MAHARASHTRA AGRICULTURAL UNIVERSITIES EXAMINATION BOARD, PUNE

SEMESTER END THEORY EXAMINATION

B.Sc.(Hons.) Agriculture

Semester	VI(New)	Term	VI	Academic Year	2021-22
Course No.	ENTO 365	Title	Management of Beneficial Insects		
Credits	2(1+1)				
Day and date		Time	2 hrs	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

Model Answer

Section 'A'

Q. 1 Enlist insect pests of honey bee and explain any one of them.

Enlisting Insect pests alongwith Scientific names : 2

Insect pests	Scientific name
Death's hawk moth	*Acherontia styx*
Greater wax moth	*Galleria mellonella*
Lesser wax moth	*Achroia grisella*
Predatory wasps	*Vespa orientalis V. magnifera*
Ants	*Dorylus labiatus*
African small hive beetle	*Aethina tumida*

Explain any one : 2 marks

2. Greater wax moth : *Galleria mellonella*

Nature of damage: The caterpillars make tunnels through near the midrib of comb during stress

Management:

- It will not attack the bees directly but feed on wax.
- Use of para dichlorobenzene.
- Simplest way is prevent wax moth getting into the hive through gaps and space.
- Use of traps to draw the moths away from the hive area.
- Wax moth larvae and eggs are killed by freezing for 24 hours.
- Wax moths can be controlled in stored comb by application of the aizawai variety of *Bt* spores by spraying.

Q. 2 Write in brief duties of worker in apiculture.

Household duties : 4 marks

- Build comb with wax secretion from wax glands.
- Feed the young larvae with royal jelly secreted from hypopharyngeal gland.
- Feed older larvae with bee-bread, a mixture of pollen and honey
- Feeding and attending queen.
- Feeding drones.
- Cleaning, ventilating and cooling the hive.

	• Guarding the hive. • Evaporating nectar and storing honey Outdoor duties : • Collecting nectar, pollen, propolis and water. • Ripening honey in honey stomach.
Q. 3	Enlist the types of silkworm alongwith scientific name and host plants. **Enlist types of silkworm :1 marks, scientific names : 2 marks and host plants : 1 marks**

Types of Silkworms	Scientific name	Host plants
Mulberry	*Bombyx mori* L.	Mulberry:
Tasar:	*Antheraea mylitta*	Asan and Arjun
Oak Tasar	*Antheraea proyeli* J.	oak
Eri	*Philosamia ricini*	castor
Muga	*Antheraea assamensis.*	Som and Soalu

Q. 4	Enlist the diseases of silkworm and write brief of fungal disease of silk worm. **Enlist diseases of silkworm :1 marks, Fugal diseases and management 3 marks**

Diseases of Silkworm
Viral Disese
Bacterial Diseases
Fungal Diseases
Protozoan disease

Fungal Diseases - Muscardine
White muscadine is caused by a fungus *Beauveria bassiana* and the green muscadine is caused by a fungus *Spicaria prasina.*
Aspergillosis is common in young age silkworms and the infected larvae will be lustrous and die. Dark green (*Aspergillus flavus*) or rusty brown (*Aspergillus tamari*) cluster are seen on the dead body.

- The diseases larvae prior to death will be lethargic and on death are flaccid
- oil specks may be seen on the surface of larvae
- They gradually be fome hard, dry and mummify into a white or green coloured structure
- The diseases pupae will be hard, lighter and mummifies

Management
1. Sundry the rearing appliances.
2. Disinfect the rearing room and utensils with 5 per cent bleaching powder
3. Avoid low temperature and high humidity in the rearing room
4. Keep the rearing bed thin and dry
5. Early diagnosis and rejection of infected lots
6. Apply Dithane M45 (3 kg/100 dfls) / Vijetha supplement as disinfectant on the larvae
7. Disinfect rearing rooms and trays with 4 per cent pentachlorophenol to control Aspergillosis.

Q. 5	Define lac culture and write short notes on types of lac and host plants used for lac production.

	Define : 1 marks , Enlist types of Lac culture :1 marks, Host plants : 2 marks **Lac Culture:** "Lac culture is the scientific management of lac insects to obtain a high amount of quality lac". **Types of Lac:** 1. Kusumi lac : Kusum trees 2. Ranjeeni lac : other than Kusum trees Lac host plant : About 113 varieties of host plants **Out of which the followings host plans are very common in India** 1. *Butea monosperma* (Vern. Palas) 2. *Zizyphus* spp (vern. Ber) 3. *Schleichera oleosa* (Vern. Kusum) 4. *Acacia catechu* (Vern. Khair) 5. *Acacia 52uxilia* (Vern. Babul) 6. *Acacia auriculiformis* (Vern. Akashmani) 7. *Zizyphus xylopyrus* (Vern. Khatber- grown in part of M.P. & U.P.) 8. *Shorea talura* (Vern. Sal grown in mysore) 9. *Cajanus cajan* (Vern. Pigeon-pea or Arhar) 10. *Grewia teliaefolia* (Vern. Dhaman preferred in Assam) 11. *Albizzia lebbek* (Vern. Siris/Gulwang) 12. *Flemingia macrophylla* (Vern. Bholia) 13. *Ficus benghalensis* (Vern. Bargad) 14. *Ficus religiosa* (Vern. Peepal) Host plants viz., **palas, kusum, ber and khair are of major importance,** while others are of regional and minor importance
Q. 6	Define Biological control and enlist the ideal characteristics of bioagents and write in brief any two. **Define : 1 marks , Enlist Ideal Characteristics of Bioagents : 1 marks, Each characteristics :1 marks each = 2 marks** **"Biological control** is a method of controlling pests such as insects, mites, weeds and plant diseases using other organisms". OR "Biological control has been defined simply as the utilization of natural enemies to reduce the damage caused by noxious organisms to tolerable levels". **Ideal Characteristics of Bioagents** a. **Narrow host range.** Generalized predators may be good natural enemies but they don"tkill enough pests when other types of prey are also available. b. **Climatic adaptability.** Natural enemies must be able to survive the extremes of temperature and humidity that they will encounter in the new habitat. c. **Synchrony with host (prey) life cycle.** The predator or parasite should be present when the pest first emerges or appears.

	High reproductive potential. Good biocontrol agents produce large numbers of offspring. Ideally, a parasite completes more than one generation during each generation of the pest. **d. Efficient search ability.** In order to survive, effective natural enemies must be able to locate their host or prey even when it is scarce. In general, better search ability results in lower pest population densities. **e. Short handling time.** Natural enemies that consume prey rapidly or lay eggs quickly have more time to locate and attack other members of the pest population. Small populations of efficient natural enemies may be more effective biocontrol agents than larger populations of less efficient species. **f. Survival at low host (prey) density.** If a natural enemy is too efficient, it may eliminate its own food supply and then starve to death. The most effective biocontrol agents reduce a pest population below its economic threshold and then maintain it at this lower equilibrium level.
Q. 7	Write short notes on *Trichogramma* sp. and Australian lady bird beetle. ***Trichogramma* sp. : 2 marks Australian lady bird beetle: 2 marks .** **1. Trichogramma sp.** ***Trichogramma*** is a genus of minute polyphagous wasps that are end-oparasitoids of insect eggs. *Trichogramma* is one of around 80 genera from the family Trichogrammatidae, with over 200 species worldwide. Although several groups of egg parasitoids are commonly employed for biological control throughout the world, *Trichogramma* spp is are the most used biological control agents in the world. Managment *Trichogramma* spp. Have been used for control of lepidopteran pests for many years. Entomologists in the early 1900s began to rear *Trichogramma* spp. For biological control. *T. Minutum* is one of the most commonly found species in Europe and was first mass reared in 1926 on eggs of *Sitotroga cerealella.* Nine species of *Trichogramma* are produced commercially in insectaries around the world, with 30 countries releasing them. *Trichogramma*wa spp are used for control on numerous crops and plants; these include cotton, sugarcane, vegetables, sugarbeets, orchards, and forests. Some of the pests controlled include cotton bollworm (*Helicoverpa armigera*), codling moth (*Cydia pomonella*), all types of sugarcane borer, rice stem borer and maize stem borer **Australian lady bird beetle :. *Cryptolaemus montrouzieri*** **Biological control agent** This species has been used as a biological control agent against mealybugs and other scale insects. It was introduced to Western Australia. In California it has been introduced in 1891 by Albert Koebele to control the citrus mealybug. It has also been introduced to New Zealand for biocontrol. As biological control agent outside

	Australia, *C. montrouzieri* has the common name *Mealy bug destroyer*. *Cryptolaemus montrouzieri* is an important predator of mealybugs (especially those infesting citrus and grapes and occasionally also of soft scales and whiteflies. The female is 3-5 mm long. The head, the prominent thorax and the legs red-brown, the elytra is shiny black covered by short hairs and slightly shorter than the abdomen. Larvae 7-10 mm in length, covered by white waxy strands, similar to mealybugs. **Life history:** Both larvae and adults of these beetles feed and may completely devour the eggs and other stages of mealybug and other coccids. Total development at 27°C required about 4 weeks and several hundred eggs (depending on the prey and its host plant) may be laid. The eggs are initially placed among the eggs of the prey, where on the predator feeds voraciously. The calculated threshold of development is around 0°C. The adults may live for several months, feeding also on honeydew. This predator is sensitive to low temperatures and several efforts had to be made in order to establish it in North America and in the Middle East.
Q. 8	Write in brief successful examples of sugarcane pests. **Sugarcane Pyrilla : 2 marks , Sugarcane white woolly aphid : 2 marks** **Sugarcane Pyrilla (*Pyrilla perpusilla*):** There was a severe outbreak of Sugarcane Pyrilla during 1972-73 in the states of Punjab, Haryana, U.P. and Bihar which was successfully controlled by utilization of potential biocontrol agents like Egg parasitoid *Tetrastichus pyrillae* and Nymphal predator *Epicania melanoleuca*. This pest in Karnataka was successfully controlled by its potential biocontrol agents. **ii. Sugarcane white woolly aphid (*Ceratovacuna lanigera*):** This pest of sugarcane was also successfully managed by bio agents *viz. Dipha aphidivora, Chrysoperla* spp., Coccinellid beetles, Syrphid flies and some spiders in the states of Maharashtra and Karnataka, where its outbreak during 2003-04 had caused considerable economic damage to the farmers.
Q. 9	Write in brief *Chrysoperla* sp. and its detail mass production procedure. **Chrysopa information including morphology and biology : 2 marks , mass Production procedure :2 marks** ***Chrysoperla* sp:** • In India, 65 species of chrysopids belonging to 21 genera have been recorded from various crop ecosystems. • Some species are distributed widely and are important natural enemies for aphids and other soft bodied insects. • Amongst them, *Chrysoperla carnea* is the most common. • It has been used in cotton ecosystem for protection from aphids and other soft bodied insects. *C. carnea* is now used extensively all over the country. **Morphology and Biology** • The eggs are stalked and green in colour. • Egg period lasts 3-4 days. The larva is white in colour on hatching.

	• The larva has 3 instars which are completed in 8-10 days. • The larva spins a cocoon from which the adult emerges in 5-7 days. • Adults on emergence mate repeatedly. • Generally, pre-oviposition period lasts for 3-7 days. • Adult females start laying eggs from 5th day onwards and peak egg-laying period is between 9-23 days after emergence. • The male longevity is 30-35 days and female can even live up to 60 days. • Fecundity is 600-800 eggs/female. • The sex ratio Male: Female is 1: 0.85. • The adult males and females live 41 and 53 days, respectively. **Production procedure** • In mass production, the adults are fed on various types of diets. • The larvae are either reared in plastic tubes or empty injection vials or in groups in large containers or in individual cells. • The adults are collected daily and transferred to pneumatic glass troughs or G.I. round troughs (30 cm x 12 cm). • Before allowing the adults, the rearing troughs are wrapped inside with brown sheet which act as egg receiving card. • About 250 adults (60% females) are allowed into each trough and covered with white nylon or georgette cloth secured by rubber band. • On the cloth outside three bits of foam sponge (2 sq.in) dripped in water is kept. • Besides an artificial protein rich diet is provided in semisolid paste form in three spots on the cloth outside. • This diet consists of one part of yeast, fructose, honey, Proteinex R and water in the ratio 1:1:1:1. • The adults lay eggs on the brown sheet. • The adults are collected daily and allowed into fresh rearing troughs with fresh food. • From the old troughs, the brown paper sheets along with *Chrysopa* eggs are removed.
Q. 10	Write short note *Chelonus blackburni* and weed killers ***Chelonus blackburni* information, Laboratory host, targeted pest, field Release dose : 2marks** ***Chelonus blackburni:*** is a highly potent eggs larval parasitoid of the bolloworms. Method of mass multiplication of parasitoid is given below. **Laboratory host:** Rice moth, *Corcyra cephalonica*, potato tuber, moth *Phthorimaea, operculella.* **Targeted pests** 1. Pink bollworm, 2. Spotted bollworm

	3. Potato tuber **Field Utilization of *Chelonus blackburni* potsto** The adult parasitoids could directly be released in the field crops or even in stored potatoes as described for earlier parasitoid **Dose:** Release of 60,000 adults/he i.e. 15000 adults per week / release and such 4 releases in the field crop. In case of stored potatoes release, 2 adults / kg tubers. **Cotton:** Release 2 lakhs adult parasitoids / ha / week. Total 6 release starting after 60days of planting. **Weed killers :** ***Zygogramma bicolorata*** **information including biology, host plant and field** **Release dose : 2 marks** ***Zygogramma bicolorata:*** Adults and larvae of Z. *bicolarata* feed on parthenium leaves. The eggs are laid single or in small groups of up to five mostly on the undersurface of the leaves and egg period lasts four five days the early stage larvae feed on the terminal portion and and buds and move on to the leaf blades as they grow. The full grown larvae enter the soil and pupate, larval and pupal periods last 10-15 days and 8-10 days, respectively. Each female is capable of laying up to 1,786 eggs (mean 836.13). **Field releases;** For inoculative raleases 500 adults of *Zygogramma bicolarata* are released per hectare coinciding with the start of monsoon showers. The beetles spread automatically to the adjoining fields.
	Section 'B'
Q. 11	**Do as directed**
1.	Fundamental role of scavengers. Scavengers play a fundamental role in the environment through the removal of decaying organisms, serving as a natural sanitation service.
2.	Define natural enemies. Insect predators and parasitoids that attack and feed on other insects, particularly on insect pests of plants are considered natural enemies.
3.	Biological control is leaf application of fungal spores of ***Ampelomyces quisqualis*** to control mildew on greenhouse crops.
4.	National Bureau of Agriculturally Important Insects Resources is located at Mysore (True/false) : **False**
Q. 12	**Fill in the blanks**
1	**Bumble** bees are also called as pollinators.
2.	***Phasmarhashabditis hermaphrpodita*** is a microscopic nematode that kills slugs.
3.	**Nistari** multivoltines race is reared in West Bengal.
4.	Rice moth, *Corcyra cephalonica* and ***Sitotroga cerealella*** are the laboratory hosts.

----------x----------