

Paper - RTZ-304

(Economic Zoology; Lac, Honey and Vermi Production)

Section A(I) Multiple Choice Questions -

(i) Leading lac producing state is - Jharkhand

(ii) Mouth part of lac insect is - Piercing and Sucking

(iv) Shape of male lac cell is - ~~long~~ Cigar shaped.

(v) Hatching of eggs of worker bees takes place in - 3 days

(vi) True stomach of honeybee is - ventriculus

(vii) Amylase digests starch to - simple sugars

(viii) Among 80% sugars of honey, majority is of - Levulose

(x) Diastase digests starch to - simple sugars.

(2) Various types of lacs -

(2)

Lac crop is collected by cutting down the lac bearing twigs of host either before larval emergence, when it is known as ARI or after when it is known as PHUNKI.

STICK LAC - Crude lac, which is obtained by scraping lac encrustations over the twig is known as STICK LAC.

Stick lac is not used for any purpose without being processed.

■ Brood lac - Stick lac, collected before larval emergence have larvae inside it, which can be used for inoculation or infection of host plant. This lac is called as brood lac.

Seed lac - Crude lac is washed with the help of water & caustic soda. Other mild alkaline material or 2% solution of potash alum may also be used for the washing. The most satisfactory washing aid is $KMnO_4$ (0.1% on weight of stick lac). Washed lac needs a final wash with dil H_2SO_4 to get rid off brownish tinge. The colored water is drained out and this washed lac is known as seed lac.

Shellac - The molten lac is stretched onto outer surface of a cylinder containing hot water to form of sheet by means of palm and cloths so that lac is converted into thin sheets. These large and thin refined lac sheets are allowed to cool and then broken up into small flakes, which are commercially known as shellac.

Button lac → A well mixed molten resin is dropped into small quantities on smooth metal sheet on which it spreads in the form of circular discs or buttons of 6-7.5 cm diameter and about 0.5 cm thickness. This is called as "Button-lac".

Bleached lac - Elimination of pale yellow or orange-red color of seed lac produces white lac or bleached lac.

Kiri lac - Impurities that continuously accumulate inside the bag still retain an appreciable amount of lac. Semimolten mass of this is poured out on the floor and made into circular slab. This by-product is known as kiri lac.

(4)

Ans 3 - Uses of lac - Some of the major industrial and domestic uses are enlisted below -

(A) As coating compositions - Largest quantity of lac is used for making coating compositions in the form of varnishes, lacquers, polishes etc. Some of the uses of shellac varnishes are as -

- ① In impregnating compounds such as sealers, primers and fillers.
- ② In shoe and leather industry.
- ③ In hat industry for stiffening felt, silk and straw hats.
- ④ In photographic industry for making negative varnish, dry mounting, photo-engraving etc.
- ⑤ In ink and paint industry for making water-proof and lithographic inks.
- ⑥ In pharmaceutical industry for coating pills and for making semi-rigid bandages.
- ⑦ In paper industry for making laminated paper boards, for finishing playing cards and so on.
- ⑧ The earthen ware treated with lac resin is impervious to water and resistant to salt and oil.

(B) As thermoplastic resin - In gramophone records, grinding wheels, sealing waxes and general moulded articles.

(C) As insulator - In insulating varnishes, laminated paper products and in insulating cloths.

(D) As adhesive and cement - Gasket, cement, general cements, optical cements, caping cements for electrical lamps, abrasive paper and cloth etc.

Ans 4 - Life history of honey bee -

After mating, queen generally lays one egg in one brood cell. The eggs are pinkish in color, elongated, slightly curved with cylindrical body, generally attached to bottom of the cell. Larvae emerge out from both the fertilized as well as unfertilized eggs. Larvae from unfertilized eggs form the drones while the fertilized eggs develop workers. Amongst the larvae of workers, one is fed on the 'Royal Jelly', which is secreted by young workers in the colony and become the queen of colony. Royal jelly consist of digested honey and pollen, mixed with glandular secretion into mouth of the workers. After 5 days of feeding, the cell is sealed and larvae undergo pupation. ~~It is~~ Emergence of young one takes place after 3 weeks and they get busy in indoor duties. Following table gives relative no. of days taken to complete the life cycle from laying of eggs to the emergence of perfect worker, queen or drone

	Worker	queen	drone
Hatching of eggs	3	3	3
caping of cell at the end of larval stage	8	8	10
Final larval moult	11	10	14
casting of pupa skin	20	15	22-23
Emergence of adult bee from cell	21	16	24

Ans 5 - Indigenous methods of honeybee keeping

The main aim of beekeeping is to get more and more honey in pure form. Old method for beekeeping is very crude, cruel and unplanned type, which is called indigenous method. It involves following activities/facts -

① Hive - Two types of hives are used in indigenous method of beekeeping

(a) Fixed hive - It is purely natural type of comb because the bees themselves prepare hive at any space on 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 beekeepers collect the clusters of swarms from a tree and then 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 bee may escape from the hive. After that, hive full of honey is removed, cut into pieces and squeezed to get honey.

Drawbacks of indigenous methods -

- ① Honey becomes impure, because during squeezing, brood cells, pollen cells, larvae etc. are also squeezed.
- ② Colony become weaker due to killing of eggs and larvae during squeezing.
- ③ Hivation of bees at the same place is "a matter of chance".
- ④ Formation of new hive by escaped bees requires extra energy which affects yields.
- ⑤ Hazards created by climatic factors cannot be controlled.

Ans 6 Types of earthworms suitable for vermicomposting—

India has about 300 species of earthworms which are adapted to a range of vermiculture needs. Following are the few types of earthworm which are used generally for vermicomposting.

(1) Eisenia foetida - It is an exotic species and commonly called as "European worm" and considered suitable for vermicomposting because of its rapid growth rate, reproductive potential and occurrence in rich organic substances in nature. It decompose more rapidly and shows higher degree of humification.

(2) Eudrilus eugeniae - It is also a widely used exotic species introduced in India and is commonly called as "African Night Crawler" and is distributed throughout world by earthworm growers and these are one of the best for vermicomposting and the production of potential meal. It has excellent growth and high conversion rate.

(3) Pheronoma sansibaricus and P. excavatus. It is one of the best known indigenous species for vermicomposting and found in the depth ranging from 3-8 cm, temp range between 20-28°C and moisture content ranging between 20-40%. It is best suited in southern part of the country.

Ans 7 Preparation of vermiculture bed -

- Make a drainage hole on lower side of a plastic bucket having 18-20 litres capacity.
- Put 3 inches of soil layer
- Put 1 inches of vermiculture layer
- Again put 1 inch soil
- Sprinkle a layer of cowdung.
- Cover it with grass cuttings or leaves to a thickness of 3 inches.
- Moisten the entire system gently by sprinkling water, which has been stored in a tube for three days. Because storage of water removes chlorine from water.
- As grass and leaves dissolve, add more of the same and continue to maintain 3 inches of this mulch layer.
- Do not allow the system to become soggy due to excess of water
- The system will take 6-8 weeks for earthworms to hatch and stabilise.

18) Bees diseases :- Diseases of adult honeybees are caused by protozoa, bacteria & viruses.

① Protozoan diseases :-

(a) Nosema diseases :- Nosema disease is caused by a protozoan Nosema apis and has been reported from several parts of India as well various parts of the world. Bees infected with N. apis consume less oxygen than normal bees. Infected bees are died earlier than healthy bees. Nosemosis causes degeneration of oocytes in the ovary of queens, ovariole sheath gets wrinkled. It also reduces pollination efficiency of bees.

(b) Amoeba disease :- It is caused by a protozoan called Malpighamoeba mellificae & had not reported from any part of India.

(c) Gregarines :- Four gregarines are associated with honeybees. Gregarines are found attached to epithelium of the midgut of adult honeybees. Honeybees are assumed to ingest gregarine spores while cleaning up faecal material deposited in the hive or while drinking contaminated water.

(d) Flagellates

Crithidia (Leptomonas) species are the flagellates associated with honeybees.

These are found either free in the lumen or attached to the epithelium of the hind gut and rectum of adult honeybees. They do not occur in bees less than 6-days old. There is no evidence that flagellates are pathogenic to bees.

(e) Bacterial diseases :- Two diseases that can be very damaging are caused by bacteria affecting larvae. They are known as 'American foul brood' & 'European foul brood'. American foul brood is caused by Bacteria bacillus larvae & spetro causes

(f) Viral disease :- Honeybee sp. are also attacked by various species of miscellaneous viruses, bacteria and fungi. Black queen cell virus (BQCV), chronic bee paralysis virus (CBPV), cloudy wing virus, Chinese sac brood virus.

(g) Bacterial sp - Bacillus caugulans, B anthraxis,

Bee enemies → Enemy of bees harm the queen colony in different ways so they have attracted considerable attention. The wax moths (Galleria mellonella) & Achroia ^{griselly} are known. Wasp ~~is~~ (~~wasp~~) black ant (Coleopterus Compressus) & bee eaters are common enemies of honeybees. King crow is other enemy of honeybee.
(Merops orientalis)

Man itself is one of the worst enemy of honeybee.

Pests of lac hosts - About 113 sps of different host plants have been recorded so far but only four are of outstanding importance on which lac insects subsist and produce lac. These are Palas, Kusum, Ber, Khair.

Pests of Palas

- ① Cyclopetta obscura ⇒ pest of leaves and tender shoots
- ② Acroclita crystallina = found on Palas flower.
- ③ Gigaurea species = caterpillars damage leaves.
- ④ Natada sp = caterpillars damage leaves and controlled by hand picking
- ⑤ Thoresa sp = do

Pests of Kusum

- ① Myllocerus discolor = Pest of Kusum leaves
- ② Myllocerus viridanus = do
- ③ Halys dentatus = Damages leaves in March.
- ④ Conthecoma furcellata = Pest of leaves
- ⑤ Phanerptera roseata = do

Pests of Ber

- ① Oocardia pudibunda = Grubs and adult damage leaves.
- ② Cricket = Nymph causes damage.
- ③ Scutellaria nobilis = Nymphs and adult damage leaves.

Pests of Khair =

- ① Semiothisa fidoniata = Serious pest
- ② Pendesma quensvadi = Parasites
- ③ Sternocera orientalis = Larvae are borers
- ④ Sternocera diardi = do
- ⑤ Sternocera orientalis = do

ENEMIES OF LAC INSECT ⇒ Like any other insects

lac insects have their natural enemies namely insect parasites & predators that hamper its population in field.

Parasites - ~~top wasps~~ Cocophagus tschirchii

② Eupelmus tachardiae

③ Erencyrtus dewitii

④ Marietta javensis

⑤ Tachardiaepagus tachardiae

- Predators -
- ① *Eublema amabilis* Moore
 - ② *Holocera pulverea*
 - ③ *Chrysopa* spp
 - ④ *Eublema scitula*
 - ⑤ *Pyroderces falcata*.

Control of natural enemies of lac insects

Physical control

- ① Brood lac should be harvested as close to the swarming as possible, never more than one week in advance.
- ② ^{Brood} Lac tied to the trees should be removed after a maximum period of 3 weeks from the date of swarming. Thus, after 2-3 weeks, the brood is of no value but it becomes harmful being a breeding and distributing centre for predators and parasites.
- ③ Except brood lac, all of the lac cut from tree should be ^{scraped} separated from stick, which destroys many larvae and pupae of parasite and predators.
- ④ During crop harvesting, it is not always possible to convert huge amount of stick lac to seed lac at a time. To avoid spreading of enemies during this time, bundles of stick lac are tied with stones and immersed in forced water for about a week. This process kills all the parasitic and predator insects as they cannot survive in water.

Biological control - Some chalcids, Braconids, Gethylids, Ichneumonids usually destroy Eublema amabilis and Holocera pulverea very effectively.

Ans 10 - Large scale commercial vermiculture farming -

Now-a-days, organic farming is getting popularized. Organic farming is the form of vermicompost obtained from the earthworms. It is one way to overcome the problems of low productivity. The earthworms enhance decomposition rate of organic waste and improve the biological activities in the soil.

Basic requirements

To produce vermicompost, enough earthworm population is required and their multiplication on large scale is essential. To achieve the goal of economic multiplication of earthworms, it is necessary to fulfill following basic requirements.

- (a) Selection of suitable species
 - ① *Eisenia foetida*
 - ② *Eudrilus eugeniae*
 - ③ *Pheronox excavatis*
- (b) Suitable and adequate food - well decomposed food of any organic waste in adequate quantity having C:N ratio less than 20 is essential for earthworm breeding.
- (c) Adequate moisture - Earthworm cannot survive without moisture in the feed. Earthworm contains 85% water in their body and hence, it is the basic need.
- (d) Suitable temperature - Temp. limit of the earthworm feed should be in the range between 0°C - 35°C and best suitable range with $20-30^{\circ}\text{C}$.
- (e) Protection from light - Earthworms are nocturnal in habit, they are injured and may be killed by exposure to light due to UV. wavelengths.
- (f) Suitable pH - pH of feeding material should be at neutral level i.e. 7.0

(g) Location - Site for multiplication should be shaded and on sloppy land, so that there are least chances for accumulation of rain water during rainy season.

(h) operation site - A small piece of land admeasuring around 2000sq ft is required for production and storage units to produce 500 tonnes of vermicompost per annum.

(i) Transport - Covered truck or tractor to transport the organic waste.

(j) Civil work

(k) Machinery -

- Mechanical choppers.
- Mechanical Sieves.

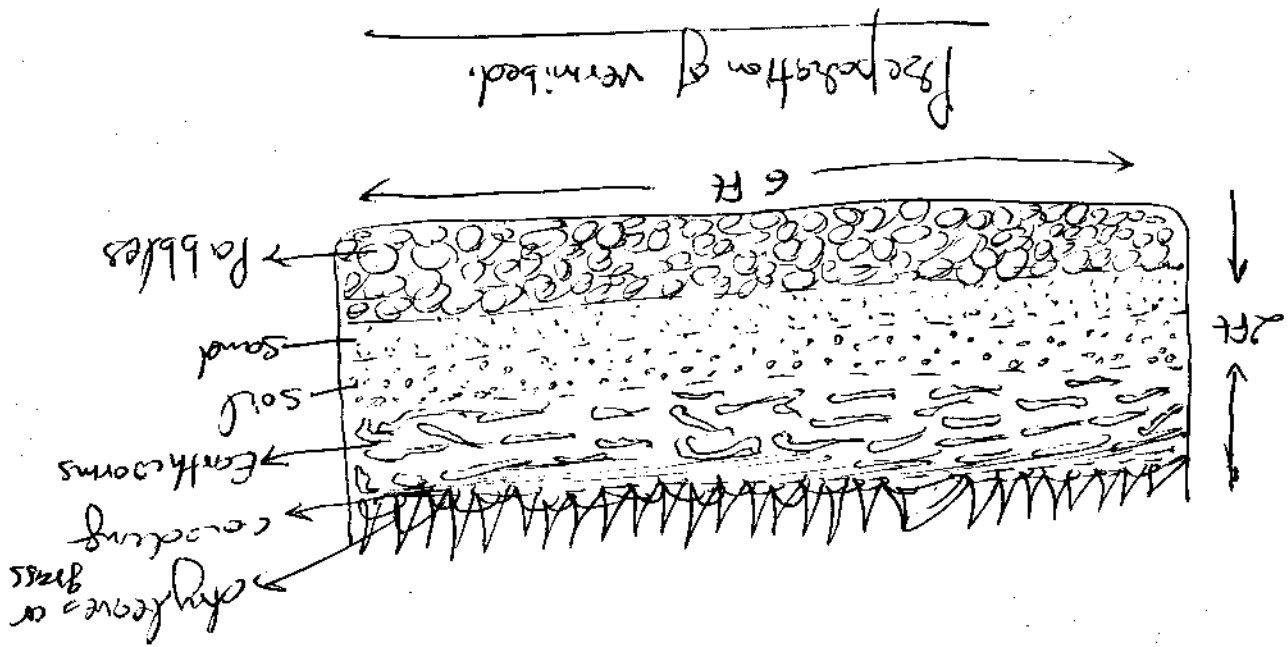
(l) Man power -

- Supervisors
- Laborers

(m) Purchase of earthworms - For processing of 125-150 tonnes of organic waste per month to yield 50-55 tonnes of dry vermicompost, 1000 kg of earthworms or 10-12 lacs adult ~~adult~~ earthworms are required

Preparation of vermibed -

Vermibed is prepared under sheds either in the form of pit, pot or raised beds or heaps; which measures about 6ft length, 3ft wide and 2ft deep. Keep a 2ft distance between two pits as a foot path for spreading the waste, spraying water, collection of vermicompost etc. Cut the two side of pits at 45° 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 to come outside. Then add pieces of bricks to prepare a layer of 2 inches and sprinkle the water. On second day, add 2 inch layer of sa



and dry leaves or hay and sprinkle the water. On third day add cow dung compost and 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 cow dung 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.

Ans 11 Artificial inoculation of lac insect -

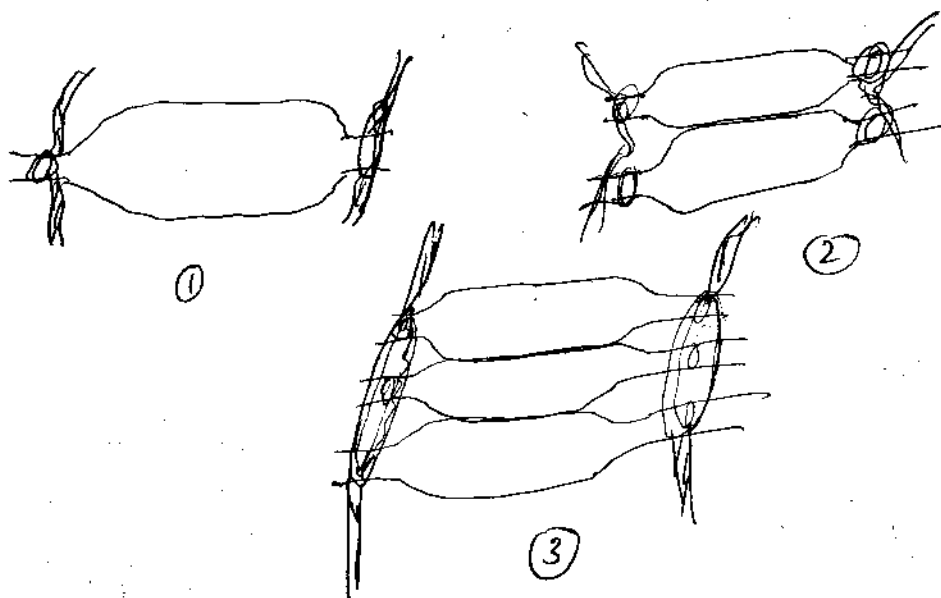
The event of infection of fresh host plants by means of newly emerged lac larvae is known as inoculation of host plants. Infection of host trees with lac insects may be either "natural" i.e. without the help of man or "artificial" i.e. human agency.

Assuming that as a result of pruning and other measures, host trees in a suitable condition are available, first operation in lac cultivation is to carry out infection or inoculation of the hosts in the correct manner. To carry out proper infection, following points should be taken care of-

- 1- Selection of brood lac - Lac bearing twigs of host trees on which cultivation is already going on are cut down about a couple of days earlier than the anticipated time of emergence of lac larvae. Such cuttings are called "brood lac". Healthy pest-free brood lac is selected and tied on the branches near the young shoots of the host trees for infection.
- 2- Ordinarily, most of the lac larvae emerge from brood lac within a week or ten days from the time of first emergence.
- 3- Selected brood lac sticks in lengths of about 6-12 inches should be first tied into bundles of 2-3 sticks and then such bundles are tied on the branches of trees at such places that the twigs above get full infection.
- 4- It may be necessary to keep brood lac on trees for more than two or three weeks. If kept longer even after the complete emergence of lac larvae, there is a danger of a larger number of enemy emerging out from the empty brood lac sticks and starting heavy infestation in the field.

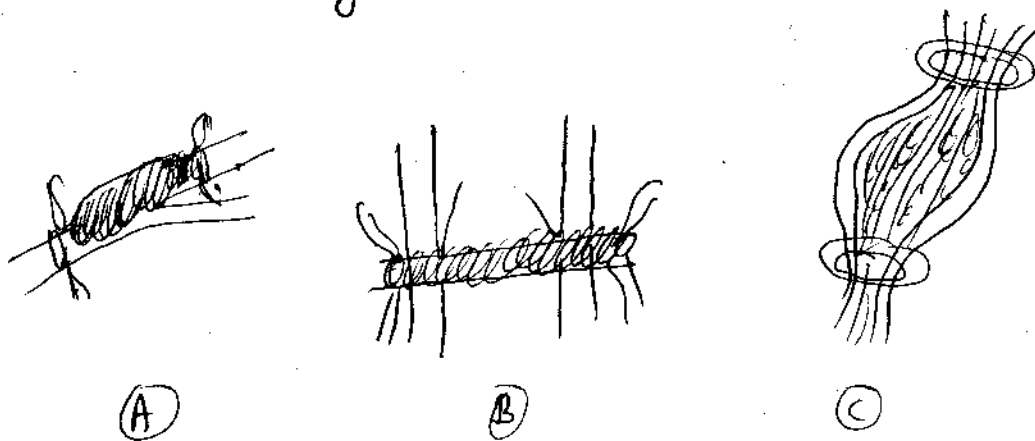
5- While tying brood bundles, care should be taken to see that they are securely tied on to upper surface of the branches of the host trees to be inoculated and in such a way that the maximum contact of the bundles with the branches is obtained.

Fig 3



Method of tying brood lac in inoculating trees

- ① method of tying single brood lac stick
- ② Two brood stick tied together
- ③ Bundle of brood sticks.



Three different ways of artificial inoculation of Lac.
 (A) - Longitudinal infection (B) Lateral infection (C) Interlaced infection.