ENTOMOLOGY CAREER DEVELOPMENT EVENT

REQUIREMENTS AND STUDY MATERIALS HANDBOOK

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FFA ENTOMOLOGY CAREER DEVELOPMENT EVENT
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FFA ENTOMOLOGY CDE

The entomology contest will be divided into two parts. The first part will be spot identification of insects or other arthropods using the list of species on the following pages. Contestants will be expected to know the arthropods' common name, their scientific order name, their type of metamorphosis, their type of mouthparts, and their significance to humans.

The second part of the contest will count as a **tie-breaker only in 2018**, but is preparation for the revised CDE to be instituted in 2019. This part will be 25-30 multiple choice questions from "Entomology" (Chapters: 1, 3, 7, 8) and "Applying Pesticides Correctly" (Chapters: Pests and Pest Control, Labels and Labeling, Pesticide Safety) – see Entomology CDE Guidelines for citations.

Number Allowed to Participate: Each county can enter as many teams as they wish. A team can consist of three or four members with the highest three scores used for the team score. Junior teams must have no member more than 13 years old as of January 1 of the year in which they are participating. Senior teams may have one or more members of junior age.

FFA/4-H members may also enter as individuals if there are not enough members from a county to make up a team. Both team and individual awards will be given at the junior and senior levels. See the state fair catalogs for specific awards.

Suggested Study Materials:

Entomology and Plant Pathology website: http://entoplp.okstate.edu/4H-FFA/index.htm

HOW TO RECOGNIZE AN INSECT

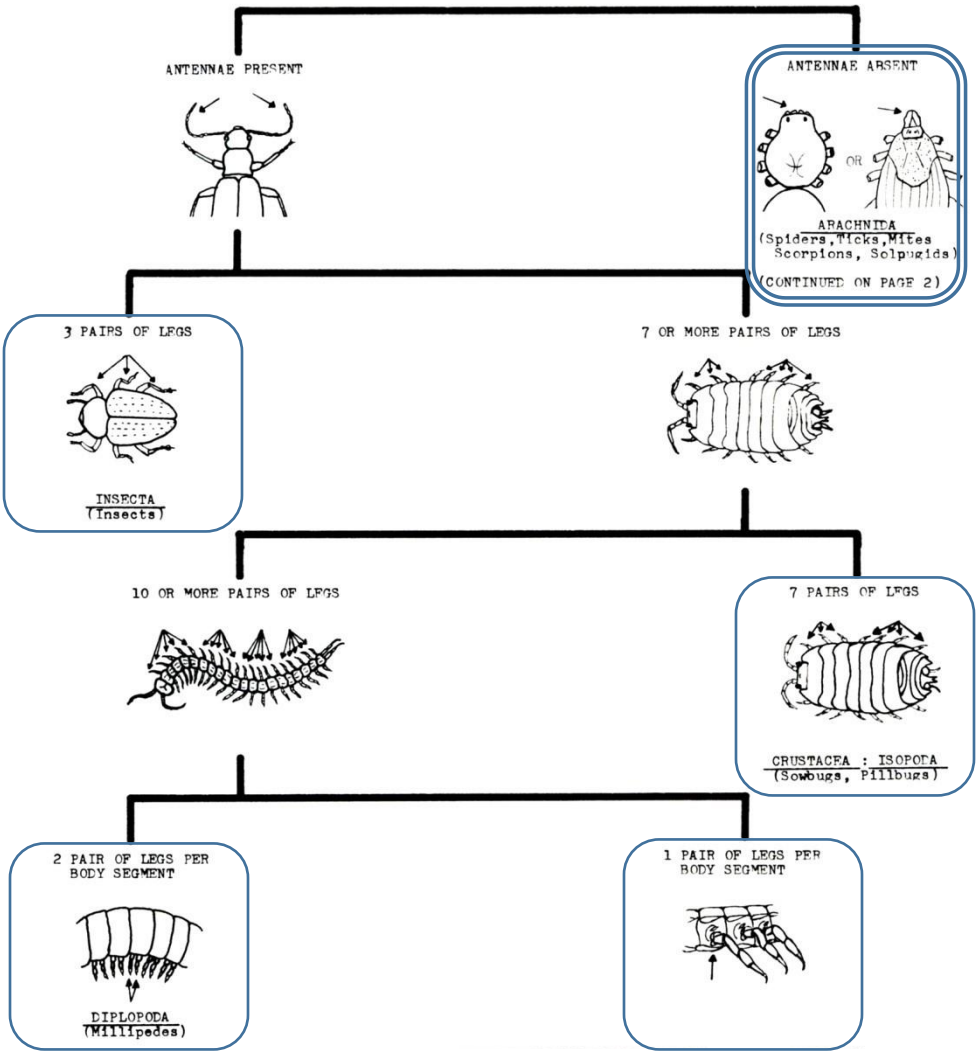
The insects belong to the classification of animals known as **Arthropoda**. Not all arthropods are insects; there are other groups in Arthropoda. Since the Entomology CDE List includes some of these other arthropods, you should know how to recognize the different groups.

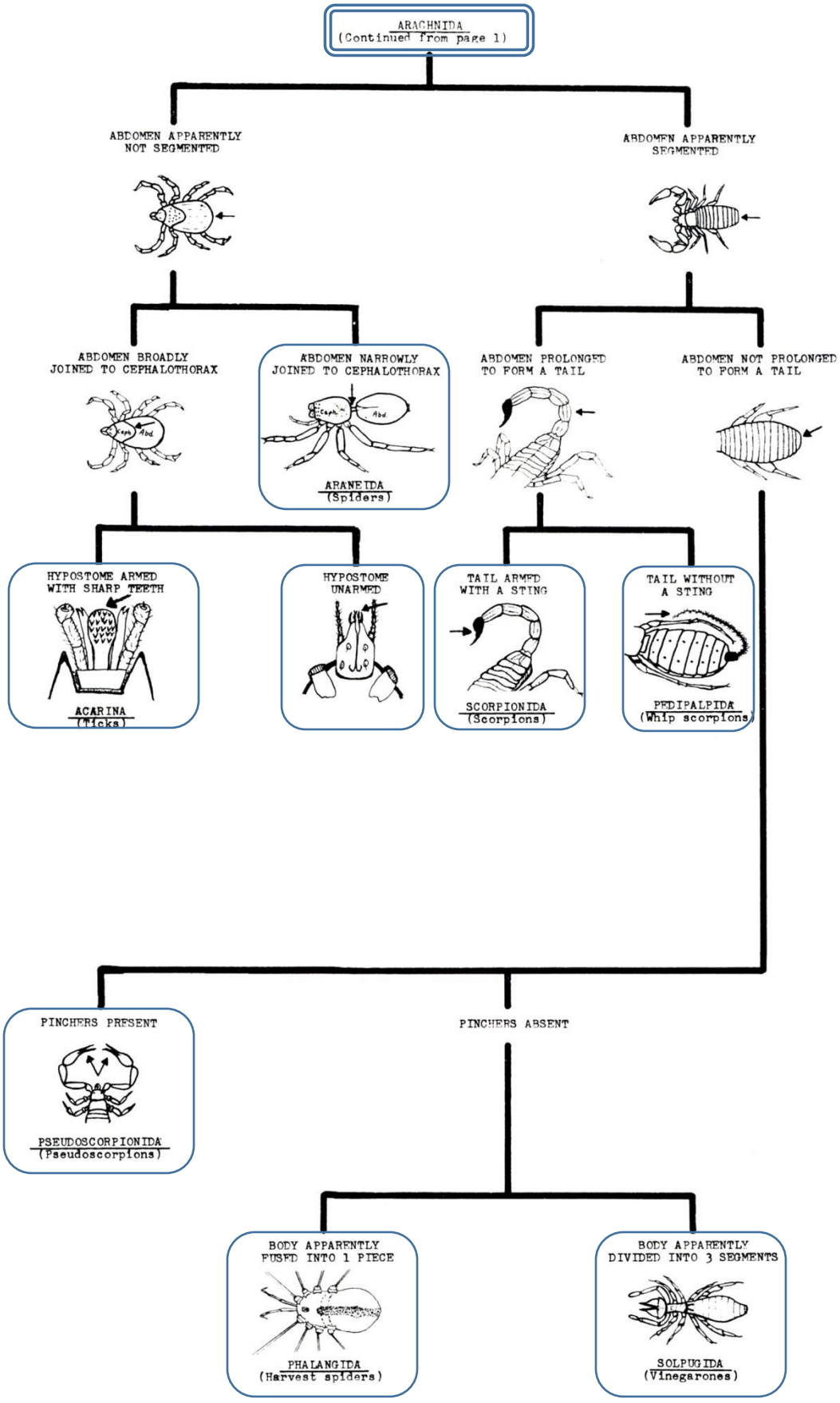
The most important characters used in separating the arthropod groups are 1) presence or absence of wings, 2) presence or absence of antennae, and 3) number of pairs of legs. Adult insects have **two antennae**, typically **two pairs of wings,** and **three pairs of legs**. Larval insects, such as caterpillars, have no wings or antennae, have three pairs of true legs near the front end but may also have several pairs of prolegs (false legs) on the abdomen. All other groups of arthropods have four or more pairs of legs as adults and some groups do not have antennae. Most adult insects have 2 pairs of wings located on the thorax (middle) region of the body. A few adult species of insects may repress the development of their wings and all true flies (Diptera) have only one pair of visible flying wings. Another characteristic of insects is the presence of **three distinct body regions** (head, thorax, and abdomen). The other groups of arthropods have only two body regions.

HOW TO USE INSECT KEYS

Keys are used to open doors to find what's inside. Insect keys use a series of double doors to help you find the name for an unknown insect. Here is the idea: take an unknown insect and start at the top of the key. Read and look at the 2 descriptions (doors), look at the insect, and make a decision: does the insect look like this (one door) or does the insect look like this (another door). Occasionally you may have more than two choices in a key. Keys will have pictures and short descriptions to illustrate your choices (doors), so be sure to carefully compare your insect with what is given. When you decide which door to take, follow a line drawn to another double door where again you will have to make a decision about which choice looks most like your insect. Finally, you will come to the name of an insect, like a dead-end. If you chose only correct doors, then the insect name is correct. The Key to Common Groups of Arthropods on the next two pages should help you separate the insects from the other groups you need to know (spiders, ticks, scorpions, millipedes, etc.).

A KEY TO THE COMMON GROUPS OF ARTHROPODS




ARACHNIDA
(Continued from page 1)
ABDOMEN APPARENTLY NOT SEGMENTED
ABDOMEN APPARENTLY SEGMENTED
ABDOMEN BROADLY JOINED TO CEPHALOTHORAX
ABDOMEN NARROWLY JOINED TO CEPHALOTHORAX
Ceph.
Abd.
ARANEIDA
(Spiders)
ABDOMEN PROLONGED TO FORM A TAIL
ABDOMEN NOT PROLONGED TO FORM A TAIL
HYPOSTOME ARMED WITH SHARP TEETH
ACARINA
(Ticks)
HYPOSTOME UNARMED
TAIL ARMED WITH A STING
SCORPIONIDA
(Scorpions)
TAIL WITHOUT A STING
PEDIPALPIDA
(Whip scorpions)
PINCHERS PRESENT
PSEUDOSCORPIONIDA
(Pseudoscorpions)
PINCHERS ABSENT
BODY APPARENTLY FUSED INTO 1 PIECE
PHALANGIDA
(Harvest spiders)
BODY APPARENTLY DIVIDED INTO 3 SEGMENTS
SOLPUGIDA
(Vinegarones)

HOW TO KNOW THE INSECT ORDERS

There are over 2 million known kinds (or species) of insects in the world and no one can learn them all. But all insects are divided into about 30 similar groups called orders which are easy to recognize. You are asked to learn about 20 of the most common scientific order names and here's a little aid to help you remember them.

MOST ORDERS END IN "PTERA" WHICH MEANS "WING"

Remember: ptera = wing

Orthoptera = Ortho "wing". Since you know that you go to the orthodontist to get braces or something to "straighten" your teeth, the "Orth" means "straight". **Orthoptera means "straight wing"** and sure enough grasshoppers and crickets have straight wings.

While we are on the subject of orthodontists, the "odon" means "tooth". Dragonflies and damselflies belong to the order **Odonata which means "dragons tooth"**. This is one of the few orders which do not end in "ptera".

Hemiptera = Hemi "wing". In your geography class you study the Western Hemisphere or the Western "1/2" sphere. Therefore, **Hemiptera means "1/2 wing"**. All true bugs (suborder Heteroptera), such as stink bugs, have the first 1/2 of their front wings tough and leathery and the outer 1/2 thin and membranous. Cicadas, leafhoppers, and treehoppers (suborder Auchenorrhyncha), and aphids (suborder Sternorrhyncha) are similar to the Heteroptera except that their front wings are not 1/2 and 1/2 but all the same (membranous).

Neuroptera = Neuro "wing". You may remember that a neurologist is a doctor who works with nerve diseases or a neuron is a nerve. Therefore, **Neuroptera means "nerve wing"**. Lacewings and antlions do have wings with many veins that look like nerves.

Coleoptera = Coleo "wing". The front wings of beetles are thickened or hardened and serve as a protective "sheath" for the hind wings. **Coleoptera means "sheath wing"**.

Lepidoptera = Lepid "wing". You may remember the disease leprosy was so called because it was a "scaly" disease. Therefore, **Lepidoptera means "scale wing"**. When touched, butterflies, skippers, and moths usually leave dust on your fingers. If you looked at this dust under the microscope, you would see many small scales.

Diptera = Di "wing". You use "di" in many words such as dice, dialogue, and divorce and it means "two". So **Diptera means "two wings"**. Almost all flying insects have four wings except flies, mosquitoes, gnats, and other true flies which belong to the order Diptera.

Hymenoptera = Hymen "wing". Hymen means "membrane" and refers to the membranous wings with relatively few veins. Therefore, **Hymenoptera means "membrane wing"**.

HOW INSECTS GROW AND DEVELOP: METAMORPHOSIS

Many animals are called “vertebrates”, which refers to the fact that they have a backbone and internal skeleton (endoskeleton). Arthropods do not have an endoskeleton, but are instead protected by a jointed “suit of armor” called an **exoskeleton** that surrounds the entire body. To grow, all arthropods must remove the old, tight exoskeleton and replace it with a new exoskeleton in the next larger size. This process is called **molting**, and you can think of it as similar to a snake shedding its skin.

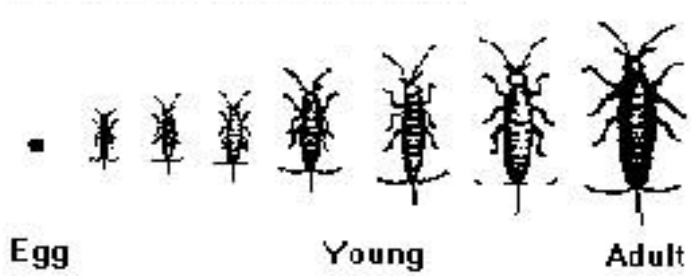
As they develop, immature insects must transform through several stages to reach adulthood. Not all of them do this in exactly the same way. For the Entomology CDE in 2018, you will only need to understand 3 types of development: holometabolous, hemimetabolous, and ametabolous metamorphosis. Many young or immature insects don't look anything like their parents. For example, the butterfly hatches from an egg into a caterpillar which becomes a pupa (chrysalis) before it emerges as a butterfly. This type of insect life-cycle includes all 4 stages (egg, larva, pupa, adult) and is therefore called **complete** "change" or **holometabolous metamorphosis**. Other insects, like the grasshopper and stink bug, look like their parents except for being smaller sized and not yet having wings or functioning reproductive organs. This kind of insect life-cycle is called **incomplete** or **hemimetabolous metamorphosis** because it consists of only 3 stages (egg, nymph, adult). Other insects having incomplete – only 3-stage – metamorphosis include dragonflies and damselflies, mayflies, and stoneflies. These immatures can also look different from the adults of their kind, but are still considered to have incomplete development because they never go through a pupal stage. A third option of life-cycle called **ametabolous metamorphosis** exists for a few primitive insects and all non-insect arthropods. The young and adults of ametabolous arthropods do molt, but do not go through any major change in form during their development. All insects in the same order have the same kind of life-cycle development (metamorphosis).

Important Note: You may often see metamorphosis expressed in many different ways in many different texts; stick to the above definitions for only 3 types of metamorphosis for the 2018 Entomology CDE. From 2019, forward, we will move on to the scientifically accepted 4 types of metamorphosis and the Entomology CDE Handbook will reflect this change next year.

METAMORPHOSIS OF VARIOUS INSECTS

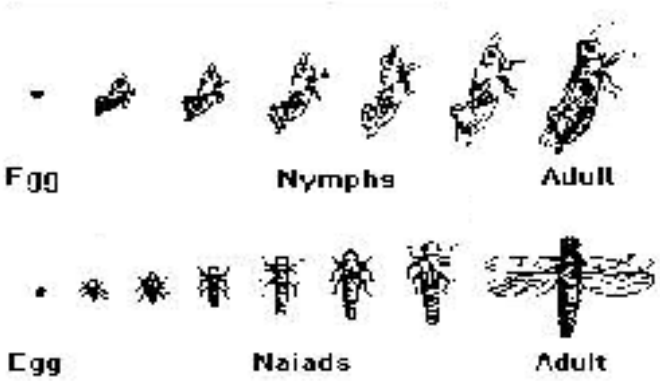
This chart illustrates the 3 types of arthropod development and list groups with that metamorphosis type.

AMETABOLOUS



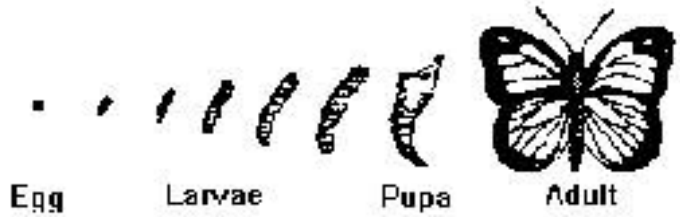
Examples	Orders
Silverfish	Thysanura
Springtail	Collembola
Mallophaga	Chewing Lice
Anoplura	Sucking Lice
(Arachnids, Centipedes, Millipedes)	

HEMIMETABOLOUS



Examples	Orders
Grasshoppers	Orthoptera
Termites	Isoptera
Booklice	Psocoptera
Thrips	Thysanoptera
True Bugs	Hemiptera
Aphids	Heteroptera
Earwigs	Dermaptera
Mayflies	Ephemeroptera
Dragonflies	Odonata
Stoneflies	Plecoptera

HOLOMETABOLOUS



Examples	Orders
Lacewing	Neuroptera
Beetles	Coleoptera
Scorpionfly	Mecoptera
Coddisfly	Trichoptera
Moths, Butterflies	Lepidoptera
Flies	Diptera
Fleas	Siphonaptera
Wasps, Bees, Ants	Hymenoptera

INSECT MOUTHPARTS

Why would anyone other than an entomologist be interested in studying an insect's mouthparts? Well, the type of mouthparts will help to determine what insect order it belongs to. The type of mouthparts will also determine the type of damage left by the insect. Often, the insect that caused the damage is long gone and we use the type of damage as a clue to determine which insect may have caused the damage. In addition, some insecticides are more effective against insects with certain types of mouthparts, so the type of mouthparts can affect control decisions. There are many types of insect mouthparts, but we will focus on the 4 most common types, chewing, piercing-sucking, siphoning, and sponging.

Piercing-sucking mouthparts form a tube which is inserted into a food source. Note the beak hanging below the head of the wheel bug. The food source could be a plant with herbivorous insects, or another insect with some insect predators.

Damage to plants caused by insects with piercing-sucking mouthparts would include stunting, yellowing, distorted growth, and honeydew (waste material from some sucking insects). Three orders of insects have this type of mouthparts: true bugs, thrips, and the Homoptera. Because the feeding occurs inside the leaf, these insects are less likely to be killed by insecticides that only coat the outside of the leaf. However, they are often very susceptible to systemic insecticides.

Chewing mouthparts are common in many different insect orders. Usually the most visible part of these mouthparts are the large mandibles on each side that move from side to side. Often there are noticeable, finger-like palps on each side of the mouth.

Many of the insect orders have chewing mouthparts, including beetles (Coleoptera), caterpillars (Lepidoptera), the Orthoptera, and termites (Isoptera). Insects with chewing mouthparts leave noticeable holes in leaves, wood, or fruit. Insecticides that lay on the surface of the plant may be effective as these insects often consume more of the surface area of plants than insects with piercing-sucking mouthparts.

Moths, butterflies, and skippers have **siphoning mouthparts** that are adapted to draw nectar from long, slender flowers. Unlike piercing-sucking mouthparts, siphoning do not penetrate into the plant

tissue. When at rest, the tube is held as a coil under the head. A few moths have tubes that may be several inches in length when extended.

The other common type is the **sponging mouthparts**. Many flies, including the house fly, blow flies, and fruit flies have sponging mouthparts. Sponging mouthparts appear as a conical process with spongelike lobes at the end. This type of mouth is modified to sop up liquids. Flies often use enzymes to liquefy the food before feeding.

INSECT SIGNIFICANCE FROM THE HUMAN PERSPECTIVE

Not all bugs are bad. Insects get labeled as "pests" when they start causing harm to people or the things we care about, like plants, animals, and buildings. Out of nearly one million known insect species, only about one percent are ever considered pests. What about the rest of them? Some insects actually help us by keeping the pests in check.

If we let them do their jobs, many types of insects can actually help us out:

- **By preying on pest insects.**
  Spiders are predators of insects. So are some types of beetles, flies, true bugs, and lacewings.
- **By parasitizing pest insects.**
  Parasitic insects, like some small wasps, lay their eggs inside insects or their eggs. This can help drive the pest population down.
- **By pollinating plants.**
  Insects like native bees, honeybees, butterflies, and moths can provide this service, helping plants bear fruit.

ECONOMIC IMPORTANCE OF INSECTS

The estimated annual value of the ecological services provided by insects in the United States alone is at least $57 billion, an amount that justifies greater investment in the conservation of these services. Without the activities of insects, human life on earth would eventually be extinguished. Over one million currently living species of insects have been identified, but the true number of species is surely much larger, about 10 million.

BENEFICIAL INSECTS

Pollinators of crops (Bees, wasps, butterflies, moths, hoverflies, beetles)

Many plants depend on insects to transfer pollen as they forage. Plants attract insects in various ways, by offering pollen or nectar meals and by guiding them to the flower using scent and visual cues. This has resulted in strong relationships between plants and insects. Value of crop production from pollination by native insects is estimated to be about $3 billion in US alone. Worldwide, pollinator disappearance would translate into a consumer loss of food estimated between dollar 190 to 310 billion.

When we talk about pollinators the ones that come to mind are honey bees and butterflies, but there are also many other insects that perform this job for flowering plants, as well. There are flies, wasps, beetles and even some other insects that most people know nothing about, such as Hemiptera. There are many important pollinating insect species in the orders: Hymenoptera (bees, wasps, and ants), Lepidoptera (butterflies and moths), Diptera (flies) and Coleoptera (beetles).

As adults these insects feed on pollen and nectar from flowers. They forage from plant to plant and may initiate pollination by transferring pollen from an anther to a stigma. Female bees and pollen wasps provision their nests with pollen and nectar that they actively collect onto their bodies. Their larvae then feed on the collected pollen and nectar. Yucca moth larvae do not feed on pollen or nectar but on the seeds of yucca plants. The adults pollinate the yucca plant by actively collecting pollen onto their palps and then placing the collected pollen on a receptive stigma to ensure proper seed set for their offspring.

Predators of pests (Dragonflies, beetles, bugs, lacewings, wasps)

The arthropod predators of insects and mites include beetles, true bugs, lacewings, flies, midges, spiders, wasps, and predatory mites. Insect predators can be found throughout plants, including the parts below ground, as well as in nearby shrubs and trees. Some predators are specialized in their choice of prey, others are generalists. Some are extremely useful natural enemies of insect pests. Unfortunately, some prey on other beneficial insects as well as pests.

Major characteristics of arthropod predators:

- Adults and immature stages are often generalists rather than specialists.
- They generally are larger than their prey.
- They kill or consume many preys.
- Males, females, immature stages and adults may be predatory.
- They attack immature and adult prey.

Important insect predators include lady beetles, ground beetles, rove beetles, flower bugs and other predatory true bugs, lacewings and hover flies. Spiders and some families of mites are also predators of insects and mite pests. Natural enemies play an important role in limiting potential pest populations.

Parasites of pests (Hymenoptera and Diptera)

Parasitoids are insects with an immature stage that develops on or in an insect host, and ultimately kills the host. Adults are typically free-living, and may be predators. They may also feed on other resources, such as honeydew, plant nectar or pollen. Because parasitoids must be adapted to the life cycle, physiology and defenses of their hosts, many are limited to one or a few closely related host species. Crop losses averted by beneficial insects from predators or parasites of agricultural pests are estimated to be $4.5 billion. The most valuable insect parasites belong to the following groups:

- Tachinid Flies (Diptera)
- Ichneumonid Wasps (Hymenoptera)
- Braconid Wasps (Hymenoptera)
- Chalcid Wasps (Hymenoptera)

These parasites live in or on one host insect pest which is killed after the parasite completes its development. Parasite (also called parasitoid) adults are free-living; the immature stage lives on or inside a host and kills the host before the host completes its development. Parasites lay one or more eggs on the outside of the host body or they insert the eggs inside their host. The immature parasite feeds on the host and requires only a single individual prey to complete its development.

Parasites are often considered more effective natural enemies than predators because many have a narrower host range, require only one host to complete development, have an excellent ability to locate and kill their host and can respond rapidly to increases in host populations.

Productive insects (Silkworm, Honey bees, Lac insects)

Sericulture involves rearing of silkworms for the production of raw silk. The silk fibers are obtained out of cocoons spun by certain species of moths. The major activities of sericulture comprises of food-plant cultivation to feed the silkworms which spin silk cocoons and reeling the cocoons for unwinding the silk filament for value added benefits such as processing and weaving.

Apiculture or beekeeping is the maintenance of honey bee colonies, commonly in hives by a beekeeper in apiary in order to collect honey and beeswax, and for the purpose of pollinating crops. The genus *Apis* is comprised of a comparatively small number of species including the western honeybee *Apis mellifera,* the eastern honeybee *Apis cerana,* the giant *bee Apis dorsata,* and the small honeybee *Apis florea.*

Nectar is a sugar solution produced by flowers containing about 80% water and 20% sugars. Foraging bees store the nectar in the 'honey sac' where enzymes will change complex sugars into simple sugars. Upon returning to the hive, the foraging bee will disgorge the partially converted nectar solution and offer it to other bees. Housekeeping bees will store the nectar in cells in the comb and finish the enzymatic conversion by rapidly beating their wings over the comb until the honey solution evaporates water down to between 14 – 20%.

Lac Insect

There are several species of lac insects found in order Hemiptera. These insects are noted for resinous exudation from the bodies of females. The Indian lac insect *Laccifer lacca* is important commercially and is known as shellac. It is found in tropical or subtropical regions living on banyan and other plants.

Human food value

There are 1,462 recorded species of edible insects. Doubtless there are thousands more that simply have not been tasted yet. 100 grams of cricket contains: 121 calories, 12.9 grams of protein, 5.5 g of fat, 5.1 g of carbohydrates, 75.8 mg calcium, 185.3 mg of phosphorous, 9.5 mg of iron, 0.36 mg of thiamin, 1.09 mg of riboflavin, and 3.10 mg of niacin. Compare this with ground beef, which, although it contains more protein (23.5 g.), also has 288.2 calories and a whopping 21.2 grams of fat. Usually crickets, grasshoppers, beetle and moth larvae and termites are eaten. Australian aborigines regularly ate honey pot ants, adult bogong moths and the larvae of wood moths.

Being rich source of protein, grasshoppers have been eaten in nearly all regions of the world. They are a common food in parts of Asia and Africa—fried, roasted or ground to be mixed with flour. The grasshoppers eat green plants, however, by far outweighs their value as food. Insects are an important food for many vertebrates – birds, amphibians, reptiles, fish and mammals – and even some plants like pitcher plants of the Venus flytrap. These insectivores usually feed on many insect species, and rarely focus on specific pests, unless they are very abundant.

Scavengers

A large number of insects thrive on dead carcasses, left over organic matter, or excreta and in the process clean the environment. Economic losses avoided every year by the burial of livestock waste by dung beetles, alone, are estimated to be over $3.8 billion.

NEUTRAL OR BENIGN INSECTS

Majority of insects, almost 98% of all insect species, live in low populations in different ecosystems, without causing appreciable damage. But they form an important component of the food web and work unnoticed. Conservation of such fauna is important since we do not know the interactions of such insects with the animal and plant species.

PEST INSECTS

Less than 1% of insects are regarded as pests. They can be classified into the following categories.

Pests of agriculture and forestry (Locusts--grasshoppers, caterpillars, bugs, hoppers, aphids etc.)

Locusts are among the most destructive of all insect pests. Swarms of desert locusts were among the plagues of the Biblical Egyptians, and they still plague farmers throughout Asia and Africa. Their threat is so great that regional and international organizations monitor desert locust populations and launch control measures when necessary.

Locusts are particularly destructive in hot, dry regions when a sudden increase in their numbers, combined with food shortage, forces them to migrate. They migrate in huge swarms, devouring virtually every green plant in their path.

Pests of stored grains

The most common insect pests of stored cereal grains are:
Rice Weevil *(Sitophilus oryzae);* Lesser Grain Borer *(Rhyzopertha dominica);* Red Flour Beetle: *(Tribolium* spp.); Sawtooth Grain Beetle: *(Oryzaephilus surinamensis);* Flat Grain Beetle: *(Cryptolestes* spp.); Indian Meal Moth *(Plodiainterpunctella);* Angoumois Grain Moth *(Sitotroga cerealella);* Khapra beetle *(Trogoderma granarium);* Rice moth *(Corcyra cephalonica).*

Insect management for stored grain depends upon good sanitation and grain storage practices. Clean storage areas to reduce the potential for insect migration into the new grain. Once the grain is dried to 13 percent moisture or less, cool it as soon as possible by running aeration fans. Reducing the grain temperature to less than 60ºF stops insect reproduction, and lowering it to less than 50ºF stops insect feeding activity.

Household pests (carpet beetles, furniture beetles, cloth moth, termites and silverfish)

Common household pests include ants, termites, bed bugs, carpet beetles, furniture beetles, book lice, house flies, fleas, cockroaches, silver fish, clothes moths and spiders – the list seems almost endless. Common household pests enter our homes for shelter and food, and also to nest and breed. Common household pests can cause damage to our homes especially clothes, eatables and furniture. Household pests can also be a threat to health of our families by spreading bacteria, diseases or allergens in our homes. Household pests can be irritating, annoying or irritating and annoying. They can be controlled by spraying insecticides or by fumigants and by maintaining hygiene.

Insects of medical and veterinary importance (Mosquitos, flea, beetles, flies)

Mosquitoes can spread diseases such as malaria, yellow fever, dengue fever. Tsetse flies spread sleeping sickness. Lice suck human blood and can cause sores, which if left untreated can become infected which may lead to blood poisoning.

Screw worm flies lay their eggs in the wounds of farm animals and pets. Horseflies and black flies suck blood and have painful bites, which can become infected. Houseflies spread germs and spoil meat by laying eggs in it. Bubonic Plague (or Black Death) was the worst disease epidemic in human history. It took 14 million lives–nearly 1 out of 4 people–in 14th-century Europe. The plague is passed to humans by the bite of the Oriental rat flea (*Xenopsylla cheopis*), which picks up the disease-causing bacteria from rats.

ENTOMOLOGY CONTEST INSECT LIST

" ** " indicates immature form of an insect.
" – " indicates insect is not considered a pest nor a beneficial.

Order ODONATA
Ordinal characteristics: (1) chewing mouthparts; (2) hemimetabolous metamorphosis

Common name	Status
Dragonfly	Beneficial
**Dragonfly nymph	Beneficial
Damselfly	Beneficial

Order ORTHOPTERA
Ordinal characteristics: (1) chewing mouthparts; (2) hemimetabolous metamorphosis

Common name	Status
Banded wing grasshopper	Pest
Katydid	--
Field cricket	Pest
Tree cricket	--
Mole cricket	Pest

Order BLATTODEA
Ordinal characteristics: (1) chewing mouthparts; (2) hemimetabolous metamorphosis

Common name	Status
American cockroach	P
Oriental cockroach	P
German cockroach	P

Order HEMIPTERA (True bugs)

Ordinal characteristics: (1) Piercing-sucking mouthparts; (2) hemimetabolous metamorphosis;

Common Name	Status
Harlequin bug	P
Milkweed bug ----	P
Squash bug	P
Leaf-footed bug ----	B
Tarnished plant bug	P
Assassin bug	B
Big-eyed bug	B
bedbug	P
boxelder bug	--
Lace bug	P
damsel bug--	B
Minute pirate bug	B
Water boatmen	B
Backswimmer	B
Giant water bug	B
Water strider ---	B
Cicada	--
Leafhopper	P
Treehopper	P
Aphid	P
Soft scale	P
Whitefly	P
Mealybug	P

Order COLEOPTERA: (Beetles)
Ordinal characteristics: (1) chewing mouthparts; (2) holometabolous metamorphosis

Common Name	Status
Ground beetle	B
Colorado potato beetle	P
Spotted cucumber beetle	P
Flea beetle	P
Green June beetle	P
**White grub	P
Dung beetle	B
Stag beetle	--
Click beetle	--
Darkling beetle	--
Longhorned beetle	P
blister beetle	P
Metallic woodboring beetle	P
Rice weevil	P
Boll weevil	P
Tiger beetle	B
Ladybird beetle	B
**Ladybird beetle larva	B
Carpet beetle	P
Rove beetle	B
Tumbling flower beetle	B
Red flour beetle	P
Firefly	--
Carrion beetle	B
Sawtoothed grain beetle	P
Whirligig beetle	--
Predaceous diving beetle	--
Water scavenger beetle	--

Order LEPIDOPTERA: (Butterflies, moths, skippers)
Ordinal characteristics: (1) Adults have siphoning mouthparts, larvae have chewing mouthparts; (2) holometabolous metamorphosis.

Common Name	Status
**fall webworm	P
**Southwestern corn borer moth	P
**Tobacco hornworm	P
Indian meal moth	P
**Bagworm	P
Luna moth	B
Skipper	B
Monarch butterfly	B
Viceroy butterfly	B
Red admiral butterfly	B
Painted lady	B
Swallowtail butterfly	B
Sulphur butterfly	B

Order DIPTERA: (Flies)
Ordinal characteristics: (1) mouthparts sponging; (2) holometabolous metamorphosis;

Common Name	Status
Mosquito	P
Horse fly	P
Deer fly	P
House fly	P
Stable fly	P
Horn fly	P
Robber fly	B
Crane fly	--
Bee fly	B
Syrphid fly	B
Blow fly	P
Robber fly	B
Flesh fly	P

Order HYMENOPTERA: (Bees, ants, wasps)
Ordinal characteristics: (1) chewing mouthparts (bees also suck nectar); (2) holometabolous metamorphosis;

Common Name	
Red harvester ant	B
Red imported fire ant	P
Velvet ant ---	--
Cicada killer	--
Paper wasp	P
Mud dauber	--
Ichneumon wasp	B
Honey bee	B
Bumble bee ----	B

Order NEUROPTERA:(Nerve winged insects)
Ordinal characteristics: (1) chewing mouthparts; 2) holometabolous metamorphosis;

Common Name	**Status**
Green lacewing	B
**Green lacewing (larva)	B
Antlion	B
**Antlion (larva)	B
Dobsonfly	--
**Hellgrammite	--

Other Orders

Order	Common name	Mouthparts	Metamorphosis	Status
THYSANURA	Silverfish	Chewing	Ametabolous	P
EPHEMEROPTERA	Mayfly	None	Hemimetabolous	--
PHASMATODEA	Walkingstick	Chewing	Hemimetabolous	--
DERMAPTERA	Earwig	Chewing	Hemimetabolous	P
ISOPTERA	Termite	Chewing	Hemimetabolous	P
MANTODEA	Praying mantis	Chewing	Hemimetabolous	B
PHTHIRAPTERA	Lice	Chewing	Hemimetabolous	P
SIPHONAPTERA	Flea	Piercing-sucking	Holometabolous	P

Other Arthropods

The following are not insects but are studied by entomologists and should be recognized.
All are ametabolous

Common Name	Mouthparts	Status
Black widow spider	Piercing-sucking	P
Brown recluse spider	Piercing-sucking	P
Garden spider	Piercing-sucking	B
Spinose ear tick	Piercing-sucking	P
Brown dog tick	Piercing-sucking	P
Scorpion	Chewing	P
Vinegaroon	Chewing	--
Harvestman	Chewing	--
Millipede	Chewing	--
Centipede	Chewing	--
Pillbug	Chewing	P