BEFORE THE HON'BLE NATIONAL GREEN TRIBUNAL, SOUTHERN ZONE AT CHENNAI

APPLICATION No. 155 OF 2017 (SZ)

M.Gobineelan,
Son of P.P.Mani,
No.5/1-l, Rest House Road,
Sirumugai, Coimbatore-641 302

...Applicant

Vs

The Secretary to the Government,
Department of Environment and Forest,
Government of Tamil Nadu,
Secretariat Fort St.George, Chennai
& 9 Others

...Respondents

STATUS REPORT FILED ON BEHALF OF THE 9TH RESPONDENT

M/s. ABDUL SALEEM
S. SARAVANAN
COUNSEL FOR THE 9TH RESPONDENT

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No.5/1-I, Rest House Road,
Sirumugai,
Coimbatore-641 302.

... Applicant

VS

1. The Secretary to the Government,
   Department of Environment and Forest,
   Government of Tamil Nadu,
   Secretariat Fort St.George, Chennai.

2. The Secretary to the Government,
   Public Works Department,
   Government of Tamil Nadu,
   Secretariat Fort St.George,
   Chennai.

3. The Secretary to the Government,
   Municipal Administration and Water Supply Department, Government of Tamil Nadu,
   Secretariat Fort St.George,
   Chennai.

4. The Chairman,
   Tamil Nadu Pollution Control Board,
   No.76, Mount Road, Anna Salai,
   Guindy, Chennai.

5. The Chairman,
   Central Insecticides Board and Registration Committee,
   Ministry of Agriculture and Farmers Welfare,
   NH 4, CGO Complex,
   Faridabad.

6. The Director of Agriculture,
   Director of Agricultural Department,
   Chepuak, Chennai.

7. The Commissioner,
   Office of Commissioner of Food and Safety,
   5th Floor, DMS Office Building,
   No.259, Anna Salai, DMS Campus,
   Teynampet, Chennai.

8. Indian Council of Agricultural Research,
   Dr. Rajendra Prasad Road,
   Krishi Bhawan, New Delhi.

9. Tamil Nadu Agricultural University,
   Lawley Road,
   Coimbatore.

10. Food Corporation of India,
    Haddows Road,
    Chennai.

... Respondents.

STATUS REPORT FILED ON BEHALF OF THE 9th RESPONDENT

I, Dr.A.S.Krishnamoorthy, S/o. Mr.A.Subbiah, Hindu, aged about 59 years, having office at Office of the Registrar, Tamil Nadu Agricultural University, Coimbatore – 641 003 do solemnly affirm and sincerely state as follows.

1. I state that I am the Registrar, the 9th Respondent herein and as such I am well acquainted with the facts of the case and am filing this Status Report in my official capacity.

2. I state that the this respondent had previously filed a Status Report and the same may be taken as a part and parcel of this present Status Report.

3. I humbly state that this Hon'ble Tribunal in its order dated 23.11.2021 had directed as follows :-

The 9th Respondent/ Tamil Nadu Agricultural University is directed to file a statement regarding the nature of concepts/ strategies included in the syllabus for B.Sc Agriculture & B.Sc. Horticulture by the University considering the pesticide policy of Government of India and also whether the best practises and concepts such as Agro Ecosystem Analysis based Integrated Pest Management (IPM), Ecologial Engineering for Pest Management, Bio-priming, Stimulo-deterrent diversion (push-Pull Strategy), Plant compensation ability etc., are part of the curriculum or not to reduce the reliance on Agro-Chemical usage and to meet the requirement of adopting the policy of Safe and Judicious use of Pesticides (Policy of the Government)."

REGISTRAR
Tamil Nadu Agricultural University
COIMBATORE-641 003.

4. I humbly state that in compliance of the above directions of this Hon'ble Tribunal, the following status report is being filed in this regard.

5. I humbly state that the Undergraduate courses are tailored in accordance with national and end-users requirement by the University. The graduate students are introduced and exposed to various aspects of plant protection in stepwise fashion with providing introductory knowledge in fundamental courses and field application of various technologies in combating the insect pests as they learn the principles and procedures. In imparting the concepts and application to the students, the best practices including host plant resistance, harnessing the potential of trophic relationships existing among primary producers, herbivores and natural enemies, biologically based pest management practices, behavioural modification principles, practices, ecological principles, pesticides and their merits, demerits, safe use of the insecticides, legal methods, besides others are taught to the students.

6. I humbly state that the syllabus for the various approved courses at undergraduate level is herewith annexed.

7. I humbly state that this Respondent is ready to abide by and comply with any directions passed by this Hon'ble Tribunal.

In light of the same, the Hon'ble Tribunal may be pleased to consider this present status report and pass such order or orders as it deems fit and thus render justice.

Dated at Chennai on this the 19 day of January 2022

REGISTRAR,
Tamil Nadu Agricultural University
COIMBATORE-641 003.

9th RESPONDENT

VERIFICATION

I, Dr.A.S.Krishnamoorthy, S/o. Mr.A.Subbiah, Hindu, aged about 59 years, having office at Office of the Registrar, Tamil Nadu Agricultural University, Coimbatore – 641 003 do hereby verify that the contents of Paragraph Nos. 1 to 7 are true to the best of my knowledge and believed to be true on legal advice and that I have not suppressed any material fact.

Verified at Chennai on this the 19 day of January, 2022

REGISTRAR,
Tamil Nadu Agricultural University
COIMBATORE-641 003.

9th Respondent

AGRICULTURE COURSES –

AEN 201 COMMON FOR AGRI & HORTI STUDENTS

Semester III

AEN 201 FUNDAMENTALS OF ENTOMOLOGY (2+1)

Theory

Unit I: History and importance of Entomology; Insect morphology

History of Entomology in India; Position of insects in the animal kingdom and their relationship with other classes of Arthropoda; Reasons for insect dominance. General organisation of insect body wall - structure and function, cuticular appendages, moulting; Body regions - insect head, thorax and abdomen, their structure and appendages.

Unit II:

Anatomy and physiology (Part – I) : Digestive, excretory, respiratory, circulatory and nervous systems in insects.

Unit III:

Anatomy and physiology (Part – II) : Reproductive systems in insects, sense organs and their functions, exocrine and endocrine glands; Embryonic and post embryonic development.

Unit IV:

Taxonomy of Apterygota and Exopterygota

Insect systematics; Distinguishing characters of agriculturally important orders and families of Hexapoda. Apterygota (Thysanura, Diplura, Protura and Collembola); Exopterygota (Ephemeroptera, Odonata, Orthoptera, Phasmida, Dictyoptera, Embioptera, Dermaptera, Hemiptera, Isoptera, Psocoptera, Mallophaga, Thysanoptera and Siphunculata).

Unit V:

Taxonomy of Endopterygota

Distinguishing characters of agriculturally important families of Lepidoptera, Coleoptera, Diptera, Hymenoptera, Siphonaptera, Neuroptera and Strepsiptera.

Practical

Observations on external features of grasshopper / cockroach, Methods of insect collection, preservation – Preparation of Riker mount. Types of insect head, antenna, mouth parts – Structure of thorax. Types of insect legs, wings and their modifications – wing coupling. Structure of abdomen, and its modifications. Metamorphosis in insects – immature stages in insects. Study of digestive and reproductive systems of grasshopper / coackroach – Observing the characters of agriculturally important orders and families.

Theory lecture schedule:

1. History of Entomology in India; Position of insects in the animal kingdom - relationship with other members of Arthropoda
2. Structural, morphological and physiological factors responsible for dominance
3. Insect body wall - its structure and function; cuticular appendages
4. Moulting process in insects
5. Structure of insect head and its appendages
6. Structure of insect thorax and its appendages
7. Structure of insect abdomen and its appendages

8. Structure of alimentary canal and its modifications; Digestive enzymes, digestion and absorption of nutrients
9. Excretory system - Malpighian tubules - accessory excretory organs and physiology of excretion
10. Respiratory system – types - structure of trachea - tracheoles - types of spiracles - respiration in aquatic and endoparasitic insects
11. Circulatory system - haemocoel and dorsal vessel - circulation of blood -composition of haemolymph - haemocytes and their functions
12. Nervous system - Structure of neuron – types of nervous systems
13. Axonic and synaptic transmissions of nerve impulses
14. Male and female reproductive systems in insects – structure and modifications - Spermatogenesis and Oogenesis
15. Oviparous, viviparous, paedogenesis, polyembryony, ovoviporous and parthenogenesis
16. Embryogenesis; Types of metamorphosis – Immature stages of insects
17. **Mid-semester examination**
18. Structure of sense organs - types of sensilla – photoreceptors, chemoreceptors and mechan oreceptors
19. Exocrine and endocrine glands and their function - effect on metamorphosis and reproduction
20. Tropism and Biocommunication in insects — Sound and light production
21. Systematics - principles and procedures of classification and nomenclature of insects
22. Distinguishing characters of insect orders — Apterygota (Thysanura, Diplura, Protura and Collembola), Exopterygota — (Ephemeroptera, Odonata and Phasmida)
23. Orthoptera (Ensifera - Tettigonidae, Gryllidae and Gryllotalpidae; Caelifera - Acrididae and Tetrigidae), Dictyoptera, Dermaptera and Embioptera
24. Isoptera — social life in termites
25. Thysanoptera, Pscoptera, Mallophaga and Siphunculata.
26. Hemiptera – Homoptera (Delphacidae, Flatidae, Cercopidae, Cicadidae, Membracidae, Cicadellidae, Psyllidae, Aleyrodidae, Aphididae, Margarodidae, Kerridae, Pseudococcidae, Coccidae, Asterolecaniidae and Diaspididae)
27. Hemiptera - Heteroptera (Tingidae, Reduviidae, Cimicidae, Anthocoridae, Miridae, Lygaeidae, Pyrrhocoridae, Coreidae, Scutellaridae, Pentatomidae, Veliidae, Gerridae, Naucoridae, Belastomatidae, Nepidae, Notonectidae and Corixidae)
28. Endopterygota — Classification of Lepidoptera – suborders; butterfly families (Nymphalidae, Lycaenidae, Pieridae, Papilionidae, Satyriidae and Hesperiidae)
29. Moth families (Psychidae, Gelechiidae, Metarbellidae, Cochlidiidae, Pyralidae, Crambidae, Pterophoridae, Geometridae, Bombycidae, Saturniidae, Sphingidae, Arctiidae, Noctuidae and Lymantriidae)
30. Classification of Coleoptera – suborders; Adephaga (Carabidae, Cicindellidae, Dytiscidae, Gyrinidae)
31. Polyphaga (Hydrophilidae, Staphylinidae, Passalidae, Lucanidae, Scarabaeidae, Dynastidae, Melolonthidae, Cetonidae, Buprestidae, Elateridae, Lampyridae, Cantharidae, Dermestidae, Anobiidae, Bostrychidae, Coccinellidae, Tenebrionidae, Meloidae, Cerambycidae, Bruchidae, Chrysomelidae, Apionidae and Curculionidae)
32. Diptera – Suborders; Nematocera (Tipulidae, Psychodidae, Culicidae, Bibionidae, and Cecidomyiidae), Brachycera (Tabanidae, Asilidae and Bombylidae,), Cyclorrapha (Syrphidae, Drosophillidae, Muscidae, Calliphoridae, Tachinidae, Hippoboscidae, Micropezidae, Agromyzidae, Chloropidae and Tephritidae)

33. Hymenoptera–Suborders; Symphyta (Tenthredinidae) Apocrita (Ichneumonidae, Braconidae, Evaniidae, Agaonidae, Chalcididae, Encyrtidae, Eulophidae, Trichogrammatidae, Bethylidae, Chrysididae, Scoliidae, Mutillidae, Formicidae, Vespidae, Sphecidae, Megachilidae, Anthophoridae, Xylocopidae and Apidae)
34. Neuroptera (Mantispidae, Chrysopidae, Myrmeleontidae and Ascalaphidae); Siphonaptera and Strepsiptera

Practical schedule:

1. Observations on external features of grasshopper / cockroach and other members of phylum Arthropoda
2. Methods of insect collection, preservation, display and storage
3. Types of insect head and antenna
4. Mouth parts of cockroach, modifications in the mouth parts in plant bug, female mosquito, honeybee, thrips, antlion grub, house fly, moths and butterflies
5. Structure of thorax and their appendages —modifications in insect legs and wings — wing venation, regions and angles — wing coupling.
6. Structure of abdomen and their appendages
7. Types of immature stages of insects
8. Study of digestive system, male and female reproductive systems
9. Observing the characters of Apterygota - Collembola and Thysanura and Exopterygota -Odonata and Ephemeroptera and Phasmida
10. Observing the characters of Dictyoptera, Dermaptera, Embioptera, Orthoptera (Ensifera - Tettigonidae, Gryllidae and Gryllotalpidae; Caelifera - Acrididae and Tetrigidae), Mallophaga and Siphunculata
11. Observing the characters of Exopterygota —Isoptera and Hemiptera — Homoptera (Delphacidae, Flatidae, Cercopidae, Cicadidae, Membracidae, Cicadellidae, Psyllidae, Aleyrodidae, Aphididae, Margarodidae, Kerridae, Pseudococcidae, Coccidae, Asterolecaniidae and Diaspididae) Heteroptera (Tingidae, Reduviidae, Cimicidae, Anthocoridae, Miridae, Lygaeidae, Pyrrhocoridae, Coreidae, Scutellaridae, Pentatomidae, Veliidae, Gerridae, Naucoridae, Belastomatidae, Nepidae, Notonectidae and Corixidae)
12. Observing the characters of orders Thysanoptera and Diptera- Nematocera (Tipulidae, Psychodidae, Culicidae, Bibionidae, and Cecidomyiidae), Brachycera (Tabanidae, Asilidae and Bombylidae,), Cyclorrapha (Syrphidae, Drosophillidae, Muscidae, Calliphoridae, Tachinidae, Hippoboscidae, Micropezidae, Agromyzidae, Chloropidae and Tephritidae)
13. Observing the characters of Hymenoptera-Symphyta (Tenthredinidae) Apocrita (Ichneumonidae, Braconidae, Evaniidae, Agaonidae, Chalcididae, Encyrtidae, Eulophidae, Trichogrammatidae, Bethylidae, Chrysididae, Scoliidae, Mutillidae, Formicidae, Vespidae, Sphecidae, Megachilidae, Anthophoridae, Xylocopidae and Apidae)
14. Observing the characters of Coleoptera - Adephaga (Carabidae, Cicindellidae, Dytiscidae, Gyrinidae) Polyphaga (Hydrophilidae, Staphylinidae, Passalidae, Lucanidae, Scarabaeidae, Dynastidae, Melolonthidae, Cetonidae, Buprestidae, Elateridae, Lampyriidae, Cantharidae, Dermestidae, Anobiidae, Bostrychidae, Coccinellidae, Tenebrionidae, Meloidae, Cerambycidae, Bruchidae, Chrysomelidae, Apionidae and Curculionidae)
15. Observing the characters of Lepidoptera - Butterfly families (Nymphalidae, Lycaenidae, Pieridae, Papilionidae, Satyriidae and Hesperiidae), Moth families (Psychidae, Gelechiidae, Metarbellidae, Cochlidiidae, Pyralidae, Crambidae, Pterophoridae, Geometridae, Bombycidae, Saturniidae, Sphingidae, Arctiidae, Noctuidae and Lymantriidae)
16. Observing the characters of Neuroptera (Mantispidae, Chrysopidae, Myrmeleontidae and Ascalaphidae), Siphonoptera. Identification and naming of collected insects based on characters — order and family
17. **Final Practical examination**

References:

1. Richards O.W. and R.G. Davies. 1977. *Imm's General Text Book of Entomology*. Vol.I and II. Chapman and Hall Publication, London. 1354p. {ISBN 0412 15220 7}

Chapman, R.F. 1998. *The Insects: Structure and Function*. Fourth Edition. Cambridge University Press. 770p. {ISBN 0 521 78732 7}

Snodgrass, R.E. 1994. *Principles of Insect Morphology*. CBS publishers and distributors, New Delhi. 667p.

David, B.V. and V.V. Ramamurthy. 2011. *Elements of Economic Entomology*, Namrutha Publications, Chennai, 386 p. {ISBN: 978-81-921477-0-3}

Srivastava, P. D. and R. P. Singh. 1997. An Introduction to Entomology. Concept Publishing Company, New Delhi.

E- References:

1. **http://www**.itis.usda.gov/it is/
2. **www.zin.ru/animalia**
3. **https://courses.cit.cornell.edu/ent201/content/*anatomy*2.pdf**
4. **www.*insects*explained.com/03*external*.htm**
5. **www.earthlife.net/*insects*/anatomy.html**
6. **www.*insect*identification.org/*orders_insect*.asp**

AEN 202 MANAGEMENT OF BENEFICIAL AND HARMFUL INSECTS (2+1)

Theory

Unit I: Classification of insects based on economic importance - Apiculture - Bee species – comparison- castes of bees, bee behaviour and bee dance; Apiary management practices – bee pasturage, foraging, seasonal variations; Bee products – properties and uses; Effect of agricultural inputs on bee activity – pesticide poisoning.

Unit II: Moriculture; Silkworm rearing; Lac insect- biology-strains-natural enemies of lac insect and lac products; Weed killers, pollinators, scavengers and soil builders; Balance of life in nature – population dynamics – role of abiotic and biotic factors. Life table – interspecific and intraspecific relationships

Unit III: Pests – definition and categories – pest outbreak – factors governing pest outbreak– pest monitoring, surveillance and forecasting. Economic Threshold Level – Economic Injury Level- Integrated Pest Management – history, principles and strategies – requirements for successful pest management programme; Cultural, physical, mechanical, ecological engineering methods and host plant resistance in pest management

Unit IV: Parasitoids, predators and microbial agents in pest management. Legal methods – definition – pest introductions – quarantine – phytosanitary certificate – pest legislation. Pesticides – history, classification – mode of action of insecticides. Pesticides compatibility, safety and hazards in the use of pesticides – pesticide poisoning - impact of pesticides in agro-ecosystem.

Unit V: Insecticide act. Insecticides residues and resistance. Semiochemicals – allomones – kairomones – pheromones- semiochemicals in pest management. Sterile male technique – chemosterilants, insect growth regulators – moult inhibitors – Juvenile Hormone mimics – antifeedants and repellents. Natural pesticides. Biotechnology in pest management. Bio safety of transgenic plants. Impact of global warming on pests. Bio-intensive/Bio-rational/ Eco-friendly Integrated Pest Management – Indigenous/traditional technologies in Integrated Pest Management

Practical

Identification, morphology and structural adaptations in honey bees. Bee keeping appliances, bee enemies and diseases. Sericulture. Lac insect-life history, hosts and culturing of lac, natural enemies and lac products. Study of useful insects- Pollinators, weed killers, scavengers and soil builders. Symptoms and types of damage caused by insect pests. Assessment of insect population and their damage in field crops. Cultural, mechanical and physical control of insects. Identification and mass culturing of different types of parasitoids, predators and entomopathogens. Behavioral approaches in pest management – Pheromone traps, light traps, sticky traps and others. Pesticide formulations and toxicity parameters. Pesticide application techniques. Preparation of spray fluids and botanicals for field application. Plant protection appliances.

Theory lecture schedule:

1. Economic classification of insects
2. Bee species – comparison – castes of bees – bee behaviour and bee dance
3. Apiary management practices – bee pasturage – foraging – seasonal variations.
4. Bee products – their properties and uses
5. Effect of agricultural inputs on bee activity – pesticide poisoning
6. Ecological requirements for mulberry cultivation – soil type – mulberry varieties – Methods of propagation – merits and demerits – selection of semi hard wood cuttings
7. Pests and diseases of mulberry
8. Types of silkworm - Mulberry silkworm – origin – classification based on voltinism, moultinism, geographical distribution and genetic nature – Characters of multivoltine races, bivoltine races, cross breeds and bivoltine hybrids – double hybrids– suitability for rearing in different seasons.
9. Morphology and biology of silkworm – sexual dimorphism in immature and adult stages – silkworm genetics – chromosome number – sex limited characters in egg, larva and cocoon for grainage use.
10. Lac insect- biology-strains-Natural enemies of lac insect and lac products

11. Weed killers, pollinators, scavengers and soil builders
12. Insect ecology – definition – balance of life in nature – reproductive potential and environmental resistance
13. Population dynamics – role of biotic factors – competition – parasitoids and predators. Life table – Interspecific and intraspecific relationship
14. Abiotic factors – physical, nutritional and host plant associated factors on insect population.
15. Pests – definition, categories and causes for outbreak of pests. Losses caused by pests
16. Pest monitoring – pest surveillance and forecasting – objectives, survey, sampling techniques and decision making. Economic Threshold Level and Economic Injury Level. Factors influencing Economic Injury Level and Economic Threshold Level
17. Midsemester examination
18. Integrated Pest Management – history, principles and strategies – requirements for successful pest management programme. Components of pest management
19. Cultural methods – definition – characteristics, requisites – farm level practices and community level practices, advantages and disadvantages- Ecological Engineering in pest management
20. Physical methods – definition – use of heat, moisture, light, electromagnetic energy and sound energy – Mechanical methods – definition – mechanical destruction and exclusion – merits and demerits
21. Host plant resistance – types and mechanisms of resistance and role of host plant resistance in pest management
22. Biological control – definition, parasitoids and predators and their role in pest management
23. Microbial control – viruses, bacteria, fungi, protozoa and nematodes and their role in pest management
24. Legal methods – definition – pest introductions – quarantine – phytosanitary certificate – pest legislation
25. Chemical control – definition – history of insecticide development – toxicity parameters – ideal qualities of an insecticide
26. Classification of insecticides based on mode of entry, mode of action and chemical nature
27. Mode of action of organophosphates, carbamates, synthetic pyrethroids, neonicotinoids, diamides and avermectins
28. Pesticide compatibility, safety and hazards – pesticide poisoning - antidotes – safe handling – impact of pesticides on agroecosystems
29. Insecticides Act 1968 – insecticide residues and waiting periods, role of pesticides in pest management, insecticide resistance management
30. Semiochemicals – definition – intraspecific semiochemicals – allomone, kairomone, synomone and apneumone - Interspecific semiochemicals – pheromone, sex pheromone, alarm and trail marking pheromone. Pheromones in Integrated Pest Management
31. Sterility methods – definition – principles – methods – requirements and limitaitons
32. Insect growth regulators – moult inhibitors – Juvenile Hormone mimics – mode of action and uses. Insect antifeedants and repellents – mode of action, groups and uses
33. Botanicals and Biotechnological approaches in pest management – bio safety of transgenic plants
34. Impact of global warming on pests. Integrated Pest Management : Issues and options. Bio-intensive/Bio-rational/ Eco-friendly Integrated Pest Management – Indigenous/traditional technologies in Integrated Pest Management

Practical schedule:

1. Identification, morphology and structural adaptations in honey bees
2. Bee keeping appliances, bee enemies and diseases
3. Mulberry nursery bed preparation – methods of planting - Pruning methods – leaf / shoot harvest– preservation of leaves.
4. Identification of damage symptoms of insects, diseases and nematodes of mulberry
5. Chawki rearing and shoot rearing
6. Lac insect-life history, hosts and culturing of lac, natural enemies and lac products

7. Study of useful insects-Pollinators, weed killers, scavengers and soil builders
8. Symptoms and types of damage caused by insect pests , Assessment of insect population and their damage in rice, cotton and brinjal
9. Cultural, mechanical and physical control of insects
10. Identification and mass culturing of different types of parasitoids
11. Identification and mass culturing of different types of predators
12. Identification and mass production of entomopathogens
13. Behavioral approaches in pest management – Pheromone traps, light traps, sticky traps and others
14. Pesticide formulations and toxicity parameters
15. Pesticide application techniques, Preparation of spray fluids and botanicals for field application
16. Plant protection appliances
17. Final Practical examination

References:

1. David, B.V. and V.V. Ramamurthy. 2011. *Elements of Economic Entomology*, Namrutha Publications, Chennai, 386 p. {ISBN: 978-81-921477-0-3}
1. Pedigo, L.P. and M.E.Rice.1996. *Entomology and Pest Management.* Prentice-Hall of Idia Pvt Ltd,_New Delhi. 812p. {ISBN-978-8120338869}
2. Dhaliwal, G.S. and R.Arora. 2001. *Integrated Pest Management – Concepts and approaches*. Kalyani publishers, New Delhi. 427p. {ISBN: 81-7663-904-4}
3. Dandin, S.B., J.Jayaswal and K. Giridhar.2003. *Hand book of Sericulture Technologies*. Central Silk Board, Bangalore, 287 p.

e resources

1. http://www.sristi.org/hbnew
2. http://www.ncipm.org.in/recent-publications.htm
3. http://www.ipmnet.org
4. www.silkbase.org
5. www.papilo.ab.a.u.tokyo.ac.jp

THIRD COURSE – V SEMESTER

1. Course Number, Title and Credits: AEN 301 PESTS OF FIELD CROPS AND STORED PRODUCES AND THEIR MANAGEMENT (1+1)

2. Aim: To impart knowledge on distribution, bionomics, symptoms of damage and management strategies of pests of field crops.

3. Theory

Unit I: Pests of Cereals and Millets

Distribution, bionomics, symptoms of damage and management strategies for insects and non-insect pests of rice, wheat, maize, sorghum, cumbu, ragi, tenai. Integrated Pest Management - case studies in rice.

Unit II: Pests of Pulses and Oilseeds

Distribution, bionomics, symptoms of damage and management strategies of insects and non-insect pests of pulses (redgram, green gram, black gram, bengal gram, cowpea.), groundnut, castor, gingelly, sunflower, safflower, jatropa, soybean and mustard. Integrated Pest Management - case studies in groundnut.

Unit III. Pests of Cotton and Sugarcane

Distribution, bionomics, symptoms of damage and management strategies of insects and non-insect pests of cotton and sugarcane. Integrated Pest Management - case studies in cotton.

Unit IV: Pests of Green Manures, Forage Crops, Stored Products and Non Insect Pests

Distribution, bionomics, symptoms of damage and management strategies of pests of green manures (Sunnhemp, Sesbania, Daicha. Glyricidia), forage crops (Lucere and Subabul) and stored products. Rodents and birds of agricultural importance and their management. Locusts and their management.

4. Theory schedule:

Distribution, bionomics, symptoms of damage and management strategies for insects and non-insect pests of

1. Rice – Sucking pests
2. Rice – Borers and defoliators
3. Maize, sorghum and cumbu
4. Wheat, ragi and tenai
5. Redgram, bengalgram, Blackgram, greengram and cowpea
6. Groundnut, gingelly and sunflower
7. Castor, soybean, safflower, jatropha and mustard
8. Cotton
9. Mid semester examination
10. Sugarcane
11. Green manures- sunnhemp, sesbania, daincha, lucerne, subabul and gliricidia
12. Role of physical, biological, mechanical and chemcial factors in deterioration of grain
13. Stored product pests
14. Methods of grain storage and various methods of stored product pest management
15. Mites, slugs and snails, rodents and bird pests
16. Locusts and their management
17. Integrated Pest Management in rice and cotton

5. Practical schedule:

Identification of symptoms of damage and life stages of pests of

1. Pests of rice (sucking pests)
2. Pests of rice (borers and defoliators)
3. Pests of maize, sorghum and cumbu
4. Pests of wheat, ragi and tenai
5. Pests of redgram and bengalgram
6. Pests blackgram, greengram and cowpea
7. Pests of groundnut, gingelly and sunflower
8. Pests of castor, soybean, safflower, jatropha and mustard
9. Pests of cotton (sucking pests)
10. Pests of cotton (bollworms and defoliators)
11. Pests of sugarcane
12. Pests of green manures-sunnhemp, sesbania, daincha, lucerne, subabul and gliricidia
13. Pests of stored products
14. Gadgets for management of stored product insects
15. Rodents and Birds pests in field and storage
16. Visit to FCI godown and farmer's fields
17. Final practical examination

ASSIGNMENT:

- Collection and submission of 50 pests of field crops
- Rearing a minimum of 15 insect pests attacking field crops and preparation and submission of two riker mounts of field crop pests.

6. Outcome/Deliverables:

The students develop skills for the identification and management of pests of field crops

7. References:

A. Text Books:

1. Manisegaran, S. and R.P.Soundararajan. 2010. *Pest Management in Field Crops- Principles and Practices.* Agrobios, Jodhpur, India. 316p. {ISBN (10): 81-7754-321-0}
2. David, B.V. and V.V. Ramamurthy. 2011. *Elements of Economic Entomology*, Namrutha Publications, Chennai. 386 p. {ISBN: 978-81-921477-0-3}

B. Reference Books:

1. Awasthi, V.B. 2007. *Agricultural Insect Pests and their Control,* Scientific publishers (India), Jodhpur, 267p. {ISBN 81-7233-491-5}
2. Dhaliwal, G.S. and Ramesh Arora. 2004. *Integrated pest management Concepts and Approaches,* Kalyani Publishers, Ludhiana, 427p. {ISBN: 81-7663-904-4}
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D. WEB RESOURCES:

1. http://www.ncipm.org.in
2. http://agritech.tnau.ac.in/
3. http://www.nbaii.res.in/
4. http://www.nrcg.res.in/

FOURTH COURSE – VI SEMESTER

Course Number, Title and Credits:

AEN 302 PESTS OF HORTICULTURAL CROPS AND STORED PRODUCES AND THEIR MANAGEMENT (1+1)

2. Aim:

To impart knowledge on distribution, bionomics, symptoms of damage and management strategies of pests of horticultural crops.

3. Theory

Unit I: Pests of Vegetable Crops

Distribution, bionomics, symptoms of damage and management strategies of insect and non insect pests of Brinjal, Bhendi, Tomato, Chillies, Onion, Garlic, Moringa, Amaranthus Crucifers, Cucurbits.

Unit II: Pests of Fruit Crops

Distribution, bionomics, symptoms of damage and management strategies of insect and non insect pests of Mango, Citrus, Banana, Guava, Grapevine, Sapota, Pomegranate, Papaya, Aonla, Apple, Pine apple, Custard apple and Jack

Unit III: Pests of Tuber Crops

Distribution, bionomics, symptoms of damage and management strategies of insect and non insect pests of Potato, Sweet potato, Tapioca, Yam and Colocasia

Unit IV: Pests of Spices and Plantation Crops

Distribution, bionomics, symptoms of damage and management strategies of insect and non insect pests of Coconut, Arecanut, Tea, Coffee, Cashew, Cocoa, Betelvine, Ginger, Turmeric, Coriander, Cardamom, Pepper, Curry leaf and Tamarind

Unit V: Pests of Flower Crops, Medicinal Plants, Lawn and Stored products

Distribution, bionomics, symptoms of damage and management strategies of insect and non insect pests of Rose, Jasmine, Crossandra, Chrysanthemum, Tuberose, Cut flowers, Gloriosa, Coleus, Phyllanthus, Aswagantha, Senna, Periwinkle, Lawn and Stored products.

4. Practical

Identification of symptoms of damage and life stages of important pests of different horticultural crops: vegetables, fruits, spices, tubers, plantation crops, flower crops, medicinal plants, lawn and stored products.

1. Theory lecture schedule:

Distribution, bionomics, symptoms of damage and management strategies for insects and non-insect pests of

1. Brinjal, Bhendi and Tomato
2. Chillies, Onion, Garlic, Moringa and Amaranthus
3. Crucifers and Cucurbits
4. Mango and Citrus
5. Banana, Guava, Grapevine and Sapota
6. Pomegranate, Papaya and Aonla
7. Apple, Pine apple, Custard apple and Jack
8. Potato, Sweet potato, Tapioca, Yam and Colocasia
9. Midsemester examination
10. Coconut and Arecanut
11. Tea and Coffee
12. Cashew, Cocoa and Betelvine
13. Ginger, Turmeric, Coriander, Cardamom, Pepper, Curry leaf and Tamarind
14. Rose, Jasmine, Crossandra, Chrysanthemum, Tuberose and Cut flowers
15. Gloriosa, Coleus, Phyllanthus, Aswagantha, Senna, Periwinkle and lawn
16. Stored product pests
17. Strategies for stored product pest management

15. Environment Impact Assessment,Introduction, Stages of EIA, -Monitoring and Auditing
16. CDM and Carbon foot print
17. Environmental clearance procedure in India

Practical Schedule

1. Sample collection and preservation from contaminated sistes
2. Waste water treatment by physical (column study with vermiculite and activated charcoal) and chemical (Alum treatment)
3. Waste water treatment through constructed wetland system and charecterisation
4. Estimation of Chlorides, Phosphates in waste water
5. Analysis of Nitrogen in industrial effluent and sludge
6. Collection of PAH's contaminated soils and analysis by GC-MS
7. Biosorption of heavymetal (Cr) by using Water hyacinth and analysis through AAS
8. Pesticide Residue analysis in contaminated water
9. Analysis of SPM in air, Methane and CO_2 in Municipal dumping site
10. Assessing the efficiency of plants to control Indoor air pollutants
11. Analysis of Organic carbon in Sludge and Organic manure
12. Composting and Vermicomposting of farm wastes
13. Energy recovery from wastes
14. Maturity indices of compost- C:N ratio and Phytotoxicity test
15. Maturity indices of compost: starch iodine test and sulphide test
16. Visit to water treatment plant
17. **Final practical examination**

Reference:

1. Tyler Miller and Scot Spoolman. 2009. Living in the Environment (*Concepts, Connections, and Solutions).* Brooks/cole, Cengage learning publication, Belmont, USA
2. P.D. Sharma, 2009, Ecology and Environment, Rastogi Publications, Meerat, India **E-Books:** Chiras D.D., 2016. Environmental Science, Tenth Edition. Jones & Bartlett Learning, Burlington, MA. ISBN: 978-1-284-05705-8, 708 Pages

SAC 355 Crop and Pesticide Chemistry (1+1)

Unit-I : Chemistry of Agricultural Crops: Chemical constituents of plants -. Proximate and ultimate constituents - Chemical composition and nutritional quality of cereals, pulses and forage crops. Chemical composition and nutritional quality of oilseeds and sugarcane. Post harvest changes in Sugarcane.

Unit-II : Chemistry of Horticultural Crops, alkaloids and Essential oils: Chemical composition and nutritional quality of fruits, vegetables, spices, condiments, tuber crops and beverages. Post harvest changes in fruits. Chemistry of medicinal and aromatic plants.

Unit-III : Pesticides and its Formulations: Pesticides - Definition - Classification-Trends in pesticide use. Pesticide formulations -dusts, wettable powders, emulsifiable concentrate, granules. Insecticides - classification-. Characteristics, Mode of action and use of Organophosphates - Carbamates - Pyrethroids Botanicals, Insect Growth Regulators and Newer insecticides.

Unit-IV : Fungicides and Herbicides : Fungicides - classification of fungicides -properties, mode of action of inorganic, organic and systemic fungicides - Rhodenticides- Zinc phosphide - Aluminium phosphide - Bromodiolone Herbicides - classification - properties - mode of action of inorganic and organic herbicides like phenoxy compounds, substituted ureas, amides, thiocarbamates, triazines, pyridines, imidazolines and sulphonyl ureas.

Unit-V : Pesticides and Environment : Insecticide Act and Insecticide Rules - Fate of pesticides in soil- Impact of pesticides on environment

Practical

Estimation of moisture, ash, crude protein, P, K and crude fibre in plant samples - Determination of reducing and non-reducing sugars in jaggery — Oil content in Groundnut- Estimation of total solids, ascorbic acid, titratable acidity in fruits- Phenols/ Mucilages in Vegetables - HCN content in Tapioca/ Sorghum - Analysis of pesticides - Physical tests - Bulk density, wettability, suspensibility, Emulsion stability -. Estimation of pesticide residues in soil, water , vegetables, fruits and pesticidal calculations. Visit to Pesticide Testing Laboratory.

Lecture Schedule

1. Chemical composition and nutritional quality of cereals and pulses - Rice, wheat, maize, minor millets, Red gram, blackgram, and soybean. Starch synthesis and protein synthesis
2. Chemical composition and nutritional quality of oil seed crops - Groundnut, sesame, sunflower, castor, coconut and palm.
3. Chemical composition and nutritional quality of sugarcane -Sucrose synthesis - Post harvest changes in sugarcane. Nutritional quality of forage crops.
4. Chemical composition and nutritional quality of fruits - Mango, banana, papaya, grapes, guava, apple and pomegranate. Chemistry of post harvest changes in fruits.
5. Chemical composition and nutritional quality of vegetables- Tomato, bhendi, brinjal, moringa, greens, cauliflower, radish and peas.
6. Chemical composition of spices and condiments (Turmeric, chillies, pepper, ginger, onion, garlic and Beverages (tea and coffee). Tuber crops- Potato & Tapioca
7. Alkaloids in medicinal plants (Cinchona, Gloriosa, Coleus and Aloevera)

8. Pesticides - Definition - Classification-Trends in pesticide use
9. **Mid semester Examination**
10. Pesticide formulations - dusts - wettable powders, flowables, sprays –Emulsion concentrates – water soluble liquids - granules, fumigants and aerosols - characteristics and uses.
11. Insecticides classification -Characteristics, Mode of action and use of Organophosphates(Chlorpyriphos, Phorate, Dimethoate, Quinalphos and Profenophos)
12. Characteristics, Mode of action and use of Carbamates (Carbaryl, carbofuran, carbosulfan, aldicarb) and synthetic pyrethroids (Deltamethrin, Fenvalerate, Cypermethrin and Lambdacyclothrin)
13. Characteristics, Mode of action and use of Botanicals (nicotine and neem), Insect Growth Regulators (Novaluron, Buprobasin and GABA inhibitors) and *and newer insecticides (Neonicotinoids - Imidachloprid, Thiachloprid, Acetamiprid, Flupendiamide, Fipronil, Emamectin, Thiomethoxam, Indoxacarb, Chlorantraniliprole)*
14. Fungicides - Classification – Inorganics (sulfur) and Organic fungicides (Chlorobenzene and Chlorothalanil) - Characteristics, mode of action and use
15. Characteristics, mode of action and use of Systemic fungicides (Benomyl, Carbendazim, Metalaxyl, Quinones, Diclones, Dicarboximides –vincozolin).
16. Herbicides - Classification of herbicides - Characteristics, Mode of action and use of 2, 4-D, Sulfonyl ureas - Metsulfuron, Pyrosulfuron, Imidazoline, Alachlor, Butachlor, Oxyfluorfen, Fulchloralin, Pendimethalin, Atrazine, Paraquat and Glyphosate. Bisperipac sodium.
17. Fate of pesticides in soil-Impact of pesticides on the environment , Highlights of Insecticide Act - 1968 and Insecticide Rules -1971

Practical schedule

1. Sampling, processing and storage of plant materials for chemical analysis -Estimation of moisture and ash content
2. Preparation of tri acid extracts of plant samples -Estimation of P and K in triple acid extract
3. Estimation of crude protein
4. Estimation of crude fibre
5. Estimation of reducing and non-reducing sugars in jaggery
6. Estimation of oil content in groundnut
7. Estimation of total solids, ascorbic acid and titrable acidity in fruit samples
8. Estimation of phenols in vegetables / Mucilages in Bhendi
9. Determination of HCN content in Tapioca/ forage sorghum
10. Determination of bulk density in dust formulation, wettability and suspensibility test in wettable powder formulations
11. Estimation of emulsion stability in EC formulation
12. Estimation of pesticide residues in soil using GC/HPLC
13. Estimation of pesticide residues in Water / Soft drinks using GC/HPLC
14. Estimation of pesticide residues in Vegetables using GC/HPLC
15. Estimation of pesticide residues in Fruits using GC/HPLC & Pesticide requirement calculations
16. Visit to Pesticide Testing Laboratory
17. **Practical Examination**

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2. Hand book of Agriculture, 2009. Published by Indian Council of Agricultural Research, New Delhi 110 012. Pp. 1583
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7. Gupta,A. 2006. Pesticide Residue in Food commodities. Agrobios Publishers, Jodhpur.
8. Hassall, K. A. 2013. The Chemistry of pesticides, their metabolism, mode of action and uses in crop production. Scientific Publishers, Jodhpur, India.
9. Koul, 0. , G. S. Dhaliwal, S. Khohar and R. Singh. 2014. Biopesticides in Sustainabie Agriculture. Progress and Potential. Amazon Publishers, India.
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— HORTICULTURE COURSES —

AEN 212 Apiculture, Sericulture and Lac culture (1 + 1)

Theory

Unit - 1: Economic entomology

Economic classification of insects; beneficial insects, productive insects and harmful insects

Unit – 2. Apiculture

Honey bee species, castes, social biology and communication in honey bees - Site selection for apiary, bee pasturage, crop pollination and seed production - Hive inspection, maintenance of hive records, general and seasonal management of honey bees. Protecting bees from pesticides -Mass queen rearing - Insect, mite and bird enemies of honeybees, brood and adult diseases - Bee products- specification and uses of honey, bees wax, bee pollen, propolis, bee venom, royal jelly

Unit - 3: Sericulture

History, development and importance of sericulture. Moriculture - Mulberry varieties, package of practices. management of pests, diseases and nutritional disorders. Silkworms - kinds and their hosts, systematic position, distribution, lifecycles. Mulberry silkworm - races, morphological features, silk glands, rearing house and equipments, disinfection and hygiene.Grainage, packing and transportation of eggs, incubation, black boxing, hatching of eggs. Cocoon characters - colour, shape, hardiness and shell ratio. Defective cocoons and stifling of cocoons.Uses of silk and by-products.

Unit - 4: Lac culture

History of lac culture in India - Lac growing areas in India - Lac insects, biology, ecology and behavior - host plants of lac insects – lac culture and harvest methods - kinds of lac and lac products - Enemies of lac insects and their management

Unit – 5: Mass production and use of natural enemies

Culturing of host insects *Corcyra,* pumpkinmealy bug – mass culturing of predators; *Chrysoperla* and *Cryptolaemus* – mass culturing of egg parasitoids *Trichogramma,* larvalparasitoids; *Goniozus* and *Bracon*– parasitoids for Uzi fly management.

Practical:

Identification of useful and harmful insects based on economic classification- Identification of honey bee species, castes, and life stages in honey bees - Types of beehives, beekeeping equipments specification and uses - Site selection for apiary - Hive inspection, maintenance of hive records - Dividing, uniting bee colonies, providing super, artificial feeding- Bee pasturage – Identification and management of insect, mite and bird enemies of honeybees - Identification and management of brood and adult diseases and their management - Honey extraction, processing, purity testing, identification of bee products - bees wax, bee pollen, propolis, bee venom, royal jelly, visit to apiary - Establishment of mulberry garden - Preparation of mulberry

cuttings. Planting methods- Maintenance of mulberry garden - Mulberry pests and diseases, and their management and nutritional disorders - Kinds of silkworms and morphology of mulberry silkworm, silkglands - Equipments for silkworm rearing - Rearing room requirements - Chawki rearing - Late age silkworm rearing and types of mountages - Economics of silk production - Pests and diseases of silkworm and their management - Lac cultivation, food plants, pruning, inoculation, cropping- Kinds of lac and lac products - Enemies of lac insects – Identification of economically important insects – mass production of natural enemies.

Lecture schedule

1. Economic classification of insects based on importance and introduction to beneficial insects
2. Types of harmful insects including pests of plants, animals and human beings and vectors of diseases
3. Honey bee species, castes, social biology and communication in honey bees
4. Site selection for apiary, bee pasturage, crop pollination and seed production
5. Hive inspection, maintenance of hive records, general and seasonal management of honey bees and protecting bees from pesticides
6. Methods for mass rearing of queen bees
7. Insect, mite and bird enemies of honeybees, brood and adult diseases and their management
8. Bee products- specification and uses of honey, bees wax, bee pollen, propolis, bee venom, royal jelly
9. Mid-semester examination
10. History, development and importance of sericulture, silkworms - kinds and their hosts, systematic position, distribution, lifecycles
11. Moriculture- Mulberry varieties, package of practices and management of pests, diseases and nutritional disorders
12. Silkworm - races, morphological features, silk glands, rearing house and equipments, disinfection and hygiene.
13. Grainage, packing and transportation of eggs, incubation, black boxing, hatching of eggs.
14. Cocoon characters - colour, shape, hardiness and shell ratio. Defective cocoons and stifling of cocoons. Uses of silk and by-products.
15. History of lac culture and lac growing areas in India, Lac insects, biology and behaviour -
16. Kinds of lac and lac products and enemies of lac insects.
17. Mass production and use of natural enemies

Practical schedule

1. Identification of useful and harmful insects based on economic classification
2. Identification of honey bee species, castes, and life stages in honey bees
3. Types of beehives, beekeeping equipments specification and uses
4. Site selection for apiary, hive inspection and maintenance of hive records and Identification of Bee pasturage, pollen and nectar yielding plants
5. Visit to apiary - Dividing, uniting bee colonies, providing super and artificial

feeding
6. Identification and management of pests and diseases of honey bees
7. Honey extraction, processing, purity testing, identification of bee products - bees wax, bee pollen, propolis, bee venom, royal jelly.
8. Preparation of mulberry cuttings, planting methods under irrigated and rainfed conditions.
9. Maintenance of mulberry garden-pruning, fertilization, irrigation, leaf and shoot harvest.
10. Mulberry pests, diseases and nutritional disorders
11. Kinds of silkworms and morphology of mulberry silkworm and dissection of silk glands
12. Equipments for silkworm rearing -. Rearing room requirements - Chawki rearing and late age silkworm rearing and types of mountages.
13. Pests and diseases of silkworm and their management - Economics of silk production.
14. Lac cultivation, food plants, pruning, inoculation, cropping
15. Kinds of lac and lac products and enemies of lac insects
16. Identification and mass production of predators and parasitoids
17. Practical examination

References

1. Abrol, D.P. 2011. *Bee keeping – A comprehensive guide to bees and beekeeping.*Scientific Publishers, Jodhpur, 896p.
2. Atwal, A.S. 2013. *Mellifera Bee Keeping and Pollination.*Kalyani Publishers, Ludhiana. 394p.
3. Dandin, S.B., J. Jayaswal and K. Giridhar. 2003. *Hand book of Sericulture Technologies.* Central Silk Board, Bangalore, 287p.
4. David, B.V. and V.V. Ramamurthy. 2011. *Elements of Economic Entomology*, Namrutha Publications, Chennai, 386 p.
5. Krishnaswami,S., M.N. Narasimhanna, S.K. Suryanarayan and S.Kumararaj. 1978. *Seiculture Manual 2 and 3. Silkworm Rearing*. FAO Agricultural Services Bulletin 15/2. Food and Agriculture Organisation of the United Nations, Rome, 131p.
6. Rangaswami, G., M.N. Narasimhanna, K. Kasiviswanathan, C.R. Sastry and M.S. Jolly. 1978. *Sericulture Manual 1 – Mulberry Cultivation*. FAO Agricultural Services Bulletin 15/1. Food and Agriculture Organization of the United Nations, Rome, 150p.
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AEN 311 Insect Pests of Vegetable, Ornamental and Spice Crops (1 + 1)

Theory:

Unit – 1: Introduction to types of pests and pest management

Pest– Definition, categories and causes of outbreak, Economic Injury Level (EIL) and Economic Threshold Level (ETL) - Role of biotic and abiotic factors on pest abundance - Importance of pest surveillance - Principles and different components of integrated pest management.

Unit – 2: Pests of Vegetables

Distribution, host range, bio-ecology, injury, integrated management of important insect-pests affecting vegetable crops (brinjal, bhendi, tomato, chilli, onion, amaranthus, moringa, cucurbits, crucifers, potato, sweet potato and tapioca).

Unit – 3: Pests of spice crops

Distribution, host range, bio-ecology, injury, integrated management of important insect-pests affecting spice crops (garlic, ginger, turmeric, coriander, tamarind, curry leaf, cardamom, black pepper, betel vine).

Unit – 4: Pests of ornamental crops

Distribution, host range, bio-ecology, injury, integrated management of important insect-pests affecting ornamental crops (jasmine, rose, Crossandra, chrysanthemum, tuberose, cut flowers, lawn and turf).

Unit – 5: Storage pests and non-insect pests of vegetables, spices and ornamentals

Pests of stored and processed vegetables, spices and dry flowers and their management - Non-insect pests and their management - Insecticidal residue problems in vegetables, ornamental crops and tolerance limits

Practical:

Types of injury and symptoms of damage caused by insects and assessment of insect population and damage in vegetables - Methods of pest management in vegetables, spices and ornamentals - Biocontrol agents for use in vegetables, spices and ornamentals - Pesticide formulation, plant protection appliances and application techniques - Study of symptoms, damage, collection, identification, preservation, assessment of damage/population of important insect-pests affecting vegetable, ornamental and spice crops in field and during storage.

Lecture schedule Theory

1. Pest– Definition, categories and causes of outbreak, Economic Injury Level (EIL) and Economic Threshold Level (ETL), Importance of pest surveillance.
2. Insect ecology – Role of biotic (food, competition, parasitoids and predators, host plants) and abiotic factors (temperature, humidity, rainfall, microclimate etc) on pest abundance.

3. Principles and different components of integrated pest management, cultural, physical, mechanical methods;l; Host plant resistance
4. Role of biological components viz., predators and parasitoids, Semio - chemicals and Insect Growth Regulators (IGRs)
5. Pests of brinjal, bhendi and tomato and their management
6. Pests of chilli, onion, amaranthus, and moringa and their management
7. Pests of cucurbits and crucifers and their management
8. Pests of potato, sweetpotato and tapioca and their management
9. Mid semester examination
10. Pests of garlic, turmeric and tamarind and their management
11. Pests of curry leaf, coriander, cardamom, black pepper and betel vine and their management
12. Pests of rose and jasmine and their management
13. Pests of crossandra, chrysanthemum and tuberose and their management
14. Pests of lawn, turf and cut flowers and their management
15. Pests of stored and processed vegetables, spices and dry flowers and their management
16. Non-insect pests and their management
17. Insecticidal residue problems in vegetables, ornamental crops and tolerance limits

Practical Schedule;

1. Types of injury and symptoms of damage caused by insects and assessment of insect population and damage in vegetable, spice and ornamental crops
2. Physical, mechanical, behavioural methods of pest management in vegetables, spices and ornamentals.
3. Pesticide formulation, plant protection appliances and application techniques.
4. Identification and use of biocontrol agents in vegetable, spice and ornamental crops
5. Pests of brinjal, bhendi, tomato and chillies
6. Pests of amaranthus, moringa, coriander and curry leaf
7. Pests of temperate vegetables cabbage, cauliflower, knol-khol, sprouting broccoli, Brussels' sprout, lettuce, palak, Chinese cabbage, spinach, , radish, carrot, turnip
8. Pests of cucurbits (Bitter guard, snake gourd, bottle gourd, ash gourd, Ivy gourd, gherkin, pumpkins, cucumber and water melon)
9. Pests of potato, sweet potato ,tapioca, colocasia, xanthosoma, amorphophallus, dioscorea
10. Pests of fenugreek, fennel, cumin, dill, celery, bishops weed, vanilla, thyme and rosemary
11. Pests of onion, turmeric, ginger, cardamom, black pepper, tamarind, clove, nutmeg, cinnamon, and all spice
12. Pests of rose, jasmine, crossandra, chrysanthemum and tuberose
13. Pests of lawn, turf and cut flowers
14. Storage pests of processed vegetables, spices and dry flowers
15. Non-insect pests of vegetable, spice and ornamental crops
16. Exposure visit to biocontrol unit/ storage go-down/ pest outbreak area
17. Practical Examination

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Web resources:

1. http://agritech.tnau.ac.in/horticulture/horti_plantprotection_pest.html
2. http://www.nbaii.res.in/insectpests/pestsearch.php?cropname=Mango
3. http:www.ncipm.org.in/data bases.htm
4. ipm.illinois.edu

Assignments:

- Submission of 25 preserved insect pests of vegetable, ornamental and spice crops.
- Rearing of 20 species of insects pests of vegetable, ornamental and spice crops of which two should be prepared as Riker mounts.

AEN 312 Insect Pests of Fruit, Plantation, Medicinal and Aromatic crops (1+1)

Theory:

Unit 1: Economic classification of insects and host plant resistance to insect pests

General economic classification of insects; ecology and insect-pest management with reference to fruit, plantation, medicinal and aromatic crops; pest surveillance and assessment of insect damage; Legal methods of pest control

Unit 2: Pests of fruit crops and management

Distribution, host range, bio-ecology, injury, integrated management of important insect pests affecting tropical, sub-tropical and temperate fruit crops (mango, sapota, citrus, papaya, guava, banana, grapevine, jack, pomegranate, pineapple, aonla, jamun, apple, pear, peach and plum)

Unit 3: Pests of plantation crops and management

Distribution, host range, bio-ecology, injury, integrated management of important insect pests affecting plantation crops (coconut, arecanut, oil palm, palmyrah, cashew, cocoa, tea, coffee, rubber and cinchona)

Unit 4:Pests of medicinal and aromatic crops and management

Distribution, host range, bio-ecology, injury, integrated management of important insect pests attacking medicinal crops (senna, neem, hemp, belladonna, gloriosa, dioscorea, coleus, stone breaker, pyrethrum, camphor, costus, *Crotalaria, Datura,* aswagantha, mint, *Solanum khasianum,* noni and *Tephrosia*)

Unit 5: Storage pests of fruit, plantation, medicinal and aromatic crops

Distribution, host range, bio-ecology, injury, integrated management of important insect pests attacking stored dry fruits, nuts and other processed products of fruit, plantation, medicinal and aromatic crops - Insecticide residue problems in fruit, plantation, medicinal and aromatic crops and their maximum residue limits (MRLs).

Practical:

Types of injury and symptoms of damage caused by insects and assessment of insect population and damage in fruit, plantation, medicinal and aromatic crops - Collection, identification, preservation, assessment of damage and population of important insect pests affecting fruits, plantation, medicinal and aromatic crops in field and storage. Non- insect pests attacking fruit, plantation, medicinal and aromatic crops.

Theory Lecture Schedule

1. Economic classification of insects with reference to fruit, plantation, medicinal and aromatic crops
2. Pest surveillance and assessment of insect damage in fruit, plantation, medicinal and aromatic crops
3. Legal methods of pest control
4. Pests of mango and citrus

5. Pests of guava, sapota and papaya
6. Pests of banana, grapevine and jack
7. Pests of pomegranate, pine apple, aonla and jamun
8. Pests of apple, pear, peach and plum
9. Mid-semester examination
10. Pests of coconut, arecanut, oilpalm and palmyrah
11. Pests of coffee, tea and cocoa
12. Pests of cashew, rubber and cinchona
13. Pests of neem, senna, hemp, bellodona and aswagantha
14. Pests of stone breaker, pyrethrum, glory lily, dioscorea and coleus
15. Pests of mint, camphor, costus, *Crotalaria, Datura, Solanum khasianum,* noni and *Tephrosia*
16. Pests of dry fruits, nuts and other processed horticultural products
17. Insecticide residue problems in fruits, plantation, medicinal and aromatic crops and their maximum residue limits (MRLs).

Practical schedule

1. Types of injury and symptoms of damage caused by insects and assessment of insect population and damage in fruit, plantation, medicinal and aromatic crops
2. Pests of mango and sapota
3. Pests of citrus, guava and papaya
4. Pests of banana and grapevine
5. Pests of apple, pear, peach and plum
6. Pests of jack, pomegranate, pine apple and aonla
7. Pests of coconut and arecanut
8. Pests of coffee, tea, cashew and cocoa
9. Pests of rubber and cinchona
10. Pests of betelvine and senna
11. Pests of neem, bellodona, stone breaker and aswagantha
12. Pests of pyrethrum, camphor, costus, glory lily and coleus
13. Pests of mint, *Solanum khasianum,* noni and *Tephrosia*
14. Pests of dry fruits, nuts and other processed products
15. Non-insect pests (mites, slugs, snails, rodents and bird pests)
16. Exposure visit to observe pest damage in plantations/ hill area / pest outbreak areas
17. Practical examination

References:

1. Ayyar, T.V.R. 1963. *Hand Book of Economics Entomology for South India.* Govt. Press., Madras. Reprinted by Nrendra Publishing House, Delhi, 1992, 528p.{ISBN: 978-81-85375-04-5}.
2. Butani, D.K. 2009. *Insects and Fruits.*Periodical Expert Book Agency, New Delhi.
3. David, B.V. and V.V.Ramamurthy.2011. *Elements of Economic Entomology.*Namrutha Publications, Chennai. 386 p. {ISBN: 978-81-921477-0-3}

4. Dhaliwal, G.S. and R.Arora. 2001. *Integrated Pest Management – Concepts and approaches*. Kalyani publishers, New Delhi. 427p.Madras.
5. Muthukrishnan,N., N.Ganapathy, R.Nalini and R.Rajendran.2005. *Pest Management in Horticultural Crops*.New Madura Publishers, Madurai,325p.{ISBN: 81-902832-0-0}
6. Nair,M.R.G.K.1986. *Insects and mites of crops in India*.Publications and Information Division, ICAR, NewDelhi. 408p.
7. ParvathaReddy.2010. *Insect, Mite and Vertebrate Pests and their Management in Horticultural Crops*.Scientific Publishers, Jodhpur. 384p. {ISBN: 978-81-7233-628-8}
8. Regupathy,A. and R.Ayyasamy.2013. *A Guide on Crop Pests*.Namrutha Publications, Chennai.368p. {ISBN: 978-81-921477-1-0}
9. Srivastava, K.P. 2003. *A text book ofApplied Entomology.Vol.I & II*.Kalyani Publishers.

Web resources:

1. http://agritech.tnau.ac.in/horticulture/horti_plantprotection_pest.html
2. http://www.nbaii.res.in/insectpests/pestsearch.php?cropname=Mango
3. http:www.ncipm.org.in/data bases.htm
4. ipm.illinois.edu

Assignments:

- Submission of 25 preserved insect pests of fruit, plantation, medicinal and aromatic crops
- Rearing of 20 species of insects pests of fruit, plantation, medicinal and aromatic crops, of which two should be prepared as Riker mounts.