A study on the Stem bleeding disease of Coconut in Palakkad district of Kerala

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Abstract

Stem bleeding incidence was high in Eruthempathi, Vadakarapathi, Kozhijampara, Nallepalli, Perumatti, Pattancheri and Ozhalapathi areas of Palakkad district. On close observation, it was noticed that the number of palms with stem bleeding incidence was higher in the plots with waterlogged condition compared to other plots. Stem bleeding incidence was found to be high in palms below the age of 20 years. Percentage of palm mortality was high in the case of palms belonging to the age group of 15 - 20 years in all places surveyed. Disease index calculated for quantify the disease incidence showed that the attack is moderate with disease index between 2.39 and 8.01. The palms with more disease index showed low yield. Testing of the soil from stem bleeding affected gardens revealed that all the palms showing the stem bleeding incidence have high content of P and K. Most of the healthy and the stem bleeding affected palms in the disease prone areas have lot of growth cracks on the stem. The pathogen enters through these growth cracks or wounds. The growth cracks may develop after sudden heavy manuring, thrash burning at the base of the palm or injury made during tractor ploughing etc. cause damage to the palms paving way for infection. Isolation of the causal organism from stem bleeding samples yielded 11 Thielaviopsis paradoxa isolates. Conidia of these isolates were hyaline, cylindrical, apex and base truncate, and thin walled, 7.73 - 5.07 x 3.02 - 4.22 µm formed enterogenously. Chlamydosprores thick walled, brown in chain of 4 - 6, remain intact for long time and resembles as multiseptate conidia and ranged from 12.64 - 7.61 x 5.6 - 3.2 µm

Stem bleeding disease is a debilitating disease of coconut which is prevalent in almost all coconut growing areas of the country causing considerable economic loss. Although several types of stem bleeding are reported in coconut the commonly noticed stem bleeding disease is caused by a soil borne fungus Thielaviopsis paradoxa (de seynes) Von Hohnel.

1. Introduction

Stem bleeding disease is a debilitating disease of coconut which is prevalent in almost all coconut growing areas of the country causing considerable economic loss. The disease is popularly known as "chennir olikkal" or "kara olikkal" in Malayalam, "Raktha kariroga" in Kannada. Although several types of stem bleeding are reported in coconut the commonly noticed stem bleeding disease is caused by a soil borne fungus *Thielaviopsis paradoxa* (de seynes) Von Hohnel. Involvement of *T. paradoxa* as the primary causative agent of the

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disease has been established (Nambiar *et al.*, 1986). The fungus infects coconut stem through growth cracks or wounds that generally occur on the stem at the base and as a result a reddish brown liquid oozes from the lesions giving the bleeding appearance. Slowly the infection spreads upwards and also laterally leading to the formation of extensive bleeding patches on the surface of the stem along with internal decay of cortical tissues. The affected palm shows gradual decrease in the yield, as the disease progresses. In the advanced stages, stem apex gradually taper and the crown size gets reduced. Limited surveys conducted on disease incidence in different parts of the country indicate an incidence of 8.8% in some parts of Kerala. *T. paradoxa* is a soil borne fungus and enters the coconut stem tissues through growth cracks/ injuries and multiplies in the infected tissues producing two types of spores, viz; endoconidia (phialospores) and chlamydospores (Petch, 1906). The chlamydospores are able to survive in the soil to tide over unfavourable conditions. These spores again germinate producing mycelium which is capable of infecting the host.

2. Material and Methods

2.1. Survey

Restricted survey was conducted in different coconut growing tracts of Palakakd districts of Kerala, based upon the information collected from the office of Assistant Director of Agriculture, Palakkad. In the survey, type of cropping system, soil type, the age group of diseased palms and the extent of stem bleeding incidence in coconut gardens were noted. Disease incidence was computed by using the formula,

$$\text{Disease incidence (\%)} = \frac{\text{No. of palms infected}}{\text{No. of palms observed}} \times 100$$

For quantifying the severity of the disease, a disease index formula by Jacob Mathew *et al.*, (1989) was used. Disease severity = 1.8 'l' + 4.3 't' where 'l' is the lesion size, expressed in 1000 cm^2 and 't' is the score of tapering of the stem.

2.2. Collection of samples

A total of 52 samples were collected from stem bleeding affected gardens for the isolation of the stem bleeding causal organism. These samples were mainly consisting of bark tissues. The samples were collected in fresh polythene bags and brought to the laboratory for the isolation of the causal organism of stem bleeding. Bark samples were collected by chiseling the bark at the region of lesion as identified by the presence of bleeding symptoms.

2.3. Isolation of the causal organism

Coconut bark tissues showing typical symptom of stem bleeding were thoroughly washed in running water. Tissues from the advancing margins of the lesions showing initial stage of infection were used for the isolation of the fungus. Pieces of 5 x 5mm size, of infected tissues were cut with sterile scalpel from the advancing margin of the lesion and were surface sterilized by 70% ethyl alcohol and inoculated in 90 mm dia. petri plates containing Potato Dextrose Agar (PDA) medium. These plates were incubated in the dark at 24 ± 1°C. Characteristic growth of *T. paradoxa* obtained on the third day was sub cultured and maintained on PDA slopes. Pure cultures of each isolates of fungi were maintained on PDA slants with appropriate labels for further use.

2.4. Studies on the variability with regard to cultural and morphological characteristics

Cultural and morphological characters of different isolates of the fungus collected from stem bleeding affected palms were studied for characterization. Petri plates of 90mm dia. containing 15 ml Potato Dextrose Agar (PDA) were used for all the studies on cultural and morphological characters.

2.4.1. Colony morphology

All the isolates were inoculated centrally on PDA plates and incubated in the dark at 24 ± 1°C for three days. Three replicates were maintained for each isolate. Colony morphology was examined against black background.

2.4.2. Growth rate

PDA plates were inoculated at the centre with a 5mm dia. mycelial disk taken from the periphery of a three day old culture on PDA medium and incubated in the dark at 24 ± 1°C. Colony diameter was measured three days after incubation. Colony diameter was measured at right angles to each other for calculating radial growth.

2.4.3. Morphology of conidia and chlamydospores

To produce spore all the fungal isolates were grown on PDA for first three days at 24 ± 1°C. Then cultures were incubated under continuous light for eight days. Three replicate plates were

maintained for each isolate 5 x 5mm mycelial discs cut from the highly sporulating part of the culture were gently immersed in a drop of cotton blue lacto - phenol stain on a glass slide. Ten such slides were observed for each isolate to find out the morphology of the spores.

3. Results and discussion

3.1. Survey

Survey on stem bleeding incidence in coconut plantations in different parts of Palakkad district of Kerala revealed that there is a variation in stem bleeding incidence. Stem bleeding incidence was high in Eruthempathi, Vadakarapathi, Kozhijampara, Nallepalli, Perumatti, Pattancheri and Ozhalapathi as compared to other places surveyed (Table-1).

3.2. Age group of palms in relation to disease incidence

On close observation, it was noticed that the number of palms with stem bleeding incidence was higher in the plots with waterlogged condition compared to other plots. Stem bleeding incidence was found to be high in palms below the age of 20 years. Percentage of palm mortality was high in the case of palms belonging to the age group of 15 - 20 years in all places surveyed. Table-2 shows the per cent palm mortality under various age groups. Palms in the age group of 10-20 years were found to be more susceptible and showed more internal decay compared to 45-60 year old palms.

3.3. Disease occurrence and losses

The characteristic tapering of the trunk, reduction in the yield all appeared two years after the development of external lesion. Disease index calculated for quantify the disease incidence showed that the attack is moderate with disease index between 8.01-2.39. The palms with more disease index showed low yield. Most of the gardens were well managed so that the tapering can be observed only when the palms were in the advanced stage of the disease (Table -3).

Table 2. Age group of palms in relation to disease incidence

Districts	% of disease incidence in age group (years) of				
	<5	5-10	10-15	15-20	>20
Eruthempathi	7.99	6.39	10.5	75.14	-
Vadakarapathi	4.43	3.02	6.85	85.68	-
Kozhijampara	0.93	3.73	4.43	90.19	1.40
Naleepalli	16.66	-	-	83.33	-
Perumatti	13.3	-	20.0	66.66	-
Pattancheri	12.5	-	-	62.5	25.0
Ozhalapathi	-	9.69	30.43	59.13	-
Ayyanchalla	-	16.67	33.33	50.0	-
Mundur	-	-	50.0	50.0	-
Alathur	-	-	100	-	-

Radha (1962) reported that undue fluctuation in soil reaction and moisture or ill drained soil conditions could cause severe stem bleeding disease leading to death of palms. Salgado (1942) reported ill drainage and hard lateritic pan formation led to crippled root growth, imbalance mineral nutrition or other physiological disorders in palms. Although affected palms initially appeared healthy, the internal decay progressed rapidly and slight discolouration externally hide extreme internal rotting.

3.4. Soil type

Soil type in the stem bleeding affected gardens was red loam. Usman (1988) reported that maximum survival of the chlamydospores was seen in the red loam soil. Testing of the soil from

Table 1. Stem bleeding incidence in Palakkad recorded in restricted survey during the year 2009-2010

Locations	No. of plots surveyed	Total number of palms observed	Number of palms with Stem bleeding	% of disease incidence
Eruthempathi	22	1136	38	3.34
Vadakarapathi	21	857	46	5.36
Kozhijampara	16	1125	28	2.48
Naleepalli	18	1315	25	1.90
Perumatti	38	2158	42	1.94
Pattancheri	29	1928	15	0.77
Ozhalapathi	14	815	10	1.22
Ayyanchalla	20	1156	15	1.29
Mundur	20	1398	2	0.14
Alathur	14	1567	1	0.06

Table 3. Disease index and nut yield in stem bleeding affected coconut palms

Locality	Mean disease index	Mean Nut yield/ palm-1 /year-1
Eruthempathi	8.01	31
Vadakarapathi	7.09	32
Kozhijampara	5.69	34
Naleepalli	4.27	36
Perumatti	2.39	40
Pattancheri	3.58	37
Ozhalapathi	3.46	38
Ayyanchalla	2.44	40

stem bleeding affected gardens revealed that all the palms showing the stem bleeding incidence have high content of P and K (Table-4). Based on the results of fertilizer trails Potty and Radakrishnan (1978) reported that increased level of phosphorous and potassium tends to increase the incidence and application of nitrogen at the rate of 0.3 Kg reduced the infection by 44 %, though further increase in the dose did not have impact on the disease incidence.

Table 4. Soil test data of stem bleeding affected gardens

Locality	Soil type	p H	Level of Major Micro nutrients		
			N (%)	P kg /ha	K kg /ha
Eruthempathi	Red loam	5.6	Average (1.5)	High (35)	High (400)
Vadakarapathi	Red loam	5.8	Average (1.05)	High (25.4)	High (400)
Kozhijampara	Red loam	5.6	Average (0.72)	High (25.8)	High (400)
Naleepalli	Red loam	5.8	Average (0.86)	High (35)	High (400)
Perumatti	Red loam	5.9	Average (1.5)	High (35)	High (400)
Pattancheri	Red loam	6.2	Average (1.05)	High (25.4)	High (400)
Ozhalapathi	Red loam	6.5	Average (1.21)	High (35)	High (400)
Ayyanchalla	Red loam	6.5	Average (0.74)	High (26.6)	High (367)

3.5. Growth cracks on the stem

Most of the healthy and the stem bleeding affected palms in the disease prone areas have lot of growth cracks on the stem. The pathogen enters through the growth cracks or wounds. The growth cracks may develop after sudden heavy manuring, thrash burning at the base of the palm or injury made during tractor ploughing etc. cause damage to the palms paving way for infection. In most of the affected gardens flood irrigation was practiced which causes the spread of the disease through water.

3.6. Isolation of the causal organism

Isolation of the causal organism from stem bleeding samples yielded 11 *T. paradoxa* isolates. Out of the isolates collected, 4 of them were from Eruthempathi 3 were from Pattancheri, 2 were from Ozalapathi, and 1 isolate each from Vadakarapathi and Perumatti. All the 11 isolates collected were isolated from bark tissues. These isolates were obtained from both monocropping and mixed cropping systems, 6 were obtained from coconut monocropping system, 3 were from Coconut + Arecanut mixed cropping system and 2 from Coconut + Arecanut + Black pepper mixed cropping system. Details of isolation *T. paradoxa* and isolates obtained are given in Table-5

Table 5. Details of *T. paradoxa* isolates obtained from stem bleeding samples of coconut

Isolate number	Locality	Cropping system
Tp1	Eruthempathi	Coconut monocrop
Tp2	Eruthempathi	Coconut monocrop
Tp3	Eruthempathi	Coconut + Arecanut
Tp4	Eruthempathi	Coconut + Arecanut + Black Pepper
Tp5	Pattancheri	Coconut monocrop
Tp6	Pattancheri	Coconut + Arecanut
Tp7	Pattancheri	Coconut monocrop
Tp8	Ozalapathi	Coconut + Arecanut + Black Pepper
Tp9	Ozalapathi	Coconut monocrop
Tp10	Vadakarapathi	Coconut monocrop
Tp11	Perumatti	Coconut + Arecanut

3.7. Cultural and morphological characteristics

Colony of all the isolates was effuse, initially white and later become grey. Mycelium is well developed branched, smooth and hyaline. Some of the isolates emitted fruity (Pineapple) smell. All the isolates produced dimorphic asexual spores, viz., conidia and chlamydospores. Conidiophores were simple, septate, unbranched hyaline subtended by sub cylindrical conidiogenous cells. Conidia are hyaline, cylindrical, apex and base truncate, and thin walled, 7.73 - 5.07 x 3.02 - 4.22 µm formed enterogenously. Chlamydosprores thick walled, brown in chain of 4-6, remain intact for long time and resembles as multiseptate conidia and ranged from 12.64 - 7.61 x 5.6 - 3.2 µm (Table-6).

4. Conclusion

Survey on stem bleeding incidence in coconut plantations in different parts of Palakkad district of Kerala revealed that disease incidence was high in Eruthempathi, Vadakarapathi, Kozhijampara, Nallepalli, Perumatti, Pattancheri and Ozhalapathi as compared to other places surveyed. On close observation, it was noticed that the number of palms with stem bleeding incidence was higher in the plots with waterlogged condition compared to other plots. Stem bleeding incidence was found to be high in palms below the age of 20 years. Percentage of palm mortality was high in the case of palms belonging to the age group of 15 - 20 years in all places surveyed. Disease index calculated for quantify the disease incidence showed that the

Table 6. Morphology of conidia and chlamydospores of *T. paradoxa* isolates

Isolates	Conidia				Chlamydospore			
	Length (µm)		Breadth (µm)		Length (µm)		Breadth (µm)	
	Mean	CV%	Mean	CV%	Mean	CV%	Mean	CV%
Tp1	7.26	15.26	3.02	11.82	10.20	13.92	5.6	32.76
Tp2	5.07	20.70	3.94	11.50	8.64	17.48	3.28	30.50
Tp3	5.10	14.88	4.22	18.40	7.61	15.82	4.85	31.51
Tp4	5.90	12.42	3.70	10.02	11.83	16.70	3.60	35.08
Tp5	5.40	21.55	3.38	9.72	12.64	16.24	4.45	37.29
Tp6	6.01	16.39	3.54	10.79	13.84	20.16	3.28	30.50
Tp7	6.42	20.06	3.48	12.92	12.64	18.04	4.25	34.59
Tp8	6.25	13.84	3.05	11.11	9.56	14.23	3.96	48.92
Tp9	7.73	12.10	3.12	10.39	11.70	15.02	3.57	34.88
Tp10	5.08	19.39	3.47	16.82	12.66	20.89	3.28	45.35
Tp11	7.09	11.16	3.47	12.45	10.64	12.31	4.54	39.96

attack is moderate with disease index between 2.39 -8.01. Testing of the soil from stem bleeding affected gardens revealed that all the palms showing the stem bleeding incidence have high content of P and K. Most of the healthy and the stem bleeding affected palms in the disease prone areas have lot of growth cracks on the stem. The pathogen enters through the growth cracks or wounds. The growth cracks may develop after sudden heavy manuring, thrash burning at the base of the palm or injury made during tractor ploughing etc. cause damage to the palms paving way for infection. In most of the affected gardens flood irrigation was practiced which causes the spread of the disease through water. Isolation of the causal organism from stem bleeding samples revealed the presence of *T. paradoxa.*

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Health Benefits of Coconut Milk

Coconut milk is the main ingredient of most curry recipes and coconut is a digestible food that is very helpful in nourishing the glandular system. Coconut milk has many uses and, in general, is great in helping to build up your immune system and your body's defenses.

"Half the medium-chain fatty acids in coconut milk are composed of lauric acid, which is anti-viral, anti-bacterial, anti-microbial and anti-fungal. Coconut milk can help boost the immune system." It also "contains many vitamins, minerals and electrolytes, including potassium, calcium and chloride."

Additionally, though it is high in saturated fat, coconut milk can help you to lose weight. "The saturated fat in coconut is made up of short-chain and medium-chain fatty acids the body quickly turns into energy instead of storing as fat. Therefore coconut can aid in weight loss." *(http://eatdrinkbetter.com)*

Source: The Cocommunity