



ASSOCIATION OF *BIPOLARIS* AND *DRECHSLERA* SPECIES WITH BIPOLARIS LEAF BLIGHT (BpLB) INFECTED WHEAT LEAVES

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ABSTRACT

Five species of *Bipolaris* and two species of *Drechslera* associated with leaf blight disease of wheat (*Triticum aestivum* L.) have been described. The associated fungi were *Bipolaris cynodontis* (Marig.) Shoemaker, *B. oryzae* (Breda De Haan) Shoemaker, *B. sorokiniana* (Sacc.) Shoemaker, *B. tetranera* (Mckinney) Shoemaker, *B. victoriae* (Meehan & Murphy) Shoemaker, *Drechslera dematioidea* (Bub. & Wrob.) Subram. & Jain and *D. hawaiiensis* (Bugnicourt) ex M.B. Ellis; Subram. & Jain.

Keywords: Wheat; *Bipolaris*; *Drechslera*; BpLB

INTRODUCTION

Wheat (*Triticum aestivum* L.) is the second most important staple food crop in Bangladesh after rice. Once wheat was a food for the poorer in Bangladesh. Most of the people used to take wheat as 'roti'. Wheat consumption is increasing due to rapid urbanization and industrialization of the country and the consequent increase in the use of numerous bakery products. Within a period of 40 years of time, wheat has been firmly established as a secure crop in Bangladesh. The average yield of wheat in Bangladesh is lower in comparison to other countries. During 2015-16 and 2016-17, total wheat production was 1.348 and 1.311 million tons from 0.445 and 0.415 million hectares of land (BBS, 2017). The country needs 5.5 million tons wheat, 80% of which are imported every year. Diseases play an important role in lowering wheat yield in the country. Wheat is attacked by 20 different diseases in Bangladesh (Talukdar, 1974; Ahmed, 1986), of which five are considered as major diseases. They are *Bipolaris* leaf blight-BpLB (*Bipolaris sorokiniana*), leaf rust (*Puccinia recondita*), seedling blight (*Bipolaris sorokiniana*), foot and root rot (*Sclerotium rolfsii* Tode) and black point [*B. sorokiniana*, *Alternaria alternata* (Fr) Keissler, *Curvularia lunata* (Wakker) Boedijn and species of *Fusarium* Link. Sadat and Choi (2016) reported wheat blast caused by *Pyricularia graminis-tritici* and *P. oryzae* from Bangladesh.

The present study was on BpLB or *Bipolaris* leaf blight disease of wheat caused by *Bipolaris sorokiniana* (Sacc.) Shoemaker (syn. *Helminthosporium sativum* PK & B; teliomorph: *Cochliobolus sativus* Ito & Kurib; *Drechslera sorokiniana* Drechs ex Dastur). Shoemaker (1959, 1962) proposed the generic name *Bipolaris* for the *Helminthosporium* species with fusoid, straight, or curved conidia germinating by one germ tube from each end (bipolar germination). The former genus *Helminthosporium* was divided into three anamorphic genera: *Bipolaris*, *Drechslera*, and *Exserohilum* with the teleomorphic stages *Cochliobolus*, *Pyrenophora*, and *Setosphaeria*, respectively (Alcorn, 1988). *Bipolaris* leaf blight is the most destructive disease of wheat in the rice-wheat cropping system in Bangladesh. In Bangladesh, the disease occurs in almost all wheat growing areas with varying degrees of severity, causing substantial loss in yield and seed quality (Rashid *et al.*, 1994; Alam *et al.*, 1995). The occurrence and severity of the disease are being increasing every year in Bangladesh (Alam *et al.*, 1993). The current study was undertaken to identify the *Bipolaris* and *Drechslera* species associated with BpLB infected wheat leaves.

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MATERIALS AND METHODS

BpLB infected wheat leaves of different varieties were collected from different locations of eight districts (Dhaka, Gazipur, Dinajpur, Joypurhat, Pabna, Sirajgonj, Kushtia and Chuadanga) in Bangladesh. Leaf samples were collected from the research station of BARI and also from the farmer fields. The fungi were isolated from Bipolaris leaf blight (BpLB) infected wheat leaves. Samples were collected during grain filling stage and placed in clean brown paper bag, labeled properly and preserved at 4°C in refrigerator for subsequent studies.

The fungi were isolated from the samples following “Tissue planting method” on Potato Dextrose Agar (PDA) medium (CAB, 1968). For surface sterilization first the diseased leaf samples were washed under running tap water and cut into 2² mm pieces. Then cut pieces were sterilized in 10% Chlorox for 2 minutes and then washed in sterilized water thrice. Finally, the inocula were placed inside the folds of a sterile blotting paper to remove excess surface water. After blot-drying, inocula were transferred to medium under aseptic conditions using laminar air flow. The inocula were placed in Petri plates containing sterilized potato dextrose agar (PDA) medium, each Petri plate contained 15 mL of PDA medium with an additional of 1 drop (ca.0.03 mL) of lactic acid which was used for checking the bacterial growth. A total number of 50 inocula were transferred in 10 Petri plates for each sample. Then the inoculated plates were incubated at room temperature (25±2°C) for seven days. Fungi which grew from the diseased leaves were transferred to separate PDA plates and PDA slants for further studies and preservation.

Detail morphological studies of the fungal isolates were made in order to determine their identification. The microscopic structural characters of the isolated fungi were recorded under Nikon D 5000 digital camera. Species identification was done by camera Lucida

drawing. All specimens, included in the present study were preserved in Mycology and Plant Pathology Laboratory, Department of Botany, University of Dhaka, Bangladesh. Then isolated fungi were identified based on following standard literatures (Ellis, 1971, 1976; Chidambaram *et al.*, 1973). Prevalence (%) of fungi in specimens was also recorded.

RESULTS AND DISCUSSION

Leaf blight disease of wheat (*Triticum aestivum* L.) caused by *Bipolaris sorokiniana* (Sacc.) Shoem. has led to considerable yield and production losses. Different species in this genus are associated with BpLB infected wheat leaves. In Bangladesh, major pathogen of leaf blight in wheat is *B. sorokiniana*. But other fungal species namely *B. cynodontis*, *B. oryzae*, *B. tetramera*, *B. victoriae*, *Drechslera dematioidea* and *D. hawaiiensis* have been also isolated from infected wheat leaves. The fungus species were identified by taxonomic methods and compared them with *B. sorokiniana*, in relation to growth characteristics on PDA and morphology of the structures. The size of the conidia also differed in length and width. In relation to septa, there were also differences among them. The frequency percentage of five *Bipolaris* species namely- *B. cynodontis*, *B. oryzae*, *B. sorokiniana*, *B. tetramera* and *B. victoriae* are 1.26, 0.357, 32.5, 4.169 and 0.417% and two *Drechslera* species namely- *D. dematioidea* and *D. hawaiiensis* are 0.179 and 5.002% (Momtaz *et al.*, 2018).

Taxonomic enumeration of Bipolaris spp. and Drechslera spp.

1. *Bipolaris cynodontis* (Marig.) Shoemaker, (1959). (Figs. 1A & 2a)

On PDA medium colony blackish ash to black, cottony, reverse black. Mycelium brown, profusely branched, septate. Conidiophores fuliginous to dark brown, arising singly or in groups of 2 or 3, short, straight or slightly bent.

The first conidium borne at a short distance from the base of the conidiophore, 4 to 9 conidia borne acropleurogenously at the geniculated tip. Conidia light to olivaceous brown, ellipsoid to ovate, broader in the middle with rounded ends, straight or slightly curved, uniform in colour, smooth, thin walled, usually 5-8 pseudoseptate, having length and breadth 37.2- 60.4 and 9.1-13.8 μm , respectively.

Specimen examined: Isolated from BpLB infected leaves of Wheat, variety-Saurab, vill.-Vutiapara, dist.- Joypurhat, S Momtaz 425, 4 April 2013.

2. *Bipolaris oryzae* (Breda De Haan) Shoemaker, (1959). (Figs. 1B & 2b)

On agar plate colonies spreading, ash grey (mouse gray) to dark greenish grey, mycelium fluffy, aerial, cottony. On reverse view colony light olivaceous grey with wavy margin. Conidiophores solitary or in small groups, straight or flexuous, pale to mid brown, bearing dark brown conidia acropleurogenously. Fuliginous to olivaceous brown, curved, widest in the middle or just above middle, tapering to rounded ends, base more rounded, not flat or definite, 7-11 pseudoseptate, having length and breadth 89.1-126.9 and 16.9-20.6 μm , respectively.

Specimen examined: Isolated from BpLB infected leaves of Wheat, variety-Shatabdi, vill.-BARI, dist. - Gazipur, S Momtaz 11, 10 March 2010.

3. *Bipolaris sorokiniana* (Sacc.) Shoemaker, (Figs. 1C & 2c)

Colonies on PDA medium olivaceous brown to very dark becoming generally lighter towards the periphery, margin mostly smooth, sometimes wavy with easily recognizable dark band, large number of conidia usually present in the centre, sometimes entire colony covered by black shiny conidia making the colony black and shiny, rarely colonies pinkish white with almost no

conidia. On reverse view colonies black to deep olivaceous brown, roughly circular with concentric rings, margin smooth or irregular, rarely colonies light pinkish white. Conidiophores brown, short, erect, in most cases single, bearing 1-6 conidia. Ellipsoid, dark brown, mostly straight or slightly curved, wall thick but less so towards the ends, broadest in the middle, ends rounded, scar clear within the basal cell. Terminal portion of the end cells subhyaline, 4-9 pseudoseptate, having length and breadth 34.4-98.1 and 15.2-25.8 μm , respectively.

Specimen examined: Isolated from BpLB infected leaves of Wheat, variety-Shatabdi, vill.-Doripara, dist. - Joypurhat, S Momtaz 362, 4 April 2013.

4. *Bipolaris tetramera* (Mckinney) Shoemaker, (1959). (Figs. 1D & 2d)

On PDA colony brown to olivaceous brown, mat, lower side brown, remarkable colony margin with brown band also noticed. Conidiophores brownish, single or in clusters of 2 to 3, conidia almost in cluster. Brown, ellipsoid, mostly cylindrical, straight with broadly rounded ends, lighter towards the terminal cells, 3 pseudoseptate, having length and breadth 23.4-32.6 and 9.9-12.8 μm , respectively.

Specimen examined: Isolated from BpLB infected leaves of Wheat, variety- Kanchan, vill.-BARI, dist.- Gazipur, S Momtaz 109, 12 February 2011.

5. *Bipolaris victoriae* (Meehan & Murphy) Shoemaker, (1959). (Figs. 1E & 2e)

Colony colour and growth characters on PDA very similar to those of *B. sorokiniana*, except in this case the conidia little lighter in color, slender and slightly curved. Conidiophores solitary or in small groups, straight or flexuous, pale to mid brown. Conidia long, ellipsoid, straight or slightly curved, thin walled, pale or mid-pale golden brown, 8-10 pseudoseptate,

having length and breadth were 46.8-70.5 and 12.6-18 μm , respectively.

Specimen examined: Isolated from BpLB infected leaves of Wheat, variety-Shatabdi, vill.-BARI, dist.- Gazipur, S Momtaz 531 , 10 April 2013.

6. *Drechslera dematioidea* (Bub. & Wrob.) Subram. & Jain, (1966). (Figs. 1F & 2f)

Colonies on PDA medium dark ash to black, reverse view is black. Mycelium fluffy and septate. Conidiophores light brown, short, straight or flexuous, sometimes geniculate and slender. Conidiophores arising singly or in twos from dark brown cells. Conidia yellowish brown or golden brown to dark brown, cylindrical to clavate, broader at the tip, tapering towards the base, ending in a wide dark scar.

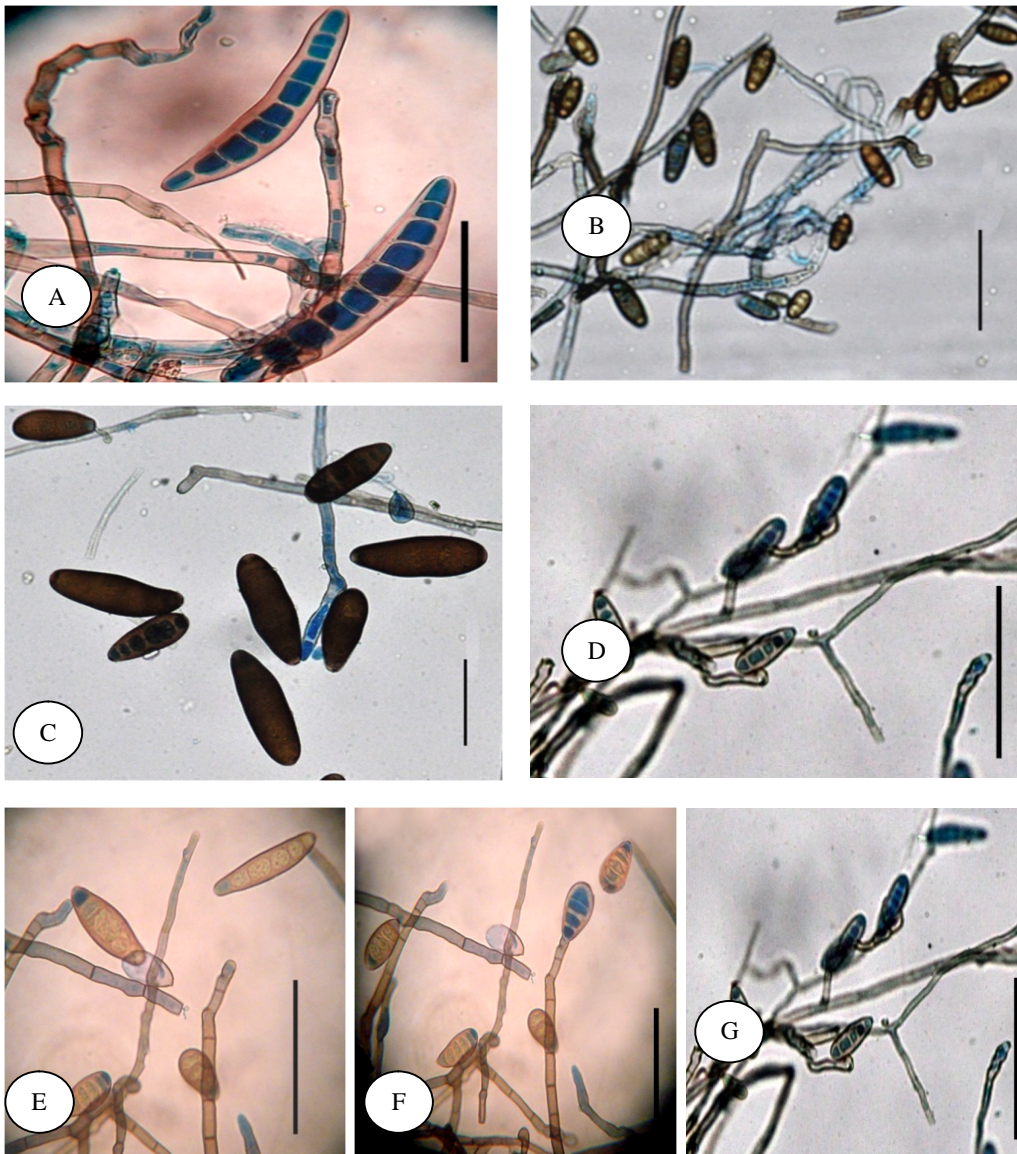


Fig. 1. Photographs showing conidiophores and conidia of A. *Bipolaris cynodontis*, B. *B. oryzae*, C. *B. sorokiniana*, D. *B. tetramera*, E. *B. victoriae*, F. *Drechslera dematioidea* and G. *D. hawaiiensis* (Bar = 50 μm).

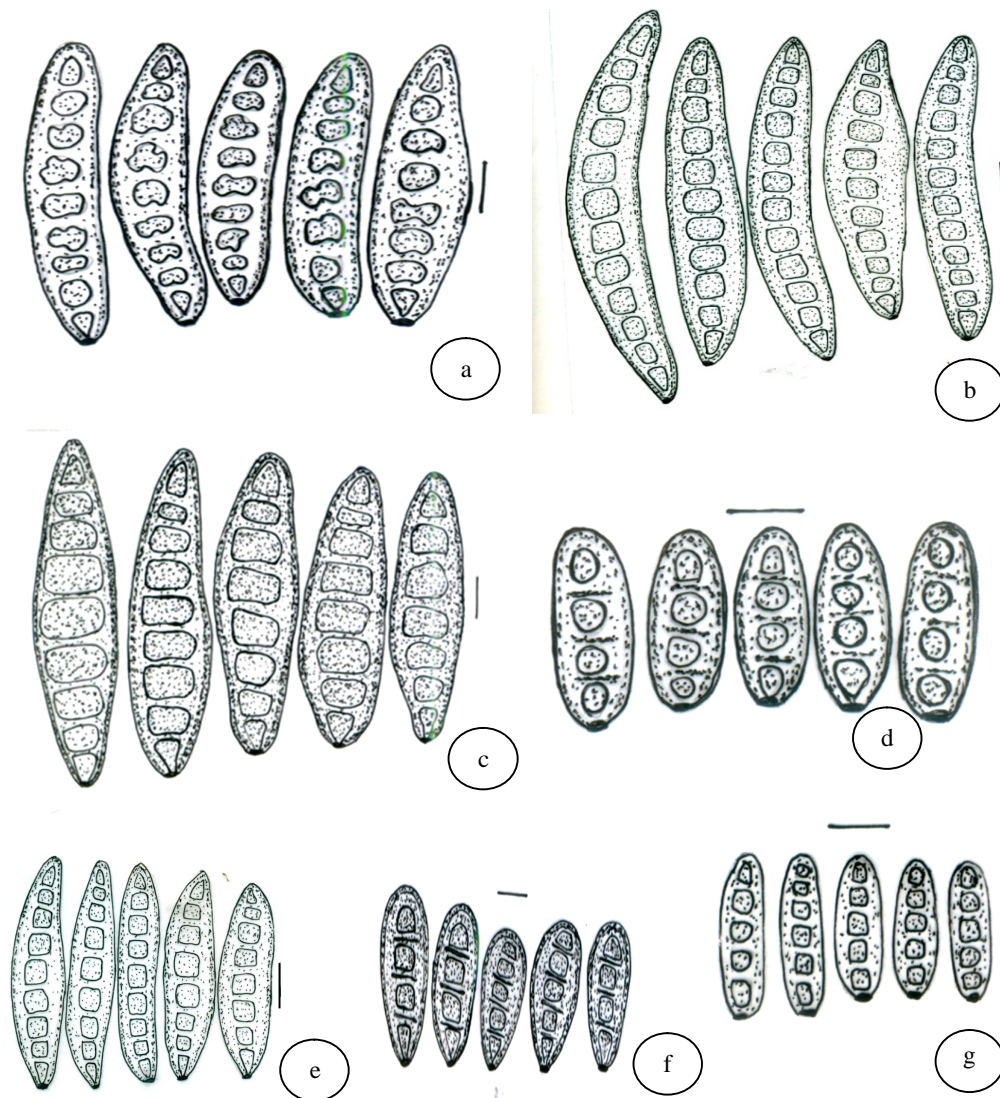


Fig. 2. Conidia of (a) *Bipolaris cynodontis*, (b) *B. oryzae*, (c) *B. sorokiniana*, (d) *B. tetramera*, (e) *B. victoriae*, (f) *Drechslera dematioidia* and (g) *D. hawaiiensis*. (Bar = 11 µm).

The narrowest part is the point of attachment, basal cell lighter in color. Conidia smooth, thick walled, 3-5 pseudoseptate, having length and breadth 27.0-40.8 and 12.2-16 µm, respectively.

Specimen examined: Isolated from BpLB infected leaves of Wheat, variety-Saurav, vill.-Doripara, dist. - Joypurhat, S Momtaz 410, 4 April 2013.

7. *Drechslera hawaiiensis* (Bugnicourt) ex M.B. Ellis; Subram. & Jain, (1966). (**Figs. 1G & 2g**)

On PDA medium colony effuse, grey, dark blackish brown or black. Conidiophores are solitary and brown in color. Conidia pale to mid brown, slender, borne in clusters towards the apex pointing out in different directions. Conidia oblong or cylindrical, rounded at the ends, hilum

within the contour of the basal cell, 4-6 septate (5 septa common), having length and breadth 16.5-29.0 and 6.5-9.2 μm , respectively.

Specimen examined: Isolated from BpLB infected leaves of Wheat, variety-Seri-82, vill.-BARI, dist. - Gazipur, S Momtaz 32, 3 April 2010.

ACKNOWLEDGEMENTS

The first author (S Momtaz) gratefully acknowledges the financial support by the Ministry of Science and Technology, Government of the People's Republic of Bangladesh, through NST fellowship.

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(Received revised manuscript on 13 May 2019)