On the Mechanism of Spore Dispersal in *Phytophthora arecae*, the causal organism of 'Koleroga' of Arecanut

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Abstract

The fruit rot or Koleroga caused by Phytophthora arecae occurs in epidemic proportions during south west monsoon season. The secondary spread of the pathogen is by sporangia produced abundantly on the infected fruits. To study the dispersal of sporangia, Hirst volumetric spore trap, bidirectional and multidirectional splash traps were used. The sporangia were liberated and spread mainly by rain splashes.

Introduction

Fruit rot of arecanut commonly known as *Koleroga* or *Mahali* caused by the fungus *Phytophthora arecae* (Coleman) Pethybridge occurs as an epidemic during the south west monsoon from June to September in southern India. The secondary spread of the epidemic is by sporangia which are produced abundantly on the infected fruit surface. The mechanism of sporangial dispersal is passive and appears to be dependent on rain drops. The present studies were undertaken to get an understanding on the mechanism of spore dispersal and spread of the disease.

Materials and Methods

The studies were carried out in an unsprayed areca plot situated in the midst of CPCRI farm at Vittal, Dakshina Kannada by using spore traps. The splash borne nature of the sporangia was studied in the laboratory by allowing water droplets to fall from a height of 7.5m on infected sporulating areca fruits and the resultant splashed droplets collected on slides and observed for the presence of sporangia. Hirst volumetric spore trap (24 h recorder) was set up at a height of 7.5m at the crown level to collect the air spores. Splash traps were made out of galvanised iron sheets based on J. M. Waller's Model (Waller, 1972; Rajasab et al., 1979). Two types of splash traps viz., multidirectional and bidirectional were used. The multidirectional traps are cylindrical in structure with a diameter of 12 cm and length of 15.5 cm with a roof to prevent the direct falling of rain water. This was supported by a funnel which drains water from the cylinder into a collection tube. The entire structure was fixed to the areca palm. The bidirectional trap is a rectangular plate of 15cm × 10cm with a narrow strip of galvanised iron sheet at the sides which drains into a collection tube. These were fixed to wooden poles and installed at 3m, 4.5m and 6m height in the field. The multidirectional traps were fixed at 7.5 m adjascent to the crown of the palm. The water

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collected in the tubes was centrifuged at 1200 rpm for 5 min, the supernatant discarded, the sediment with 1 ml of water was obtained and observed for the presence of sporangia. The number of sporangia present was quantified using a haemocytometer. The slides collected from the Hirst volumetric spore traps were examined for the presence of *Phytophthora* sporangia.

Results and Discussion

In the laboratory studies on the splash dispersal it was observed that the water droplet falling on the sporulating fruit surface, after the impact, breaks into smaller droplets and splashes. During this process it liberates and carries the sporangia present on the fruit surface. These droplets were collected on slides and the number of sporangia present was counted (Table 1). The first droplet did not liberate any sporangia, but the subsequent droplets carried the sporangia. The number of sporangia liberated reduced gradually after 11th droplet.

Splash water collected from all the splash traps were examined for the presence of sporangia. There were no sporangia from the water collected from splash traps installed at 3m and 4.5m. Sporangia were observed in the splash water collected from the bidirectional splash trap installed at 7.5m. The number of sporangia caught on these traps, collected during first day to fifth day of August, 1981 are presented in Table 2. During this period there was maximum incidence of the disease. There was no sporangia in the slides obtained from the Hirst volumetric spore trap. This indicates that the sporangia are liberated and dispersed mainly through rain water.

Table 1. Number of sporangia liberated through water droplet (mean of 4 observations)

Droplet No.	No. of sporangia	Droplet No.	No. of sporangia
1	—	9	20
2	11	10	12
3	29	11	12
4	26	12	11
5	23	13	9
6	20	14	9
7	20	15	4
8	21		

Table 2. Number of sporangia caught in the splash traps

Splash Trap No.*	Ht. of observation (m)	Qty. of water collected (ml)	Sporangia present/mm3
1	6	50	20
2	6	45	10
3	6	60	30
4	7.5	55	70
5	7.5	50	200
6	7.5	75	150
7	7.5	45	120
8	7.5	50	160
9	7.5	40	110
10	7.5	35	170

* 1-3 bidirectional splash traps
4-10 multi-directional splash traps

The disease is reported to spread rapidly during the period of alternate sunshine and rain (Coleman, 1910; Nambiar, 1956). Since the fungus requires sunlight for the production of sporangia, a short period of bright sunlight would induce sporulation and the subsequent rains help in spreading the sporangia which results in the rapid spread of the disease. Thus the fungus requires the help of falling rain water for the liberation and dispersal of the sporangia.

References

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Discussions

PM Gowda:

Is there any radial dispersal of sporangia of *P. arecae* when there is no rainfall?

M Anandaraj:

There is no radial spread when there is no rainfall.

RN Brahma:

Could you collect sporangia from the dew drops which may also have role in dispersal?

M Anandaraj:

During south west monsoon season it rains throughout the season. There is no dew formation. When there is dew formation in November - December there is no incidence of the disease.

Abi Cheeran:

Having deciduous sporangia there is a possibility for dispersal of sporangia by air current and this cannot be ruled out. Please clarify the point.

M Anandaraj:

The Hirst volumetric spore trap was installed at a height of 7.5 m in an unsprayed garden and there was incidence of disease in this garden. The absence of sporangia in the slides of Hirst trap and its presence in splash trap indicates the dependence on rain water for dispersal.