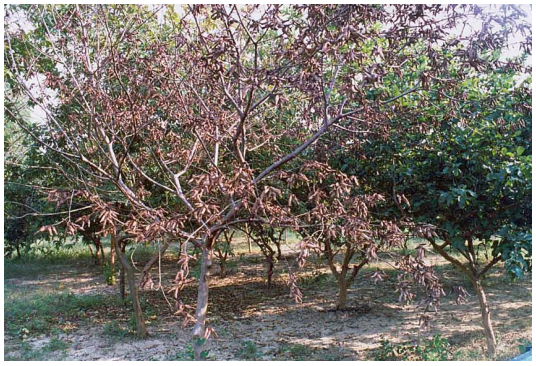
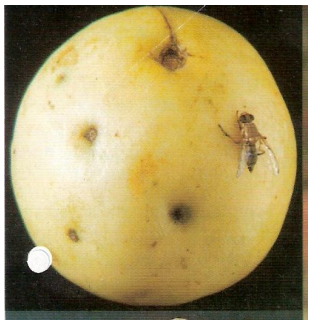
Extension Bulletin No. 2

IPM SCHEDULE FOR GUAVA PESTS










Horticulture Year, 2012

National Horticulture Mission

Ministry of Agriculture

Department of Agriculture & Cooperation

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IPM SCHEDULE FOR GUAVA PESTS

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IPM SCHEDULE FOR GUAVA PESTS

A. DISEASES

1. Wilt: The exact cause of the disease is still not fully understood but the pathogens, viz. *Fusarium oxysporum f.sp. psidii, F. solani*, *Macrophomina phaeseoli, Rhizoctonia bataticola, Cephalosporium* sp. and *Gliocladium roseum* are reported to cause wilting.

Symptoms

Wilt is a pernicious disease and a curse to guava industry. First external symptom of the disease is the appearance of yellow colouration with slight curling of the leaves of the terminal branches. Plants, at a later stage, show unthrifty-ness with yellow to reddish discoloration of leaves. Subsequently, there is premature shedding of leaves. Some of the twigs become bare and fail to bring forth new leaves or flowers and eventually dry up. Fruits of all the affected branches remain underdeveloped, hard and stony. Later, the entire plant is defoliated and eventually dies (Fig. 1). The roots also show rotting at the basal region and the bark is easily detachable from the cortex. Light brown discoloration is also noticed in vascular tissues. The pathogen attacks young as well as old fruit bearing trees but older trees are more prone to the disease.



Fig 1. Wilted plants

Mode of spread:

1. Through movement of plants containing sick soil in virgin areas.
2. Short distance spared is by water.
3. Root injury predisposes wilt disease.

Reasons of Severity:

1. High rain fall during August/ September.
2. Stagnation of water in guava field for long duration.
3. Maximum and minimum temperature ranges 23-32 C with 76% RH are conducive.

4. Lack of timely application of suitable control measures.

Management: Following practices are required for the management of the disease:

- Disease can be kept under check by proper sanitation in the orchard. Wilted trees should be uprooted, burnt and trench should be dug around the tree trunk.
- While transplanting, roots of plants should not be damaged severely.
- Maintenance of proper tree vigour by timely and adequately
- Manuring, intercutlure and irrigation enable them to withstand infection.
- The pits may be treated with formalin and kept covered for about 3 days and transplanting should be done after two weeks.
- Organic manures, oil cakes and lime also check the disease.
- Use of rootstocks resistant to wilt could be an alternative effective method for the control of disease. Cross of *Psidium malle* x P. *guajava* has been found free from wilt and this material can be used as resistant root stock.
- Eco-friendly approach of guava wilt control is suggested where biological control, soil amendment and intercropping are effective.
- Biological control by Aspergillus niger strain AN-17 is found effective. *Aspergillus niger* multiplied in FYM @ 5 kg/pit, applied in the pits while planting new plants. In older plants *Aspergillus niger* enriched FYM can be applied @ 10 kg plant[1.]
- Partially wilted plants recovered fully after rejuvenation / heavy pruning of the tree.

2. Anthracnose: [*Gloeosporium psidii* (Delacroix Sacc. = *Glomerella psidii* (Del.) Sheld./ *Colletotrichum psidii* Curzi.]

Symptoms: Die back phase: The plant begins to die backwards form the top of a branch. Young shoots, leaves and fruits are readily attached, while they are still tender. The greenish colour of the growing tip is changed to dark brown and later to black necrotic areas extending backwards causing the die back. The fungus develops from the infected twigs and then petiole and young leaves. These may droop down or fall leaving the dried twigs without leaves. The disease appears in epidemic form, during August to September.

Fruit and leaf infection phase: Fruit and leaf infection is generally seen in rainy season crop. Pin-head spots are first seen on unripe fruits, which gradually enlarge. Spots are dark brown in colour, sunken, circular and have minute black stromata in the center of the lesion, which produce creamy spore masses in moist weather. Several spots coalesce to form bigger lesions (Fig 2 &3). The infected area on unripe fruits become corky and hardy, and often develops cracks in case of severe infection. Unopened buds and flowers are also affected by disease which caused their shedding. On leaves, the fungus causes necrotic lesions at the tip or on the margin. These lesions are usually ashy grey and bear fruiting bodies.



Fig. 2 Disease on young fruits



Fig. 3. Disease on mature fruit

Mode of spread:

1. By wind borne spores available on dead leaves, twigs and mumified fruits in the orchard.
2. Dense canopy is congenial for germinating of spores due to suitable moisture regime.
3. Movement of planting material through infected foliage
4. Transportation of fruits from high disease pressure area without any treatment.

Reasons for severity:

1. Closer planting without canopy management
2. Lack of timely harvesting
3. Availability of free water in the farm of dew or rains encourages spore production and its dispersal around canopy.
4. Lack of timely application of control measures.

Management:

- Spray of Bordeaux mixture (3:3:50) or Copper oxychloride (0.3 %) just after initiation of disease.
- For post harvest treatment, 20 min. dip in 500 ppm tetracycline is effective.
- Application of bio agent viz Streptosporangium pseudovulgare on fruits before emergence of symptom (Fig.4)

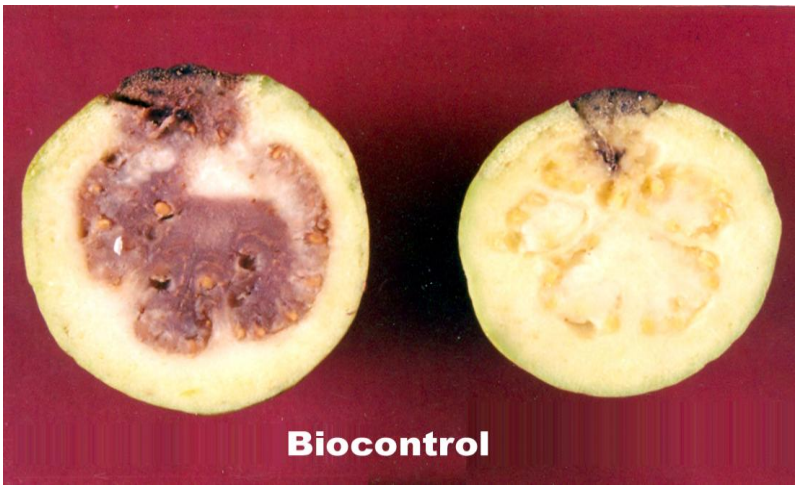

Fig. 4. Bio control

3. Canker [Pestalotia psidii Pat.]

Symptoms: The disease generally occurs on green fruits and rarely on leaves. The first evidence of infection on fruit is the appearance of minute, brown or rust coloured, unbroken, circular, necrotic areas, which in advanced stage of infection; tears open the epidermis in a circinate manner. The margin of lesion is elevated and a depressed area is noticeable inside. The crater like appearance is more noticeable on fruits than on leaves (Fig. 5). The canker is confined to a very shallow depth and does not penetrate deep in the flesh of the fruit. In older cankers, white myceliums consisting of numerous spores are noticeable. In severe cases, raised, cankerous spots develop in great numbers and the fruits break open to expose seeds. The infected fruits remain underdeveloped, become hard, malformed and mummified and drop. Sometimes, small rusty brown angular spots appear on the leaves. In winter, the cankerous spots are common but in rainy season minute red specks are formed. In cv. Sardar (Lucknow-49), development of canker pustule is large, more elevated and numerous.



Fig. 5. Canker on fruit

Mode of Spread: The pathogen is primily a wound parasite and avoid injury to fruits.

Reason for Severity: Germination of spores is maximum at 30 ^{0}C and do not germinate below 15^0 C or above 40^0 C with 98% RH.

Management: The spread of disease (in early stage of infection) is controlled by 3 to 4 sprays of 1 per cent Bordeaux mixture or lime sulphur at 15 days interval.

4. Algal leaf and Fruit Spot [Cephaleuros virescens Kuntze (= C mycoidae Karst.), C. parasiticus]

Symptoms: Alga infects immature guava leaves during early spring flush. Minute, shallow brown velvety lesions appear on leaves and as the disease progresses, the lesions enlarge to 2-3 mm in diameter. On leaves the spots may vary form specks to big patches. They may be crowded or scattered. Leaf tips, margins or areas near the mid vein are most often infected (Fig. 6). On immature fruits the lesions are nearly black. As fruits enlarge, lesions get sunken. Cracks frequently develop on older blemishes as a result of enlargement of fruits, lesions are usually smaller than leaf spots. They are darkish green to brown or black to colour. Disease begins to appear from April and is more serious during May to August. The pathogen sporulates readily during the period of high rainfall (July-September) and the disease incidence is greatest during September. In winter, symptoms are not available.



Fig. 6 Algal spots on leaves

Management: The control of alga can be achieved by sprays of Copper oxychloride (0.3%) 3-4 times at an interval of 15 days when initial symptoms noticed.

5. Cercospora Leaf Spot (*Cercospora sawadae* Yamamoto)

Symptoms: The disease appears as water soaked, brown irregular patches on the lower surface and yellowish colour on the upper surface of the leaf. Older leaves are mostly affected and the severely affected leaves curl and subsequently drop off (Fig. 7).



Fig. 7 Cercospora Leaf spot

Management

- Spray mancozeb or Dithane-M-45 (0.2%) at monthly interval.

6. Sooty mould [*Phragmocapnias betle, Scorias philippensis, Tichomerium grandisporum, Limacinula musicola, Aithaloderma clavatisporum, Tripospermum* sp., *Polychaeton* sp., *Leptoxyphium* sp. *and Conidiocarpus* sp.]

Symptoms: Sooty mould proliferates in abundance on the foliage of guava, subsisting on the honeydew secreted by scale insects, aphids, white flies and mealy bugs. Symptoms consist of blackish brown velvety thin membranous covering on the leaves. In severe cases, the foliage appears black due to heavy infection. The affected leaves curl and shrivel under dry conditions (Fig 8)



Fig. 8 Sooty Mould

Management:

1. The control of disease consists in removing the cause by destroying the insects. The mould will die out for want of suitable growth medium if honeydew-secreting insects are killed by suitable insecticides.
2. Foliar spraying of wettasul + chloropyriphos+Gum Accecia (0.2+ 0.1 +0.3%) at 15 days interval has been found very effective.

7. Damping off of Seedlings (*Rhizoctonia solani* Kuhn).

Management

Both pre emergence and post emergence phases of the disease are observed. In pre emergence phase the infected seeds and seedlings show water soaked discoloration, the seed becomes soft and ultimately rots. The affected young seedlings are killed before they reach the soil surface. In post emergence phase, hypocotyle at ground level or upper leaves are discolored into yellowish to brown colour, which spreads downwards and later turn soft and finally rot and constrict. The affected seedlings ultimately topple down and die. Strands of mycelium may appear on the surface of the plants under humid conditions. The pathogen is also responsible for causing fruit rot, if they are kept on soil after harvest or touching the ground. The disease occurs in warm wet growing area during rainy season. Initially, lesions appear firm, brownish and water soaked enlarging into irregular-shaped sunken cankers (Fig 9). Rotting is rapid and infected fruit become covered with dense grayish brown mould. *Sclerotial* bodies are seen in due course of time on fruits.



Fig. 9. Damping off guava seedlings

Management:

1. Diseased seedlings and weeds should be removed and burnt.
2. Excessive use of water and close planting should be avoided as the organism is moisture loving. Seedbeds should be prepared with proper drainage arrangement.
3. As the fungus survives on several hosts, planting of susceptible hosts should be avoided.
4. Two minute dipping of guava seeds in captan / thiram (0.2%) is advocated before seed sowing.
5. Drenching of soil with Copper oxychloride (0.3%) helps in reducing the diseases intensity in nursery.

8. Phytophthora fruit rot [*Phytophthora parasitica* Dastur/ *P. nicotianae* var. *parasitica, P. citricola]*

Symptoms*:*

The symptom starts at calyx disc of the fruit during rainy season. Affected area is covered with whitish cotton like growth which develops very fast as the fruit matures and pathogen is able to cover almost the entire surface within a period of 3-4 days during humid weather. Under high relative humidity, the fruits near the soil level covered with dense foliage are most severely affected. The fallen fruits are badly affected. The skin of the fruit below the whitish cottony growth becomes a little soft, turns light brown to dark

brown and emits a characteristics unpleasant smell ultimately such fruits either remain intact or drop off from the tree (Fig 10 & 11).

Mode of spread:

1. Rain and the wind are important for spread.
2. The pathogen produces a great number of sporangia (Spores) on the surface of diseased tissues principally when the temperature is near 25^0 C and this is an important source of inoculums in the development of epidemics.
3. Drops of rain are necessary for the liberation of sponrangia from the infected plant material or soil.
4. Infection ceases when temperature is less than 15^0 C or more than 35^0 C

Reason for Severity:

1. Cool, wet environmental conditions with high soil moisture favour diseae development.
2. High humidity, temperature from 28-32^0C, poorly drained soils and injuries are important for initiation of disease.
3. Lack of timely fungicidal sprays.
4. Close plantation.



Fig. 10 Phytophthora on foliage



Fig. 11 Phytophthora fruit rot on green fruits

When the disease appears on young and half grown fruits, they shrink, turn dirty brown to dark brown, hard in texture either remain intact as mummified fruit or drop off. The disease incidence varies from 8-30%, depending upon the weather and foliage conditions.

Management:

- Dithane Z-78 (0.2%) or Ridomil or Aliette (0.2%) or Copper oxychloride (0.3%) are found effective to control foliar infection.
- Soil drenching with Copper oxychloride (0.3%) or Ridomil or Aliette (0.2%)
- Plant spacing and fertilizer régimes should be managed to avoid unnecessarily dense plant canopy.

9. Stylar end rot [*Phomopsis psidii* De camara and *P. destructim*]

Symptoms:

The visible disease symptom is the discoloration in the region lying just below and adjoining the persistent calyx. Such area gradually increases in size and turn dark brown. Later the affected area becomes soft. Along with the discoloration of epicarp, the mesocarp tissue also shows discoloration and the diseased area is marked by being pulpy and light brown in colour in contrast to the bright white colour of the healthy area of the mesocarp (Fig. 12)

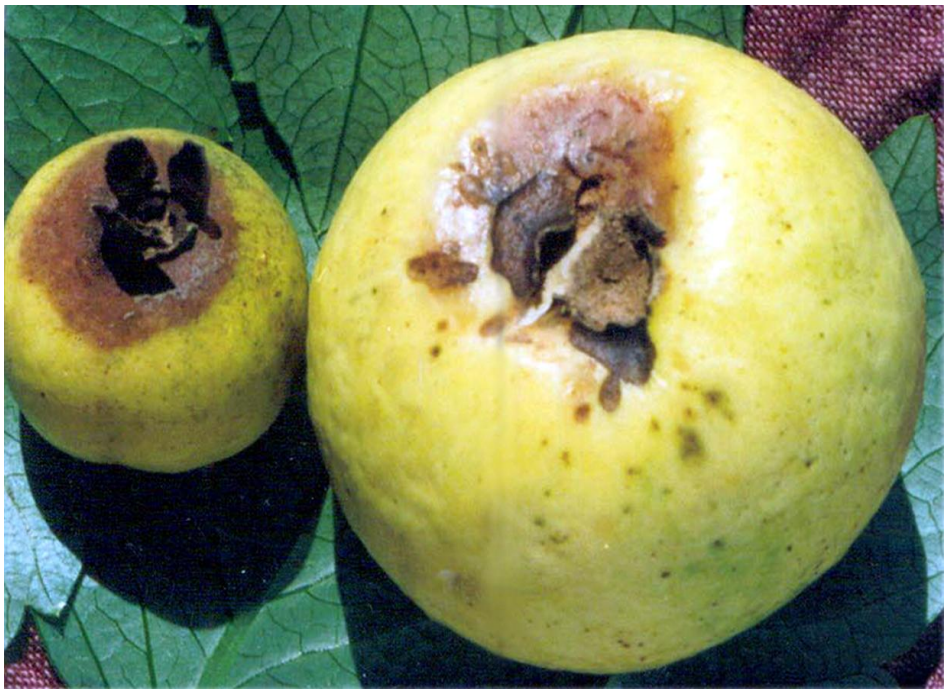

Fig.12. Stylar end rot

At an advanced stage due to disorganization of the inner affected tissues, size of the fruit shrinks and concentric wrinkles develop on the skin. Finally the affected fruit is covered with dark colour pycnidia. Serious losses up to 10% occur in the orchard if disease is not properly controlled.

Management:

- Spray Copper oxychloride (0.3%) or carbendazim or Thiophonate methyl (0.1%) before onset of winter fruiting.
- However, care should be taken that no spraying is done 15 days prior to harvesting.
- Avoid fruit injury.

10. Soft watery rot (*Botryodiplodia theobromae Pat*)

Symptoms

The infection starts as a brownish discoloration mostly at the stem end and it gradually proceeds downwards in an irregular wavy manner. Finally the whole fruit may get involved. The decay takes the form of a soft, watery break down, resulting from infection via wound or through the stem end. In advanced cases, numerous small pycnidia are produced over the entire surface of the fruit (Fig 13.)



Fig. 13 Soft watery rot

Management

(i) Ensure careful handling in order to reduce the incidence of wounding

(ii) Captan and homeopathic drug arsenic oxide are found effective against the fungus

(iii) Applications of *Bacillus subtilis* and *Streptosporangium pseudovulgare* on guava fruits have been found effective.

11. Botryosphaeria rot (*Botryosphaeria ribis* Gross. & Duggar)

Symptoms

The disease has been identified as *Botryosphaeria ribis* which cause serious losses during December. The infection usually occurs at or near the distal end in the region of persistent calyx. The rot begins with a translucent zone around the distal end that becomes brown in colour. With the evolution of the disease, the lesion becomes dark black and wrinkled with dry skin, while maintaining translucent margins (Fig. 14)

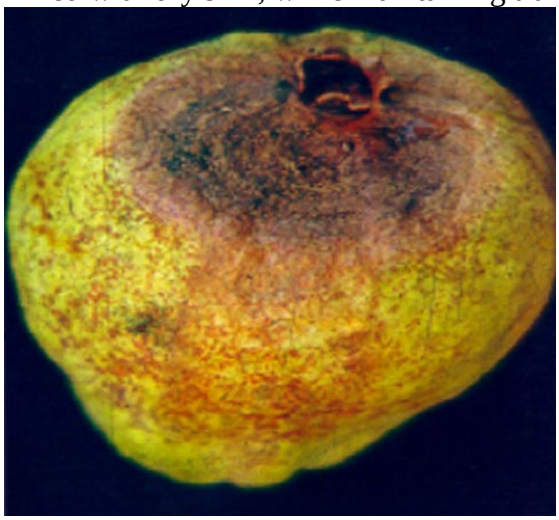

Fig. 14. Botryosphaeria rot

Spots on the skin of the fruit often slightly sunken that tends to increase in size with the formation of Pycnidia embedded in the disease tissues as lesions age containing characteristics spores. The fungus produces asexual stage is responsible for infection in the orchards.

Management: Orchard sprays with Copper oxychloride (0.3%)/ dithane M 45 (0.2%) at 15 days interval.

12. Hyaloderma leaf spot (*Hyaloderma sp.)*

Symptoms:

The fungus preferentially infects mature leaves during wet weather. In the more advanced stage, when the conditions are highly favourable, the disease can cause a severe spot on the leaves around middle lamina. Under humid conditions, it is common to see the brick red colour spots (Fig. 15& 16).

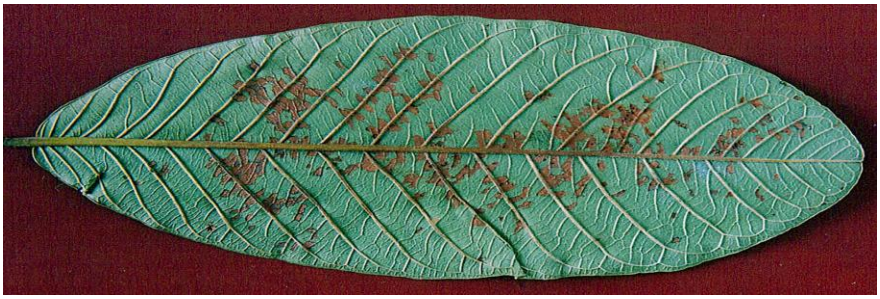

Fig. 15. Hyaloderma leaf spot (lower surface)

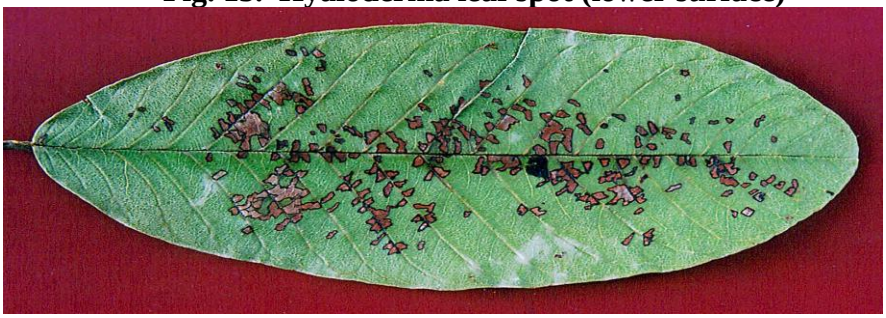

Fig. 16 Hyaloderma leaf spot (upper surface)

On the lower surface of the leaves, in the areas corresponding to the spot, the growth of the fungus can be observed. Abundant spotting causes defoliation of leaf. The lesions spread easily to healthy leaves, and can coalesce forming a large irregular to semi circular lesions area on the surface of the leaf, upto 4-5 mm in diameter, sharply defined, and occasionally depressed. Initial infections on the underside of the leaf may cause chlorotic patches or spots to occur on the upper side of leaf. Since, it is a new disease, more research is warranted, to know its epidemiology, biology and control etc.

Management:

- The diseases could be managed with Copper oxychloride (0.3%) spray during rainy season.

13. Parasites *(Loranthus sp.)*

Symptoms:

The guava tree is the prey of many parasites and the most interesting of these are so called phanerogamic parasites and epiphysis. Guava trees are commonly affected with

these parasites particularly in the neglected orchards. They are commonly present on trunk or branches of the tree, thus making the tree weak. The foliage infected host plant is sparse, reduced in size and its bearing capacity and quality of fruit is considerably lowered. Since the appearance of parasitic plants is quite distinct from the guava host, they can be easily distinguished in infected trees. The point at which the guava host is penetrated is usually characterized by swollen growths called "burrs". The burrs help in the identification of sites at which the parasite has entered the host, an important feature while controlling these plants (Fig. 17).



Fig. 17. Parasite*(Loranthus sp.)*

Management

1. The affected branches should be cut sufficiently to eradicate the haustoria. In early stages, it can be removed easily. If small bit of haustorium is left in the host, it re-grows with renewed vigour and soon starts damaging the host as before.
2. Cuttings out affected portion of tree for enough below burrs to remove haustoria and cut surface is treated with wound dresser viz. Copper oxychloride (0.39%) paste/spray to prevent the secondary pathogens infecting through wounds.
3. Spraying of emulsion of diesel (30-40%) in soap water is recommended as it was found affective.

B. INSECTS

About 80 species of insects have been recorded on guava trees, affecting yield and quality of fruits. Of these, less than 20 species occupy the status of major potential and minor pests. Rests of them are casual feeders. Fruit flies, bark-eating caterpillars, fruit borer and coccids (scale insects and mealy bugs) are considered as major pest of guava, while aphids, white flies, thrips, cockchafers, stem borers and fruit borers, etc., are the minor pests.

14. Fruit Fly

The fruit fly is the most destructive insect in the production of guava, particularly during rainy season. Guava fruits are attacked by a number of fruit flies including *Bactrocera cucurbitae*, B. *correcta*, B. *diversus*, B. *dorsalis*, and B. *zonata*. These pests are widely distributed throughout the country and are polyphagous pests, breeding on a number of fruits and vegetables and as such are of great economic importance. The

main species, infesting guava in North India, have been identified as B. *correctus* and B. *Zonatus*. Eggs are laid on ripening fruits (Fig18.) and the maggots feed on pulp of fruits. Pupation takes place in the soil. In North India, after the harvesting of mango, the pest shifts over to guava with the peak population in July-August, thereafter, population declines and larvae hibernate in winter.

Symptoms: Ovipositional damage in the form of minute depressions may be seen from outside (Fig. 18). Fruit soften at the site of infestation. The affected fruits rot and drop down prematurely. Ovipositional apertures lead to secondary infection by several pathogens.

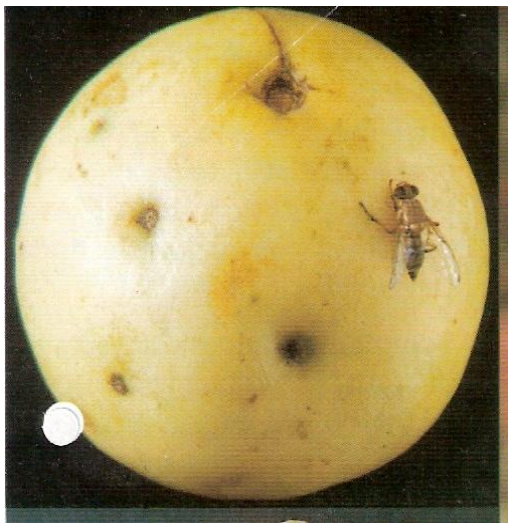

Fig. 18. Fruit fly with ovipositional damage



Fig 19. Fruit flies attracted to drop of pheromone

Management

- To check the carryover of the pest, collect and destroy fallen and infested fruits along with fruit fly maggots.
- Tillage of tree basin also helps in checking the pest population as the pupae and hibernating larvae are destroyed by natural enemies.
- Hanging of methyl eugenol bottle traps (containing 100 ml solution of 0.1% methyl eugenol & 0.1% malathion) is highly effective in controlling the pests. It is also helpful in early detection of this pests and monitoring of its population. Ten such traps may be hanged in a hectare at a height of 5-6 ft, well before the ripening of fruits. If mango orchard is in the vicinity, traps should be hanged form the second week of April. The solution may be changed at weekly intervals.

15. Bark- Eating Caterpillar [*Indarbela tetraonis* Moore *and I. quadrinotata* (Walker)]

Symptoms: The infestation of this pest may be identified by the presence of irregular tunnels and patches covered with silken web consisting of excreta and chewed up wood particles on the shoots, branches, stem and main trunk (Fig.20). Shelter holes may also be seen particularly at the joints of shoots and branches. The young shoots dry and die away giving sickly look to the plant (Fig.21).

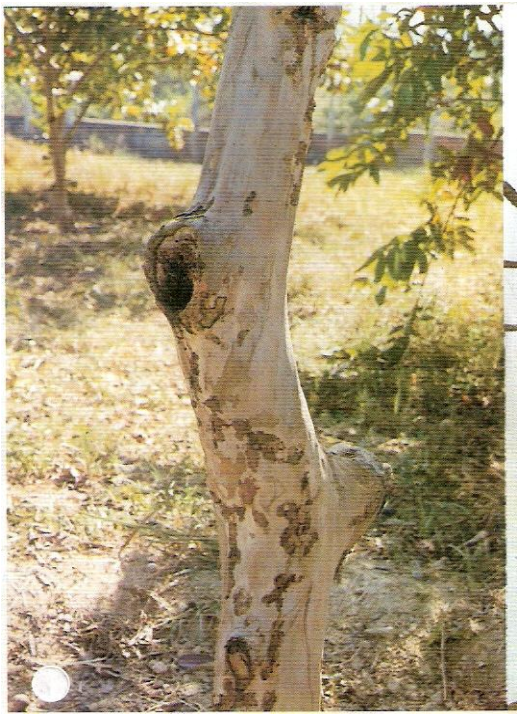

Fig. 20 Damage of bark eating caterpillar on trunk



Fig. 21. Infestation of bark eating caterpillar on twigs.

Management:

- Keep the orchard clean and healthy to prevent the infestation of this pest.
- Detect early infestation by periodically looking out for drying young shoots.
- Kill the caterpillars mechanically by inserting the iron spike in shelter holes made by these borers at early stages of infestation.
- In case of severe infestation, remove the webs and insert the swab of cotton wool soaked in 0.05 per cent dichlorovos or inject water emulsion of 0.05 per cent monocrotophos or 0.05 per cent chlorpyriphos and plug the holes with mud.

16. Fruit borers

(i)Pomegranate butterfly: [*Deudorix (Virachola) isocrates* (Fab)]

The pomegranate butterfly, D. *isocrates* is a main pest of pomegranate, but recently infestation of this pest has been reported increasing in guava growing regions of Uttar Pradesh and other places in North India. The attack of this pest occurs in fruiting season both in rainy and winter season crops. The violet brown female butterfly lays shiny, white eggs singly on calyx of flowers and fruits. The larva bores the fruit (Fig.22) and feed on the flesh and seeds, making the fruit hollow from inside (Fig 23). The larva is flattened, stout built, covered with short hair and about 2 cm long mature larvae may come out and pupate near the exit hole or many remain inside. Infestation of this pest results in fruit loss. The entry and exit holes of the larvae also pave way for secondary infection by different pathogens.

(ii)Castor capsule borer: [D punctiferalis (Guenee)]

This borer is another polyphagous insect, larvae of which damage fruits of guava. It is a primarily a pest of castor but also attacks guava, and other fruits and forest trees and occasionally cause serious damage. Larvae of this moth mainly bore fruits but they may also bore buds and tender shoots. The mature larva is pinkish in colour, speckled

with minute black spots, measuring about 1.5 cm in length. The larvae feed on pulp and seeds of developing fruits resulting in premature dropping of fruits. The pupa is formed in pupal chamber made inside at the basal end of the fruit. The infestation of this insect takes place in rainy season guava.

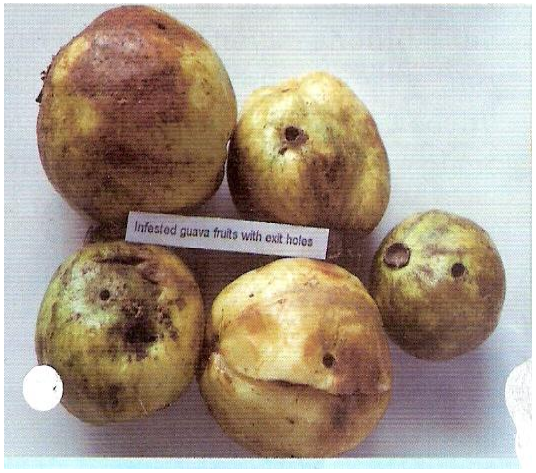

Fig.22 Fruits damaged by D. isocrates

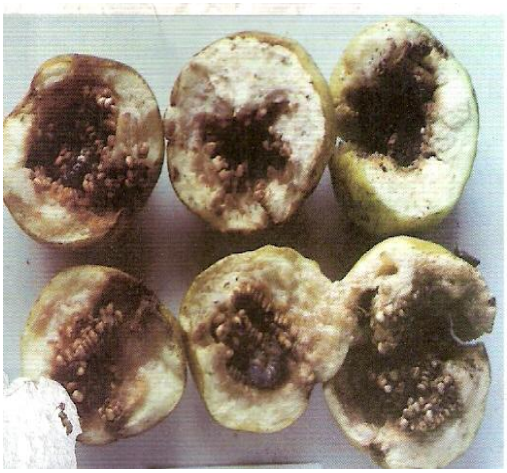

Fig 23. Larvea (D. isocrates) inside the damaged fruits

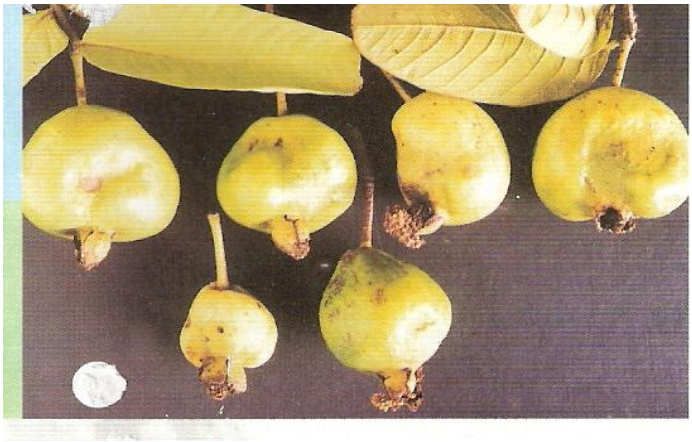

Fig. 24. Fruits damaged by D. punctiferalis

Symptoms: The affected fruits are generally deformed at the point of entry of larvae. Larvae faeces may be seen exuding out of the borer hole (Fig. 24). Such fruits weaken, rot and drop down.

Management:

- Cultivation of pomegranate should be discouraged close to guava as this is the most preferred host of this pest.
- Regular collection of infested fruits and their destruction to check the further spread and carryover the population.
- To prevent the infestation of pest, spray carbaryl (0.2%) or ethophenprox (0.05%) at the beginning of fruiting season and before ripening of fruits. At least 15 days waiting period should be observed before beginning of harvest. The spray may be repeated at fortnightly intervals depending on severity of attack.

17. Coccids

A large number of coccids have been reported infesting leaves, shoots and fruits of guava. Only few of them are of regular occurrence. The common species are Chloropulvinaria psidii, Drosicha mangiferae, Ferisia virgata, Hemiaspidioproctus cinerus and Nipaecoccus viridis, Planococcus citrii, Saisetia oleae, S. coffeae, etc. C. psidii is the main scale insect causing serious damage to guava crop in Central and South India.

Sporadic incidences of N. *viridis* on fruits and F. *virgata* on leaves and shoots have been recorded in North India. F. *virgata* occasionally appears in large numbers particularly on young plants. The adults are conspicuous, secreting white, glossy threads of wax encircling the body. Body is covered with waxy powder. Eggs are laid in groups in ovisacks. Nymph after hatching feed on leaves and shoots (Fig. 25). The attacks of these insects are more common in summer.



Fig. 25. Infestation of mealy bug D. mangiferae on leaf

Incidence of mango mealy bug, *Drosicha magiferae* has been noticed in winter season corp. The nymphs suck sap form leaves, shoots and fruits. Development of sooty mould takes place on the honeydew excreted by these insects on the affected parts (Fig. 26) The infested fruits drop prematurely and mature fruits loose their market value.



Fig. 26. Infestation of mango mealy bug on fruits

Symptoms:

Excessive de-sapping results in yellowing, withering, drying and shedding of leaves, drying of young shoots and dropping of affected fruits. Secondary infection of sooty mould takes place on honeydew, excreted by these insects, hindering the photosynthetic activity of the plant.

Management:

- The affected leaves and young shoots may be pruned and destroyed along with the pest in early fruiting of non-fruiting season. It helps in brining down the initial pest population and prevents further spread.
- Overlapping and overcrowding branches may also be pruned to check spread of these pests in the orchards.
- In case of heavy infestation of F. virgata, spray of 0.1 per cent buprofezin or 0.045 per cent dimethoate in early fruiting season or non-fruiting season is suggested. Spray may be repeated at fortnightly intervals depending on the severity of attack.
- For prevention and control of mango mealy bug, (D. *magiferae)* alkathene banding (400 gauge 25 cm wide) may be tied with the help of thread on tree trunk. In case of heavy infestation, 1.5 per cent chlorpyriphos dust @ 250 gm/ tree may be applied by raking the soil round the tree trunk. This may be done particularly when guava orchards are located in the vicinity of mango orchards.
- Releasing of *Cryptolaemus montrouzieri* @ 3000 /ha before fruiting season.