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EVALUATION OF FIELD INOCULATION TECHNIQUES FOR SCREENING MAIZE (*ZEA MAYS*) GENOTYPES AGAINST BANDED LEAF AND SHEATH BLIGHT (*RHIZOCTONIA SOLANI*) DISEASE

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ABSTRACT : A field experiment was conducted during kharif season 2008 and 2009 at the Regional Agricultural Research Station, lam farm, Acharya N G Ranga Agricultural University, Hyderabad to develop a suitable non damaging method for inoculating *Rhizoctonia. solani* which causes banded leaf and sheath blight disease in maize. Results revealed that inoculation with paddy straw method is superior to other methods as well as reported techniques and can be adopted on a large scale for evaluating maize germplasm against banded leaf and sheath blight disease.

Key words:, BLSB, inoculation techniques, maize, *Rhizoctonia solani*

INTRODUCTION

Maize (*Zea mays* L.) is one of the most important cereal crops in the world agricultural economy as food, feed and industrial product. In India, maize is grown in almost all the states. It is fourth in area (6.3 m ha), next to rice, wheat, andorghum, but third in production (10.8 mt). It is mainly utilized for direct human consumption and livestock/ poultry feed. During the last few years, there has been a progressive escalation in its demand for the value-added products, like glucose, sorbitol, dextrose, starch-based products and oil. The productivity of the crop in India is 1.8 t/ha, which is quite low as compared to the yield levels in other major maize growing countries of the world.

Maize crop suffers from various diseases resulting in considerable loss in yield. Among them banded leaf and sheath blight (BLSB) on maize incited by *Rhizoctonia solani* f.sp. *sasakii* Exner (*Thanatephorus sasakii* (Shirai) Tu & Kimbro), is gaining economic importance. It was reported for the first time from Sri Lanka (Bertus, 1972) under the name Sclerotial disease. The disease was of minor importance in the western central Himalayan foothill region of India in early sixties. Presently, the disease is considered as a major disease not only in India but also in several countries of tropical Asia wherever maize is grown. The disease causes direct losses resulting in premature death of the plant, stalk breakage and ear rot besides causing indirect losses by reducing the gross yield. Singh and Sharma (1976) estimated 40.5% loss in grain yield with 71% disease index. However, the magnitude of grain loss may reach as high as 100% if the ear rot phase of the disease predominates. In India, losses in grain yield have been estimated in the range of 23.9 to 31.9% in ten cultivars (Lal *et al*., 1980). Payak and Sharma (1985) reported that annually around 1% of the total grain yield is reduced by BLSB in India.

Identification of disease resistant germ plasm is the primary and essential management practice of any crop. In order to evaluate germplasm plant for resistance/susceptibility field inoculation with a pathogen for inducing high disease incidence constitutes an essential methodological step. In case of *Rhizoctonia solani f.sp. sasakii* a serious limitation is that the predominant phase in its life cycle is non sporulating type. Therefore, the mycelial phase it self has to be utilized as inoculum. It has to be in an actively growing phase at the time of inoculation and should remain in contact with the host for longer period than sporulating phase. Thus, even after inoculation the mycelium should have a nutrient substrate to sustain growth.

Amin (1975) used agar discs with mycelial growth to induce banded blight in rice while Singh and Sharma (1976) adopted a similar technique in maize. Further Ahuja and Payak (1978) tested seeds and other plant parts for mass multiplication of inoculum in the laboratory and found that barley is the best substrate and sheath application of four grains resulted in high disease intensity. However the technique has limitations in applying the grains in sheath to large plant population in the field besides damage of sheath. Hence this study was taken to develop a reliable non destructive method for inoculating maize in the field that could be used to evaluate genotypes for résistance to sheath blight fungus.

MATERIALS AND METHODS

The experiment was laid out in randomized block design with six treatments replicated thrice during the year 2008-09 of *kharif* season. Maize variety DHM 117 was sown in 5x4 m plots with 75x20 cm spacing.

Inoculum

Maize plants showing banded leaf and sheath blight disease symptoms specimens were collected, and the pathogen was isolated under aseptic conditions on Potato Dextrose Agar (PDA). *R.solani* was identified based on morphological characters (Barnett, 1960) and maintained on PDA for further studies.

Inoculum preparation

1. Culture grown on paddy straw: Dried paddy straw was chopped in to 5 cm pieces and soaked in water over night. The straw after draining the water was sterilized at 16 lb pressure for 30 minutes. *R. solani* was inoculated on sterilized paddy straw and incubated for 15 days.
2. Culture grown on sorghum seed: Sorghum seed was over soaked for 24 h and dispensed 50 gm in 250 ml flasks and sterilized. *R. solani* culture was grown on sterilized sorghum grain.
3. Culture grown on host extracts: Maize plant was chopped in to fine pieces and 10% of host extract was prepared by adding 100 g plant material in 1 L instead of adding potato.
4. Potato Dextrose Agar and Potato Dextrose Extract were prepared according to standard procedure (Dhingra and Sinclair, 1995)

Inoculation

Ten days old mycelium grown on PDA was homogenized in sterile water and 5 ml was used for seeding the flasks.These were incubated at 27^{o}C for15 days.

Inoculation techniques

The six techniques compared in this study were:1). Culture grown on Paddy straw bit was inoculated at 3rd internode 2). Culture grown on sterilized sorghum grain for 15 days 3).Culture filtrates grown on potato dextrose extract was sprayed 4). Culture grown on maize host extracts was sprayed 5). Sclerotia grown on PDA were inoculated at 3rd internode 6). Mycelium grown on PDA was sprayed (Fig.1).

The sites of inoculation selected were whorls, sheaths and stem. Culture grown on paddy straw bits and 4 sorghum grains and sclerotia on PDA were inserted between the rind of the stalk and the enclosing sheath at 3rd or 4th basal internode where as culture filtrates, host extracts, and mycelial extracts were sprayed on 3rd to 4th internodes. The inoculated plants were observed daily for development of blight symptoms.

RESULTS AND DISCUSSION

The symptoms of the disease appeared in two to three days of inoculation. At first, irregularly round, water soaked, straw coloured lesions developed on leaf bases and leaf sheaths.These lesions enlargeed and discoloured areas alternating with dark bands became apparent on infected leaf sheaths (Fig.2).The dark alternating bands were oriented perpendicularly to the long axis of the leaves. These symptoms were similar to earlier description (Sharma, 2005). Sclerotial production was also apparent in some treatments. The disease was scored on 1-5 scale (Ahuja and Payak 1983).

The range of ratings obtained was from 1 to 5.0 (Table-1). Ear infection was observed in paddy straw, sorghum grain and sclerotia placement treatments. But complete symptom expression and sclerotial formation was observed in paddy straw method only. This method is successful in not only inducing all the characteristic symptoms observed in nature but also quite easy to adopt for inoculation and thus applicable to screen large germplasm. In sorghum grain and sclerotial placement treatments damage of rind was observed and it is also tedious to inoculate the plant by placing 4 grains or sclerotia in the sheaths. Other spraying treatments also caused symptoms but not characteristic and uniform. This may be due to the failure of germination of mycelial fragments in time.

Table-1.Evaluation of different inoculation techniques for causing banded leaf and sheath blight disease in maize

Treatment		No. of plants inoculated	No. of plants showed symptoms	Disease rating scale shown by majority of plants
T1	Culture grown on Paddy straw bit inoculation inoculation	**100**	**100**	**5.0**
T2	Culture grown on Sorghum grain	**100**	**70**	**4.0**
T3	Culture filtrates grown on potato dextrose extract spray	**100**	**15**	**1.5**
T4	Culture grown on Host extracts spray	**100**	**27**	**2.0**
T5	Sclerotia grown on PDA inoculation	**100**	**34**	**2.5**
T6	Mycelium grown on PDA spray.	**100**	**11**	**1.5**
T7	Water spray	**100**	**0**	**0**

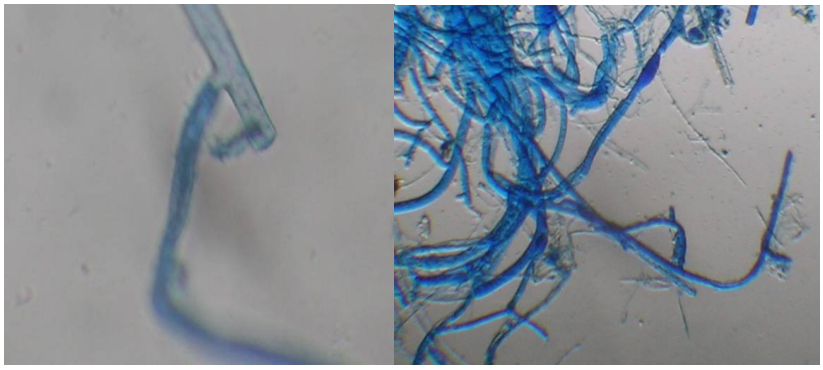

Fig: 1. *R. solani* mycelium grown on PDA

Fig:2. BLSB symptoms (left), sclerotia (right) produced by paddy straw inoculation method.

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