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Research Articles

GANODERMA DISEASE OF ARECANUT PALM— ISOLATION, PATHOGENICITY AND CONTROL

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ABSTRACT

'Foot rot' or 'Anabe' disease caused by *Ganoderma* spp. is widespread in arecanut plantations in Karnataka causing often serious damage. Annual loss of 4.71% palms has been estimated due to this disease. The fungus could be isolated from freshly affected stem piece/sporophores using Waksman's agar medium. Sporophore or bracket formation was noticed when the cultures grown on sand-maize medium were kept for more than 2½ to 3 months. Disease symptoms appeared within 8–9 months from the time of inoculation in healthy arecanut palms. The fungus could be reisolated from the affected portions, thus proving pathogenicity of *Ganoderma* on arecanut.

Disease spread is through root-to-root contact and is more in irregularly planted or closely spaced arecanut gardens as compared to wider spaced gardens. It is necessary to isolate the diseased palm by digging trenches around. Field trials have indicated that drenching the base of the palm with Captan/Bavistin at 0.3% concentration was effective in preventing the spread of the disease to the neighbouring palms.

INTRODUCTION

'Anabe' disease means a disease caused by bracket forming fungus. The disease is also known as 'foot rot', 'root rot' or betelnut plague. The symptoms were described by Venkatarayan, 1936. The initial visible symptom is yellowing of outer whorl of leaves. The yellowing gradually extends to the inner whorls. The affected leaves later droop down. The bearing capacity is gradually affected. The affected palms exhibits a dull brownish patch at the base of the trunk from which a brownish gummy juice comes out. The fruiting body or 'anabe' of the fungus develops after the death of the palm. The disease was reported from Karnataka, Tamil Nadu, Kerala, Assam and Bengal (Sharples, 1928). *Ganoderma* disease on arecanut is found to be severe in ill drained, overcrowded gardens (Venkatarayan, 1936). The fungus has a wide host range like coconut, tamarind, jack, mango, cassia, khair (Venkatarayan, 1936; Bakshi, Reddy and Sujan Singh 1976), oil palm, tea, cocoa, rubber etc. (Verghese, Chew and Hussain, 1987).

Venkatarayan (1936) reported the causal organism as *Ganoderma lucidum* (Leys) Karst. But later on, the disease could not be reproduced by inoculation of the fungus (Anonymous 1973; 1974). Earlier workers had made recommendations of many chemicals and fungicides

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for the disease control based on *in-vitro* and field studies (Venkatarayan, 1936; Nair and Rao, 1965; Nambiar and Nair, 1974). Koti Reddy and Saraswathy(1976) found that Benomyl, Thiram and Difolatan were most effective as soil drenches when the soil moisture is about 100%. Hence, with a view to filling up the existing gap this work was taken up. The results on the isolation, pathogenicity and control of the fungus are reported in this paper.

MATERIALS AND METHODS

1. *Isolation of the fungus*

Isolation of the fungus was attempted from fruiting bodies, affected stem portions and roots of affected palm using Waksman's agar. The plates were incubated at 28–30°C. The isolate selected for pathogenicity test was obtained from the fruiting body of the fungus.

2. *Loss*

An assessment was made during 1978–82 in 5 selected gardens (located in five different villages) on the number of palms affected and lost due to the disease. Observations were recorded annually on the total number of existing palms in respective gardens. The total number of palms in different gardens varied from 114 to 480.

3. *Pathogenicity trials*

The following six methods of inoculation were attempted for the pathogenicity studies:

i. *Stump inoculation method:* In this a healthy stump was planted beside a healthy palm and these stumps were inoculated by boring hole of 1 cm diameter and 4-5 cms depth in the stem, just above the bole region and the mycelial mat placed inside the bore hole which was plugged later with cotton wad.

ii. *Planting diseased stump:* In this a diseased stump was planted beside a healthy palm taking care that the roots of the affected stump are in contact with the roots of healthy palm.

iii. *Stem inoculation method:* A hole of 1 cm diameter and 4-5 cms depth was bored in the stem of healthy palm just above the bole region and the inoculum was introduced into the stem and plugged with cotton wad.

iv. *Stem insertion method:* A diseased stem piece was inserted into the healthy stem in which a hole was made as mentioned above.

v. *Root inoculation:* Five to six healthy roots all around were exposed and the selected roots were dipped in the inoculum after making a cut at the root tip.

vi. *Soil inoculation:* In this method the inoculum was grown on sand-maize medium for 6–8 weeks and was mixed up with the soil at the root zone. Under field conditions palms of 18–20 years of age and seedlings of 2–3 years age under pot culture experiments, were tested for pathogenicity tests conducted at the CPCRI Research Centre, Hirehalli. Isolation trenches were dug around the treated palms to avoid root contact from the neighbouring palms.

4. *Control*

i. *Cultural method:* To control lateral spread of the disease, 28 cm wide

and 45 cm deep isolation trenches were dug out around the affected palms to contain the disease to the palms of initial infection and to avoid root-to-root contact. This was done in 2 selected gardens and in 3 other gardens where no trenches were made.

ii. *Chemical method:* Gardens located in four different villages were selected to study the efficacy of different chemicals in controlling *Ganoderma* disease under field conditions. Diseased palms surrounded by 6–8 apparently healthy palms in these gardens were marked out and chemicals were applied to these palms @ 10 lit. per palm at quarterly intervals. Following chemicals were tested: Captan, Thiram, Difolatan, Cuman, Dithane Z–78 and Bavistin at 0.3% and Vitavax at 0.2%.

RESULTS AND DISCUSSION

1. *Isolation*

The percentage of positive isolation of *Ganoderma* from freshly infected stem pieces, freshly formed sporophores and the roots immediately below the zone of sporophore formation was 50, 20 and 75 respectively.

2. *Loss due to* anabe

The data on the mortality of palms due to the disease over a period of 4 years (Table I) showed that percentage of palms lost due to the disease varied from 15.9% to 20.1% with an average mortality of 18.8% or 4.7% annually.

3. *Pathogenicity*

In about 6 months time, reddish brown pin head size spots appeared at the base of the trunk in treated palms. These spots later enlarged and coalesced to form reddish brown patches in about 7 months from the time of inoculation. Within another 2 to 3 months time, this was followed by bending and drooping of the outer whorl of leaves and yellowing of the crown in method 2 (planting diseased stump) and method 3 (stem inoculated palms). Pathogenicity tests were positive with method 2 (6 out of 8 palms), method 3 (2 out of 4 palms) and method 4 (3 out of 4 palms). Re-isolation of *Ganoderma* from infected tissues confirmed pathogenicity to that host.

Venkatarayan (1936) attempted pathogenicity of *Ganoderma* spp. on

Table I. *Mortality of arecanut palms due to* Ganoderma *infection over a period of 4 years*

Villages	No. of palms observed from 1978	Mortality of palms during				Palms lost in 4 years	Percentage
		1979	1980	1981	1982		
Kyathasandra	238	9	10	9	10	38	15.96
Hirehalli	214	10	12	10	11	43	20.09
D. Hosahalli	114	6	5	6	5	22	19.30
Chikkahalli	201	8	10	10	8	36	17.91
Singanahalli	480	24	26	22	24	96	20.00
Total	1247	57	63	57	58	235	18.84*

* Average per year: 4.71%

Table II. *Effect of isolation trenches on the spread of the disease*

Villages	No. of anabe affected palms at the start of experiment		No. of healthy palms	No. of fresh infections in 1981	% loss	Average loss per year
Kyathasandra*	T	32	265	5	1.9	0.48
Singanahalli**	T	52	203	6	2.9	0.97
Hirehalli*	NT	15	78	11	14.1	3.50
D. Hosahalli*	NT	10	64	12	18.7	4.70
Chikkahalli*	NT	31	156	28	17.9	4.50

T = Trenches were dug in these gardens
NT = No trenches were made (control)
* Initiated in 1977
** Initiated in 1978

arecanut palm by root inoculation technique. Out of 55 palms inoculated, one palm showed disease development in about 5 months time. The larger amount of inoculum present in inoculation methods 2 and 4 might have resulted in higher percentage of infection (Navaratnam, 1964).

4. *Control*

i. *Cultural method:* A study conducted for over 4 years has shown that isolation of the affected palms by trenches helped in reducing the infection to 0.72% as against 4.23% fresh infections per annum in gardens with no such trenches (Table II). This indicated that lateral spread of the disease can be checked by making isolation trenches around the affected palms thus limiting the root–to–root contact. This method thus helps in controlling the disease to the original zone of infection. Bakshi et al (1976) working on *Ganoderma* root rot of khair, found that trenching helped in preventing further spread of the disease.

ii. *Chemical control:* The fungicidal control trial showed that drenching the basins with Captan or Bavistin at 0.3% concentration was effective in preventing the spread of the disease (Table III).

Table III. *Effect of fungicides on the control of anabe disease of arecanut*

Chemical and concentration	No. of palms affected initially	No. of surrounding palms treated (1978)	No. of palms showing fresh infection at the end of the observation (1982)	Percentage of fresh infection
Captan (0.3%)	4	24	1	4.1
Vitavax (0.2%)	4	26	5	19.2
Thiram (0.3%)	4	20	3	15.0
Difolatan (0.3%)	4	25	3	12.0
Cuman (0.3%)	4	20	5	25.0
Bavistin (0.3%)	4	20	2	10.0
Dithane Z–78 (0.3%)	4	18	4	22.0
Control	4	16	6	37.5

As a prophylactic measure, the basins of apparently healthy palms surrounding the affected palm should be treated with the chemical to prevent further infection of the disease.

However, for effective check of disease spread, an integrated approach comprising phytosanitary, cultural and chemical methods is imperative as opined by Verghese et al (1987).

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