MAHARASHTRA AGRICULTURAL UNIVERSITIES EXAMINATION BOARD, PUNE
SEMESTER END EXAMINATION
B.Sc. (Hort.)

Semester : V (NEW)	**Academic Year: 2019-2020**
Course No. : H/ENTO-354	**Title : Apiculture, Sericulture and Lac culture**
Credits : 2 (1+1)	
Day and Date:	**Time :** **Total Marks: 40**

Note:
1. Solve **ANY EIGHT** questions from **SECTION "A".**
2. All questions from **SECTION "B"** are compulsory.
3. All questions carry equal marks.
4. Draw neat diagrams wherever necessary.

SECTION "A"

Q.1. What do you mean by Apiculture? Write down the importance of apiculture in India

Apiculture : **(1 mark)**

The practice of rearing bee is called **beekeeping or Apiculture.** Beekeeping is an art and skill maintaining the bees in modern movable frame hives for hobby or fascination, production of hive products (honey, bee wax etc.) and for pollination services **OR** Apiculture is synonym of the beekeeping and is derived from Latin word '*Apiscultura*'. *Apis* means 'bee' and *cultura* means 'cultivation through education'. Beekeeping is a high profit enterprise it can be taken up both as subsidiary industry and as well as whole time profession.

Importance of Apiculture in India : **(3 marks)**

- Apiculture is an agro based enterprise, which farmers can take up for additional income generation.
- Honey bees convert nectar of flowers into honey and store them in the combs of the hive.
- The growing market potential for honey and its products has resulted in bee keeping emerging as a viable enterprise.
- Honey and wax are the two economically important products of bee keeping.
- Bees play an important role as pollinators in the environment.
- Bee keeping requires less time, money and infrastructure investments.
- Honey and beeswax can be produced from an area of little agricultural value.
- The Honey bee does not compete for resources with any other agricultural enterprise.
- Beekeeping has positive ecological consequences. Bees play an important role in the pollination of many flowering plants, thus increasing the yield of certain crops such as sunflower and various fruits.
- Honey is a delicious and highly nutritious food.
- Beekeeping can be initiated by individuals or groups.
- The market potential for honey and wax is high.
- Responsible for 1/3 of the world's food supply by pollination of more than 90--100 species of flowering plants.
- Worldwide economic value to food production of 50-100 billion USD annually with little or no "carbon footprint"

Q.2. Explain in brief history of apiculture in India.

History of Apiculture in India : **(4 marks)**

Bees and honey were known to human being in India since time immemorial as their references are mentioned in epics, on murals, sculptures, etc.

Vaishali Stupas in Muzaffarpur (Bihar) were built in commemoration of offering of honey to Lord Buddha by king of monkeys and his people whenever Lord Buddha visited the place.

Several references of bees have been made in the oldest scripture of India, the Rig Veda.

The earliest method of keeping bees was to use hollowed out tree trucks, empty pots or any other suitable receptacles smeared with wax and sweet scented leaves of *Cinnamomum iners* on the inner surface; these receptacles were kept in jungles to entice (invite) the bees during swarming seasons. When the bees had settled there, these recepticles were carried to and kept in desired places. This type of hive is called *pot hive* and it was in practice in Mysore, Coorg, Malabar, Godavari, Kasmir etc.

In our country, first attempt to keep honey bees in movable frame hive was made in early 1880s in pre-partition Bengal and Punjab. Commercial beekeeping in India started in 1910 in South when **Rev. Newton** devised a movable frame hive suitable for Asiatic hive bee, *Apis cerana.* This hive was named after him as **'Newton Hive'**. This hive is still popular for keeping the indigenous hive bee, *A. cerana.* During 1911-17, Newton also trained a large number of beekeepers in Southern India.

The Royal Commission on Agriculture (1928) recommended development of beekeeping as a cottage industry in India. The **All India Beekeepers' Association (AIBA)** was established in 1938-39. This association started publishing the ***Indian Bee Journal* (IBJ)**. During 1880, high yielding **European bees, *A. mellifera***, were introduced in our country. A sizable quantity of this species was imported from 1920 to 1951 in the states of Maharashtra, Kerala, Karnataka, Tamil Nadu, West Bengal, Punjab and Kashmir but none succeeded to establish this exotic honey bee species in the country.

After independence, **Khadi and Village Industries Commission (KVIC)**, Govt. of India took up beekeeping as one of its ventures. Some states like Jammu & Kashmir, Karnataka, Uttar Pradesh and Himachal Pradesh established Departments of Beekeeping under their Ministry of Agriculture/ Industries. Further, considering the importance of applied and basic research in apiculture, KVIC established **Central Bee Research and Training Institute (CBRTI)** at Pune in 1962.

The research in beekeeping started when Indian Council of Agricultural Research (ICAR), New Delhi started funding different projects. Two Beekeeping Research Stations were also established at **Nagrota-Bagwan** (erstwhile Punjab, now in H.P.) in 1945 and at **Coimbatore** (Tamil Nadu) in 1951. Recently in Gujarat, Department on Entomology, N.M. College of Agriculture, Navsari Agricultural University, Navsari has initiated research on honey bee & other pollinators sponsored through ICAR, New Delhi with Project entitled **"All India Co-ordinated Research Project on Honey bee and Pollinators from the year 2015-16"**

Q.3. Explain in brief equipments used in bee keeping. **(4 marks)**

Bee hive: It is movable wooden hive for bees with an entrance and parallel movable frames on which bees raise their combs.
Nucleus hive: Small bee hive for keeping 4-6 frames. These are used for mating of queens and division of colonies.
Observation hive: Small hive with glass sides to observe movements and behaviour of bees.
Synthetic combs: It is made up of high density polythene (plastic). It can be used in both super and brood chambers.
Hive stand: This is used to keep the bee hive above the ground so as to protect the colony from termites, ants and other crawling insects
Bottom board: It forms the floor of the hive made up of a single piece of wood or two pieces of wood joined together.
Brood chamber: It is a four sided rectangular wooden box without a top and bottom.
Super chamber: It is kept over the brood chamber and its construction is similar to that of brood chamber. Surplus honey is stored in super chamber.
Hive cover/Top cover: It insulates the interior of the hive
Inner cover: The inner cover is provided with a central ventilation hole covered with wire gauze help in air circulation.
Hive Frames: The frames are so constructed that a series of them may be placed in a vertical position in the brood chamber or the super chamber so as to leave space in between them for bees to move.

Q.4. Write short notes (Any Two)

a) Requirements for site selection of apiary **(2 marks)**

- Apiary should be located where there is abundance of nectar and pollen yielding plants within the radius of one to one and half kilometer.
- The site should not be exposed to strong winds or at least the hives should not face the direction of the prevailing winds. Trees and bushes may be provided to make the site less windy.
- The site should be flat but with good drainage facilities.
- Clean and fresh running water should be available to the bees in or near the apiary.
- A young orchard is an ideal choice.
- If the site is shade less and exposed, an artificial shade may be provided.
- An apiary should not be located too near highways.
- A good barbed wire fence or live hedge may be provided to keep out intruders.
- The site should be free from termite and black ant infestation.

b) Sericulture : **(2 marks)**

Sericulture is an agro based Industry, the term which demotes Production of Silk through silk worm rearing or in other words commercial production of Silk through silkworm rearing. Sericulture is a labour intensive agro industry ideally eradicates unemployment. Further improves their economic standards of rural poor. "Silk" the queen of textiles has a great importance ever before pre Vedic era. The term 'Silk' was mentioned in Rig-Veda, Ramayana and Mahabharata. It is estimated that one of mulberry and its allied activates can provided employment to people either directly or indirectly. Sericulture improves frequent returns throughout the year with relatively less expenditure common in puts.

c) Properties of lac : **(2 marks)**

- Lac is soluble in alcohol and weak alkalis but insoluble in water.
- It has capacity of forming uniform durable film.
- It possesses high scratch hardness.
- Resistance to water and Heat soluble, at 80°C it melts.
- It is good adhesive in nature.
- Ability to form good sealers, undercoat primers.
- It has a capacity to allow quick rubbing with sandpaper without slicking or gumming.
- It is non-conductive and non-toxic.

Q.5. State the importance of lac. Explain the necessity of lac cultivation.

State the importance of lac. **(2 marks)**

Lac is a natural resinous substance of profound economic importance in India. It is a product of a beneficial insect *Kerria lacca* (Kerr.) Millions of these sessile lac insects sustain their life on specific host plants, secreting resin as their body covering, which eventually harvested in the form of resin, dye and wax of commercial importance. It is the only resin from animal origin lending itself to diverse applications e.g. as a protective and decorative coating in the form of thin films, adhesives and plastics. It makes a small but significant contribution to the foreign exchange earning of the country, but the most important role of lac is considered to be an important cash crop by the poor cultivators (usually the tribal inhabitants) in almost all the major lac-growing states i.e. Jharkhand, Chhattisgarh, Odisha, West Bengal, Madhya Pradesh, Maharashtra and UP. The lac plays in the economy of the country is that roughly 3-4 million tribal people, who constitute the socio- economically weakest link of Indian population earn a subsidiary income from its cultivation.

India is the major producer of lac, accounting for more than 50% of the total world production. It virtually held a monopoly in the lac trade during the period of the world war-I, producing nearly 90% of the world's total output. Today an average of about 20 -22 thousand tons of stick lac (raw lac) is produced in the country per year. Most of the lac produced in our country is from homestead land, wasteland and rural areas, a large number of poor cultivators producing lac in very less quantity. For them, there is hardly any investment, except in years of adverse conditions. They either own a few lac hosts or take them out on lease or rental basis, and generally only part-time family labour is employed. When the lac matures, it fetches them ready cash. Usually host trees standing on raiyati lands are used for lac cultivation and in some areas trees on Government land are taken on lease or rental basis.

Necessity of lac cultivation? **(2 marks)**

- A good source of livelihood resource for poor farmers.
- Assured source of income during drought years.
- Require meager inputs (like water, pesticides *etc.*)
- Most suitably grown on marginal and degraded land.
- No competition with other horticultural, agricultural crops for land and farm operation.

- Do not harm host tree health neither other flora nor fauna.
- Avoids migration of rural population to urban areas.
- Increases opportunities for women for better occupation and returns.

Q.6. Enlist important research and training institutes on sericulture in India. Explain the role of Central Silk Board, Government of India. **(2 marks)**

1. Central Sericultural Research & Training Institute (CSRTI), Mysore (Karnataka) deal with Mulberry sericulture.
2. Central Sericultural Research & Training Institute (CSRTI), Berhampore (West Bengal) deal with Mulberry sericulture.
3. Central Sericultural Research & Training Institute (CSRTI), Gallandar Pampore, Kashmir, (J&K) deal with Mulberry sericulture.
4. Central Tasar Research and Training Institute (CTRTI), PO- Piska-Nagri Ranchi- 835 303 (Jharkhand) deal with Tasar sericulture.
5. Central Muga Eri Research and Training Institute (CMER & TI), P.O. – Lahdoigarh, Jorhat, Assam deal with Muga and Eri sericulture.

Role of Central Silk Board, Government of India. : (2 marks)

Central Silk Board (CSB), Ministry of Textiles, Govt. of India, Bangalore (Karnataka) is nodal agency. The main Research & Training Institutes of the CSB provide scientific and technological support for enhancing production and productivity for sustainable sericulture through innovative approaches.

Q.7. **Explain in brief important equipments used in sericulture unit. (4 marks)**

1) **Rearing house:** The rearing room should have proper ventilation, optimum temperature and proper humidity.

2) Rearing stand: Rearing stands are made up of wood or bamboo and are portable. These are the frames at which rearing trays are kept.

3) **Ant well:** Ant wells are provided to stop ants from crawling on to trays, as ants are serious menace to silk worms.

4) **Rearing tray:** These are made of bamboo or wood so that they are light and easy to handle. These are either round or rectangular.

5) **Paraffin paper:** This is a thick craft paper coated with paraffin wax with a melting point of 55^0 C. It is used for rearing early stages of silk worms and prevents withering of the chopped leaves and also helps to maintain proper humidity in the rearing bed.

6) **Chopping board and Knife:** The chopping board is made up of soft wood it is used as a base for cutting leaves with knife to the suitable size required for feeding the worms in different instar stages.

7) **Feeding stands:** These are small wooden stands (0.9 m height) used for holding the trays during feeding and bed cleaning.

8) **Hygrometers and Thermometers:** These are used to record humidity and temperature of the rearing room.

9) **Leaf chambers:** These are used for storing harvested leaves. The sidewalls and bottom are made of wooden strips. The chamber is covered on all sides with a wet gunny cloth. **Feeding basins, sprayer, and leaf baskets may also be required.**

Q.8. Enlist important pests of silkworm. Explain nature of damage and management practices for Uzi fly. **(1 mark)**

1) Uzi fly *Exorista sorbillans* (Tachinidae: Diptera)
2) Beetles *Dermestes cadeverinus* (Dermestidae:Coleoptera)
3) Ants (Hymenoptera)
4) Lizards, birds, rats and squirrels

Uzi fly : Nature of damage : **(1.5 marks)**

- The flies lay eggs on grown up larvae of silkworm and maggots on hatching feed the body contents of caterpillar.
- Mature maggot causes reduction in yield of cocoons and cocoon quality.
- Also causes death of silkworm larva.
- Presence of creamy white oval eggs on the skin of larvae in the initial stage.
- Presence of black scar on the larval skin.
- Silkworm larvae die before they reach the spinning stage (if they are attacked in the early stage). In later stage, pierced cocoon is noticed.
- **Control measures :** **(1.5 marks)**
- Prevent fly's access to silkworms by mechanical means.
- Fly proof rooms/doors/ventilators.
- All crevices of the rooms should be closed to prevent maggots pupating in the soil.
- Dusting of China clay @ 3g/100 on spinning larvae before mounting.

Q.9. What is Moriculture? Explain in brief pruning of mulberry plant and harvesting of mulberry leaves for Moriculture.

Moriculture: **(1 mark)**

The cultivation of mulberry plants for silkworm rearing is called Moriculture as the plant belongs to the family Moraceae. Among 20 species of mulberry, the most common are *Morus alba, M. indica, M. serrata* and *M. latifolia*, while the local *M. indica* offers certain good features like quick growing, hardiness, flush remains throughout the year but with comparative low yield.

Pruning of mulberry plants: **(3 mark)**

Pruning is the process of removing the branches of mulberry plant with the objective to give a convenient shape and size to increase the leaf yield and to improve its feeding value. Pruning of mulberry plant is also useful in adjusting the production period to synchronize with the leaf requirement for silkworm rearing and also to extend the leaf production period throughout the year.

1. Bottom pruning: Plants are cut at ground level leaving 10-15 cm stump above the ground once in a year.

2. Middle pruning: Branches are cut at 40- 60 cm above the ground level. After bottom pruning's, subsequent cuts are made at 45-50 cm height.

3. Kolar or Strip system: Branches are cut at ground level every time in closely planted area. Thus, it receives five pruning every year. This type of severe pruning requires heavy fertilization and irrigation.

Harvesting of mulberry leaves:

There are three methods of harvesting mulberry leaves *viz.*, (1) Leaf picking (2) Branch cutting and (3) whole shoot harvest.

1. Leaf picking: Picking starts at 10 weeks after bottom pruning and subsequent pickings are done at an interval of 7-8 weeks with harvesting of individual leaves with or without petiole.

2. Branch cutting: Entire branches are cut and fed to the worms. Before that, toping is done to ensure uniform maturity of the lower leaves.

3. Whole shoot harvest: Branches are cut at ground level by bottom pruning. Shoots are harvested at an interval of 10-12 weeks and thus five harvests can be made in a year.

Time of harvest: It is preferable to harvest the leaves during morning hours.

Preservation of leaves: Use wet gunny bags to store the leaves or cover the bamboo basket with wet gunny bags to keep it cool and fresh.

Q.10 Enlist different types of silkworm. Explain in brief regarding mulberry silkworm.

Types of silkworm : **(1 mark)**

Mulberry silkworm - *Bombyx mori*
Eri silkworm - *Philosamia ricini , P. Cynthia*
Tassar silkworm - *Antheraea pernyi, A. mylitta, A. yamamai*
Muga silkworm - *A. assama*

Mulberry silkworm: **(3 mark)**

The maximum quantity of silk about 95% produced in the world is the mulberry silk. Host plant is mulberry. Cocoons are Silvery white in colour. Continuous and uniform type with high silk production. Domestication and feasibility in India is easy and economical. Silkworm passes through a complete metamorphosis from egg to adults' stage.

SECTION 'B'

Q.No.11 Fill in the blanks **(4 marks)**

a. The place, where the hives are maintained is called as **Apiary.**
b. Scientist **Dr. A.S.Atwal** and his co-workers introduced *A. mellifera* species of honey bee in 1962 at Beekeeping Research Stations in Himachal Pradesh.
c. **Silk** is called as the queen of textiles.
d. Lac is a product of ***Kerria lacca*** **(Kerr.)** beneficial insect.

Q.No.12 Match the following pairs **(4 marks)**

1) Little bee	**b)** ***Apis florea***
2) Indian hive bee	**d)** ***Apis cerana indica***
3) Rock bee	**a)** ***Apis dorsata***
4) European or Italian bee	**c)** ***Apis mellifera***

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