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STUDIES ON LEAF SPOT DISEASE OF ARECANUT : SYMPTOMS, CAUSE AND CONTROL

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ABSTRACT

Leaf spot disease of arecanut was severe during S. W. monsoon in several gardens in Uttara Kannada, Dakshina Kannada and Kasaragod districts. *Phyllosticta arecae* Hohnel and *Colletotrichum gloeosporioides* (Penz.) Sacc. were found to be the most common pathogens associated with this disease. Pathogenicity of these fungi individually and in combination was established on arecanut seedlings. The frequency of isolation of these two fungi varied from place to place. *In vitro* fungicidal evaluation against these two pathogenic fungi revealed that Carbendazim (Bavistin, 0.05%), Captafol (Foltaf, 0.2%) and Mancozeb (Dithane M-45, 0.3%) checked the growth of the two fungi completely, while Bordeaux mixture (1%) inhibited 85.7% growth of *P. arecae* and 81.6% growth of *C. gloeosporioides*. Field control trails involving these four fungicides were carried out at two locations, viz., Yellapur (Uttara Kannada dist.) and Puttur (Dakshina Kannada dist.) It was observed that monthly sprays of Mancozeb (Dithane M-45, 0.3%), Captafol (Foltaf, 0.2%) and Carbendazim (Bavistin, 0.05%) during June-August were effective in reducing the intensity of leaf spot disease during S.W. monsoon period.

INTRODUCTION

During the last few years, severe incidence of leaf spot disease on arecanut was noticed in several gardens in Uttara Kannada and Dakshina Kannada districts of Karnataka and Kasaragod district of Kerala. Severe leaf spot symptoms appeared on the outer whorl of leaves leading to drying and drooping of leaves. A perusal of literature indicates that several fungi such as *Curvularia* sp. (Rao, 1962), *Alternaria tenuis* (Agnihotri, 1963), *Nigrospora sphaerica* (Naidu and Kumar, 1964), *Phyllosticta arecae* (Saccardo, 1931) and *Colletotrichum gloeosporioides* (Hegde and Hegde 1986) were reported to be associated with leaf sports/blight diseases on arecanut seedlings and young palms in Karnataka. However, no detailed investigations on the etiology and control of the leaf spot diseases of arecanut prevalent in Karnataka and Kerala were carried out. Hence, the present study on incidence and etiology of the disease, and reaction of the pathogens to various fungicides were conducted to evolve suitable chemical control measures against the disease.

MATERIALS AND METHODS

Incidence of the disease

A total of twenty arecanut gardens in Sirsi and Yellapur (Uttara Kannada), Puttur (Dakshina Kannada) and Kasaragod (Kerala) were observed for disease incidence during pre-monsoon (April), monsoon (July) and post-monsoon (November) periods during 1987 and 88. In each selected garden data on symptoms and intensity of the disease were recorded on 25 palms. Based on the number of palms and leaves affected and severity of infection of individual leaf, a quantitative index of severity (DI) was calculated.

Etiology

Isolation of fungi was carried out on Potato Dextrose Agar (PDA) from the leaf spot-affected samples collected from Bairumbe, Puttanamane, Shirvalli and Gundagal (Uttara Kannada), Vittal, Kavu and Haleneranki (Dakshina Kannada) and Vorkady (Kasaragod). Fifty samples showing

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leaf spots of different sizes and stages from each location were plated and the fungi were isolated. Pathogenicity of the most frequently isolated fungi was tested on one year-old arecanut seedlings grown in pots. Ten seedlings were used for each fungus. The inoculation was done on the three lower most leaves in each seedling using spore cum mycelial suspension of the fungi by pin-prick method. The inoculated leaves were covered immediately with polythene bags containing wet cotton wads for providing higher humidity. The inoculated seedlings were kept in green house (20-25°C) for 20 days for observation.

In vitro evaluation of fungicides

Screening of fungicides was carried out against two leaf spot fungi which were found to be the causative organisms. Eight fungicides, namely, Carbendazim (Bavistin), Mancozeb (Dithane M-45), Captafol (Foltaf), Bordeaux mixture, Copper oxychloride (Blitox), Tridemorph (Calixin), Kitazin and Zineb (Dithane Z-78) were evaluated at different concentrations on PDA by poisoned food technique. Three replications were maintained for each fungicide and the plates were incubated at 25 ± 2°C. Radial growth of the fungi was recorded on the 10th day after inoculation and the percentage inhibition of growth calculated using Vincent equation (Vincent, 1927).

Field control trials

Field control trials were laid out in leaf spot-affected areca gardens one each at Yellapur and Puttur to represent the two different agroclimatic zones. Four fungicides found to be promising in *in vitro* studies were selected. Each treatment had fifty palms in each location. The unsprayed palms served as control. The treatments were given as foliar sprays for three rounds, once during pre-monsoon (June) and twice during monsoon (July and August). About one to one and a half litres of fungicidal solution was required to spray the upper and lower surfaces of all the leaves of the affected palm. Triton AE sticker was added to the fungicidal solution at the rate of 0.1% Conc. before spraying. The data on disease intensity were recorded in all the experimental palms before (June) and after the treatments (September) and the disease index was calculated using Mc Kinney (1923) formula.

RESULTS AND DISCUSSION

Incidence of leaf spot disease

Symptoms

During the course of observation in different areca gardens, leaf spot symptoms were studied in different localities. The leaf spot symptoms observed in Uttara Kannada, Dakshina Kannada and Kasaragod areas were similar in nature. The leaf spot disease was observed in palms of all age groups, but the severity of the disease was more in seedlings and young palms. Up to 80% of the affected palms were below 10 years. The leaf spots were noticed on the leaves of outer and middle whorls and one to six leaves were affected in each palm. The highest intensity was observed on the lower most leaf and the intensity gradually decreased in the inner leaves. Brown to dark brown or black spots with a broad or narrow yellow halo (Fig. 1) appeared initially on the leaves and these spots enlarged to the size of 20-40 mm and coalesced to form large blighted areas in the advanced stages (Fig. 2). Some of the spots showed a central dried greyish portion with dark fructifications (Pycnidia) of the fungus on the upper surface. The affected palms showed drying and drooping of leaves in the advanced stages. In seedlings the entire crown dried up due to the severity of the disease.

Seasonal difference in incidence

The leaf spot disease was observed in different intensities during the three seasons. The

disease index (mean of 500 palms spread over 20 gardens in Sirsi, Yellapur, Puttur and Kasaragod areas) was maximum during S-W monsoon period (22.05) and comparatively lower during pre-monsoon (13.5) and post-monsoon (16.5) periods in the affected gardens. This may be due to the prevalence of favourable conditions for disease development and spread during the monsoon period.

Etiology

Phyllosticta arecae Hohnel and *Colletotrichum gloeosporioides* (Penz.) Sacc. were the most commonly isolated fungi from all types of leaf spots (Table I). The identification of fungi was confirmed by C.M.I. (IMI Nos. 324014 & 324026). In Sirsi and Yellapur areas of Uttara Kannada district, 63.5% samples yielded *P. arecae* and 20% samples yielded *C. gloeosporioides*. In Dakshina Kannada and Kasaragod areas, these two fungi were isolated more or less in more or less in equal proportions (28-30%). In pathogenicity tests, *P. arecae* produced water soaked lesions initially which developed into light brown circular spots of 3-4 mm size on 23% of the inoculated leaves after 10 days of inoculation. *C. gloeosporioides* produced sunken, dark brown, round or oval spots of 4-6 mm size on 37% of the inoculated leaves after 7 days. The combined inoculation of both fungi produced light brown to dark brown or balck circular spots of 3-8 mm size on 55% of the inoculated leaves after 7 days. This indicates that *P. arecae* and *C. gloeosporioides* were able to cause leaf spots disease individually and also in combination. Maximum infection rate was obtained when these two fungi were inoculated together.

In vitro evaluation of fungicides

Fungicidal evaluation was carried out against *P. arecae* and *C. gloeosporioides* since both these fungi were found to cause leaf spot

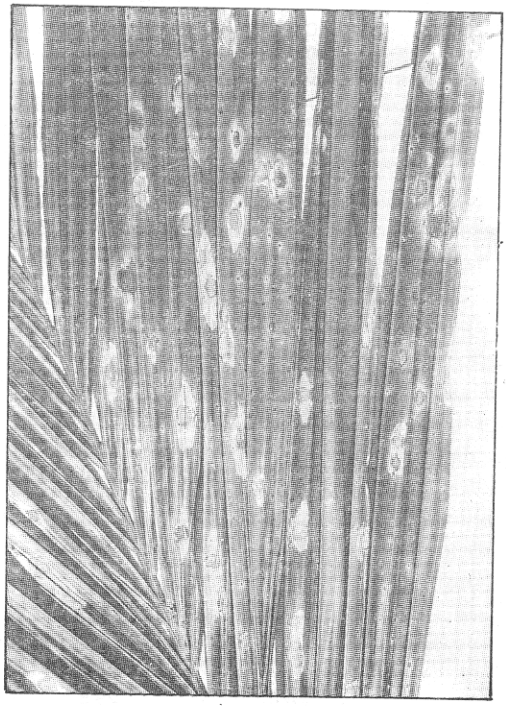

Fig. 1. Arecanut leaf showing Brown or dark brown spots

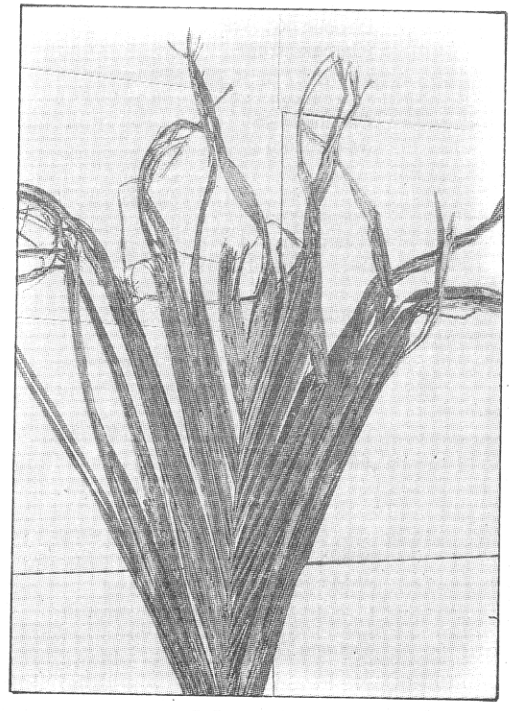

Fig. 2. Arecanut leaf showing blighting

Table I. Fungi isolated from the leaf spot affected samples from different localities*

Location	Number of samples yielding			
	P. arecae alone	*C. gloeosporioides* alone	P.a+C.g together	Other fungi**
Bairumbe (U.K.)	32	8	6	4
Puttanamane (U.K.)	29	11	7	3
Shirvalli (U.K.)	28	15	4	3
Gundagal (U.K.)	38	6	1	5
Mean for U.K. dist.	127 (63.5%)	40 (20%)	18 (9%)	15 (7.5%)
Vittal (D.K.)	13	19	13	5
Kavu (D.K.)	17	14	15	4
Haleneranki (D.K.)	14	14	19	3
Vorkady (Kasaragod)	12	13	19	6
Mean for D.K. and Kasaragod districts	56 (28%)	60 (30%)	66 (33%)	18 (9%)

* 50 samples from each location were plated on PDA
** Other fungi includes *Aspergillus, Botryodiplodia, Fusarium, Pestalotia* and *Helminthosporium*

Table II. Effect of fungicides on the growth of P. arecae and C. gloeosporioides on PDA

Fungicides	Conc. (%)	Inhibition of growth(%)	
		P. arecae	*C. gloeosporioides*
Bavistin 50% WP (Carbendazim)	0.025	1000.0	88.7
	0.05	100.0	100.0
	0.1	100.0	100.0
Dithane M-45 (Mancozeb)	0.1	87.7	59.2
	0.2	100.0	83.3
	0.3	100.0	100.0
Foltaf 80% W (Captafol)	0.05	77.3	54.8
	0.1	100.0	82.6
	0.2	100.0	100.0
Bordeaux mixture	1%	85.7	81.6
Calixin 80% EC (Tridemorph)	0.05	100.0	18.3
	0.1	100.0	25.3
	0.2	100.0	29.5
Kitazin 48% EC	0.05	43.7	23.9
	0.1	55.4	26.7
	0.2	73.7	49.2
Blitox 50% W (Copper oxychloride)	0.1	62.3	28.1
	0.2	76.0	39.4
	0.3	80.0	45.0
Dithane Z-78 (Zineb)	0.1	61.3	19.7
	0.2	72.1	25.3
	0.3	78.4	29.5

* Mean of three replications

Table III. Effect of fungicides on the intensity of leaf spot of arecanut

	Fungicide	Disease index (mean of 50 palms)			
		Yellapur (UK)		Puttur (DK)	
		Pre treatment (June)	Post-treatment (September)	Pre-treatment (June)	Post-treatment (September)
1.	Bavistin (0.05%)	12.8	13.5	9.9	11.8
2.	Dithane M-45 (0.3%)	13.2	14.0	10.9	11.3
3.	Foltaf (0.2%)	13.6	14.2	10.7	11.1
4.	Boredaux mixture (1%)	11.9	18.5	12.1	19.1
5.	Control	13.4	21.6	9.8	20.2
		C.D. (P = 0.05) = 3.96		C.D. (P = 0.05) = 5.32	

diseases in these areas. Among the eight fungicides tested *in vitro*, Carbendazim (Bavistin, 0.05%), Mancozeb (Dithane M-45), 0.3% and Captafol (Foltaf 0.2%) inhibited cent per cent growth of both fungi, while Bordeaux mixture (1%) inhibited 85.7% growth of P. arecae and 81.6% growth of *C. gloeosporioides* (Table II). Hence these four fungicides were selected for field control trials.

Field trials

The mean disease index of each treatment during pre-treatment (June) and Post-treatment (September) observed in the two field control trial plots located at Yellapur and Puttur is presented in Table III. The post treatment disease indices (PDI) of palms sprayed with Bavistin (0.05%), Dithane M-45 (0.3%) and Foltaf (0.2%) were significantly less in comparison with D.I. of unsprayed palms in both the locations. These three fungicides were almost at par in controlling leaf spot disease as indicated by their post treatment disease indices. Palms sprayed with Bordeaux mixture (1%) recorded higher disease indices compared to the other three fungicides in both plots. Because of the recent ban on the use of captafol as foliar fungicide, Carbendazim (Bavistin, 0.05%) and Mancozeb (Dithane M-45, 0.3%) were recommended for the control of leaf spot diseases of arecanut during S-W monsoon period. The fungicides should be sprayed on all the leaves of the affected palms once during pre-monsoon and thereafter two sprays at monthly intervals.

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DISCUSSION

B. CHANDRA MOULI : What is the Economic threshold of the pathogen? When do you resort to chemical treatment? At what stage of infection?

B. RAMANUJAM : No studies on the economic threshold of pathogen was carried out. The fungicidal spraying has to be given during S.W. monsoon period in some of the severely affected gardens in the three districts.

T. NATARAJ : Whether Bavistin induced curative effect? What is the mode of treating the tree with fungicide.

B. RAMANUJAM : The efficiency of Bavistin was tested in terms of disease index. Bavistin sprayed palms showed minimum increase in disease index compared to control. Bavistin was applied as foliar spray on all the leaves of the affected palms.

E.V.V. BHASKARA RAO : Bordeaux mixture was fairly effective in inhibiting the growth of both fungi. What are the reasons for poor result under field conditions?

B. RAMANUJAM : Bordeaux mixture (1%) was not as effective as the other three fungicides tested both *in vitro* and under field conditions.