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Preliminary study on the varietal resistance of Standing cane to Pine apple disease and the influence of the disease on the juice quality

by

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Introduction: Pine apple disease caused by *Ceratostomella paradoxa* do synes was for the first time noticed by Went in Java in 1893. Since then this has been reported in every sugar producing country through out the world. This is primarily a disease of the stalk. The causal organism is a wound parasite and once it invades the cane stalk it develops rapidly in the parenchyma of the tissue and destroys it. Since the cut ends of the cane setts are exposed, this explains why the disease is very commonly found in the sugar cane setts used for planting.

The occurence of this disease is not very common in the standing canes. In 1933 it was reported to have been found in the standing canes in Coimbatore by Subramaniam (L. S.) Incidence, of this disease though reported to be of rare occurence, of late it has been found in several varieties of the standing canes in some places of the sugarcane areas of this tract. The incidence varying from 3·9% to 21·8% was recorded in some varieties of the standing canes in Nellikuppam area by Subramaniam (C. L.) during the year 1955–'56.

The disease can find access on the standing canes in one of the following possible ways (1) through the crack on the rind which is the characteristic of some of the varieties (2) through the punctures or wounds caused by insects like internode borer *(Proceras indicus K.)* or by rodents like squirrels (3) through the mechanical breakages in canes. The leaves of the badly affected stalks may at times show signs of wilt; otherwise the plants exhibit no external symptoms by which the presence of the disease may be detected. The ultimate effect of this disease on the crop is that it causes drying of the stalk and this results in the reduction of the juice quality of the cane. An investigation was carried out in Philipines during 1927—'28 by Henares (H. G.) and Aurelio (C. G.) to ascertain the low sucrose

content of some of the varieties. The result of baggase and juice analysis indicated that the drop was due to extensive infection of canes by Pine apple disease.

Having found that many of the varieties of the standing canes are affected by pine apple disease to varying degress, experiments were conducted at the Central Sugarcane Research Station, Cuddalore N. T. to find out the reaction of the varieties to pine apple disease. This aspect of the disease has not been studied so far any where else. The influence of the disease on the juice quality of the canes was also carried out.

Materials and methods: The following five varieties Co. 419, Co. 449, Co. 527, Co. 658 and Co. 1001 were inoculated at the age of seven months with the culture of *Ceratostomella paradoxa* by standard plug method as adopted in the varietal resistance test to red rot. Fragments of mycelium from oats culture were inserted into the holes 6 mms. in diameter in the middle of the internodes at the seventh internode of each stalk in all the varieties. 100 canes in each variety were thus inoculated with the fungus. The canes were examined at two intervals—half the number of canes (i. e. 50 Nos.) in each variety were split open and the length of lesion was recorded after an interval of nearly two months. The remaining half were examined at the time of harvest i. e. 131 days after the canes were inoculated. Juice analysis was carried out with the canes that were examined at the time of harvest. For the sake of comparision juice analysis was also carried out with the healthy canes of each variety from the same plot.

Results: The inoculated canes were closely watched for infection. Three weeks after inoculation slight discoloration of the rind was observed at the internode where inoculation was carried out and this discoloration advanced slowly to adjacent internodes, as time advanced in all the varieties. Except in a few canes the infection did not manifest itself by symptoms, like wilting of canes till the time of harvest.

(a) Total infection at 57 days and 131 days: While recording the spread of infection the canes were divided into three lots and measurements were taken and the data were satistically analysed. The following table gives the total length of lesion at 57 days and 131 days after inoculation.

No.	Variety	Length of lesion in Cms. at 57th day	Length of lesion in Cms. at 131 days
1.	Co. 419	23	47
2.	Co. 449	26	36
3.	Co. 527	20	39
4.	Co. 658	15	19
5.	Co. 1001	22	57
	Z test at P-0'05	satisfied	satisfied
	S. E.	2·12	9·2
	C. D.	4·89	21
	Conclusion	2 : 1 : 5 : 3 : 4	5 : 1 : 3 : 2 : 4

(b) Rate of spread of infection in two periods: In the above table the spread of the infection for 57 days and 131 days was recorded. To find out whether there is any difference in the spread of the fungus in these two periods the rate of spread of infection for the first 57 days and the second 74 days (131–57) was calculated and the data statistically analysed. The following table gives the details.

S. No.	Variety	Length in Cms. 57th day	Length in Cms. 131st day	Spread in 74 days Cm. (3–2)	Spread per day in the first 57 days in Mms.	Spread per day in the second period (74 days) in Mms.
1	Co. 419	23	47	24	4·0	3·3
2	Co. 449	26	36	10	4·6	1·4
3	Co. 527	20	39	19	3·5	2·6
4	Co. 658	15	19	4	2·6	0·5
5	Co. 1001	22	57	35	3·9	4·6
	Average				3·7 mm.	2·5 mm.

Main Treatments (Spread in two periods)
Z Test satisfied at P = 0·05
S. E. = 0·33
C. D. = 0·68

Conclusion : First phase ; Second phase.
Sub treatments (Varieties)
Z Test satisfied at P = 0·05
S. E. = 0·52
C. D. = 1·08

Interaction (variety x spread in two periods)
Z Test not satisfied
S. E. = 0·7341

(c) Downward and upward spread of infection from the point of inoculation : During the recording of length of lesion caused by the fungus it was found that the spread was both upward and downward from the point of inoculation. The upward and down spread was recorded on internode basis and the details are furnished below :

S. No.	Variety	Average No. of internodes in upward direction	Average No. of internodes in the downward direction
1	Co. 419	2·9	1·4
2	Co· 449	1·8	0·8
3	Co. 527	3·0	1·4
4	Co. 658	0·7	0·4
5	Co. 1001	4·2	2·5
	Average	2·5	1·3

Main effects (i. e. upward and downward spread)
Z test satisfied
Significant at P = 0·05
S. E. = 0·11
C. D. = 0·49

Minor effects (varieties)
Z test satisfied
Significant at P = 0·05
S. E. = 0·48
C. D. = 1·02

Interaction (varieties x main effects)
Z test not satisfied at P = 0·05
S. E. = 0·68

(d) Juice quality as affected by the fungus: Juice analysis was carried out with the inoculated canes after making necessary observations at the time of harvest. Healthy canes from the same plot were analysed for juice at the same time. The table below gives the details.

Main treatments		Sub-treatments		Interactions			Difference	Significant
Treatment	C. C. S. %	Variety	C. C. S. %	Variety	Healthy	Inoculated		
Control (Healthy)	13·3	Co. 419	9·4	Co. 419	12·7	6·1	6·66	Yes
Inoculated	9·3	Co. 449	11·8	Co. 449	13·6	10·0	3·59	Yes
		Co. 527	11·9	Co. 527	13·5	10·3	3.15	No
		Co. 658	12·7	Co. 658	13·3	12·1	1·21	No
		Co. 1001	10·6	Co. 1001	13·3	8·0	5·25	Yes
Z test satisfied		Z test satisfied		Z test satisfied			For comparing healthy and inoculated within the same variety	
S. E. = 0·68		S. E. = 0·64		S. E. = 0·80			S. E. = 1·75	
C. D. = 1.75		C. D. = 1·30		C. D. = 1·63			C. D. = 3·55	
Control — Inoculated		4:3:2:5:1		Control 2:3:4:5:1				
				Inoculated 4:3:2:5:1				

(e) Relation between the length of lesion and C. C. S. %: In order to compare the reduction in C. C. S. % of the varieties, the length of lesion is brought to a unit and the reduction in C. C. S. % of the varieties are calculated as shown in the table.

Co. 419		Co. 449		Co. 527		Co. 658		Co. 1001	
Length in Cms.	C. C. S. %	Length in Cms.	C. C. S. %	Length in Cms.	C. C. S. %	Length in Cms.	C. C. S. %	Length in Cms.	C. C. S. %
27	8·0	38	8·4	87	7·4	12	12·8	64	6·4
74	2·3	37	8·6	34	10·0	15	13·1	132	2·3
33	7·0	27	10·9	36	10·6	18	12·3	29	0·1
55	7·5	29	10·4	18	11·0	25	11·5	21	12·0
68	4·5	0	13·6	19	11·1	27	11·1	33	10·8
26	7·1	...	...	0	13·5	17	11·9	64	7·4
0	12·7	...	...	...	...	0	13·3	0	13·3
r = — 0·93 ± 0·19		r = — 0·97 ± 0·13		r = — 0·96 ± 0·14		r ± 0·89 ± 2040		r = — 0·98 ± 0·11	
Significant at P = 0·01		Significant at P = 0·05		Significant at P = 0·05		Significant at P = 0·05		Significant at P = 0·01	
byx = — 0·1105		byx = 0·1330		byx = — 0·063262		byx = — 0·08250		byx = — 0·0845	

Discussions: The five varieties tested showed varying degrees of susceptibility to pine apple disease. The differences in length of lesion observed among the four varieties Co. 419, Co. 449, Co. 527, Co. 1001 are not statistically significant both at 57 and 131

days after inoculation while Co. 658 alone has recorded a significantly lower length of lesion at both the periods of observations though it is on par with Co. 449 and Co. 527 at 131 days. From the calculation of lengths of lesion at two periods it is seen that the rate of spread of the fungus is more in the first 57 days than in the second period of 74 days. The differences observed in the two periods are statistically significant. The lowering of the rate of spread of the fungus may be possibly due to (a) age of the cane or (b) the resistance developed within the cane (c) the virulity of the fungus going down as time passes by. The varieties behave similarly in respect of spread of infection in two periods. The examination of the inoculated cane showed that the spread of infection was both upward and downward from the point of inoculation. The spread in the upward direction is greater than the spread downwards and the differences are statistically significant. The upward spread has been found to be about twice the downward spread. It is probably due to the differential resistance offered by the internodes below and above which are of different ages or it may be due to the greater availability of minerals and other nonsugar materials which are generally more on the younger parts of the cane than in older parts. The upward and downward spread of the fungus is similar in all the varieties and it is uniformly high in the upward direction than the downward.

The results of juice analysis show that there is reduction in the juice quality of the inoculated canes in all the varieties. The C. C. S. % of the inoculated cane is found to be significantly lower than the healthy ones. This is due to the causal organism which causes deterioration in canes resulting ultimately in the reduction in juice quality. There is very little difference in C. C. S. % between the varieties in the healthy canes and they are on par but the C. C. S. % varies significantly from variety to variety in the inoculated canes. Among the varieties Co. 658 recorded the highest C. C. S. % while Co. 419 and Co. 1001 recorded the lowest. On comparing the juice quality of the healthy and inoculated canes in each of the same variety it is found that the lowering in juice quality of Co. 658 and Co. 527 is not significant while the differences in C. C. S. % of the inoculated and healthy canes in the varieties Co. 419, Co. 449 and Co. 1001 are highly significant.

While comparing the length of lesion and C. C. S.% of the varieties it is found that the decrease in C. C. S.% of the variety Co. 658 is low so also the length of lesion. The length of lesion in Co. 419 and Co. 1001 is high and the lowering in C. C. S.% of these

varieties is also high. In the varieties Co. 527 and Co. 449 there is very little difference in the length of lesion between these two varieties but the reduction in C. C. S.% of Co. 449 is found to be significant. Thus there is variation from variety to variety in C. C. S.% in relation to the length of lesion. In order to compare the varieties in relation to the reduction in C. C. S.% per unit increases in the length of lesion the regression co-efficient of C. C. S.% on the length of lession is calculated and compared. The regression co-efficient of C. C. S.% on the length of lesion denotes the reduction in C. C. S.% for an unit increase in the length of lesion. In general there is high negative correlation between the length of lesion and C. C. S.%. The regression co-efficient was found to be high for Co. 449 and less for Co. 527. This may be the reason for significant decrease in Co. 449. The varieties Co. 419, Co. 449 and Co. 1001 have recorded high regression co-efficient as compared to the other two varieties Co. 527 and Co. 658. The reduction in C. C. S.% due to an unit increase in the length of lesion caused by the fungus varies from variety to variety. Thus the effect of the fungus in the reduction of C. C. S.% is not the same in all the varieties. This is probably due to varietal characteristics.

Conclusions: The five varieties tested for pine apple disease are found to be susceptible to it to varying degrees. Among the varieties Co. 658 has been found to be least susceptible.

The fungus reacts in a similar manner in all the varieties. The rate of infection goes down in all the varieties as the canes reach maturity and infection spreads both upwards and downwards from the point of inoculation; the spread in the upward direction being more.

The fungus causes reduction in the C. C. S.% of the canes in all the varieties. The reduction in juice quality of Co. 658 and Co. 527 are not significant while it is highly significant in the varieties Co. 419, Co. 449 and Co. 1001.

The reduction in C. C. S.% is not the same in all the varieties in relation to the length of lesion caused by the fungus. The regression co-efficient of C. C. S.% on the length of lesion varies from variety to variety. The reduction in C. C. S.% due to the fungus as in the case of susceptibility appears to be a varietal characteristics.

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Proper Storage, disinfestation and fumigation of good grains (Bag storage)

by

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The important factors that are responsible for the deterioration and damage of food grains are (i) insects, (ii) rats and (iii) moisture. The methods of proper storage and prevention of waste due to these causes are dealt with below.

Standard godowns for storage: The buildings (Godowns) should have high plinth, the floor should be above ground level to prevent dampness seeping in during rains. They should be located in places which are not subject to inundation during rains. The flooring should be 2½ to 3 feet thick of cement concrete with a damp proof course and brick masonry walls 18' high to permit stacking upto 15 bags. There should be good ventilation with adequate number of windows. The doors and windows must be close-fitting and should open outside. The ventilators should be just below the top of the walls so as to let in light. The ceiling should be terraced so that the