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TAMILNADU, INDIA.

Tel.No. : 0431 - 2420079 Website: www.thanthaiperiyargasc.ac.in E-mail : periyarevrcollege@yahoo.com

Criterion III - Research, Innovations and Extension

3.3 Innovation Ecosystem

3.3.1 ***Institution has created an ecosystem for innovations, Indian Knowledge System (IKS),including awareness about IPR, establishment of IPR cell, Incubation centre and other initiatives for the creation and transfer of knowledge/technology and the outcomes of the same are evident***

Incubation centre and other initiatives

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SERICULTURE

Sericulture is the science that deals with the production of silk through the rearing of silkworms. Silk is called the queen of textiles due to its glittering lustre, soft feeling, elegance, durability and tensile properties. The silk is a natural proteinaceous fibre discovered as per legend in China during 2600-2700 B.C during the reign of the great emperor of China, Haung Ti and gradually spread east and west via the so called Silk Road. During the early Taisho era (1912-1926) when the progress attained the stage of establishing genetic hybridization, there was said to be 1250 varieties, and this increased by 750 varieties in the Taisho-Showa era and the total became 2000 varieties (Hiratsuka, 1969).

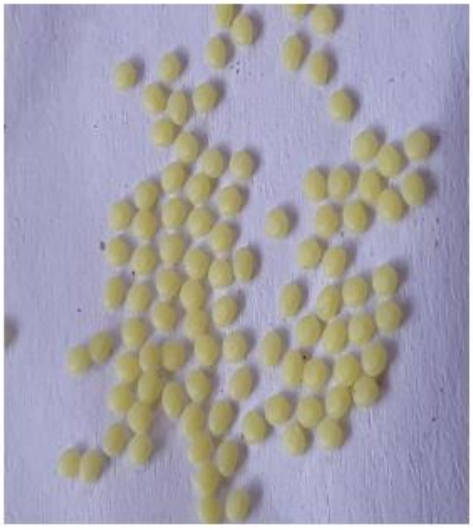
Silk is a way of life in India. Over thousands of years, it has become an inseparable part of Indian culture and tradition. No ritual is complete without silk being used as a wear in some form or other. Silk is the undisputed queen of textiles over centuries. Silk provides the much needed work in several developing and labour richcountries. Sericulture is a cottage industry par excellence. It is one of the most labour intensive sectors of the Indian economy combining agriculture and industry, which provides a means of livelihood to a large section of the population in capacities like mulberry cultivator, co-operative rearer, silkworm seed producer, farmer-cum-rearer, reeler, twister, weaver, hand spinners of silk waste, traders etc. It is the only cash crop in the agricultural sector that gives returns within 30 days. This industry provides employment to nearly to thirty five million people in our country. Sericulture is practised in Karnataka, West Bengal, Tamil Nadu, Andhra Pradesh, Jammu and Kashmir, Gujarat, Kerala, Maharashtra, Uttar Pradesh, Rajasthan, Bihar and Orissa.

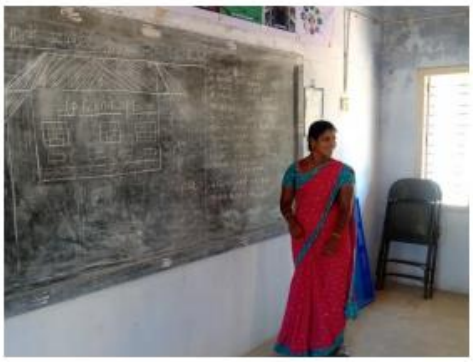
Sericulture is suitable to many kinds of farm situations. Mulberry, the food crop for silkworm, is a hardy and perennial crop. It can be cultivated in a variety of soil types, a wide

range of agro-climatic conditions and both in rain-fed and irrigated areas. It can be also cultivated as inter-crop with some plantation crops. Similarly, the cocoon production can also be taken up under a variety of situations. Silkworms can be reared in a wider range of climatic and seasonal conditions. Thus, sericulture can be considered as a versatile enterprise suitable for different kinds of farming situations.

Sericulture was thought as an elective paper for the undergraduate students of Zoology and as Economic zoology for the allied Botany students. Apart from this, several post graduate students did their project work related to sericulture. Many M.Phil students completed their dissertation related to silkworm. One minor project was completed earlier with fortification of mulberry leaves with various nutrients and biocomposts. Two PhD theses were awarded-one with fortification of mulberry leaves and other with feed supplementation of mulberry leaves with probiotics.

In the current assessment period, one Ph.D was awarded with the work related to sericulture and two Ph.D scholars are pursuing in feed modification and colour cocoon production in silkworms.





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Ph.D. Research work related to Sericulture

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Dr. S. R. Vasugi
Associate Professor (Rtd.)
P. G. and Research Department of Zoology
Periyar E. V. R. College
Tiruchirappalli 620 023
Tamil Nadu, India

CERTIFICATE

I hereby certify that the thesis entitled "**Molecular Study of Pigment Transport System and the Role of Carotenoid Binding Protein (CBP) in Colour Manipulation of Wild and Hybrid Races Fed with Dye Mixed Modified Diet in Mulberry Silkworm - *Bombyx mori L.*"**, submitted to Bharathidasan University, Tiruchirappalli for the award of the degree of **Doctor of Philosophy in Zoology** is a record of original work independently carried out by **Ms. Anumol Anto** under my guidance and supervision at PG and Research Department of Zoology, Periyar E. V. R. College, Tiruchirappalli-620 023. I further certify that no part of the thesis has not been submitted elsewhere for the award of any other degree, diploma of this or any other universities.

Place : Trichy

Date : 16.10.18

(Dr. S. R. Vasugi)

Research Supervisor

Signature Not Verified
Digitally Signed
Signed by: P S VIJAYALAKSHMI
Reason: NAAC
Location: TAMILNADU, INDIA
Date: 29-Jul-2023 19:52:46

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Phone No.0431-2407092, Fax : 0431-2407045, Email: office@bdu.ac.in Website : www.bdu.ac.in
(Accredited with "A+" Grade by NAAC)

DR. S. MUTHUSAMY
DIRECTOR(RESEARCH)

Ref:41043/Ph.D.K9/Zoology/Full Time/April 2017 Date:.02.2021

To.
Mr. R. Kebaraj
Research Scholar
Dept. of zoology
Periyar E.V.R College (Auto)
Tiruchirappalli – 620 023.

Sir / Madam,

Sub: Ph.D. Programme, **-Confirmation Order** — reg.
Ref: Letter dated **19.01.2021. & 03.02.2021** of
Dr. A. Balasundaram .

With reference to the above cited communication, the provisional registration of your Ph.D. Programme with research topic titled "**VIBRANTLY COLOURED SILK PRODUCTION USING MODIFIED FEED FORMULATION WITH VITAL DYES AND AQUALACT PROBIONT IN SILKWORM BOMBYX MORI**" is hereby confirmed on due consideration of the progress reports and the recommendations of Doctoral Committee. You are also permitted to proceed with your research work further.

Yours Sincerely,
15/2/21
DIRECTOR(RESEARCH)

Copy to:
1. Dr. A. Balasundaram, Assistant Professor,
Dept. of Zoology, Periyar E.V.R College (Auto),
Tiruchirappalli – 620 023.

All Communications are to be addressed to the Director only - Please quote our reference in all your replies

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AQUACULTURE

Aquaculture is the breeding, raising, and harvesting of fish, shellfish, and aquatic plants. Aquaculture is an environmental responsible source of food and commercial products and helps to create healthier habitats, and is also used to rebuild stocks of threatened or endangered species. Aquaculture represents one of the fastest growing food-producing sectors of the world. The rapid growth of aquaculture witnessed in the production of farmed fish, crustaceans and molluscs, grew from insignificant levels in 1950's to 25% of global aquatic production, with 125.3 million metric tonnes (MT) in 1999 (FAO, 2001). One of the fastest growing aquaculture production sectors is that of the penaeid shrimp. Among the cultured shrimp produced worldwide 80% of production is from Asia (Rosenberry, 1994). Black tiger shrimp, *Penaeus monodon*, is the main species cultured in Asia except in Japan and China (Lavilla-Pitogo, 1996). Penaeid shrimp culture alone accounts for 14% of the total aquaculture production value (FAO, 2001).

Aquaculture was thought as a Skill based elective paper for the undergraduate students and post graduate students of Zoology and as Economic Zoology for the allied Botany students. Many post graduate students completed their project work in aquaculture related topics. In the current assessment period one Ph.D thesis was awarded in the field of aquaculture, with feed preparation for prawns and its safety assessment in the year 2020.

Dr.S. UMAMAHESWARI, M.Sc.,M.Phil.,Ph.D.,
Associate Professor and Head,
Department of Zoology
Thanthai Periyar Government
Arts & Science College (Autonomous)
TIRUCHIRAPPALLI-620 023.




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ORNAMENTAL FISH CULTURE

Ornamental fish culture, also known as ornamental fish farming or ornamental fish keeping, refers to the breeding, rearing, and trade of fish species primarily for their aesthetic value rather than for food production. It is a popular hobby and industry worldwide, with enthusiasts and businesses dedicated to the care, breeding, and sale of ornamental fish. It involves a wide range of fish species, including various tropical fish, goldfish, koi, betta fish, guppies, angelfish, discus, and many more. Different species have different care requirements, preferred water conditions, and levels of difficulty in breeding. Breeding techniques can vary depending on the species, but they often involve providing appropriate conditions for spawning, separating male and female fish, and ensuring the survival of the fry (young fish).

Ornamental fish can be bred and reared in various types of aquaculture systems, including indoor tanks, outdoor ponds, and specialized facilities. These systems need to provide suitable water conditions, filtration, aeration, temperature control, and adequate space for the fish to thrive. Maintaining proper water quality is essential for the health and well-being of ornamental fish. Factors such as pH level, temperature, ammonia, nitrate, and nitrite levels need to be monitored and controlled. Filtration systems, regular water changes, and the use of appropriate water treatments are employed to ensure optimal conditions.

They are susceptible to various diseases, so disease prevention and management are critical. Quarantine procedures for new fish, regular monitoring for signs of illness, and prompt treatment are essential to maintain the health of the fish population. Maintaining good hygiene practices and providing a stress-free environment also help prevent disease outbreaks.

Ornamental fish are bought and sold globally, with a thriving market for hobbyists, aquarium enthusiasts, and pet stores. Some fish farms specialize in producing high-quality specimens for the market, while others focus on rare or exotic species. The ornamental fish industry also has a responsibility to promote sustainable practices and conservation efforts. Sustainable breeding practices, responsible sourcing, and education about the importance of protecting natural habitats are crucial to ensure the long-term viability of ornamental fish species.

Ornamental fish culture combines art, science, and business, providing enthusiasts and professionals with the opportunity to appreciate and care for these beautiful creatures while contributing to a thriving industry.

Taking this into consideration Ornamental Fish Culture was thought of as a Skill based elective paper for the undergraduate students and for the allied Botany students as Economic Zoology.

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Syllabi Based on Aquaculture

B.Sc. Zoology:

Semester III **Hours 6**
CBE I **Credits 4**

AQUACULTURE

UNIT I

Aquatic Biomes-Brief introduction of the aquatic biomes; Freshwater ecosystem (lakes, and rivers),Estuaries, intertidal zones,oceanic pelagic zone, marine benthic zone,-Physicochemical Characteristics of fresh water bodies and Sea water.

UNIT II

Fresh water aquaculture - Culture of Indian Major carps-pond construction-pond preparation-stocking- fish feeds - natural feeds - plankton; artificial feed-pellets - encapsulated feed - live feed - Artemia, Rotifer. -water quality management in fish pond –types of aerators- Fungal (Cooton wool),and Bacterial (Tail fin and mouth rot) and viral (EUS) diseases of fish and prawns and its prophylaxis.

UNIT III

Fish breeding techniques: Fish seed from natural sources- Bundh breeding-induced breeding - hypophysation - hybridization - hatchery techniques -transport of fish seed -.- Monoculture and Polyculture.- sewage fed fish culture - Ornamental fish culture.

.UNIT IV

Shrimp farming- *Macrobrachium malcomsonii,* - *Penaeus monodon* - pond construction - seed collection - nursery management - feeding – Economic importance of Coastal aquaculture-Crab culture : Culture of Scylla serrata,- culture of Seaweeds and its economic importance- Culture of edible Oysters, pearl oysters and mussels.

UNIT V

Culture of brackish water fishes ;*Lates calcarifer*, *Etroplus suratensis* and *Mugil cephalus*

Integrated fish farming: Paddy cum fish culture; duck cum fish culture; fish cum cattle farming. Crafts and gears used in fish harvest; - preservation and transport of fishes and prawns. Fish by- products,- Organization related fish culture-MPEDA, CMFRI, CIBA and CIFRI and their role in fishery development.

Text book :

Aquaculture- Principles and Practices (II Edition). Pillai TVR, Kutty MN.

References :

1. Jhingran VG, 1982. Fish and fisheries of India, Hindustan Publishing Corp-
2. Rath RK. Freshwater aquaculture, 1993. Scientific Publishers.
3. Pandey and Shukla, 2007. Fish and fisheries (II Edition), Rastogi Publishers.
4. Santhanam.P, Ramanathan. N and Jegatheesan. G, 1990. Coastal Aquaculture in India.
5. Aquaculture: Dr. N. Arumugam, Saras Publications.

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Allied Paper for Botany and Chemistry:

Offering Department: Zoology **Receiving Department: Botany and Chemistry**
Semester II **Hours: 4**
Allied III **Credits: 4**

ECONOMIC ZOOLOGY

Unit - I

Aquaculture: Scope, site selection, pond construction and management of freshwater fish farming - Edible South Indian Fishes: Fresh water fishes-*Catla catla, Labeo rohita, Mirigal* - Marine water fishes- *Mugil cephalus, Sardinella longiceps, Rastrelliger kanagurta* - Fish by-products.

Unit - II

Aquarium fishes-marine (any two), fresh water (any two). Setting up and maintenance of aquarium - Economic importance of aquarium fishes.

Unit - III

Mulberry culture - Biology and life history of *Bombyx mori* - Rearing techniques – Harvesting- Bacterial diseases (Septicemia and Bacterial intoxication) and Viral diseases (Grasserie and Flacherie) of silk worm- Enemy of silkworm : Uzi fly-Economic importance.

Unit - IV

Vermiculture: Scope - Culture of *Eisenia foetida, Perionyx excavates* - Methods of vermicomposting- Economic importance of Vermiculture - Vermiwash.

Unit - V

Vector borne diseases: Malaria, Dengue, Filaria : Transmission and Prophylaxis - Household pests: Mosquitoes, Cockroaches, House flies - Agricultural pests: Life cycle and control measures of *Scirpophaga incertuals* (paddy stem borer), *Amsacta albistriga* (red hairy caterpillar), *Oryctes rhinoceros* (rhinoceros beetle), *Pectinophora gossypiella* (Pink boll worm).

Text Books:

1. Vasantharaj David, 2001. Elements of Economic Entomology, Popular Book Depot., Chennai-600015.
2. Shukla Upadhyay, Economic Zoology. Rastogi Publication, Meerut.
3. Dr Jawaid Ahsan and Dr. Subhas Prasad Sinha, A Hand book on Economic Zoology. S,Chand Company Ltd, New Delhi.

References:

1. Sultan Ahamed Ismail, 2005. The Earthworm Book, IIEd., Mother India Press Goa.
2. Dr.N.Arumugam, Aquaculture. Saras Publication.
3. Ganga, S and Sulochana Chetty J. An Introduction to Sericulture (II Ed.,) Oxford and IBH Pub., Co. Pvt. Ltd., New Delhi.

VERMICULTURE

Vermiculture refers to the artificial rearing or cultivation of worms (Earthworms) and the technology is the scientific process of using them for the betterment of human beings. Vermicompost is the excreta of earthworm, which is rich in humus. Vermiculture means "worm-farming". Earthworms feed on the organic waste materials and give out excreta in the form of "vermicasts" that are rich in nitrates and minerals such as phosphorus, magnesium, calcium and potassium. These are used as fertilizers and enhance soil quality. Earthworms that are commonly used in Vermiculture are, *Eisenia fetida, and Lumbricus rubellus* horticultural in temperate climates and *Pheretima posthuma, Perionyx excavatus* and *Eudrilus eugeniae* and in the tropical areas.

The method used by farmers to multiply earthworms is by mixing high amounts of organic wastes, including the plant materials, cattle dung in a proportion of 1:1. Once the substrate medium has been made, around 40-50 earthworm species are released into the medium and it is protected from various environmental factors. Regular maintenance is important for the growth of earthworms. The temperature should be between 15 to 25-degree centigrade and the moisture level should be at 80-90%. Within one to two months, the earthworms can multiply up to 300 times relying on this process and then they can be harvested.

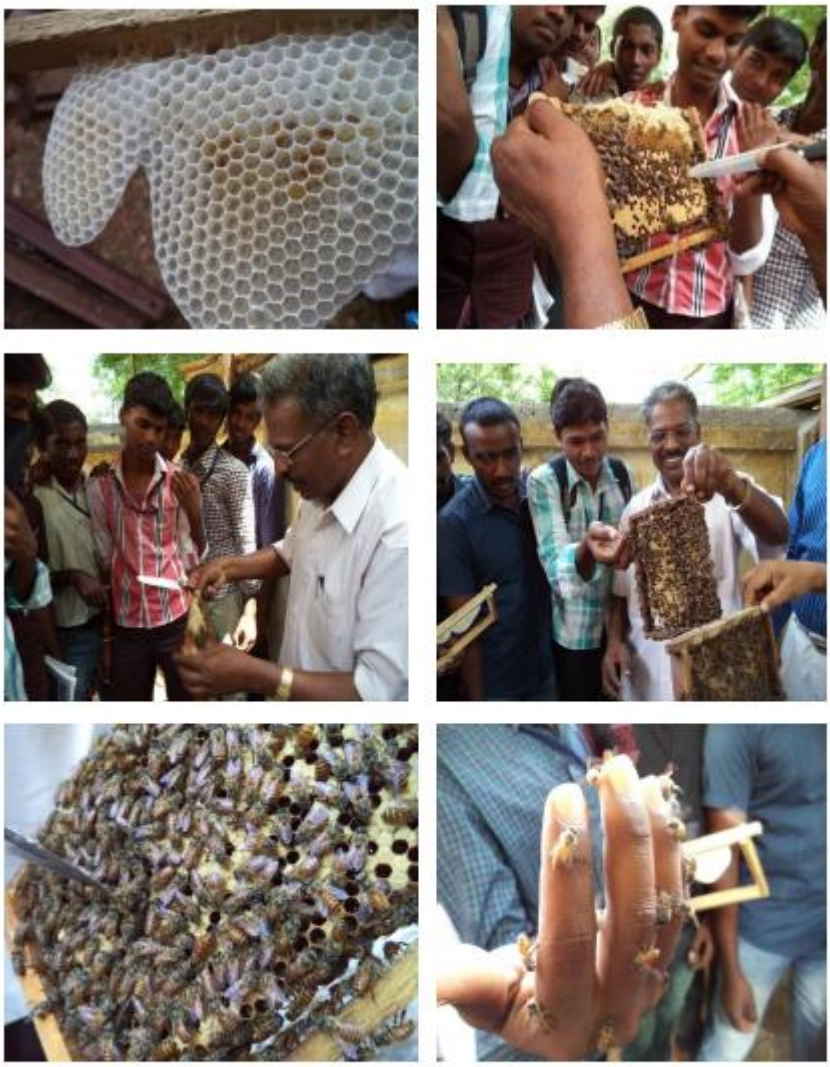
Vermiculture and vermicomposting was thought of as a Skill based elective paper for the undergraduate students and as Economic Zoology for the allied Botany students. Many post graduate students completed their project work in vermiculture related topics. One minor project was completed in bioremediation of dye effluent sludge earlier. Many bioremediation projects were carried out in tea wastes, tannery ETP sludge, etc., Two Ph.D theses were awarded in the field of vermifiltration of waste water treatment.

APICULTURE

Apiculture - the maintenance of honeybees and hives - provides farmers and hobbyists with a variety of enterprises including production of beeswax, honey and other edible bee products; crop pollination services, and the sale of bees to other beekeepers. Bees are mainly reared for their honey. Besides that, we also obtain beeswax through beekeeping. Bees produce honey from the sugary secretions of plants. Although honey is an important ingredient in many food dishes, beeswax holds a lot of commercial significance too. It is used in the cosmetic and medical industry, as well as a coating for cheese, and as a food additive. It is also used as the main component for making candles, preparing polishes for the shoe, furniture, etc.

Those bee species whose names begin with "Apis" are cared for by beekeepers, as they are the only ones that make honey. The following are some of the most commonly farmed honey bee species: ***Apis dorsata*****:** The rock bee is another name for Apis dorsata. It is a massive bee that generates between 38 and 40 kg of honey each colony. ***Apis indica*****:** Apis indica is also known as the Indian bee. It is easy to domesticate, and it is most usually used to make honey. Honey yields 2 to 5 kg per colony each year. ***Apis florea*****:** Apis florea is also known as the tiny bee. Because it rarely stings, harvesting honey from its hive is simple. Each colony generates roughly 1 kilogram of honey every year. ***Apis mellifera*****:** Apis mellifera is also known as the Italian bee. This species has a highly characteristic dance routine to advertise the availability of food, and it stings less than the small bee. This species is not native to the area, as its popular name implies. However, beekeepers frequently raise it due to the large amount of honey produced.

Apiculture was thought of as a Skill based elective paper for the undergraduate students and as beekeeping for the allied Botany students as Non-Major elective.



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Syllabi of Apiculture

Skill Based Elective Paper for B.Sc. Zoology

SEMESTER: I **Hours: 2**
SBE I **Credits: 2**

APPLIED ZOOLOGY

Unit – I

Scope of Apiculture- Honey bee species- Biology of *Apis indica* – Social organization of honey bees- Communication in bees – Methods of Bee keeping : Newton's beehive - Description-Accessories used in apiculture - Extraction of honey - Properties-Composition and uses of honey. By-Products of Bee keeping -Bee wax, bee venom, propolis, royal jelly.

Unit-II

Diseases of honey bees - Viral diseases: Thai Sac Brood Virus, Apis iridescent virus – Bacterial diseases: American Foul Brood, European Foul Brood – Enemies of Honey bee : Wax moths, ants, wasps, birds, rattle snake -Economics of Apiculture.

Unit-III

Scope of Vermiculture – Biology of composting earthworms – *Eudrilus eugeniae* and *Lampito mauritii* – Classification of earthworms: epigeic, endogeic, aneic, saprophages, geophages –Identification and characteristics of earthworms.

Unit-IV

Organic waste sources – Vermicomposting methods: Small and large scale production methods –Pit method, heap method, windrow method, indoor method – Vermiwash- Factors affecting vermicomposting: pH, moisture, temperature, nutrition.

Unit-V

Advantages of vermicomposting – Applications of vermicomposting – Economics of vermiculture, NABARD, Nationalized Banks and KVIC supports for vermiculture.

Textbooks:

1. Teenai valarpu-Thigarajan-TeeJay Publications, Thanjavur.
2. Cherian,R. and K.R Ramanathan, 1992. Bee keeping in India.
3. Sultan Ahmed Ismail, 2005. The Earthworm Book, Second Revised Edition, Other India Press, Goa, India.

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1. Sharma,P. and Singh L. 1987-Hand book of bee Keeping, Controller Printing and Stationery, Chandigarh.
2. Mishra,R.C.,1985-Honey and their management in India, ICAR.
3. Nagaraja, N and, D. Rajagopal, 2009. Honey bee diseases, Parasites, Pest, Predators and their Management. MJP publishers, Chennai, Tamil Nadu, India.
4. Renganathan, L.S., Manpuzhum manpuzhu vuramum. Manivasagar Publications, Chennai.
5. Sathe,T.V., 2004. Vermiculture and Organic Farming. Daya Publications.

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TAMILNADU, INDIA.
Tel.No. : 0431 - 2420079 Website: www.thanthaiperiyargasc.ac.in E-mail : periyarevrcollege@yahoo.com

Non-Major Elective Paper for B.Sc. Botany:

Semester: IV **Hours: 2**
NME I **Credits: 2**

APICULTURE

(Receiving dept: Botany)

UNIT – I

Scope of Apiculture - Honey bee species- characteristics - Comb types ; Life cycle of *Apis Indica* - communication in bees - Nuptial flight - waggle dance- pheromones.

UNIT – II

Modern method of bee keeping - Description Newton's bee hive - Accessories- Location of Apiary- Bee pasturage- Floral calendar.

UNIT – III

Care and Management of Bee hive - Social organization of honey bee - division of labour- Acquiring of Bee hive - Queen and its management - summer and winter season management - swarm control- advantages of bee pollination in crops.

UNIT – IV

Diseases and enemies of honey bees ; Viral diseases - Thai Sac Brood Virus, Apis iridescent virus; Bacterial diseases- American Foul Brood, European Foul Brood . Enemies - wax moth, *Galleria mellaonella* , wasps , rats, birds, Rattle Snake.

UNIT – V

Honey and Byproducts of Apiculture - Extraction of honey- properties - composition and uses of honey. Byproducts - Bee wax, bee venom , propolis, royal jelly. Economics of Apiculture.

Textbooks

5. Sankar .C ,et ., al. - 2006, Theni Valarppu Thozhilnutpangal, Hans Rover Agriculture Science Centre, Perambalur.

References

9. N.Arumugam et.,al. 2009. Applied Zoology, Saras Publication, Nagercoil.
10. Jawaid Ahsan et .,al. - 2000- A Handbook on Economic Zoology , S.Chand & Co.Ltd, New Delhi.