

STUDIES ON THE SOFT ROT OF GINGER (*ZINGIBER OFFICINALE* ROSE)
CAUSED BY *PYTHIUM APHANIDERMATUM* (EDSON) FITZ.*

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Soft rot of ginger is a very serious disease in all ginger growing tracts of India more particularly in Kerala. In exceptionally wet years the loss due to the disease may be as high as 80% (Ramakrishnan, 1949) *Pythium aphanidermatum* (Edson) Fit, *Pythium myriotylum* Dreschler and *Pythium Veans* de Bary have been reported as incitants of this disease. Of these the occurrence of *Pythium Veans* is limited to areas of high altitude (Ramakrishnan, 1949). In view of the importance of the disease on ginger detailed studies were taken up and the results are presented in this paper.

Materials and Methods

Pythium spp. were isolated from the soils of the college farm and the pathogenicity of the isolates were tested on ginger. Inoculation studies were conducted on germinating buds of rhizomes, on mature rhizomes and on young plants. Twenty one varieties of ginger were screened for their susceptibility to the disease.

The agar block technique adopted by Rangaswami (1958) was employed for the isolation of *Pythium* spp. Preliminary pathogenicity tests were conducted on buds of sprouting rhizomes of the exotic variety Rio-de-Jeneiro. Pieces of the rhizomes of this variety were kept under moist conditions to induce sprouting. Actively growing buds were inoculated with a 48 hour old culture of *Pythium* spp. with and without injury. Three sets of buds were inoculated and were incubated under moist condition and under room temperature for 4 days. For the experiment with mature rhizomes, the rhizomes were cut into pieces and holes were made on the centre portion of the pieces in which 48 hr old culture of *Pythium aphanidermatum* was placed. For inoculation without tissue puncture the inoculum was kept on the intact outer rind of the rhizomes and it was covered with moist cotton. Sufficient moisture was provided and the pieces were incubated at room temperature for 4 days. In the case of pathogenicity tests on young plants six, eight, ten and twelve week old plants were used. The plants were inoculated with injury at the portion between the rhizome and pseudostem. The optimum age of the culture for inoculation studies was found by using cultures of different ages grown on Potato

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Dextrose Agar. Twenty one varieties of ginger obtained from the Horticultural Research Station, Ambalavayal were used for the investigation on disease resistance. Uniform pieces of rhizomes were inoculated with 48 hr old culture of *P. aphanidermatum* adopting tissue puncture method. The inoculated rhizomes were incubated at room temperature providing sufficient moisture for four days. The degree of rot was estimated by cutting the individual piece longitudinally and measuring the area of rotten tissue.

Results and discussion

Two isolates of *Pythium* spp. were obtained from Vellayani soil. Based on the morphological characters they were identified as *Pythium aphanidermatum* (Edson) Fitz and *Pythium debaryanum* Hesse. Of the two isolates *Pythium aphanidermatum* alone was pathogenic to ginger. This isolate produced rotting symptoms on injured as well as uninjured buds of ginger rhizomes five days after inoculation. The ability of this fungus to bring about pathogenesis on ginger was reported by Butler as early as 1907. Later various other investigators have confirmed the pathogenicity of this fungus on ginger.

The results of the inoculation studies on germinating buds and on mature rhizomes are presented in Table 1. The results indicated that the optimum age of the culture for maximum infection to be two days. Infectivity was more when buds and rhizomes were inoculated with injury. Maximum infection took place on germinating buds when inoculated with injury.

Table I. Pathogenicity studies on germinating buds and mature rhizomes of ginger

Age or culture in days	Infection percentage (Mean)			
	Without injury		With injury	
	Germinating bud	Mature rhizome	Germinating bud	Mature rhizome
1	10	-	53	43
2	20	10	93	77
3	10	-	67	63
5	-	-	57	40
7	-	-	33	23
9	-	-	13	

In pathogenicity studies on 4,6,8,10 and 12 week old plants the percentage of infected plants were seen as 86,70,56,36 and 30 respectively. The symptom expression was quicker in 4 and 6 week old plants than the rest. The relative ease with which the fungus could infect germinating

buds can be ascribed to the vulnerability of the tender tissues to the pathogen. Mature plants as well as rhizomes are not easily infected by the pathogen. This factor can be attributed to the fact that the pectolytic enzymes produced by the pathogen remaining equal in both cases, the development of disease syndrome can be more pronounced in tender portions of the host. No report is available on this aspect of the pathogen on ginger.

The results of the screening trials of the different ginger varieties are presented in table 2. All the varieties sustained varying degrees of infection. Since the variety 'Maran' showed the minimum infection it may be more suitable in disease prevalent areas.

Table 2. Susceptibility of different varieties of ginger to soft rot caused by *Pythium aphanidermatum*

Varieties	Mean percentage of infection	Varieties	Mean percentage of infection
1. Maran	12.6 (20.83)	12. Sierra Leone	41.6 (40.19)
2. Thingpuri	20. (26.49)	13. Uttar Pradesh	41.6 (43.09)
3. Narasapattam	21.56(27.54)	14. Tura	48.4 (44.05)
4. Burdwan	24.6 (29.72)	15. Vengara	49.4 (44.63)
5. Karakkal	27.0 (31.27)	16. Ernad Manjeri	49.2 (44.82)
6. Wynad Kunnamgulam	31.7 (34.27)	17. Wynad Manantody	51.0 (45.57)
7. Assam	33.0 (35.04)	18. Rio de Janeiro	57.5 (49.32)
8. Mysore	33.5 (35.36)	19. Jugijan	57.9 (49.57)
9. Thodupuzha	35.4(36.48)	20. Ernad Chernad	66.67(54.78)
10. Jorhut	38.4 (38.25)	21. China	75.0 (60.77)
11. Himachal Pradesh	40.9 (39.25)		

Transformed values are given in brackets

The data was significant at 0.01 percent level

Summary

Two species of *Pythium* were isolated from soil of the Agricultural College farm Vellayani. Of this *P. Aphanidermatum* was alone pathogenic to ginger. Its pathogenicity to young sprouts, mature rhizomes and young plants, with and without injury was assessed. Young sprouts and 4 to 6 week old plants were more susceptible. Percentage of infection was more

when tissues were inoculated with injury. Two day old culture produced maximum infection. Of the 21 varieties tested for disease resistance, the variety 'Maran' was significantly resistant.

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