

(AU 7018)
Department of Rural Technology and Social Development, GGU, Bilaspur (C.G.)
B.Sc. IIIrd Semester: End Semester Examination 2014
RTZ-304 Economic Zoology (Lac, Honey and Vermi Production)

Section - A

(Multiple Choice Questions)

1. Choose the correct answer:

1. Air dried and crushed to granules of lac is called

Ans. (b) Seed lac

2. Mouth parts are absent in the lac insect

Ans. (a) Adult male

3. Lac produced is for

Ans. (a) Protection

4. Honey bee belongs to class

Ans. (c) Insecta

5. Rock bee is

Ans. (b) *Apis dorsata*

6. Sucrase acts on

Ans. (b) Sucrose

7. Flavors of honey depends upon

Ans. (c) Floral sources

8. Bacteria that decompose organic waste in presence of oxygen are called

Ans. (a) Aerobic

9. Leading lac producing state is

Ans. (c) Jharkhand

10. True stomach of honey bee is

Ans. (b) Ventriculus

Section-B
(Short Answer Type Questions)

2. Briefly describe various uses of lac.

Ans. In 19th century lac dye was in more use than lac resin. The manifest uses of lac is one of the nature's standing gifts. The various uses of lac are:

- (1) It is utilized in the preparation of gramophone records.
- (2) It is of utility to jewellers and goldsmiths who use lac as filling material in the hollows in gold ornaments.
- (3) It is an essential gradient used extensively for making polishes, paints and varnishes for finishing wooden as well as metal furnitures and doors etc.
- (4) It is utilized for the preparation of tuys, buttons, in pottery and artificial leather.
- (5) It is used in the manufacture of photographic material.
- (6) It is used as an insulating material for electrical goods.
- (7) It is also used in confectionary trade as antifowling for applying on ship bottom and for fire works.
- (8) It is used commonly as sealing wax.
- (9) It possesses very good adhesion to mica.
- (10) It is also used as coat for preserving archaeological and zoological specimens.
- (11) It is used in the electric industry in the form of insulating varnishes and moulded insulators.
- (12) Lac dye was formerly used for dyeing silk wool and feathers, but has now been largely replaced by the more versatile synthetic dyestuffs.
- (13) It has the biggest consumption in the surface coating industry; like laminated paper boards, photographic and engraving industry; plastic moulded articles etc.

3. Draw labelled diagrams of female and male lac insects.

Ans. (A) Male lac insect

Comments:

- (1) Male is red in colour and 1.2 to 1.5 mm in length

- (2) It secretes bright creamy lac.
- (3) It has reduced eyes and ten segmented antennae.
- (4) The mouth-parts are of piercing and sucking type.
- (5) Thorax bears three pairs of legs and one pair of hyaline wings.

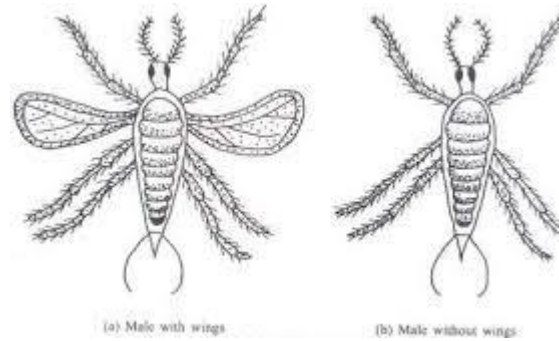


Fig.(A) Male lac insect

(B) Female lac insect

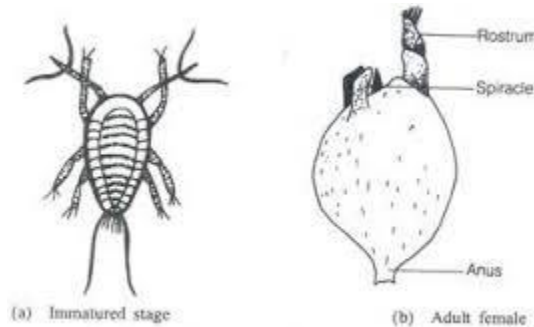


Fig.(B) Female lac insect

Comments:

- (1) Female is larger than males and measures about 4 to 5 mm in length.
- (2) The pyriform body of the female is enclosed in a resinous cell.
- (3) The head, thorax and abdomen are not clearly distinct.
- (4) The mouth parts are of piercing and sucking type.
- (5) The antennae are clearly visible and degenerated.

4. Write short note on social organization of honey bees.

Ans. Social Organization of honey bee

A highly organized division of labour is found in the colony of honey bee. A good and well developed colony of bees has 40-60 thousands of individuals consisting of 3 casts that is –

(1) Queen (2) The Worker (3) The Drones.

The queen after fertilization, lays fertilized and unfertilized eggs both. From fertilized eggs, worker bees are produced whereas, from the unfertilized eggs, the male bees are emerged, which are known as Drones. The workers when feed on royal jelly, developed into queen.

Queen \implies Queen is well developed fertile female having immensely developed ovaries. Usually one queen is found in each hive and feeds on Royal jelly. The queen is guarded by several attendants and never allotted any duty except egg laying. The queen is 15-20 mm in length having long tapering abdomen short legs and wings. Structurally it is unable to produce wax or honey or gather pollen nector. It is believed that queen gets mated only once in its life during which the drone releases 2 crore sperms which are sufficient for the fertilization of the eggs at the time of laying by the female throughout its life span. One queen lays about 1500-2000 eggs in a day depending upon the seasonal variation and other ecological factors. The total weight of 100 eggs is equal to its body weight. In the whole life span of two to five years, a queen lays about 1500000 eggs [Fifteen lakhs]. When the queen in a colony loses its egg laying capacity, another worker of the same colony starts feeding on queen's diet i.e. Royal jelly and develops into a new queen and is provided with facilities of real queen. At the same time old queen may be driven out along with some workers. Sometimes, when 2-3 queens are developed in a colony, only one takes the position of real queen and other come out with some workers to establish a new colony.

Workers \implies The workers are the smallest of the three casts but they function as the main spring of the complicated machinery like honey bee colony. Like the queen, workers are also produced from fertile eggs laid by queen and live in a chamber called as WORKER CELL. It takes 21 days in the development from egg to the adults and total life span of a worker is about 6 weeks. The workers are atrophid female which sacrifice themselves for the well being of colony. Total indore and outdoor duties of the colony are performed by the workers only that is why they have some special structures for particular work..

(1) Long procoscis for sucking the nector

(2) Strong wings for fanning

(3) Pollen basket for collection of pollen

(4) Powerful sting to defend the colony against any attack

(5) Wax gland for wax secretion.

The workers who are engaged in outdoor duties, collect the nectar, pollen, gum and water which are received and stored properly by the house bees. The indoor workers are further subgrouped for specific duties., Some of them who are very sincere, attend the queen while some others look after the nursery and called as NURSERY BEES. Some other produce wax for the formation of new hive and are known as BUILDER. Some other workers are REPAIRERS of the comb. The dead body and other impurities are removed from the hive by the CLEANERS. The fanning in the hive is performed by WINGS of the workers. The GUARD BEE always watches at the gateway. It is believed that upto half of the life period, workers perform indoor duties and later on become engaged in outdoor duties.

Drone \implies The drone is the male member of honeybee colony, who fertilizes queen and so called KING of the colony. They take 24 days to be developed from eggs to the adult stage. The sting and wax glands are absent but male reproductive organs are very well developed. They are reared from unfertile eggs in large DRONE CELLS. Drone are totally dependent on workers. The sole duty of the drone is to fertilize the virgin queen. At the time of swarming, drone follows the queen, copulates and dies after copulation.

5. Shortly describe indigenous methods of bee keeping.

Ans. The main aim of bee keeping is to get more and more honey in pure form. The old method for bee keeping is very crude, cruel and unplanned type, which is called indigenous method.

Indigenous method

(1) Hive – Two types of hive are used in indigenous method of bee keeping.

(a) Fixed hive – It is purely natural type of comb because the bees themselves prepare the hive at any space or wall or tree.

(b) Movable Hive – It is made up of hollow empty boxes, or earthen pots etc. placed in corridor of houses. They have two holes, one for entrance and other for exit of bees. Some bee keepers collect the clusters of swarms from a tree and keep them in hive.

(2) Extraction of Honey – For extraction of honey, burning fire or sometime smoke is brought near the hive in night, so that bees may escape from the hive. After that , hive full of honey is removed , cut into pieces and squeezed to get honey.

Drawbacks of Indigenous method –

- (1) Honey bees impure because during squeezing, the brood cells, pollen cells, larvae etc. are also squeezed.
- (2) Colony become weaker due to killing of eggs & larvae during squeezing.
- (3) Formation of new hive by the escaped bees requires extra energy which effects yield.
- (4) The hivation of bees at the same place is a matter of chance.
- (5) The honey robbers like rat, ant, wasp and monkeys may effect the hive.
- (6) The hazards created by climatic factors cannot be controlled.

6. Write short note on classification of earth worms.

Ans. Earthworms are classified ecologically and according to their ventrical distribution in soil biota as (1) Epigeic (2) Endogeic (3) Anecic

(1) Epigeic: These worms live in the soil surface of 3 to 10 cm and feed on organic matter like leaf litter or animal excrements. These are very active and have high regenerative capacity within a short period of time. Normally they are richly pigmented worms. These have no effect on the soil structure as they generally cannot dig and they are efficient agents of communication and fragmentation of leaf-litter, so classified as phytophagus earthworms.

(2) Endogeic: These worms live deep in the soil from 10-30 cm and feed on the humic materials and mineral matter. They have very long life cycles with limited regeneration capacity and lightly pigmented. Due to feeding habit on humus also called Detritivores, and also feed on dead roots and other plant debris in the organic matter rich surface soil horizon. ex *Octochaetona serrata*, from Madras.

(3) Anecic: These worms can go very deep into soil upto 60 to 90 cm. and form complicated burrows for their movements. They plaster the burrows with their own excrements and mucus secretions. These are called geo-phytophagus earthworms. The external abiotic parameters and the poor nutritive resources of the soil system appear to be the controlling factors for earthworm population.

7. Write short note on - (a) Honey extractor (b) Uncapping knife (c) Gloves (d) Gum boot.

a) Honey extractor: It is used for extraction of honey from the comb and functions on the principal of centrifugal force. When combs are centrifuged by this machine, the pure honey is thrown out without any damage to the comb. A drum or container holds a frame basket which spins, flinging the honey out. With this method the wax comb stays intact within the frame and can be reused by the bees. Extractors are either tangential or radial depending on how the frames are put into the basket. Radial baskets have the top bar of the frame facing outwards while tangential baskets have one side of the comb facing outward. Large commercial extractors are radial and rely on the upward slope of the comb cells. This slope allows to extract honey by applying centrifugal force toward the upper edge of the comb (opposite to the direction of gravity while in the hive).



Fig. (C) Honey extractor

b) Uncapping knife: When all of the combs are filled with honey, they are sealed by capping with the wax. So, before such capped combs are placed in the honey extractor, the wax sealing has to be removed with the help of an uncapping knife heated by stem before use. A plain steel knife may also be used in its place if warmed frequently in hot water.



Fig. (D) Uncapping Knife

c) Gloves: These are optional instruments. Gloves may be made up of thick clothing or rubber to handle the equipments during beekeeping. These gloves have exceptional durability, superior protection against Bee's sting. These gloves fit a little tighter than cow skin gloves. They have the same reinforced thumbs as cowskin gloves. Not ventilated.



Fig. (E) Gloves

(d) Gum boot: Gum boots are waterproof and are most often made from rubber or polyvinyl chloride (PVC) a halogenated polymer. They are usually worn when walking on wet or muddy ground, or to protect the wearer from heavy showers and puddles. They are generally just below knee-high although shorter boots are available. Though most commonly called "gum boots" or "gumbies", an alternative name, "Blucher Boot", is occasionally used by some older Australians. In some countries, the sound of people dancing in gumboots has been incorporated into a form of semi-traditional popular music, sometimes known as "gumboot music" or "gumboot zydeco" in Africa, or Welly boot dance by people from Britain.

(Long Answer Type Questions)

8. Describe improved practice of lac cultivation upto harvesting.

Ans. Cultivation of Lac: Lac cultivation is a complicated process, so the cultivators should know well about the inoculation, swarming period and harvesting of lac.

Inoculation

The first procedure in the lac cultivation is the inoculation of lac insect. Inoculation is the process by which young ones get associated properly with the host plant. Inoculation is of two types –

1. Natural inoculation: The inoculation taking place in normal routine or in natural way is very simple and common process during which the swarmed nymphs infect the same host plant again and start to suck the juices from the twigs. The natural incubation of swarmed nymphs has some drawbacks which are as follows –

(a) **Incomplete nutrition:** Lac insect with their piercing and sucking mouth parts, pierce into succulent twigs and suck the cell sap of the same host plant for nutrition. If the cell sap of the same host plant is further sucked out by the swarmed nymphs of the second crop continuously, the growth of the host plant would be retarded. In this way lac insect may not be able to get enough nutrients from the same host plant.

(b) **Irregular inoculation:** During the natural inoculation it is not sure that uniform sequence of inoculation takes place. If inoculation is not of continuous fashion, a regular crop of lac may not be obtained.

(c) **Unfavourable climatic conditions:** At the time of swarming a number of factors like high intensity of sunlight, heavy rainfall, flow of wind etc. affect the proper inoculation of nymphs. These natural environmental factors may also affect the host plant at the same time and may cause a gap of inoculation resulting in irregularity of the lac crop.

(d) **Multiplication of parasites and predators:** Lac insects have certain enemies in the form of parasites and predators. If the crop is not harvested in time and lac is allowed to remain on the same twig, the multiplication of parasites and predators takes place which hampers the population growth of lac insects.

2. Artificial inoculation: The main idea behind the artificial method of inoculation is to check all possible drawbacks of natural inoculation. In this method first of all host plant should be pruned in January or June. The twigs bearing insect nymphs which are about to swarm, or just before swarming are cut in sizes ranging between 20 to 30 cm in length. Then the cut pieces of these twigs are tied to fresh trees in such a way that each stick touches the tender branch of the

tree at several places which form bridges for the migration of the nymphs. After swarming, these twigs should be removed and separated from the host plant.

Inoculation Period

In India two types of crops viz., Rangini and kusumi are grown in a year. The Rangini crop is of two types called as Kartiki and Baisakhi crop which produce Kartiki and Baisakhi lac respectively. The Kusumi crop is also of two types viz., Aghani and Jethi which produce Aghani and Jethi lac respectively. The inoculation of Kartiki, Baisakhi, Aghani and Jethi crops are recommended in months of June to July, October to November, July and January to February respectively.

Swarming

It is very important phase in the life history of lac insect. So one should have accurate knowledge about the actual date of the swarming. At the time of swarming, the upper surface has yellow spot on the anal region. At this stage muscles contracts and insect gets detached from the place of attachment.

Harvesting of lac

The process of collection of ready lac from host tree is known as harvesting. In common practice the harvesting is of two types.

1. Immature harvesting: The harvesting of the lac before swarming is called as immature type of harvesting and the lac thus obtained is known as 'ARI LAC'.
2. Mature harvesting: The collection of crop after the swarming is called as mature harvesting and the lac obtained is known as 'MATURE LAC'.

The harvesting of lac before the swarming has some drawbacks because the lac insects may be damaged at the time of harvesting which would affect the population of lac insects and lac insects and ultimately result in great economic loss to the cultivators. But in case of palas lac (Rangini lac) it is found that Ari lac gives better production. Therefore, Ari lac harvesting is recommended in case of palas only. In all other cases immature harvesting should be discouraged. It is also found that in cold areas mature crop yields better quality of lac.

Harvesting period: The harvesting periods of different crops are quite different in accordance with the inoculation of crops. Kartiki crop is harvested in October to November whereas, Baisakhi crop in May and June.

9. Explain theories of communication in honey bees.

Ans. The forager honeybees communicate their floral findings in order to recruit other worker bees of the hive to forage in the same area. The factors that determine recruiting success are not completely known but there are two main hypothesis to explain how foragers recruit other workers –

(1.) The “Dance language theory” and

(2.) “Odor plume theory”

Karl von Frisch suggested dance language theory, however, it is assumed that both the theories are employed by the honey bees for foraging purposes.

(1). Dance language theory – Honeybees have an unique and one of the best understood communication language with the help of which they inform each other the distance and direction of source of food. The forager bees perform basically three kinds of dances.

(a) Round dance - Whwn the food source is very close to the hive (1-50 m), a forager performs round dance. She may repeat the dance several times at the same location or other locations. The movement of bees occur in round shape.

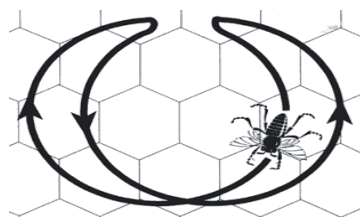


Fig. (F) Round dance

(b) Sickle dance – When food source are at intermediate distance from hive (50-150 m), forager performs sickle dance. This dance is crescent shaped and represents transitional dance between round and waggle dance.

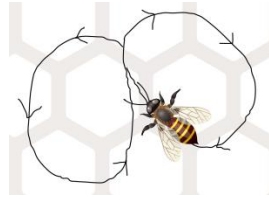


Fig.(G) Sickle dance

(c) Waggle dance – The Waggle dance is performed by forager bee if source of food is more than 150 m from the hive. Bee runs straight for a short distance then they make semicircle on one side and make another semicircle on opposite dirscion to complete a full figure of eight. The forager dances on the comb in a circular pattern and occasionally crossing the circle in a zigzag or waggle pattern.



Fig.(H) Waggle dance

(2) Odor plume theory – While the majority of researchers believe that bee dance give enough information to locate resources, the odour plume theory argue that the dance gives no actual guidance to a nector source. They argue that bees are primarily recruited by odor. The purpose of the dance is simply to gain attention to the returning worker bees so they can share the odor of the nector with other workers.

Few of the biologists actually suggest that both the theory may contribute in communication of honey bees. The forager bees search the pollen and nector sorces and bring a load to the hive. Distance and direction of the source is communicated to fellow foragers by means of peculiar dances which are performed in relation to the position of the sun. The richness of the source is communicated by the liveliness of the dance. Other bees than go in the direction and search for source with scent perceived from the pollen or nector load of the dancer.

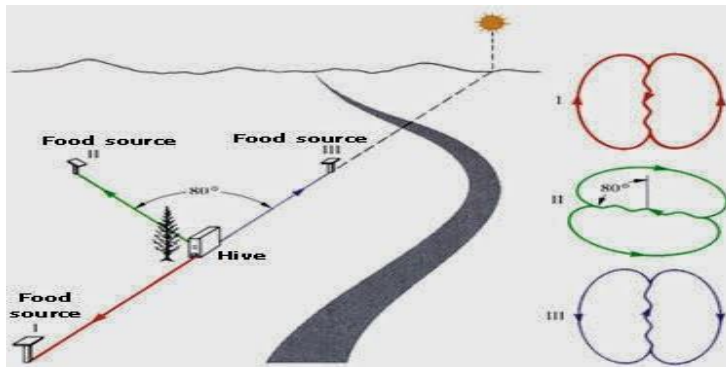


Fig.(I) Indication of direction of food source in respect to sun

10. Describe the digestive system of honey bee.

Ans. Digestive system of honey bee consists of a well-developed alimentary canal and its associated glands. Alimentary canal is long coiled tube extending from mouth to anus.

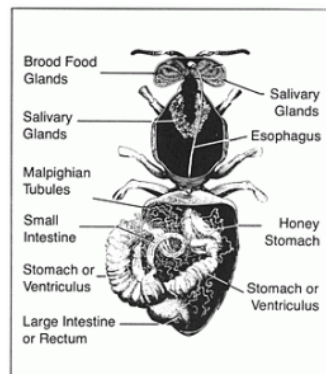


Fig. (J) Digestive System of Honey bee

(1) Mouth – It is present in lower wall of head open into cavity of sucking pump.

(2) Sucking pump – It is large sac of muscular wall present in the head. It extends from mouth to neck foramen. Sucking pump of honeybee is combination of preoral cibarium and post oral pharynx. Liquid food like nectar and honey are sucked up from canal of proboscis. Sucking pump narrows at its upper end to form gullet or oesophagus.

(3) Oesophagus – It traverse through neck, thorax and anterior portion of abdomen, where it enlarges into a thin walled sac called honey stomach, which is like crop of other insects.

(4) Honey stomach – It serves for carrying nectar and storage place for ingested food. Next to stomach, a short narrow part of digestive canal is called proventriculus. It regulate entrance of food into stomach. Ventriculus make X-shaped opening with the help of which nectar or honey can be retained in honey stomach but pollen is delivered to ventriculus.

(5) Ventriculus – Next to proventriculus, true stomach or ventriculus is present. Its epithelial layer secretes digestive juices and enzymes.

(6) Intestine – It is divided into two regions – anterior part is narrow called intestine and posterior end is sac like structure called rectum. Rectum opens through anus into cavity containing sting. Long thread like tubes called malpighian tubules open at junction of intestine and ventriculus, which are organs of excretion.

Associated glands :-

(1) Salivary glands – There are two glands –

(a) Cephalic gland or Head gland – A pair of gland located in head and secretes saliva.

(b) Thoracic gland – Second pair of salivary gland are thoracic glands. The saliva is ejected by salivary syringe into the cavity on the labium of the root of tongue.

(c) Brood-food glands – These are present in cephalic region of worker bees. Food glands are also called Hypopharyngeal gland. These glands produce a secretion which is a rich food material called “Royal jelly”, which is fed to queen, workers and drones larvae.

(d) Abdominal glands – Four pairs of wax glands are situated upon underside of workers abdomen on anterior part of last five segments. Wax is secreted into packets as fluid, which rapidly solidifies to a small translucent white cakes.

(e) Nassenou glands – It is present on upper side of abdomen and secretes a scent.

(f) Venom gland and Alkaline glands – are associated with sting in abdomen.

11. Write an essay on preparation of Vermicomposting.

Ans. Vermicompost is prepared under sheds either in the form of pit, pot or raised beds or heaps; which measures about 6 Ft length, 3 Ft wide and 2Ft deep. Keep a 2 Ft distance between two pits as a footpath for spreading the wastes, spraying the water, collection of Vermicompost etc. Cut the two sides of pit at 45°C, so that there is no chance for soil to fall inside the pit while working. Fill the pit with ample of water so that non-essential animals like ants, insects etc. start coming out side. Then add pieces of brick to prepare a layer of 2-inches and sprinkle the water. On second day add 2 inch layer of sand and dry leaves or hay and sprinkle the water. On third day, add cowdung compost and soil with addition of soil with addition of water so that vermibed is prepared at the level of earth. Now add a layer of about 6 inches of partially decomposed wastes, soil and cowdung and prepare a heap like bed with addition of water. Now vermibed is ready for inoculation of earthworms. On next day add 8-10 earthworms per square feet in vermibed.

Collection of compost and separation of earthworms:

When earthworms are released into waste mix (vermibed), they start feeding from the top layer of the waste and make their way downwards into the medium. They have the tendency to move away from their own excrements. Within a span of 1 to 2 months earthworm feed actively, assimilate only 5 to 10% for their growth and the rest is excreted as loose granula rice shaped pellets as vermicastings on the surface.

Stop to sprinkle the water 3-4 days before harvesting, due to this upper layer become dry and in search of moisture they go in deep layers of vermibed. Before disturbing the bed, the excrements and left over feed should be removed. The worms are harvested by hand sorting. Small conical heaps can be made and left for a few hours. Within 6 to 8 hours time earthworms move down and settle at the bottom of the heap as a cluster. The separated worms can be added to the next fresh material for continuation of the next cycle. The compost is passed through 3 to 4 mm. mesh sieve to separate the unfed material along with cocoons and young earthworms, which can be added to the fresh material. After drying the compost in sheds/shed till it is semi-dry can be stored in sacs until marketing or further use.

Several research institutions use virus vermiculture technology to solve the problems of sewage disposal and water shortage. The sewage is fed to a vermicomposting plant where earthworms convert it to vermicomposting, releasing clean water in the process. The vermicastings obtained are used by the school to green its surroundings, while the water produced suffices for gardening, flushing and other such operations, making considerable saving in water bill. The central pollution board is now taking effective steps to promote this effective method of sewage treatment.