

# COCOA DISEASES AND CURRENT STRATEGIES FOR THEIR CONTROL

R. CHANDRA MOHANAN and P. CHOWDAPPA

Central Plantation Crops Research Institute, Regional Station,  
Vittal-574 243, Karnataka State

In India large scale cultivation of cocoa (*Theobroma cacao* L.) was initiated during 1970. It has been found to be a suitable and profitable mixed crop in existing arecanut and coconut gardens. Cocoa cultivation is mainly concentrated in Kerala State and Dakshina Kannada district of Karnataka State. The area under cocoa cultivation is expanding to other parts of Karnataka such as Shimoga, Uttara Kannada and Mysore Districts. With the expansion of area under cocoa and with the increase in age of the plantations pests and diseases are becoming more important. This article summarises the major diseases of cocoa occurring in India and current strategies for their control.

## NURSERY DISEASES

### 1. Seedling dieback

The occurrence of this disease in India was first noticed in 1978. Since then it has been frequently observed during rainy season (June—September) in nurseries of Kerala, Karnataka and Tamil Nadu. The disease is reported to be severe on younger seedlings.

Defoliation and dieback of seedlings are the characteristic symptoms of this disease. Generally the infection starts from the tip of the stem and proceeds downwards as dark brown to black water soaked linear lesions. The lesions also extend to the leaves through the petioles resulting in wilting and subsequent defoliation of the seedlings. The infection also initiates from the collar region, cotyledonary stalk or leaves as dark brown to black discoloration. In all the cases the infection spreads to the entire stem causing wilting, defoliation and ultimately the death of the seedlings.

Seedling dieback is caused by the fungus *Phytophthora palmivora* (Butl.) Butl. The disease can be controlled by improving the drainage in the nursery and by drenching the seedlings and the soil around the seedlings with Bordeaux mixture (1%) or any copper oxychloride just before the onset of monsoon and thereafter at frequent intervals. All the infected and dead seedlings should be removed and destroyed. Severe incidence of *phytophthora* infection has been observed in grafted and budded seedling leading to high mortality. The infection usually initiates from the grafted or budded region. This has been observed as a serious problem in nurseries and

warrants control measures. However, very little work has been done on cocoa seedling dieback and therefore, there is a need to undertake investigations on the causal organisms associated with this disease in different localities, resistant/tolerant accessions and better management strategies.

### 2. Other diseases

*Colletotrichum gloeosporioides* Penz. causes blight or 'shot-hole' symptom on flush leaves, intensity of this disease varies from locality to locality due to high variability of the pathogen. Control measures may be adopted depending on the severity of the disease.

White thread blight caused by *Marasmius scandens* Masee is found in nurseries with high humidity and thick overhead shade. The fungus infects seedling of any age group causing dieback. As high humidity and less aeration and sunlight due to thick shade are the pre-disposing factors for the occurrence of white thread blight, care should be taken to adopt proper cultivation practices.

Among the nutritional disorders, zinc deficiency has been reported to be of major importance.

## POD ROTS

### 1. Black pod disease

Black pod disease was first reported from Guyana and West Indies by Jenman and Harrison in 1897. At present, it occurs in all the cocoa growing countries. The occurrence of black pod disease in India caused by *phytophthora* was first reported in 1965. It occurs in the rainy season (June-September) when the humidity is high with a constant low temperature. Pods of all ages are susceptible to the disease. The infection appears as one or more small, brown, circular lesions anywhere on the pod surface. They increase rapidly and cover the whole surface of the pod. As the lesion advances a whitish growth of the fungus consisting of the mycelia and sporangia is produced over the dark brown pod surface. Ultimately the whole pod and the beans are invaded by the fungus and the pod turns black in colour. Pods affected by the disease during the end of rainy season remain on the tree as black mummified fruits with very little growth of the fungus on the pods surface.

*Phytophthora palmivora* is the predominant species causing black pod disease in India. Recent studies revealed the natural occurrence of black pod disease caused by *phytophthora capsici* and *phytophthora citrophthora* in some of the localities in Kerala State. Considering the relative virulence of these two species in other cocoa growing countries, there is every possibility that these two species may become potential pathogens of cocoa in India.

Under condition of high rainfall and long periods of high humidity the disease spreads rapidly. Since the infected pods will form the main source of further infection of healthy pods, the infected pods should be cut and removed from the gardens at weekly intervals. This will help to reduce the spread of the disease to a great extent. The beans in ripe pod which are partly black may escape from infection because the beans are separated from the husk on ripening. Thus the beans in such partly infected pods can be saved by timely harvesting. But all unripe pods which are infected should be discarded. If the diseased pods are not removed it is difficult to get better control from fungicide application alone. Since high humidity and low temperature are favourable for disease development cocoa should not be planted very closely. Proper pruning of cocoa trees is also very essential to minimise the shade.

**Chemical control.**—Weekly removal of infected pods and spraying bordeaux mixture (1%) or Copper oxychloride at frequent intervals depending on the severity of the disease will give good control of the disease. The spray should be mainly directed at the pods and bearing branches.

### 2. Charcoal pod rot (*Botryodiplodia theobromae*)

It is found throughout the year with severity during summer months. Pods of all ages are susceptible. The infection takes place through wounds generally caused by rodents, other pests and insects. The infection appears as dark brown to black spot anywhere on the pod surface and spreads rapidly. As a result of which the pods turn black and remain on the tree as mummified fruit. On the surface of the affected pods spores appear as black powdering mass resembling soot. The infection spreads to the internal tissues and the affected beans turn black in colour.

Spraying with one per cent Bordeaux mixture is recommended for the control of this disease. Since *B. theobromae* causes infection through wounds, measures to control insects and rodent pests will also help to reduce the incidence.

### 3. *Collectotrichum* pod rot

Until recently this disease was not considered as a major problem in India, but the expansion of cocoa cultivation this disease is found to be prominent due to wide spread distribution and severity of infection in some of the major cocoa grown areas.

In India, *C. gloeosporioides* has been reported to cause rotting of immature pods. The infection mostly starts from the stalk end particularly at the point of attachments of stalk to the pod. Then it proceeds to-

wards the tip as dark brown discolouration with a diffuse yellow halo. The infection also extends to stalk and reaches the cushion, but does not spread further on the cushion. The infected stalk is highly shrunken and is easily distinguishable from a healthy stalk. With the progress of infection, the internal tissue of the pod also turns dark brown to black. Ultimately the whole pods turns to black and persists on the tree as mummified fruit. Sometimes the infection initiate from parts other than the stalk region as dark brown, sunken lesion. Under conditions of high humidity profuse sporulation is observed as pinkish mass on the lesions. However, nearly matured pods are reported to be free of *C. gloeosporioides* infection. The disease can be controlled by spraying Indofil M-45 @ 3 g/lit. of water.

## TRUNK AND BRANCH DISEASES

### 1. Stem canker (*P. Palmivora*)

In India, stem canker was noticed in 1978. It is generally observed during December-February after the south west monsoon period. The appearance of grayish brown, water soaked lesions with broad dark brown to black margin anywhere on the main trunk, jorquettes or fan branches is the earliest symptom of this disease. A reddish brown liquid oozes out from these lesions, which later dries upto form a rusty deposit. The internal tissues beneath the outer grayish brown lesions appear as reddish brown which can be easily distinguished from the healthy tissue. As a result of infection the wood shows grayish brown discolouration with black streaks. When the cankers girdle the trunk or branches discolouration, Wilting and ultimately defoliation of the leaves takes place. Such plants or branches shows symptoms of dieback and eventually the portion above the point of attack dies.

The canker often develops from the pods infected by *P. palmivora*. The infection from the pods spreads to the peduncle and then to the cushion and bark causing canker. Hence such infected pods should be removed and destroyed. This disease can be controlled in the early stages by the excision of diseased bark followed by wound sealing with Bordeaux paste.

### 2. Chupon blight and twig dieback (*P. Palmivora*)

The infection usually initiates in the axils of leaves at the tip of twigs or chupons during the rainy season. It also starts from anywhere on the leaf lamina or petiole and extends to the stem. The characteristic symptoms is the appearance of water soaked lesions turning dark brown to black. When the lesions girdle the stem, the portion above the point of the infection dies causing twig dieback or chupon blight. The infection results in severe defoliation.

The disease can be controlled by removing the infected twigs and chupons and by spraying the plants with one percent Bordeaux mixture during the monsoon period at regular intervals.

*Phytophthora* infection of chupons and twigs are usually very much neglected. But it is very important as *phytophthora* survives on the stem of cocoa plants.

Infected chupons, twigs and leaves serve as a source of inoculum. Hence these phases of *Phytophthora* infection cause severe incidence of black pod disease and canker.

Dieback of cocoa caused by *Calonectria rigidiuscula* (Berk. & Br.) Sacc. has also been recently reported from many cocoa garden in India.

### 3. Pink disease (*Pellicularia salmonicolor*)

This disease is insignificant in most of the cocoa growing regions, but cause damage in some isolated ones. This disease becomes more severe under humid conditions. This disease is characterised by the presence of a pinkish powdery coating on the stem. It causes wilting of shoots, shedding of leaves and ultimately drying up of the branches.

The control measures include reducing overhead shade, within canopy pruning to improve aeration, pruning of smaller infected branches and fungicidal treatment. The disease can be checked effectively by pruning the affected branches and swabbing the ends with Bordeaux paste. Its incidence can be prevented to a greater extent by spraying one per cent bordeaux mixture at regular intervals during the rainy seasons.

### 4. Vascular streak dieback (*Oncobasidium theobromae*)

Vascular streak dieback (VSD) has been reported as the most destructive disease of cocoa on the main land of New Guinea and Papua, Island of New Britain and in Malaysia. The characteristic external symptoms are leaf yellowing with small islets remaining green swelling of lenticles and proliferation of lateral buds. The leaf symptoms are usually seen on the second and third flushes in the early stage of the disease. The abscission of such leaves occurs prior to that of older leaves on the same branch. New shoots may sprout from the axils of abscised leaves and in the majority of the cases these also dies. The VSD infections can be easily diagnosed from the browning of xylem vessels which appear as streaking within the vascular tissue. The discoloured vascular traces are visible when the infected leaves are removed. In wet weather the fungus forms white patches around leaf scars.

Pruning of affected branches 30 cm below the point of visible streaking of the wood prevents the spread of the disease. Removal of the prunings from the garden is not necessary because the fungus cannot live in dead and decaying plant parts. VSD has been observed in several districts of Kerala State. But it has not been so far noticed in Karnataka State. An immediate survey of the cocoa growing areas in India may be necessary to find out the occurrence and distribution of this disease. Every effort must be made to prevent the spread of disease of VSD in this country and to eradicate the disease as far as possible before it spreads to a large area.

### 5. White thread blight (*Marasmius scandens*)

Thread blight occur in most cocoa growing countries. There are two types: White thread blight caused

by *Marasmius scandens* and horse hair blight caused by *M. equicrinus*. This disease has been reported to occur in the cocoa garden of Kerala and Karnataka States during the rainy seasons. The white mycelial threads of the fungus spread longitudinally and irregularly along with the surface of the stem of young branches and enter the leaf along the petioles. On the leaf lamina it spreads extensively and form a much branched system of fine threads. The affected leaf turn dark brown and such dead leaves eventually get detached from the stem, but found suspended by the mycelial thread. The extensive death of young branches and suspended leaves in rows are the common field symptoms.

The disease generally spreads from plant to plant through the dead leaves with the mycelial mat which are easily carried by wind. Removal and burning affected plant parts and removal of heavy shade when cocoa is grown as a mixed crop will help in the control of the disease.

Horse hair blight forms a tangle of black fungal threads through the canopy. The leaves are not killed as in the case of white thread blight. But the net work of the fungal threads affects the new growth.

### 6. Colletotrichum leaf spot (*C. gloeosporioides*)

Leaf blight and shot hole are the major foliar symptoms caused by *C. gloeosporioides*. The symptoms appear as round to slightly irregular chlorotic spots. Later they turn brown with a clear yellow halo. Such spots increase in size progressively or coalesce to form large blighted areas. Defoliation occurs when such lesions cover a major portion of the leaf.

The shot hole symptoms initiate as minute, pin-point sized, round, sunken, light brown spots with yellow halo. When such spots attain 4-6 mm diameter the centre of the necrotic spot shrivells and drops off forming shot holes. In very severe cases defoliation occurs.

Control measures may become necessary if the disease attains a very serious proportion.

## NUTRITIONAL DISORDER

### Zinc deficiency

Severe incidence of zinc deficiency leading to foliar abnormality and twing dieback has been observed in many cocoa gardens in Kerala, Karnataka and Tamil Nadu States. Chlorosis of the leaves is the initial symptom of zinc deficiency. It appears in patches and in advanced conditions the green portion is found along the sides of the veins, giving a vein banding appearance. The leaves later show mottling and crinkling with wavy margin. The younger leaves produced subsequently are much reduced in size and sickle shaped. In severe cases premature defoliation followed by dieback occurs.

Foliar spray of a mixture of 0.3% zinc sulphate and 0.15% (w/v) lime has been reported to be an

effective and quick method of correcting zinc deficiency in cocoa.

iseases such as swollen shoot (virus disease), Witches broom, *Monilia* pod rot *Cercospora* wilt and green point gall which are all of fungal etiology are known to occur in severe form in other countries. But these diseases were so far not recorded from India. With the expansion of cocoa cultivation in India, strict quarantine measures may be necessary to prevent the introduction of these diseases.

#### SELECTED BIBLIOGRAPHY

BRITON—JONES, H.R. (1934). *The Diseases and Curing of Cacao*. McMillan & Co. London. pp. 161.

CHANDRAMOHANAN, R. (1978). Cacao canker caused by *Phytophthora palmivora*. *Plant Dis. Repr.* 62 : 1080—1082.

(1979). Cocoa seedling dieback. *Indian Cocoa, Arecanut & Spices Journal*. 3 : 5-6.

ANANDARAJ, M and JOSHI, Y. (1979). Studies on *Phytophthora* diseases of cacao occurring in India. *Proc. PLACROSYM II*, 1979. 335—342.

and KAVERIAPPA, K.M. (1983). Symptomatology of *Colletotrichum* disease of cocoa in India. *Planter, Kuala Lumpur*. 59 : 333—338.

MENON, M.A., YADUKUMAR, N. and NAIK, B.G. (1981). Zinc deficiency in cocoa; diagnosis and correction. *Planter, Kuala Lumpur*. 57 : 120—124.

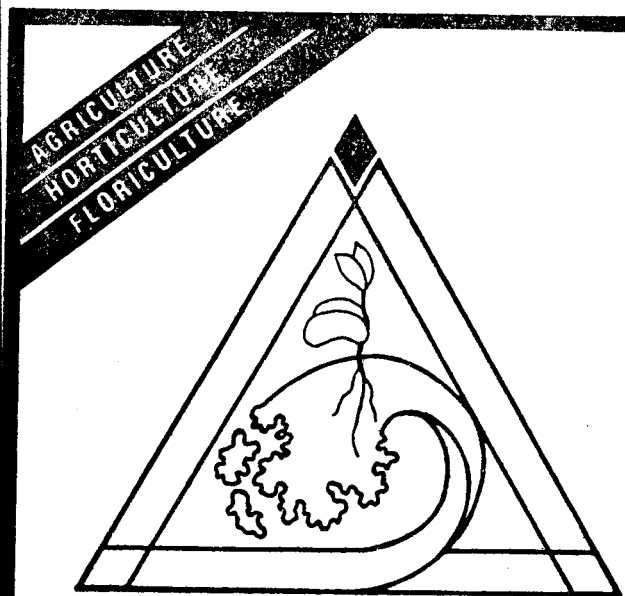
GREGORY, P.H. (Ed.) (1974). *Phytophthora diseases of Cocoa*, Longman Group Ltd., London. pp. 348.

KEANE, P.J. and TURNER, P.D. (1972). Vascular Streak dieback of cocoa in West Malaysia, In : *Cocoa and Coconuts in Malaysia* (Ed. R.L. Wastie & D.A. Earp.) Incorporated society of Planters, Kuala Lumpur. 50—57.

LASS, R.A. (1985). Diseases In : *Cocoa* (Eds. G.A.R. Wood and R.A. Lass) Longman, New York. pp. 265—365.

RAMAKRISHNAN, K. and THANKAPPAN, M. (1965). First report of black pod disease of cocoa in India. *South Indian Hort.* 13 : 33-34.

THOROLD, C.A. (1975) *Diseases of cocoa*. Clarendon Press, Oxford. pp. 423.



# SANJIBAN

## SANJIBAN

An Organic Microbial Growth Stimulant  
for Higher Yields and  
Improved Soil Structure.  
Non-Toxic.

Mfg. by: SANJIBAN BIOTECH PRODUCTS

Marketed by :

PRANTIK INTERNATIONAL Pvt. Ltd.  
10, Ambalattadouayer Madom Street  
Pondicherry 605 001 Phone : (0413) 35085 & 37300

*District - wise Dealer Enquiries Welcome*