HIGHLIGHTS OF MAJOR PROBLEMS AND THEIR MANAGEMENT IN APPLE ORCHARD

Abstract

Apple is considered an important fruit crop which belongs to the family Rosaceae. Apples are very prone to many different types of biotic and abiotic factors such as insect-pests, diseases and unfavourable weather conditions which may cause damage to apple orchards. The most common pests that cause significant damage to apple include mites, apple scab (*Venturia inaequalis*), Powdery mildew fungus (*Podosphaera leucotricha*), Fire blight of Apple (*Erwinia amylovora*), Root rots (*Phytophthora spp*.), Codling moth *(Cydia pomonella),* Scale insect *(Quadraspidiotus perniciosus),* and certain grasses and weeds which compete with apple trees for nutrient and water (Walsh *et al*., 1996). IPM techniques are more common and best methods to control the pests, viz. Proper sanitation, mechanical destruction of insects, growing of other crops attracting the major pests of apple, utilization of natural enemies, etc.

Keywords: Apple, Insect- pest, Diseases, Management

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I. INTRODUCTION

The apple: Apple is considered a member of the family Rosaceae and it is among the oldest trees domesticated in the world (Harris *et al*., 2002). According to Jackson, 2003 and Harris *et al.,* 2002, the crop originated between Asia and Persia border on the mountain region. When humans started to migrate, apple distribution also increased to Greece, Italy, and Egypt in accordance with the need for food crops. Now, apple orchards are believed to be cultivated all around the world's temperate regions with higher altitudes except for the Antarctic region (Luby, 2003) and counted among the top five crops grown in the temperate region in majority (Dirlewanger *et al*., 2002).

With the advent of more cultivation and higher production there are some problems that arise as apples are very prone to pests, diseases and unfavourable weather conditions which may cause damage to apple orchards which in turn results in poor production and economic loss to fruit growers. This study aims to highlight the major problems (insects, disease and weeds) associated with apple orchards and to provide adequate management strategies. The most common pests that cause significant damage to apple include mites, apple scab (*Venturia inaequalis*), Powdery mildew fungus (*Podosphaera leucotricha*), Fire blight of Apple (*Erwinia amylovora*), Root rots (*Phytophthora spp*.), Codling moth *(Cydia pomonella),* Scale insect *(Quadraspidiotus perniciosus),* and certain grasses and weeds which compete with apple trees for nutrient and water (Walsh *et al*., 1996). As only a handful of protection means is available for orchards, the physical injuries increase resulting in compromised fruit quality. By keeping in mind all these problems and major pests certain practices may be implemented in accordance with the age or stage of tree. With the implementation of IPM techniques good results can be achieved in order to protect the orchards by using all the suitable measures viz. Proper sanitation, mechanical destruction of insects, growing of other crops attracting the major pests of apple, utilization of natural enemies, etc. using chemicals only when needed.

II. MANAGEMENT ACTIVITIES

Management strategies at various development stages of apple are evaluated to protect the crop from various malfunctioning such as, insect infestation, disease development, weeds development, and other pest management is ensured by certain advanced techniques that need to be evaluated.

1. **Pre planting stage:** For the management of apple orchard, the basic need is to start the practices even before the planting which comprises of nutrient and weed management. The pests which are soil borne, they are controlled by certain digs are prepared approximately 1 meter cube during summer as to expose the pests by leaving the digs open. To check the fertility and soil condition various samples of different horizons need to be analysed which in addition to type of soil, kind of trees, cultural practices, climate and crop load will act as basis for fertilizer dose. The actual time of application of manures and fertilizers is the time of filling of pits. It is advisable that soil with optimum fertility needs to have N, P and K in the ratio 70:30:70 g/year/tree. For the management of weeds deep ploughing is necessary before planting followed by cross harrowing as to destroy the existing weeds in the field.

2. **Planting stage:** During the time of planting the pits which were made need to be filled with combination of FYM, pond silt and red soil followed by super phosphate per pit in accordance with the ratio. For proper management of weeds intercropping can play a vital role along with some agronomic plasticises. By keeping in mind the other problems associated with insects, nematodes and pathogenic diseases adoption of resistant / tolerant varieties is the best option for less damage. Infested stocks could be the reason for apple scab, powdery mildew and aphids arrival as they spread through infested stocks. Wooly aphid is considered to be the major pest of apple that can be controlled by biological control using parasitoid Aphelinus mali.

III. VEGETATIVE STAGE 1ST YEAR ONWARDS

The management of orchard work in series i. e. in continuity at every stage in accordance to the growth and development. It is believed that during the first year of growth the stabilized dose of N: P: K may be supplemented by FYM initially at 10kg/tree which can be increased with the age of tree to 100kg. The year when there won't be fruiting the FYM dose can be minimized to 250g however In bearing trees, phosphorus along with potassium and FYM is applied in December and January followed by nitrogen in two phases i.e. February and march a week before breaking of buds and after one month of flowering. weeds monitoring should be done adequately in the tree basin, between the tree rows by ploughing or by certain chemical application in order to control grasses and broad leaved weeds in orchards.

1. **Reproductive stage:** There are times when nutritional deficiency is observed at reproductive stage that needs to be corrected as soon as possible by the application of foliar spray of particular nutrient by proper diagnosis of deficient nutrient. Weeds management will carry on with every stage.

2. **Tight cluster stage:** The tree reaching the tight cluster stage is an invitation to insect pests and disease development viz. San jose scale, Phytophagous apple mites, Stem borer, moths and caterpillars and apple scab. For the management of these pests different IPM practices can be incorporated.

   - **San jose scale:** San Jose scale, *Quadraspidiotus* is a major pest of apple and is widely distributed in all the apple growing countries of the world. They are usually found sucking the young plants which results in weakness and sometimes death of young plants in nursery.

     Crops can be grown that can attract the natural enemy of said pest under cultural practice, pruning of branches and twigs with infection can be done mechanically and destroying them.

     - **Parasitoids:** encarsia pernicioisi and Aphytis diaspidis.
     - **Predators:** coccinellids beetles.
     - **Chemicals:** malathion, oxydemeton and lime sulphur.

   - **Phytophagous apple mites:** The European red mite, *P. ulmi Koch*, and the two-spotted spider mite, *T. urticae Koch*, both belonging to Acari family Tetranychidae,

are the most common mite pests of apple. Both of these species infest leaves and suck fluids from the cells resulting in leaves dessication and poor fruit development (Hoyt *et al.*, 1979, Beers, 1993).

- **Predators:** Chrysoperla zastrowi sillemi, anthocorid bug, predatory mite (Amblyseius fallacis), coccinellid (Stethoruspunctum)
- **Chemicals:** bifenthrin, fenazaquin, hexythiozox, malathion, propargite and spiromesifen

- **Stem borer**
  - Attacked shoots are pruned and burned during winter.
  - Stem borer can be killed by pokling a wire into the holes follwied by sealing with cotton soaked in petrol.
  - Chemicals: dimethoate.

- **Lepidopteran caterpillars (Indian gypsy moth)**
  - The eggs of gypsy moth are clearly visible (eggs covered with yellow hair) in orchards that can be collected and destroyed
  - By providing shelter to the larvae during day time can help in destroying by examining frequently.

- **Scab:** Apple scab is caused by the ascomycete fungus *V. Inaequalis which is considered to be the* is the most economically damaging pathogen in humid apple. It can be observed as lesions which are usually blistered and scabby in appearance (Belete and Boyraz, 2017).
  - For the protection of apple from scab the protection of orchards from destructive parts is the first necessity. In order to prevent the sexual cycle for scab development the incorporation of proper destruction of collected fallen leaves, pruned material and plant debris is needed. Urea can also be used on fallen leaves to increase decomposition.
  - **Chemicals:** bitertanol, captan, carbendazim, difenaconazole, hexaconazole, mancozeb , thiophanate etc.

3. **Pink bud stage:** With the increase in development of orchard the increase in pest and problems are seen. At the time of tree when it attains pink bud stage fungal infestation (powdery mildew), insects (blossom thrips and Lepidopteran insects) and mites are more visible.

- **Powdery mildew:** *Powdery mildew (**Podosphaera leucotricha)*** is an ascomycete fungus which is found in all apple-producing regions. The symptoms are visible on the leaves and fruits having silvery gray appearance.

To prevent the spread of fungus, proper sanitation in orchards is a key importance. It is believed that pruning and trimming reduces the humidity which makes the environment unfavourable for the development of inoculums. The

terminals in which the fungal spores are overwintering, need to be removed by pruning at the point below 6 to 8 inches from infestation.

- **Chemicals:** aureofungin, dinocap, lime sulphur and sulphur.

- **Mites, blossom thrips and Lepidopteran insects**

  - Regular monitoring is needed for the control of lepidopterans. The major pest, codling moth can be controlled by mating disruption as to reduce the population during the mating period.
  - **Predators:** coccinellids, anthocorid bugs, lygaeid, predatory thrips etc.

4. **Petal-fall / pea stage:** At petal fall stage or pea stage same management practices are carried as the infestation carries of Scab, San jose scale, mites, powdery mildew etc. Until reaches the fruit development stage (walnut size).

IV. FRUIT DEVELOPMENT (20 DAYS AFTER WALNUT STAGE)

Woolly aphid: Aphids are small sap sucking insects causing damage to plant parts by directly feeding on them and secretion of honey dew also invite the black sooty moulds to develop. The wolly aphid *Eriosoma lanigerum*, is believd to form galls on stems and leaves that starts with the formation on wooly appaeanve at the nodes.

- **Parasitoids:** Aphelinus mali
- **Predators:** Coccinella septumpunctata, Chrysoperla zastrowi sillemi, Menochilus sexmaculatus, Syrphus confrator
- **Chemicals:** carbofuran, phorate, chlorpyrifos malathion, oxydemetommethyl quinalphos in addition to the management of wolly aphid Scab, Marssonina blotch and Alternaria blight, Phytophagous-mites management are also running.

V. PRE-HARVEST STAGE (20-25 DAYS BEFORE HARVEST)

Pre harvest stage is considered one of the crucial stage as it is prone to many problems in relation to insects, mites, pathogens and rotting due to such several outcomes.

1. Apple tree root rot is a common and destructive disease of fruit trees throughout the world (Ellis, 2008). This disease is caused by any one of three species of *Phytophthora (P. cactorum, P. cinnamomi* and *P. cambivora*). Disease are commonly found in poorly dreained soil and the symptoms in apples trees appear as delay in bud break, discolored leaves, and twig dieback.

2. **Fruit scrapping caterpillar, other caterpillars, and mites:** The codling moth, *C. pomonella* is the key pest of apple production worldwide (El Iraqui and Hmimina, 2016, Witzgall *et al*., 2008, van der Geest and Evenhuis, 1991). The infested apple turns to become brighter in color and drop down if attacked at early stage. (Paul, 2008).

For the control of other caterpillars in apple regular monitoring is an essential requirement in addition to pre harvest spray 20-25 days before the harvest at pre harvest stage as loss of fruit can lead to poor production.

3. Mites can cause greater damage to apple orchards once reach the ETL therefore it is mandatory to regularly carry management practices right from the initial stage upto harvest.

- **Recommended chemicals**

  - Scab, Marssonina blotch, Alternaria blight, Sooty blotch and fly speck, Bitter rot and brown rot.
  - **sooty blotch:** mancozeb
  - **bitter rot:** captan or difenoconazole
  - **fly speck:** captan

- **Post-harvest:** Prominent postharvest diseases of apple are caused by fungi which include blue mould caused by *Penicillium expansum*; brown rot by *Monilinia sp., Alternaria sp.*, gray rot by *Botrytis cinerea*, and *Gloeosporium* rot by *G. albumand* and *G. Frugtigenum* (Valiuškaitė *et al.*, 2006). Infection by fungi and bacteria may occur during the growing season, at harvest time, during handling, storage, transport and marketing, or even after purchase by the consumer *Moinina et al., (2019).*

- **Dormant stage:** When the orchards are in dormant stage the major problem that arises are the black rot/ canker, white rot/root rot and insects (sanjose scale, wolly aphid and stem borer).

  - **Black rot / Canker:** In order to protect an orchard from canker mechanical injuries need to be avoided by proper pruning.

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