



MANAGEMENT OF COCOA SEEDLING BLIGHT CAUSED BY *PHYTOPHTHORA PALMIVORA*

Prabha K. Peter and R. ChandraMohanana*

Division of Crop Protection, Central Plantation Crops Research Institute, I.C.A.R., Kasaragod-671 124 (Kerala), India.

Abstract

Susceptibility of cocoa seedlings to blight or dieback caused by *Phytophthora palmivora* with respect to the age of the seedlings was studied under two nursery conditions for 2 years. Seedlings which were 5 to 6 months old in the month of June (beginning of south- west monsoon season) escaped from blight or dieback leading to death of seedlings. There was no disease incidence in 4 months old seedlings when they were raised inside a shed. The disease incidence reduced with increase in age of seedlings. Six months old seedlings are recommended for field planting in the month of June. When seedlings were raised by sowing cocoa beans during rainy season of two consecutive years there was 98.3 - 100 % and 67 - 75 % mortality in open condition and under shed respectively. When integrated disease management (IDM) practices were adopted for seedlings raised during rainy season, the disease incidence was very low. Based on the management trials conducted for two years, a cocoa nursery management strategy was evolved to combat *Phytophthora* disease of seedlings raised during rainy season.

Key words : Cocoa nursery, *Phytophthora palmivora*, disease management.

Introduction

Phytophthora diseases are the most prevalent and destructive diseases of cocoa (*Theobroma cacao* L.) in all cocoa growing countries. Cocoa is cultivated mainly as a mixed crop in coconut and arecanut gardens and in a negligible area in oil palm plantations in southern states of India. Seedling blight or dieback caused by *Phytophthora palmivora* (Butl.) Butl. is the main constraint in seedling production in all high rainfall areas and particularly in a country like India where expansion of area under cocoa cultivation is progressing fast. *P. palmivora* infection causing high seedling mortality was reported as the major problem in all nurseries in India during rainy season especially during south-west monsoon period (Peter and ChandraMohanana, 2011).

Phytophthora inoculums will be carried to main field through partially infected seedlings or contaminated soil leading to inoculum build up in the garden. Thus the pathogen will be introduced to new areas resulting in severe incidence of *Phytophthora* diseases of cocoa, especially black pod and stem canker diseases. Therefore, management of seedling blight in cocoa nurseries is very much imperative not only to reduce huge loss in nurseries

but also as a pre requisite for the management of *Phytophthora* diseases in the main field or orchards. Studies have not been conducted so far in India on the management of seedling blight or dieback caused by *P. palmivora* except some general recommendations (ChandraMohanana, 1994). Hence, studies were conducted to evolve management strategies for *P. palmivora* infection in cocoa nursery.

Materials and Methods

To develop an economically viable strategy for management of seedling blight of cocoa in nurseries, trials were laid out during 2010 and 2011 in Subramanya taluk, a major cocoa growing area of Dakshina Kannada district of Karnataka. Cocoa seedlings were raised under two nursery conditions, such as nursery in open area without any overhead shade and another nursery under shade of a water proof roof made of plated coconut leaves (shed). The roof was made at a height of 2.5 m at the centre and 2.0 m at the sides from ground level, so that all sides remained open to provide air movement and light. The overhead roof of the nursery did not allow water to drip and cause splashing of soil to the seedlings. Both the nurseries were raised side by side at a distance of about 7 m between them and they were about 200 m away

* **Author for correspondence :** Email: rcmcpcri@yahoo.co.in

from cocoa plantations. The seedlings were raised in polythene bags of 30 x 20 cm size filled with potting mixture.

The disease management trial was laid out with 9 treatments. Treatments 1-7 consisted of different age group of seedlings such as (1) 6 months (2) 5 months (3) 4 months (4) 3 months (5) 2 months (6) 1 month and (7) 15 days and other treatments were (8) sowing in rainy season with integrated disease management practices and (9) sowing in rainy season (August) without any treatment (control). For treatments 1 to 7, cocoa beans were sown at different intervals so that they were of the respective age groups during the 2nd week of June in 2010 and 2011. In addition to finding out the susceptibility of cocoa seedlings of different age groups to *Phytophthora* infection during rainy season under two nursery conditions, the effect of different disease management practices on disease incidence in seedlings raised during rainy season (Treatment 8) was also studied as large quantity of seeds (beans) are available prior to or during the beginning of rainy season.

Integrated disease management practices adopted in the nursery (Treatment 8)

- ❑ Cleaned the nursery site by removing all weeds and waste materials such as plant debris and levelled the area with a slight slope to one side.
- ❑ Sprayed the soil surface of the nursery site with copper oxychloride (Blitox 50 WP 0.3%) and covered the soil surface with a plastic sheet.
- ❑ Provided overhead cover (roof) at a height of about 2.50 m for the nursery so that rain water will not drip into the polythene bags and cause splashing of soil.
- ❑ Solarised the potting mixture.
- ❑ Arranged polythene bags filled with potting mixture at a spacing of 6-7 cm in between the bags.
- ❑ Beans were bio-primed with *T. harzianum* using Trichoderma coir pith cups to prevent pre-emergence infection. *Trichoderma* coir pith cups were prepared following the technology developed for the preparation of *Trichoderma* coir pith cake (ChandraMohan et al., 2013). They were placed in the potting mixture in polythene bag (@ one cup/bag) in such a way that the top of the cup was at the level of the soil surface. Watered the polythene bags and sown the seeds inside the cup @ one seed / bag.
- ❑ Sprayed mancozeb (0.3 % Indofil M -45) at an interval of 15 days from the time of germination of the beans.
- ❑ Observed the seedlings at weekly interval.

- ❑ Removed and destroyed infected seedlings , if any , along with polythene bag containing potting mixture

All the above nine treatments were included in both the nursery conditions (with and without shade). There were sixty seedlings per treatment in three replications. The seedlings in all the treatments were observed for incidence of seedling blight caused by *Phytophthora* at weekly interval for a period of four months and disease incidence was recorded.

Results and Discussion

Phytophthora infection of seedlings leading to blight or dieback symptoms and ultimately death of seedlings varied with the treatments in the nurseries raised in open area and in a shed with overhead roof (two nursery conditions). Disease incidence was not noticed in seedlings which were 5 and 6 months old during the rainy season in both the years irrespective of two nursery conditions adopted (table 1). There was also no disease incidence in 4 months old seedlings during rainy season when they were raised in a shed. On the other hand, there was 5 and 8.33% disease incidence in 4 months old seedlings raised in open area during 2010 and 2011 respectively. Lim (1980) reported that seedlings up to 4 months old in polybags were susceptible to blight disease. The present study also revealed that the disease incidence decreased with increase in age of seedlings in the month of June. Since 6 months old seedlings are recommended for field planting in the month of June, it is advisable to sow beans during January – February so that seedlings can be maintained *Phytophthora* disease- free without any treatments. The disease incidence was the highest when seedlings were raised during rainy season followed by 15 days old seedlings in the month of June. The disease incidence was also always more in 15 days old seedlings than 1-month-old seedlings irrespective of the two nursery conditions. The disease incidence of 2 months old seedlings raised in open area ranged from 47 to 52%. Incidence increased with decreasing age of the seedlings during monsoon season and was the highest when the beans were sown during rainy season (August) without any treatment.

The disease incidence in seedlings raised during rainy season of both the years without any treatment and with integrated disease management (IDM) practices varied significantly. When there was 98 to 100% disease incidence in seedlings without any treatment, it was only 43 to 55% in seedlings received IDM practices in open area. On the other hand, there was only 3-5% disease incidence in seedlings raised with IDM practices in a

Table 1 : Effect of different management practices on *Phytophthora* disease in cocoa nursery.

S. no.	Treatments	% of infected seedlings			
		2010		2011	
		Disease incidence in open area (without overhead shade)	Disease incidence of seedlings maintained under a roof	Disease incidence in open area (without overhead shade)	Disease incidence of seedlings maintained under a roof
1	Age of seedlings: 6 months	0.0	0.0	0.0	0.0
2	5 Months	0.0	0.0	0.0	0.0
3	4 Months	5.0(10.46)	0.0	8.33 (16.61)	0.0
4	3 Months	23.33(28.87)	11.67(19.89)	28.33(32.03)	16.67(24.05)
5	2 Months	46.67(43.11)	25.00(29.70)	51.67(46.01)	20.00(26.46)
6	1 Months	85.00(68.13)	43.33(41.18)	83.33(66.29)	51.67(45.98)
7	15 Days	91.67(73.44)	65.00(53.78)	96.67(83.89)	68.33(55.79)
8	Sowing in rainy season with IDM	55.00(47.90)	5.00(12.92)	43.33(41.18)	3.33(8.6)
9	Sowing during August	100.00(90.05)	68.33(55.79)	98.33(85.73)	76.67(61.79)
	CD (P=0.05)	7.84	4.67	9.80	7.98

Figures in parenthesis are transformed values.

shed (table 1). In general, the disease incidence was less when seedlings were protected from direct rain. Seedlings of 5 to 6 months old without any treatment in the month of June (beginning of monsoon season) were found to be better than all other treatments for field planting. Thus, the management trials conducted for two years revealed that while raising cocoa seedlings in large number during rainy season they should be protected from direct rainfall with an overhead roof and the IDM practices adopted in Treatment 8 may be strictly followed to produce disease-free cocoa seedlings. This integrated disease management strategy was found to be very effective. Based on comprehensive survey of the occurrence of *Phytophthora* diseases of various crop plants including cocoa in the Philippines by the Bureau of Plant Industry some general recommendations were made for the integrated management of *Phytophthora* diseases of nurseries (Portales, 2004). There were some differences between the integrated disease management strategy developed during this investigation and that developed by other workers in other cocoa growing countries. (Portales, 2004 and Guest, 2004). Moreover, the management practice developed for the Indian condition is simpler than that developed by Portales (2004) and modified by Guest (2004). The basic fundamental approach in IDM is to use healthy planting material in a healthy soil.

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