

## (B) INVESTIGATORY PROJECTS

A student of science must have scientific attitude. Whatever researches or investigations are carried on in the field of science they fulfil two aims firstly, knowing facts of science & secondly, finding the truth. These in turn help in developing reasoning ability. There is a definite pattern to perform scientific task called as scientific method. To work scientifically one has to apply own understanding thus one can develop reasoning capacity. In other words provision of investigatory project aims at acquiring a complete scientific attitude. The syllabus of biology practicals includes a project or investigatory experiment to develop the concept of original thinking, planning and performing it scientifically. Students are supposed to do by themselves first and second step of scientific method, i.e. observation and identification of problem which are given here in the form of a few projects. Further, what has to be done to achieve the goal, which experiment has to be designed etc. will be done by students.

### How to execute and write a project report:

The aim of the project is to encourage the inquisitiveness to search for the reasons and causes. To carry out any project, first the student must work out a plan. Then enlist the task or experiment to be performed so as to calculate the time which will be required. If the student needs to frame or prepare a model then it should also be kept in mind. When the experiment is over then time should also be spared to record observations and their analysis.

### Application of Equipments and Working plan :

The student must plan his/her experimental work

and to do so one should have thorough knowledge of the laboratory and literature. Student must very well learn the methods, techniques to use the apparatus, to prepare required solutions and reagents. Accurate and minute observations have their own significance. While doing experiments keep record of observations step wise. This is another important aspect of investigatory experiments. It should be preplanned that how the records are to be preserved. Obtained data and correct statistical analysis can help us to achieve success in the project, therefore, one must collect the records consciously. Student can preclude the results only on the basis of collected data. Conclusively student must comprehend the illustrations and data under following headings:

1. **Preface :** This sort of introduction of the project like why such and such project has been selected and in nutshell what are the basic results. Lastly, the hypothesis framed can be mentioned.
2. **Experimentation :** The method adopted, instruments/apparatus used and the technique applied to use them must be included.
3. **Result/Inference :** Explanation of observation and the recorded data along with the interpretation.
4. **Conclusion :** This is the final result and what has been achieved after going so long, has to be entered here.
5. **Summary :** It is the last but important part of the project writing.

In following pages, important instructions are given for suggested projects. Students can plan, execute and submit them by the end of the session to concerned incharge.

## 1. STEPS IN SCIENTIFIC METHOD

You know that the scientific study is done in various steps. These are observations, identification of problem, making a hypothesis, testing the hypothesis (experimentation), conclusion and formulation of laws or theory. On the basis of these steps some experiments can be done and exhibited. One such experiment is given below.

### 1. Observation and Identification of a Problem

We all have seen that in a particular season different types of living organisms are visible. During the onset of rainy season, frogs are seen in the logged water or insects are seen on the cowdung or moss on the moist soil, centipedes and millipedes are also observed on surface of the soil. Many people think and believe that insects and other things appear on the earth by themselves. Do these insects and animals exist themselves or their existence is also like other animals which take birth from their parents.

### 2. Hypothesis

The students of biology very well know that insects and animals do not exist themselves. Their birth is by sexual or a sexual reproduction. To prove this, life cycle of a housefly can be experimented and studied.

### 3. Experiment

- (a) **Object** : Study of the life cycle of housefly.
- (b) **Material Required** : Two small tin boxes, paper, fresh cowdung, hand lens, needle or pin.
- (c) **Method** : Take two old tin boxes (ice cream cups or small earthen pots can also be taken instead of boxes).
  - (i) Now label the boxes as (a) and (b)
  - (ii) Collect fresh cowdung before any fly sits on it. Put some part of the dung in the box (a) and some part in the box (b).
  - (iii) Allow the fly to sit on the cowdung in the box (b). Watch for half an hour to one hour till the fly sits on it. As soon as the fly sits on the cowdung you will see that some whitish material comes out of its back portion. These are the eggs of fly. By the help of a hand lens observe the shape and size of the eggs.
  - (iv) Now cover the box (b) like box (a) and with the needle make small pinholes. Keep these boxes in safe place in the laboratory for 8 to 10 days for observation.
  - (v) Put few drops of water on the cowdung in both the boxes, so that humidity is maintained. Be careful to see that no fly enters in box (a). Observe cowdung in both the boxes.
  - (vi) After two or three days of the experiment small white larva will be seen on the cowdung in box (b) and there will be no larva on the cowdung in the box (a). If no larvae are seen after 3-4 days in the box (b) then scrub the cowdung with a needle, larva will be seen.
  - (vii) On observing the boxes daily you will see that the size of larva increases everyday. On the fourth to fifth day larva increases in size to form pupa. Pupae lie in one

place. Now study the character of one larva and one pupa with the help of a hand lens.

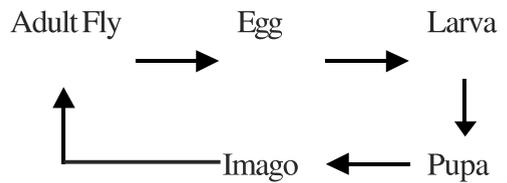
- (viii) In 7-8 days larva will become imago and the empty case of pupa can be seen on the cowdung.
- (ix) No larva, pupa or fly will be seen in the box (a).

**4. Conclusion**

The following conclusion can be made on observing the above experiment :

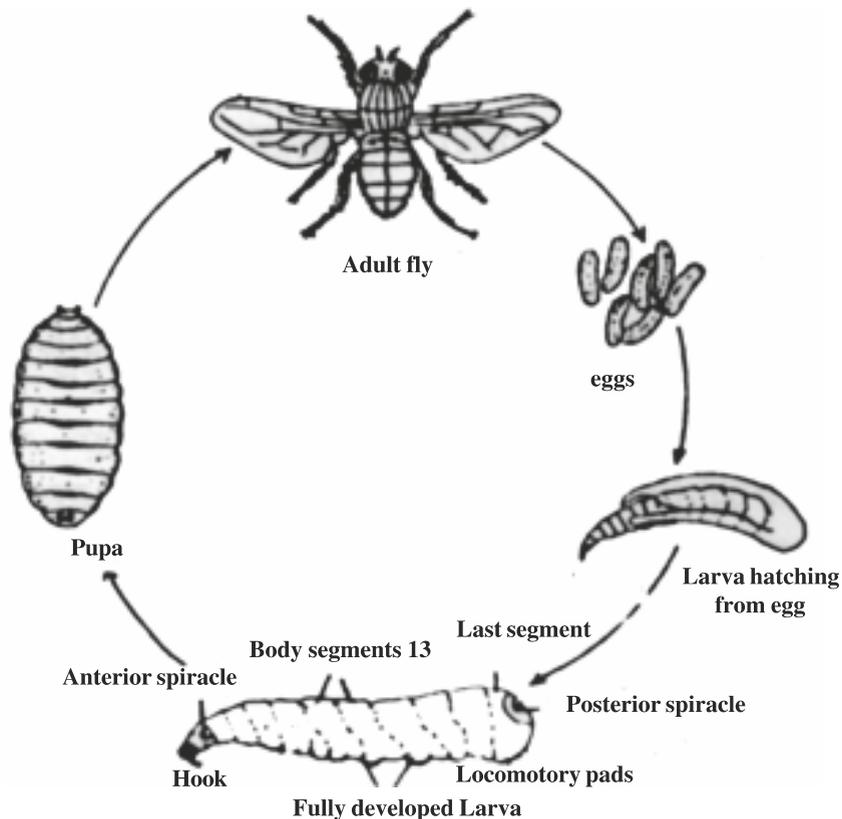
- (i) No appearance of larva or pupa in the box (a) is an indication that the concept of spontaneous origin does not exist. Fly was not allowed to sit in this box. It shows that there were no eggs.
- (ii) The presence of larvae, pupae and small flies in the box (b) shows that life comes from preexisting life.

- (iii) The presence of eggs to imago (small flies) shows the stages of life cycle of fly :



- (iv) The conditions in the box (a) were as of box (b) except that no flies were allowed to sit on the cowdung in the box (a).

For deriving any conclusion the control experiment is a must in the scientific approach. The above experiment represents all steps of scientific method. On the basis of an observation, identification of a problem & making a hypothesis to get the solution, and finally designing experiments to reach the conclusion are the major steps of scientific method.



**Fig. 1.1 Stages in Life Cycle of a house fly**

## 2. Pollution Related Disease

Pollution is one of the major problems today. Plants and animals suffer from many diseases due to pollution. You must observe the effects of water, air and soil, pollution occurring in your locality. If in your city / village or in the nearby areas a factory is present then find out the type of health problems of the workers in the factory normally suffer from. You can get information also from a local doctor. Similarly you can compare the colour, form and growth pattern of plants found near the factory and those found far away and try to find the reasons for it.

In the cities you can easily see the amount of dust collecting on the leaves of plants growing along busy roads. This can affect the photosynthetic activities of the plant which can affect the growth pattern or time of flowering etc in the plant.

Here as examples, you are being told about two diseases each in humans and plants which are due to pollution. On the basis of the above discussion you can find and investigate any other disease and prepare a report on it.

### (A) Pollution related diseases in human beings :

**1. Amoebic dysentery :** This disease happens as a result of drinking polluted water. The causal organism of the disease is a unicellular parasitic protist called *Entamoeba histolytica* which lives in the small intestine of man. These parasites damage the mucous membrane of the small intestine and sometimes also reach the liver through the blood vessels.

Due to damage of the intestinal mucous membrane mucous along with blood is released out along with the faeces. Thus due to the presence of these parasites a person suffers from amoebic dysentery. The symptoms

of the disease are diarrhoea accompanied by blood and mucous. There is periodic severe pain and indigestion.

For the purpose of reproduction the parasite makes a thick wall around itself and is called cyst. These cyst come out from the body of an affected person along with the faeces and mix with the water of rivers and drains, thus contaminating the water. If an affected person does not wash his hands properly with soap after defaecating then the cysts may remain under the nails and contaminate the food and water and the parasites may reenter the body of the same person or affect others in the family also. Sometimes the sewer lines of the city mix with the drinking water lines and contaminate the drinking water.

You gather information about people in your locality suffering from this disease and find out about the cleanliness and personal, hygiene habits of these people and their surroundings.

### (2) Diseases related to breathing :

Due to polluted air and suspended dust particles people may suffer from many respiratory disorders. One of them is asthma and allergy. The incomplete oxidation of fuel (leaded petrol) in the vehicles release carbon monoxide (CO) into the air. This gas is also found in the emissions of steel industry, oil refineries, Cigarette smoke etc. It is a very poisonous gas. It forms a compound with haemoglobin of the RBC and is carried to the lungs where it causes suffocation due to lack of oxygen. Due to this person suffers from tiredness, laziness, headache, blindness etc.

You will find that people living near industrial areas are more commonly suffering from respiratory diseases than the people staying in other areas. You can carry out a survey with respect to this.

**(B) Plant diseases caused due to pollution:**

**(1) Chlorosis :** In many industries ores of Cu, Zn, Pb Ni and Fe are used and from oxidation of their components,  $\text{SO}_2$  is released which comes out from the chimneys of these industries and mix with the air. This gas is also released from motor vehicles, burning of coal, oil refineries, When it mixes with the air compounds like  $\text{SO}_3$ ,  $\text{HSO}_3$  and  $\text{H}_2\text{SO}_4$  are formed. These substances enter the cells of the plants and produce many harmful effects.  $\text{SO}_2$  destroys the chlorophyll of the leaves and it is called chlorosis.

As a result leaves become yellow. Slowly the cells start breaking and the affected part or the entire plant dies. This is known as necrosis.

**(2) Black tip disease of Mango :** In another disease caused by the excess of  $\text{SO}_2$  in the atmosphere, the tip of the mango becomes black. Some of the leaves also become black at the tip. That is why the disease is called black tip disease of mango. In this mango slowly the cells die and necrosis takes place.

These two diseases are caused due to excess of  $\text{SO}_2$  in the air, but can also be caused by disease causing bacteria and viral infection.

You try to observe such symptoms in the plants of busy and polluted areas, around you. Compare them with plants growing in pollution free areas and prepare a report.

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### 3. Medicinal & Economically Important Plants

**(A) Medicinal Plants :**

From ancient times man has been using different kinds of plants to treat various diseases. Most plants producing medicines are found in the wild but some are also cultivated. The roots, stem, leaves, flower, fruit stem, seeds and also the bark of the plants are used for medicinal purposes. The medicinal properties of the plants are due to some chemicals present in the plant which show their effect on the working of the human body. Some important medicinal plants include agar, ergot, aconite, asfoelida, garlic, ginger, turmeric, sandal, belladonna, tulsi, neem, opium, quinine etc. Some of them are described below :

**(1) Neem :** This is a member of the Meliaceae family called *Azadirachta indica*. Neem is very important from the medicinal point of view. It is commonly found in India and Pakistan.

The leaves, stem, flowers, fruits etc. of the plant are all useful. The leaves of the plant help in digestion have carminative, expectorant and

pesticidal properties. The juice of the leaves is used to treat skin diseases and jaundice. It is also used for killing intestinal worms. In our country small twigs of the neem plant are used for brushing teeth from ancient times.

**(2) Tulsi :** Its scientific name is *Ocimum sanctum* and it is a member of family Labiatae. The tulsi plant has religious and medicinal importance. Its plant is found all over India. The leaves of the plant are used as expectorant, anticatarrhal and tonic purposes. The concoction of tulsi is also used for the treatment of cough, liver disorders and malaria.

**(3) Bel :** It is a member of family Rutaceae and is found all over the world.

The fruits are used as a tonic and astringent. It is useful for the treatment of diarrhoea, intestinal tract problem and constipation. From the fruits of bel, a refreshing drink is also made.

**(4) Awla (Gooseberry) :** Its botanical

name is *Embllica officinalis* and it belongs to family Euphorbiaceae.

The fruits of this plant are rich in Vitamin C. They produce cooling effect and also have laxative

and diuretic properties. It improves stomach disorders, eye sight as a constituent in Triphla Churna. The fruit is also used in the preparation of medicinal hair oil.

**The botanical names and the medicinal importance of some plants grown in Madhya Pradesh is given in the following table :**

S.No.	Botanical Name	Medicinal Importance of Plants
1.	(Reserpin) <i>Ranwolfia serpentina</i>	Used in hypertension, snake bite and veneral diseases.
2.	<i>Gloriosa superba</i>	Used in the treatment of false pregnancy and irregular menstruation.
3.	<i>Curculigo orchioides</i>	Used in the treatment of mental diseases and irregular menstruation.
4.	<i>Chlorophytum arundinaceum</i>	Used as a normal tonic and in the treatment of blood pressure.
5.	<i>Octimum basilicum</i>	Used in cough, cold fever and heart diseases.
6.	<i>O. gratissimum</i>	Used in the treatment of nausea, cold and cough.
7.	<i>Curcuma aromatica</i>	Used in the treatment of snake bite, skin diseases, sprains. also used as a blood purifier.
8.	<i>C. caesia</i>	Used in the treatment of leprosy, bruises of skin.
9.	<i>Hiptage bengalensis</i>	Used in the treatment of skin diseases, urinary diseases and as a vermicide.
10.	<i>Solanum indicum</i>	Used in the treatment of lungs, liver diseases, cough and as a blood purifier.
11.	<i>Murraya koenighii</i>	Used as a blood purifier.
12.	<i>Syzygium cumini</i>	Used in the treatment of diabetes and dysentery.
13.	<i>Gymnema sylvestre</i>	Used in the treatment of diabetes, swelling in glands.
14.	<i>Crataera nurvala</i>	Used in the treatment of sprains, fracture as a contraceptive.

S.No.	Botanical Name	Medicinal Importance of Plants
15.	<i>Asparagus recemosus</i>	Used as a normal tonic.
16.	<i>Celastrus paniculata</i>	Used in the treatment of arthritis and mental diseases.
17.	<i>Amorphallus campanulatus</i>	Useful in the disorders of alimentary canal and a normal tonic.
18.	<i>Zingiver cassumunar</i>	Useful in the disorders of alimentary canal and diarrhoea.
19.	<i>Strychnos nux vomica</i>	Useful in paralysis, joint pain and stomach diseases.
20.	<i>Mimosa pudica</i>	Useful in the treatment of dysentery.
21.	<i>Hydrocotyl ariatica</i>	Used as a brain tonic and blood purifier.
22.	<i>Andrographis paniculata</i>	Useful in the treatment of malaria and diabetes.
23.	<i>Hemidesmus indicus</i>	Used in the treatment of asthma, ulcer, whooping cough and diarrhoea.
24.	<i>Datura alba</i>	Useful in the treatment of asthma, swelling, menstruation disorders and arthritis.
25.	<i>Cuscuta reflexa</i>	Used as a blood purifier and menstruation disorders.
26.	<i>Calotropis gigantea</i>	Useful in the treatment of skin diseases and dog bite.

### (B) Plants of Economic Importance

Man and all other animals are directly and indirectly dependent on the plant kingdom. Their basic needs of food, clothing, shelter, are fulfilled by wild plants, crop plants and medicinal plants. Economically important plants are classified in the following groups - cereals, pulses, vegetables, oils, fruits, sugars, spices beverages, timber, fibres, rubber and paper producing plants. A tabular account of these products and the plants from which they are obtained is being given here. If you get the chance to see any of these plants, try to get more information about them.

S.No.	Plant Name	Botanical Name	Uses
1.	Wheat	<i>Triticum species</i>	Mainly as cereals, Bakery industry, straw is used as food by domestic animals & in the preparation of various items.
2.	Maize	<i>Zea may's</i>	used as cereal, strach Industry, Laundry powder, Also useful in the manufacture of Glucose and Alcohol.

S.No.	Plant Name	Botanical Name	Uses
3.	Rice	<i>Oryza sativa</i>	Mainly as cereal, Manufacture of starch and Alcohol. Husk of rind is useful in the manufacture of caps, shoes etc.
4.	Sorghum	<i>Sorghum vulgare</i>	The green and dried stem parts, grains are used as cattle food. Industrially in the manufacture of Brush, Syrup, Paper, Starch, Alcohol etc.

### Pulses :

5.	Gram	<i>Cicer arietium</i>	Nutritious and rich in vitamins, used as flour and Pulse.
6.	Moong bean	<i>Phaseolous mungo</i>	Pulse is nutritious and useful for patients.
7.	Urd	<i>P. radiatus</i>	Used as pulse, flour is used for various dishes, useful for the patients of arthritis and paralysis.
8.	Pigeon pea	<i>Cajanus indicus</i>	Useful in the dal and dry plants are used as fuel.

### Oily crops :

9.	Cotton seed	<i>Gossypium sp.</i>	Oil used in the manufacture of vegetable ghee, soap and water resistant sheet.
10.	Sesame	<i>Sesamum indicum</i>	Manufacture of edible oil, soap & hair oil.
11.	Sunflower	<i>Helianthus annus</i>	Used in the preparation of edible oil, vegetable ghee, soap, varnish & paint industry
12.	Coconut	<i>Cocos nucifera</i>	Used as edible oil in South India and as a hair oil in rest of the part of India, also used in Soap, shampoo and cosmetic industry
13.	Ground nut	<i>Arachis hypogea</i>	Useful in the manufacture of shaving cream.

### Vegetables :

14.	Carrot	<i>Ducus carota</i>	Roots are modified for the storage of food. Main source of vitamin A.
15.	Turnip	<i>Bassica rapa</i>	Tap root is used in salad. In the manufacture of Sugar in European countries.

S.No.	Plant Name	Botanical Name	Uses
16.	Onion	<i>Allium cepa</i>	The stem in the form of underground bulb is very useful medicinal use.
17.	Garlic	<i>Allium sativum</i>	The stem remains in the form of bulb like onion. Enriched in medicinal and anti bacterial properties.
18.	Cabbage	<i>Brassica oleracea</i>	Cabbage is used in vegetable and Salad while Cauliflower is used in vegetable. Rich in vitamins and sulphur.
19.	Brinjal	<i>Solanum melongena</i>	Vegetable is full of iron elements.
20.	Lady's finger	<i>Hibiscus esculentus</i>	Used as fruits and vegetables. Seeds are of medicinal importance.
21.	Tomato	<i>Lycopersicon esculanum</i>	The fruits are of berry type and used in the preparation of soup and sauce.
22.	Sweet pea	<i>Pisum sativum</i>	Seeds are used for eating. They are rich in protein and other minerals. Most popular vegetable.
23.	Potato	<i>Solanum tuberosum</i>	Except vegetable, the underground tuber is also used in the manufacture of starch.

### Fruits :

24.	Apple	<i>Pyrus malus</i>	Fruits are of pome type, rich in iron element, useful in the manufacture of Jelly, Jam, soft drink and alcoholic drinks.
25.	Banana	<i>Musa sapientum</i>	Very nutritious. Rich in vit. A, B, C, D and E. Potassium, Calcium, Iron and Phosphorus elements.
26.	Guava	<i>Psidium guajava</i>	Having laxative properties. Rich in vitamin A, B and C useful in the preparation of Jam and Jelly.
27.	Mango	<i>Mangifera indica</i>	Fruit is of drupe type. Very nutritious and tasty. Important source of vitamin A. India is the largest producer of mango.
28.	Papaya	<i>Carica papaya</i>	Pulp is nutritious, tasty, digestive, Provides freshness to the body. The milky latex of unripened fruit is used for the preparation of papain enzyme. Latex is also used for the preparation of chewing gum

S.No.	Plant Name	Botanical Name	Uses
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**Sugar :**

29.	Sugarcane	<i>Saccharum officinarum</i>	Plant is mainly used in the preparation of various sugar products.
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**Fibres :**

30.	Cotton	<i>Gossypium sp.</i>	Useful in cloth industry, Manufacture of ropes and different kinds of threads.
31.	Jute	<i>Carchorus sp.</i>	India is the largest producer of jute in the world. Useful in the preparation of long fibres, ropes & other fibre product
32.	Teak	<i>Tactona grandis</i>	High quality wood is mainly used in the manufacture of furniture, buildings railway sleeper & boat. The teak of M.P. is supposed to be of best quality.
33.	Seal	<i>Shorea robusta</i>	Useful in the preparation of window, doors, furniture, Railway sleepers, poles of tents, truck body and wheels of vehicle.
34.	Shisham	<i>Dalbergia sisso</i>	Used in agricultural utensils, construction work of buildings and sport articles. Timber is of good quality and durable.
35.	Cork	<i>Quereus suber</i>	Cork is prepared by the bark of tree. It is slight water resistant, heat resistant and durable.
36.	Bamboo	<i>Dendrocalamus strictus</i>	Used in the construction of huts and in the manufacture of nets, basket and paper.
37.	Gum	<i>Acacia senegal</i>	Obtained form the bark of babool and other trees. Useful in medicines, sweets, ink and in the industry of colouring of clothes. Also used in paper industry and as a adhesive.
38.	Rubber	<i>Hevea brasiliensis</i>	Latex like substance is prepared from the stem.
39.	Tannius	-	Like babool, plum, arjun, oak etc and bark of many wild plants, leaves, fruits roots and other chemical substances secreted by wood which are useful in the tanning of leather.

S.No.	Plant Name	Botanical Name	Uses
40.	Catechu	<i>Acacia catechu</i>	It is a substance of medicinal importance obtained by boiling babool and wood of other wild plants.
41.	Lac	-	A substance secreted by the insect of lac on Palash, Plum & other wild plants. Used in the industry of economic importance, inflammable.

## 4. Economic Importance of Arthropoda

Of all the animals of the animal kingdom 75% belong to the group Arthropoda. There are four types of organism included in phylum Arthropoda which are :

- (1) Class crustacea : Crabs, Prawas etc.
- (2) Class Myriapoda : Centipede, millipede etc.
- (3) Class Insecta : Cockroach, Mosquito, house fly, bed bugs, head louse, honeybee, silkworm and lac insect etc.
- (4) Class Arachnida : includes spiders, scorpions etc.

These different kinds of organisms may be beneficial or harmful to man directly or indirectly. This is why we will study the economic importance of this group in this chapter.

### 1. Economic importance of Crustaceans :

The large variety of crabs and lobsters are included in this group. They are eaten by non vegetarians. In our country also 75 types of prawns are cultivated at a commercial scale along the coastal areas.

Various types of microscopic crustaceans are found on the water bodies in the form of zooplankton. They are food for many big fish and whale etc. We all know how important fish are in the diet of non-vegetarians. Thus fish products

depends on the crustaceans. They are also used as bait for catching fish.

Some crustaceans are harmful also. For example some prawns. destroy aquatic plants. Some marine crustaceans (like *Lepus*, *Balanus* etc.) stick to the surface of ships in lakhs and cause bad smell. A lot of money has to be spent to clear the ships. Similarly microscopic crustaceans like *Cyclops* and *Daphnia* are carriers of disease germs.

### 2. Economic importance of Myriapods

Centipedes and millipedes belonging to this group do not have much economic importance. Some millipede cause harm to the roots of plants. The bite of centipede is very painful.

### 3. Economic importance of Arachnids

It is a collection of many different kinds of scorpions, spiders, mites and ticks.

Scorpions on one hand help us by destroying many harmful insects by eating them but on the other hand they cause a lot of pain and discomfort by their sting when they bite us. The poison of scorpion also has medicinal properties.

Different kinds of mites and ticks are parasitic on the domestic animals and birds. They

bite these animals and suck their blood, causing harm to them. The animals may develop skin ulcers due to this. Through these open wounds many other germs may enter their bodies.

#### 4. Economic importance of insects :

They make up 90% of all the arthropods taken together. Insects have a very close relationship with human economics. Many different types of insects destroy our crops, books, forests and grains. Some are carriers of many human diseases. On the other hand silk, honey and lac are invaluable products which we get from insects. Here you will learn a brief description of these useful and harmful insects.

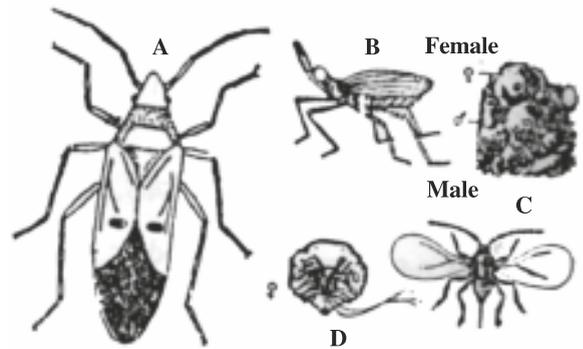
##### Harmful insects :

- (a) **Poisonous insects :** Many insects and their larvae have poisonous substances. Honey bee, wasps and ants are such insects. Some flies and mosquitoes puncture the skin and cause discomfort.
- (b) **Insects causing harm to crop :** Insects cause harm to crops in many different ways:
- (1) **Many insects harm the plants by eating their leaves, beans, buds and stem etc. or by sucking their juices :** Some such examples are grasshoppers, locusts beetles, cabbageworm etc. Locusts fly in swarms. They take rest in the night and the fields



**A** **B**  
Fig. (A) Locusts (B) Insect of cabbage

where they take rest, they destroy the crops completely.

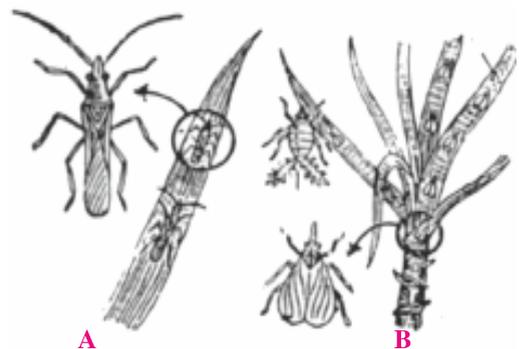


**Fig. (A) Worms of Cotton (B) Plant-hopper (C) Male scale insects (D) Female scale insects**

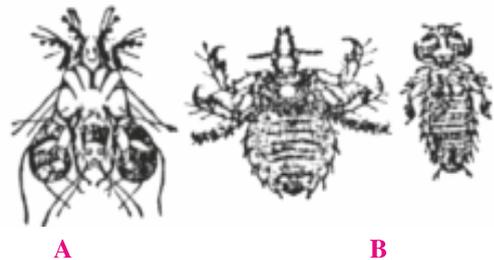
Insects which suck juices of plants include aphids and red worms of cotton.

- (2) **Insects which bore holes in the plants :** These insects lay eggs in the stems, roots and fruits of plants. The larvae of the insects come out the eggs, suck the plant juice and destroy them. It is difficult to kill these insects.

Sugarcane moth, pyrilla, rice bug, cotton weevil, potato and cucumber beetles are



**A** **B**  
Fig. (A) Rice bug (B) Sugarcane moth



**A** **B** **C**  
Fig. (A) Cotton weevil (B) Potato beetles (C) Cucumber beetles

some of the borers which cause harm to these crops.

- (3) **Canker causing insects :** These insects are called gall worms. They make large tumours in the plants and stop their growth. Some important insects are wheat

joint worms, grape phylloxera, etc. which cause great damage.

- (4) **Insects causing damage to roots :** This includes woolly apple aphids which suck juices from the roots of apple plants in both juvenile and adult stages. They destroy

the plant roots and minerals are not made available to the plants from the soil. Thus the plants are destroyed.

**(c) Insects causing harm to cattle are shown in the table below :**

S.No.	Name of Insect	Name of Affected Animal	Harm caused
1.	Horse fly	Horse, Donkey, mules & cattle	They puncture the skin and suck blood. These insects carry the anthrax bacteria.
2.	Stable fly	Domestic Cattle	It bites the legs of quadruped animals. This troubles them. They also suck blood and this brings about reduction in weight of animals and reduction in milk production of animals.
3.	Itch	Cattle	They puncture the skin and make 1 inch deep tunnels where they stay. The females lay eggs over there. The larvae coming out of the eggs feed on the flesh of the cattle and cause discomfort to them.
4.	Horn fly	Horned cattle like cow, buffalo, bulls etc.	This causes similar damage as the stable fly.
5.	Face fly	All cattle	They settle on the mouth of the cattle in swarms and suck the blood.
6.	Little red louse	All Cattle	These also live in swarms and feed on the skin. They do not allow physical development of the animal to take place.
7.	Cattle tick	Cattle	These also suck blood. They are carriers of tick fever pathogens.
8.	Ox warble	All cattle	They make boils inside the skin.

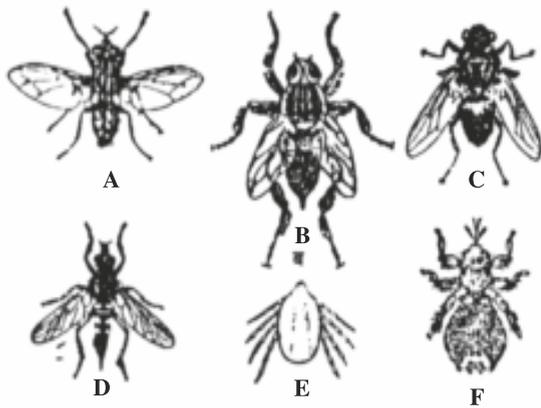


Fig. (A) Face Fly (B) Horn Fly (C) Ox worble (D) Fly (E) Cattle tick (F) Cattle louse

#### (D) Harmful insects of Poultry farming :

There are various kinds of insects which cause diseases in poultry birds - one of these is the cause of Ranikhet disease. Other than this, pox, coccydiosis, cholera, white dysentery, anemia etc.

The insects causing the above diseases are poultry lice, fowl tick, chicken mite etc.

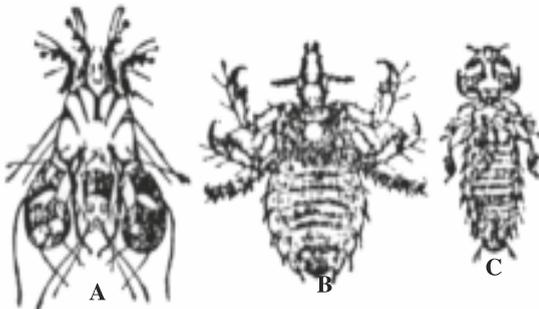


Fig. (A) Featehr mite (B) Poultry lice

#### (E) Insects causing damage to stored grains :

(1) **Weevils** : This is dark red insect. It is head projects anteriorly into a snout. Its scientific name is sitophilus granarius and the rice weevil is called sitophilus oryza. This insect and its larva both feed on rice and wheat grains and make them hollow.

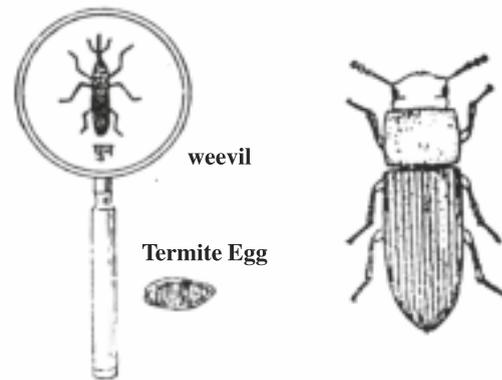


Fig. (A) granary weevil (B) Red Weevil of rice

(2) **Meal Worm** : *Tenebrio molitor* they feed on flour.

(3) **Flour moth** : The female of this moth lays eggs in the flour. The larvae emerging from the eggs eat the flour and also, produce a sticky substance This stick to the flour and rolls it. Thus these insects are enemies of the flour mills.

(4) **Khapra beetle** : *Trogoderma* a granarium. This is a dark red round insect. The eggs are light brown in colour. They cause harm to wheat, jowar, maize etc.

(5) **Pulse beetle** : It is dark red or chocolate coloured. They infect all kinds of pulses such as peas, moong, arhar, gram, masoor, etc. The females lay eggs on the pods of the pods of the standing crops. The larva enter the pods and feed on the seeds and bore holes in them. The larvae live inside the seeds and grow into adults inside them, making the seeds totally hollow.

#### (F) Insects destroying books and clothes:

**Books and clothes** include cockroach, termites, cloth moth, carpet beetle and book lice.

The larvae of cloth moth feed on woollen clothes and garments made of feathers and furs and make numerous small holes in them.

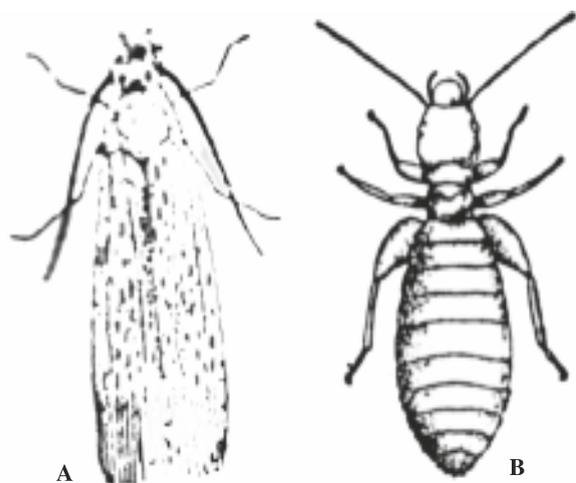


Fig. (A) Cloth moth (B) Book lice

Clothes which have not been used for days and are confined to boxes are destroyed by larvae of carpet beetles. The biggest enemy of books termites, because their food is cellulose. Other than termites tiny wingless insects also destroy books. They are called book lice.

### (G) Insects spreading diseases in man :

There are many insects which cause harm to man. They carry the germs of diseases from infected to healthy people some of these insects.

**(1) Mosquitoes :** When mosquitoes bite man, they release many disease germs living in their bodies in the blood of man. Diseases spread by mosquitoes are malaria, filaria, elephantiasis etc.

**(2) Houseflies :** They sit on the faces of infected people and pick up the germs on their own body hairs and then spread them to other people through food and utensils. We can call the housefly as a 'vehicle of many diseases'. Diseases spread by houseflies are cholera, diarrhoea, intermittent fever, trachoma etc. Other than housefly other flies also spread diseases like the tse-tse fly of Africa which spreads sleeping sickness which has no cure.

**(3) Body louse :** They are ectoparasites

on man and suck their blood spreading diseases typhus, trench fever and relapsing fever.

**(4) Bed bug :** They also suck human blood. In Africa they spread a disease called 'Chage' In our country they spread a disease called kalazar.

**(5) Fleas :** They live as ectoparasites on

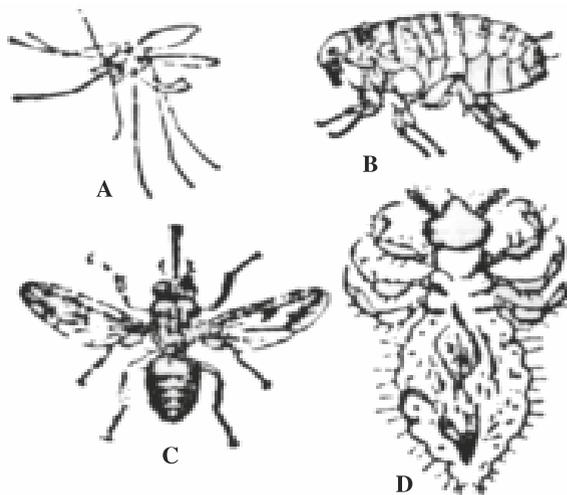


Fig. (A) Sand fly (B) Flea (C) Tse-Tse fly (D) Lice

many animals. Fleas parasitic on rats called xenopsylla cheopsis are causal organisms of disease called plague.

### Useful insects :

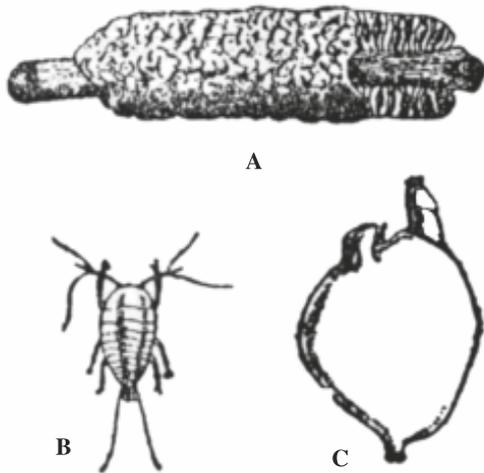
Although most insects are harmful but some of them are useful to us. Some of them are.

**(A) Productive insects :** Honey bee, silkworm, and lac insects which give honey, silk and lac respectively, same bee of the genus Apis make honey in their hives. From the hives other than honey useful bees wax is also obtained.

Honey is a valuable food product and is also medicinal.

Silk is produced by moths of the genus Bombyx. Every year 2.5 lakh quintals of silk is used as cloth in the world.

Lac is a secretion of female lac insects



**Fig. (A) Lac made by female lac insect on branch of tree (B) male lac insect (C) Female lac insect**

Trachardia lacca and Lucifer lacca. Many useful products are made from lac such as gramophone records ink, bangles, varnish etc.

In our state sufficient quantity of lac and silk is produced. The world produces around 40 crore kilos of raw lac.

**Note :** If you have a silk rearing centre or an apiary close to your locality, you must visit them to collect information about them.

**(b) Pollination by insects :** Insects play the chief role in pollination in flowers. While drinking nectar, the pollen grains from the anthers stick to the backs of the insects when they visit other flowers the pollen grains are sprinkled on the gynoecium and thus pollination is carried out.

Honey bees, wasps, bumble bees, flies, ants, butterflies, moths helps in pollination. Research has found that if honey bees are reared in the crop fields the productivity of crops increases.

**(c) Scavenger insects :** Many insects such as silver fish, termites, ants, houseflies, many beetles, larvae, cockroaches etc. feed on dead organisms and fallen leaves and fruits and clean the surroundings. Thus the dead organism do not get opportunity to decompose.

**(d) Biological Control :** Some insects destroy other insects. The use of this property is called biological control. Some destroy harmful insects by feeding on them while others live as parasites on insect thereby destroying them.

**(e) Insects used as food :** Many birds, frogs, fish, lizards etc. feed on insects. In some backward countries the tribals eat insects or their larvae.

**(f) Insects used in medicines :** In ancient times the maggots of flies were used for treating infections.

The venom of honey bee is used for treatment of arthritis. Honey is also a kind of antiseptic. Cantheriodine is made from the blister fly.

## (5) Preparation of Herbarium sheets

Plant or plant part (leaves flowers in florescence etc.) collected during field trips or at any other time should be immediately dried and preserved in old newspaper so that they can be preserved properly. When these preserved plants or plant parts are stuck on a thick chart sheet and on one corner it is labelled carrying information about the plant then such a sheet is called a herbarium sheet. To prepare herbarium sheets follow the given instructions and precaution.

(1) A herbarium sheet can be of thick paper or drawing sheet. All the sheet should be of a standard size normally 16.5 such long  $\times$  11.5 inch broad. Sheet should be rectangular.

(2) The dried and pressed plants or plant parts are stuck on these sheets individually. Normally gum is used for this purpose, but a transparent sticking tape can also be used. If none of these are available, then the specimen can be stitched to the paper with needle and thread. The

knots of threads should be on wrong side of paper in that case. While using gum if 1% mercuric chloride is added to it then it acts as a preservative for the plants. Nowadays synthetic gum is available when can be used directly also.

(3) After sticking a blotting paper should be gently pressed on the sheet, so that it gets dried quickly.

(4) On the lower right hand corner some information regarding the plant has to be given. Nowadays ready to use labels (3 inch × 5 inch size) are also available which can be stuck. The labels should carry the following information:

- (1) Genus, species and Family name of the plant ie classification of plant.
- (2) Place of collection.
- (3) Habitat of the plant
- (4) Date of collection
- (5) Name of the collector.

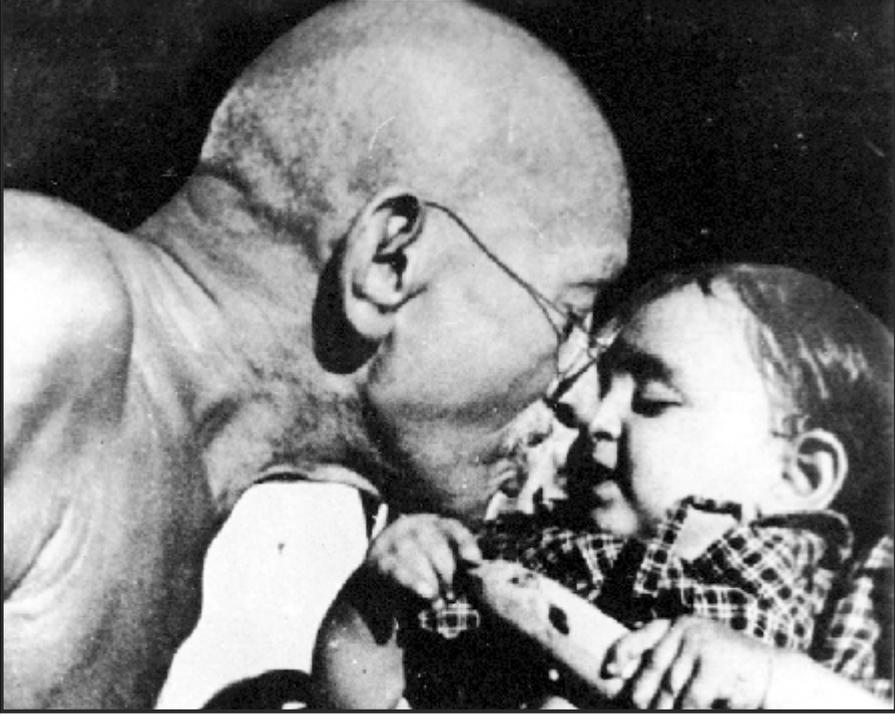
After making the sheets they should be stored in safe places away from the attack of big and small insects, rats, termites etc. The ready sheets should be kept in wooden or steel almirahs.

**Note :** You are required to prepare herbarium sheets as per the curriculum. Therefore you must do it.

## समग्र स्वच्छता अभियान संदेश

1. खाना खाने के पहले हाथ धोयें।
2. शौच के बाद साबुन से हाथों को अवश्य धोयें।
3. शौच के लिए शौचालय में ही जायें।
4. घड़े में से पानी डंडी वाले लोटे से ही निकालें,  
पानी में उंगलियाँ नहीं डुबाना चाहिये।





विद्यार्थियों को ऐसी तालीम दी जानी चाहिए जिससे वे संसार के महान धर्मों को आदर के साथ सीख सकें ।

-महात्मा गांधी

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# राष्ट्रीय गीत

## वन्दे मातरम्

श्री बंकिमचंद्र चट्टोपाध्याय : आनन्दमठ

वन्दे मातरम्, वन्दे मातरम् ।  
सुजलाम् सुफलाम् मलयज शीतलाम् ।  
शस्य श्यामलाम् मातरम् । वन्दे मातरम् ॥  
शुभ्रज्योत्स्नाम् पुलकित यामिनीम् ।  
फुल्ल कुसुमित द्रुमदल शोभिनीम् ॥  
सुहासिनीम् सुमधुरभाषिणीम् ।  
सुखदाम् वरदाम् मातरम् । वन्दे मातरम् ॥



## राष्ट्रगान

जन-गण-मन-अधिनायक जय हे  
भारत-भाग्य-विधाता  
पंजाब-सिन्धु-गुजरात-मराठा  
द्राविड़-उत्कल-बंग  
विन्ध्य-हिमाचल-यमुना-गंगा  
उच्छल-जलधि-तरंग  
तव शुभ नामे जागे, तव शुभ आशिष मागे,  
गाहे तव जय-गाथा ।  
जन-गण-मंगल-दायक जय हे  
भारत-भाग्य-विधाता  
जय हे, जय हे, जय हे,  
जय जय जय जय हे ।

(हर देश का अपना एक विशिष्ट झंडा और राष्ट्रगान होता है। “तिरंगा झंडा” भारतवर्ष का राष्ट्रध्वज है और “जनगणमन” राष्ट्रगान। राष्ट्रध्वज में ऊपर की पट्टी केसरिया रंग की और नीचे की हरे रंग की होती है। बीच की सफेद पट्टी के बीचों बीच २४ शलाकाओं का नीले रंग में गोल-चक्र होता है। केसरिया रंग त्याग का, सफेद शांति का और हरा रंग प्रकृति की सुन्दरता का प्रतीक है। चक्र का स्वरूप अशोक की सारनाथ-स्थित सिंहमुद्रा में अंकित चक्र की भाँति है यह चक्र सत्य और सब धर्मों का प्रतीक है।

राष्ट्रगान की रचना गुरुदेव रवीन्द्रनाथ ठाकुर ने की थी। इसमें संपूर्ण देश के लिए मंगल-कामना है। राष्ट्रगान और राष्ट्रध्वज का सम्मान करना हमारा कर्तव्य है। जब राष्ट्रगान गाया जाये या उसकी धुन बजाई जाये अथवा राष्ट्रध्वज फहराया जाये, तब हमें सावधान की स्थिति में खड़े होकर इसे सम्मान देना चाहिए।)