The insecta (hexapoda) constitute the largest class in

numbers of species in the phylum arthropoda, which in turn

comprises of a greater number of species than all other phyla

of the animal kingdom combined. Various estimates of

described species of insects in the world range from 625,000

to 1500000, and the number ultimately known will probably be

much greater.

**Order Common names Estimated No in the world**

1. Diptera Flies, gnats, mosquitoes… 85,000 species

2. Anoplura sucking lice 250 species

3. Mallophaga Chewing lice 2,675species

4. Hemiptera True bugs 55,000 species

5. Siphonaptera Fleas 1,100species

6. Hymenoptera Ants, bees, wasps 103,000species

7. Lepidoptera Butterflies, moths 112,000species

8. Orthroptera Grasshoppers, Crickets 22,500 species

9. Coleoptera Beetles, weevil’s 277,000 species

10. Dictyoptera Cockroaches 4000 species

11. Isoptera Termites 60 species

According to the classification system used, some 26-29

orders of insects may be recognized. Differences arise

principally since there are no hard- and-fast rules for deciding

the taxonomic ranks.

**Order Diptera**

Members of the order diptera are a diverse group in both

structure and development. These include all the flies, gnats

and mosquitoes. Beyond their having a single pair of wings

(the hind are reduced to balancing organs called halters) and

all being homometabolic, the suborder have quite different

patterns of development and structures. There are over 85000

species of dipterans in 140 families.

The insects grouped into the order diptera are the two winged

(di = two; ptera = wings). The wing could be used as a

classifying factor. As insects, they are with three body division

(head, thorax, and abdomen). All these insects are

characterized by having only one pair of wings; the hind pair

has degenerated, therefore, all that remains is a pair of

drumstick-like organs, the halters, used for balance in flight.

Dipterans are important to humans for a variety of reasons,

many flies are pests. In addition, many serve as either

mechanical or biological vectors of infectious agents. Tse tse

fly transmits the agent causing African sleeping sickness;

mosquito transmits malaria, lymphatic filariasis, and hundreds

of viruses; biting midges transmit filarioid nematodes and

viruses such as blue tongue virus; tabanids transmit tularemia.

Since these flies are blood-suckers, they can be serious pests

regardless of whether they are vectors of infectious agents.

Many flies are parasitic as larvae; they can be serious medical

and economic problems.

Diptera are only able to take fluid food, which in the case of

bloodsucking flies is obtained by injecting the piercing

mouthparts (proboscis) into living tissue. In other flies, food is

liquidized externally by puddling it with spongy mouth parts in

digestive fluid regurgitated from the foregut (crop).

All Diptera go through a complete metamorphosis in their life

cycle, developing from the egg through a number of larval

stages to the pupa from which the adult emerges. The larva,

which is the feeding and growing stage, is typically found in a

completely different environment from the adult, although the

adult will be associated with the larval environment when

mating and laying eggs.

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A large group within the diptera, sometimes known as the

calypterate flies (because the halters are shielded from above

by saucer-like processes known as calypters), includes

houseflies (musca species), bluebottle (calliphora species),

green bottle (lucilia species), lesser houseflies (fannia

species) and grey flesh flies (sarcophaga and wohlfahrtia

species). These species are closely associated with human

and have adapted to the human domestic environment

(synanthropic).

They are small to moderate, wings restricted to mesothorax,

and metathorax. Mouth parts vary from non-functional to biting

and sucking. Immature stages (larvae, maggots) variable,

without jointed legs, with sclerotized head capsule or variably

reduced ultimately to remnant mouth hooks. Mouth parts of

diptera vary into two aspects:

• Those having spongy (non-biting) mouth parts and

not able to penetrate into the skin. Example Male

mosquitoes. Some feed on plant flower nectars,

hence not risk to health. But some others can feed

on solid substances (by dissolving) or fluids by

sucking. So they are dangerous for transmission

and contamination of food and utensils with disease

agents; example the common housefly

• Groups with biting mouth part/piercing and sucking

type. These are with sharp mouth parts (proboscis)

for piercing the skin and blood sucking; so

important biological vectors; example. Tse tse fly,

female mosquitoes, etc

The mode of development (life cycle) of all the diptera group is

complete (complex) metamorphosis. The presence of a pair of

halters (i.e. two halters) at the base of the thorax is another

factor for identification of diptera. In the laboratory, diptera are

the most used as experimental subjects for various research

works: example the drosophila groups are used to study

population explosion modeling.

**Order Anoplura.**

‘a’ means without, ‘oplas’ means sting, and

‘oura’ means tall.

These are the sucking lice. They are minute to small (from 0.4

to 6.5 mm) and may be characterized by their narrow than

long head, two to five segmented antennae, piercing-sucking

mouthparts that are retracted into head, greatly reduced eyes,

absence of wings and cerci, and dorsoventrally flattened body.

The legs are short, and the single tarsus and claw are

modified into a grasping organ.

Sucking lice feed on blood, and their entire life cycle is spent

on mammalian hosts. Metamorphosis is incomplete (gradual).

Eggs are glued to the hair of the host. A high degree of host

specificity and preference for specific regions on the host are

recognizable. The human louse, Pediculus humanus, infests

humans, and whether it feeds on the head or body region has

direct influence on its morphology and behavior (these two

varieties, head (Pediculus humanus capitis) and body lice

(Pediculus humanus corporis), sometimes treated as two

separate species). They are very similar in appearance, but

biologically they are very different; the head louse is found

only on the hair of the head, sucking blood from scalp, where

as the body louse lives on underclothing and feeds on the

body. Adults appear about nine days after hatching from the

egg. The crab louse, Pthirus pubis, another species found in

man is found mainly in the pubic and perianal region of

humans. The pubic louse doesn’t transmit disease. However,

an infestation known as phthiriasis or ‘crabs’ may cause

considerable discomfort and sometimes embarrassment,

since it is typically acquired by close contact, usually sexual

intercourse, with an infested person. Prevalence of louse in

the human population is a sign of poverty and unhygienic life.

**Order Mallophaga**

These are the chewing lice. They are small (from 2 to 6 mm)

and have a head usually broader than long, modified chewing

and piercing mouthparts, reduced compound eyes, two to five

segmented tarsi, no cerci, and lack wings. The body is

flattened dorosoventrally. Eggs are fastened to feathers or hair

of the host. Metamorphosis is incomplete (gradual). Both

nymphs and adults ingest dead skin, feather, hair, or scabs.

Under high population pressures, the dermal skin layer also

may be attacked, particularly around wounds. There are 2,675

species and these are divided into six families. Most chewing

lice infest birds, although a few utilize mammals as a host.

Host specificity is marked, transferred to one host to another

normally occurs only between two birds of the same species

as the birds mate or nest. If a host dies, the louse fauna

usually perishes. This order is of economic importance when

domestic animals become infested; over 40 species are

known to parasitize poultry. Loss of weight and lowered egg

production, in the case of birds are two common results of

infestations.

The chewing lice spend their entire lives on animal hosts like

sheep, goat, horses, cattle and antelopes. Man comes in

between when caring for these animals. The chewing lice feed

on blood by sucking. Their behavior of continual host contact

and their blood sucking habits make them potentially

dangerous vectors.

**Order Hemiptera. ‘**Hemi’ means half and ‘ptera’ means wing.

Some groups of this order are winged and some others nonMedical

winged. They are sometimes called the true bugs. Examples: -

Bedbug, assassin bug (killer bug), kissing bug.

The true bugs vary in length up to 100mm, compound eyes

are usually large, antennae are from four to five segmented

and often longer than the head. Mouthparts are piercing-sucking

with the segmented beak arising from the anterior of

the head, tarsi are one-three segmented, and cerci are

absent. In most species, wings are present and positioned flat

over the abdomen when at rest, separated by an enlarged

scutellum; the front pair of wings is usually thickened at the

base and membranous apically to form a hemelytron. The

hind wings are membranous and slightly shorter than the

hemelytra. In some like bedbugs, poultry bugs and bat bugs,

the wings are reduced to inconspicuous pads. Great variation

in legs exists. Metamorphosis is gradual (incomplete). Eggs

are deposited in the habitat in which development occurs;

many nymphs and adults are terrestrial, but a significant

number are aquatic. Food is liquid (either sap or blood) and

varies from the common herbivores to carnivorous. A number

of true bugs are of economic importance. Some species of

assassin bugs are naturally infected with Chagas’ disease;

most of these bugs belonging to the genus Triatoma. The

infection may be transmitted to humans by rubbing the

protozoan organism in Triatoma feces through the skin by scratching.

Groups of this order may serve as vectors on man and animals (e.g. chagas disease or trypanosomiasis is transmitted by the bite of kissing bug through armadillos). They have a life cycle of gradual metamorphosis. They may be detected in various habitats which include:

**Water habitat**: Examples of some of the bugs inhabiting on

water bodies are:

• The water-striders: walk on water

• The back- swimmers: swim on their

backs

• The water-boatman: row on the water.

**Habitat on the land**: Examples are the bed-bug and the

kissing bugs.

The bed-bug gives irritation while biting to suck blood and is

annoying and a nuisance insect. Nevertheless, no disease is

known that is transmitted by bed-bugs.

**Facultative:** Habitat both on water and on land

Example: The winged bug known as the giant-water bug. It is

big in size and is known to posses some sort of electrical

charge (shock).

**Order Siphonaptera**

‘Siphon’ means tube, ‘a’ means without,

and ‘ptera’ means wing. These are the fleas. Fleas are

wingless. They are all blood-sucking, temporary ectoparasites

of warm-blooded animals, mainly mammals, but a few will

feed on birds. Only a small proportion will attack humans.

Fleas, like bedbugs, are comparatively host-specific, but will

often feed readily on other animals if their preferred host is not

available.

Fleas are minute to small (from 0.8 mm to 5 mm) and have the

following characteristics: compound eyes are absent or each

is represented by a single ommatidium. Most fleas have a pair

of small simple eyes (ocelli), although some are blind, usually

those which live on hosts with underground burrows.

Antennae are short and can be folded into grooves in the

head, mouth parts are piercing-sucking, coxae are long and

tarsi are five-segmented, cerci are small and one segmented,

and wings are absent.

Fleas are flattened from side to side (laterally, as opposed to

dorsoventrally in most insects); this is a useful adaptation to

enable them to move easily through the hairs or feathers of

their host. Their length ranges between 1-6 mm; they are oval

in shape and light to dark brown in color. The small head has

a proboscis that projects down wards and small antennae

recessed into grooves. Fleas have powerful legs adapted for

jumping and can leap 10-15 cm. The abdomen is the bulkiest

part of the body and is conspicuously segmented. The ending

is rounded in the female, whereas in male the genitalia are

apparent.

Metamorphosis is complete. Eggs are oviposited on the host

or more often in the host’s nest; in the former case, eggs fall

off prior to hatching. The legless larva feeds upon such

organic matter as may be available including fecal material

from adult fleas that contains blood residues. Pupation is in

silken cocoons. Adults feed on blood from either birds or

mammals, the latter being more common. Some species

predominantly live on the host, but if the host has a nest,

many species of fleas leave the host during non-feeding

periods. Beyond irritation, fleas are of medical importance to

humans through disease transmission. Fleas are vectors of

plague (bubonic form) and endemic or murine typhus. Several

species of tape worm can, but not commonly, infect humans

after utilizing the flea as an intermediate host. In the tropics,

the chigger flea attaches itself to humans and can initiate

severe lesion. Fleas can also become pests to such

domesticated animals as dogs and cats.

They are vectors of disease. They are associated with

mammals including man. All mammals have fleas of their own

(dogs, cats, etc). Diseases from these animals could be

transmitted to one another and to human beings. The bubonic

plague is an epidemic between rats, flea and man.

• Fleas are also causes for chigger on man and

other animals.

• Fleas are annoying and irritating.

**Order Hymenoptera**

These are insects having wings which is membrane like. They

include the ants, bees, and wasps. Their sizes range from

0.21 to 65mm in length, excluding the appendicular ovipositor.

Characteristics include filiform antennae, chewing or chewing-lapping

mouthparts, large compound eyes except for ants,

long legs with five segmented tarsi, cerci minute or absent,

and wings absent or two pairs that are long and narrow with

fused venation. Metamorphosis is complete. They are

described as socially organized groups with labor division and

cast system. Through instinct they behave like civilized. The

queen is the organizer and the mother. The workers are sterile

females; collect nectar, fight enemies, clean the home,

remove dead body, etc.

Hymenoptera, all posses’ two pairs (four) of wings; are fliers

(ants though initially have wings loose them because they are

not firmly attached to the body). The groups of this order have

mouth parts of the chewing type (chewing mandibles). The

mouth of bees has saw like structure and is also adapted to

sucking.

**Biological use:**

• Bees, wasps: cross pollination of plants.

• Ants: serve as biological control means by feeding

on larvae of others destroying unnecessary pests

as in orchards and gardens; certain ants kill

cockroaches in dwellings.

• Help clean the environment-feed on some wastes

from homes and kitchens such as bones, flesh,

orange peel, etc.

**Vector ness:** Not of significant role due to their habitat, but

rarely may serve in mechanical contamination

since certain species of ants readily enter

houses and are attracted to human food, they

are capable of contaminating such foods with

viable pathogens on their bodies or in their

digestive tracts or mouth parts.

**Order Lepidoptera:** “Lipid” means scale, and “ptera” means

wings)

The order Lepidoptera comprises of the moths and butterflies.

These are the most beautiful of all insects; so are frequented

as collectors’ items. Color is the result of not only of pigments

in the hair and scales, but also from structural ridges and

layers that reflect light differently to cause iridescence.

Antennae vary greatly and are useful in identification.

Groups of this order have two pairs (four) wings, but also

absent in some (rarely). The adults have sucking type mouth

parts. They are of advantage in plant cross-pollination and

some are silk producers (cocoon of the bombidae family = silk

worm); nevertheless their larvae are the greatest economical

destructors. Their being a vector is not of significance. All

Lepidoptera go through a complete metamorphosis, eggs

being laid on the food, plant or other material on which the

caterpillar-like larval stages feed. In addition to true legs on

the thorax, these larvae have several pairs of stumpy false

legs (pseudopods) on the abdomen (in comparison with the

beetle larvae which do not have pseudopods). The pupal

stages are in the form of a chrysalis, often in a web or cocoon.

Examples of larvae of Lepidoptera which are known for their

economical destruction include: the army worm, the cloth

moth, plant worms

**Order orthoptera**

Orthroptera are insects having straight wings. These Include

such insects as grass hoppers, preying mantids, katydids,

crickets, walking stick, etc. All possess chewing mouth parts,

long legs with 1-5 segmented tarsi, and large compound eyes.

Wings are usually present and have many veins and are

modified with the fore wings often narrowed and thickened into

a tegmen, where as the hind wings are broad, membranous,

and folded fanwise under the mesothoraxic pair. Flight is

mainly through action of the hind wings. Stridulation or sound

production by scraping is a means of attracting mates. An

appidicular ovipositor is common and often measures as long

as the abdomen. Cerci are often short. Antennae commonly

are elongated and multi segmented. Size ranges from 12mm

to over 250 mm in length. Egg laying is variable some eggs

deposited in the soil (short-horned grasshoppers), but others

are deposited in or on vegetation (long-horned grasshoppers).

Metamorphosis is incomplete. Most orthoptera are

herbivorous, but some are carnivores (mantids). Some

species are of economic importance e.g. grasshoppers have

been pests of crops through out recorded history, especially in

the temperate and arid regions of the world. Field crickets may

damage seedlings in truck crops.

**Dictyoptera (cockroaches)**

Cockroaches are an ancient group, extending back to the

Silurian and showing little change in general structure since

the Devonian, some 320 million years ago. Though pest

species are for the most part cursorial (running) insects and

nocturnal, many others are active diurnal fliers, inhabiting

tropical forests. Others live in the ground or under stones,

boards, or various types of rubbish; some are commensal or

suspectedly so in nests of ants, termites, or wasps; some

inhibit rodent burrows or live in caves in association with bats;

some are even aquatic or bore into decayed wood.

Cockroaches are usually flattened dorsoventrally with a

smooth (sometimes pilose) integument, varying in color from

chestnut brown to black in the more pestiferous houseinvading

species, but are frequently green, orange, or other

colors, specially in the tropical species. The prominent

antennae are filiform and many- segmented. The mouth parts

are of the generalized biting-chewing type (orthopteran).

There are two pairs of wings in most species; in some, the

wings are vestigial; in others, for example, *Blatta orientalis,*

they are well developed in the male and short in the female.

The outer pair of wings (tegmina) is narrow, thick and leathery;

the inner pair is membranous and folds fanlike.

The cockroaches are mechanical disease transmitters

because of their dirty living and feeding habits, as well destroy

property in homes: (they can destroy book bindings and

practically eat every human food including human waste).

Their body parts (if inhaled as dust contact) produce allergy to

some people.

The so called domiciliary, domestic, or synanthropic species

are becoming adapted to living in close association with man

in homes, restaurants, hotel kitchens grocery stores, rest

homes, dump basements where food is available, sewer

systems connected with any of the above or other man made

structures that provide sufficient moisture, food, and hiding

places; they carry contaminants to human food, pollute air with

their allergens, produce their characteristics disagreeable

odors, and degrade the environment aesthetically

Cockroaches.

Cockroaches favor environments where both human

pathogens and human food are found and they pass readily

from one to the other. They may carry pathogens in and on

their bodies, and these may remain viable on the cuticle and in

the digestive tract and faces to the extent that the insects may

even be chronic carriers.

**Order Coleoptera:**

“Coleas” means sheath or cover and “ptera” means wings.

This group is identified by having two pairs (four) of wings and

mandibulate (biting-chewing mouth parts). They vary from

small to large, often sturdy and compact, heavily sclerotized or

armored, with fore wings modified as rigid elytra covering

folded hind wings at rest, legs variously modified, often with

claws and adhesives structures. Immature stages (larvae) are

terrestrial or aquatic with sclerotized head capsule and

opposable mandibles.

The coleopteran pass through complete (complex)

metamorphosis. They are the largest in the number of

species (277,000) compared to other animal groups. The

order of coleoptera is the beetles and the weevils. Examples

of beetles are tiger beetle, whirligig beetle ground beetle, and

diving beetle. Examples of some weevils are boll weevil, bean

wevil and root worm. Some coleopterans are scavengers

(dead plant eaters= Phytophagous and dead animal eaters =

Saprophagous) and some others are predators; hence aid as

environmental cleaners. Examples of scavenger/predator

beetles:

• Scarab beetle: removes human and animal wastes

(excreta)

• Carrion beetle: feeds on dead bodies (carcass).

• Rove beetle: snail eater

However, most are well known as economically destructive

groups; example:

• Weevils: spoil cotton, grains

• Beetles: destroy potatoes, wood, skin and hides

(e.g. Torgidae and dermastidae are two species of

beetles which are eaters of skin and hides)

The beetles form the largest of the insect orders. They are

extremely varied in size, shape and habitats. Only a few

species are of public health significance, feeding on stored

products, clothing, furnishings and wood. Beetles go through a

complete metamorphosis in their life cycle. The larval stage

often the most destructive, but many adults are also of

economic importance. Beetle larvae have a conspicuous head

capsule and six legs on the thorax. They do not have the

stumpy false legs (pseudopods) which moth and butterfly

caterpillars have on the abdomen.

Beetles may be found in land (soil), plants, or in water bodies.

Some groups of coleopteran are vectors or may release

harmful chemicals. Examples: - Mechanically scatter

microorganisms (contamination): scarb beetle-works on

human excreta.

• Chemically skin blistering: Meloidae groups.

• Some serve as intermediate hosts of helminthic

parasites.

• Accidental invasion of natural body openings by

beetles is also common.

**Order Isoptera**

The termites (white ants) are grouped in this order. They have

two pairs (four) wings although temporarily used. Termites

vary from 2mm to 12mm in length, except for physogastric

queens. Termites are characterized by a prognathic head,

moniliform antennae with from 9 to 30 segments, chewing

mouth parts, short and stout legs with four-segmented tarsi

normal, 1 to 8 segmented short cerci, and an absence of

wings except for the reproductive caste. Wings, when present,

are longer than the body and are membranous. Fore and hind

wings are similar in shape and size. White termites are of

great biological and economic importance. In the tropics and

in forests their feeding recycles nutrients and aids in soil

development. In other instances, however, their eating is in

direct conflict with humans. Since Isoptera feed upon paper,

wood, and other similar cellulose goods, they cause

considerable damage.

The life cycle of termites is a gradual (incomplete)

metamorphosis. All termites are social. Being socially

organized, they have labor divisions: queen (mother), soldiers,

workers. Termites are destructors in economic sense as they

are able to ruin, destroy or spoil house, plants and the soil.

The termatica is the house of subterranean termites; spoils

crop, forest, grassland and the soil.