

## STUDIES ON DISEASES OF MAIZE III : STALK ROT

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A number of pathogens have been observed to incite stalk rot. Stalk rots have not normally been found to be severe under hilly conditions in Darjeeling district due to light texture and acidic conditions of soil and terraced field permitting easy drainage. Under conditions of bad drainage and stagnation of water in the field, stalk rot may appear. Of the various organisms involved in inciting stalk rot, *Rhizoctonia zeae* was found to be the most destructive under Kalimpong conditions. Other organisms which have been observed also to cause stalk rot were *Gibberella zeae*, *Diplodia zeae*, *Pythium aphanidermatum* and *Erwinia carotovora* f. sp. *zeae* (= *E. chrysanthemi*).

### INTRODUCTION

Stalk rot of maize, though not very prevalent in the hilly areas of Darjeeling district is noticed in the fields with bad drainage and stagnation of water. Hence study of stalk rot was taken up to find out the organisms involved and predisposing conditions for the same

1. *Rhizoctonia* stalk rot caused by *Rhizoctonia zeae* Voorhes. In India this disease was reported by Ullstrup in 1960 to be occurring in Sikkim and Behar (Ullstrup, 1960). Now this disease was occasionally observed in some maize growing tracts in high rainfall areas in India.

The disease is characterised by necrosis of epidermal tissues of stalk beneath the leaf-sheath, primarily confined to the areas surrounding the nodes.

Under severe condition it might cause extensive damage of stalk resulting in breakage even before appearance of tassel with total loss of yield.

Leaf and sheath blight caused by *Rhizoctonia zeae* caused severe damage. A close parallelism was noticed between the leaf and sheath blight caused by *Rhizoctonia zeae* and stalk rot caused by the same pathogen. They might be considered different phases of one disease complex. Both these phases appeared to be influenced under similar environmental conditions. Heavy rain in the earlier period of plant growth caused more damage as were the cases in 1975 and 1976 in contrast with 1974.

Total rainfall recorded during the month of May and June being 840 mm and 628 mm in 1975 and 1976 respectively, where as in 1974, the total rainfall recorded during the same period was 423 mm only. In 1974 only 10.20 per cent of variety was found to be affected with an average disease score of 1.04. In 1975 and 1976, per cent of varieties affected were 31.53 and 27.45 with an average disease score of 7.02 and 5.59 respectively.

## 2. *Gibberella* stalk rot caused by *Gibberella zeae*.

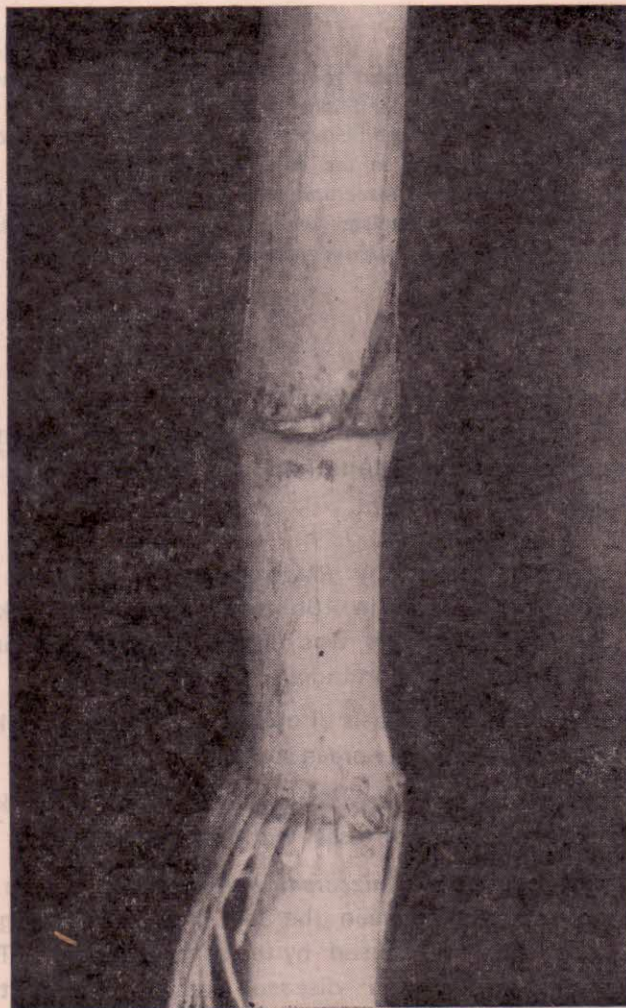


Fig. 1 : *Gibberella* stalk rot showing the presence of bluishblack perithecia on the nodal region of the stem.

Ullstrup (1960) observed the presence of perithecia of *Gibberella zeae* on old maize stalks at Kalimpong. This disease has not yet been reported from elsewhere in India. During the four years of study this disease was observed, but it was sporadic in nature.

The disease was generally found to make its appearance after fullsilk stage. Pink to red discolouration of the pith, the most characteristic symptoms of the disease was observed on splitting open the affected stalk. Formation of bluish-black perithecia were also observed quite late in season, which is the another diagnostic symptom of this disease (Fig. 1).

The disease was found to be confined to a few varieties. The number of varieties affected ranged from 3.63 to 11.22 per cent. Though no definite conclusion could be arrived at regarding the effect of environmental conditions on this stalk rot it was however observed that heavy rainfall in the later part of the season (July and August) might be conducive to infection as was noticed in 1974, in which year highest disease incidence of 11.22 per cent was observed. In other years of study variation of disease incidence were negligible (3.63 to 4.61 per cent).

Jugenheimer (1975) also reported that *Gibberella* stalk rot is prevalent in cool, humid areas.

### 3. Diplodia stalk rot caused by *Diplodia zeae*

The disease was found to be most important in the cornbelt of U. S. A. but less important in the drier and cooler areas (Jugenheimer, 1975). In India the disease was first reported from Himachal Pradesh (Singh and Sharma, 1972).

During the four years of study only a few varieties (1.53 to 4.54 per cent) were found to be affected by this pathogen. The characteristic symptom of this stalk rot was the appearance of black dots of pycnidia erupting through the infected tissues of the basal region of the stem, particularly surrounding the nodes, late in the season.

Rooting was never found to extend to the extent of stem breakage. Though extensive damage of ears was found to be caused by *Diplodia zeae* the intensity of damage due to stalk infection was observed to be very low. This is the first report of its occurrence in the Eastern Himalayan region.

### 4. Pythium stalk rot caused by *Pythium aphanidermatum*

Though the disease has been reported to be severe in the plains, it was not found to cause much damage in the hilly regions in Kalimpong area. The main reason being unfavourable conditions for the development of the disease. Pythium stalk rot was found to be severe under conditions of high (30-35°C) temperature and high humidity. Though under Kalimpong conditions, moisture in

the soil and the humidity are favourable for the development of disease but temperature is comparatively low and not favourable for the development of infection.

Sporadic infections were however observed in some years in the month of July when the temperature was comparatively high. Only a few varieties were affected by this disease.

Bacterial stalk rot caused by *Erwinia carotovora* f. sp. *zeae* = *E. chrysanthemi*

Sporadic infection of this bacterial stalk rot was observed in the Kalimpong hills. Though the disease was found to be severe in the areas of high rainfall or in the field receiving irrigation water, the incidence of the disease at Kalimpong was low in spite of high rainfall. Lower temperature might play an important part. The disease was noted to be favoured by high temperature and high humidity in the areas where it was observed to be severe.

Infection was usually noticed after flowering usually in the month of July when temperature tended to be high. The incidence of disease was very low and only a few varieties were found to be affected.

TABLE 1. Data (summarised) on incidence of different kinds of stalk rot in the years of study

Year	Name of the Disease	Percent of variety affected	Highest disease incidence of the season	Lowest disease incidence of the season	Average disease incidence of the season
1974	Rhizoctonia	10.20	25.00	2.50	1.04
1975	stalk rot	31.53	50.00	3.50	7.02
1976		27.45	50.00	3.00	5.59
1977		8.18	50.00	2.00	1.40
	Average	19.34	43.75	2.63	3.76
1974	Diplodia	4.08	5.00	2.00	0.17
1975	stalk	1.53	5.00	5.00	0.07
1976		1.96	5.00	3.00	0.08
1977		4.54	5.00	2.50	0.20
	Average	3.03	5.00	3.13	0.13
1974	Gibberella	11.22	25.00	1.85	1.17
1975	stalk rot	4.61	33.37	5.00	0.66
1976		4.57	10.00	2.30	0.27
1977		3.63	5.25	2.50	0.16
	Average	6.00	18.40	2.91	0.57
1974	Erwinia stalk	6.12	10.00	3.33	0.47
1975	rot	4.61	14.28	5.00	0.45
1976		0.65	10.00	—	0.06
1977		1.81	16.66	1.38	0.16
	Average	3.30	12.73	2.43	0.28

### DISCUSSION

Of the different stalk rot diseases, that caused by *Rhizoctonia zae* was more serious. Though rainfall and humidity were found to be favourable, temperature which was comparatively moderate during the growing season was not conducive to all. Reason for increased severity of infection due to *Rhizoctonia zae* may be its ability to attack plants in other phases of growth also. Perpetuation of the disease and build up of an inoculum were more favoured under such condition.

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