Volume : 6 | Issue : 3 | March - 2017 ISSN - 2250-1991 | IF : 5.761 | IC Value : 79.96

Original Research Paper Agricultural Science

Monitoring of foliar blight pathogens in wheat *(Triticum aestivum L.)*

C. K. Yashwant — N. D. University of Agriculture and Technology, Kumarganj, Faizabad, Uttar Pradesh, India.

Gyan Manjary Rao — Uttar Pradesh Council of Agricultural Research (UPKAR) Lucknow, India.

S. K. Singh — Department of Plant Pathology, N. D. University of Agriculture and Technology, Kumarganj, Faizabad, Uttar Pradesh, India.

ABSTRACT

The wheat crop in eastern India, suffers from a number of fungal foliar diseases, namely, Alternaria leaf blight (*Alternaria triticina*), Curvularia leaf spot (*Curvularia lunata*), Spot blotch (*Bipolaris sorokiniana*) and Tan spot (*Pyrenophora tritici-repintis*). Spot blotch covers over 70 per cent of the foliar blight incidence. Over the years the focus, as major foliar blight pathogen, is shifting to *Cochliobolus sativus* (Ito and Kurib.) Drech. Ex Dastur [anamorph: *Bipolaris sorokiniana* (Sacc.) Shoem. Thus, spot blotch caused by the pathogen is, logically, responsible for major losses attributed to foliar blights. Spot blotch are responsible for over two thirds of area coverage and much of the yield losses by these diseases. Foliar blight initiated by December end on foliage, January end on sheath and March beginning on neck and ear head of normal sown of wheat. Colony shape of foliar blight pathogens isolates from different parts of wheat were observed as uniformly circular with aerially produced mycelia.

KEYWORDS Wheat, *Bipolaris sorokiniana, Alternaria triticina, Curvularia lunata, Pyrenophora tritici-repintis.*

Wheat (*Triticum aestivum* L. emend. Fiori and Paol.) crop suffers from a number of devastating diseases caused by fungi, bacteria, viruses, mycoplasma, nematodes and environmental factors. Sixty-nine listing of fewer pathogens causing twenty-three diseases being more important than those caused by other groups of pathogens or factors. However, in eastern Uttar Pradesh only fungal diseases, such as black rust [*Puccinia graminis* f.sp. *tritici(*Pers) Eriks and Henn], brown rust (*Puccinia recondita* Rob. Ex. Desm), yellow rust (*Puccinia striiformis* West), foliar blights (*Helminthosporium stivum* Pamm. King & Bakke and *Alternaria triticina* Prasada & Prabhu), loose smut [*Ustilago nuda var. tritici* (Jens) Schaf], karnal bunt [*Neovossia indica* (Mitra) Mundkur] and powdery mildew (*Erysiphe graminis* D C), are of major consequence. With the change in cropping system, cropping intensity, crop management and varietal spread, the foliar blights are causing major losses to wheat crop in eastern Uttar Pradesh. A number of pathogens causing leaf blight, blotches and spots on this crop have been reported. Foliar blights in wheat are caused by species of *Alternaria* and *Helminthosporium*. This disease caused by both of these pathogens is generally taken as a group because in most of cases it is rather difficult to distinguish one from the other field condition.

Wheat foliar blights have been studied extensively in India (Joshi *et al.,* 1986; Singh *et al.,* 1986 and Singh and Srivastava, 1997), but due to difficulty in distinguishing the symptoms at field level and isolation and identification of pathogens in laboratory (Goel *et al.,* 1999), many of the findings are suspect in nature and represent foliar blights in general, though attributed, most of the time, to a specific pathogen. Consequently work on epidemiology and on the components of integrated management of foliar blights, exclusively, has been scarcely attempted.

Material and method

Studies were conducted at the Student Instructional Farm (SIF), Main Experiment Station (MES), Net House, Glass House, Wheat Pathology Laboratory and other facilities at the Main Campus of N. D. University of Agriculture & Technology, Kumarganj, Faizabad (U.P.). It is located in the Indo-Gangetic plains of Eastern Uttar Pradesh at latitude 26.47^{0}N, longitude 82.12^0 E and altitude 113 m above the sea level. Field trials were conducted during *Rabi* 2009-10 and 2010-11. Samples were closely examined using naked eyes and hand lens to selectively choose foliar blight affected one following the symptoms described by Misra (1973 a, b), Bazlur Rashid *et al* (1987) and Anderson (1952). Sheath, leaf, neck and ear head showing typical symptoms were cut and arranged separately for isolating the fungi associated with the samples. The diseased leaf samples, showing distinct characteristics of foliar blights disease, were selected for isolation of the pathogen. The selected plant parts were washed with fresh sterilized water in order to remove the dust particles and surface contaminants. The washed diseased plant parts were cut into small bits, with some healthy portion. The cut plant parts were surface sterilized with 0.1 per cent mercuric chloride solution under aseptic condition inside a laminar flow and washed thoroughly 3 to 4 times with sterilized water to remove the traces of mercuric chloride. Excess moistures were removed by placing these in the fold of sterilized blotting papers. The pieces, thus sterilized, were transferred in petridishes previously sterilized at 160^{0}C for two hours in an electric oven and poured with 2 per cent potato dextrose agar medium. The medium was previously autoclaved at 15 pound per square inch pressure for 20 minutes. Three to four pieces of diseased plant parts were placed per petridish properly marked with glass marking pencil indicating date of isolation and isolate number etc. The petridishes were then transferred at 30^{0}C in an incubator.

Isolated and raised pure cultures of different fungi were identified on the basis of morphological and cultural characters (Gilman, 1967, 1975; Subramaniam, 1971; Ellis, 1971, 1976; Bernett and Barry, 1972; Malone and Musket, 1964 and Singh, 1983).

Result and Discussion

Field observations revealed presence of foliar blights in wheat crop by the end of December during both the years. Collection of samples start on 1st January and isolations made on 2 and 19 of January. In identification on 10 and 27 January produced *Bipolaris sorokiniana* (Sacc.) Shoem. and *Alternaria triticina* Prasada and Prabhu (Table-1,2). Foliar blight pathogens were isolated from beginning (January, 01) to the end of the season (April, 02). February, 01 and 16 isolations yielded *Alternaria triticina* and *Drechslera tritici-repentis* also, March, 03 isolations additionally, yielded *Alternaria alternata* also. *A. triticina* and *A. alternata* too remained present till the end of season. Occurrence of one or more of these pathogens in the country and region, have been reported by Sokhi *et al.* (1972), Singh *et al* (2001a, b, c), Sharma *et al.* (2004a, b) and Singh *et al.* (2004c, e) also. Rare occurrence of *D. tritici-repentis* in the region is in conformity with its presence being

recorded by Mishra 1973a and Mishra (1973b) in Bihar, Singh *et al.* (2001b, c) in wider areas in very low proportion and absence by Mahto (2000a), Dubin and Van Ginkel (1991) and Nagarajan (2001) have also emphasized the fact that in South-Asia, the incidence of *B. sorokiniana* prevails over that of *D. tritici-repentis*.

Sheath showed apparent symptoms by the January end. February, 3rd to March, 3rd isolations, in both years, and March, 18 isolations only in 2009-10 yielded *B. sorokiniana* alone. Later isolations, March, 18 in 2010-11 and March, 18 and April, 02 in 2009-10 yielded *A. alternata* and *A. triticina* as well. This coincides with late season isolation of this fungus from leaves also. Neck and ear head symptoms appear in March beginning. April isolations, however, yielded *Curvularia* spp. also. In addition April isolations yielded *A. alternata* as well. *B. sorokiniana* causing sheath, neck and ear head blight phase of spot blotch of wheat has been well documented in India (Mishra, 1973a and Mishra, 1973b) and abroad (Anderson, 1952). *B. sorokiniana* isolates obtained from wheat proved pathogenic to their host reported earlier also from this centre (Singh *et al.*, 1998b; Singh, 1999 and Singh *et al*., 2001a,b,c). But the successful cross pathogenicity of the isolates from this region has never been reported earlier, such studies elsewhere in wheat isolation, showed the pathogen to appear as a continum of isolates differing in aggressiveness as noted by Duveiller *et al*., (2005).

Table-1 Fungi isolated from different infected parts (Sheath, Leaf, Neck and Ear head) of wheat plant during 2009-2010

Date of sampled collections	Date of isolation	Sheath	Leaf	Neck	Ear head
1 Jan.	3 Jan.	Healthy	*Bipolaris sorokiniana*	Healthy	Healthy
16 Jan.	19 Jan.	Healthy	*B. sorokiniana* *Alternaria triticina*	No heading	No heading
1 Feb.	3 Feb.	*Bipolaris sorokiniana*	*B. sorokiniana* *A. triticina* *A.alternata*	No heading	No heading
16 Feb.	18 Feb.	*B. sorokiniana* *A. triticina* *A.alternata*	*B. sorokiniana* *Alternaria tinussima* *D. trtici-repentis*	Infected sample not available	Infected sample not available
1 March	3 March	*B. sorokiniana* *A.alternata* *A. triticina*	*B. sorokiniana* *D. trtici-repentis* *A. triticina* *A. tinussima*	*B. sorokiniana*	*B. sorokiniana*
16 March	18 March	*B. sorokiniana* *A. triticina* *A.alternata* *Epicocum sp.*	*B. sorokiniana* *D.trtici-repentis A.alternata* *Epicocum sp.*	*B. sorokiniana* *A. triticina* *A.alternata*	*B. sorokiniana* *A. triticina* *Epicocum sp.*
1 April	3 April	*B. sorokiniana* *A.alternata* *Epicocum sp.* *A. triticina*	*B. sorokiniana* *D. trtici-repentis* *A. tinussima* *A. triticina*	*B. sorokiniana* *A. triticina* *C. lunata* *A.alternata*	*B. sorokiniana* *A. triticina* *C. lunata* *Epicocum sp.*

Table-2 Fungi isolated from different infected parts (Sheath, Leaf, Neck and Ear head) of wheat plant during 2010-2011

Date of sampled collections	Date of isolation	Sheath	Leaf	Neck	Ear head
1 Jan.	2 Jan.	Healthy	*Bipolaris sorokiniana*	Healthy	Healthy
16 Jan.	19 Jan.	Healthy	*B. sorokiniana* *A.alternata + A. triticina*	No heading	No heading
1 Feb.	3 Feb.	*Bipolaris sorokiniana*	*B. sorokiniana* *D. trtici-repentis* *A. triticina + A.alternata*	No heading	No heading
16 Feb.	18 Feb.	*Bipolaris sorokiniana*	*B. sorokiniana* *Alternaria tenuissima* *D. trtici-repentis*	Infected sample not available	*B. sorokiniana*
1 March	3 March	*B. sorokiniana* *A. triticina* *A.alternata*	*B. sorokiniana* *D.trtici-repentis A.alternata* *+A. triticina, A. tinussima*	*B. sorokiniana*	*B. sorokiniana* *A. triticina* *Epicocum sp.*
16 March	18 March	*B. sorokiniana* *A. triticina, A.alternata* *Epicocum sp.*	*B. sorokiniana* *D. trtici-repentis* *A.alternata* *Epicocum sp.*	*B. sorokiniana* *A. triticina* *A.alternata*	*B. sorokiniana* *A. triticina* *Epicocum sp.*
2April	2 April	*B. sorokiniana* *A.alternata, C. lunata* *Epicocum sp.*	*B. sorokiniana* *D. trtici-repentis* *A. triticina, A. tenuissima*	*B. sorokiniana* *A. triticina* *A.alternata* *C. lunata*	*B. sorokiniana* *A. triticina* *C. lunata* *Epicocum sp.*

References:

1. Anderson, A.L. (1952). Development of wheat head blight incited by Helminthosporium satium. Phytopathology, 42: 453-456.
2. Bazlur Rashid, A.Q.M., Bahadure, meah and Jalaluddin, M. (1987). Effect of leaf blight caused by Drechslera sorokiniana (Sacc.) Subram. And Jain on some yield components of wheat. Crop Protec.6: 256-260.
3. Bernett, H.L. and Barry, B. (1972). Illustrated Genera of Imperfect fungi (3rd Edi.) Burgess Pub. Co. Mannestota.
4. Dubin, H.J. and van Ginkel, M. (1991). The status of wheat diseases and disease research in the warm areas. In: Wheat for the Nontraditional Warm Areas (Ed. Saunders, D.A.). pp. 125-145. CIMMYT, Mexico City, Mexico.
5. Duveiller, E., Dubin, H.J., Recves, J. and Mc Nab, A. (1998). (Eds.) Helminthosporium Blight of wheat, spot blotch and tan spot. Mexico, D.F. CIMMYT, Mexico, 376 pp.
6. Duveiller, E., Kandel, Y. R., Sharma, R. C. and Shrestha, S. M. (2005). Epidemiology of foliar blights (spot blotch and tan spot) of wheat in the plains bordering the Himalayas. Phytopath. 95: 3, 248-256.
7. Ellis, M.B. (1971). Dematiaceous Hyphomycetes. 608 pp. Kew; Common Wealth Mycological Institute.
8. Ellis, M.B. (1976). More Dematiaceous Hyphomycetes. 507 pp. Kew; Common Wealth Mycological Institute.
9. Gilman, C.J. (1967). A manual of soil fungi. Oxford and IBH Publishing Co., New Delhi, pp: 339-340.

10. Gilman, C.J. (1975). A manual of soil fungi (Third Edition). Oxford and IBH Publishing Co., New Delhi.
11. Goel, L.B., Nagarajan, S., Singh, R.V., Sinha, V.C. and Kumar, J. (1999). Foliar blights of wheat: Current status in India and identification of donor lines for resistance though multilocational evaluation. Indian Phytopath.52:398-402.
12. Joshi, L.M., Singh, D.V. and Srivastava, K.D. Eds. (1986). Problems and Progress of Wheat Pathology in South Asia. Malhotra Publishing House, New Delhi, 401pp.
13. Mahto, B.N. (2000a). Effect of cultural practices on foliar blight incidence in wheat. Ann. Agric. Res. 21: 177-181.
14. Malone, J.P. and Musket, A.E. (1964). Seed borne fungi. Description of 77 fungus species. Proc. Int. Seed Test. Assoc., 29: 179-384.
15. Mishra, A.P. (1973a). Helminthosporium species occurring on cereals and other gramineae. Final report. Pl-480 project. Tirhut College of Agric. Dholi, Muzaffarpur, India, pp.289.
16. Misra, A.P. (1973b). Helminthosporium species occurring on cereals and other gramineae. College of Agriculture, Muzafferpur, 290 PP.
17. Nagarajan, S. (2001). Editorial. Indian Wheat Newsl. 7 (1)1.
18. Sharma, R.C. and Duveiller, E. (2004a). Effect of Helminthosporium leaf blight on performance of timely and late-seeded wheat under optimal and stressed levels of soil fertility and moisture. Field Crops Research 89: 205-218.
19. Sharma, R.C., Duveiller, E., Gyawali, S., Shrestha, S.M., Chaudhary, N.K. and Bhatta, M.R. (2004b). Resistance to Helminthosporium leaf blight and agronomic performance of spring wheat genotypes of diverse regions. Euphytica, 139: 33-44.
20. Singh, D. (1999). Studies on Helminthosporium blight of wheat (Triticum aestivum L.) Ph.D. Thesis, Deportment of Plant Pathology, N.D.U.A. &T., Kumarganj, Faizabad. pp 112+ i.
21. Singh, D.V. and Srivastava, K.D. (1997). Foliar blights and Fusarium scab of Wheat. In: Management of Threatening Plant Diseases of National Importance: Present status and Strategies for Management (Eds. Agnihotry, V.P., Sarabhoy, A.K. and Singh, D.V.).pp. 1-16. Malhotra Publishing House, New Delhi.
22. Singh, D.V., Joshi, L.M. and Srivastava, K.D. (1986). Foliar blights and spots of wheat in India. Indian Jour. of Genet. 46: 217-245.
23. Singh, R.N., Singh, A.K., Ahmad, R. and Singh, S.P. (1998b).Influence of agronomic practices on foliar blight and identification of A. alternata hosts in the rice-wheat cropping system. In: Helminthosporium Blights of Wheat: Spot Blotch and Tan Spot (Eds. Duveiller, E., Dubin, H.J., Reeves, J. and Mcnab, A.). pp. 346-358. CIMMYT, Mexico City, Mexico.
24. Singh, R.N., Singh, A.K., Chauhan, A. and Singh, S.P. (2001a). Etiology, epidemiology, yield loss and management of leaf blights in bread wheat. 27th Annual meeting of Mycological Society of India and International Symposium on Frontiers of Fungal Diversity and Diseases in South East Asia, February 9-11,2001. Held at Department of botany, DDU, Gorakhpur University, Gorakhpur. Souvenir and abstracts.pp.97-98.
25. Singh, R.N., Singh, Singh, S.P. and Singh, B.N. (2001b). Prevalence and distribution of foliar blight pathogens attacking wheat in India. Indian Phytopath. 54: 175-178.
26. Singh, R.S. (1983). Plant diseases. Oxford and IBH Publishing Co., pp. 56.
27. Sokhi, S.S. and Joshi, L.M. (1972). Physiologic specialization in Alternaria triticina. Indian Jour. of Microbiology., 12 : 209-210.
28. Subramanian, C.V. (1971). Hyphomycetes, ICAR, New Delhi, 930 pp.