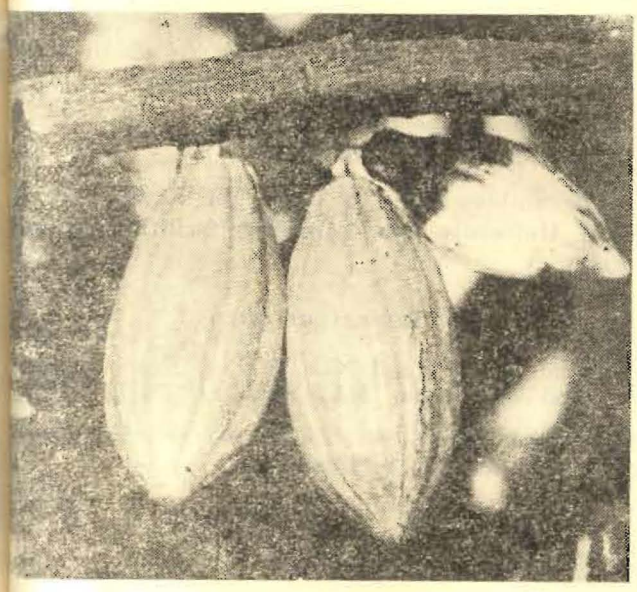
CHARCOAL POD ROT OF COCOA IN KERALA

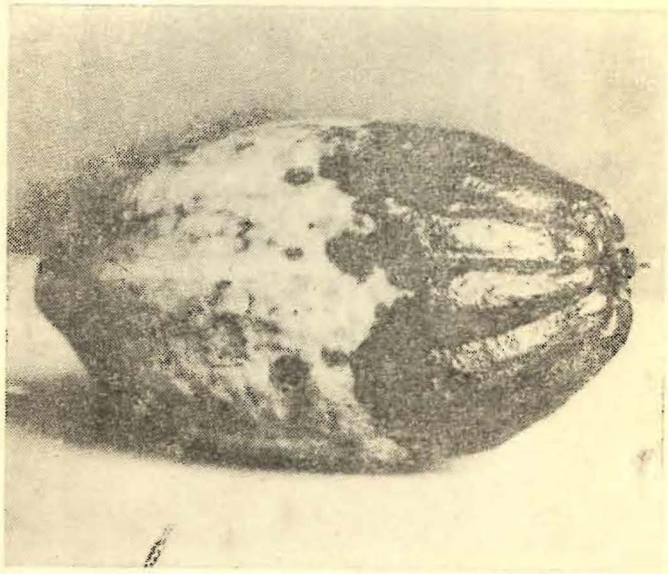
M. VIJAYAN & K. I. WILSON
College of Agriculture, Vellayani, Kerala

Cocoa (*Theobroma cacao L.*) is a tropical plant indigenous to the equitorial regions of the Americas, the beans of which are used for the preparation of cocoa powder, butter and chocolate. In India, over 13,250 hectares of land are at present under this crop, of which Kerala alone accounts for 10,500 hectares. Since the crop has turned out to be highly lucrative in our country, large number of farmers have taken up cocoa cultivation during the last few years. The present production of dry cocoa beans in India is within the range of 300 to 500 tonnes.

Although a number of diseases have been reported on this crop, only a few of them are recorded in our country. During the year 1977, a disease causing rotting of cocoa pods was observed at Karakulam in Trivandrum District. The disease was identified as Charcoal pod rot caused by *Botryodiplodia theobromae* Pat. Charcoal pod rot caused by B. *theobromae* was first recorded by Patouillard in 1892. In India, Nambiar and Nair (1972) reported the disease from Vittal in Karnataka State.



Cocoa pod exhibiting *Botryodiplodia* infection on the plant.



Cocoa pod exhibiting *Botryodiplodia* infection originating from the stalk end.

The symptoms on pods initially appeared as pale yellow spots which enlarged into larger lesions having chocolate brown colour. The infection was observed to originate mostly at the stalk-end or at the tip of the pod. At times, lesions originating from other parts of the pod were also observed. In most cases, the complete pod became black in colour and exhibited a sooty covering all over, consisting of myriads of spores of the fungus. Young pods became mummified and shrivelled. Infected pods dried up and mostly remained attached to the plants. Over 50% of the pods were found infected in the plantation.

The disease was also found to affect the twigs and branches causing die-back symptoms. Defoliation of die-back affected twigs and branches was also noticed. Such twigs appeared dark brown to almost black in colour.

The fungus was isolated from the infected plant parts and maintained on Czapek's agar medium.

Cocoa pod completely infected and blackened, showing the fructifications of the fungus.

Pathogenicity trials revealed that the fungus could infect cocoa pods at all stages of growth. Injury was found to be a pre-requisite for infection by the fungus. Insects like mealy bug (*Planococcus lilacinus*) and tea mosquito (*Helopeltis antonii*) were observed to cause injury to cocoa pods in disease affected area.

Morphology of the fungus

Pycnidia produced on cocoa pods are erumpent, globular to pyriform, black in colour and variable in size ranging from 86.5 to 259.2 microns in diameter. The pycnidiospores are initially hyaline, smooth walled and granular. On maturity, the spores became pale brown and two-celled, measuring 19.2 to 26.4 × 12.0 to 16.0 microns in size. Most of the two-celled spores showed longitudinal striations with a slight transverse groove at the septum.

Most range studied indicated that the fungus could infect and cause rotting of the following fruits and vegetables on artificial inoculation: Avocado, Banana, Bhindi, Breadfruit, Brinjal, Cabbage, Carrot, Chilli, Cluster bean, Coconut, Cowpea, Cucumber, French bean, Ginger, Grape, Jackfruit, Lime, Mango, Nutmeg, Onion, Orange, Papaya, Pear, Plum, Potato, Pumpkin, Rubber, Sapota, Snakegourd, Tapioca and Tomato.

The fungus was able to grow well on Czapek's agar, Potato dextrose agar, Oat meal agar and Host extract dextrose agar media. Good sporulation was obtained on Czapek's agar and Potato dextrose agar (Table I).

Control of the disease

A field experiment was conducted for testing the comparative efficacy of seven proprietary fungicides for the control of the disease. The fungicides were Bavistin (1000 ppm), Blue copper (3000 ppm), Difolatan (3000 ppm), Dithane M-45 (3000 ppm), Fytolan (3000 ppm), Mildothane (2000 ppm) and Rovral (2000 ppm). Eight plants were sprayed with each of the fungicides and eight plants served as control. Six sprayings were given at monthly interval beginning from the month of December, since the disease was found to be more severe during dry months as reported by Nambiar and Nair (1972). Data collected 30 days after the sixth spraying are presented in Table II. It was noticed that Rovral had the maximum efficiency in controlling the disease. Statistical analysis of the data also revealed that Rovral was significantly superior to all the other fungicides for the control of the disease.

Acknowledgement

The authors wish to thank the Kerala Agricultural University for providing facilities for the studies.

Literature cited

Nambiar, K.K.N. and Nair, R.R. (1972). Charcoal pod rot of cacao (*Indian Phytopath*), **24**; 595-597.

Patouillard, N. (1892). *Bulletin de. la. Societe. Mycologiracue de Fnce*, 8: 136.

TABLE 1

Growth and sporulation of Botryodiplodia theobromae *on different culture media*

Medium	Mean colony diameter in mm*	Colony characters
Coon's agar	82.66	Colony greyish white, cottony with more or less entire margin. Fair sporulation.
Czapek's agar	90.00	Colony aerial, middle half dark grey with greyish white entire margin. Good sporulation.
Host extract agar	57.76	Colony thin, smoke grey with entire margin. Meagre sporulation.
Host extract dextrose agar	85.00	Colony greyish white with more or less entire margin. Fair sporulation.
Oat meal agar	83.00	Mycelium subaerial with dark grey centre and light grey entire margin. Fair sporulation.
Potato dextrose agar	90.00	Colony grey coloured with light grey entire margin. Good sporulation.
Richard's agar	90.00	Mycelium cottony white, fluffy with slightly wavey margin. Fair sporulation.
Sabouraud's agar	71.60	Colony greyish white, cottony with entire margin. Fair sporulation.

*Average of 3 replications.

TABLE 2

Effect of spraying fungicides on the incidence of Charcoal pod rot of cocoa caused by Botryodiplodia theobromae

I Treatment	Percentage of infected pods* II Pre-treatment (on the day of first spraying)	III 30 days after sixth spraying	IV Per cent efficiency of treatment (based on column III) over control
Bavistin	33.00	21.87	53.03
Blue copper	45.31	24.67	47.02
Difolatan	43.60	13.82	70.32
Dithane M-45	50.84	15.05	67.68
Fytolan	43.60	25.74	44.72
Mildothane	31.19	17.00	63.49
Rovral	35.60	5.73	87.69
Control	44.88	46.56	

*Average of eight plants F. test — Siginificant C.D. = 9.50

T_7	T_3	T_4	T_6	T_1	T_2	T_5	T_8
8.60	17.46	19.49	20.40	58.05	29.20	33.04	44.79