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HOSTS OF BIPOLARIS SOROKINIANA, THE MAJOR PATHOGEN OF SPOT BLOTCH OF WHEAT IN UTTAR PRADESH

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ABSTRACT

Wheat is an important cereal crop in India. *Bipolaris sorokiniana* (Sacc.) Shoemaker (teleomorph *Cochliobolus sativus*) is the causal agent of Spot blotch, common root rot, leaf spot and seedling blight, head blight and black point of grains of wheat. It causes significant yield losses in Uttar Pradesh and considered as a serious foliar disease constraints in warmer growing areas. Numerous plant species other than wheat are identified as the host of *B. sorokiniana* world wide. Fifteen crops including *Avena sativa* (oats), *Arachis hypogea* (peanut), *Brassica campestris* (mustard), *Cicer arientenum* (chickpea), *Glycine max* (soybean), *Hordeum vulgare* (barley), *Halianthus annus* (sunflower), *Lens culinaris* (lentil), *Pennisetum amaricanum* (millet), *Oryza sativa* (rice), *Sesamum indicum* (sesamum), *Sorghum bicolor* (sorghum), *Vigna radiata* (green gram), *Vigna mungo* (black gram) and *Zea mays* (maize) which are grown in different agro-ecological zones of wheat production were tested against local isolate of *B. sorokiniana* by *In vitro* technique. Ten crops viz., *Avena sativa, Hordeum vulgare, Brassica compestris, Glycine max, Lens culinaris, Vigna radiata, Vigna mungo, Sorghum bicolor, Zea mays* and *Pennisetum amaricanum* are found to be the hosts of *B. sorokiniana* in *In-vitro* condition. Two more crops viz., *Oryza sativa and Sesamum indicum* also found as a host of *B. sorokiniana* in *In-vivo* condition.

KEYWORDS Wheat, Spot blotch, Host and *Bipolaris sorokiniana.*

Introduction

Bipolaris sorokiniana (Sacc.) Shoemaker (Sivanesan, 1990) is a seed, soil and air borne pathogen, causes head blight, seedling blight, foliar blight/ spot blotch, common root rot and black point of wheat, barley and other small cereal grains and grasses (Wiese, 1998). It is considered as one of the most important wheat pathogen in the warmer areas of the world (Dubin & Van Ginkel, 1991). In the Southern province of Sindh, where winter temperatures are warmer, *Helminthosporium* leaf blight has been reported (Bhatti & Ilyas, 1986; Hafiz, 1986) and the pathogen causes significant yield losses (Aftabuddin *et al*., 1991). High temperature and high relative humidity favour the outbreak of the disease (Aggarwal *et al*., 2000). Plant with common root rot produces fewer tillers and fewer kernels per ear. Under favourable conditions, spikelets may be affected, causing grain shriveling, it can initiate epidemics by infecting the primary leaf via the coleoptile during seedling emergence and heavily infected seedlings may fail to emerge (Kumar *et al*., 2002). Due to this destructive pathogen, the yield loss was estimated at 18-22% in India (Singh *et al*., 1997) and 23.8% in Nepal (Shrestha *et al*., 1997). The pathogen causes grain yield losses up to 15, 10 and 20 % through common root rot and seedling blight in Canada, Scotland and Brazil respectively (Murray *et al*., 1998).

The presence of other hosts plays an important role in disease epidemic. The primary inoculum of *B. sorokiniana* comes from several sources such as weed hosts, soil, crop debris which enhances the disease level. The grass weeds as a collateral host of *B. sorokiniana* in rice–wheat system is considered as a possible reason for perceived increase in *Helminthosporium* leaf blight and cause major losses to the crop (Hobbs & Morris, 1996). The perennial nature of some grasses and their presence in wheat growing areas is reported to facilitate over wintering and survival of the pathogen. The crop rotation with non-host plants reduces the impact of leaf diseases by separating the new wheat crop from existing inoculum sources. The most common and beneficial rotation has been found by leguminous crops (Chang & Wu, 1998). Thus initial study was under taken to confirm such hosts which are grown in wheat growing areas and where pathogen gets shelter for their survival. This can be helpful ultimately in designing the management strategies in future.

Materials and methods

Preparation of inoculum: The isolate was collected from Faizabad district (Uttar Pradesh) which was considered the most aggressive isolate in previous studies, was used in this study. The pure mother culture of *Bipolaris sorokiniana* was multiplied on potato dextrose agar medium (PDA). The inoculated PDA plates were incubated at 22°C ± 3°C for 12 days till the full growth of the fungus was observed on the media and then these cultures were used as inoculum.

***In vitro* test:** Fifteen crops including *Avena sativa* (oats), *Arachis hypogea* (peanut), *Brassica campestris* (mustard), *Cicer arientenum* (chickpea), *Glycine max* (soybean), *Hordeum vulgare* (barley), *Halianthus annus* (sunflower), *Lens culinaris* (lentil), *Pennisetum amaricanum* (millet), *Oryza sativa* (rice), *Sesamum indicum* (sesamum), *Sorghum bicolor* (sorghum), *Vigna radiata* (green gram), *Vigna mungo* (black gram) and *Zea mays* (maize) were tested for the infection of the pathogen *B. sorokiniana* by *In-vitro* method. Test tubes (29cm x 3cm) were filled with one fourth cotton swab from the bottom. Twenty ml distilled water was added to each test tube to moist the cotton and were covered with aluminum foil. The test tubes were autoclaved and upon cooling were used for inoculation. Seeds of each crop were surface disinfected with 1% Clorox solution for one minute and rinsed twice with sterilized distilled water. Three seeds of each crop were placed in test tube on cotton swab in triplicate along with one disc of 5 mm culture of *B. sorokiniana*. The inoculum potential was 3.2 x 104 conidia/ disc. After inoculation, the mouth of each test tube was covered with aluminum foil and was incubated at 25°C in growth chamber. After 30 days data was recorded. Symptoms on foliar parts were recorded by noting the presence and absence of lesions on the leaves developed by the infection of the pathogen. The pathogen was re isolated and compared with the mother culture.

***In-vivo* test:** Fifteen crop including *Avena sativa* (oats), *Arachis hypogea* (peanut), *Brassica campestris* (mustard), *Cicer arientenum* (chickpea), *Glycine max* (soybean), *Hordeum vulgare* (barley), *Halianthus annus* (sunflower), *Lens culinaris* (lentil), *Pennisetum amaricanum* (millet), *Oryza sativa* (rice), *Sesamum indicum* (sesamum), *Sorghum bicolor* (sorghum), *Vigna radiata*

(green gram), *Vigna mungo* (black gram) and *Zea mays* (maize) were tested for the infection of the pathogen *B. sorokiniana* by *In-vivo* method. The entire fifteen crops grown in the pots at net house of N.D.U.A. & T. Kumarganj, Faizabad (U.P.). After 65 days the inoculums of *B. sorokiniana* spray on each crop. Data was recorded at fourteen days after spray. Symptoms on foliar parts were recorded by noting the presence and absence of lesions on the leaves developed by the infection of the pathogen. The pathogen was re isolated and compared with the mother culture.

Results and Discussion

In-vitro: The typical spot blotch symptoms were produced on the leaves of 10 crops including *Avena sativa* (oats), *Brassica campestris* (mustard), *Glycine max* (soybean), *Hordeum vulgare* (barley), *Lens culinaris (*lentil), *Pennisetum amaricanum* (millet), *Sorghum bicolor* (sorghum), *Vigna radiata* (green gram), *Vigna mungo* (black gram) and *Zea mays* (maize) under *In vitro* conditions (Table 1). The pathogen was reisolated and found alike with mother culture upon microscopy. Out of these hosts *Hordeum vulgare*, *Avena sativa*, *Cicer arientenum*, *Sorghum bicolor* and *Zea maize* have already been reported as hosts of *B. sorokiniana* (Jones & Cliford, 1983, ARS Fungal Database-http://nt.ars-grin.gov/fungaldatabases), however Zillinsky (1983) reported that rye is less susceptible and oats are seldom infected.

In-vivo: The symptoms of spot blotch were produced on the leaves of 12 crops including *Avena sativa* (oats), *Brassica campestris* (mustard), *Glycine max* (soybean), *Hordeum vulgare* (barley), *Lens culinaris (*lentil), *Oryza sativa* (Rice), *Pennisetum amaricanum* (millet), *Sesamum indicum* (sesamum), *Sorghum bicolor* (sorghum), *Vigna radiata* (green gram), *Vigna mungo* (black gram) and *Zea mays* (maize) under *In-vivo* condition (Table-1). The pathogen was re isolated and found alike with mother culture upon microscopy.

Table 1. Status of crops as hosts of *Bipolaris sorokiniana* other than wheat.

S. No.	Crop (common name)	Status	
		***In-vitro* test**	***In-vivo* test**
1.	*Avena sativa* (Oats)	+	+
2.	*Arachis hypogea* (Peanut)	-	-
3.	*Brassica compestris* (Mustard)	+	+
4.	*Cicer arientenum* (Chickpea)	-	-
5.	*Glycine max* (Soybean)	+	+
6.	*Hordeum vulgare* (Barley)	+	+
7.	*Halianthus annus* (Sunflower)	-	-
8.	*Lens culinaris* (Lentil)	+	+
9.	*Pennisetun amaricanum* (Millet)	+	+
10.	*Oryza sativa* (Rice)	-	+
11.	*Sesamum indicum* (Sesamum)	-	+
12.	*Sorghum bicolor* (Sorghum)	+	+
13.	*Vigna radiata* (Green gram)	+	+
14.	*Vigna mungo* (Black gram)	+	+
15.	*Zea mays* (Maize)	+	+

The results of our studies revealed that the plants of *Oryza sativa, Halianthus annus, Arachis hypogea* and *Cicer arientenum* were non host of *Bipolaris sorokiniana In-vitro* condition bur *In-vivo* condition *Oryza sativa* found a host, which are in contrast to the results which are reported in USDA ARS Fungal Databasehttp:// nt.ars-grin.gov/fungaldatabases, where *Cicer arientenum* and *Oryza sativa* are reported as a host of *B. sorokiniana*. The results on these crops still need confirmation as these crops along with other weed grass species in the wheat field helps in survival of this pathogen (Jones & Clifford, 1983). This pathogen infects number of both cultivated and wild plants. Eighteen monocotyledonous plants have been identified as its hosts (Balogh *et al*., 1991). More than 29 species of Graminae and other crops in Northeastern China, 65 species of Graminae in Yellow and hai river region and 17 plant species in Guandong province are reported as the hosts of this pathogen (Chang & Wu, 1997). Keeping in view the wide host ranges of this fungus and on the basis of these preliminary studies further detailed investigations needed to be done which will ultimately help in sorting the spot blotch management. As one of the strategy to manage the disease is to rotate the crops with oat, rye, legumes or flax to reduce source of fungal spores from residue (http://www.ipmcenters.org/cropprofiles/docs/NDbarley.html).

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