

COCONUT DISEASE

IN VITRO ASSAY OF FUNGICIDES AGAINST PREPONDERANT FUNGI OF LEAF ROT DISEASE OF COCONUT PALMS

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ABSTRACT

Efficacy of contact (Indofil M-45, Fytolan, Captaf, Thiride) and systemic (Contaf, Calixin, Aureofungin-sol with and without copper sulphate) fungicides *in vitro* was assessed against preponderant fungi (*Colletotrichum gloeosporioides*, *Exserohilum rostratum*, *Gliocladium vermoeseni*, *Fusarium solani*, *F. moniliforme* var. *intermedium* and *Thielaviopsis paradoxa*) of coconut leaf rot. Differential inhibition of fungi by fungicides was observed. Complete inhibition of all fungi except *F. moniliforme* var. *intermedium* by Contaf was recorded at 0.15%. Indofil M-45/Calixin, Thiride were next in the order of efficacy. Usefulness of fungicides with broad spectrum activity/eradication potential in leaf rot control is stressed.

Key words: Bioassay, broad spectrum, coconut, efficacy, fungi, fungicides, leaf rot.

INTRODUCTION

Leaf rot is an endemic fungal disease, widely superimposed on root (wilt) affected coconut palms, in southern districts of Kerala State (Menon and Nair, 1951; Srinivasan, 1991). Recent investigations have brought out species composition of the disease complex (Srinivasan and Gunasekaran, 1993; Srinivasan *et al.*, 1995). Among them *Colletotrichum gloeosporioides*, *Exserohilum rostratum*, *Gliocladium vermoeseni*, *Fusarium solani* and *F. moniliforme* var. *intermedium* have been regarded as predominant species. *Thielaviopsis paradoxa* has also been found to be associated with leaf rot occasionally to a considerable extent. Pathogenic nature of these fungi has been confirmed (Srinivasan and Gunasekaran, 1994). *C. gloeosporioides* and *E. rostratum* are regarded as core pathogens of leaf rot (Anonymous, 1995).

Fungicidal control of leaf rot is in vogue (Joseph and Rawther, 1991). Menon and Nair (1951) indicated sensitivity/tolerance of leaf rot associated fungi to copper sulphate and also lethality of mercuric chloride, and phenol. *In vitro* inhibition

of *Helminthosporium halodes* (= *E. rostratum*) by different copper fungicides was reported by Prasannakumari *et al.* (1960). However, more information on efficacy of fungicides was felt necessary in light of complex nature of the disease; fungicides with potential range could be strategically utilized in the disease control measures after screening in the laboratory. This paper presents the results generated from bioassay of certain fungicides, against the above mentioned leaf rot fungi.

MATERIAL AND METHODS

One -week -old cultures of *C. gloeosporioides*, *E. rostratum*, *G. vermoeseni*, *F. solani*, *F. moniliforme* var. *intermedium* and *T. paradoxa*, grown in potato dextrose agar medium (PDA) in petridishes, were utilized for assessing the efficacy of selected contact and systemic fungicides. The fungicides and details of their concentrations used are presented in Table 1.

Four concentrations of each fungicide were tested against six species of fungi on PDA in petridishes (90 mm diameter) by "poisoned food technique".

The medium amended with specific concentration of fungicide was aseptically poured into sterile petridishes (approximately 15 ml/ petridish). Circular discs (7 mm diameter) representing inoculum of each fungus were prepared using a sterile cork borer and transferred onto centre of solidified medium. There were five replications per fungus for each concentration of fungicide. Suitable controls, without fungicide, were also inoculated. The inoculated petridishes were incubated in a BOD incubator at $30 \pm 1^\circ\text{C}$.

The fungal colony diameters for all species, except *T. paradoxa*, were measured at three stages as 2nd, 4th and 8th day after inoculation. The measurement for *T. paradoxa* was limited to 2nd and 4th day with the control petridishes full by the growth of the fungus. The per cent inhibition of each fungus was worked out by the following formula:

$$\text{Per cent inhibition} = \frac{100 (C-T)}{C}$$

Where, C and T represent diameters of fungus colony in control and treatment petridishes, respectively (Tomy Philip *et al.*, 1995).

The fungal inhibition (in percentage) at different concentrations and in three stages of observations was tabulated after rounding off the values to nearest whole numbers. Mean inhibition by fungicides specially for the observations of 2nd and 4th days was computed and the data statistically analyzed for interpretation.

RESULTS AND DISCUSSION

Differential inhibition of experimental fungi by fungicides has been observed. The data on growth inhibition at different stages are presented in Table 2.

Contaf exerted cent per cent inhibition to *C. gloeosporioides*, *E. rostratum*, *F. solani* and *T. paradoxa* at earliest stage and in minimal concentration itself. Even at the highest concentration of Contaf, inhibition of *F. moniliforme* var. *intermedium* was only up to

82%. Indofil M-45 completely inhibited *E. rostratum* at all concentrations, but *C. gloeosporioides* growth was inhibited only up to 88% at the maximum concentration. Fytolan caused 100% suppression of growth of *C. gloeosporioides*. Thiride also caused more or less similar reactions on *C. gloeosporioides* and *E. rostratum*. Captaf did not inhibit completely any of the fungi. Calixin suppressed *E. rostratum* and *G. vermoeseni* only at the maximal concentration even as its potential inhibition of *T. paradoxa* was accomplished at the lowest. Inhibitory effect of Aureofungin-sol, with or without Copper sulphate was more or less similar. While Aureofungin - sol was found to completely inhibit *T. paradoxa* at the lowest dose, suppression of *C. gloeosporioides*, *E. rostratum* and *G. vermoeseni* to such an extent was recorded at higher concentrations only. The fusarial fungi were generally less inhibited.

Mean values for 2nd and 4th day (Table 3) also revealed cent per cent inhibition of four fungi by Contaf followed by Indofil M-45, Fytolan and Thiride/Calixin. Among the fungi *T. paradoxa* was most sensitive and maximally inhibited by five fungicides followed by *C. gloeosporioides*, *E. rostratum*/*G. vermoeseni*, but *Fusarium* spp. comparatively less inhibited.

Scrutiny of data revealed that Contaf caused maximum suppression in growth of various fungi and was superior to other fungicides in its fungicidal action (Table 3, Fig. 1). Fungicide concentration had generally direct relation on the extent of inhibition in fungal growth. Sensitivity of *Alternaria tritici* increased with concentration of various fungicides including antibiotics (Khan and Saxena, 1995 a, b). Clare Grant and Kennedy (1995) reported effective control of Leek rust (*Puccinia allii*) with hexaconazole (Contaf) irrespective of concentration and regarded this fungicide with greater eradicant effect. Control of rice blast with hexaconazole has also been reported to be highly beneficial (Hooda and Srivastava, 1995). Broad spectrum/effectiveness of hexaconazole (Contaf) against leaf rot fungi has also been found out in the present study.

TABLE 1

Fungicides and their concentrations used for *in vitro* assay.

Sl. No.	Fungicides	Concentrations (%)			
		1	2	3	4
CONTACT FUNGICIDES					
1.	Indofil M-45 (Mancozeb 75% WP)	0.20	0.30	0.40	0.50
2.	Fytolan (Copper Oxychloride 88% W/W)	0.40	0.50	0.60	0.70
3.	Captaf (Captan 50% WP)	0.15	0.20	0.30	0.40
4.	Thiride (Thiram 75% WS)	0.15	0.20	0.30	0.40.
SYSTEMIC FUNGICIDES					
5.	Contaf (Hexaconazole 5% EC)	0.10	0.15	0.20	0.40
6.	Calixin EC (Tridemorph 80% EC)	0.10	0.15	0.20	0.40
7.	Aureofungin - Sol (Aureofungin 46.15% S.P)	0.22 (1x10 ⁵)	0.43 (2x10 ⁵)	0.65 (3x10 ⁵)	0.87 (4x10 ⁵)*
8.	Aureofungin - Sol + 5 ppm Copper sulphate	"	"	"	"
* units/ml of medium.					

Leaf rot control is considered generally a task. Perhaps fungal complex nature of the disease could have thus far been a hurdle to the disease amelioration. In the past, a few reports (Menon and Nair, 1951; Prasannakumari *et al.*, 1960; Joseph and Rawther, 1991) were made on the fungicidal inhibition of leaf rot fungi. The need for fungicides with broad spectrum potential was envisaged. In the present study, a number of fungicides against predominant fungi of leaf

rot had been evaluated in the laboratory. The results generated with a broad spectrum fungicide like Contaf as evaluated in the bioassay, might be useful in the management of leaf rot.

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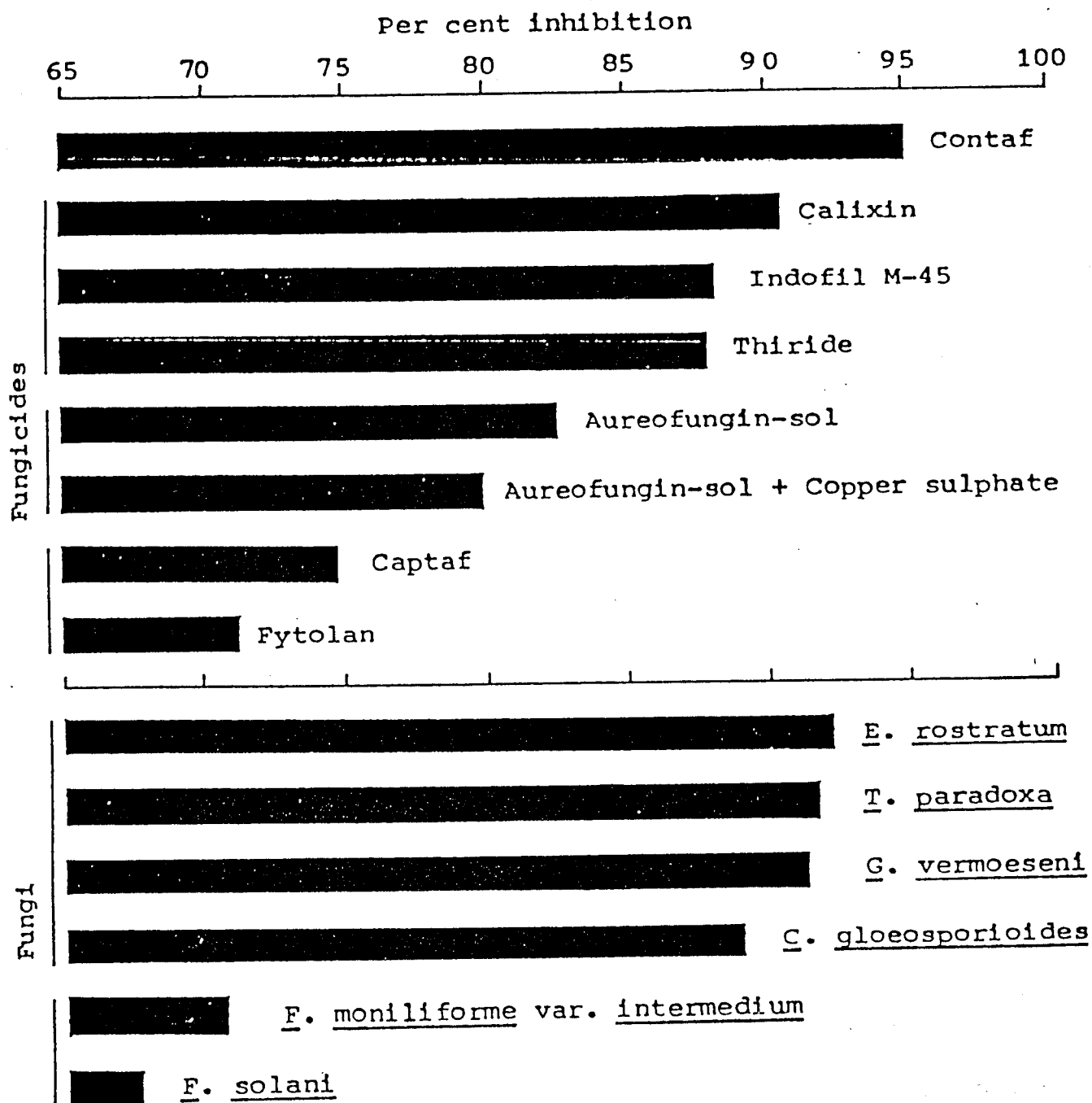


Fig. 1: Average growth inhibition of leaf rot fungi on fourth day and comparative efficacy of fungicides (C.D. at 5% level: Fungicides 4.3; Fungi 3.8).

TABLE 2

In vitro growth inhibition of leaf rot fungi by fungicides (for concentrations refer Table 1)

Fungicides	Concentrations	Per cent growth inhibition of fungi on different days after inoculation*																	
		<i>C. gloeosporioides</i> **			<i>E. rostratum</i> **			<i>G. vermeseni</i>			<i>F. solani</i>			<i>F. moniliforme</i>			<i>T. paradoxa</i> ***		
		2	4	8	2	4	8	2	4	8	2	4	8	2	4	8	2	4	8
Indofil M-45	1	75	59	46	100	100	100	100	100	100	76	65	48	64	72	66	100	100	-
	2	75	65	54	100	100	100	100	100	100	80	79	73	64	72	62	100	100	-
	3	75	88	80	100	100	100	100	100	100	80	85	74	64	81	66	100	100	-
	4	75	88	82	100	100	100	100	100	100	75	81	74	64	81	70	100	100	-
Fytolan	1	100	100	100	81	86	75	100	100	100	22	38	36	64	23	25	79	58	-
	2	100	100	100	81	84	76	100	100	100	40	52	44	64	37	30	80	64	-
	3	100	100	100	81	80	74	100	100	100	47	49	40	64	46	27	79	54	-
	4	100	100	100	81	86	76	100	100	100	43	50	39	64	46	32	80	59	-
Captaf	1	76	77	74	47	63	71	72	69	75	65	64	65	66	75	87	90	83	-
	2	76	76	75	52	66	74	72	70	77	65	63	72	66	78	80	90	86	-
	3	76	77	78	63	78	82	72	72	84	65	59	62	66	78	83	90	92	-
	4	76	77	82	60	73	79	72	76	87	65	64	68	66	78	80	90	92	-
Thiride	1	100	100	100	81	81	81	72	84	88	65	65	76	66	84	84	90	83	-
	2	100	100	100	96	98	96	72	84	88	65	77	78	66	78	84	90	86	-
	3	100	100	100	96	98	97	72	84	88	65	65	78	87	94	94	90	86	-
	4	100	100	100	96	98	98	72	84	88	93	97	97	87	94	94	90	92	-
Contaf	1	100	100	100	100	100	100	45	79	88	100	100	100	70	74	76	100	100	-
	2	100	100	100	100	100	100	100	100	100	100	100	100	70	77	81	100	100	-
	3	100	100	100	100	100	100	100	100	100	100	100	100	70	77	81	100	100	-
	4	100	100	100	100	100	100	100	100	100	100	100	100	70	75	82	100	100	-
Calixin	1	76	88	81	80	90	92	77	89	92	76	88	84	66	83	78	100	100	-
	2	76	88	86	80	90	92	77	89	92	76	88	87	66	83	84	100	100	-
	3	76	88	86	80	90	92	77	89	92	76	88	87	66	83	84	100	100	-
	4	76	88	87	100	100	100	100	100	100	76	88	88	66	83	88	100	100	-
Aureofun- gin-sol	1	66	79	81	92	96	97	87	93	94	20	17	56	51	44	53	100	100	-
	2	66	77	79	100	100	100	87	93	94	53	31	58	51	49	57	100	100	-
	3	93	100	100	100	100	100	87	93	97	53	31	57	80	91	94	100	100	-
	4	93	100	100	100	100	100	100	100	100	91	95	93	80	91	94	100	100	-
Aureofun- gin-sol + Copper sulphate	1	66	48	50	92	96	97	68	83	92	20	32	44	51	45	40	100	100	-
	2	80	87	82	100	100	100	87	93	97	53	32	55	51	51	45	100	100	-
	3	93	97	98	100	100	100	87	93	97	53	45	55	51	59	53	100	100	-
	4		100	100	100	100	100	100	100	100	100	53	76	67	51	78	59	100	100

* Mean of 5 plates/fungus/concentration.
 ** Designated core pathogens of leaf rot.
 *** Observations limited at 4th day with full growth of the fungus in control petri dishes.

TABLE 3

Mean *in vitro* growth inhibition of leaf rot fungus by fungicides *

Fungicides	Mean percent growth inhibition of different fungi						C.D. at 5% level for Fungicide x Fungus interaction
	<i>C.gloeo- sporioides</i>	<i>E. rostra- tum</i>	<i>G. vermoe- seni</i>	<i>F. sol- ani</i>	<i>F. moni- liforme</i>	<i>T. para- doxa</i>	
<u>2nd Day:</u>							
Indofil M-45	75.0	100.0	100.0	77.8	64.0	100.0	10.3
Fytolan	100.0	81.0	100.0	38.0	64.0	79.5	
Captaf	76.0	55.5	72.0	65.0	66.0	90.0	
Thiride	100.0	92.3	72.0	72.0	76.5	90.0	
Contaf	100.0	100.0	86.3	100.0	70.0	100.0	
Calixin	76.0	85.0	82.3	76.0	66.0	100.0	
Aureofungin-sol.	79.5	98.0	90.3	54.3	65.5	100.0	
Aureofungin-sol. + Copper sulphate	84.8	98.0	85.5	44.8	51.0	100.00	
<u>4th Day:</u>							
Indofil M-45	75.0	100.0	100.0	77.5	77.3	100.0	10.6
Fytolan	100.0	84.0	100.0	47.3	38.0	58.8	
Captaf	76.8	70.0	71.8	62.5	77.3	88.3	
Thiride	100.0	93.8	84.0	76.0	87.5	86.8	
Contaf	100.0	100.0	94.8	100.0	75.8	100.0	
Calixin	88.0	92.5	91.8	88.0	83.0	100.0	
Aureofungin-sol.	89.0	99.0	94.8	43.5	68.8	100.0	
Aureofungin-sol. + Copper sulphate	83.0	99.0	92.3	46.3	58.3	100.0	
* Mean of four concentrations.							

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Mathew, Principal Scientist for analysis of data.

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