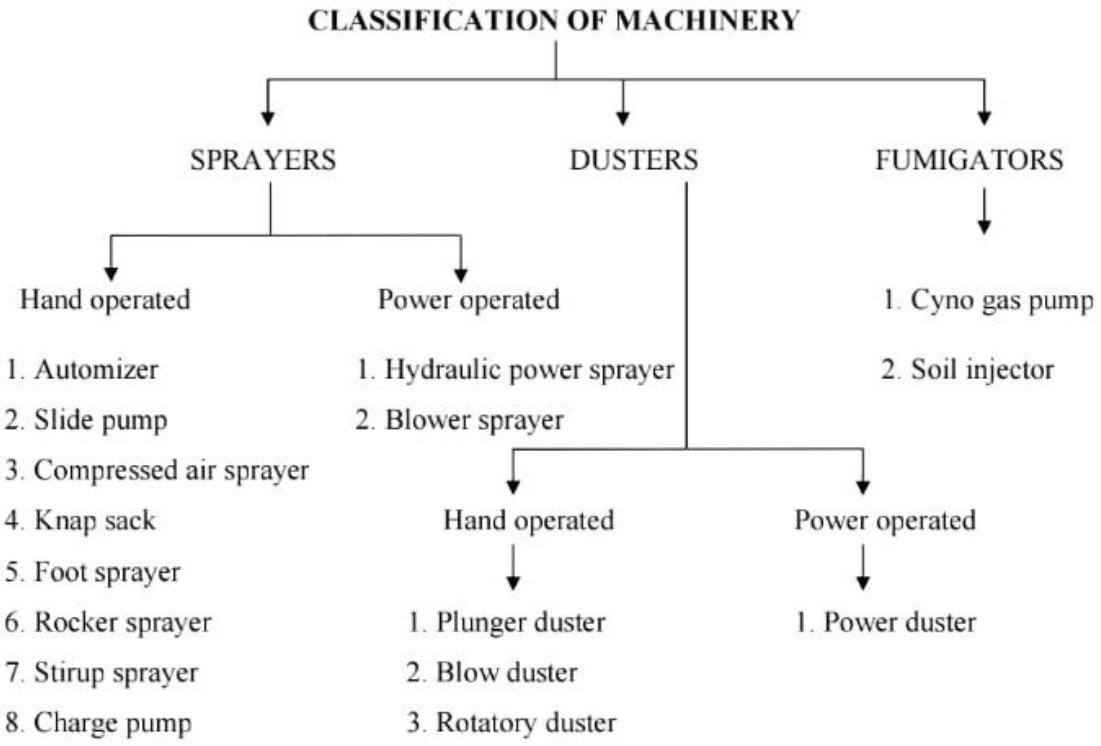
Ex No: 8

PESTICIDES APPLIANCES: HANDLING AND THEIR MAINTENANCE

For the effective control of pests infesting crops in fields or grains during storage, different types of pesticidal machineries are used and their selection mainly depends upon habit and habitat of the pest, type of the crop and its area to be treated etc. The efficiency of machinery is reflected by the ability to cover maximum area and mortality of insects with minimum use of the chemical. This is possible only when uniform spray is discharged by the equipment and it covers larger area. In order to meet out these requirements, different types of machineries have been designed and developed. They may be grouped as follows:

i) **Sprayers:-** They are mainly used to spray the fluid.
ii) **Dusters:-** They are meant for dusting the chemicals.
iii) **Fumigators:-** By and large they are helpful in fumigating the soil or food commodities.

The various pesticidal application methods and equipments in use have conviniently been classified and depicted in the following chart.



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SPRAYERS

The liquid formulation of insectides is used with the help of a sprayer and the qualities of a good sprayer are given below:

1. It should discharge uniform spray on the treated material.
2. The metal used for the construction of a sprayer should not react chemically with the insecticide and must be strong enough.
3. The construction should preferably be simpler so as to clean difficulty.
4. Sprayer should treat maximum area in minimum time.
5. Solution must be broken down into very fine uniform droplets before it reaches the materials to be treated.
6. Spray must cover the desired distance and height.
7. There should not be any wastage of chemical either through leakage or falling from the sprayer when using it in field.

The description of some commonly used hand operated sprayers is given below:

A. Hand Automizer (Flit Pump)

It is generally used to kill mosquitoes, houseflies etc. by spraying the chemical in houses. This type of automizer does not give a continous spray, but spray fluid comes not only when it is pumped like a syringe. It has following parts:

a) **Barrel:-** It is hollow cylindrical and tin made barrel which measures 25 cm in length with a diameter of 4 cm. It is connected to the cap of tank on the lower side of the anterior end and this end of the tube is closed with a small hole in the middle, which is called nozzle. There is a tube (1/8" diameter) projecting from the tank & ending near the just half of the nozzle and it travels upto the bottom of the tank and force liquid in the spray form. The barrel has a small air hole (1/6" diameter) on its posterior end and it acts as an outlet and inlet for the air.

b) **Barrel cap:-** The posterior end of the barrel is also-covered with a lid known as barrel cap which has a hole in its centre through which plunger rod moves.

c) **Plunger rod:-** It is made up of a wire (1/6" diameter) and provided with a wooden handle on the posterior end which helps in the operation of the plunger. On the anterior end of plunger, a washer and a nut are attached and in between, there is one leather valve, which closely fits within the walls of the barrel.

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Draw the diagram:-

d) **Tank:-** It is rounded in shape and have the capacity of half pound. The tank is furnished with a cap known as filler cap.

Working

It operates almost in the same fashion as the cycle pump. First of all the liquid to be sprayed is filled in the tank. In the upstroke, when the plunger is pulled back, the air comes in the barrel through the nozzle and when plunger is pressed forward the pressure is exerted on the air. Since the leather valve is directed forward and is closely fitted within the barrel, the half portion of the nozzle is surrounded by the delivery tube. Therefore, the air of the delivery tube also goes out with the air of barrel and thus resulting in vacuum in the delivery tube. This is occupied by the spray liquid which in turn is thrown out in the form of a fine mist.

B. Hand Compression Sprayer

This type of sprayer is generally used to spray the field crops and trees. It is operated by a single man and it functions like a stove or petromax. This machine is available in two, three and four gallons capacity. By and lage the sprayer has the following important components:

a) **Pump:-** This pump operates exactly on the same principles as a football pump. It is fitted in between the upper end of the tank and hangs inside it. The pump has handle, plunger and plunger spring which are visible outside of the tank, whereas barrel, leather

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valve and ball valve are found inside the tank. The function of the ball valve is to check the incoming of the air which is filled in the tank back into the pump.

Draw the diagram:-

b) **Tank:-** It has the cylindrical shape with the upper end convex and is made of brass or copper. The pump is fitted in the middle of the tank and the spray filled through a small opening having a diameter of 1 inch and covered by a filter cap which is situated on the upper end of the tank. The pressure guage is attached just close to it which is meant to determine the pressure of air inside the tank. The bottom of the tank end is connected with other tube. The former tube is called delivery tube, this tube runs parallel to the bottom where as the latter one is a lance. In order to check the flow of the spray liquid by the opreator, there exists one cut off cock between the joint of tubes. Besides; there is one stand that keep the tank in a right position and it is provided with a waist-plate. On the upper side of the tank, there is one circular plate around its body which is fitted with buckets. Each bucket is attached with the strap and at the distal end of each strap the hooks are provided. During spraying operation these hooks are connected with the waist plate.

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Working

Before, spraying operation, the liquid is filled in the tank preferable upto $3/4^{th}$ of the total capacity of the tank. Thereafter the pressure is developed by pumping to the level of 55-60 psi (per square inch). Following this, sprayer is fitted on the back of the operator with the help of buckets, straps, hooks and waist plate; Then the cut-of cock is opened which is just near the bottom of the tank to fill the spray liquid in the form the spray of the liquid, the other cut-off cock which is fitted at the base of the extension rod is opened and thus the spray liquid is thrown out through nozzle in the form of a fine mist by the force of air pressure. In this type of machine the spraying is continued as long it is desired.

C. Paddle Pump Sprayer

This type of sprayer is more suitable to field crops and particularly the trees which are upto the height of 20 feet.

An iron stand is provided as base to this sprayer. This machine is assembly of a plunger, a stand suction hose, delivery hose and an extension rod having a spray nozzle at its free end. Since this is a foot operated sprayer, a paddle is attached to the plunger rod to make its up and down movement which ultimately operates the sprayer.

Working

No tank is provided to this sprayer but a separate bucket containing spray liquid works as a tank. A suction hose which is generally 2 in long and having a strainer at its free end is dipped in the spray liquid when the pedal is pushed down with the foot. The plunger is pushed up in the body of pump thus the air is compressed and moves out of the delivery tubes. The vacuum thus created results in the filling of the suction no tube with spray liquid. Continuous padling is required which sucks the liquid mixture into the body of the sprayer and is released through the delivery tube to the lance and finally through the nozzle which can be adjusted for desirable mist. One sprayer with a nozzle is enough to spray one hectare of a medium sized crop in day.

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Draw the diagram:-

D. Power Sprayers

The manually operated sprayers are used for small holdings (up to 4 hectares) and for large scale spraying, power sprayers are required. Broadly, they may be classified into three groups:

i. Engine mounted power sprayer.
ii. Tractor mounted power sprayer.
iii. Aeroplane sprayer.

On the basis of amount of liquid sprayed and concentration of insecticide, they a be classified as follows:

i. Low concentration and high volume sprayer.
ii. High concentration and low volume sprayer.
iii. Mist blowers and fog or aerosols generator.

(i) **Low concentration high volume sprayer-**

This is the simplest form of power sprayer in which power is generated by a petrol or diesel engine of one or more cylinders and may have the capacity of 10 to 270 liters per minute. There is provision for overflow with a mechanical arrangement for agitation of spray liquid in the tank. The air chamber has a sturdy structure and helps in maintaining a high pressure of 25 kg per sq cm. The engines are generally of 1 to 20 H.P. depending on the

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pump's capacity and pressure range. They draw the power is taken off the tractor. In such type of sprayers the spray liquid is forced out through the nozzle in small droplets under pressure developed by the pump. The droplets are deposited on the surface sprayed by the sheer force of the spray. The delivery hose varies from 25 m to 103 m or more in length and is provided with a hand operated spray gun which has a control valve mechanism for adjusting the spray pattern. In these sprayers the concentration of the spray liquid is low, quantity of spray used per hectare is about, 1,120 litres and the particle size is big.

(ii) High concentration low volume-

In these sprayers a relatively small volume of liquid is automised by a large volume of air high velocity. The principle involved is the same as in the case of hand automizer. They produce a much greater degree of automization than the nozzles used in low concentration sprayers as the spray liquid is discharged at 7 kg per sq cm. These sprayers work by compressed air or have a rotary fan and a propeller turbine for production a current of air blowing at very high velocity into which a small quantity of spray material is introduced by gravity or with the help of a high pressure pump. In this case only 10-110 litres of the spray liquid is necessary, for one hectare. Special nozzles are required for these sprayers and generally the insecticides are used in E.C. form because wettable powders may clog the nozzles.

Draw the diagram:-

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(iii) Mist blowers-

These sprayers work on the same principle as the low volume high concentration sprayers; the only difference being that the droplets are broken into particles of small size ranging from 50 to 100 micron.

The fog or smoke generators have been developed to disperse the spray material in extremely fine droplets (1 to 50 microns in diameter). The setting of aerosol droplets is very slow and as such is very much affected by the prevailing wind currents. This type of equipment can be successfully used where the foliage is dense and where fog takes time to settle and does not drift with the wind. A fog machine consists of tank with or without the engine and thermal or mechanical arrangements to break up the liquid into the desired droplet size and to create a force for carrying the fog from the machine.

E. Knapsack sprayer:

Knapsack sprayers have tanks of fertilizer, insecticide or herbicide that gardeners wear on their backs to spray gardens or trees. The gardener controls a nozzle with his right hand and a pump handle with his left hand to keep up the pressure in the tank.

a) **The Tank:** Knapsack sprayers usually have 2 to 5 gallon tanks. These can really cut into your back with prolonged use. You can add Styrofoam (and duct tape) to make them fit more comfortably on shoulder bones and lower back. Sprayers should always be stored with a clean, empty tank. Fill the tank with plain water and spray it all out. This is especially important after using a herbicide (flush two times), because if your next use is insecticide the residue of herbicide can damage your plants. Never use chlorine or Clorox as this will damage the mechanism. Always mix dry ingredients before putting the mixture in the tank (do not mix in tank) by putting half the water in a container, then the dry ingredients, then the rest of the water. For liquid active ingredients, put the water in the tank first then add the liquid.

b) **The Nozzle:** The nozzle tip forms the spray pattern. The tip is one of several components that screw into each other at the end of the spray wand. Most sprayers come with multiple tips--one for spraying narrow streams and another for spraying wide streams. There are also adjustable tips (mist to steady stream) and connections (called booms) that have multiple nozzles for spraying between several rows at once. In the tip assembly there is also a screen that should be cleaned occasionally. The screen is located near the interchangeable tips. Unless you are using a variable nozzle or a boom, the typical tip delivers 0.3 to 0.5 gallons per minute.

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c) **The Pump:** It is necessary to keep pressure in the tank so the liquid in the tank will spray out when the trigger is pulled. You should pump the handle 10 to 15 times when starting out and once every 5 seconds while working. Check the pressure gauge the first few times you use the system to be sure you have the rhythm of pumping that keeps the pressure steady. The pressure gauge (and the release valve and the cap on the top of the tank) should be kept oiled so that the seals are solid. Otherwise you will lose pressure. The normal pumping rate (when walking 4 feet per second) is a little over 15 gallons per acre for a spray width of 3 feet and a 0.3 gallon per minute tip, or a 6-foot spray width and a 0.5 gallon per minute tip, if the pressure is consistent.

Draw the diagram:-

DUSTING MACHINERY

1. Hand Rotary Duster-

The apperance of this duster is larger as is operated by fitting it to the left side of the operator. It is basically made up of a blower, gear box and a hopper. These are of hand-carried type of shoulder mounted type of dusters.

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Draw the diagram:-

a) **Hopper:** This is a drum shaped container which has the capacity generally of 5 kg. The hopper should not be filled more than three fourth of its capacity. A brass is attached on the back side of the hopper. Two banded iron bars known as agitator are connected with a crank shaft which passes through the centre of the hopper. These agitators move the dust continuously inside the hopper on the fan side which propels the dust into the blower through the exit hole situated in the hopper. To regulate the discharge of the blower feed regulator is provided on the outer side of this exit hole.

b) **Gear box:** There is a box like structure attached to the blower on the right hand side of the drum and consists of four gears. Crank shaft is the main attachment to which the largest gear A is fitted in the centre of the box. This gear rotates a small double gear B with its grooved connections. Similarly, gear B rotates another duble gear C and finally to smallest gear D which is attached to the fan shaft. This gear system helps in causing many rounds of gear D for one round of gear A and thus fan moves very fast. To operate the main gear one bended iron rod is linked with the crank shaft and called as crank.

c) **Blower:** This is a closed round shaped structure which opens to the opposite side of the drum through a small projected opening generally 1" in diameter. A fan provided with five blades arranged longitudinally is fitted in the centre of the blower. Rotation of this fan throws the air outside to create vacuum in the blower which is further occupied by the dust

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from the hopper and air from wire netting provided on the left side of the blower. The projected end of the blower is connected with a long tube known as lance which is fitted with a triangular reflector at its distal end.

Working:

Dust should not be filled more than the 3/4 of the capacity of the hopper and this mist be closed tightly with its lid. The duster is tied to the left side shoulder of the operator with the help of straps provided with the duster keeping the breast plates on the chest. Lance is attached to the blower properly and reflector is also adjusted according to the need while operating the duster. Operator should move slowly forward in the direction of the wind rotation the handle continuously to ensure the uniform dust coverage of the crop.

There are other types of dusters also namely plunger type, blower type, knapsack type, fan type and power dusters, but they are not very common in use.

2. Power Dusters:

These are operated by Means of an engine or a tractor power take off (PTO) device. A power duster comprises a hopper containing one or more agitators, a regulator for controlling the discharge of dust, a fan or blower producing an air blast for drawing in the dust from the hopper and blowing it out and flexible pipes with nozzles. The dust regulation device adjusts the dust flow at desired rate ranging from 1 to 10 kg per minute. The machines have arrangements for mixing a blast of air current with the powder. The mixed stream blowing out at velocity of about 320 km per hour.

Draw the diagram:-

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The fans provided re mostly of centrifugal type. The fan case provided with one Outlet o r a series of four to eight or more outlets. These outlets are connected with flexible pipes to nozzle arranged on a boom in the rear of the tractor for carrying the dust. A power duster with one outlet can dust 12 to 16 hectares per day, depending upon the crop height and dosage.

Dusting versus spraying:

1. Dust can be used where water is limited or scarce.
2. Dusting is a quicker process as compared to spraying.
3. Sprays are more effective than dusts having the same amount of toxic chemical.
4. Sprays are not affected so much by wind as the dusts.
5. Excess of spray applied simply runs off, keeping safety value against excessive deposits.
6. The cost of dusts is comparatively low than the sprays.
7. The equipments required for spraying are comparatively costlier and heavier than the dusters.
8. In the case of dusting uniform deposition is not possible, while in case of spraying it may be obtained upto a great extent.
9. Dusting is preferred in morning hours, while the spraying during evening hours.

Care and maintenance of plant protection equipments:

The following measures may be observed to keep the machines in good working order:

1. Clean the machines properly and store them in dry place when not in use.
2. Flush the equipment- with clean water to wash inside parts of containers, tubes and nozzles to keep them free from chemical.
3. The hoses and nozzles of the sprayers should be thoroughly washed with clean water after use and then kept dry. Similarly, the dust from the duster should be taken out and cleaned with a cloth.
4. The moving parts should be greased and oiled regularly.
5. Keep the machines in working order by following a regular maintenance programme.
6. The oil should be kept-at the required level in the power equipment.
7. Rubber hose should not be bent at angle when in use and should be removed and kept rolled when not in use.

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8. Always stock spare parts, washers, nozzles etc. for replacements when the old parts get worn out.

Inspect pump valve seat, p

9. unger cups and packing at least once in a year to check leakage from these parts.
10. The spray liquid should be strained so as to avoid clogging of the nozzle and the delivery tube.
11. Test pressure regulator and pressure gauge periodically for efficient functioning of the sprayers.
12. Change oil regularly in the crank case to prevent corrosion of the bearings, gears and shafts.

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Ex No: 9

IDENTIFICATION OF BIOCONTROL AGENTS

Objective: To study and identification of different important biocontrol agents

1. Predator:

"A free-living organism throughout its life, it kills its prey, is usually larger than its prey and requires more than one prey to compete its development.

Characteristics:

- A free living organism throughout its life cycle and usually with long life cycle
- Requires several prey to complete its development
- Larger than its prey
- Kill their prey immediately
- Usually both immature and adult stages are predatory, except some cases eg. Blister beetle larvae feeds on eggs of grasshopper, whereas the adult feeds on flowers

There are some important predators with their taxonomical characteristics are given below:

Order : Odonata
Sub order :Anisoptera Eg. Dragon fly
Sub order : Zygoptera Eg. Damsel fly

- Relatively larger sized insects
- Immature stages are aquatic (naiads) feeding on aquatic insects
- In naiads, labium is modified into a prehensile organ called mask for catching the prey
- Adults feed on midges, mosquitoes, flies and small moths
- Adults are capable of catching prey during flight with the help of basket shaped legs

Order : Dictyoptera
Family : Mantidae

- Preying mantids are large elongate insects
- Nymphs and adults are cryptically coloured with long prehensile raptorial forelegs

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- Highly predaceous feeding on variety of insects like flies, grasshopper and many caterpillars Eg. *Mantis religiosa*

Order : Hemiptera

Family : Reduviidae

- Assassin bugs or cone nose bugs or kissing bugs
- Usually blackish or brownish in colour
- The beak or proboscis is short and three-segmented
- Most are predaceous and some are blood sucking
- Both nymphs and adults predaceous
- Eg. *Harpactor costalis* on the red cotton bug *Dysdercus cingulatus*

Family : Pentatomidae

- Stink bugs
- Bugs are shield shaped with 5 segemented antennae
- Some of the species are predaceous on lepidopterous larvae
- Both nymphs and adults are predaceous
- Eg. *Eucanthecona furcellata* on the larvae of red hairy caterpillar, *Amsacta albistrilga* and gram caterpillar, *Helicoverpa armigera*

Family : Belostomatidae

- Giant water bug
- Elongate oval and somewhat flattened with raptorial forelegs
- Feed on variety of aquatic insects

Family : Miridae

- Elongated soft bodied insects
- A few species are predaceous
- Eg. Green mirid bug, *Cyrtorhinus lividipennis* feeds mainly on the eggs and early stage nymphs of green leaf hopper (GLH), brown plant tapper (BPH) and white backed plant hopper (WBPH) in rice

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Family : Veliidae

- Ripple bugs
- Aquatic insects living on the surface of water
- Brown or black in colour
- Eg. *Microvelia atrolineata* feeding on the first instar catarpillar of lepidopteran pests and GLH, BPH and WBPH in rice ecosytem

Order : Neuroptera

Family : Myrmeliontidae

- Antlions
- Larvae construct pit falls and remain buried in the soil
- Feed on the ants and other insects that fall into the pits
- Feed by inserting the mandibulo - suctorial mouth parts into the prey and sucking the internal contents

Family : Chrysopidae

- Aphidwolfs, aphidlions or green lace wing
- Adults are green in colour with golden or copper coloured eyes
- Feed on more than 18 families of insects
- The larvae are predaceous mainly on aphids and also on eggs of lepidopteran insects, psyllids, coccids, thrips and mites
- Larvae have sharp mandibles
- The eggs of aphidlions are stalked (pedicellate)

Order : Diptera

Family : Asilidae

- Robber flies
- Adults are mostly elongate with tapering abdomen
- Body is covered with dense hairs
- Legs are long, strong and well developed
- Adults are predaceous and attack a variety of insects like wasps, bees, grasshoppers, flies etc
- Mouth parts are piercing type. They feed by sucking the body fluid of the prey

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Family : Syrphidae

- Hover fly adults are brightly coloured and resemble various bees and wasps
- Good pollinators
- Maggots are green in colour and feed on aphids by sucking their body fluids

Order : Coleoptera

Family : Coccinellidae

- Lady bird beetles
- Beetles are small, oval, convex and often brightly coloured
- Grubs are elongate, somewhat flattened and covered with minute tubercles or spines
- Adults and grubs feed on aphids, coccids, mealy bugs, whiteflies and other soft bodied insects
- Except one or two species in the family all are predaceous
- Eg. *Rodolia cardinalis* on cottony cushion scale, *Icerya purchasi*

Family : Carabidae

- Ground beetles
- Dark in colour and shiny and somewhat flattened
- Most of them feed on caterpallar
- Eg. *Anthia sexguttata*, *Ophionea indica*

Family : Cicindelidae

- Tiger beetles
- Beetles are very active and brightly coloured
- They run and fly rapidly
- Both adults and grubs are predaceous
- Adults capture the prey with sickle shaped mandibles
- Eg. *Cicindela spp.*

Family : Staphylinidae

- Rove beetles
- Eg. *Paederus fuscipes* feeds on rice leaf folder

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Order : Hymenoptera

Family : Vespidae

- Wasps collect various insects and feed their larvae with them
- Mudwasps construct nests made of mud and provide caterpillars for the young ones in the nest

Family : Sphecidae

- Digger wasps construct nests made of mud and feed its young ones with insect caterpillars

Family : Formicidae

- About half the members of the family are predaceous upon insects

2. Parasitoid:

"A parasitoid is an insect parasite of an arthropod which is parasitic in immature stages and adults are free living".

Adult parasitoids seek out their host in the environment using a variety of olfactory and tactile cues from the host and its habitat visual. The female lays eggs in, on or near the host. Parasitoid larvae feed on host tissue, but may not kill their host until they develop to adult stage. Most insects parasitic upon other insects are protelean parasites i.e. parasitic only in their immature, larval stages and lead free life as adult. Adult parasitoid requires food such as honeydew, nectar, pollen, host body fluids and water.

There are some important parasitoids with their taxonomical characteristics are given below:

Order : Hymenoptera

The ovipositor originates and protrudes ventrally from the abdomen and is used to insert eggs into their hosts. There are three super families.

Super Family : Ichneumonoidea

- Possess long and filiform antennae
- Wings are veined

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Family : Ichneumonidae

- Eg. *Eriborus trochanteratus*, a larval parasitoid on coconut black headed caterpillar, *Opisina arenosella*
- Antennae longer with more than 16 segments
- Trochanter two segmented
- Possesses two recurrent veins and rarely one
- Abdomen three times as long as the rest of the body
- Ovipositor longer than body
- Large slender black, yellow or reddish yellow insects
- Larvae are endo or ecto parasitic on many groups of insects and spiders

Family : Braconidae

- Eg. *Bracon brevicornis*, a larval parasitoid on *O. arenosella*, *Chelonus blackburni*, egg larval parasitoid on cotton spotted bollworms, *Earias spp.*
- Adults are relatively small, more stout bodied than ichneumonids
- Abdomen is about as long as the head and thorax combined
- Not more than one recurrent vein
- Adults not as bright as ichneumonids
- Mostly endoparasitic on lepidopteran larvae

Super Family : Chalcidoidea

- Mostly smallest parasitoids and gregarious
- Antennae geniculate
- Abdomen very short or globular with very slender propodeum
- Wings without veins

Family : Chalcididae

- Eg. *Brachymeria nephantidis* a larval parasitoid on *O. arenosella*
- Minute insects
- Abdomen humped
- Hind femur enlarged and toothed
- Wings are not folded longitudinally when at rest
- Ovipositor straight and short

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- Parasitic on Lepidoptera, Diptera and Coleoptera

Family : Trichogrammatidae

- Eg. Trichogramma chilonis, an egg parasitoid on many lepidopterous pests
- Mostly egg parasitoids
- Minute insects (0.3 to 1.0 mm long) with three segmented tarsi and broad and elongated fore wings with rows of microscopic hairs on them
- Hind wings reduced with hairs

Family : Eulophidae

- Eg. *Trichospillus pupivora* and *Tetrastichus israeli*, pupal parasitoids on *O. arenosella*
- Adults have four segmented tarsi
- Many have brilliant metallic colouring
- Males of many species have pectinate antennae
- Mostly parasitic on aphids and scales and some are on pupae of Lepidoptera

Super family : Bethyloidea

- Smaller than Ichneumonoidea and larger than Chalcidoidea

Family : Bethylidae

- Eg. *Parasierola* (*Goniozus*) *nephantidis*, a larval parasitoid on *O. arenosella*
- Small to medium sized, usually dark coloured wasps
- Females of many species are wingless and antlike in appearance
- In a few species, both winged and wingless forms occur in each sex
- Parasitic on Lepidoptera and Coleoptera

Order : Diptera

Family : Tachinidae

- Eg. *Sturmiopsis inferens*, a larval parasitoid on sugarcane shoot borer, *Chilo infuscatellus*
- Large bristle flies
- Eggs may be macrotype or microtype

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- Macrotype eggs are laid directly on the host's body usually attached to the neck region by a glutinous secretion
- Eg. *Spoggosia bezziana* on *O. arenosella*
- Microtype eggs are laid on the host plant and the host larvae feeding on the plant tissue ingest them

Order : Lepidoptera

Family : Epiricanidae

- Eg. *Epiricania melanoleuca*
- Parasitic on nymphs and adults of sugarcane leafhopper, *Pyrilla perpusilla*

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