

Seasonal Distribution of Mycofloras Associated with Foliar Blight of Wheat

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Abstract: Foliar blight disease of wheat has been emerging as one of the major concerns for cultivation of wheat in warmer and humid regions of the world. Due to the climate change and global warming, there has been a drastic change in the distribution of mycofloras associated with the disease. The study was conducted to identify the different fungal genera and estimate their percent occurrence in different periods of the cropping season. *Alternaria triticina*, *Curvularia lunata* and *Chaetomium dolicoctrichum* were the prevailing fungi in the cooler part of the cropping season i.e., in January. In the mid of February, *Cladosporium herbarum* and *Cephalosporium gramineum* were observed but in lesser frequency. Finally, when the temperature began to rise from March, *Bipolaris sorokiniana* started to outnumber *A. triticina*.

Keywords: Wheat, foliar blight, mycofloras and temperature

INTRODUCTION

Wheat (*Triticum aestivum* L.) belongs to family Poaceae. It contains considerably more protein than rice, maize, barley and millet. Wheat flour is used to make traditional food products such as bread, noodles and pasta. The crop is affected by a number of fungal, bacterial and viral diseases, which pose serious threat to successful cultivation of wheat. A number of pathogens are associated with leaf blight of wheat. They are *Drechslera sorokiniana*, *D. tetramera*, *D. nodulosa* var. *tritici*, *D. tritici repentis*, *Alternaria alternata*, *A. triticina*, *A. tenuissima*, *A. triticola*, *Dilophospora alopecuri*, *Pyricularia oryzae*, *Leptosphaerulina trifolli*, *Chaetomium dolicoctrichum* (Joshi *et al.*, 1978). Among these pathogens, *D. sorokiniana* and *A. triticina* are most important throughout the country and are especially important in the eastern part, in Bihar and West Bengal. Substantial economic loss in wheat production has occurred due to the severity of foliar blight, affecting the livelihood of millions of small farmers in warm and humid regions of South Asia. Indian subcontinent has 10 million ha of affected land, out of which India alone has 9 million ha, most of which is in the rice - wheat cropping system (Nagarajan and Kumar, 1998). Many fungal genera do exist, out of which some are parasites, some

others are saprophytes and a few are facultative in nature. They have different modes of feeding as well as variable requirements of environmental conditions (temperature, relative humidity, light, pH, etc.) for growth and multiplication. Hence the study was undertaken to determine their seasonal distribution.

MATERIAL AND METHODS

The experiment was conducted at the Department of Mycology and Plant Pathology, Banaras Hindu University, Varanasi. Diseased wheat leaf samples showing the typical blight symptoms were collected from the Agriculture Research Farm and brought to the laboratory. The leaf sampling was commenced from the beginning of January and continued till the end of March at a periodical interval of 10-15 days. The symptomatic leaf samples were surface sterilized with 1% sodium hypochlorite and cut into small pieces (1-2cm) having lesions with the help of sterilized scissors. Six leaf bits were placed in each moist chamber, with four moist chambers per sample and incubated at 25±2°C. The moist chamber was prepared by placing blotting paper in a 9 cm diameter sterilized Petri-plate, moistening it with sterile distilled water and autoclaving it at 121°C. The spore formation took place on the third day of incubation

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(De Wolf *et al.*, 1998). The moist chambers were observed under stereoscopic microscope at regular interval of 12 hours for microscopic structures of the fungi, if any. The encountered fungi were isolated from the incubated leaf bits and maintained on potato dextrose agar media (Peeled potato: 200g, Dextrose: 20g, Agar-Agar: 20g, Distilled water: 1000ml) acidified with 4-5 drops of 25% lactic acid. After their growth in the media, these encountered fungi were characterised based on their taxonomic features and compared with relevant literature of various workers.

RESULTS AND DISCUSSION

The data on variation in occurrence of the different mycofloras associated with foliar blight of wheat with respect to the different period during the cropping season showed occurrence of *Alternaria triticina*, *Bipolaris sorokiniana*, *Cephalosporium gramineum*, *Cladosporium herbarum* and *Curvularia lunata* (Table 1). The sampling of leaves while the average temperature was around 15°C yielded *A. triticina* as the dominant fungus. *C. lunata* and *C. dolico-trichum* were the two other fungal species prevailing at the lower temperature. *B. sorokiniana* was first seen in the late January. After the first fortnight of February, two other species viz. *C. herbarum* and *C. gramineum* were noticed but in less frequency and *B. sorokiniana* was found to increase in its number. In the later part of the cropping season i.e., in March, when the average temperature was around 27°C, *B. sorokiniana* started to outnumber *A. triticina*.

Bipolaris sorokiniana

The colony colour produced by the fungus varied from light whitish to light gray and some of them converted to black to olivaceous black in colour and presence of knotting of the mycelium. The conidia showed bipolar germination and the germ tube was in semi axial position. The number of septa varied from 3-4 (7 days old young culture), while its number varied from 7-9 in older conidia. The conidiophores were un-branched, septate, light brown to dark brown in colour and erect. The young conidia measured 23.5×12.5µ, whereas, the old conidia were 44×25µ. These morphological characters were confirmed with relevant literature (Asad *et al.*, 2009; Alcorn, 1982; Alcorn, 1983) and the fungus was identified as *B. sorokiniana*.

Alternaria triticina

The mycelium was initially hyaline, becoming olive-buff to deep olive-buff, branched, septate, 2-6 µm wide.

The conidiophores were similar to mycelium in colour, septate, unbranched or occasionally branched, erect, broader towards the distal end, on the host single or fasciculate, emerging through stomata, amphigenous, geniculate or straight, length variable, between septa 17-28 × 3-7 µm. The conidia were acrogenous, borne singly or in chains of 2-4, smooth, irregularly ovoid, both ends rounded, or ellipsoid, or conical-ellipsoid, gradually tapering into a beak. The beak is a secondary conidiophore concolorous with the main conidial body, straight, 20-36 × 3-6 µm. The spores were pale brown to dark olive-buff, while the older ones were darker, verrucose, having 1-9 transverse septa, 0-5 longitudinal septa, constricted at septa. The spores were 15-89 µm long and 7-29 µm including beak. These morphological characters were confirmed with relevant literature (Prasada & Prabhu, 1962)

Curvularia lunata

The fungus produced rapidly growing, woolly colonies. The hyphae were septate and brown in colour. The conidiophores were brown, geniculate, simple or branched. The conidia (also called the poroconidia) were multiseptate, straight or pyriform, brown in colour, and having dark basal protuberant hila. The septa were transverse and divided each conidium into multiple cells. The central cell was typically darker and enlarged compared to the end cells in the conidium. The central septum also appeared darker than the others. The swelling of the central cell usually gave the conidium a curved appearance. The conidia of *C. lunata* had 3-4 septa. These morphological characters were confirmed with relevant literature (Dematiaceous Hyphomycetes by M.B. Ellis, 1971).

Cephalosporium gramineum

The fungus produced spores in a "head" of mucus at the end of a short, unbranched conidiophore. Usually the spores were nonseptate, 2-7 µ wide and 4-11 µ long, and wedge shaped.

Cladosporium herbarum (Persoon) Link

The colony of the fungus was 3-6 cm in diameter in ten days on MEA at 20°C, olivaceous-green to olivaceous-brown, velvety, reverse olivaceous-black. The conidiophores were 250 µ long and 3-6.5 µ wide, with terminal and intercalary swellings (7-8 µ diameter), geniculate and elongated. The conidia were terminal, by extension of the tip falsely lateral, on short knee-like swellings, single or at times in chains,

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Table 1
Predominance of mycofloras associated with foliar blight of wheat during the cropping season

Date of leaf sampling	Name of the fungal species encountered	Number of colonies of the encountered fungal species	Total number of fungal colonies*	Per cent occurrence
1 st Jan	<i>Alternaria triticina</i>	18	24	75
	<i>Curvularia lunata</i>	4	24	17
	<i>Chaetomium dolicoctrichum</i>	2	24	8
15 th Jan.	<i>Alternaria triticina</i>	16	24	67
	<i>Curvularia lunata</i>	6	24	25
	<i>Chaetomium dolicoctrichum</i>	2	24	8
31 st Jan.	<i>Alternaria triticina</i>	12	24	50
	<i>Curvularia lunata</i>	6	24	25
	<i>Chaetomium dolicoctrichum</i>	1	24	4
	<i>Bipolaris sorokiniana</i>	5	24	21
10 th Feb.	<i>Alternaria triticina</i>	10	24	42
	<i>Curvularia lunata</i>	4	24	17
	<i>Chaetomium dolicoctrichum</i>	1	24	4
	<i>Bipolaris sorokiniana</i>	9	24	38
20 th Feb.	<i>Alternaria triticina</i>	8	24	33
	<i>Curvularia lunata</i>	4	24	17
	<i>Chaetomium dolicoctrichum</i>	1	24	4
	<i>Cephalosporium gramineum</i>	2	24	8
	<i>Cladosporium herbarum</i>	1	24	4
	<i>Bipolaris sorokiniana</i>	8	24	33
	<i>Alternaria triticina</i>	7	24	29
28 th Feb.	<i>Curvularia lunata</i>	3	24	13
	<i>Chaetomium dolicoctrichum</i>	0	24	0
	<i>Cephalosporium gramineum</i>	2	24	8
	<i>Cladosporium herbarum</i>	2	24	8
	<i>Bipolaris sorokiniana</i>	10	24	42
	<i>Alternaria triticina</i>	8	24	33
	<i>Curvularia lunata</i>	3	24	13
10 th March	<i>Chaetomium dolicoctrichum</i>	0	24	0
	<i>Cephalosporium gramineum</i>	2	24	8
	<i>Cladosporium herbarum</i>	2	24	8
	<i>Bipolaris sorokiniana</i>	9	24	38
	<i>Alternaria triticina</i>	5	24	21
	<i>Curvularia lunata</i>	3	24	13
	<i>Chaetomium dolicoctrichum</i>	1	24	4
20 th March	<i>Cephalosporium gramineum</i>	3	24	13
	<i>Cladosporium herbarum</i>	2	24	8
	<i>Bipolaris sorokiniana</i>	10	24	42
	<i>Alternaria triticina</i>	7	24	29
	<i>Curvularia lunata</i>	1	24	4
	<i>Chaetomium dolicoctrichum</i>	0	24	0
	<i>Cephalosporium gramineum</i>	2	24	8
30 th March	<i>Cladosporium herbarum</i>	2	24	8
	<i>Bipolaris sorokiniana</i>	12	24	50

*Total 4 moist chambers per sample, each with 6 leaf bits

of various shapes, elongated, oval, and then usually one-celled, or cylindrical-ellipsoidal and then with 1-4 septa, smoky-brown or olive-green, slightly constricted at the septa, with a finely granulate or spiny wall, of very different diameters and lengths. Conidium was one-celled, reaching 5.5-12×3.0-5 μ.

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