, classes are divided into ORDERS, orders are divided into FAMILIES, families are divided into GENERA (singular, genus), and finally genera are divided into SPECIES. Thus, the German cockroach can be classified as follows:

Classification	**German Cockroach**
Kingdom	Animal
Phylum	Arthropoda
Class	Insecta
Order	Dictyoptera
Family	Blattellidae
Genus	*Blattella*
Species	*germanica*



Note: The insect order may also be divided into a number of primary divisions called suborders, which in turn may also be divided into groups called families. It is usual for the name of an insect family to end in -IDAE, for example the name of the family of the LEPIDOPTERA to which the Common Clothes Moth, *Tineola Bisselliella* belongs, is in the family Tinaeidae. In many cases, but not all, the families are divided into subfamilies, in which case it is usual for the name to end in -INAE. In all cases, however, the families or subfamilies are divided into the smallest groups known as Genera (singular is Genus). Each genus is made up of one or more distinct kinds known as species. An insect's body is essentially an elongated tube with paired appendages, e.g., legs, wings and body, with the segments being grouped into three distinct regions: the head, the thorax and the abdomen. The insect's skeleton is on the outside of its body, i.e., exoskeleton, rather than on the inside, i.e., endoskeleton like ours.

It must be emphasized that the classification of insects is a natural one, insects being classified in the way that they evolved, closely related species being placed together. The closest relationship is thus the genus, then the subfamily and then the family.

When a creature is being identified, the scientific name given usually only includes the genus and the species names, e.g., *Blattella germanica*. It should always be written in *italics* or <u>underlined</u>. This name may also be followed by a person's name, e.g., (Linnaeus). It may appear in parentheses and it may be abbreviated (L.). This individual named or (re)classified the insect.

There are only several classes of arthropods that are of interest as pest species:

Crustacea - Aquatic crabs, shrimp, crayfish, lobsters, sow bugs and pill bugs. This group contains animals of very diverse appearance - most are aquatic but a few are terrestrial. Members of this class breathe by means of gills and thus must either live in water or in very damp conditions. Most have two pairs of antennae and at least five pairs of legs. The common sow bug, which is frequently found around water-soaked wood or in wet debris/ plants, is our principal pest of this group.

Diplopoda - Millipedes. This class consists of animals whose bodies are made of segments all of which are essentially alike with the exception of the first segment which is the head. This group can be distinguished by the fact that each of the body segments has two pairs of legs which are joined to the underside of the body on a straight line down the middle. The antennae are short.

Chilopoda - Centipedes. Members of this class are many-segmented in much the same manner as millipedes. They can be distinguished by the fact that there is only one pair of legs to each segment of the body and these walking legs are attached close to the body margins on the underside. The first pair of legs are modified to form poisonous claws. The antennae are usually long and many-segmented. Some can inflict a painful bite.

Myrlapoda - This group is made up of the two classes Diplopda and Chilopoda.

Arachnida - Spiders, mites, ticks, scorpions, daddy long legs and others all with the body divided into two distinct parts. This class usually has the head and thorax joined together to form a cephalothorax joined to the abdomen. The adults have four pairs of legs and no antennae on the cephlathorax region. Many immature forms, e.g., immature ticks, have only three pairs of legs. These arthropods usually have mouth parts with two prominent structures that end in a needlelike piercing tip. The mouthparts and legs are attached to the first region. The reproductive organs and digestive system are contained in the second. In the Harvestmen, the two regions are fused so only one part of the body is discernible.

Insecta (Hexapoda) - The insects. This class has three body regions (head, thorax, abdomen), the head bears a single pair of antennae; the thorax bears three pairs of legs, usually wings; the abdomen contains most of the digestive system and reproductive organs. The British entomologist estimated that 10^{18} (a billion billion) individual insects are alive at any given instant. This amounts to 10 billion for every square kilometer of land surface and 200 million living insects for every living human being!

Other Divisions Used in Classification - Classes of arthropods, insects, for example, are divided into orders. These are distinct groups that look very much alike, e.g., the order of moths and butterflies, or the order of beetles. Orders are subdivided into families made up of related species. Species of animals can be thought of as "kinds of animals". Very closely related species are grouped together in a genus. Species or types of animals (and plants) are given scientific names that always consist of two words; the first word is the genus name (the first letter is always a capital), the second is the species name (always lower case). Both written in italics or underlined, e.g., *Musca domestica*. The scientific names are latinized, because at the time of Linnaeus - Latin was the international language of scholars. Well-known species can be given nonscientific names, called "common names", e.g., house fly.

Beneficial insects include predators and parasites that feed on pest insects, mites and weeds, e.g., ladybird beetles (lady bugs) and praying mantids. **Over 99% of all insect species are considered to be beneficial. They are food for other animals. Some insects, e.g., butterflies, are considered pleasant to look at.** Pollinating insects are also very important, such as honey bees, butterflies and beetles. Honey bees make food for humans and animals. Some other benefits derived from insects are silk from the cocoons of silkworms or dyes for paints made from insect secretions. Many insects destroy pest insects.

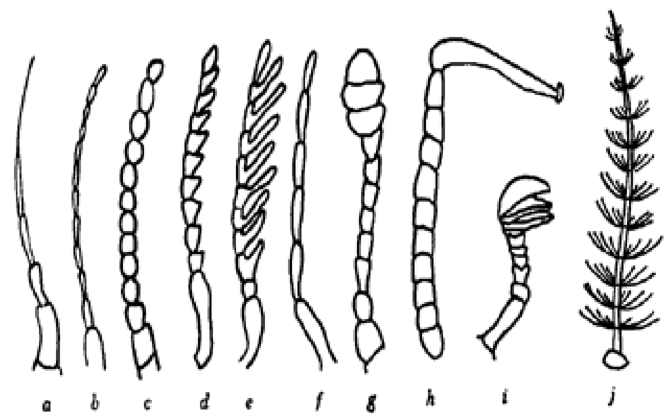
Pest insects include the smallest number of species. These insects feed on, cause injury to, or transmit disease to humans, animals, plants, food, fiber and structures. Some examples of pest insects are flies, lice, mosquitoes, ticks, fleas, termites, aphids and beetles.

All insects begin life as eggs. Most eggs are fertilized by the male, but some aphids, wasps and other insects are able to give birth without male fertilization, a process called parthenogenesis. Still other insects such as tsetse flies and flesh flies and many aphids, produce living young; yet even they pass through an egg-like stage within the body of the female (rather like a kangaroo joey) before being born alive.

All adult insects have two other common characteristics, they all have three pairs of legs and they all have three body regions - the head, thorax and abdomen. Attached to the insect head are the antennae, eyes and mouthparts. All of these parts vary in size and shape, and can be helpful in insect pest identification.

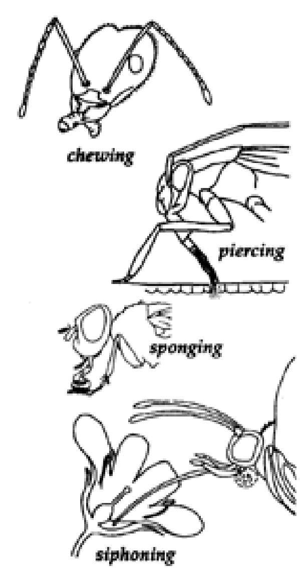
Antennae are paired appendages usually located between or below the eyes. Antennae vary greatly in size and form and are used in insect classification and identification. Some of the common antennae types are:

filiform - threadlike; the segments are nearly uniform in size and are shaped like a cylinder, e.g., ground beetle, cockroach.
moniliform - look like a string beads; the segments are similar in size and round inshape,e.g., termites. and some bark beetles.
geniculate - elbowed, e.g., ants
capitate - with a head, e.g., larder beetle and some powder-post beetles.
serrate - saw-like; the segments are more or less triangular, e.g., click and drugstore beetles
clavate - clubbed, e.g., ladybug beetle.
lamellate - leaflike, e.g., June beetle.
pectinate - comblike, e.g., pyrochorid beetle
setaceous - tapering, e.g., dragonfly
clubbed - segments increase in diameter away form the head, e.g., Japanese beetle
plumose - feathery; most segments with whorls of long hair, e.g., male mosquito.



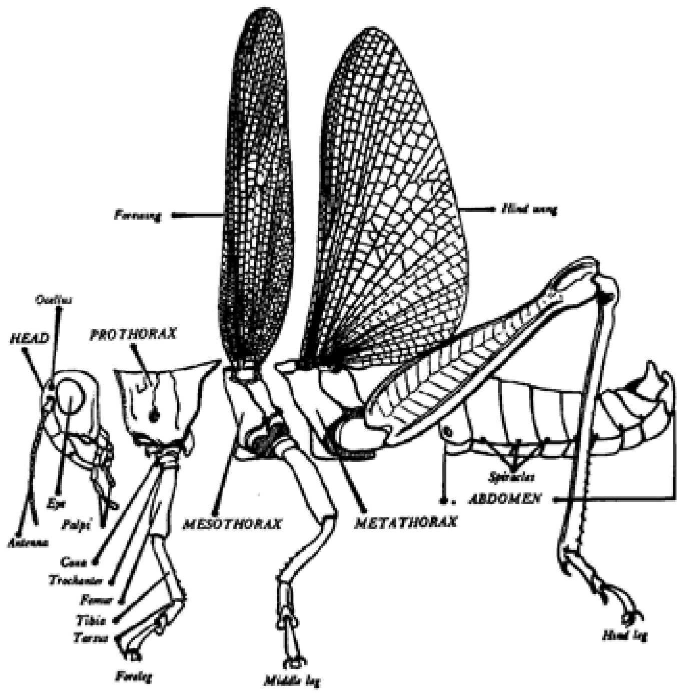
Several types of insect antennae: *a*, setaceous or bristlelike; *b*, filiform or threadlike; *c*, moniliform or beadlike; *d*, serrate or sawlike; *e*, pectinate or comblike; *f*, filiform or threadlike; *g*, capitate or headlike; *h*, geniculate or elbowed; *i*, lamellate or platelike; *j*, plumose or plumed. (Redrawn from various sources.)

Mouthparts are different in various insect groups and are often used in classification and identification. The type of mouthpart determines how the insect feeds and what sort of damage it does. It is important that you have some knowledge of these types of insect mouthparts:



1. **Chewing mouthparts** have toothed jaws that bite and tear the solid food, e.g., beetles, cockroaches, ants, caterpillars and grasshoppers. This the most primitive and basic type of mouthpart.
2. **Piercing-sucking mouthparts** are usually long slender tubes that are forced into plant or animal tissue to suck out fluids or blood, e.g., mosquitoes, aphids.
3. **Sponging mouthparts** are tonguelike structures that have spongy tips to suck up liquids for food
that can be made liquid by the insect's vomit, e.g., house flies, blow flies.
4. **Siphoning mouthparts** are long tubes used for sucking nectar, e.g., butterflies, moths.
5. **Rasping-sucking** and
6. **Chewing-lapping** mouthparts.

The thorax, or middle body segment, has three pair of legs and sometimes one or two pair of wings, e.g., forewings, hindwing.



The external structure of a male grasshopper. (USDA)

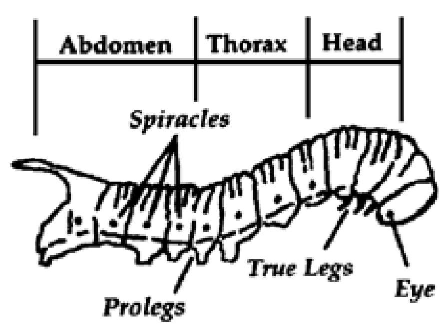
Legs come in many sizes, shapes and functions and are helpful in identifying insects. Used for walking, running, jumping and climbing, legs have become very specialized in some insects like the large jumping leg in the grasshopper. Crickets and long-horned grasshoppers have an eardrum at the base of one of their leg segments.

Wings also vary in size, shape and texture. The pattern of veins on the wings of an insect are often used to identify insect species. Forewings in some insects are hard and shell-like, e.g., beetles. The grasshoppers have forewings that are leathery. The forewings of flies are thin, clear and like membranes. The wings of moths, butterflies and mosquitoes are membranous and are also covered with scales.

The **abdomen** of the insect is built of segments. Along the side of the segments are openings, called spiracles, which the insect used to breathe. The abdomen contains digestive and reproductive organs. Parts of the abdomen used in identification include: the ovipositor, male genitalia and cerci.

In most insects, reproduction results from the males fertilizing females. The females than lay the eggs. **Once the young insect hatches from the egg, it grows through a series of stages called molts or instars.** During the first instar the insect eats and grows until its external skeleton can not expand any further. At this point it uses protease enzyme to split and shed the skin, or molts, and grows a new one. Its form between each molt is known as its next instar; the number of instars varies among species and can be effected by temperature, humidity, food availability and the climatic conditions. Juvenile hormones, also called insect growth regulators (IGR's), trigger the change from one instar to the next. Synthetic versions of these juvenile hormones have been formulated into pest control products for preventing the further growth and/or reproduction of fleas, cockroaches and other insect pests.

The form the insect takes as it goes from egg to adult defines the type of metamorphosis it undergoes. Some insects, e.g., silverfish, do not change structural form at all; as they pass from young to adult they merely become larger. We call this **Without Metamorphosis**. Others, e.g., cockroaches have three distinct stages in their development; we call this **Simple/Gradual Metamorphosis**. Others undergo slightly greater physical changes, as when a wingless nymphal damselfly becomes a winged adult; we call this **Incomplete Metamorphosis**. Still others undergo four distinct stages in their development, we call this **Complete Metamorphosis**, as when a caterpillar hatches from an egg, spins a cocoon in the pupal stage, then emerges as a moth or butterfly.



In pest management, it is important to recognize these various changes or stages because different IPM tactics must be devised to control the different stages.

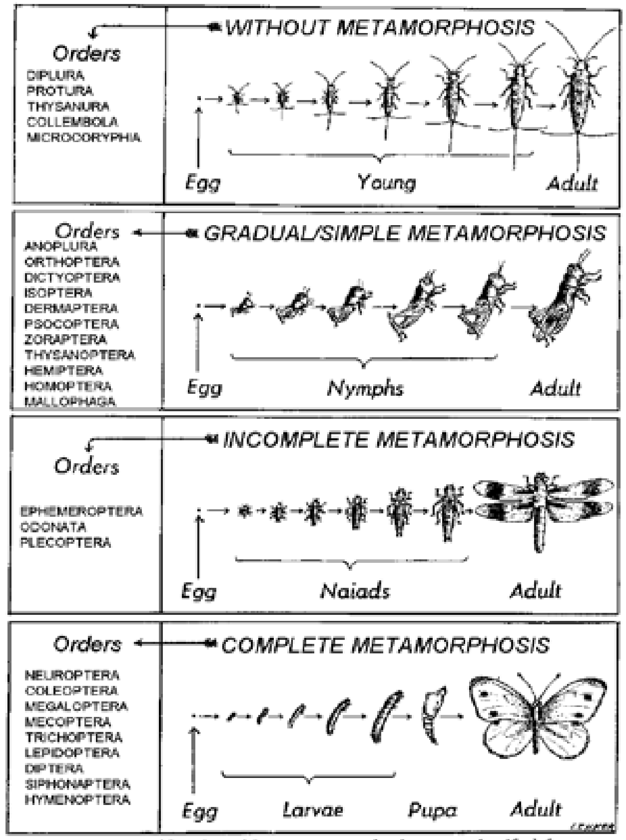
METAMORPHOSIS - The process of change from egg to adult is known as metamorphosis which literally means “a change in form”.

GROWTH AND DEVELOPMENT

Growth - The arthropod body is confined in its exoskeleton. This outer covering or cuticle can expand only a little at pliable or soft places. Cuticular penetration of the insecticide is an important component of insecticide pharmacokinetics and/or an important cause of insecticide resistance (Oppenoorth, 1958). The cuticle does not grow continuously. Arthropods grow in stages. They form a new soft exoskeleton under the old one, then shed - or molt - the old one. The arthropod creates a protease enzyme to act as a chemical “zipper” to split and then shed the old exoskeleton. The soft new one fits the accumulated growth. The new exoskeleton is white at first, but it hardens and darkens in a few hours. After the molting process, which usually takes place in hiding, the arthropod resumes its normal activities. Safe Solutions, Inc. protease enzymes are Pestisafes® and quickly “unzip” or penetrate the cuticle.

Note: The insect’s cuticle is 60-70 um thick and is composed of the epicuticle, the exocuticle, and the endocuticle. Beneath the cuticle are the epidermis and basal membrane. The cuticle is secreted by the hypodermal cells and at first is clear, soft, pliable, and moist. In most insects, the cuticle quickly becomes hard and dark. This is the process of sclerotization and results from tanning of the protein by quinines. The sclerotized layer is the exocuticle, and the remainder is the endocuticle. The exocuticle and the endocuticle together make up the procuticle.

THE DEVELOPMENT OF INSECTS



Note: Insects said to be without metamorphosis are so classified for convenience. They do undergo some metamorphosis, although not readily discernible.

It is well recognized that the texture of the outermost layer of the cuticle (epicuticle) is very important in determining insecticide penetration. Polar insecticides penetrate more quickly than apolar insecticides. The epicuticle typically consists of a thin layer of tanned protein impregnated on its outer surface with lipoid or wax. It may be overlaid with grease (blattids) or with a heavy layer of wax *(Dytiscus,* coccids, psyllids) or with a thin layer of cement. The rest of the epicuticle beneath the outermost wax layer is cuticuline, which is protein mixed with polymerized phenols to form a hard crust. The cuticuline is about 3 um thick. The epicuticle is resistant to strong acids (which dissolve the remainder of the cuticle). It is impermeable to water but is dissolved by strong alkali and is penetrated by fat solvents such as acetone and chloroform and/or Safe Solutions, Inc. protease enzymes and surfactants. The function of the epicuticle is to prevent the passage of moisture outward through the cuticle, thus protecting the insect from desiccation.

The endocuticle is 70 % water and contains crystallites of chitin, arranged parallel to the cuticle surface but fully rotatable in that plane, and imbedded in a matrix of arthropodin (water-soluble protein; that is why Safe Solutions, Inc. protease enzymes and surfactants quickly destroy this protective “shield”. Note: You can dilute the Safe Solutions, Inc. enzymes/surfactants in such a way that you destroy the pest species and save the beneficials.). The exocuticle, which is sclerotized, is dark, hard, dry, and rigid. It is insoluble in water. The cuticle of most insects is perforated by pore canals which reach from the hypodermal cells to the exocuticle. They are generally overlaid by the epicuticle, although in some insects *(Periplaneta)* they extend through the epicuticle. There are as many as 300 pore canals per hypodermal cell in *Periplaneta;* however, in other insects they are sparse, and they are completely absent from the cuticle of mosquito larvae.

Dermal glands are found in the cuticle of many insects which secrete wax or grease (Blattidae), glandular incrustations (Coleoptera), or odorous material (Lepidoptera).

In many insects, especially sclerotized active forms such as flies, bees, and wasps, the cuticle is set with hair sensillia. They are inserted in little circular membranes, the areolar membranes, which are extremely thin to allow free movement of the sensilla. In every case the exoskeleton is quickly dissolved and/or penetrated by Safe Solutions, Inc. protease enzymes.

Development - Arthropods hatch as tiny individuals and grow as nymphs by molting, usually keeping the same appearance until they become adult. (The reader will find that a spectacular and very important exception occurs in the class Insecta, e.g., Group 4.)

The insect class is divided into groups according to the way insects change during their development. This change is called by the technical term, metamorphosis, which means “change in form”. Five main types of metamorphosis have been identified.

Group 1. Without Metamorphosis or Ametabolous Metamorphosis
This group including the order of springtails and silverfish, makes no drastic visible change. They simply hatch and grow larger by molting periodically, but each instar looks just like the last one - except for the increase in size. Only a few small orders are included together in this group.

Group 2. This Group has the Simple Metamorphosis
Simple Metamorphosis: The development of insects in three developmental stages: egg, nymph (naiad for aquatic insects) and adult. The nymphal (growth) stage looks similar to the adult stage. The nymphs have compound eyes and developing wing pads if the adults have these structures. The nymphs are commonly found in the same habitat as the adults. Originally this group included simple and gradual.

Group 3. Gradual metamorphosis
In this form of simple metamorphosis the nymphs undergo a very gradual change at each molt. Winged insects that under go this type of metamorphosis have wing pads that gradually enlarge during the nymphal stages and are fully developed when they reach the adult stage. Structural pests that undergo gradual metamorphosis include cockroaches, crickets, bedbugs and lice
.

Group 4. Incomplete Metamorphosis
These are the aquatic insects that have gills (e.g., dragonflies, damsel flies and May flies)...only a few small groups develop this way. Changes which take place in the body are greater than simple or gradual metamorphosis, but not as great as in complete metamorphosis. The young known as Naiads have a completely different mode of life and body structure than the adults. Naiads of this group live in the water (are outfitted with gills) and the adults live on dry land and can fly. Wings develop only in the last stage or adult.

Group 5. Complete Metamorphosis
Almost 90% of all insect species have four clearly defined stages - egg to larva (with several instars or molts) to pupa and then to adult. The orders that develop by complete metamorphosis make a complete change in appearance. These nine orders contain the majority of insect species. In fact, they number more than all of the other species in the entire animal kingdom! This major group consisting of nine orders, includes beetles, moths and butterflies, flies, fleas, and the stinging insects, ants, bees and wasps. Insects with complete metamorphosis hatch from eggs as larvae, (wigglers, grubs, maggots and caterpillars). The mission of the larval stage is to feed and grow. Larvae continue their development through a number of molts until they become mature; then, they change into pupae. Not active like larvae; the purpose of the pupal stage is one of change or body rearrangement resulting in a complete change into the adult stage. The mission of the adult stage is to reproduce. These developmental stages of insects with complete metamorphosis support rather than compete with each other. It is as if the single species is represented by two or three completely different animals with different needs and habits: The larvae feed and live in one spot; they sometimes leave that spot to pupate a short distance away. The adult emerges and often lives in another area, returning to the larval feeding site only to lay eggs. For this reason, intelligent pest controllers manage species with complete metamorphosis in different ways according to the different stages, where each lives, and what they do. The reader will want to pay special attention to sections that discuss the growth cycle, behavior, and harborage (the area in which the creature lives and finds

its food) of each pest. Examples include moths, bees, wasps and flies. Note: There are some arthropods like a few beneficial predators, e.g., *Phytoseiulus persimilis, Galendromus occidentalis* and *Mesoseiulus longipes*, that have 5 life stages: egg, larva, protonymph, deutonymph and adult.

Larva - The larva is the form which hatches from the egg in insects with complete metamorphosis. Examples of larvae are the caterpillar of the clothes moth, the hairy larva of the carpet beetle, the aquatic wiggler of the mosquito, and the smooth, soft maggot of the house fly. Larvae (plural of larva) of different insects exhibit many different characteristics which fit them for their particular mode of life. Some larvae, such as maggots (the larvae of flies) and those of some weevils, are legless and wormlike. Others, such as carpet beetle larvae, have legs on the thorax but none on the abdomen. Still others, particularly the common caterpillars, have fleshy leg-like appendages, called prolegs, attached to several segments of the abdomen as well as having legs on the thorax. The appendages disappear when the larva changes to pupa. Some beetle and fly larva have gills which enable them to live under water. Wings are not present on larvae and most larvae have only simple eyes located on the sides of the head. The larvae or maggots of many flies have no visible head. Since larva are in a very active growing stage and constantly seeking nourishment, they usually are the stage doing damage. Larvae of clothes moths, for example, feed upon and damage woolen fabrics while the adults do not feed at all. Frequently the larval stage is found in a completely different environment than the adult stage. Therefore, it is important to be able to recognize this stage as well as the adult stage, and to know the biology and habits of both stages in order to locate and destroy all damaging pest infestations.

Pupa - The larva, after undergoing several molts, turns into a so-called resting stage known as the pupa or tumbler stage of the mosquito. Although called a resting stage, this is actually one of the most active stages in the life history of an insect for it is in this state that the body structures of the adult are developed. The legs become fully formed, wings develop, and antennae become fully developed. Although many physical changes are taking place, most pupae (plural of pupa) are generally confined to a slight movement of the abdominal segments. Many pupae are completely unprotected, while others such as those of moths and butterflies are protected by a silken cocoon. In many species of flies the next-to-the-last instar larva becomes separated from the old larval skeleton but does not break out of it. This old larval skin becomes dark and hard and gives effective protection to the soft-bodied pupa which is formed at the next molt. This dark case is called a puparium.

Adult - After full development of the pupa, the adult insect emerges from the pupal case. There is no growth in the insect after leaving the pupal case. A small fly, for example, is not a baby fly; it is a species of fly which is small as an adult compared to other larger flies. Adult insects differ from the immature stages by being different in size (usually larger) and in form, by being sexually mature, and by usually having two pairs of wings (some adults have only one pair and others have none). In many instances, the adults do not even resemble the young. Insect blood contains sodium, potassium and chloride ions that lower its freezing point.

Why are there no monster size insects like in the movies? Insects breathe through spiracles and the insect's respiratory system is too rudimentary to keep a large creature going. Certain tissues would die as the insect attempted to pass oxygen along the trachae to the ends of the tracheoles and into the insect's tissues. The largest insects live in the tropics where the oxygen can diffuse more readily in the heat. A creature needs lungs and a better pump (heart) to grow large. Another factor is the insect's exoskeleton, which must be routinely shed in order to grow. A large insect would simple collapse under its own weight, waiting for its new exoskeleton to harden. Another factor is time: Insects do not live as long as mammals. The last factor is nature's natural predators who would feed on and destroy the (slower and more vulnerable) immature stages.

Damage by insects is done either by the immature or the adult form and sometimes by both. A specialist aphid, the vine phylloxera (there are several strains), in various stages of its life cycle, attacks both the roots and the leaves of grape vines. Many insects suck the plant's sap (virtually all sap suckers are the true bugs [Hemiptera]). Some adult insects only eat fresh leaves, e.g., grasshoppers and beetles; other insects feed on plant foliage only in their immature stages, e.g., caterpillars. Young of silverfish and cockroaches feed on the same things as the adults and cause the same type of damage. The larva of the clothes moth feeds on woolens while the adult does not feed at all. The larvae of the various grain beetles cause damage to cereals and grains as do many of the adults. The cadelle beetle feeds on grain in both the larval and adult stages. Larvae of the mosquito are harmless while adult females bite and feed on humans and, in some species, carry disease organisms. The larva of the house fly burrows in decaying materials while the adult is free-flying and annoying. The type of damage is often so characteristic that it provides a clue to the kind of insect causing it. It has been observed that the scientific name of an insect consists of two words. The first word of the name is the name of the genus, that is, the smallest group of the related species, and it is spelled with a capital letter. The second word of the name is the name of the species and it is always spelled with a small letter. In manuscript and typescript both words are underlined to signify that they would appear in italics when printed. The name given to a genus is never duplicated although this may be so in the case of specific names. Thus the combination of the generic name and the individual specific name can only mean one particular species and, furthermore, its relationship with a group of species can be seen at once. More correctly, the name of the author who first described and named the insect according to the Linnaean system should follow the name either in full or in abbreviated form, but this rule need not be adopted on every occasion. This Linnaean system of naming animals (named after its founder Linnaeus 1707-78) has been universally adopted and it has enables the naming of insects to be conducted in an exact manner. That is not to say that complications and anomalies never arise, but, taken generally, the system works very well. Note: It has been estimated that there may be 30 million different species of insects on earth, but less than 0.1% or about 1,000 are considered pests the other 99.9% are considered beneficial and play a crucial role in our food chain and **many are indispensable.** Broad spectrum pesticide poisons can/will, obviously, kill more beneficial insects than they will kill "pest" insects. We now apply 4.6 billion pounds of just the poisons' active ingredient annually.

DAMAGE DONE BY PEST CONTROL OPERATORS: The Author has been at a pest control meeting where the President of the State Association *bragged* that every pest control operator in the room "was in violation of the (pesticide) label" to which the Author responded, """Not me, or you would have had my pest control license years ago." FMC President Larry Brady at the 1995 National Pest Control Association's Legislative Day pointed out that the pest control *industry* employs 66,000 people (who routinely spray [broad spectrum] synthetic pesticide poisons) in 12 million residences, 288,000 retail food outlets, 450,000 restaurants, plus 66,000 hotels and motels. Read Chapters 12 - 14 - **most are dispensable** - never hire a company that recommends monthly spraying of any volatile poison - especially if pest insects are not present.

DAMAGE DONE BY THE REGULATAORS: The Author has waged a lifetime war against the "regulators" who demand only the maximum amount of "registered" pesticide poison permited or allowed by the label must be applied in every situation.

DAMAGE BY POLITICIANS: At the time of this original writing, Tom Delay, a Texas pest control operator, then House of Representatives' (Republican) Majority Whip, was directing a drive to reverse all environmental gains, e.g., House Agricultural Subcommittee Staffer, Neil Moseman is *working* directly on reauthorizing FIFRA so the pest control industry can review it line by line to be sure it will pass the "common sense" test. Neil recently bragged to pest control operators, "Our highest priority on FIFRA is to get the Delaney Clause *fixed*. That clause states all cancer-causing chemicals must be zero in processed foods. That has been an albatross around your neck for years. It's basically time to get in and get it fixed." Congressman Tom Delay in Volume 1, Number 3, Fall, 1995 of the Agenda was quoted in parts, "As a pest control business owner, stupid, inconsistent and ridiculous federal regulations drove me crazy.". . . and . . . "Reforming those regulations has been and will continue to by my holy grail."

In recognition of Mr. Delay's unceasing contributions to the pest control industry NPCA recognized Mr. Delay in 1997, with its first special Congressman of the year award. The new Republican Congress is aware of and apparently is in agreement with the recent statement of Jay Vroom, President of the National Agriculture Chemical Association, "We are past the point of patience with regard to the rhetoric of Browner (Carol Browner, EPA Administrator)." Browner had observed that synthetic pesticide poisons were overused, e.g., that 3 billion pounds of agricultural pesticides are used each year (at that time) and that tolerances for pesticides (poison contamination) are not health-based. Bob Russell, a past President of the National Pest Control Association (NPCA), noted that, "if EPA is increasing the restraints on pesticide use in agriculture (by soon suspending 43 active ingredients for use on 6 crops and outdoor mosquito abatement on farms) what may soon happen with our (the pest control industry's) 200-gallon (poison) applications for treating a house for termites? What about the question of indoor air? **Yes, Bob, these volatile, termiticide poison applications for termite *control* are and always did contaminate the ambient air - and should be highly restricted or cancelled or "voluntarily withdrawn"!**

Republican Congressman David McIntosh, speaking to the NPCA's Legislative Day, assured the poison *Industry* he would cut "the red tape" and use "good science" to change FIFRA. "We can rewrite the regulatory process."

Republican Charles Norwood, when advised by the NPCA of the proposed OSHA 24-hour notice before application of a pesticide or hazardous material, rose to speak in the House; he said basically, and I quote, "This is nuts." Amazing! Representative Delaney subscribed to the concept that there is no threshold level below which a carcinogen may not be responsible for an occasional cancer - in 1958 the majority of Congress originally subscribed to this view - now the poison "industry" has spent a lot of (PAC) money and has "won" the Congress to their side and we are again going to get carcinogens in our food where the "acceptable" risk "justifies" the use of these carcinogenic poisons. May be only one in a million . . . one in a million . . . one in a million . . . and we hope it's you - the purveyor (or applicator or "regulator") of these poisons. The May 2007 issue of Pest Control Magazine, pg.20 had an article by Allen James with this line, "Anti-pesticide activist groups had been shut out of federal policy-making until the election of the 110th Congress last November." **Obviously, many of these (elected) pests are dispensable.**

"Great minds have purposes, others have wishes."
— Washington Iriving - 1783-1859

"Avoid what is evil; do what is good; purify the mind - this is the teaching of the Awakened One."
— The Pali Canon - 500-250 B.C.E.

"The only medicine for suffering, crime, and all the other woes of mankind, is wisdom."
— Thomas Henry Huxley

"He who has begun, has half done. Dare to be wise; begin!"
— Horace - 65-8 B.C.E.

"Well begun is half done."
— Aristotle - 384-322 B.C.E.

The only real difference between an amateur and a professional is that an amateur gives up when encountering difficulties and a professional speeds up.

"He that can not endure the bad will not live to see the good." — Yiddish Proverb

"Why was the mosquito created before man?" The Talmud asks. "So when he becomes haughty he can be deflated by being told: "The mosquito came before you."

The Author's hero is Carl Von Linne who incredibly named so many of these creatures and plants without a computer, camera, airplaine, train, car, recording device or any modern convenience. As the Author stood at his grave in Uppsala, Sweden, he could only weep with gratitude for his unbelievable creativity and perseverence in the creation of a two-word system for naming the various organisms. Ta Da Rabah!

http://www.getipm.com/personal/warrior/warrior.html