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## SECTION A: INTRODUCTION

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'Integrated Pest Management' course is meaningful only if the learner gets the actual field experience. Hence, you need to undertake a 2 credit project related to this course. The project is a preliminary form of research. It will help you to collect first hand information and expose you to the problems being faced in the field of pest management. It is compulsory for you to undertake one of the projects for successful completion of this course. Planning for the project should start as soon as you receive the self-instructional materials for this course. **In case, you face difficulty you may contact your counsellor.** You should be able to complete the project work in approximately 60 hours. This includes planning, conduction of the project and report writing. While choosing the subject for your project, kindly keep this time constraint in mind. The theme should be relevant to the 'Pest Management' and the work involved in the project should be within your capacity and reach. We advise you to finish your project work as soon after appearing for the theory as possible in any case, within one year.

In this guidebook, we will discuss what a project work actually involves.

- In the next section i.e. Section B, we have provided the general guidelines to carry out the project.
- In Section C, we have discussed the important considerations for evaluation of project report.
- In Section D, we have given some themes/topics of projects. Detailed guidelines are provided to carry out the project. These themes are only suggestive though you are welcome to make necessary modifications in these themes to suit your local convenience or you can opt for other themes relevant to the course.
- Finally, you will find copy of certificate of originality that you will have to fill, when submitting your project report.

Please go through this guide carefully before getting into your project.

**REMEMBER THAT GRADES/MARKS FOR THE ENTIRE COURSE WILL NOT BE CREDITED UNLESS YOU COMPLETE SUCCESSFULLY BOTH THEORY AND PROJECT.**

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## SECTION B: GENERAL GUIDELINES

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This section will tell you about how to choose, plan and carry out the project. Guidelines for preparation and submission of project report are also given in this section.

### Choosing a Project

Making the choice of exactly what you wish to study is the most important and often the most difficult part of any project work. At this stage, it is well worth devoting a lot of thought and preparation in order to minimize the problems that may arise when collecting and processing the information. Choose a project, which interests and motivates you. It should, however, be related to various aspects of pest management (we have listed some areas in Section D). Your topic must also be feasible in terms of time, equipment and location.

Following are some of the important considerations, which should be taken into account while selecting your project:

- i) Avoid choosing a project which merely ends up proving the obvious.
- ii) Try to choose a project which is fairly narrow in scope rather than one that is too broad and general.
- iii) Choose a subject that will enable you to collect most of the information yourself. This will make for an original approach which is far more satisfactory than relying on someone else's data.

- iv) A number of other considerations may influence your final choice. Which parts of your course have particularly interested you? Would any of the other subjects that you are taking be of help? Or what sort of habitats are available for you to study around your area? Are any of these subjected to any particular urban pressures?
- v) Choose a subject that you should be able to complete in 60 hours.
- vi) You can discuss with your counsellor or any expert in this field regarding your choice for the project.

### **Planning a Project**

Before you start to collect any data, plan various activities related to the project and anticipate any problems which might arise. You should ensure that:

- i) The habitat that you have chosen to study is easily accessible and the time is best for collecting and studying the behaviour of pests.
- ii) All the apparatus/equipments you need to carry out the project is available.
- iii) Try to work out in advance what you are going to sample.
- iv) Decide how you start, you should also consider how to analyse the data collected, especially if this involves statistical techniques.

### **Carrying out a Project**

Following the planning stage, you can commence the project. This step will take a long time. You should identify the fields, households, local markets, companies from where you would collect the data. It involves preparation of questionnaires, feedback forms, if your project demands. This can be divided up into three stages.

Stage 1 Collecting the data

Stage 2 Summarising and analyzing the data in the form of tables, graphs or by statistics.

Stage 3 Describing 1 and 2 in a written account.

### **Preparing the Final Report**

After the project is completed, a report must be prepared. The written account should be concise and written in a logical sequence. This should consist of **approximately 5000 words**. It can be meaningfully divided into the following sections:

- **Title of the project**
- **Introduction and Objectives**
- **Review of Literature**
- **Material and Methods used**
- **Results and Analysis**
- **Discussion**
- **Data Appendices**
- **Conclusion**
- **Bibliography**

Let us elaborate a bit on each title:

- i) **Title of the Project:** This should be clearly mentioned on the top. It should be short, unambiguous and reflect the main idea behind the project.
- ii) **Introduction and Objectives:** Introduction should include the importance of the subject and theme selected. It should reflect upon the relevance of the same to this particular course and may highlight the reasons as to why you decided to undertake this project. It is always good to write a few objectives to be clear as to what you expect to do in this project. This makes your purpose and helps you to move towards concrete conclusions.
- iii) **Review of Literature:** It is very unlikely that your project is completely original, so read through some suggested texts to gain a background knowledge of the topic. This may also suggest ideas for further investigation.

- iv) **Materials and Method:** Provide a brief methodology adopted by you. You are required to enclose sample copy of any questionnaire or proforma used by you. Any statistical tests applied must also be mentioned.
- v) **Results and Discussion:** Present your results neatly and in detail. They are an important part of your project. You may present the information in the form of tables, charts or graphs. Photographs to support your information may also be included. The results should be followed by a brief discussion that critically reflects on your results. In the discussion, the usefulness of the project to yourself and to agriculture and environment must be elaborated. Shortfalls, if experienced during conduction of the study must be brought out and solutions provided thereof.
- vi) **Conclusion:** In the end, you are required to provide a conclusion which must satisfy the objectives.
- v) **Bibliography:** List of books or other study material referred by you for your project work should be given in bibliography.

To your report, you should also attach copies of questionnaires, feedback forms or other aids used by you during your project.

### Submitting your Report

- i) The Project Work should be submitted in A-4 size, (29×20 cm) typed in double space, in a bound volume. The project report must be neatly typed, consisting of 30-35 double space pages of approximately 5000-6000 words (excluding Appendix, questionnaires, feedback forms, illustrations, photographs and other exhibits).
- ii) Candidates should submit a statement, certifying that the work is an original one and has not been submitted earlier either to this University or to any other Institution for fulfillment of the requirement of a course of study. Format of the Certificate is provided as Appendix.

**YOU NEED NOT SUBMIT PROJECT PROPOSAL/SYNOPSIS.**

**YOU SHOULD KEEP A COPY OF THE PROJECT REPORT WITH YOU.**

You should submit this report to

**The Director  
SR & E Division  
Indira Gandhi National Open University  
Maidan Garhi, New Delhi-110 068**

alongwith certificate of originality. Kindly mention on the top of the envelope "PROJECT REPORT APM-01".

**1<sup>st</sup> June to 30<sup>th</sup> November**  
(for accountability in Dec. TEE)  
if missed, then submit between  
**1<sup>st</sup> December and 31<sup>th</sup> May**  
(for accountability in June TEE  
**next Year**)

## SECTION C: EVALUATION

The weightage of the project work is 25%. **To complete your course successfully, you will need to pass in both the components of the course separately—the theory portion (worth 6 credits) as well as your project work (worth 2 credits).**

**REMEMBER, PROJECT NOT FOUND TO BE ORIGINAL OR CONTAINING REPRODUCTION OF PUBLISHED OR UNPUBLISHED MATERIAL WOULD BE DISQUALIFIED.**

While evaluating your project we would consider how you conducted the project, analysed the data, and interpreted the results and in general, the way you have presented your results.

In the next section, we have provided some project themes. We have given detailed guidelines for conducting the project and time allocation for each activity of the project. However, these are only suggestions, you are free to choose any topic for your project related to pest management.

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## SECTION D: SUGGESTIVE TOPICS FOR PROJECT

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### 1. SURVEY OF PESTS AND THEIR NATURAL ENEMIES

#### Introduction

The estimated number of insect species on earth is 1.5 million of which around 15,000 species are pests. Any crop in the field will have not only pests but also beneficial insect fauna alongwith other casual visitors. The beneficial insect fauna includes both parasitoids and predators which in any sustainable agroecosystem maintains pest populations below economic threshold level. In modern times, due to non judicious human interventions, natural enemy population goes down resulting in an outbreak of the existing pest population.

This project will help you to familiarise yourself with not only the major pests of a crop but also their associated natural enemies.

#### Method

Try to develop your project along the following lines:

- i) Select a suitable crop (crop duration should not be more than 4-5 months) in your locality for your observations.
- ii) Select 4 fields and mark five 1m<sup>2</sup> plots with sticks.
- iii) Make ten net sweeps per plot (each sweep will mean moving the net from right to left and back or vice-a-versa). This procedure has to be undertaken once a week for three months or for the entire crop duration.
- iv) Identify the pests with the help of the study manual. Not all insects you collect will be pests. Some of them will be parasitoids/predators of the pests present on the crop while some of them will be casual visitors who come only for foraging.
- v) Look for the larval/pupal stages of the pests.
- vi) Collect the larvae/pupae and keep them in rearing jars in the laboratory.
- vii) Draw diagrams of the pests alongwith their larval/pupal stages alongwith their associated parasitoids, if any.
- viii) Observe and identify the stage causing damage to the crop.
- ix) Observe any predator predated on the larval/pupal stages.
- x) Observe pest succession.
- xi) From the literature, compile a list of the pests recorded alongwith their natural enemies on the selected crops.
- xii) Try to identify the insect groups parasitising or predated on the pests.

Compile your observations and discuss them in light of the already available literature.

#### Time Allocation

- |   |          |
|---|----------|
| i) Review of literature   | 10 hours |
| ii) Selection of 4 fields and marking of plots                            | 2 hours  |
| iii) Weekly sweeping for insect collection                                | 24 hours |
| iv) Sorting, processing and preservation of the collected insect material | 4 hours  |
| v) Compiling the data & making illustrations                              | 10 hours |
| vi) Analysing the data and drawing broad conclusions                      | 5 hours  |
| vii) Report writing   | 5 hours  |

## 2. MODERN AND TRADITIONAL GRAIN STORAGE STRUCTURES AND PRACTICES

### Introduction

In a country like India with rural majority, storage of grains for short term or long term is of vital importance. This system of storage is categorized as rural storage and may involve from very short periods of storage to longer periods of storage depending on the season, price fluctuation, economic status of producer etc. The present position of rural storage is far from satisfactory as estimated losses in storage range from 10-12%. The methods of storage in rural areas are both traditional and modern, both indoor and outdoor, in bags and underground pits.

This project will help you to familiarise with the modern grain storage structures & practices.

### Method

You can develop your project along the following lines. Identify 20 households in your area randomly. Collect information on:

- i) Types of produce being stored.
- ii) Quantity being stored.
- iii) Duration of storage.
- iv) Purpose of grain storage (whether for consumption or for use as seeds etc.)
- v) Whether grain/seed protectants are being used.
- vi) Storage structures being used: traditional like underground cellars (Khattis), mud bins, straws bins, woven bins (Thekkas) etc. or modern improved ones like Pusa bin, Pusa Cubicle, Pusa Kothar, Pant Nagar Kuthla.
- vii) Occurrence of stored grain insects [Information about which insects are present & in which type of bin; whether infestation is carried over from field, (e.g. *Sitotroga* in case of paddy), damage by *Sitophilus*, bruchids and rodents].
- viii) Damage, if present, to what extent (visual estimate).

Compile all the information and in view of the modern improved storage structures suggest ways for improvement and precautions for safe storage of grains.

### Time allocation

- |  |          |
|--|----------|
| i) Review of literature  | 10 hours |
| ii) Identifying twenty households and preparation of a questionnaire | 5 hours  |
| iii) Gathering information from households                           | 20 hours |
| iv) Compiling the data and   | 15 hours |
| v) Analysing the data and drawing broad conclusions                  | 5 hours  |
| vi) Report writing   | 5 hours  |

## 3. STUDY ON BODY LICE/HEAD LICE AND VARIOUS CONTROL METHODS

### Introduction

Insects can cause problems and sufferings to humans in two main ways (i) Direct as causative agents (ii) Indirect as vectors of deadly diseases. In the direct mode of causing health problem to human beings, lice are suitable example to study the impact of these human ectoparasites.

### Method

Following method can be used to study the occurrence, biology and control measures of lice. Select about 10 houses each in 4 different residential colonies:

- i) High income group

- ii) Middle income group
  - iii) Low income group
  - iv) JJ colony (Jhugi Jhompri colony)
- Collect specimens (different life stages) of body lice and head lice and preserve it, and note down the adaptations of these insect parasites.
  - Collect the data on occurrence and density of lice on head and body on different groups of people.
  - Correlate the lice infestation with people of different status (social & economic effect).
  - Correlate the lice infestation with people of different working profession.
  - Correlate the lice infestation in different age groups of host.
  - Prepare a list of different methods of controlling lice infestation, that are being practised.
  - Prepare the detailed notes on biology and life cycle of lice.
  - Write detailed notes on prophylactic measures and control practices of lice as external parasites.
  - Collect information to avoid lice infestation – through newspaper, TV, radio, signboards.

#### **Time allocation**

- |   |          |
|---|----------|
| i) Review of literature   | 5 hours  |
| ii) Identification of the households and preparation of a questionnaire     | 15 hours |
| iii) Collection of specimens of different stages of body lice and head lice | 20 hours |
| iv) Compilation of the data   | 10 hours |
| v) Analysis of the results  | 5 hours  |
| vi) Writing the report  | 5 hours  |

#### **4. COMMUNICABLE DISEASES TRANSMITTED BY RAT FLEAS/ MOSQUITOES/SAND FLIES**

##### **Introduction**

Epidemiology is study of community medicine. This study has 2 main parts:

- i) Descriptive epidemiology: Study of distribution of the disease with respect to time, person & space.
- ii) Analytical epidemiology: Study of cause, control and eradication of the disease

The aim of this project is to create awareness regarding the details of the disease caused by insect (arthropod) as vector.

##### **Method**

- Describe systematic position and life cycle of rat fleas/mosquitoes/sand flies. (6 hours)
- Describe the pathogens of the disease spread by rat fleas/mosquitoes/sand flies. (6 hours)
- Describe the symptoms of the disease. (6 hours)
- Describe the transmission of the disease pathogens. (6 hours)
- Discuss the factors (like environment, host sex, host age, etc.) influencing the occurrence of the disease. (6 hours)
- Describe the vector control measures. (6 hours)
- Describe the prophylactic measures for this disease. (6 hours)
- Describe the treatment of the disease. (6 hours)
- Describe the recent outbreak of the disease in our country or elsewhere. (6 hours)
- Explain the role of individual, community, government and International forum towards dealing with this noxious disease. (6 hours)

## 5. BIOLOGY AND ECONOMIC IMPORTANCE OF HOUSEFLY

### Introduction

Housefly is the most common household pest and its economic importance and nuisance are much more than one can imagine in view of its common presence all around.

### Method

Following method can be adopted to understand the gravity of problems caused by housefly:

- Collect and preserve different life stages of housefly. (6 hours)
- Describe its feeding habits and ecology. (6 hours)
- Describe its life cycle and reproductive potential. (10 hours)
- Discuss the various diseases that are carried by these houseflies, (for example: typhoid, dysentery, trachoma, poliomyelitis, diarrhoea etc.). (10 hours)
- Carry out a small experiment in your house by observing number of houseflies visiting different food items (cooked, semi-cooked foods, fruits, milk, sugar, honey etc.) uncleaned kitchen utensils and nearby garbage sites at different timings of the day. (20 hours)
- Note the common practices to avoid the nuisance of houseflies. (8 hours)

(Note: Similar approach can be followed for cockroaches to study their noxious effect).

## 6. PREPARE IPM MODULE FOR ANY OF THE FOLLOWING CROPS (PADDY, SUGARCANE, COTTON, MAIZE, OIL SEEDS, PULSES, VEGETABLES, FRUITS, ETC.)

### Introduction

Farmers carry out cultural practices such as ploughing, selection of seed, sowing, seed treatment, weeding, application of fertilizers and irrigation to grow crops. These practices also influence the population of different insect pests on the crops. Besides, farmers also apply insecticides and biological control agents such as *Trichogramma* to suppress pest population.

### Method

You can interview 15-20 farmers in a village with the following questionnaire and collect information regarding various methods being used for suppression of pest population.

- i) Do they carry out deep ploughing of fields in summer?
- ii) Do they destroy weeds and crop residues?
- iii) Do they know that crop should be preferably sown at the same time in an area?
- iv) Do they carry out early, normal or late sowing of the crop?
- v) Do they use resistant varieties of crops?
- vi) Do they carry out seed treatment with pesticides?
- vii) Do they know that excess use of nitrogen increases pest incidence?
- viii) Do they use B.t. and *Tricho* cards in their field?
- ix) Do they adopt mixed cropping?
- x) Do they collect pest stages and damaged plant parts and destroy them?
- xi) Do they know that there are friendly insects (natural enemies of the pests) and these should be conserved?
- xii) Which insecticides do they use?
- xiii) Do they use pesticides as granules, dust or spray?

Time: 40 hours

### Compilation of information and report writing:

The information collected will be used to find out methods viz., resistant varieties, cultural methods, mechanical methods, biological control and insecticides, utilized by farmers to

suppress pests. The collected information can be supplemented by information from books or other reading material for formulating pest management modules for pests of crops.

Time: 20 hours

Example: A general pest management module for a crop should include information on the following aspects:

- i) Deep ploughing of fields
- ii) Selection of resistant varieties
- iii) Destruction of weeds and crop residues
- iv) Uniform sowing in an area
- v) Optimum use of fertilizers
- vi) Regulation of irrigation
- vii) Conservation of natural enemies of pests
- viii) Collection and destruction of pests and damaged plant parts
- ix) Application of pesticides in such a manner so as not to harm natural enemies.

## **7. OBSERVE, COLLECT AND PREPARE A LIST OF PESTS OF PADDY**

### **Introduction**

Paddy is an important crop of India. Paddy, like any other crop, is attacked by different organisms including insect pests damaging the crop plants in different ways.

This project will help you to familiarise yourself with the insect pests attacking different parts of the paddy plant.

### **Materials And Method**

Small vials (may be empty injection vials, homeopathic medicine vials), 70% alcohol, etc. Develop your project along the following lines:

- Visit a paddy field of your area, or a nearby locality/town.
- This visit is to be made at the time when paddy crop is grown in the field.
- Observe the paddy plants carefully, and find out whether the plants are healthy or give a sickly appearance.
- Observe the stem, leaves and ear heads of paddy plants, and look for the insects damaging them.
- The damaged leaves may
  - i) show cut margins,
  - ii) be rolled,
  - iii) show yellow colour instead of green,
  - iv) have tubular cases floating in the water.
- Stems may be seen damaged or cut. They may also show wilting or dead hearts.
- Ear heads may show drying.
- Make your field visits at least two times a day/first in the morning and next in the evening.
- At each visit, observations should be made for at least one hour.
- Collect as many insects (both adult and larval forms) as possible: preserve them either dry (in the case of adult), or wet (in the case of larvae and pupae) and identify them.
- Also collect and preserve damaged parts of the plants.

Time: 45 hours

The collected information can be supplemented by information from books or other reading material; compiled in a logical sequence for project.

Time: 15 hours

- [This type of project can be prepared about pests of sugarcane, cotton, maize, oil seeds, pulses, vegetables & fruits, of course with certain modifications in the methodology.]

## 8. ENVIRONMENTAL HAZARDS DUE TO PESTICIDES

### Introduction

This project would familiarise you with the potential pesticidal hazards to environment. This hazard is multidimensional in nature. Pesticides leach down after soil/foliar application and contaminate the ground water. Aerosol formulations and fumigators contaminate air and similarly pesticide run-off from fields also contaminate the water bodies. All these together are a serious threat to mankind. Even the milk we get in market is having high residues of pesticides, since the cattle feed on treated foliage. Over a period of time the pesticides gets accumulated in the animal tissues and is passed on to milk also. Since most of the pesticides are carcinogenic in nature so non-judicious use of pesticides must be discouraged and use of biological control methods may be encouraged.

### Materials And Method

Try to develop the project on the following guidelines:

- i) Collect literature on the environmental pollution due to pesticides. (12 hours)
- ii) Carry out a survey in your neighbouring locality or fields and note down the type and amount of pesticides being used by the farmers. (10 hours)
- iii) Also note the quantity of the spray fluid/granules/dusts being used. (5 hours)
- iv) Find out whether the farmers are using the recommended plant protection equipment with proper nozzle or not. (5 hours)
- v) Observe how the runoff takes place and whether neighbouring water bodies are getting contaminated or not (only visual observations). If so, you can guide the farmers to prevent it. (8 hours)
- vi) Observe whether farmer is following proper precautions during pesticide application viz. weather conditions (rainfall, sunlight, wind direction, wind velocity), time of application (early and late hours, when the activity of pollinators is less), type of formulations (dust, wettable powder, granules, emulsifiable concentrates, suspension concentrate, ultra low volume formulations) etc. (8 hours)
- vii) Prepare a report on these activities highlighting how farmers' activities can lead to environmental pollution. Also suggest ways for judicious use of pesticides. (12 hours)

## 9. STUDY ON LIFE HISTORY, DAMAGE AND CONTROL OF STORED-GRAIN PESTS

### Introduction

Food grains have to be stored necessarily after harvesting for shorter or longer intervals either for future consumption/marketing or for the purpose of seed for the next cropping season. It is essential that during the period of storage, food grains should not suffer any deterioration either in quantity or in quality. Our worst enemies in this respect are a host of pests, especially insects which attack stored grain and consume them or otherwise affect their value either as food or as seed. The extent of the loss has been estimated as about 5% of the total food grains stored which can easily be reduced with the knowledge of the life history and habits of the pests and by various methods of their control so as to render them, to a great extent, impervious to pest attack. In view of this, it is very important to have practical knowledge of all these aspects and to document all possible information at one place, for which following steps might be undertaken:

### Method

- i) Prepare a list of pests of some of the most important stored-food grains of your area. (10 hours)
- ii) Collect an important insect pest from godown/shop/house to study its life history, nature and extent of damage and economic loss caused in your area. (10 hours)

- iii) Document the nature and extent of damage caused to some important commodities of your area. Also mention the reasons for choosing a particular pest species by you for this study. (10 hours)
- iv) Enumerate various traditional and non-traditional control measures being adopted in the area. (10 hours)
- v) Enlist modern methods available for the control of stored grain pests. (10 hours)
- vi) Writing the project report. (10 hours)

The information documented through this project will be useful for the farmers and consumers to know about the most harmful pests of the stored commodities and their proper control measures.

## **10. SAFE HANDLING OF PESTICIDES**

### **Introduction**

Pesticides are generally used to eliminate the harmful organisms which affect the health, economy and environment of man. The word 'Pesticides' generally means the chemicals which are being used to kill these harmful organisms particularly the insects. These chemicals are toxic and injurious to the users/applicators and thus require the knowledge of their toxicity and methods of safe handling, before use. In view of this, following observations must be undertaken.

### **Method**

- i) Prepare a list of pesticides and their dosages recommended for various purposes. (3 hours)
- ii) Prepare a list of pesticides (with general and scientific names), easily available in the local market/adjoining area and most commonly used for domestic/ agricultural purposes. (6 hours)
- iii) Identify the class of popularly used pesticides. (3 hours)
- iv) Observe the labels of different containers and record their colour and level of injury (warning) etc., written on it. (3 hours)
- v) Observe the recommended dosages and the use of various pesticides against the variety of pests of different crops and record it. (6 hours)
- vi) Record the precautionary measures to be adopted for preparation of pesticide solution/mixture for application. (6 hours)
- vii) Make a list of various materials required to protect the user/operator from the contact of pesticide sprays, dusts, granules, etc. (6 hours)
- viii) Prepare a list of various methods to be adopted for the safe storage of pesticide containers. (3 hours)
- ix) Prepare a list of methods for safe disposal of unused pesticides/containers. (3 hours)
- x) Prepare a list of possible methods of giving first-aid in case of emergency. (6 hours)
- xi) Prepare a directory of doctors/primary health centres of local/easily approachable areas, for immediate help in case of emergency. (5 hours)
- xii) Writing the project report. (10 hours)

Information gathered during this project, will be useful for all those, who are interested in safe handling of the pesticides and their use for various purposes in day to day life and also to communicate this message to other people.

## **11. STUDY OF STATUS OF BIOPESTICIDES IN INDIA**

### **Introduction**

This project will help you to familiarise yourself with available biopesticides in India. Biopesticides are defined as any biological organisms/materials/by-products that may be used for reducing pest population. Biopesticides include bacteria, fungi, protozoa, viruses and botanical insecticides. Commonly used biopesticides are products containing *Bacillus thuringiensis* (Bt), nuclear polyhedrosis virus (NPV), granulosis viruses, neem and karanj

products etc. Use of biopesticides must be encouraged since they provide perpetual control or maintain the pest population below economic threshold level for fairly long time. The microbial pesticides are self perpetuating, so with each application, subsequent requirements would decrease over a period of time.

### Materials And Method

Try to develop the project along the following lines:

- i) Collect the literature and list out the biopesticides registered in India. (6 hours)
- ii) Once the list is prepared, note the formulations being marketed by different companies. (4 hours)
- iii) Make a survey in the local market and also in the neighbouring markets/shops selling pesticides and enquire about the sales and use of biopesticides from the shopkeepers. (10 hours)
- iv) Find out the average consumption of each biopesticide (formulation wise) in your locality/field and neighbouring localities and fields. (8 hours)
- v) Enquire with farmers, why they are hesitant in using biopesticides, whether they are costly, not available in time, difficult to use, have less shelf life, slow in action, relatively less efficient or the farmers are ignorant about the biopesticides. (20 hours)
- vi) Prepare a report after reviewing the literature on the total production and consumption of biopesticides in India that may include the most popular formulated products alongwith its reasons for popularity. Give a general overview of the biopesticides use in your locality and also of your neighbouring locality alongwith the reasons of their popularity/non-acceptability. (12 hours)

## 12. STUDY OF THE LIFE HISTORY OF CITRUS BUTTERFLY (*Papilio* sp.)

### Introduction

This project will help you to familiarise with one of the most common and beautiful butterfly. Only few people can suspect that object of beauty in its adult stage, has its caterpillars quite harmful causing considerable damage to the plants belonging to the citrus family.

You can refer to Unit 2 of this course for the description of citrus butterfly and its life cycle

### Materials And Method

Few small vials (may be empty injection vials or homeopathic vials), glass jars (or wide-mouthed glass bottles or transparent plastic containers of suitable size), 70% alcohol (may be obtained from the laboratories), blotting paper; etc.

- i) Visit a garden or an orchard where plants of citrus family (such as lemon, mausami, orange, etc.) are grown.
- ii) These plants can be easily identified by the shape of their leaves and a peculiar smell when crushed between the fingers.
- iii) Observe the plants, especially the leaves, carefully. You may find that these are cut in a semi-circular fashion. This is a sure symptom of the citrus butterfly activity.
- iv) A more careful look of the plants, will enable you to see the yellowish white eggs on young leaves and tender shoots. These eggs are laid singly and not in clusters.
- v) Pluck these leaves and shoots carefully, put them in a plastic bag, and bring them to your house.
- vi) With the help of a fine brush, remove some of these eggs from a leaf, and preserve them in 70% alcohol in a small vial.
- vii) Take a clean wide-mouthed glass bottle or a transparent plastic container. Put some wet sand in it, and cover the sand with a piece of blotting paper. Put the leaves and the shoots (with eggs) in the container and cover it with a piece of muslin cloth (a piece of thin cloth may also be used for covering the container).
- viii) Keep this container at a safe place in your house.
- ix) After few days, the eggs will hatch out and the tiny dark brown coloured caterpillars will come out. These young caterpillars soon start feeding on the leaves. After a couple of days, they develop irregular white markings on their body surface and look

You can refer experiment 32 of LSE-8(L) for detailed information on collection, preservation and identification of insects.

- couple of days, they develop irregular white markings on their body surface and look as if they are not caterpillars but some irregular masses of bird's excreta. (This is a protective adaptation to escape the notice of predatory birds in nature).
- x) Change the old, dried leaves with fresh tender leaves. Add some water on the blotting paper to make it moist.
  - xi) You can pick up 1-2 young caterpillars and preserve them in 70% alcohol in a small vial.
  - xii) The caterpillars will continue to feed, grow in size and moult at regular intervals. Every time the caterpillar moults, it increases in its size and is called as instar.
  - xiii) Such moulting occurs 4-5 times. Preserve 1-2 specimens of each instar in 70% alcohol in a small vial.
  - xiv) In about 15-20 days (depending on the temperature), the caterpillars become fully grown and acquire a green colour. The fully grown caterpillars are voracious feeders. Preserve 1-2 specimens of fully grown caterpillars in 70% alcohol in a small vial.
  - xv) Do not forget to clean the container, change the leaves, and drop some water on the blotting paper daily.
  - xvi) After feeding vigorously on the leaves, the fully grown caterpillars stop feeding, hang on the leaves with a thread secreted by them, and pupate.
  - xvii) Pick one such pupa and preserve it in 70% alcohol in a vial.
  - xviii) Pupa does not feed, in fact it is a quiescent stage. After about 10-12 days, the skin of the pupa ruptures, and the adult butterfly comes out, leaving the pupal case hanging on to the leaf.
  - xix) You can pick up the butterfly after some time, and preserve it dry on a piece of cardboard or thermocol.

(Note: Consult your counsellor for methodology of preserving the adult butterfly)

#### **Time allocation**

i) Study of the literature	8 hours
ii) Visit to the garden or orchard	8 hours
iii) Locating the plants	6 hours
iv) Study of various stages of the life-history	16 hours
v) Preservation of the specimens	6 hours
vi) Making drawings	6 hours
vii) Writing up the project report	10 hours

[This type of project can also be prepared for studying the life-history of Tobacco caterpillar, Rice moth, Flour beetle and Melon fruit fly (*Dacus* sp.)]

### **13. OBSERVE, COLLECT AND PREPARE A LIST OF PESTS OF CRUCIFEROUS VEGETABLES LIKE CABBAGE OR CAULIFLOWER AND THEIR PREDATORS.**

#### **Introduction**

Insect pests damage the vegetable crops from germination to harvest in the field. They not only reduce yield of crops but also affect their quality. The presence of insects or their excreta on vegetables reduces their market value greatly. Therefore to get a good crop, management of pests becomes a must. The information on different pest species associated with the crop, their period of activity and plant part damaged by them is essential before adopting any measure against them.

#### **Materials & Method**

The following materials will be required for collecting different stages of the pests:

- i) Insect collection net
- ii) Killing bottle (Any wide-mouthed bottle, cotton soaked in ethyl acetate/chloroform)
- iii) Collection tubes

- v) Stretching board
- vi) Collection box (any card board box with thermocol at the base)
- vii) Pins
- viii) Polythene bags

Observe the crops at weekly intervals for presence of pests and their damage after germination in the nursery and then in the field after transplanting.

### Activities

- i) Collection of pests, damaged plant parts and predators at weekly intervals. (24 hours)
- ii) Processing of collected pests and damaged plant parts. (12 hours)
- iii) Identification of pests and predators by referring course materials, books and counsellor's help. (10 hours)
- iv) Report Writing: At the end of the study, you can prepare the list of pests associated with the crop during its growing period. The list of predators observed on the crop should also be mentioned. It will be better if pests are mentioned in the order of development stages of crops like pests during seedling stage, vegetative stage and flowering stage. The nature of damage caused by pests and plant part damaged should also be mentioned. (14 hours)

Similar procedure can be followed for observing, collecting and preparing list of insect-pests of other crops viz., rice, sugarcane, cotton, maize, oilseeds, pulses, other vegetables and fruits.

## 14. HEALTH HAZARDS CAUSED BY CONGRESS GRASS (*PARTHENIUM*) AND ITS MANAGEMENT

### Introduction

Congress grass/ white top/ gajar ghas/Ramphool (*Parthenium hysterophorus*) is a native to Mexico. It is a serious weed of waste lands, pastures and agricultural fields in India, USA, Brazil, China, Australia, Sri Lanka and several other countries. In India, it got an accidental entry alongwith wheat import from USA and was spotted growing near Pune around 60 years ago. Since then, it has spread almost throughout the country and has become noxious weed.

As far as health hazards are concerned, gajar ghas is known to cause skin allergies in some susceptible human beings, leading to death in severe cases. It affects livestock indirectly by reducing the availability of fodder and also directly when consumed. The terrestrial weed is considered as one of the most serious cause of dermatitis. Through this project you will become aware of the gravity of weed menace and its safe management.

### Materials And Method

To work on this project you must consult some one who is familiar with the congress grass. Common people know it as gajar ghas. **Remember, be careful, plant has trichomes (on leaf) which are air borne. Some people when come in its touch can get allergies. In case you feel skin irritation or any other kind of suspected allergy move on to the other project.**

After recognizing the plant, you must study its surrounding plants. There could be situation when gajar ghas will inhibit growth and development of other neighbouring plants. Enlist such plants, these indicate prosperous future of gajar ghas while sending a signal for us to develop suitable control/management programme.

Similarly, you may find certain local plants competing with the gajar ghas, note down these plants, they may be repelling or suppressing it due to their allelopathic effects (Plant release chemicals to prevent growth of others).

Similarly, you may find certain local plants competing with the gajar ghas, note down these plants, they may be repelling or suppressing it due to their allelopathic effects (Plant release chemicals to prevent growth of others).

- You may also involve people and launch a programme (a sort of campaign) for the management of this weed. The details may be ascertained from the expert/counsellor.
- Visit florists in your locality and verify, if they are using *Parthenium* inflorescence (shoot) in the bouquet. Advise them not to do so, and also educate them for health hazards caused by this weed.

Time: 45 hours

Finally, prepare a nice report.

Time: 15 hours

## **15. TERMITES (WHITE ANTS) AND THEIR MANAGEMENT**

### **Introduction**

Termites (white ants) are one of the commonest insects injurious to our belongings both at home and in the fields, forests, etc. These are serious enemies of our books, wooden furniture, doors and anything made of wood. In the agricultural fields they attack the planted crops at various stages and affect the agricultural output. The termites may even attack the grains if stored improperly. In the forests the termites continue their activity unhindered and cause much damage to wood, specially the dry wood. From nature's point of view we may justify to say that termites are "useful" by breaking down dead plant material into its simpler compounds, that get incorporated in the natural cycles of chemical elements. But our primary concern here is to enable the project worker to familiarise himself/herself with these insects.

### **Materials And Method**

- Materials required for the study of termites would generally include a hoe, a needle, forceps, specimen tubes (for preserving specimens) etc.
- Termites always live and work in closed tunnels and hence, normally cannot be seen directly. You will have to look for earthen tunnels if exposed on the surface of objects, on the barks of trees, on the walls, or detecting any hollowness (by tapping) of wooden articles. Young plants if attacked by the termites may bend or droop down.
- **Specimens.** When you break open any "live" (undisturbed) tunnel you will come across the small whitish termites, majority of them are workers (with biting and chewing type of mandibles), and just a few are soldiers (with long pointed "sword-like" mandibles for defence). **Collect** these specimens in small specimen tubes (or any substitute) and preserve them in 70% alcohol. Collect such samples from various situations. Make a record of the collection in your diary giving as much useful information as possible, such as date of collection, place from there collected, and any other relevant information. In case you come across a mound ("baami") which is a small or large earthen "hillock" having termites, you should collect by digging out all the different castes, including the king and queen.
- **Identify the castes** - Workers, soldiers, nymphs, etc. Differentiate the termites from true ants (look at the antennae, thorax and abdomen).
- **Termite activities** - Observe the manner in which the termites bring wet soil from underground and keep on extending their runways and tunnels.
- **Collect information**
  - i) **Ask** the farmers about the nature of damage caused by termites, in their crops, and the treatments they adopt.
  - ii) **Ask** the masons (as well as farmers) about the preventive measures they adopt in the buildings, huts, storage places, etc. to safeguard against termites.
  - iii) **Collect** information about the natural enemies of termites such as partridges, ant-eaters which contribute in minimising termite infestation.
- **Make a special observation of the swarming** flights of termites, around lights after the first few showers of rainy season. **Collect** winged forms. Observe pairing of the dealated forms. Preserve specimens in 70% alcohol.

**Time Allocation**

Study of background information	-	10 hours
Collection of specimens and their study	-	30 hours
Information compilation based on interviewing different people	-	10 hours
Documentation (writing of the project)	-	10 hours

**16. INDIGENOUS FARMERS TECHNICAL KNOWLEDGE IN PLANT PROTECTION****Introduction**

In the battle to combat pest problems, people/ farmers through their long experience and keen observations, have evolved/ identified relatively tolerant cultivars (varieties), cultural practices and use of natural products as pesticides and grain protectants. These eco-friendly products are often available locally and used as a wealth of Indigenous farmers technical knowledge (IFTK) especially in developing countries.

There could be animal products like cow urine, whey, ash, cow dung etc., or plant products like neem leaves, neem seed kernel extract, karanj seed extract, tobacco leaf extracts. Release of fishes in ponds/ wells to clear certain aquatic insect pests or manufacturing of rat traps. Further more, up keep of pets like cat to get rid of rats or dogs to repel some of the vertebrates are a few classical examples. It depends on your interest to increase these practices through your interaction with the people in your locality for healthy and pollution free environment.

**Materials And Method**

After studying unit 13 of this course carefully, you may develop a questionnaire. Select 10 farmers and 10 housewives and begin with the project as follows:

- Enlist the IFTK's, through preliminary survey in your area and try to give scientific interpretations or explanations to these.
- You may categorize them as per their prevalence /use under the broader areas like
  - a) Crop pest management
  - b) Animal pest management
  - c) Household pests and their management
  - d) General practices (others) against specific problems.
- Select the most common IFTK and compare it with the modern scientific alternatives being used in the locality. Analyse demerits of modern technique, if any, and motivate a group of people to choose better option.

Time: 45 hours

Finally, prepare a report.

Time: 15 hours

**17. RODENTS AND THEIR MANAGEMENT****Introduction**

Rodents include mouse, domestic rats, field rats, gerbils, porcupines and squirrels. However, economically important rodents are only few like black rat and mole rat which damage crops in field and storage. Of course, house mice which remain in the house posing more nuisance besides gnawing expensive electrical fittings, clothes and household items can not be overlooked. Sometimes, rats also act as carriers of certain diseases, which lead to epidemics.

**Materials And Method**

After reading unit-4 of the course, you will have better understanding of non-insect pests wherein rodents are also dealt. In this project you need to recognize a field rat injurious to any field crop in your area. Choose at least 5 fields. Establish their burrow, if need be,

**Integrated Pest  
Management**

with the help of farmers. Liaise your activity with their harvesting schedule. Take a khurpi and spade before entering into the field. Study mouth of the burrow whether it has fresh mud/soil/stones or any crop residue. Start digging the burrow and go on sketching on a plain paper. The details may include number of openings, exit hole, breeding chamber (nest), partition if any, storage chambers. If, you find grain (ear heads) inside the burrow, study how they are stalked inside, and quantify. In case young ones are present in the nest, count down the number.

Time: 45 hours

Finally, write a detailed report and suggest management practices accordingly.

Time: 15 hours

### Certificate of Originality

Programme

BDP

Course Code

APM-01

Enrolment No.

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Study Centre Code

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Regional Centre

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Title of Project: \_\_\_\_\_

The work/investigation embodied in the project is the bonafide work done/carried by me for the completion of course on Integrated Pest Management (APM-01).

Signature of the Candidate \_\_\_\_\_

Name of the Candidate \_\_\_\_\_

Address, if any \_\_\_\_\_

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Year \_\_\_\_\_