

Research Article

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## Plant Maturity in relation to Plant Development in *Sorghum bicolor* effected by charcoal rot

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### Keywords

*Sorghum bicolor*,  
*Macrophomina phaseolina*,  
Plant Maturity,  
Charcoal Rot.

### Abstract

*Sorghum bicolor* (L.) Moench commonly known as "Jowar" is the most important Rabi and Kharif crop of India belonging to the family "Poaceae". Charcoal rot occurs in almost all stages of plant growth but the symptoms are more spectacular in older plants even though the infection starts much earlier. It was observed that disease rating increased with the increase in age of plants. Plants which were 15 and 30 days old showed less disease development in comparison to 45 and 60 days old plants; respectively. Maximum disease rating (3.95%) was observed when the plants were inoculated at 60 days and minimum (1.99%) at 15 days of growth stage.

### Introduction

*Sorghum bicolor* (L.) Moench commonly known as "Jowar" is the most important Rabi and Kharif crop of India belonging to the family "Poaceae". It is among one of the four major cereal crop of the world, the other three being wheat, rice and maize.

Sorghum is mainly cultivated in the states Maharashtra, Karnataka, Andhra Pradesh, Madhya Pradesh, Gujarat, Chennai, Rajasthan and Uttar Pradesh. More than 90% of India's production is accounted by these states (Anahosur, 1982).

In Rajasthan Sorghum is grown in an area of about 556,000 hectares. It is being cultivated as rainy season crop (Kharif, June to October).

Sorghum crop suffers from biotic and abiotic stresses. Among biotic stresses, diseases play an important role. Many diseases are caused by various microorganisms like bacteria, viruses, mycoplasma and fungal pathogens.

Charcoal rot caused by *M. phaseolina* is a root and stalk rot disease and has a great destructive potential as a disease in most Sorghum growing regions during Rabi and Kharif season. First report of the disease was given by Uppal et al., (1936) who found the association of *M. phaseolina* in lodged plants in Rabi Sorghum.

Charcoal rot occurs in almost all stages of plant growth but the symptoms are more spectacular in older plants even though the infection starts much earlier. It has been noticed that it develops very rapidly in fully matured plants. It is an important disease of polygenic character (Rana et al. 1976). The affected part of seedling shows sunken spots around the collar region which rapidly spreads to rest of the parts, finally results in death of seedling. In adult plants symptoms appear much later. The ear do not form properly, plants ripens prematurely, the stems break easily and infected tissues become fibrous and hollow and results in lodging of diseased plants. The diagnostic characters of charcoal rot are deterioration of pith and production of large number of tiny black mustard like bodies in the tissues called

microsclerotia which serves as primary source of inoculum. Sclerotia produced in plant tissue are released into the soil as crop residues and remain viable for 2-15 year's depending on the environmental conditions (Cooks et al. 1973; Papavizas, 1975; Short et al. 1978 Cloud and Rupe, 1991). These are responsible for overcoming the seasonal adversity Pycnidia and Pycnidiospores are reported on aerial parts such as leaves.

The tap roots may appear light gray or silvery in appearance when the outer skin or bark is peeled from roots and stem base, small black specks can be seen. These specks are so numerous that they appear grayish black and hence the name of the disease is "CHARCOAL ROT" (Livingston, 1945).

In Rajasthan state there is no published report about the extent and various aspects of the disease. So, looking to the paucity of the information on the disease in Rajasthan state an immediate attention from the research side was needed. Therefore, it was felt necessary to take up this problem. Hence the present investigation was aimed to undertake a thorough study on Plant maturity, especially in Tonk district and some Sorghum growing districts of Rajasthan.

### Review of Literature

Very little work has been done on Plant maturity in relation to disease development in Sorghum. However, some work on other crops have been reported. Chen' - Tu (1972) demonstrated that the susceptibility of Jute plants increased with increase in age and crop became highly susceptible during its harvesting period.

Anahosur and Flegde (1987) made a valuable contribution while working with charcoal rot of Sorghum for assessing the susceptible stage of the host

for infection. They selected five growth stages and found that the growth stage of 75 days and onwards was the most susceptible phase of the host plant.

### Materials and Methods

In order to find out whether the age of plant plays any significant role in disease development field experiment was conducted with highly susceptible Sorghum CSH- 5 variety in a plot size of 10 X 10 with four replications.

For this, four sowings were done at an interval of 15 days. When the first sown Were 60 days of age all plants were inoculated by toothpicks infested by *M. phaseolina*. After one month of inoculation, plants were split open for recording disease rating.

### Results

Almost very less work has been done on the effect of plant maturity in relation to charcoal rot disease development in Sorghum. Therefore, this experiment was planned ° find out the precise maturity period/age of Sorghum plant, when it become easy for *Macrophomina* to infect it. The method adopted was given by Anahosur and Hegde, 1987 and savita Pareek, 1991.

Practical was plants in two consecutive years and results were pooled for disease rating. It was observed that disease rating increased with the increase in age of plants. Plants which were 15 and 30 days old showed less disease development in comparison to 45 and 60 days old plants; respectively. Maximum disease rating (3.95%) 'as observed when the plants were inoculated at 60 days and minimum (1.99%) at 15 days of growth stage (Table and Fig.).

**Table. Effect of plant maturity in relation to the development of charcoal rot disease of sorghum induced by *Macrophomina phaseolina***

S. No.	Age of the plants at the time of inoculation (days)	Average Disease Rating		
		Kharif 2001	Kharif 2002	Pooled Analysis
1.	60	3.92	3.92	3.95
2.	45	3.22	3.37	3.30
3.	30	2.82	2.077	2.80
4.	15	2.02	1.95	1.99

Number of replications 4  
 Total number of plants/treatment 40  
 Average rating of 40 plants

Source of variation	DF	S.S.	M.S.	F Ratio calculated	F Tabulated
Replicates	1	0.000611	0.000611	252.49**	9.28
Age	3	4.124838	1.374946		
Errors (A)	3	0.016337	0.005446		

C.F. 72.661513  
 C.V. 2.448571  
 S.E.M. 0.052  
 C.D. at 5% 0.23  
 G.M. 3.01  
 Highly significant at 5% level

## Discussion

Earliest workers on charcoal rot disease of Sorghum (Mackie, 1931; Cheng and Tu 1972; Sekhar, Anahoser and Hegde, 1987) and other crops had observed that the symptoms were best expressed when the plant reaches maturity. In the younger plants the charcoal rot is rather a hidden disease.

Similar observations have also been recorded in case of charcoal rot of jute (Cheng and Tu, 1972) caused by *M. phaseolina*. Here too the plant maturity was a potent factor.

Therefore, in the present study an experiment was set to find out the relation of plant maturity to disease development and the effect of inoculation on plants of different ages i.e. 15, 30, 45 and 60 days. The results presented in (Table) showed that although the infection could occur even at 30 days age, yet the disease was maximum expressed in 60 days old plants. However, in case of charcoal rot of Sorghum, only one experimental evidence is available which may throw light on this problem.

In Sorghum it was found by Sekhar, Anahosur and Hegde (1987) that the most susceptible stage of the plants to charcoal rot disease began at 75 days of age and onwards i. e. the post flowering and grain filling stages. At this stage the stem reserves depleted and translocated to the developing grains, hence the stalks get weakened and are Predisposed to the infection of *M. phaseolina* resulting in exhibited bending and Thus, our results are at par when compared with them.

## Summary

While making an attempt to study the effect of plant maturity in relation to disease development, it was found that toothpick inoculated plants of all age group (15 to 60 days) were susceptible to charcoal rot

infection, though toothpick inoculation of 45 and 60 days old plants were observed to be more valuable to charcoal rot infection. Maximum disease incidence was observed in 60 days old plants. It was estimated that Sorghum plants become more vulnerable to charcoal rot infection with increase in age.

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