

Coconut

Bud Rot of Coconut

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Symptoms

The earliest visible symptom is the withering of the spindle marked by pale colour. In the adult palm the spindle (spear leaf) turns dull and bends over. In seedlings, the spindle turns brown and comes off easily with a gentle pull. The base of the spindle rots and emits a foul smell. If allowed to degenerate further, the leaves next to the spindle also begin to rot leaving only the fully matured leaves on the crown (Figure 1). In the end, the palm succumbs to the disease. Simultaneously, the infection proceeds to the deeper softer tissues of the cabbage and finally attacks the growing



Figure 1

tip. Once the apical meristem is affected, the palm dies. Symptoms of attack of the fungus can be noticed as water-soaked lesions at the base of the petiole of the leaves also. The older nuts persist on the crown for some time, while the younger ones may fall off.

Pathogen

Phytophthora palmivora (Figure 2 A and B. The Sporangia)

Management

1. Regular spraying with any copper fungicides, *viz.*, 1 per cent Bordeaux mixture, Dithane M-45, or copper oxychloride at 40 days interval especially before and after monsoon is an effective preventive measure.
2. Perforated sachets containing 3g Dithane M-45 should be kept in leaf axils of copper sensitive palms during rainy season.
3. Cut and remove severely infected or dead palms to control secondary spread of the disease as well as to reduce the inoculums in the garden. Rotten portions of the crown should be destroyed by burning.
4. In the early stage of disease incidence, cut and remove all infected tissues. After thorough cleaning of the cut surface, apply 10 per cent Bordeaux paste. The treated portion should be covered with polythene sheet or mud pot.
5. In adult palms, it is possible to keep bunches until the nuts are harvested. However, treat the infected bud region with Bordeaux mixture or copper fungicide to kill the mould.
6. As a prophylactic measure, all the healthy palms surrounding the diseased ones should be sprayed with 1 per cent Bordeaux mixture on the spindle and base of 2 – 3 inner most leaves.
7. Systemic fungicides can also be applied as prophylactic before the onset of monsoon so that they can protect the palms during the critical period.
8. Stem injection or root feeding of systemic fungicides, Akomin (16.8ml), Aureofungin – sol (36.4 g/palm) or Calixin (21 ml/palm), is effective in protecting the palms for a period of eight weeks after application.
9. Plant resistant/tolerant cultivars with proper spacing. The low lands with generally high humidity are highly favourable for the development of the disease, especially when the drainage is poor.

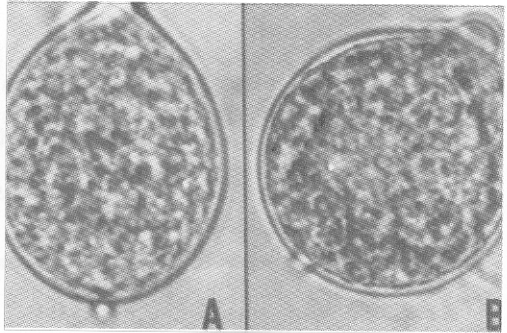


Figure 2A&B

10. Crown cleaning is strictly advised as *Phytophthora* propagules survive in the crown debris of both diseased and healthy palms in the off-season. This is a potential inoculum that can serve as the source for the subsequent season.
11. Sequential application of botanicals and biocontrol agents, *T. harzianum* and *B. amyloliquefaciens*, with suitable interval can effectively suppress the disease.

Basal Stem Rot of Coconut

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Symptoms

Withering followed by yellowing and drooping of older leaves in a quick succession is the characteristic initial visible symptom (Figure 1). Even before this, decay of finer roots would have started. The root decay gradually extends up to the bole region and from there to the stem. This is accompanied by exudation of reddish brown viscous fluid from the basal portion of the trunk (Figure 2). The bleeding patch enlarges in size and traverses upwards, to a height of 3 to 4 metres in certain cases. There is commensurate internal decay just below the bleeding patch. More leaves droop and bunches subtended by these leaves also droop, often resulting in nut fall. The crown dries, weakens and topples over in the slightest wind. Dead palms and



Figure 1



Figure 2

stumps show the presence of brackets of *Ganoderma* (Figure 3). The disease progresses rapidly in dry areas during summer especially in sandy soils.

Pathogen

Ganoderma applanatum and *G. lucidum* (Leys) Karst.

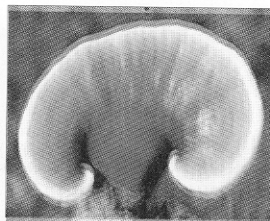


Figure 3

Management

1. Phytosanitation

Palms in the advanced stage of disease and giving uneconomic returns should be cut and removed and the root system along with the bole burnt. The bleeding patch in the stem may be chiseled and protected with Tridemorph (5 per cent Calixin) and subsequently with hot coal tar.

2. Isolation Trenches

The palms in the early or middle stages of the disease should be isolated from the neighbouring healthy palms by taking trenches of 1M deep and 30 cm wide to prevent root contact.

3. Cultural Practices

Avoid repeated ploughing, closer spacing, flood irrigation, and water logging. Grow *Ganoderma* resistant inter/mixed crops like banana in the garden.

4. Nutrient Application

Apply fertilizers @ 500:320:1200 g. NPK per palm per year and enough organics (at least 50 kg per palm). In addition, each palm should be given 5 kg neem-cake during September-October.

5. Chemical Treatment

The diseased palms may be treated with Aureofungin - sol @ 2.0g + 1g copper sulphate in 100 ml. water through root feeding thrice a year in July, October and January. Treatment with calixin 5 per cent at quarterly intervals was also found to be equally effective.

Whenever *Xyleborus* or *Diocalandra* attack is noticed on the stem of affected palms, swabbing with Carbaryl (Sevin 10 per cent) WP may be done.

6. Containing the Disease

Do not transport seedlings from infected area to healthy area. In sporadic cases of occurrence, the severely affected palms should be removed and other infected palms isolated from healthy ones by taking trenches in two circles. The palms in early stages of disease are to be treated with Aureofungin-sol as mentioned above. Each palm may be given 5 kg neem cake in addition to the regular fertilizer and recommended dose of organics.

Stem Bleeding of Coconut

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Symptoms

The typical symptom of stem bleeding is the exudation of reddish brown gummy fluid from growth cracks on the trunk, which becomes black on drying (Figure 1). In the initial stages of infection, bleeding symptoms appears only one or two longitudinal cracks at the base and later spreads upward on the stem. The longitudinal patches may coalesce to form larger patches. The tissue inside the lesions shows discoloration and decay. In young palms under cooler conditions, the decay may extend into the deeper layers of central cylinder. As a result of extensive damage in the stem tissue, the outer whorl of the leaves turn yellow, dry and shed prematurely. The trunk tapers and reduces the crown size. In the advanced stages, scoletid beetles like *Diocalandra* and *Xyleborus* infest the palms and further weaken the stem.



Figure 1

Pathogen

Thielaviopsis paradoxa (Figure 2: The mycelium and conidia)

Management

1. The affected bark should be chipped off and paint with 5 per cent Calixin (5 ml Calixin in 95 ml water). The painted wound should be left to dry for one day and then covered with molten coal tar.

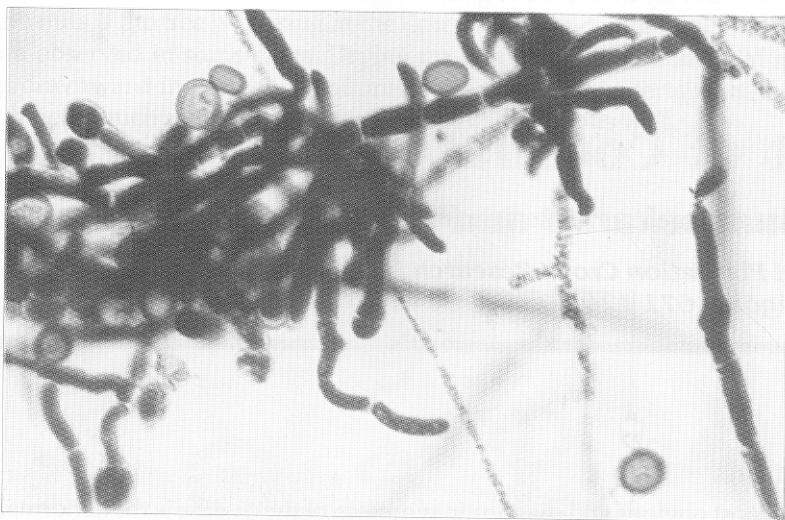


Figure 2

2. Root feeding of 5 per cent Calixin at quarterly intervals is effective in controlling the disease.
3. Apply neem cake @ 5 kg/palm/year in the basins during Sept – Oct.
4. Avoid wounding of coconut trunk.
5. Provide regular basin irrigation during summer months.
6. Good drainage facilities may be made in the garden, wherever necessary.

Wilt of Coconut

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Symptoms

The most obvious and diagnostic symptom of the disease is the abnormal inward bending of the leaflets termed ribbing or “flaccidity”. Foliar yellowing of the outer whorl of leaves and marginal necrosis are the other associated symptoms (Figure 1). In seedlings and juvenile palms yellowing of foliage is virtually absent and flaccidity is the only symptom evident. Instances of diseased palms having their outer leaves quite healthy but with yellowing of leaves in some of the inner whorls are also noticed.



Figure 1

With the progress of the disease, extensive rotting of roots is observed. Shedding of immature nuts if the tree is bearing at the time of disease contraction is yet another symptom observed in some cases. Drying up of spathes and necrosis of spikelets from tip downward in unopened inflorescence is noticed in certain cases. The oil content is very much reduced and the oil loses its flavour as well.

Pathogen

Phytoplasma (Figure 2: The electron micrograph of Phytoplasma) are suspected as the cause of the disease

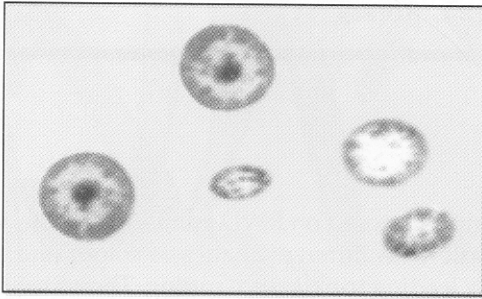


Figure 2

Disease Management

For the Heavily Diseased Contiguous Area

1. Remove all severely infected adult palms and palms in the prebearing age (juvenile palms).
2. Nutrient management: Balanced fertilizer application, addition of organic manures, raising of green manure crops in the basins and incorporation, irrigation during summer months, practicing plant protection methods and adopting inter and mixed cropping.
3. Mixed farming in the diseased gardens involving the raising of fodder crops in the inter spaces, maintaining milch cows and recycling of organic waste will increase the yield of palms and consequently the income from unit area.
4. Mixed cropping with cocoa and intercropping with tapioca, elephant foot yam and yams in the disease-affected gardens increase the mean nut yield and slow down the progression of the disease.
5. For the mildly affected area: Systematic rouging of diseased palms in the mildly affected area could prevent the further spread of the disease.
6. Provide irrigation in summer.
7. Adopt control measures for leaf rot disease. As leaf rot occurs super imposed on root (wilt) disease and reduces the yield of the palm drastically.

Leaf Rot of Coconut

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Symptoms

Leaf rot occurs, superimposed on RWD palms, as minute, water soaked lesions on the emerging spindle with different shades of colour and shape. These lesions enlarge, coalesce freely leading to extensive rotting. The rotten portions dry up, turn black and fall off. Tips of leaflets and midribs often become blackish and shriveled. The progress of rotting slows down with the maturity of the leaflets. Continuous attack of newly emerging spindle leaf results in the gradual exhibition of similar symptoms in all the leaves in the crown (Figure 1). Sometimes the decayed leaflets glue together so that spindle does not open out. Though the disease does not kill the palm outright, its slow progress results in reduction of leaf surface in the crown, which causes steady decline in the yield. Palms of all ages are susceptible to the infection.



Figure 1

Pathogen

Colletotrichum gloeosporioides and *Exserohilum rostratum* (Figure 2. The Conidia of *E. rostratum*).

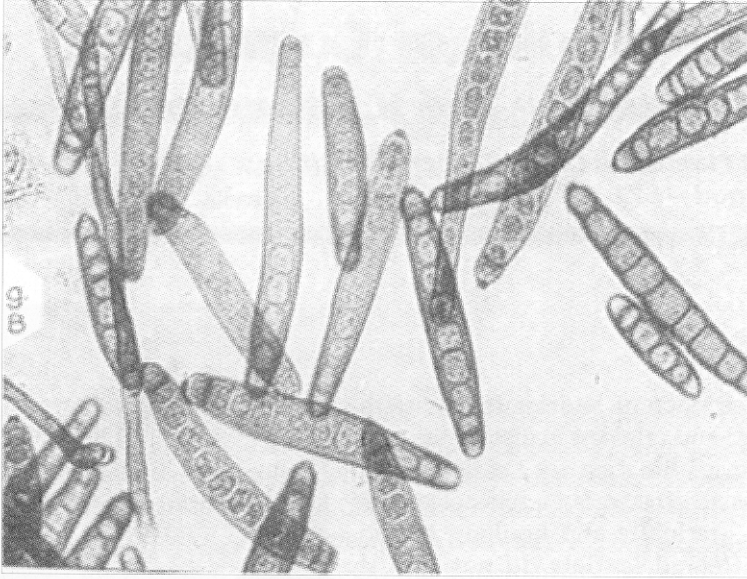


Figure 2

Management

Leaf rot can be effectively controlled by:

1. Cutting of the rotten portions of the spindle and the adjacent two innermost fully opened leaves.
2. Pouring either Contaf - 5EC 2 ml or Mancozeb (Indofil M-45) 3 g in 300 ml of water in the well around the base of the spindle leaf during April-May and October–November.
3. Application of Furadan 3G 30 g or Phorate 10G 20 g mixed in 200 g of sand around the base of the spindle leaf. Treatment of all the palms to be carried out twice a year *i.e.*, during April- May and Oct – Nov. along with harvest of nuts.

Crown Choke of Coconut

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Symptoms

Emergence of shorter leaves with deformed and crinkled leaflets is the first symptom of the disease. Leaflets often show severe tip necrosis. Number of leaflets reduces gradually and hooking is also seen. Affected leaflets do not unfurl properly and in many cases give a choked appearance to the frond. As the disease progresses stick-like leafstalks emerge. The inner leaves crowd round the bud, and prevent normal unfurling of the flag leaf. Necrosis may proceed to the deeper tissues and kill the meristem. Premature nut falls is seen and gradual reduction in yield is noticed. Inflorescence emergence is hindered resulting in yield loss.



Cause: Boron deficiency.

Management

1. Soil application of Borax @ 50g/palm at half yearly intervals, during Feb-March and Aug-Sept., improves the condition of the palm.
2. Making slits in the tight extension of the petioles and opening out the crown would help in the normal emergence of fronds.

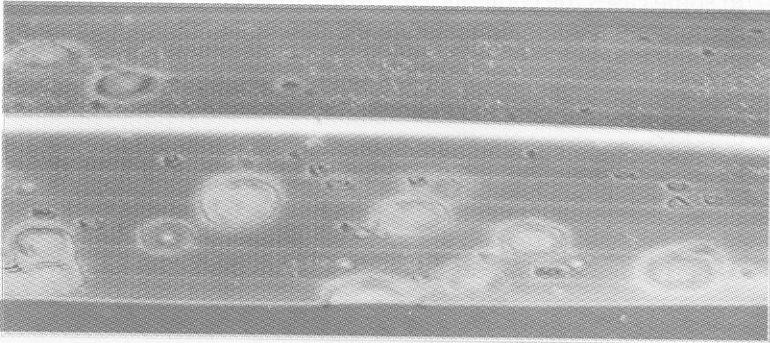
Gray Leaf Spot Disease

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Symptoms

The symptoms appear on the outer whorl of leaves as minute yellow spots with a gray brown margin. The lesions may be oval in shape measuring up to 5 cm length. The center of the spots turns grayish white while the colour of the margin deepens. Many spots coalesce to form large irregular necrotic patches. The leaves in advanced stage of infection present blighted appearance. Complete drying and shriveling is common when the infection is severe. On the upper surface of the leaf the black pycnidia of the fungus appears as minute specks. The disease causes serious damage in nursery plants, but in adult palms the infection does not cause serious damage.



Pathogen

Pestalotiopsis palmarum

Management

1. Remove severely affected leaves and burn.
2. Spray the foliage with 1 per cent Bordeaux mixture or 0.3 per cent Mancozeb.
3. Apply potassic fertilizers
4. Improve the drainage of the gardens.

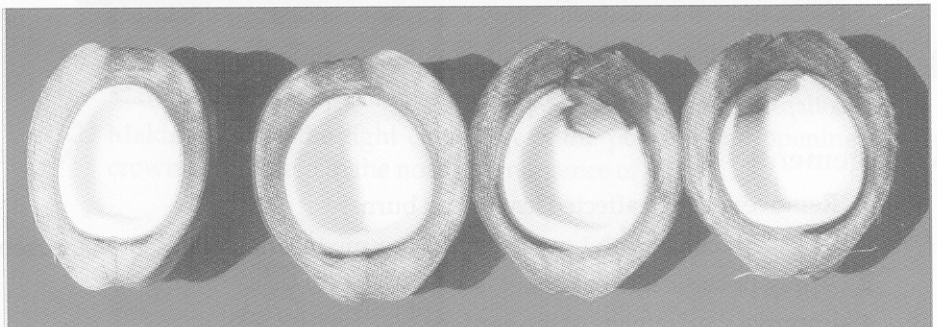
Nut Rot

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Symptoms

1. Sporadic incidence of abnormal rotting/drying of immature nuts *in situ* was observed in Kerala state, India.
2. Infection usually originates from the apex. Early symptoms are dark grey to brown lesions with wavy to undulated margins starting from the apex of the nuts. Lesions progress covering a large area of the nuts.
3. Affected nuts become desiccated, shrunk, deformed and remained attached to bunch.
4. In some cases the contents leak owing to splitting of such nuts.
5. When cut open, the infected nuts reveal extensive rotting of the epicarp, which spread to meso and endocarps as well, especially in 6-8 month old nuts.
6. Symptoms caused by *Phytophthora* sp. slightly differ. Near the stalk, a discoloured area is developed, which will appear at first water-soaked and darker green than the rest of the surface of the nut. Later on, the lesions turn brownish in colour and appear as depressions due to the decay of the underlying tissues.



Pathogen

Phytophthora palmivora and *Lasiodiplodia theobromae*

Management

1. Spraying with 1 per cent Bordeaux mixture during the pre-monsoon and post monsoon periods can successfully control fruit rot due to *Phytophthora* infection.
2. For *Lasiodiplodia* infection, spraying 0.1 per cent Bavistin is recommended.
3. Regular phytosanitary practices, thorough cleaning of the crown and collection of shed nuts debris and burning should be adopted.