

Study of Seed Borne Pathogens Associated with Rabi Sorghum (*Sorghum Bicolor L. Moench*) Genotypes

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Abstract

An experiment was conducted to study the seed borne pathogens associated with Rabi sorghum genotypes at Regional Agricultural Research Station, Bijapur Karnataka. Fungi associated with Rabi sorghum genotypes were detected by using blotter method and studied the fungal colony characters after isolation. About six different seed borne pathogens were identified in the order of infection were, *Aspergillus Spp*, *Penicillium Spp*, *Fusarium Spp*, *Rhizopus Spp*, *Botrytis Spp*, *Curvularia Spp*. Among these fungi the most predominant fungi were *Aspergillus spp.* (20%), *Penicillium spp.*(16%), *Fusarium spp.*(16%), *Rhizopus spp.*(12%) in terms of per cent of infection on the seeds.

Keywords: Rabi sorghum; Seed borne fungi; Genotypes; Isolation; Standard blotter method.

Introduction

Sorghum [*Sorghum bicolor* (L.)Moench] is the “King of millets” and is one of the important tropical grain and fodder crop. It is the fifth important among the cereal and millets next to wheat, rice, maize and barley in the world. Sorghum crop originated and domesticated in Africa about 5,000-8,000 years ago (4). It is grown in tropics and subtropics under variety of names. In India, the crop is known as “jola” in Kannada, “jowar” in Hindi, “cholam” in Tamil which indicates the variability of Indian culture/biodiversity and is a staple food for human beings in many states of India. India has the largest share (32.5%) of world sorghum in area and ranks second in production. (1). About 50 percent of people in Karnataka depends on sorghum as a staple food particularly in Northern districts of Karnataka viz., Bijapur, Dharwad, Haveri, Belgaum, Raichur, Koppal, Gulbarga and Bellary (2).

Seed is the most important and critical input for crop production. Pathogen free healthy seed is required to maintain desired plant populations and good harvest. Many plant pathogens are seed-borne, which can cause enormous crop losses. Among the various factors responsible for the low yield of the crop, diseases play a vital role. Out of 16% annual crop losses due to plant diseases, at least 10% loss is incurred due to seed-borne diseases. (6). Sorghum crop suffers from more than 30 fungal diseases (14). There are more than 40 seed-borne fungal pathogens causing 32 different diseases in the crop. Hence, there is a need to identify the pathogen infection on seed which is of commercially important and evidently there is a need to increase the yield and improve the health and seed quality of the crop by controlling seed borne fungal pathogens.

Materials and Methods

An effort was made to study the major seed borne mycoflora associated with rabi sorghum genotypes under the laboratory

condition in the Department of Plant Pathology, Agricultural College Dharwad. Sixty rabi sorghum genotypes which were harvested from the field were further tested in the laboratory for the presence of seed borne pathogens in the seeds by following standard blotter method as given by ISTA guidelines (8). The mycoflora associated with grains of sorghum genotypes listed earlier was studied by blotter technique. (13)

Methodology

Sterile Petri plates measuring 10 cm were used in the study. Three discs of blotter paper were moistened with sterilized water; excess of water removed and were placed at the bottom of each Petri plate and labeled. Ten seeds were placed at equidistance on blotter paper in each Petri plate. For better growth and sporulation of fungal flora 12 hours artificial light was provided by placing the plates below a 40W fluorescent tube and alternated with 12 hours darkness. Fungal growth was observed four days after incubation under stereobinocular microscope. For further details, they were observed under research microscope.

Ten seeds from each genotype were taken for this study and each genotype was replicated thrice. For isolation of internal mycoflora ten seeds were taken and seeds were surface sterilized with 0.1 percent mercuric chloride solution for thirty seconds followed by three washings in sterile distilled water. Then the grains were placed in the petriplates containing moist sterilized blotters. After eight days of incubation they were observed under stereo binocular microscope for the presence of different seed borne pathogens and the pathogens were isolated and studied.

Percent seed infection

The percent infection of seedborne pathogens on different Rabi sorghum genotypes is calculated by taking the number of seeds infected with pathogens out of incubated seeds and multiplied with 100.

Result and Discussion

The major pathogens identified during the investigation were *Aspergillus Spp*, (*A. niger*) *Penicillium spp*, *Fusarium spp*, *Rhizopus spp*, *Curvularia spp*, (*Curvularia lunata*) *Botrytis spp*, based on their morphological characters by using standard blotter method (Plate 1). Identification of *Fusarium spp* was done based on the spore morphology and genotype of the fungus by referring to the illustrated genera of imperfect fungi, characters like colony colour, macroconidia, microconidia and formation of chlamydo-spores were used for the identification of genus *Fusarium*. It produces abundant loose, aerial, white mycelium on incubated seed. In this mycelium, several shiny, hyaline and transparent to milky white spherical droplets can be seen hanging at the tips of long thin stalks. These stalks are primary conidiophores, which arise laterally from the hyphae in the aerial mycelium. The hanging droplets are moist false heads in which conidia are produced. Mucoïd and moist pionnotes and snow white to dull white sporodochia are also produced on the seed surface. Microconidiophores (monophialides) that bear the microconidia are very long and slender and measures 15-40×2-3 µm, whereas those bearing macroconidia (macro-conidiophores) are short and measures 10-25×3-4.5 µm.

Microconidia are hyaline, 1-2 septate, oval, ellipsoid to sub-cylindrical and measure 5-20×2.8-7 µm. Macro conidia are hyaline, stout, measure 22-75×35-7 µm, subcylindrical (or) slightly curved, with short blunt and rounded apical cells and indistinctly pedicellate basal cells (Plate 2 and 3). The walls of the conidia are thick, with dorsal and ventral surfaces parallel for most of their length. They are mostly 3-septate but 4-7 septate conidia are not uncommon. Chlamydo-spores are formed singly and in pairs or in clusters in sporodochia. They are globose to subglobose, smooth (or) rough-walled and 6-11 µm in diameter (Kraft, 1969; Ram Nath et al., 1970; Booth, 1971).

Penicillium species are commonly considered as contaminants (Plate 2). The colonies of *Penicillium* are rapid growing, flat, filamentous, velvety, wooly or cottony in texture. The colonies are initially white and become blue green, gray green, olive gray, yellow or pinkish in time. Colonies of *Penicillium* species are often dominated by copious clear to yellow or brown exudates at the centers. Hyphae are septate, hyaline measuring 1.5-5 mm in diameter with simple or branched conidiophores. Metulae are secondary branches that form on conidiophores. Metulae carry the flask shaped phialides. The organization of the phialides at the tips of conidiophores is very typical. They form brush like clusters which are also referred to as "penicilli". Conidia (2.5-5 mm in diameter) are round, unicellular and visualized as unbranching chains at the tips of phialides.

Aspergillus species Colonies effuse, variously colored, often green or yellowish, sometimes brown or black. Mycelium partly immersed or partly superficial. Conidiophores macronematous, often with a foot cell, straight or flexuous, colourless or with the upper part mid to dark brown, usually smooth, swollen at the apex into a spherical or clavate vesicle the surface of which is covered by short branches or in some species by phialides. Conidiogenous cells discrete, several arising together at the end of terminal branches or over the surface of vesicle. Conidia catenate, semi-endogenous or acrogenous, spherical, variously colored, smooth, rugose, echinulate, sometimes with spines arranged spirally

Colonies of *Botrytis cinerera* often produces grayish white mycelium on the seed surface. This fungus produces long, slender and

erect conidiophores which are branched at the apex. The colonies of *B. cinerea* are white to light gray to grayish brown, spreading short distance around the infected seed. Conidiophores are produced at the tips and at intervals along the hyphae and appear to arise as pegs on the swollen ends of hyaline branches. They are light gray, nearly 200 µm long, and 16-20 µm thick and dichotomously branched. Conidiophores are brown at the base, becoming paler towards the apex, with the ends of the branches often colorless and bearing conidia in clusters. Conidia are produced on short denticles at the tips of the conidiophores. They are usually single-celled, occasionally ellipsoidal or abovoidal, apiculate at the base, colourless to pale brown and 4-20 x 4-18 µm. The ornamented arrangement of conidia on the conidiophores resembles a cruciferous inflorescence under a stereobinocular microscope. (5,10).

In the present investigation there are genotypes which were associated with all the six seedborne pathogens viz., IS8777 (*Aspergillus niger*, *Penicillium spp*, *Rhizopus spp*, *Fusarium spp*, *Aspergillus spp* and *Curvularia lunata*), five pathogens were present in IS30540 (*Botrytis cinerea*, *Curvularia lunata*, *Aspergillus niger*, *Penicillium spp* and *Fusarium spp*). Similar observations were made by (7,11,12). The results of the present study revealed that seed borne pathogens are present on most of the cultivated *Rabi* sorghum genotypes including imported germplasm lines for the research purpose. Although in certain instances they occurred in trace levels but under suitable environmental condition they may create the disease in epidemic level. Some of the pathogens were recorded only from genotypes which sent for evaluation that were not present on check varieties and it was observed that particular pathogen was observed under particular genotype. This indicates the reason may not be known, however they may be contaminated accidentally at trace level.

Percent Seed Infection of Seedborne Pathogens

All the sixty rabi sorghum genotypes which were tested for the presence of seedborne pathogens were calculated for the percentage of seed infection (Table 2). In the present investigation *Aspergillus spp*. showed maximum infection (0-20%), followed by *penicillium spp*. (0-16%), *Fusarium spp*. (0-12%), *Rhizopus spp*. (0-12%). Remaining two seed borne pathogens showed less (0-8%) viz, infection (*Botrytis spp*, *Curvularia spp*).

Conclusions

From the present investigation it is concluded that fungi are universal microorganisms present all around seed in the world and these are most deadly organisms associated with many of the crop plants. Among the field crops, sorghum crop is one which contain many of the common fungal pathogens especially on seeds. In the present investigations the sorghum genotypes were isolated by using standard blotter method and studied for the presence of seed borne pathogens which are common and always associated with *Rabi* sorghum genotypes. The pathogens isolated and studied were *Aspergillus niger*, *Penicillium spp*, *Rhizopus spp*, *Curvularia lunata*, *Botrytis spp*, *Fusarium spp*. Among the sixty sorghum genotypes most of them associated with *Fusarium spp*, *Aspergillus spp* and *Penicillium spp*.

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