Unit 4

Control of Insect Pests and Diseases in Flower Crops

Integrated Pest Management (IPM) is an integration of all suitable plant protection measures like cultural, biological, physical and chemical to manage key pests of selected crops below economic threshold levels, keeping in view the profitability of production, health and safety of consumers and sustainability of the environment.

All the decision making problems depend on the baseline studies of the area and dynamic monitoring of pests. IPM in greenhouses is very important considering the sensitivity of the crop, rapid multiplication of pests and high investment of the greenhouse growers.

The basic component of any IPM is monitoring (scouting). Monitoring includes the following:

(1) Making accurate diagnosis of pests and diseases and related crop injury.
(2) Determining the level of pest incidence.
(3) Recording crop stage and habitat analysis including natural enemies present and the management measures already taken, being taken or can be taken possibly.
(4) Recording all the field observations and their possible relation with pest incidence.

Monitoring helps in decision making. It helps in early warning of the presence of pests and diseases. This enables adoption, execution and monitoring of pest management measures, failing which, the pests or diseases escalate and cause greater losses. IPM is based on holistic data through an appropriate agro-ecosystem analysis including the pervading habitat, natural enemies and other natural suppression mechanisms in operation. Thus, IPM is a holistic and ecosystem-based strategy. In this unit, the techniques for identifying the pests and diseases along with the symptoms and their management practices and important physiological disorders of flowers are discussed.

Session 1: Monitoring and Management of Pests and Diseases

A weekly monitoring programme is ideal for most greenhouse situations. More frequent monitoring may be deemed necessary for high value crops or for pest-prone or pest-infested areas. Crop monitoring tools like sticky traps or plugs should be inspected every three to four days. The person inspecting them should have thorough knowledge of the pest complex for the specific crop varieties and have some basic education in plant and pest biology including major diagnostic symptoms. Standard protocols for selected crops may be prepared along the prevalent patterns for monitoring and diagnostics. Any pre-determination should be counter-checked with the observations and recorded thereby. Sampling of the greenhouse should be in standard zig-zag manner to avoid personal and observational bias but not avoiding the infested patches. Diseased or pest infested areas must specifically be observed on the periphery and centre also.

Pest Monitoring Techniques

To monitor pests in a greenhouse, various pest monitoring techniques are available. The type of technique selected will largely depend on the crop, its stage of growth and the situation against which it needs protection. Some pests are always present and

can be monitored using conventional methods such as sticky traps or visual observation of plant parts. Some unique monitoring methods, which are pest-specific, are required such as the use of pheromone traps.

Visual observation

If the pest scout is to diagnose the pest visually and directly, then it is the best confirmation. Stage of a crop, part of the plant or soil or indicator plants also confirm the presence of a pest. Sucking pests that do not fly, for example, mites or immature stages of other pests or the disease symptoms can be located using this technique. On the other hand, flying pests like whiteflies, and aphids can be located using sticky traps besides direct visualisation. As discussed above, observation should be done following a zig-zag pattern and random selection of plants. Visual observation is subjective and competence dependent, hence, it is advisable that the same person monitors the crop throughout the season.

Sticky traps

Pests monitored regularly, especially sucking pests, which multiply rapidly can be controlled by using blue sticky traps (thrips), yellow sticky traps (aphids/ whiteflies) and pheromone traps with lures for moths of caterpillars. Sticky traps like yellow sticky traps or blue sticky traps are common tools of observation and monitoring of small flying insects such as whiteflies, thrips, leaf miners, psyllids, aphids and leafhoppers, by the pest scouts or growers. They are very simple and economical and easily available in the market. The growers can also make the sticky traps on their own by using simple yellow or blue polythene stuck on boards and pasted with sticky glue or grease on which flying insects can easily get stuck. These traps are also available in triangular hut-shaped 'delta traps'. They are particularly helpful in double door greenhouses, which not only helps in monitoring the pests but also in checking their entry into greenhouses through the doors during workers' movements.

Pheromone traps

Insects secrete pheromones to alert other insects about information such as trail location, the sex of the insect and alarm. Synthetically produced pheromones mimic the chemicals produced by insects and are used to lure specific insect species for specially designed traps. Easy to use and inexpensive, species-specific, and environmentally safe characters make pheromone traps one of the ideal tools for IPM programmes. However, large-bodied insects like borers rarely enter a greenhouse so the use of pheromone traps in greenhouses has little relevance.

Fig. 4.1: Yellow sticky trap (Delta trap)

Fig. 4.2: Pheromone trap

Baseline Studies

Baseline studies are carried out even before the fabrication of a greenhouse so as to understand the situation of the farm, common pest problems of the area, management techniques and tools, and diagnostic or technical support available in the area. Such a study helps in preparing for future problems of plant protection that would require attention.

Accurate Identification of Pests and Diseases

In a pest management programme, it is very important to accurately identify the pest, insect, weed, plant disease, or vertebrate animals. This step is essential for taking appropriate and effective IPM decisions.

In addition, the damage is not always caused by pests; sometimes these problems are due to environment or nutritional disorders that cannot be remedied with pesticides. If the problems are incorrectly diagnosed, inappropriate chemical treatments used will be ineffective and would incur unnecessary expenditure besides causing environmental degradation. Once the pest has been identified accurately and confirmed that it is causing damage, one has to get familiarised with its life cycle, habitat, time and location of occurrence, and reproductive habits to work out the weak or vulnerable stages for its management. Pests may leave signs of their presence or symptoms of damage on the hosts and this can help in pest identification. Pest symptoms include discoloration, insect feeding indicators or reduced plant growth due to competition with weeds for nutrients.

Therefore, implementation of IPM involves the following stages.

(1) Baseline studies

(2) Preventive measures, including quarantine (such as site selection, crop rotation, sanitation and crop hygiene, summer ploughing and solarisation, removal of weeds and alternate hosts, crop geometry and habitat, timely sowing or transplantation, balanced fertigation, biodiversity and habitat management, soil health management, removing stubbles of old crop and residues, hygiene and weed management around greenhouses and maintain natural enemy population)

(3) Monitoring, scouting and diagnosis

(4) Integration that is, active pest management (physical, chemical, biological control, bio-rational pest management, etc.)

Proper IPM implementation also includes review of measures taken and proper and safe disposal of pesticide bottles, polythene, etc., away from children, water bodies and animals. Worker safety tips should also be provided for using chemicals and equipment safely.

Notes

Practical Exercise

Activity 1

Study different types of traps such as light, pheromone and yellow sticky traps.

Material required: Writing material, camera and different types of traps

Procedure

- Take photos of different traps.
- Label the different parts of the traps.
- Prepare a brief report on their utility.

Check Your Progress

A. Fill in the blanks

1. A basic component of IPM programme is _____.
2. Monitoring serves as an early warning system for the presence of _____ and _____.
3. The most common way to determine the presence of pests on plant parts is _____ observation.

B. Multiple choice questions

1. Traps that mimic the pheromones of insect species are _____.
   (a) light traps
   (b) pheromone traps
   (c) sticky traps
   (d) None of the above
2. Microorganisms that can cause a reduction in plant health include _____.
   (a) fungi
   (b) bacteria
   (c) virus
   (d) All of the above

C. Subjective questions

1. What is IPM?

   _____

   _____

   _____

2. What is monitoring and what does it include?

   _____

   _____

   _____

3. How do sticky traps and pheromone traps help in pest management?

_____

_____

_____

D. Match the columns

A	B
1. Baseline study	(a) Sucking pest
2. Microorganism	(b) Scouting
3. Sticky traps	(c) Holistic status of field and crop
4. Monitoring	(d) Disease

Session 2: Management of Pests and Diseases

In this session, the management practices of major pests and diseases along with their symptoms are being discussed with a focus on flower crops cultivated under protected cultivation.

Rose and Gerbera

Name	Symptoms	Control measures (chemicals may be used as per CIBRC guidelines and registration compliances)
Pests		
Mites	Pests which are present in large colonies on the underside of the leaves, covered with fine silky webs. White specks that appear on the leaves coalesce and appear as white patches due to their feeding. Ultimately, the affected leaves become mottled, dry, stiff and shiny. Plants grow weak and pale.	Spraying horticultural oil or other biorational oils like neem or azadirachtin with plain water helps. Sulphur dusting also helps. For chemical control, Dicofol @ 0.5 ml/L or Abamectin @ 0.25 ml/L should be sprayed.
Aphids	Large, dark green or pink brown aphids feed on buds, shoots and leaves. Foliage of infested plants is fouled with sticky honeydew and sometimes with sooty moulds and the plant growth may be checked.	Excessive use of nitrogenous fertilisers should be avoided. Light dusting with Pyro dust or spraying Nuvacron may be helpful. Systemic insecticides like dimethoate @ 2 ml/L or Imidacloprid 0.3 ml/L should be sprayed to control aphids. Spraying of nicotine sulphate may also help.

Thrips	Flower buds may become deformed and fail to open due to high population of thrips on roses. Petals could be covered with brown streaks and spots. Western flower thrips can act as vector for certain tospovirus including impatiens necrotic spot virus and several strains of tomato spotted wilt virus. They affect the top parts of the plant.	Systemic insecticides like Thiamethoxam @ 0.3 g/L or Imidacloprid @ 0.3 ml/L or dimethoate (1.7 ml/L) should be sprayed to control thrips.
Leaf miner	This insect makes zig-zag mines inside the leaves, which make the leaves turn from yellow to brown.	Strict monitoring should be done. Leaves should be plucked as soon as tunnels are noticed in the leaves. The infected plants should be destroyed. Spraying Cypermethrin or Dichlorvos (0.5–0.75 ml/L) controls leaf-miner.
Diseases		
Die-back	This is the most serious disease of the rose plant in India. Die-back implies the death of the plant from top downwards indicating drying of the twigs. The pruned surface of the twigs is the first to get affected by this disease.	The diseased stem has to be cut about 5–7 cm below and the cut wound must be treated with copper sulphate or Bordeaux paste or after mixing it in cow dung. Over watering should be stopped especially under humid conditions. Cuttings should be procured from certified nurseries only. Drench the soil with carbendazim @2 g/L to control the disease. Spraying captan or mancozeb @ 3 g/L or copper-oxychloride @ 3 g/L immediately after pruning and then twice at 10 days interval is effective to control the die-back of the rose.
Black spot	The disease is characterised by the development of black circular spots of 2–12 mm on the upper leaf surfaces.	The infected leaves should be pruned and burnt. Preventive spraying of carbendazim @ 2 g/L must be done at fortnightly intervals.
Powdery mildew	It is a major disease of protected cultivation including rose. The disease affects all the aerial parts of the plant, but the leaves are more prone to it. The younger leaves curl and become purplish in colour. The leaves develop raised blister like areas and get coated with the white powdery growth of the fungus.	The infected plants should be sprayed with wettable sulphur at the rate of 3 g/L of water at fortnightly intervals. Fungicides like Triadimefon, Fenarimol, Penconazole may be tried.
Collar rot	The symptom is noticed at the soil surface on the collar portion of the stem. In severe cases, the leaves turn yellow and the entire plant wilts.	Drench the soil either with metalaxyl @ 2 g/L or with contact fungicide such as captan (2 g/L) or copper oxychloride at the root zone of the plants. Drenching with Fosetyl-Al also helps.

Root rot	Several fungi, namely Pythium sp., Sclerotium rolfsii and Rhizoctonia solani affect the root system of gerbera and other protected cultivation crops particularly at the initial stage.	Sterilise the soil before planting and regularly apply fungicide like copper oxychloride @ 3 g/l to the soil to control the disease. Drenching with Fosetyl-Al also helps.

Orchids

Name	Symptoms	Control measures
Pests		
Mealy bugs	Cottony masses especially infest the junctures such as the crook between two leaves. Stunting of plants can be noticed.	During early infestation, remove the affected region with a cotton swab dipped in methylated spirit. On severe infestation, use an insecticide containing malathion or nicotine.
Scales	This is a round or oval shell in brown, grey or white colour often accompanied by a sooty mould. The plant may be stunted, leaves may turn yellow and fall off.	Pick the infested part with a knife or tweezers or swab with methylated spirit. Spraying of adult scales with an insecticide containing malathion or nicotine also helps.
Slugs and snails	The plant is punctured with ragged holes, and a slimy trail is visible from where the pests have passed.	A tuft of cotton wool around the stem protects the flowers. Trap snails and slugs with pesticide bait containing metaldehyde or methiocarb @ 4–10 g/m^2 or lure slugs at night into a saucer of beer to drown them.
Spider mites	Leaves appear pitted or striped with white. Webs can be noticed.	To break the webs, spray foliage with warm water. Spray heavy infestations with pesticide containing dicofol @ 0.5ml/L or abamectin @ 0.25 ml/L.
Diseases		
Black rot	Purplish blotches edged with yellow discolouration appear on leaves and new shoots. Rotting may occur both in acropetal and basipetal succession.	Water plants in the morning, avoid watering foliage during hot weather, choose resistant variety of roses, encourage air circulation, keep the greenhouse clean and remove dead leaves, take up preventive management. Drench infected plants with a fungicide such as captan or zineb @ 2–3 g/L. Remove infected parts, cut 2.5 cm into the healthy tissue and seal the cuts with fungicide. Destroy severely infested plants.
Leaf spot	Raised or sunken spots in yellow, brown or purplish colour appear on the leaves. They spread quickly. Leaves turn yellow or brown and die in the advanced stages.	Increased air circulation and low humidity is beneficial. Cut off diseased leaves; spray with fungicide. Apply captan or a systemic fungicide containing thiophanate-methyl 2–4 g/L weekly.

Petal blight	Small brown circles, often with pink edges, appear on the sepals and petals. Sometimes burnt symptoms may be noticed.	Destroy infected blossoms. Spraying with a fungicide containing captan, thiophanate-methyl, thiram or zineb also helps.
Virus	Leaves show yellow, black or brown pitting, mottling, and streaking. The flowers may also be streaked or mottled.	There is no remedy. Destroy the infected plants by burying or burning. The hands and tools of the workers may spread the viral disease in the entire greenhouse. When dividing, sterilise the knife over a flame between cuts, or dip potting sticks in 10 per cent bleach solution may also help. Control aphids, which are also vector for virus transmission by spraying proper systemic insecticides like dimethoate (1.7 ml/L) or acetamiprid or spinosad to control the sucking pests that spread infestation.

Fig. 4.3: Powdery mildew on rose

Fig. 4.4: Aphid on rose

Fig. 4.5: Thrips infected rose

Fig. 4.6: Black spot on rose

Fig. 4.7: Orchid mealy bugs

Fig. 4.8: Orchid slugs and snails

Fig. 4.9: Orchid leaf spot

Important note

The use of chemical pesticides has to be done only as per CIBRC guidelines and registration compliances. These are a must and binding.

Practical Exercise

Activity 1

Visit a nearby pesticide shop and collect trade names of different chemicals available in the market.

Material required: Writing material and practical file

Procedure

Enlist the following:

- Insecticides (formulation and expiry date)
- Fungicides (formulation and expiry date)
- Weedicide (formulation and expiry date)

Activity 2

Prepare a herbarium of different diseased plant samples.

Material required

Writing material, newspaper or blotting paper, herbarium sheets

Procedure

- Take the diseased leaves.
- Try to identify the disease.
- Press between the blotting paper or newspaper for a week.
- Remove sheets of blotting paper and stick the sample in a file and label it.

Check Your Progress

A. Fill in the blanks

1. Pests, which are minute in size and found in large colonies on the underside of the leaves covered with fine silky webs, are _____.
2. Honeydew is secreted by_____.
3. Insect vectors for tospovirus are _____.
4. When the leaves develop raised blister like areas and get coated with white powdery growth of fungus, these are the symptoms of _____.

B. Multiple choice questions

1. The chemical abamectin is sprayed against _____.
   (a) bacteria
   (b) fungi
   (c) mites
   (d) ants
2. Black spots can be controlled by spraying _____.
   (a) dimethoate
   (b) abamectin
   (c) carbendazim
   (d) imidacloprid
3. Dieback is the most serious disease of _____.
   (a) carnation
   (b) orchid
   (c) rose
   (d) gerbera

C. Subjective questions

1. List the pests and diseases of flower crops.

   _____
   _____
   _____

2. How will you manage thrips and mites in a greenhouse?

   _____
   _____
   _____

3. How will you manage mealy bugs?

   _____
   _____
   _____

4. How will you manage soil-borne diseases?

_____

_____

_____

5. How will you manage plant viruses?

_____

_____

_____

D. Match the columns

A	B
1. Root rot	(a) Sooty mould
2. Aphids	(b) Brown streaks and spots
3. Die-back	(c) Disease of rose plant
4. Thrips	(d) Pythium

SESSION 3: PHYSIOLOGICAL DISORDERS OF FLOWER CROPS

Plant disorders often result from nutritional deficiency, improper cultivation practices or storage situations. Unfavourable temperature, humidity, pH, other abiotic stresses, erratic water or nutrient supply, poor light, and stressful atmosphere, cause deficiency or unthrifty growth and physiological disorders or deformities in flower crops.

Rose

Blind shoot

A common occurrence is the failure to develop a flower on the apical end of the stem. Such shoots are termed as blind. The sepals and petals are present, but the reproductive parts are absent or aborted. Reasons for this are various, such as insufficient light, chemical residues, insect-pests, fungal diseases and other factors.

Bull heads or malformed flowers

The centre petals of the bud remain partly developed and the bud appears flat. This is due to the lack of carbohydrates.

Colour fading

Off-coloured flowers cause a problem. In some yellow varieties, the petals may be dirty white or green instead of a clear yellow. Rise in the night temperature by several degrees cause reduction in the number of off-coloured flowers.

Limp necks

Limp necks is when the area of the stem just below the flower 'wilts' and is not able to support the head. Sometimes, this is due to insufficient water absorption. Cutting off 1 to 2 inches of the lower stem and placing the cut stem in water at 37°C revives the flower.

Blackening of rose petals

Blackening is caused by high anthocyanin content in the flowers and low temperature. This effect is less pronounced at high temperature (30°C during the day and 20°C at night) than in low temperature (20°C during the day and 4°C at night). In other words, low temperature and high anthocyanin content may cause blackening of rose petals.

Nutritional disorders

Iron deficiency can cause pale foliage (interveinal chlorosis of younger leaves). pH adjustment in the soil or application of $FeSO_4$ (0.5%) may solve this problem.

Carnation

Calyx splitting

The calyx may split either partially or completely, depriving the petals of their support, which results in bending of petals. Thus, the regularity of shape and structure of the flowers is disturbed. Splitting

is associated with light and it occurs when the temperature fluctuates. Splitting can be reduced by keeping the night temperature from 10–15°C. High plant density causes more calyx splitting. High dose of nitrogen reduces the number of split calyces while increase in the potassium rate enhances it. Varieties tolerant to calyx splitting are Palmir, Epson, etc.

Curly tip

This disorder affects the growing tips mainly, which curl and become distorted. The tips of young shoots fail to separate and the continuation of growth results in a typical curvature. Poor light and other adverse conditions are thought to be the causes of the disorder. Water stress and potassium deficiency are suspected causes for physiological die-back and curly tip of the carnation flowers.

Gerbera

Bushiness

An abnormality characterised by short petioles, small laminae and numerous leaves, which gives some cultivars of gerbera a bushy appearance, is known as bushiness. No internode elongation is seen and the nodes are also not clearly distinguished.

Stem break

This is mainly caused by water imbalance. It could be ethylene associated early senescence and linked with water stress. It is a common post-harvest disorder in cut gerberas.

Yellowing and purple margin

Yellowing and early senescence of leaves occurs due to nitrogen deficiency, while phosphorus deficiency causes the flower to turn pale yellow with a purple margin. Increase in levels of nitrogen and phosphorus promotes the development of suckers and improves flowering in gerbera.

Practical Exercise

Activity 1

Collect pictures and samples of physiological disorders of flowers.

Material required: Writing material and practical file

Procedure

- Collect samples of physiological disorder of flowers, branches or leaves, etc.
- Write down the symptoms of the physiological disorders of flowers and control measures in brief.
- Take their photographs and paste them in a brief report.

Check Your Progress

A. Fill in the blanks

1. Colour fading is very common in _____ coloured rose varieties.
2. Blackening of rose petals is due to _____ and high _____ content.
3. Curly tip is a common disorder of _____.

B. Multiple choice questions

1. Bull head is a common disorder of _____.
   (a) gerbera
   (b) rose
   (c) carnation
   (d) orchid
2. Calyx splitting is a common disorder in _____.
   (a) carnation
   (b) rose
   (c) gerbera
   (d) lilium

C. Subjective questions

1. Define plant disorder.

   _____

   _____

   _____

2. List the important disorders of rose.

   _____

   _____

   _____

3. What is calyx splitting in carnation? How can it be controlled?

_____

_____

_____

D. Match the columns

A	B
1. Calyx splitting	(a) Rose
2. Blind shoot	(b) Gerbera
3. Stem break	(c) Carnation