RPS DEGREE COLLEGE

BALANA (MAHENDERGARH)-123029

Lab Manual

Zoology (B.Sc.5th & 6th Semester)

Department of Zoology

INDEX

EXPERIMENT:-1

AIM:- To identify different types of fishes.

Catla-catla

Taxonomic position :-

- Phylum - Chordata
- Class - Osteichthyes
- Order - Cypriniformes
- Genus - *Catla*
- Species - *catla*

Identification points:-

1. It has large and Stout body.
2. Large gill apparatus is present.
3. On dorsal side it is of gray colour and on ventral side silver white colour is present.
4. Dorsal fin is larger then caudal fin.
5. Swim bladder is divided into anterior and posterior chambers.
6. Common name is katla.

Labeo rohita

Taxonomic position:-

- Phylum - Chordata
- Class - Osteichthyes
- Order - Cypriniformes
- Genus - *Labeo*
- Species - *rohita*

Identification points:-

1. Body is elongated.
2. On the dorsal side it is of brown colour.
3. The head is depressed.
4. Common name is Rohu.
5. The air bladder is divided into anterior and posterior chambers.

Labeo calbasu

- Phylum - Chordata
- Class - Osteichthyes
- Order - Cypriniformes
- Genus - *Labeo*
- Species - *calbasu*

Identification points:-

1. Body is elongated with conical head.
2. The size ranges between 35 to 45 cm.
3. It is mainly found in Punjab, Orissa, west Bengal.
4. The breeding season is July-August.
5. Barbels are elongated.

Cirrhina mrigala

Taxonomic position:-

- Phylum - Chordata
- Class - Osteichthyes
- Order - Cypriniformes
- Genus - *Cirrhina*
- Species - *mrigala*

Identification points:-

1. The distribution is same as that of Labeo calbasu.
2. Body is elongated with wider mouth.
3. Cycloid scales are present on the body except head.
4. On the dorsal side dark gray colour is present and on ventral side it is of orange reddish colour.
5. The Caudal fin is bifurcated.

Channa punctatus

Taxonomic position:-

- Phylum - Chordata
- Class - Osteichthyes
- Order - Ophiocephaliformes
- Genus - *Channa*
- Species - *punctatus*

Identification points:-

1. The body is elongated.
2. The head is snake like.
3. It is distributed in India, Pakistan and Sri lanka.
4. The dorsal fin is larger than caudal fin.
5. It feedes on phytoplanktons and small fishes.

Mystus seenghala

Taxonomic position:-

- Phylum - Chordata
- Class - Osteichthyes
- Order - Siluriformes
- Genus - *Mystus*
- Species - *seenghala*

Identification points:-

1. It is distributed in every part of India.
2. The body is elongated.
3. On the dorsal side brown colour is present and on the ventral and lateral side it is silvery white.
4. It feeds on small carps and prawns.
5. Upper jaw is longer than lower jaw.

Wallago attu

Taxonomic position:-

- Phylum - Chordata
- Class - Osteichthyes
- Order - Cypriniformes
- Genus - *Wallago*
- Species - *attu*

Identification points:-

1. It is a fresh water fish with size range 150 to 180 cm.
2. It has a long head and small trunk.
3. To pairs of barbells are present.
4. Caudal fin is bifurcated.
5. Spines are absent on dorsal fin.

EXPERIMENT:-2

AIM:- To identify the given specimen.

Palaemon

Taxonomic position:-

- Phylum - Arthropoda
- Class - Crustacea
- Order - Decapoda
- Genus - *Palaemon*

Identification Points:-

1. Body is divided into anterior cephalothorax and posterior abdomen.
2. The cephalothorax bears five pairs of leg, three pairs of maxillipedes and five pairs of cephalic appendages.
3. Five pairs of pleopods and one pair of oropods is present in the abdominal region.
4. In the cephalothorax five segments of head and eight segments of thorax are present.

Cancer (crab)

Taxonomic position:-

- Phylum - Arthropoda
- Class - Crustacea
- Order - Decapoda
- Genus - *Cancer*

Identification points:-

1. Body comprises cephalothorax and abdomen.
2. Cephalothorax bears five pairs of thoracic legs, antennules, antennae and compound eyes.
3. Abdomen is covered by cephalothorax.
4. Pleopods are reduced.
5. The copulatory organs in male are two pairs of pleopods.
6. Common name is crab.

Palinurus (lobster)

Taxonomic position:-

- Phylum - Arthropoda
- Class - Crustacea
- Order - Decapoda
- Genus - *Palinurus*

Identification Points:-

1. Body is divided into two parts the cephalothorax and abdomen.
2. In the cephalothorax five pairs of legs, one pair of antennae, annenules and compound eyes are present.
3. Fan like pleopods are present in abdominal region.
4. It shows both walking and swimming.
5. It walks with thoracic legs and swims with fan like pleopods.
6. Used as food in many countries.

Solen (Clam)

Taxonomic position:-

- Phylum - Mollusca
- Class - Pelecypoda
- Order - Eulamellibranchiata
- Genus - *Solen*

Identification Points:-

1. Body is covered with two equivalved shell.
2. Cylindrical and highly muscular foot is present.
3. It is a omnivorous feeder.
4. Common name is razor clam.
5. It shows both fossorial and swimming locomotion.

Mytilus (mussel)

Taxonomic position:-

- Phylum - Mollusca
- Class - Pelecypoda
- Order - Filibranchiata
- Genus - *Mytilus*

Identification Points:-

1. The body is covered by equivalved shell of two valves.
2. Byssal threads are present on foot.
3. At the posterior end exhalent and inhalant siphons are present.
4. Fertilization occurs with the help of water tubes of gill called marsupial.
5. Common name is sea – mussel.

Ostrea

Taxonomic position:-

- Phylum - Mollusca
- Class - Pelecypoda
- Order - Pseudolamellibranchiata
- Genus - *Ostrea*

Identification Points:-

1. The shell is irregular and rough.
2. The shell valves are unequal.
3. Sedentary in nature.
4. Foot is absent.
5. Commonly called edible oyster.

EXPERIMENT - 3

AIM:- To determine the pH of given sample of soil.

Apparatus used:- Test tubes, beaker, soil samples.

Reagents:- Barium sulphate, Universal indicator.

Procedure:-

1. Take a test tube and fill the soil sample up to 1 cm. mark.
2. Then put barium sulphate above it up to another 1cm. mark.
3. Add 10 ml of distilled water.
4. Shake the tube until soil completely mixes with rest of the contents.
5. Leave it until the contents have settled.
6. Filtered it using the filter paper.
7. Now add five drops of universal indicator in the filtered water.
8. Repeat above mentioned points with the other soil samples.
9. Compare the colour of the liquid in each test tube with the standards provided for the indicator liquid.

Result:-

Test tube	pH of soil
1.	
2.	
3.	
4.	
5.	

EXPERIMENT - 4

AIM:- To determine the pH of given sample of water.

Apparatus used:- Test tube, beaker.

Reagents:- Universal indicator, water samples.

Procedure:-

1. Take a test tube and fill it with water sample up to 2cm. mark.
2. Now add five drops of universal indicator in it.
3. Shake well.
4. Repeat the procedure with all given water samples.
5. Compare the colour of each test tube with the standards provided for the indicator liquid.

Result:-

Test tube	pH of water
1.	
2.	
3.	
4.	

EXPERIMENT – 5

AIM:- To determine the free CO_2 in a given sample of water.

Apparatus used:- Burette, burette stand, conical flask, pipette, measuring cylinder, beakers, glass rod.

Reagents:- Sodium hydroxide solution 0.02N (0.909g of NaOH in 1 litre of distilled water)

Phenolphthalein indicator (1g of phenolphthalein in 100 ml of 95% ethyl alcohol).

Principle:- Free CO_2 in water reacts with sodium hydroxide to form bicarbonates which give pink colour on adding phenolphthalein indicator.

Procedure:-

1. Take 100 ml of water in a test tube and add 5 to 6 drops of phenolphthalein indicator.
2. If pink colour develops then CO_2 is absent.
3. If no colour develops then titrate the solution using NaOH solution filled in burette.
4. Stop titration when slight pink colour develops.
5. Note the end point an take at least three readings.

Observation table:-

Initial reading (V_1)	**Final reading (V_2)**	**Volume of titrant used (V_2-V_1)**

Calculation:-

Free CO_2 conc. = $\frac{\text{ml of titrant used} \times 1000}{\text{ml of sample taken}}$

EXPERIMENT – 6

AIM:- To determine dissolve oxygen (DO) in given sample of water.

Apparatus used:- Burette, burette stand, conical flask, pipette, pipette bulb, measuring cylinder, beaker, glass rod.

Reagents:-

1. Maganous sulphate solution (dissolve 364 g of $MnSO_4.H_2O$ in distilled water to make the solution 1 litre.
2. Alkaline iodide sodium azide solution.
    a) Add 150 g of KI in distilled water to make the solution 1 litre.
    b) Dissolve 10 g of NaN_3 in 40 ml of distilled water.
    c) Add slowly solution b in a to make alkaline iodide sodium azide solution.
3. Sodium thiosulphate solution (dissolve 25g of sodium thiosulphate in distilled water. make the solution 1 litre.
4. Starch solution (add 1g of starch in 100ml of hot distilled water).
5. Conc. H_2SO_4.

Principle:- oxygen combine with manganous hydroxide to form higher hydroxide which on acidification liberate iodine. The liberated iodine when titrated again thiosulphate solution using starch as indicator give blue coloured complex.

Procedure:-

1. Take the water sample in conical flask.
2. Add 1ml of manganous sulphate and 1ml of alkaline iodide azide solution one after the other with the help of pipette.
3. Shake well, if dissolves oxygen is present yellowish brown ppt. is formed.
4. Allow the ppt. to settle for 15 minutes.
5. Then dissolve the ppt. by adding 1ml of conc. H_2SO_4.
6. Take 50ml of water sample in a flask and titrate against sodium thiosulphate solution till the colour changes to light yellow.

7. Now add 1ml of starch solution and titrate again till the blue colour disappears.
8. Note the volume of titrant used.
9. Take at least three readings.

Observation Table:-

Initial reading (V_1)	**Final reading (V_2)**	**Volume of titrant used (V_2-V_1)**

Calculation:-

Amount of dissolved oxygen = N_2 × equivalent wt. of oxygen = N_2 × 8g per litre.

Amount of dissolved oxygen in ppm = $\frac{N_1 \times V_1 \times 8 \times 1000}{V_2}$

N_1 = normality of standard thiosulphate solution.

V_1 = Volume of standard thiosulphate solution.

V_2 = Volume of given water sample.

N_2 = Normality of given water sample.

As $N_1 \times V_1 = N_2 \times V_2$

So $N_2 = \frac{N1 \times V1}{V_2}$

EXPERIMENT – 7

AIM:- To determine presence of nitrate, phosphate and chloride in a given sample of soil.

Apparatus used:- Burette, burette stand, conical flask, pipette, pipette bulb, measuring cylinder, beaker, glass rod.

Reagents:-

1. For nitrate ($FeSO_4$, Conc. H_2SO_4)
2. For phosphate ($Pb(C_2H_3O_2)_2$, conc. HNO_3, ammonium molybdate solution).
3. For chloride (conc. H_2SO_4, MNO_2 powder, HNO_3(dilute), silver nitrate solution and NH_4OH).

Procedure:-

1. Take 10g of soil sample, add 60ml of distilled water in it.
2. Mix well, allow the soil to settle.
3. Filtered it through a filter paper.
4. Use the super natant for test.
    - **A.** Test for nitrate:- To given solution add equal volume of $FeSO_4$ solution. Mix well, add 2-3 ml of conc. H_2SO_4 carefully. A brown ring confirms the presence of nitrate.
    - **B.** Test for phosphate:- To 10ml of soil solution add 2ml of lead acetate. White ppt. confirms the presence of phosphate.
    - **C.** Test for chloride:- To soil solution add conc. H_2SO_4 and MNO_2 powder. Heat the solution, chlorine gas is released which turns the blue litmus paper first red and then decolour it.

EXPERIMENT – 8

AIM:- To study the slides of different types of fish parasites.

1. Clinostomum

Identification Points:-

- It is the parasitic fluke, small in size.
- Metacercariae are found below the skin or in the muscles.
- The encysted metacercariae appears yellow, oval shaped, 3 to 6 mm long.
- It is the causative agent of yellow grub in fishes.

2. Argulus

Identification Points:-

- Small in size but visible with naked eye.
- It is flat in size have in ovan or rounded carapace.
- Female is larger than male.
- It attaches it self to the fish by hooks and two suckers below the eyes.
- The fish can become anemic when attacked by it.

3. Lernaea

Identification Points:-

- It is the parasite of fresh water fishes.
- The male is non parasitic in nature and female attacks the gills and insert into flesh of fish.
- It has a small semispherical cephalothorax.
- The trunk carry the four pair of legs.

EXPERIMENT – 9

AIM:- To study the different type of nets.

1. Drag Net.

- It is generally used in the ponds for fishing.
- There is a floating line on the upper surface and lower surface is line by lead line.
- Around 25 to 30 persons are required to carry the net from one end of pond to the other end.
- Commanly called chanti net or pattii jal.
- It is used against the water current.

2. Gill nets.

- These are the permanently fixed nets.
- The colour of the gill nets should be transparent.
- It is made up of nylon fibers.
- Fixed in night to have better result.

Types:-

a) Simple gill net:- These are placed vertically to the flow of river. The size of mesh depends upon the varity of fish to be captured. These are again of three types named floating gill net (floating surface), anchored gill net (fixed permanently), Staked gill net (fixed at bottom with anchor stakes).

b) Trammel gill net:- It has three walled structure. Outer and inner walls fix with mesh and middle one with small mesh webbing called lint.

3. Cast net.

- It is bell shaped.
- Its strings are formed of nylon or cotton.
- The number of mesh at apex is 50 and 1000 around the margins.
- It is operated from a boat, thrown in water holding it by hauling line.
- Spreads in water like an umbrella.

- Due to heavy weight it sinks in water, the hauling line is pulled to lift the net.

4. Trawl.

- These are the large sized nets with a wide mouth and narrower blind cod end.
- Mouth bears a float line along the upper surface and a rope along the lower surface.
- It gives the appearance of a conical bag.
- It is used for fishing by filtering water.

EXPERIMENT – 10

AIM:- To study the insect pest of sugarcane.

1. Sugarcane leaf hopper (*Pyrilla perpusilla*)

Systematic Position:-

- Phylum - Arthropoda
- Class - Insecta
- Order - Hemiptera
- Family - Lophopidae
- Genus - Pyrilla
- Species - perpusilla

Morphological Features:-

- The body is soft.
- It is a pale straw coloured insect.
- The eyes are light green in colour.
- The head is pointed.
- The forewings are yellow brown in colour and covered with minute black dots.
- The female bears anal threads.

Hosts:-

- Main Host Sugarcane
- Secondary Host Wheat, bajra, maize

Nature of damage done:-

- The main damage is caused by both nymphs and adults.
- Both adults and nymphs suck the cell sap from the leaves.

- The leaves become yellow and dry.
- The pyrilla produces a sticky substance named honeydew which attracks a fungus named *capnodium.* This fungus covers the leaves with black dots.

2. Sugarcane whitefly (*Aleurolobus barodensis*)

Systematic Position:-

- Phylum - Arthropoda
- Class - Insecta
- Order - Hemiptera
- Family - Aleuodidae
- Genus - *Aleurolobus*
- Species - *barodensis*

Morphological Features:-

- It is a small insects around 30 to 35 mm long.
- The insect is a tisry insect.
- It is pale yellow in colour with black eyes.
- The wings are expanded.
- The Female is longer and heavier than male.

Hosts:-

- Main Host Sugarcane
- Secondary Host Wheat, barley and members of grass family

Damage done:-

- Main damaging stage is nymph.
- These suck the cell sap of leaves.
- The plant look yellowish and dry.
- The sucrose content is decreased.

3. Surgarcane top borer (*Scirpophaganivella*)

Systematic Position:-

- Phylum - Arthropoda
- Class - Insecta
- Order - Lepidoptera
- Family - Pyralididae
- Genus - *Scirpophaga*
- Species - *nivella*

Morphological Features:-

- It is silver white in colour.
- The female is larger than male.
- The abdomen of male is pointed and that of female blunt.
- On the anal part of female a tuff of orange hairs present.
- The adults have dark black eyes.

Hosts:-

- Main host Sugarcane
- Secondary host Sarkanda, kahi, barley

Damage done:-

- The main damage is caused by caterpillars.
- The caterpillars bores into nodes of the upper shoot.
- As a result the leaves dry up and get curled forming dead hearts.
- Quality and quantity of sugarcane reduced.

4. Sugarcane root borer (*Emmalocera depressella)*

Systematic Position:-

- Phylum - Arthropoda
- Class - Insecta
- Order - Lepidoptera
- Family - Pyralididae
- Genus - *Emmalocera*
- Species - *depressella*

Morphological Features:-

- It is a small insect with expended wings.
- On the fore wings longitudinal strips are present.
- On the hind wing black dots are present.
- Head is pointed.

Hosts:-

- Main host Sugarcane
- Secondary host maize, jawar, sarkanda

Damage done:-

- Main damaging stage is the caterpillar.
- Caterpillar bores into the stem below the soil.
- The semicircular tunnels are formed as a result of infestation.
- It causes around 10 to 15% reduction in yield.

5. Gurdaspur borer (*Bissetia steniellus*)

Systematic Position:-

- Phylum - Arthropoda
- Class - Insecta
- Order - Lepidoptera
- Family - Pyralididae
- Genus - *Bissetia*
- Species - *Steniellus*

Morphological Features:-

- It is a small insect around 25 to 45 mm in length.
- The colour of the insect is grayish brown.
- On the boundary of forewings a number of dark spots are present.
- The hindwings are devoid of spots and grayish white in colour.

Hosts:-

- Sugarcane

Damage done:-

- The main damage is caused by caterpillar.
- The caterpillar continuously feed on upper part of the stem and form tunnels.
- It cause around 25 to 50% of reduction in yield.

EXPERIMENT:- 11

AIM:- To study the insect pest of cotton.

Red cotton bug (*Dysdercus cingulatus*)

Systematic Position:-

- Phylum - Arthropoda
- Class - Insecta
- Order - Hemiptera
- Family - Pyrrhocoridae
- Genus - *Dysdercus*
- Species - *cingulatus*

Marphological Features:-

- It is the small insect of around 16 mm in length.
- Reddish in colour.
- It has piercing and sucking type of mouth parts.
- On the abdominal region white strips are present.
- On the forewings black dots are present.

Hosts:-

- Main host Cotton
- Secondary host maize, lady finger, hollyhock

Damage done:-

- Both adults and nymphs cause damage to the cotton.
- Both suck cell sap of stem and bolls.
- The bolls are stained.
- Lint is reduced so quantity of oil extracted is reduced.

EXPERIMENT – 12

AIM:- To study the insect pest of wheat.

Wheat stem borer (*Sesamia inferans*)

Systematic Position:-

- Phylum - Arthropoda
- Class - Insecta
- Order - Lepidoptere
- Family - Noctuidae
- Genus - *Sesamia*
- Species - *inferans*

Morphological Features:-

- It is of dull white or cream colour insect.
- The wings are expanded.
- On the hindwings dark brown streaks are present.
- It is a nocturnal animal.

Hosts:-

- Main host Wheat
- Secondary host Jawar, bajra, paddy, sugarcane, maize

Damage done:-

- Main damage is caused by caterpillar.
- It bores into young shoot as a result the shoot dry up and dead hearts are formed.
- Both quality and quantity of wheat reduced.

EXPERIMENT – 13

AIM:- To study the insect pest of paddy.

1. Rice Gundhi bug (*Leptocorisa varicornis*)

Systematic Position:-

- Phylum - Arthropoda
- Class - Insecta
- Order - Hemiptera
- Family - Coreidae
- Genus - *Leptocorisa*
- Species - *varicornis*

Morphological Features:-

- It is a light brown insect of around 20 mm length.
- Four pairs of large long legs are present.
- The nymphs are green in colour.
- The adult emits a strong unpleasant smell so known as gundhi bug.

Hosts:-

- Main host Rice
- Secondary host Jawar, bajra, maize, sugarcane

Damage done:-

- The main damaging stage are both adults and nymphs.
- These suck cell sap from the grain so that the grain shrinks.
- The ears turn white.
- Up to 40% damage is caused by the insect.
- The damage grains are attacked by fungus and marked by black spots.

Rice grass hopper (*Hieroglyphus banian*)

Systematic Position:-

- Phylum - Arthropoda
- Class - Insecta
- Order - Orthoptera
- Family - Acrididae
- Genus - *Hieroglyphus*
- Species - *banian*

Morphological Features:-

- It is the large insect of about 5 to 7 cm length.
- The colour of the insect is greenish yellow.
- The thorax is marked by 2 or 3 black spots.
- It shows hooping type of movement.

Hosts:-

- Main host Rice
- Secondary host Jawar, bajra, sugarcane, maize, grasses, pulses

Damage done:-

- The main damage is caused by both adults and the nymphs.
- It feed on leaves, tender shoots, ear heads.
- The reduction is a round 50%.
- The heavy infestation can destroy the plant completely.

2. Rice stem borer (*Tryporyza incertulus*)

Systematic Position:-

- Phylum - Arthropoda
- Class - Insecta
- Order - Lepidoptera
- Family - Pyralidae
- Genus - *Tryporyza*
- Species - *incertulus*

Morphological Features:-

- It is the light brown insect of around 20 mm length.
- The female is larger than male.
- On the forewings black spots are present.
- The female is lighter in colour than male.

Hosts:-

- Rice

Damage done:-

- The male damaging stage is the caterpillar.
- The caterpillar bores into the stem.
- The stem become dry and hard forming dead hearts.
- The late varities are infested more.
- Ear heads dry up.

3. Rice hispa (*Hispa armigera*)

Systematic Position:-

- Phylum - Arthropoda
- Class - Insecta
- Order - Coleoptera
- Family - Chrysomelidae
- Genus - *Hispa*
- Species - *armigera*

Morphological Features:-

- It is a small beetle of 10 mm length.
- It is bluish black in colour.
- On the whole body black coloured bristles are present.
- Common name is “dhan ka hispa”

Hosts:-

- Rice

Damage done:-

- The main damage is caused by both adults and grub.
- The adults scrap green content from the leaves and feed on it.
- The grubs bores into the leaves from tip to base.
- Both quality and quantity reduced.

EXPERIMENT – 14

AIM:- To study the insect pest of vegetables.

1. Aulocophora faveicollis

Systematic Position:-

- Phylum - Arthropoda
- Class - Insecta
- Order - Coleoptera
- Family - Chrysomelidae
- Genus - *Aulocophora*
- Species - *faveicolis*

Morphological Features:-

- It is small beetle having 5 to 8 mm length and 4 mm breadth.
- The mouth parts are biting and chewing type.
- On the dorsal side orange red colour is present and on the ventral side black colour is present.
- On the abdominal region white hairs are present.

Hosts:-

- The members of family cucurbitaceae like pumpkin, cucumber, ghia, tori, tinda.

Damage done:-

- The damaging stage are both grubs and adults.
- The grubs feed on root and bore into fruits.
- The adults feed on young buds and flowers.
- The maximum damage is caused to seedlings.
- Both quality and quantity is reduced.

2. Dacus cucurbitas

Systematic Position:-

- Phylum - Arthropoda
- Class - Insecta
- Order - Diptera
- Family - Trypetidae
- Genus - *Dacus*
- Species - *cucurbitas*

Morphological Features:-

- It is a reddish brown fly.
- The length is around 7 mm and breadth is 3 mm.
- The wings are colourless, transparent having brown strips.

Hosts:-

- Main host Pumpkin, watermelon
- Secondary host cucumber, tori, tomato, brinjal, papaya, guava

Damage done:-

- The damage is done by adults flies and maggots.
- The feed on flesh of fruit and pollute their pulp.
- Heavy infestation cause 50% damage to plants.

3. Tetranychus telarious

Systematic Position:-

- Phylum - Arthropoda
- Class - Arachinida
- Order - Acarina
- Family - Tetranychidae
- Genus - *Tetranychus*
- Species - *telarious*

Morphological Features:-

- These are the very small insect found in colonies below the leaves.
- These are covered by white silky fibers.
- The male is smaller than female and also more active.

Hosts:-

- Lady finger, brinjal, beans

Damage done:-

- Both nymphs and adults cause damage to the plant.
- These are present on the lower surface of leaves and form web with the help of fine silky threads.
- White speck marks seen on the leaves, leaves are discoloured, rate of photosynthesis decreased.
- As a result quality and quantity reduced.

4. *Epilachna vigintioctopunctata*

Systematic Position:-

- Phylum - Arthropoda
- Class - Insecta
- Order - Coleoptera
- Family - Coccinellidae
- Genus - *Epilachna*
- Species - *vigintioctopunctata*

Morphological Features:-

- It is a dark red coloured beetle.
- The length is around 8 mm and the breadth is 6mm.
- On the elytron black spots are present.

Hosts:-

- The members of the solanaceae like brinjal, potato, tomato.

Damage done:-

- Both grubs and adults cause damage by scraping the upper surface of leaves.
- The adults feed on the leaves in a semicircular manner.
- The leaves become yellowish and dry.
- Both quality and quantity is reduced.

EXPERIMENT – 15

AIM:- To study the insect pest of stored grains.

1. Pulse beetle (*Callosobruchus maculatus*)

Systematic Position:-

- Phylum - Arthropoda
- Class - Insecta
- Order - Coleoptera
- Family - Bruchidae
- Genus - *Callosobruchus*
- Species - *maculatus*

Morphological Features:-

- These are the small insect having a length of 3 to 5 mm.
- The colour of the beetle is chocolate brown.
- The head is small and two white spots are present in the middle of the body.
- On the post abdominal region of female to black spots are present while in the male no spot is present.

Hosts:-

- Soyabean, lobia, cicer, black pea, mung.

Damage done:-

- The main damage is caused by grubs.
- The grubs bore into the seeds and feeds on the endosperm leaving only testa behind.
- The seeds are marked by a hole.
- The infestation is very heavy in humid condition.

Rice weevil (*Sitophilus oryzae*)

Systematic Position:-

- Phylum - Arthropoda
- Class - Insecta
- Order - Coleoptera
- Family - Curculionidae
- Genus - *Sitophilus*
- Species - *oryzae*

Morphological Features:-

- It is a brown coloured beetle having a length of 3 to 4 mm.
- Head is elongated with prominent rostrum.
- On the forewings the light brown spots are present.
- The female is larger than male.

Hosts:-

- Rice, wheat, maize.

Damage done:-

- The grub is the main damaging stage.
- It feeds on grains.
- The grains are left only with testa incapable of germination.
- Due to heavy infestation the loss can up to 50%.

2. Grain & Flour moth (*Sitotroga carealella*)

Systematic Position:-

- Phylum - Arthropoda
- Class - Insecta
- Order - Lepidoptera
- Family - Gelechidae
- Genus - *Sitotroga*
- Species - *cerealella*

Morphological Features:-

- The adults moth are 5 to 7 mm in length.
- The colour of the insect is light yellow.
- Black spots are present on the forewings.

Hosts:-

- Wheat, rice, maize, jawar, bajra.

Damage done:-

- The caterpillar is main damaging stage.
- Feed on greens leaving only upper layer.
- In the bulky store only upper layerish damaged.

3. Rust-red flour beetle (*Tribolium castaneum*)

Systematic Position:-

- Phylum - Arthropoda
- Class - Insecta
- Order - Coleoptera
- Family - Tenebrionidae
- Genus - *Tribolium*
- Species - *castaneum*

Morphological Features:-

- It is a red colour beetle.
- The length varies from 3 to 5 mm.
- The life span of adults is more than 540 days.
- Long slender legs are present.

Hosts:-

- Rice, wheat, bajra, jawar.

Damage done:-

- The damage is cause by grub.
- The grub feed on grains and flour.
- The flour become grayish after infestation and unfit for use.

4. Lesser grain borer (*Rhizopertha dominica*)

Systematic Position:-

- Phylum - Arthropoda
- Class - Insecta
- Order - Coleoptera
- Family - Bostrychidae
- Genus - *Rhizopertha*
- Species - *dominica*

Morphological Features:-

- It is a brownish black beetle.
- The length vary from 1 to 2 mm.
- The head is globular.
- Three pairs of legs are present.

Hosts:-

- Wheat, rice, maize.

Damage done:-

- Damage is caused by both adult and gurb.
- They feed continually on the grains leaving only the testa.
- The seeds left are unable to germinate.

EXPERIMENT – 16

AIM:- To study the life history of silk moth (Bombyx mori).

Life cycle of silk moth

The silk worm (Bombyx mori) produces the silk for the commercial importance. It is the caterpillar of a moth whose cocoon is used to make silk. It is known as mulberry silkworm. The silk worm shows progressive type of metamorphosis in which four different stages complete the generation. These four stages are as following:-

1. **Egg**
    - It is the first stage of silk worm life cycle.
    - The female lays eggs during summer.
    - The eggs are very small and hard due to the presence of shell.
    - The egg hatching takes place in the spring.
2. **Larva**
    - The egg hatches into larva.
    - The larva is extremely hairy.
    - It feeds upon mulberry leaves.
    - It undergoes four moulting during development.
    - The period between successive moulting is known as instar.
    - After first moulting, the larva looses all its hairs and become smooth.
    - The larva stage lasts for about 27 days.
3. **Pupa**
    - As the silk worm prepares to pupape it spins a protective cocoon about the size of a cotton ball.
    - After final moulting inside the cocoon, the larva develops into a brownish hard structure called pupa.
4. **Imago**
    - It is the reproductive stage where the mating takes place between adult male and female.

- The female lay eggs at this stage.
- The adults are flightless and lack functional mouth parts.
- Males are larger than females and more active. They flap their wings very fast to attract the female.
- With in 24 hours of mating, the male die while female die after egg laying.
- Thus a new life cycle begins.

EXPERIMENT – 17

AIM:- To study the life cycle of honey bee (Apis indica).

Life cycle of honey bee

The colonies of honey bee consist of three different type of bees, queen bee (lay eggs), worker bees (non egg producing bees) and drones (for mating purpose)

The total developmental time for a queen bee 16 days, for worker bee 21 days and for drone it is 24 days. In the life cycle four different stages are their which are as following.

1. **Egg**
    - It is the first stage of development the life cycle of honey bee.
    - The eggs are very small in size.
    - The appearnece of eggs is like small seeds.
    - Every egg has a small opening on broader side through which sperm enters.
    - The egg hatching takes place after three days of egg laying.
2. **Larva**
    - The egg hatches into larva which is without legs and eyes.
    - The larva feed upon a jelly like substance (royal jelly) for first two days.
    - As the third day progressive the larvae that are going to develop into queen continue to feed on royal jelly while the worker larva feed on honey and water.
    - The total larva stage lasts for nine days.
3. **Pupa**
    - The worm like body of larva now divided into three different body parts.
    - Pupa is actually the immature adult.
    - For queen the pupal period is 7.5 days, for worker bee it is of 12 days and for drone it is 14.5 days.

4. Adult

- In this stage all the three type of bees are fully grown with all body parts.
- A typical colony of honey bee consists of 50000 to 60000 worker bees, 600 to 1000 drone and only one queen bee.

EXPERIMENT – 18

AIM:- To study the permanent slides of WM of chick embryo.

1. WM of chick embryo (13 to 18 hours)

Identification Points:-

- The primiaive streak becomes distinct.
- A central furrow seen called primitive groove.
- At the cephalic end of primitive streak a thickened area seen known as Henson's node.
- Area pellucida becomes elliptical in shape.
- The notochord becomes elongated forming a prominent structure.

2. WM of chick embryo (24 to 36 hours)

Identification Points:-

- At the initial days four pairs of somites are visible.
- The Henson's node is pushed towards caudal end.
- Primitive streak is reduced.
- The neural tube increase in length.
- At the latter the number of somites Increases upto 13 pairs.

3. WM of chick embryo (36 to 48 hours)

Identification Points:-

- Cranial torsion can be seen.
- Twisting in the cephalic region takes place in a manner that left side company near the yolk and right side away from the yolk.
- Appearance of auditory pit can be seen.
- 19 pairs of somites are seen in the early stages which can increase upto 22 pairs later stages.
- Neural plate is well developed.

4. WM of chick embryo (48 to 72 hours)

Identification Points:-

- Torsion takes place in the whole upper part of the embryo.
- Optic vesicles and auditory vesicles are opposite to each other.
- The visceral arches becomes thicker.
- The number of somites increases from 29 to 36 pairs.
- Optic cup and lens are differentiated in the eye region.

EXPERIMENT – 19

AIM:- To prepare the permanent/temporary slides of developmental stages of frog.

Requirements:-

- 70% alcohol
- Hot water
- 5% KOH
- D.P.X.
- Stains
- Microscope

Procedure:-

1. Collect a freshly hatched tadpole larvae of frog.
2. Kill it by using 70% alcohol or chloroform or water.
3. Then put it into 5% KOH upto the body becomes transparent.
4. Then remove KOH and wash out all the KOH with water.
5. Then dehydrate the specimen using a series of alcohols.
6. Use single staining technique and clearing xylol and mount with the help of D.P.X.
7. Observe the slide under microscope.

EXPERIMENT – 20

AIM:- To prepare the permanent/temporary slides of developmental stages of mosquito.

Requirements:-

- 70% alcohol
- Hot water
- 5% KOH
- D.P.X.
- Stains
- Microscope

Procedure:-

1. Collect the larvae of mosquito in the breeding season (june to Sep.).
2. Kill it by using 70% alcohol or chloroform or water.
3. Then put it into 5% KOH upto the body becomes transparent.
4. Then remove KOH and wash out all the KOH with water.
5. Then dehydrate the specimen using a series of alcohols.
6. Use single staining technique and clearing xylol and mount with the help of D.P.X.
7. Observe the slide under microscope.

EXPERIMENT – 21

AIM:- Window preparation and identification of stages of development in chick egg.

Requirements:-

- Certilized eggs
- Incubators
- Dissection scissors
- 18G needle
- 10cc syringe
- Scotch tape
- Gauze
- Forceps

Procedure:-

1. **Incubation:-** Incubate the eggs at 37-38℃ with relative humidity set above 60-70℃.
2. **Sterilization of egg:-**sterilize the egg using a wire gauge.
   saturate a gauge; use its pieces to swab the eggs. Discard when gauge is boiled.
3. **Removal of albumin:-** Before removing albumin, observe whether embryo is formed or not. It can be done by "candling" i.e. by translumination from side or below. The embryo floats immediately under the shell.
   Now, covered the rounded ends with a small piece of scotch tape approximately 1 cm^2. The tape covered rounded ends are punctured with help of a scissor point, using a syringe of 10cc slowly withdraw 3-5ml of albumin by pointing the needle (18 ganged, 1 inch) at an angle of 45U.
4. **Windowing:-** The space thus need can be used for cutting window. Cut and place a wide piece of wide scotch tape and paste along the long axis of egg so that covers most of the top of egg. avoid cutting into embryo or vitelline membrane. An incomplete oval opening is cut by pulling up the scissors.

The oval cut is not completed end to end leaving a hinge type shell lid on the top of egg.

5. **Closing, Reopening and Sealing the egg:-** Cut about a 2”-3” long and ½ wide tape and close the window. The eggs are placed in incubator. Use a pair of sterilized forceps to reopen the egg. Always seal and the window cover entire horizontal surface of eggs. The eggs should not be removed for incubator daily for not more than 5 minute, observed, photographed and videoed by merely opening the lid.

Precautions:-

1. It is critically important to have aseptic conditions during this experiment. All materials including forceps, needles that may have come in contact with developing embryo should be washed in 70% ethanol or autoclaved.
2. Fertilized eggs are best held at 13 - 16℃ prior to incubation but 4℃ is best.

Development of the Chick:-

Events in the development of the Chicken Embryo.

Days	Events
Day1	Head and eyes begins to form Vertebral column (spine) Begins to form
Day2	Blood vessels form Heart begins to beat Ears form
Day3	Limb buds visible Extra-embryonic membranes begin to form
Day4	Eye pigmentation begins Tongue begins to form
Day5	Formation of the reproductive organs
Day6	Beak begins to form
Day7	Egg tooth is distinct

	Segments of wing and legs distinct
	Feather tracts on back
Day8	Feather tracts are more distinct
Day9	Toes are formed
Day10	Beak begins to harden
Day12	Down present on body
	Eyes nearly closed
	Sclaes on shanks
Day14	Eyes closed
	Embryo turns to point head to air cell
Day17	Head of embryo under right wing
Day19	Yolk sac enter body
Day20	Yolk sac completely in body
	Chick pips shell
Day21	Chick hatches