MANGROVES PROTECT US FROM THE SEA LET US PROTECT THEM

Guyana Mangrove Restoration Project
NAREI
Phone: (592) 220-2843, (592) 220-2843
Fax: (592) 220-4481/220-2843
Email: macsecretariat@gmail.com
URL: www.mangrovesgy.org

GOVERNMENT OF GUYANA
International Fund for Agricultural Development

Rural Enterprise and Agricultural Development Project
Loan No: 72 - GY
Grant No.: DSF - 8015-GY

MINISTRY OF AGRICULTURE

PESTS & DISEASES OF PUMPKIN IN GUYANA

Oudho Homenauth
and
B. Dwarka

January 2011

Figure 28: Mosaic symptoms on a pumpkin leaf caused by a virus

MANAGEMENT STRATEGY

Cultural control:
Control weeds within and around fields. The use of reflective mulches is expensive, but has been shown to reduce infection.

Chemical control:
Attempts to control insects for virus disease control may be futile, because insects may transmit the virus before insecticides are effective.

plants on which they feed. Beetles apparently prefer to feed on plants with bacterial wilt symptoms. Fortunately, only a small number of beetles become active carriers of the bacteria and infection can only take place when there is a film of water on the leaf sufficient for the bacteria to reach a wound and gain entry into the inner leaf tissue.

MANAGEMENT STRATEGY

Cultural control:
Avoid planting pumpkins next to other cucurbits, which may increase disease pressure.

Chemical control:
Insecticides aimed at reducing cucumber beetle populations are recommended.

VIRAL DISEASES

Viral diseases of pumpkins may be caused by any of several different pathogens: cucumber mosaic virus (CMV), squash mosaic virus (SqMV) and watermelon mosaic virus (WMV). WMV is the most common virus diseases of pumpkins.

SYMPTOMS
Symptoms of viral diseases are mottling, strapping, and vein distortion. One virus may cause mild symptoms while additional viruses in the same plant cause much more dramatic symptoms. In some cases the symptoms may appear to be phytotoxic chemical damage. Fruit from infected plants may be discoloured or have raised bumps or mottles.

The extent of crop loss due to virus disease is highly correlated with the crop growth stage at which the virus becomes established in the field.

PESTS & DISEASES OF PUMPKIN IN GUYANA

BACTERIAL WILT -

Erwinia tracheiphila

Bacterial wilt is a vascular wilt caused by the gram negative bacterium Erwinia tracheiphila and affects only members of the cucumber family. Water melons are immune to the disease. It is one of the most important diseases of pumpkin.

SYMPTOMS

Symptoms of the disease first appear on a single leaf which suddenly wilts and becomes dull green. The wilting symptoms spread up and down the runner sometimes as a recurring wilt on hot, dry days. Soon infected runners and leaves turn brown and die. The bacteria spread through the xylem vessels of the infected runner to the main stem, then to other runners. Eventually the entire plant shrivels and dies.

A creamy white bacterial ooze consisting of thousands of microscopic, rod-shaped bacteria may sometimes be seen in the xylem vascular bundles of an affected stem if it is cut crosswise near the ground and squeezed. This bacterial ooze will string out forming fine, shiny threads (like a spider's web) if a knife blade or finger is pressed firmly against the cut surface, then slowly drawn away about 1 cm. Two cut stem ends can also be put together, squeezed, then separated to look for shiny strands of bacteria.

Figure 26: Wilting of pumpkin plant in field

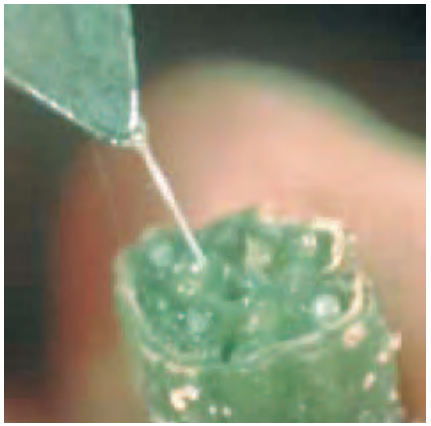

Figure 27: Bacteria ooze in an affected stem

CONDITIONS FOR DEVELOPMENT

Bacterial wilt is an unusual disease in that the bacterial pathogen can survive in the digestive tract of striped cucumber beetles and spotted cucumber beetles. The bacteria can then infect the plant through wounds produced by the feeding of the beetles or other chewing insects. Bacteria cannot infect the plant through normal plant openings (stomates and hydathodes) nor are they carried on or in seed. The beetles' mouthparts become contaminated with the bacteria while feeding on infected leaves. In this manner the beetles carry the bacteria to the next three or four

Figure 25: Lesions on the surface of the fruit

CONDITIONS FOR DEVELOPMENT

The fungus can persist in the soil for 2 – 3 years. It is favoured by prolonged dampness of the soil. It is spread by contaminated soil, water and equipment. Fusarium diseases increase whenever plants are stressed by unfavourable growing conditions or heavy fruit set.

MANAGEMENT STRATEGY

A number of management strategies are required or the control of this disease since there is no known chemical control treatment. Some of the strategies are:

1. Plant resistant cultivars. Because pathogens exist in numerous races, knowledge of the prevailing races is needed.

2. Rotate out of cucurbits for 3-4 years.

3. Start with certified, disease-free seed.

4. Avoid moving contaminated soil by equipment or water.

5. Soil fumigation is initially effective, but soils are quickly recolonized.

TABLE OF CONTENTS

CONDITIONS FOR DEVELOPMENT

Most downy mildew fungi require cool weather for reproduction and development. This is not true of the cucurbit downy mildew fungus. Optimum temperature for infection is at 16 to 22º C. It can survive when temperatures are over 37.8º C. The most critical factor for infection is a film of moisture and / or long dew periods on leaves.

Disease spread is primarily through by wind and rain splash. The fungus attacks only members of the cucumber family, mostly those that are cultivated, although it can infect wild cucumber and a few other weed hosts

MANAGEMENT STRATEGY

A number of management strategies are used to control downy mildew. These are as follows:

1. Destroy crop residues after harvest.

2. Control cucumber beetles, which are responsible for fungal spread.

3. Spray copper when the disease is observed

4. Avoid humid conditions during storage.

FUSARIUM CROWN & FRUIT ROT -

(Fusarium oxysporum)

The pathogen Fusarium oxysporum is responsible for crown and fruit rot in pumpkin and squash and can severely affect the quality of the fruit. The fungus is seed and soil borne. Fusarium crown rot is caused by different Fusarium pathogens than those that cause Fusarium wilt diseases.

SYMPTOMS

Some crown rot fungi also are responsible for a characteristic fruit rot that occurs on pumpkins. Initial symptoms on pumpkins include a general yellowing of the entire plant; over the subsequent 2-4 weeks, the entire plant will wilt, collapse, and decay. Fruit symptoms vary depending upon the specific Fusarium pathogen involved. Lesions may be small, dry, and pitted, or larger sunken areas covered with gray or white mold.

DOWNY MILDEW -
(Peronospora cubensis)

Downy Mildew on pumpkin is caused by the airborne fungus Peronospora cubensis. This disease affects the leaves of the plant and during wet cool weather it can cause considerable damage.

SYMPTOMS
This disease produces irregular to angular, yellow to brownish areas on the upper side of diseased leaves. The underside of the leaves may show a pale, grayish-purple mould following damp weather. The mould may vary from white to nearly black in colour. The diseased spots may enlarge rapidly during warm, moist weather, causing the leaves to curl, shrivel and die. The leaves tend to be destroyed from the base upwards. The fruit from diseased plants is usually small and of poor quality.

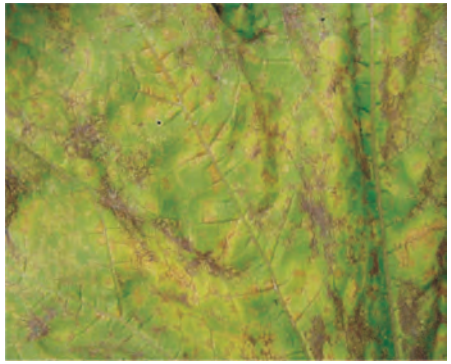

Figure 21: Necrotic lesion on leaf

Figure 22: Chlorotic lesions on leaf

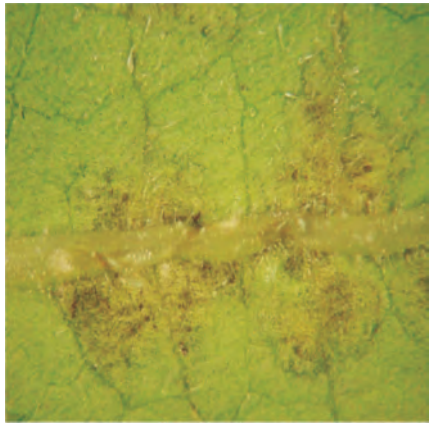

Figure 23: Lesion on the lower leaf surface

Figure 24: Necrosis of leaves in field

INTRODUCTION

Pumpkin (Cucurbita maxima) belongs to the Cucurbitacae family which includes cucumber and melon. Pumpkins can be grown throughout the year. They are also rich sources of vitamin A and minerals. Pumpkin has been targeted as a crop for expansion under the Agricultural Diversification Strategy.

In order to enhance the production and productivity of pumpkins in Guyana, attention must be given to the management of pests and diseases. The purpose of this booklet therefore is to assist extension personnel and farmers to identify the various pests and diseases affecting pumpkin production and advise on the management strategies to employed to mitigate their effects.

PESTS

MANAGEMENT STRATEGY

A number of management strategies are used to control black rot. These are as follows:

1. Select seed that has been certified as disease-free.

2. Treat seed with hot water to eradicate the bacteria. Treat seed for 15- 30 minutes at 50° C, dry, and test for germination. This process must be done carefully and it is recommended that a small sample of seed be tested for the effect on germination first.

3. Avoid dense seeding rates which can prolong periods of leaf infection and favour pathogen spread.

4. Monitor seedlings and promptly remove and destroy infected seedlings.

5. Do not trim seedlings as the bacteria are easily spread by contaminated tools.

6. Practice a three year rotation and control cruciferous weeds.

7. Do not work fields when they are wet and avoid overhead irrigation.
8. Do not locate cull piles near fields or storage areas.

9. Promptly incorporate crop residues after harvest to speed decomposition.

Chemical recommendations:

acibenzolar-S-methyl (Actigard 50 WG): 1 oz/A. Suppression only. Apply preventively in sufficient water to ensure adequate coverage. Do not apply Actigard to plants that are stressed by drought, excessive moisture, herbicide injury, etc.

cupric hydroxide (Kocide 4.5LF): 0.6 to 1.3 pt/A. Apply as soon as disease appears on a 7-10 day schedule. Tank mixes with Maneb or manex may improve disease control, although not all crucifers are on the Maneb or manex label. Do not apply in a spray solution of less than 6.5 as phytotoxicity may occur.

cuprous oxide (Nordox 75WG): 2/3 to 2 lb/A. Apply as soon as disease appears on a 7-10 day schedule.

BACTERIAL LEAF SPOT -
(Xanthomonas campestris)

Bacterial leaf spot is caused by the bacteria, Xanthomonas campestris. This is a bacterial disease that plugs the water-conducting tissue of the plant with xanthan, a mucilaginous sugar. Its most important means of transmission is on seed and as little as 0.03% infection can cause epidemics. Bacterial leaf spot affects leaves, stems, and fruit of pumpkins.

SYMPTOMS
Symptoms can appear at any growth stage as yellow, V-shaped lesions that extend toward the base of the leaf resulting in wilt and necrosis. The pathogen may move into the petiole and spread up the stem or into the roots and become systemic. As the disease progresses, the veins of infected tissues turn black and the normal flow of water and nutrients is impeded. Bacterial leaf spot is often followed by invasion of soft-rotting organisms.

Figure 20: Bacterial leaf spot of pumpkin

CONDITIONS FOR DEVELOPMENT
The bacteria can persist in infected plant debris for up to two years; it survives in the soil for 40-60 days. It is favoured by warm temperatures and symptoms may not appear in the seedbed, allowing infected plants to be transplanted into the field. It is spread within the field by splashing water, wind, equipment, people, and insects. X. campestris can be spread long distances by infested seeds and transplants.

CRICKET
Gryllotalpa spp. (Orthoptera: Gryllotalpidae)
Acheta spp. (Orthoptera: Gryllidae)

Figure 1: Adult Cricket

SYMPTOMS
Cricket attacks seedlings of all vegetables. Fully grown crickets are brown in colour and are about 2.5 – 3.5 cm long (Figure 1). The various species of these insects usually live either in the soil, bushes or under decaying crop residues and vegetation.

Mole crickets which have heavily sclerotised front legs that are adapted for digging, are usually common in sandy soils. All crickets are nocturnal, feeding at night and secluded by day, under the soil. They feed at or slightly below the soil surface and can cause considerable damage before being discovered. Seedlings may be denuded of leaves or cut below the soil surface without any trace of insect on them. Crickets spend their entire life cycle below the soil, which may be for a period of approximately 28-35 days. They are termed soil insects.

MANAGEMENT STRATEGY
Good field sanitation: Rid the field of weeds and plant residues from previous crops.

Cultural control: The areas where vegetables are grown should receive full sunlight, kept clean of weeds and all crop residues should be removed and burnt.

Proper land preparation serves to control weeds, diseases and soil insects, and also helps in the destruction of large soil clods, which act as hiding places for cricket.

Chemical control: Any approved soil insecticide at the recommended rate may be applied, such as Basudin 60% E.C (Diazinon) or Vydate L 40%E.C at the rate of 10 mls to 4500 mls water, to seed beds and cultivated cropping areas.

CUTWORMS -

Agrostis sp. (Lepidoptera: Noctuidae)

Cutworms are larvae of the moth, Agrostis spp., that chew and cut through plant parts (as the name suggest). Generally, the seedling stage of the crop is affected with young stems and leaves of the plant affected (Figure 2). Moths vary in colour from dull brown to black with wing spans ranging from 30-50 mm. Cutworms are dull grey, brown or black, and may be striped or spotted, up to 25 - 50 mm in length, soft bodied and smooth. They hide under the soil or litter by day. They can often be located by scratching the surface near damaged plants; when disturbed they curl-up and remain stiff as a defensive response. They feed in late afternoon and at night, spending the days hidden in the soil, except under very overcast conditions.

SYMPTOMS

Cutworms cut leaves and young stems damaging seedlings and transplants above, at or just below the soil surface. Older cutworms consume foliar material and burrow into the stem resulting in wilting and lodging of older plants. Evidence of cutworm presence is greenish-black excreta pellets below the seedlings.

Figure 2: Cutworm feeding on young seedling

CONDITIONS FOR DEVELOPMENT

Weedy fields and continuous cropping favours the buildup of cutworms. Preferred laying site is moist soil or low growing weeds. Warm conditions favour more generations of cutworms.

CONDITONS FOR DEVELOPMENT

Powdery mildew develops quickly under favourable conditions because the length of time between infection and the appearance of symptoms is usually only 3-7 days and a large number of conidia can be produced in a short time. Favourable conditions include dense plant growth and low light intensity. High relative humidity (RH) is favourable for infection and conidial survival, but infection can take place at RH levels as low as 50%. Dry conditions are favorable for colonization, sporulation, and dispersal. Rain and free moisture on the plant surface are unfavourable, however, disease development occurs in both the presence or absence of dew. Infection can occur at 50-90°F; mean temperatures of 68-80°F are favourable. Powdery mildew development is arrested at daytime temperatures of 100°F or higher. Plants in the field are often not affected until after fruit initiation.

MANAGEMENT STRATEGY

A number of management strategies are used to control powdery mildew. These are as follows:

1. Genetic resistance is used extensively as a control measure in cucumber and melon, and is being incorporated into other cucurbit crops.

2. Successive cucurbit plantings should be physically separated because older plants can serve as a source of conidia.

3. Fungicides should be applied every 7-10 days beginning early in disease development following detection through an IPM scouting program. Examine upper and under surfaces of five older leaves at ten separate sites or until symptoms are found. Initiate a weekly spray program when symptoms are found.

4. For a preventive schedule, applications should begin when plants start to run and/or to produce fruit. To obtain adequate control, fungicide is needed on the undersurface of the leaves and on leaves low in the plant canopy because those surfaces are optimum for the development of the fungus. Control is best accomplished by using systemic materials (i.e. triadimefon, benomyl, thiophanatemethyl).

5. Another approach is to improve the efficacy of contact materials (i.e. chlorothalonil, copper) by maximizing spray coverage on undersurfaces of leaves.

2. Fungicides should be used preventively. Soil infested with P. infestans can be treated with Ridomil. . Fields should be routinely scouted and plants should be treated with Ridomil at first sign of the disease.

3. Crop rotation should be the practice, especially in areas with a history of phytophthora blight. Do not rotate with crops such as tomatoes, peppers or boulangers since these crops are also susceptible to P infestans.

4. Provide proper drainage in fields in order to prevent water logging following heavy rainfall or irrigation.

5. When available, plant pumpkin varieties with a hard rind. Mature fruits of these varieties are less susceptible than varieties with softer rinds.

POWDERY MILDEW -

Erysiphe cichoracearum

Powdery Mildew is a common disease of pumpkin caused by the fungus Erysiphe cichoraceaurum. This species is specific to pumpkin, squash, cucumbers and melons along with some other vegetable crops. The typical parts of the plants affected are the leaves, stem, fruits and growing points.

SYMPTOMS

The primary disease sign is the presence of a white, powdery, fungal growth or mould which first appears on the lower stems and petioles. As the disease continues to develop, the white moldy spots occur on the underside of leaves. Yellow spots may form on upper leaf surfaces opposite powdery mildew colonies. Symptoms on the upper leaf surfaces usually signal a severe outbreak. The edges of infected leaves eventually roll upward, exposing the fungus. Infected leaves will drop prematurely from the plant, exposing the fruit to the sun, perhaps causing sunscald on the fruit.

Figure 19: White, powdery fungal growth

MANAGEMENT STRATEGY

The management strategies for cutworm control include:

1. Plant seedlings that have been hardened or at least 4-5 weeks; or

2. Ploughing fields 3 – 6 weeks prior to planting;

3. Maintaining weed-free fields following crop emergence;

4. Natural predators – wasps, grasshoppers - should be encouraged by avoiding unnecessary spraying;

5. Under severe cutworm infestation (3 – 10 % crop damage), insecticides may need to be used. Insecticide treatment for cutworms should be made in late afternoon or evening to minimise insecticide degradation prior to larvae emerging to feed. Any approved soil insecticide at the recommended rate may be applied, such as Basudin 60% E.C (Diazinon) or Vydate L 40% E.C at the rate of 10 mls to 4500 mls water, to seed beds and cultivated cropping areas.

APHIDS -

Aphis gossypii (Homoptera: Aphididae)

Aphis gossypii commonly known as “aphids” or “plant lice” or “nit” are small, soft bodied, yellow, green or black pinhead sized insects. They are slow moving and multiply rapidly within a short time span. The lifecycle ranges between 21-28 days. These insects attack plants at all stages of growth and are usually found in dense clusters on the under surface of the young leaves and also on young tender stems and growing points. Aphids are known to act as vectors of plant diseases.

SYMPTOMS

Aphids feed on the underside of leaves, or on growing tip of the pumpkin plant, sucking plant sap or nutrients from the plant (Figure 3). The foliage may become chlorotic and die prematurely (Figure 4). Seedlings are weakened and killed when the infestation is high and growth of older infested plants is retarded. Infested leaves curl, shrivel and may turn brown and die. Aphids secrete a sweet substance known as “honey dew” while they feed. This substance attracts ants and serves as a substrate for sooty mould (black fungus) thus impairing photosynthesis.

Figure 3: Aphids on pumpkin leaf

Figure 4: Interveinal Chlorosis of pumpkin leaf

MANAGEMENT STRATEGY

Good field sanitation: Rid the field of weeds and plant residues from previous crops.

Biological control: The natural predator lady bird beetle, frequently feeds on aphids. When aphid population is low and lady bird beetles are present, there is no need for chemical control.

Chemical control: Chemicals may be applied when the population is high. A contact or stomach insecticide may be used such as Fasta or Karate at 6mls to 4500mls water, Sevin 85% W.P. (Carbaryl) at 6g to 4500 mls water or Malathion 57% E.C. at 15 mls to 4500 mls water. A systemic insecticide such as Decis can also be used. Abamectin is also recommended for chemical control of aphids.

N.B. Sprays should be directed to underside/surfaces of leaves. When Sevin or Malathion is used, crops should not be harvested until 7 -10 days after application of the chemical. In the case of Fastac, Decis or Karate, crops can be harvested within 3-5 days after chemical application.

If insecticides are used to suppress melon aphid, care should be taken to obtain thorough cover of foliage. Leaf distortions caused by aphid feeding provide excellent shelter for the insects, so systemic insecticides are useful. Excessive and unnecessary use of insecticides should be avoided. Early in the season, aphid infestations are often spotty, and if such plants or areas are treated in a timely manner, great damage can be prevented later in the season. Use of insecticides for other, more damaging insects sometimes leads to outbreaks of melon aphid. Inadvertent destruction of beneficial insects is purported to explain this phenomenon. However, resistance by melon aphid to chlorinated hydrocarbons, organophosphate, and pyrethroid insecticides is widespread.

infections. The white fungal growth of P. infestans on the fruit should not be confused with the white growth of powdery mildew, which is a common problem on cucurbit leaves. Fruit rot progresses rapidly, resulting in complete collapse of the fruit and invasion of secondary rots. Fruit rot can also develop after harvest.

Figure 18: Fruit Rot

CONDITIONS FOR DEVELOPMENT

Seedlings during the first three weeks after sowing are particularly susceptible. Factors which favor the disease are sowing seeds in disease-infested soils or growth medium, overwatering, poor drainage, inadequate light, overcrowding, poor ventilation, and applying excess levels of nitrogen to soil. The presence of nematodes may exacerbate disease development.

Spores are resistant to desiccation and can survive in soil for long periods.

MANAGEMENT STRATEGY

Since no single procedure will effectively control phytophthora blight, an integrated management programme is essential. Normal rotations with non-cucurbit crops will help prevent serious epidemics.

1. Prevention is the first step in managing this disease since this disease is difficult to suppress once it gets started in the fields.
   - Decontaminate all equipment when moving from infested areas to non--infested areas
   - Workers should disinfect hands and boots after handling infected plants or visits to an infested field.
   - Use only pathogen free seeds and transplants. Seeds from affected fields should never be used for planting.

PHYTOPHTHORA BLIGHT -

Phytophthora infestans

Phytophthora blight is caused by the soil borne fungus Phytopthora infestans. The fungus affects seeds, seedlings, transplants, leaves and other plant parts. Phytophthora blight is a serious threat to production of susceptible crops worldwide, particularly cucurbits and solanaceous plants. It is a fast spreading, aggressive disease, capable of causing complete crop failures.

SYMPTOMS

Plants infected with this fungus express several symptoms depending on the plant part affected and the stage of disease development.

Foliar symptoms on leaves and petioles appear as rapidly expanding, irregular, water-soaked lesions, resulting in a rapid collapse and death of leaves. Leaf spots are chlorotic (yellow) at first and then turn brown with yellow or light green borders.

Vine blight appears as water-soaked lesions on the vines (Figure 17). Lesions turn brown and necrotic within a few days, resulting in stem girdling, wilting and death of foliage above the lesions. Dieback of shoot tips, wilting, shoot rot, and plant death quickly follow initial infection. P. infestans can devastate entire squash plantings in a matter of days when conditions are warm and moist.

Figure 17: Lesions on Vines

Fruit rot often starts on the underside of the fruit where it sits on the soil. It can also develop on the upper side of the fruit following rain or overhead irrigation. Early symptoms include large, water-soaked or slightly sunken, circular lesions, which expand to cover the fruit with white mold (Figure 18). The mold consists of millions of sporangia (spores), which can spread with wind and rain to cause further

WHITEFLIES -

Bemisia tabaci (Homoptera: Aleyrodidae)

Bemisia tabaci commonly known as whiteflies, are tiny, sap-sucking insects that are frequently abundant in vegetable crops. They derive their name from the mealy, white wax covering the adult's wings and body. They affect the vegetative and reproductive stages of the crop basically affecting the leaves. Whiteflies are known to transmit viruses to pepper plants.

SYMPTOMS

Whiteflies suck phloem sap and tend to fly upwards when the plant is disturbed. Large populations can cause leaves to turn yellow, appear dry, or fall off plants. Plants can be distorted and discoloured. Like aphids, whiteflies excrete honeydew, so leaves may be sticky or covered with black sooty mold (Figure 5). The honeydew attracts ants, which interfere with the activities of natural enemies that may control whiteflies and other pests.

Figure 5: Whiteflies on the lower surface of pumpkin leaf

CONDITIONS FOR DEVELOPMENT

Outbreaks often occur when the natural biological control is disrupted. Management is difficult. Whiteflies develop rapidly in warm weather, and populations can build up quickly in situations where natural enemies are destroyed and weather is favorable.

Whiteflies, have a wide host range that includes many weeds and crops, they breed all year, moving from one host to another as plants are harvested or dry up.

MANAGEMENT STRATEGY
Management of heavy whitefly infestations is very difficult. Whiteflies are not well controlled with any available insecticides. The best strategy is to prevent problems from developing in your farm to the extent possible. In many situations, natural enemies will provide adequate control of whiteflies; outbreaks may occur if natural enemies that provide biological control of whiteflies are disrupted by insecticide applications, dusty conditions, or interference by ants. Avoid or remove plants that repeatedly host high populations of whiteflies. In gardens, whitefly populations in the early stages of population development can be held down by a vigilant program of removing infested leaves, vacuuming adults, or hosing down (syringing) with water sprays. Aluminum foil or reflective mulches can repel whiteflies from vegetable gardens and sticky traps can be used to monitor or, at high levels, reduce whitefly numbers. If you choose to use insecticides, insecticidal soaps or oils such as neem oil may reduce but not eliminate populations. Caprid, Admire, Pegasus, Basudin, Vydate L at 10 mls to 4500 mls water applied early in the morning or late in the evening may be used in a rotational manner.

MITES -

Tetranychus spp. (Acari: Tetranychidae)

Mites are arachnids, not insects, but are microscopic arthropods related to ticks and spiders. Mites that are plant pests include spider mites (family Tetranychidae). Spider mites are given their name as they often spin characteristic protective silk webs (giving rise to the name). These mites cause damage by piercing plant cells and sucking out their contents. In heavy infestations mites may even kill the host plant. Mites may cause serious damage to plants since they are microscopic and are not usually noticed until damage symptoms appear on the plant.

SYMPTOMS
Mites appear as dust-like particles on the underside of leaves. Both immature and mature stages suck plant sap. Feeding causes yellow spots on the leaves and in heavy infestations, foliage has a yellowing or bronzing appearance and may suffer from premature leaf drop (Figure 6). In situations where there is severe damage this may lead to plant death. Mites prefer the young leaves, however in heavy infestations, the older leaves are also affected and sometimes webbing may be seen all over the plant. Fruits may also be affected especially by the rust mite.

SCLEROTINIA STEM ROT -

Sclerotium rolfsii

Sclerotinia Stem Rot is caused by the fungus, Sclerotium rolfsii. The fungus is an omnivorous, soil borne pathogen that causes diseases on a wide range of agricultural and horticultural crops. Infection is usually restricted to plant parts in contact with the soil such as stems, roots, leaves and fruits.

SYMPTOMS
Diagnostic signs of the fungus include characteristic white mycelial fans and brown sclerotia extending from infected tissues. Disease on cucurbits, known as Southern Blight, results from infection of fruit and runners at the soil surface (Figure 15 and Figure 16). The watery, soft, decayed tissue tends to remain on the ground when an infected fruit is picked up.

The Sclerotinia fungus affects a wide variety of crop plants. The pathogen produces resilient structures, called sclerotia that can survive in our soils indefinitely.

Figure 15: Mycelial growth on plant stem

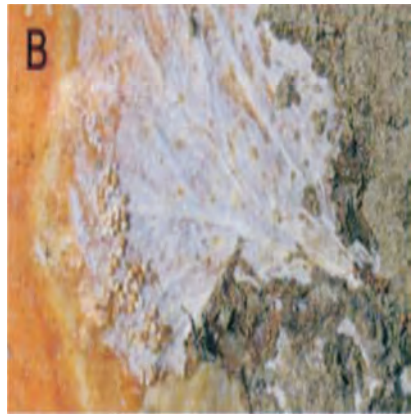

Figure 16: Mycelial growth on fruit

CONDITIONS FOR DEVELOPMENT
The sclerotia contain viable hyphae and serve as primary inoculum for disease development. High temperatures and moist conditions are associated with germination of sclerotia. High soil moisture, dense planting, and frequent irrigation promote infection. Since S. rolfsii does not produce spores, dissemination depends on movement of infested soil and infected plant material. Use of contaminated equipment and machinery may spread sclerotia to uninfested fields.

MANAGEMENT STRATEGY
The wide host range, prolific growth, and ability to produce persistent sclerotia contribute to the difficulty to manage this pathogen. Rotations with non-host crops will limit the potential for damage to subsequent vegetable crops. Also, deep plowing serves as a cultural control tactic by burying sclerotia deep in the soil, but survival can exceed a year. Fungicides may be effective if applied to young plants.

DISEASES

Figure 6: Chlorosis of cucumber leaves caused by mites

CONDITIONS FOR DEVELOPMENT

In the tropics, under hot, dry conditions, spider mites thrive: more eggs are laid, development is at a higher rate, and survival of adults is extended. Drought-like conditions also favour the development of high population of mites.

MANAGEMENT STRATEGY

Timely inspection of susceptible plants is important in preventing serious damage. A hand lens (with X 10 or 20 magnification) is essential for adequate viewing of the mites. The best method of monitoring mites is to walk through the crop, randomly checking the underside of new and medium aged leaves on a weekly basis. Look out for yellow or distorted leaves as these may be symptoms of mite infestation. The regular use of miticides may kill predatory mites or create problems with pesticide resistance in the plant feeding mites. Soft chemical sprays such as petroleum oil and potassium soap are effective in controlling certain species of mites in crops. When using potassium soap 2 mls per litre of spray oil is usually added to the spray. Good spray coverage is essential when applying pesticides. Some miticides that may be used for their control are Abamectin, Newmectin, or Vertimec at 5mls to 4500mls water. Because most miticides do not affect eggs, a repeat application at an approximately 10 to 14 day interval is usually needed for control.

THRIPS -

Frankiniella sp. (Thysanoptera: Thripidae)

Thrips, Frankiniella spp., is a small insect originating from North America that is established as a major pest in most of the world. Thrips are yellow, tiny, elongated insects about 1mm in length and can be found on the upper and lower surfaces of leaves. Infestations are more severe in the dry season.

Figure 7: Thrip

SYMPTOMS

The insect damages the plant in several ways. The major damage is caused by the adult ovipositing in the plant tissue. The plant is also injured by feeding, which leaves holes and areas of silvery discoloration when the plant reacts to the insect's saliva.

Both young and adult suck the sap from leaves and cause them to loose their colour. If attack occurs early, the young leaves become distorted. Older tissues become blotched and appear silvery or leathery in affected areas, thus hindering photosynthesis (Figure 8). Flowers and fruits are also affected, thus yields are reduced. Infected fruits are discoloured, distorted and hardened.

Thrips are also vectors of major viral diseases.

Figure 8: Necrotic lesions on cucumber leaf caused by thrips

PICKLE WORM -

Diaphania hyalinata (Lepidotera: Pyralidae)

Pickle Worm is the larval stage of the moth Diaphania hyalinata, and is restricted to feeding on the foliage of cucurbits (Figure 13).

SYMPTOMS

Pickle worm feeds principally on foliage. Usually the leaf veins are left intact, resulting in lace-like plant remains. However, if the available foliage is exhausted, or the plant is a less preferred species, then the larva may feed on the surface of the fruit, or even burrow into the fruit (Figure 14).

Figure 14: Burrowing of larvae

MANAGEMENT STRATEGY

Moths are not attracted to light traps. Therefore, checking plants for early stages of leaf damage and the presence of larvae are the most effective ways to monitor crops.

When the insect population is very high, chemical control may be required; an appropriate contact insecticide may be used such as Malathion, Seven, Fastac, Decis, and Karate at 6ml to 4500ml water. Spraying starts as soon as plants are in the field and once every two weeks up to harvest.

In addition to chemical insecticides, Bacillus thuringiensis is commonly recommended for suppression.

Culturally destruction of crop residue which may contain pickleworm pupae is also recommended.

Figure 11: Holes in pumpkin leaves

Figure 12: Pits on the rind of the fruit

MANAGEMENT STRATEGY

Management strategy should include cultural control, ridding the field of surrounding weeds and debris. Also, at transplanting, monitoring should be done for beetles. Once plants are at the 2nd or 3rd true-leaf stage, monitoring efforts should shift from monitoring beetles to checking the defoliation level. Monitoring the defoliation level is much faster and still allows for the detection of bacterial wilt. A defoliation level of 25% can be used as an action threshold. When the insect population is very high, chemical control may be required. An appropriate contact insecticide may be used such as Malathion, Sevin, Fastac, Decis, and Karate at 6ml to 4500ml water. Spraying should start as soon as plants are in the field and at intervals once every two weeks up to harvest.

Some research indicates that striped cucumber beetle damage can be reduced by the use of vermicompost fertilizer compared to inorganic fertilizer. Researchers suggest that the mechanism by which vermicompost reduces beetle damage is due to an increase in phenolic compounds in plants grown with vermicompost.

Figure 13: Pickle Worm

MANAGEMENT STRATEGY

An integrated approach is recommended for the management of thrips:

Good field sanitation: Rid the field of weeds and residues of all previous crops.

Crop rotation: Cultivation of crops (vegetables) which are not host to the pest.

Irrigation: Overhead irrigation will help in reducing the population of infestation during the dry season.

Chemical control: Among the insecticides which may be used are Regent (Fipronil), Admire, Abamectin and Vydate L at 5 mls to 4500 mls water, to both surfaces of leaves for effective control.

N.B. Spray should be directed to both surfaces of leaves for effective control.

FRUIT SUCKING BUGS -

Nezara viridula: (Hemiptera: Pentatomidae) and
Phthia picta: (Hemiptera: Coreidae)

There are many species of plant bugs. However, of importance are two in Guyana, N. viridula and P. picta.. N. viridula, commonly known as 'stink bug' is bright green in colour approximately 1 – 1.5 cm long with shield-shaped body, and emits an awful odour when molested.

P. picta, are brownish – black bugs with a red band across the back of the thorax; and are about 2-2.5 cm in length. Both the adult and the nymphs of these two pests cause economic losses.

SYMPTOMS

These sucking bugs actually do the same type of damage, by puncturing and sucking the sap from leaves, flowers and fruits.

Affected fruits become discolored, hardened and deformed; thus the market value of the fruits is reduced.

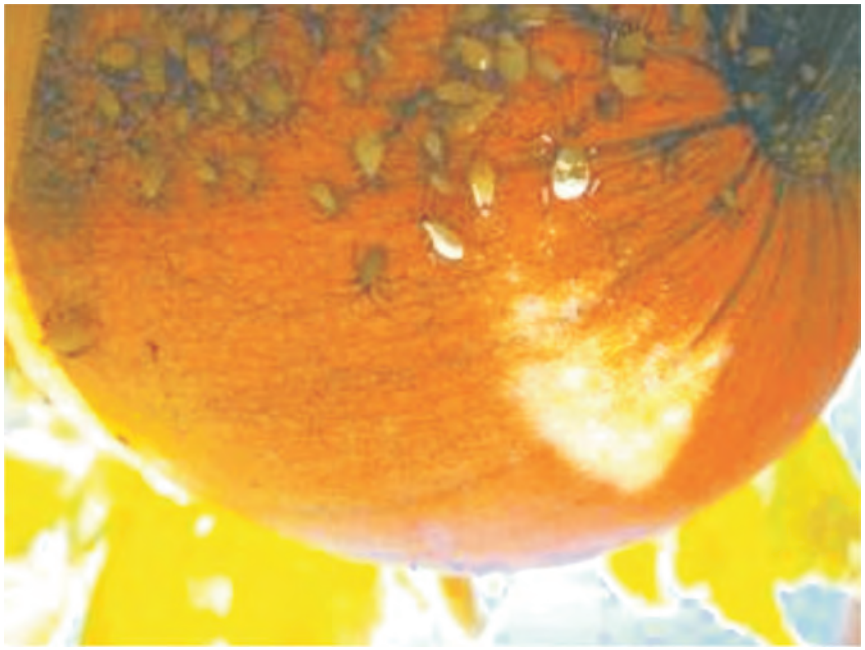

Figure 9: Fruit sucking bugs on pumpkin

MANAGEMENT STRATEGY
Management of these pests includes:

Good field sanitation: Rid the field of weeds and plant residues from previous crops; and

Chemical control: Among the insecticides which may be used are Fastac, Decis, Karate and Ambush at 6 mls to 4500 mls water or Sevin at 10 gms to 4500 mls water.

STRIPED CUCURBIT BEETLE -

Acalymma vittatam (Coleoptera: Chrysomelidae)

The striped cucumber beetle is a small chewing beetle that feeds on foliage, stems, flowers and fruits of the plant (Figure 10). All stages of the crop are affected. It is approximately half a centimeter in length, and characterized by brown-yellow elytra completely covering the abdomen and longitudinally transversed by three thick black stripes.

Figure 10: Striped cucumber beetle

CONDITIONS FOR DEVELOPMENT
Striped cucurbit beetle feeds on wild hosts until cucurbits are planted. Once cucurbits are present, adults can appear in a matter of hours in a field. They move from fence rows and wooded areas into the first few rows. Once in the field, beetles congregate on a few plants in large numbers. Beetles are most active in the morning and the late afternoon as they first begin to move into cucurbit fields. After a few days of massing and mating, beetles disperse throughout the field where they continue to feed. After dispersing, females begin to lay eggs in the soil near the base of cucurbit plants.

SYMPTOMS
Striped Cucurbit Beetle hides in the soil around the plant, under clods of soil, or in cracks in the soil to escape predators or the heat of the day. Therefore, feeding on the stem will often occur right at the base of the plant where the stem meets the soil. Pumpkins at the cotyledon and first 1-2 leaf stage are more susceptible. At this size, the plants are small enough and high populations can either defoliate the plants completely or girdle the stem.

As soon as the cucumber, squash, pumpkin, melons and related seedlings push up through the soil, beetles can eat off the stems and cotyledons, frequently killing them. Adults later feed on the leaves, vines, flowers and fruits of plants that survive (Figure 11). Sometimes, deep pits are gnawed into the rind, making the produce unfit for consumption or market (Figure 12).

Most important, these beetles are vectors of a serious cucurbit disease known as bacterial wilt. Plants infected with this disease wilt quickly with leaves drying out prior to plant death. The causative bacteria, Erwinia tracheiphilia is introduced into the plants through the fecal contamination of feeding wounds. This is the only natural method of infection known. Beetles also spread squash mosaic virus.