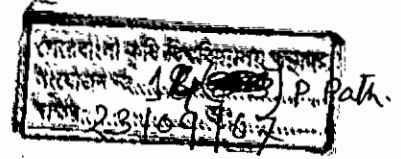


I-13/14

VARIETAL REACTION OF LEAF BLIGHT OF WHEAT
CAUSED BY *Bipolaris sorokiniana*

BY
LUTFUNNAHER LAILA
Registration no. 26214/00505



A. (14)

Sher-e-Bangla Agricultural University
Library

Accession No. 37338

Sign: *[Signature]* Date: 10/12/13

A thesis

Submitted to the faculty of Agriculture,
Sher-e-Bangla Agricultural University, Dhaka
In partial fulfilment of the requirements
For the degree of

MASTER OF SCIENCE (MS)
IN
PLANT PATHOLOGY
SEMESTER: JULY-DECEMBER, 2006

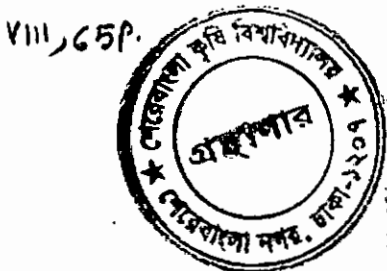
Approved by:

Dr. F. M. Aminuzzaman
Assistant Professor
Supervisor

Dr. Md. Rafiqul Islam
Associate Professor
Co-Supervisor

571.92
L142
2006

Dr. Md. Rafiqul Islam
Chairman
Examination Committee



DECEMBER – 2006



শেরে বাংলা কৃষি বিশ্ববিদ্যালয়
Sher-e-Bangla Agricultural University
Sher-e-Bangla Nagar, Dhaka 1207

PABX : +88029144270-9

Fax : +88029112649

e-mail : vcs@dhaka.net

শেরে বাংলা কৃষি বিশ্ববিদ্যালয়
সংস্করণ নং: ১৭ (১৯৯৯)
তারিখ: ২৩/১০/০৬

P. Path.


CERTIFICATE

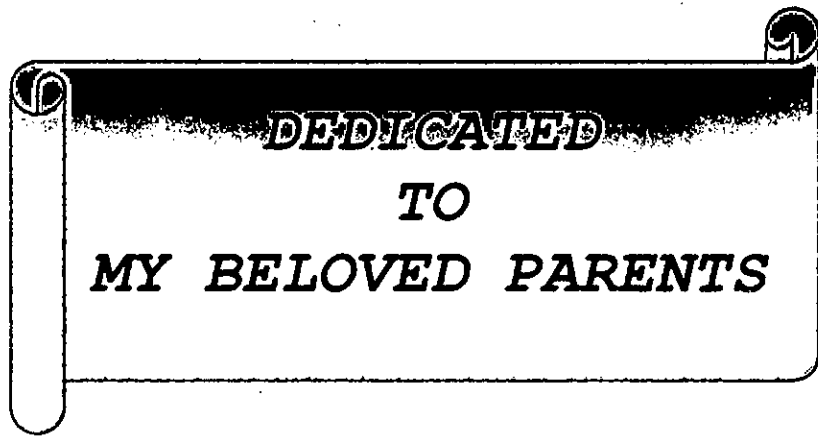
This is to certify that the thesis entitled "**VARIETAL REACTION OF LEAF BLIGHT OF WHEAT CAUSED BY *Bipolaris sorokiniana***" submitted to the Faculty of Agriculture, Sher-e-Bangla Agricultural University, Dhaka, in partial fulfillment of the requirements for the degree of **MASTER OF SCIENCE IN PLANT PATHOLOGY**, embodies the result of a piece of bona fide research work carried out by Registration No. **26214/00505** under my supervision and my guidance. No part of the thesis has been submitted for any other degree or diploma.

I further certify that any help or source of information, received during the course of this investigation has been duly acknowledged.

SHER-E-BANGLA AGRICULTURAL UNIVERSITY

Dated: 30.12.2006
Dhaka, Bangladesh


Dr. F. M. Aminuzzaman
Supervisor
Assistant Professor
Department of Plant Pathology
Sher-e-Bangla Agricultural University
Sher-e-Bangla Nagar, Dhaka-1207.



ABBREVIATIONS AND ACRONYMS

AEZ	: Agro-Ecological Zone
BAU	: Bangladesh Agricultural University
BBS	: Bangladesh Bureau of statistics
cm	: Centimeter
<i>et al.</i>	: and others
etc	: Etcetera
g	: Gram
m	: Meter
m ²	: Square meter
NewsI	: Newsletter
NS	: Not significant
%	: Percent
°C	: Degree Celsius

ACKNOWLEDGEMENTS

Having unflicching faith on to “Omnipotent Creator” for his never-ending blessing, the author deems it a great pleasure to express her profound gratitude to her respected parents, who entiled much hardship inspiring for prosecuting her studies, thereby receiving proper education.

The author feels proud to convey her earnest respect, sincere appreciation and enormous indebtedness to her supervisor Dr. F. M. Aminuzzaman, Assistant Professor, Department of Plant Pathology, Sher-e-Bangla Agricultural University, Dhaka, for his continuous direction, constructive criticism and valuable suggestions in carrying out the research work and preparation of this thesis.

The author also expresses her gratitude and best regards to her respected Co-Supervisor, Dr. Md. Rafiqul Islam, Associate Professor and Chairman, Department of Plant Pathology, Sher-e-Bangla Agricultural University, Dhaka for his scholastic supervision, helpful commentary and unvarying inspiration throughout the research work and preparation of the thesis.

The author also expresses heartfelt thanks to all the teachers of the Department of Plant Pathology, Sher-e-Bangla Agricultural University, Dhaka for their valuable suggestions and encouragement during the period of the study.

The auther is very thankful to Nirmal Das, Coordinator (Research), WAVE Foundation for analysing the data and helpful suggestion for preparation of this manuscript.

The author expresses her sincere appreciation to her brother, sisters, relatives, well wishers and friends for their inspiration, help and encouragement throughout the study period.

The Author

VARIETAL REACTION OF LEAF BLIGHT OF WHEAT CAUSED BY

Bipolaris sorokiniana

ABSTRACT

Subsequently three experiments were conducted in the Seed Pathology Laboratory, net house and experimental field of Sher-e Bangla Agricultural University, Dhaka, Bangladesh during the period from October 2005 to April 2006 to study the varietal reaction of leaf blight of wheat caused by *Bipolaris sorokiniana*. The wheat seeds of varieties Sonalika, Kanchan, Barkat, Shatabdi, Aghrani, Pavon-76, Akbar, Gourab, Sourav and Protiva were collected from Bangladesh Agricultural Research Institute (BARI), Gazipur. In laboratory experiment the maximum number of conidia/seed (320) was recorded for the variety Sonalika and minimum number of conidia/seed (100) was recorded in variety Shatabdi. Maximum lesion length (11.67 cm) on inoculated root was recorded from the variety Sonalika. No lesion i.e. infection (0.00 cm) was recorded in the varieties Shatabdi and Akbar. In blotter test maximum germination (92.00%) was recorded in the variety Shatabdi, Sourab and Agrani and minimum (72.00%) was recorded in the variety Sonalika. Maximum (37%) incidence of seed borne *Bipolaris sorokiniana* was recorded in the variety Sonalika and minimum (17%) in Shatabdi. At panicle initiation stage, flowering stage, milking stage and hard dough stage minimum disease severity was recorded in the variety Shatabdi and maximum in the variety Sonalika. The highest grain yield/pot (5.97 g) was recorded in the variety Gourab. In the field maximum disease severity in all the counting periods was recorded in the variety Sonalika and minimum in the variety Shatabdi. The highest number of healthy spikelets/ear (26.77), number of grains/ear (38.66), number of healthy grains/ear (37.41) and 1000-seed weight (42.12 g) were recorded in the variety Shatabdi. The highest grain yield/plot (391.77 g) was recorded in the variety Shatabdi and the lowest yield/plot (183.08 g) was recorded in the variety Aghrani.

TABLE OF CONTENTS

CHAPTER	TITLE	PAGE
	ACKNOWLEDGEMENTS	i
	ABSTRACT	ii
	TABLE OF CONTENTS	iii
	LIST OF TABLES	vi
	LIST OF FIGURES	vii
	LIST OF PLATES	vii
	LIST OF APPENDIX	vii
1.	INTRODUCTION	01
2.	REVIEW OF LITERATURE	04
3.	MATERIALS AND METHODS	09
	3.1. Laboratory experiment	09
	3.1.1. Collection of seeds	09
	3.1.2. Determination of seed health status	10
	3.1.3. Determination of the number of conidia/seed of <i>Bipolaris sorokiniana</i> by deep freezing blotter method (Limonard, 1968)	10
	3.1.4 Determination of lesion size of inoculated roots of different wheat varieties	11
	3.1.5 Assessment of % leaf segment diseased due to the inoculation of <i>Bipolaris sorokiniana</i>	11
	3.2. Pot Experiment	12
	3.2.1. Preparation of pot for seed sowing	12
	3.2.2. Sowing of seeds	12
	3.2.3. Determination of germination percentage	12
	3.2.4. Intercultural operation (irrigation and drainage)	12

CHAPTER	TITLE	PAGE
	3.2.5. Recording of disease severity	12
	3.2.6. Harvesting	12
	3.2.7. Data recording	13
3.3.	Field Experiment	14
3.3.1.	Experimental site	14
3.3.2.	Experimental period	14
3.3.3.	Soil type	14
3.3.4.	Climate	14
3.3.5.	Crop	15
3.3.6.	Treatments	15
3.3.7.	Layout of the experiment	15
3.3.8.	Land preparation	15
3.3.9.	Manure and fertilizer application	15
3.3.10.	Sowing of seed	16
3.3.11.	Intercultural operation	16
3.3.11.1.	Irrigation	16
3.3.11.2.	Weeding	16
3.3.12.	Recording of disease severity	16
3.3.13.	Harvesting of crop	16
3.3.14.	Data recording	17
3.15.	Statistical Analysis	18
3.16.	Pathogen isolation and identification	18

CHAPTER	TITLE	PAGE
4	RESULTS	19
	4.1. Laboratory Experiment	19
	4.1.1. Number of conidia/seed	19
	4.1.2. Lesion length in root and % leaf segment diseased of wheat varieties	21
	4.1.3 Seed germination and incidence of <i>Bipolaris sorokiniana</i>	23
	4.2. Pot Experiment	25
	4.2.1. Germination of seed	25
	4.2.2. Disease severity at panicle initiation stage and flowering stage	27
	4.2.3. Disease severity at milking stage and hard dough stage	29
	4.2.4. Days to attain different growth stage	31
	4.2.5. Plant growth and spikelet formation of wheat varieties	33
	4.2.6. Grain formation and grain yield of wheat	35
	4.3. Field Experiment	38
	4.3.1. Disease severity at panicle initiation stage and flowering stage	38
	4.3.2. Disease severity at milking stage and hard dough stage	40
	4.3.3. Days attain different growth stage	42
	4.3.4. Plant growth and spikelet formation of wheat varieties	44
	4.3.5. Grain formation and grain yield of wheat	46
5.	DISCUSSION	48
6.	SUMMARY AND CONCLUSION	52
7.	REFERENCES	55
8.	APPENDICES	64



LIST OF TABLES

	Title	Page
Table 1.	Number of conidia/seed of <i>Bipolaris sorokiniana</i> by deep freezing blotter method on different variety in laboratory condition	20
Table 2.	Lesion length in root and % leaf segment diseased of wheat varieties due to the inoculation of <i>Bipolaris sorokiniana</i> in laboratory condition	22
Table 3.	Germination of different wheat varieties in pot	26
Table 4.	Leaf blight severity of wheat varieties at panicle initiation stage and flowering stage	28
Table 5.	Leaf blight severity of wheat varieties at milking stage and hard dough stage	30
Table 6.	Growth performance of different wheat varieties in pot	32
Table 7.	Plant growth and spikelet formation of wheat varieties	34
Table 8.	Grain formation and grain yield of wheat	37
Table 9.	Leaf blight severity of wheat varieties at panicle initiation stage and flowering stage	39
Table 10.	Leaf blight severity of wheat varieties at milking stage and hard dough stage	41

	Title	Page
Table 11.	Growth performance of wheat varieties in the field	43
Table 12.	Plant growth and spikelet formation of wheat varieties	45
Table 13.	Grain formation and grain yield of wheat	47

LIST OF FIGURES

	Title	Page
Figure 1.	% Germination of different wheat varieties on blotter	24
Figure 2.	Incidence of seed yielding % <i>Bipolaris sorokiniana</i> on seed of different wheat varieties	24

LIST OF PLATES

	Title	Page
Plate 1.	Pure culture of <i>Bipolaris sorokiniana</i> on PDA media	18

LIST OF APPENDICES

	Title	Page
Appendix I.	Results of mechanical and chemical analysis of soil of the experimental plot	53
Appendix II.	Monthly average temperature, relative humidity and total rainfall of the experimental site during the period from October 2005 to April 2006	53



Chapter 1

Introduction

Chapter I

INTRODUCTION

Wheat (*Triticum aestivum* L.) is one of the most important cereal crops as well as staple food all over the world. About two third of the total world's population consume wheat as staple food (Majumder, 1991). Dubin and Ginkel (1991) reported that the largest area of wheat cultivation in the warmer climates exists in the South-East Asia including Bangladesh, India and Nepal. In Bangladesh it is the second most important cereal crops next to rice that plays a vital role in the national economy by reducing the volume of import of cereals for fulfilling the food requirements of the country (Razzaque *et al.*, 1992). Besides these it also meet the nutrients requirements for the human being, on the another way wheat and straw are also used as animal feed. Wheat straw is used as fuel and also shade for the house of the poor man of Bangladesh.

Wheat is well adapted cereal crop for its vegetative growth and development in our native climatic condition. Though the crop introduced in Bangladesh former East Pakistan in 1967 but its reputation increased after 1975. Now the popularity of wheat as staple food is rising day by day in our country. Wheat cultivation has increased manifolds to meet up the food shortage in the country. In spite of its importance, the yield of the crop in our country is low in comparison to the other countries of the world, where average yield estimated 2.69 t/ha (FAO, 1997). Though the area, production and yield of wheat have been increasing dramatically during the last decade, but still it is too low (2.2 t/ha) in comparison to the developed countries like Japan, France, Germany and UK producing 3.76, 7.12, 7.28, and 8.00 t/ha, respectively (FAO, 2000). At present about 706.86 thousand hectares of land in Bangladesh is covered by wheat cultivation with the annual production of 1570 thousand tons (BBS, 2005).

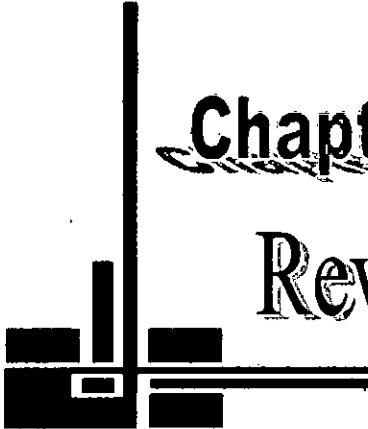
All the growth stages of wheat are prone to the attack of numerous diseases which play a major role among the various factors responsible for reducing the yield (Rashid, 1996). It suffers from as many as 200 diseases of which leaf blight caused by *Bipolaris sorokiniana* is the most destructive one. It is a major pathogen of wheat in temperate regions of the world also. It causes leaf blotch, leaf spot, leaf blight, foot rot, seedling blight, discolored grain, black point and impaired grain filling. The leaf blight disease is considered to be a threat to the wheat cultivation all over the world (Duveiller and Gilchrist, 1994). In Bangladesh the disease is also considered as highly devastating (Hossain and Azad, 1992).

The causal agent of Bipolaris leaf blight, *Bipolaris sorokiniana* is one of the most important pathogen, reported to be highly seed transmitted and causes seedling blight, head blight and black point in the growing crop (Ali and Fakir, 1992; Rashid *et al.* 1997). Almost all old commercial varieties have been recorded susceptible to this disease to various degrees resulting sustainable losses in yield. The severity of the disease increases with plant age and reaches to its maximum towards crop maturity.

The yield loss due to leaf blight disease in the country has been reported to be 20% in var. Sonalika, where as 14% and 8% in Akbar and Kanchan, respectively (Razzaque and Hossain, 1991). In farmers field the yield loss is estimated to be 14.97% (Alam *et al.*, 1995), where as 29% yield reduction was estimated during 1991 and 1992 in Kanchan (Alam *et al.*, 1994). In another field experiment Ahmed (2001) found that the yield decreased up to 51.17%. In case of severe attack it may result even 100% yield loss (Hossain and Azad, 1994). Efforts for controlling the disease through different measures have been made by many workers (Nene and Saxena, 1971; Pidoplichko and Andreeva, 1980; BARI, 1984; Meisner *et al.*, 1994; Hossain and Azad, 1992; Wildermuff

et al., 1992; Malaker *et al.*, 1994; Dewey and Albrechtsen, 1997). Cultivation of resistant variety is one of the important option to avoid the disease problem in the field. Hossain and Azad (1992) evaluated 522 wheat germplasms in the field. None of the materials were found to be free from the disease. Akram (2003) evaluated 148 wheat genotypes against leaf blight (*Bipolaris sorokiniana*). None was immune to this disease. However, the present piece of research work was carried out to determine the varietal reaction of wheat to leaf blight (*Bipolaris sorokiniana*) with the following objectives-

1. To evaluate the wheat varieties to leaf blight caused by (*Bipolaris sorokiniana*).
2. To evaluate the wheat varieties on yield and yield contributing characters.



Chapter 2
Review of literature

Chapter II

REVIEW OF LITERATURE

Wheat is the second most important cereal crop in Bangladesh. The crop has acknowledged much concentration by the researchers on various aspects of its production. Very few studies on the related to the varietal reaction of leaf blight of wheat caused by *Bipolaris sorokiniana* have been carried out in many countries of the world. The work so far done in Bangladesh and is not adequate and conclusive. Nevertheless, some of the important and informative works and research findings so far been done at home and abroad on this aspect have been reviewed in this chapter.

Adlakha *et al.* (1984) tested six hundred and twenty five lines for resistance to *B. sorokiniana*. Leaf lesions on resistant cultivars of wheat were fewer and smaller and sprouted less than lesions on susceptible cultivars. The crosses involved four resistant and four susceptible wheat cultivars. Resistance was dominant in the F₁ progenies. Disease reactions of the F₂ indicated that resistance was conditioned by two genes in the cultivar Motia and in lines E5895 and HD 1927 and Monogenic in line DT 188.

Bazlur Rashid *et al.* (1987) determined the effect of *D. sorokiniana* on some yield components of susceptible wheat cultivars under induced epiphytotic conditions. The lower leaves became significantly more infected than the flag leaves, but the infection of flag leaves caused the highest yield loss, and infection of third leaves caused the least. The maximum loss was incurred in grain weight per ear at the maximum disease severity score.

Hossain and Azad (1992) studied the severity of leaf blight of 533 wheat materials of local and exotic origin during the growing season of 1989-1990.

None of the materials was highly resistant to leaf blight. Of them 76 were graded to be resistant and 89 were moderately resistant. The remaining 90, 99 and 179 materials were graded as moderately susceptible, susceptible and highly susceptible, respectively. In the following year the wheat materials those showed resistance under field condition were screened by artificial inoculation against nine *H. sativum* isolates at the seedling and the flag leaf stage. Seedling inoculation revealed that some materials were resistant to some isolates but were susceptible to others. In case of flag leaf, inoculated materials were resistant to all isolates. Moreover, 16 and 31 materials were graded as moderately resistant at the seedling stage and at the flag leaf stage, respectively.

Rashid *et al.* (1992) tested 103 seed samples by the freezing blotter method, 8 species of *Bipolaris* were isolated, of which the commonest was *B. sorokiniana*. Seedborne infection was highest in cv. Sonalika seed collected from Mymensingh (27.4%) and Meherpur (25.7%) and lowest (1.5%) in cv. Kanchan seed collected from Pabna.

In a field inoculation trial Singh *et al.* (1995) found that only 15 of 257 genotypes were consistently resistant to *H. sativum*. While 47 were moderately resistant and 158 were moderately susceptible, having 33 rated susceptible and 4 highly susceptible. No genotypes were free from infection during the three test years (1990-1993).

Cristaldo *et al.* (1997) assessed twelve wheat genotypes were assessed, in vitro and in vivo, for resistance to spot blotch by *B. sorokiniana*. Toxic filtrates were obtained from 2 fungal isolates and added to the culture medium in which the wheat callus developed, spore suspensions were also produced and applied to wheat seedlings. The callus reaction was quantified by the difference between

growth of those exposed to the filtrates and the untreated checks. The response measured by the percentage of necrotic lesions present on the leaves. A smaller callus growth corresponded to a higher percentage of lesions on the seedling leaves.

Rahman (1997) conducted an experiment in a glass house with 58 wheat genotypes to investigate the relationships of the components of resistance at seedling stage to *B. sorokiniana*. Infection frequency, lesion size, lesion cover, necrosis, spore production, disease severity index and percent disease index were recorded on 58 wheat genotypes. A clear evidence of relationship among the above components of resistance was recorded. A similar experiment was conducted by Sharif (1998) under natural condition with 57 wheat genotypes. Following multivariate analysis he detected four clusters based on six components of resistance.

Molan *et al.* (2001) conducted an experiment with wheat samples affected by foliar blight were collected from various locations during 2000-2001 in Riyadh, Saudi Arabia. The pathogen was isolated and identified as a *B. sorokiniana*. Experimental design in a randomized complete block with six replications was carried out in the greenhouse at the college of Agriculture King Saud University to evaluate two wheat cultivars and 18 wheat genotypes against *B. sorokiniana*. The 14 days old seedlings of these genotypes were inoculated with conidial suspensions adjusted to 2×10^6 conidia/ml of *B. sorokiniana*. Disease severity was rated 7 days after inoculation, using a scale ranging from 0-5. Results indicated that four wheat genotypes were resistant and nine genotypes were moderately resistant and the remaining genotypes were susceptible.



The evaluation of reaction types of 10 wheat genotypes after inoculation by 11 *Bipolaris sorokiniana* strains collected at different geographical locations was conducted by Mikhailova *et al.* (2002) and significant differences between both fungal strains and wheat samples were observed. However, the pathogen genotypes vs. wheat genotypes interaction were not significant, suggesting the absence of race specialization of *B. sorokiniana*. Nevertheless, it was supposed that the search for differentials is more perspective among wheat genotypes resistant and moderately resistant to spot blotch.

Akram (2003) conducted an experiment on 148 wheat genotypes under greenhouse conditions during the 1997/1998 cropping season to characterize the host response to *B. sorokiniana*. In the following year 24 wheat genotypes were sown in the field and under green house conditions. Out of 148 genotypes, none was immune to the disease. Twenty six genotypes, which showed disease leaf area coverage between 1 and 10% on the flag leaf, were rated as resistant and 33 genotypes as moderately resistant (10-30%). The response of the genotypes varied depending on the environmental conditions and different inoculum loads. The incubation period varied between 13 and 6 days in the field and 5 days in the greenhouse for all the genotypes.

Singh *et al.* (2003) conducted a laboratory experiment to determine the relationship between the degree of resistance of wheat cultivars M₃, Salamouni, Attila, Katepwa, Chirya 7, NL 623, NL 297, N/D 495, Yangmai, Altar, 6B 235, Bhirukuti, UP 262, Glenlea and CIANO, to *Bipolaris sorokiniana* and its toxin, primarily helminthosporol. The toxin was extracted and purified from 2 isolates of *B. sorokiniana*. The toxin was assayed using a detached leaf technique. The pathogen was inoculated into potted plants possessing varying degrees of resistance to leaf blotch and on detached leaves by observing the number of fungal spores. Data were recorded for the number of spots produced, infection

responses, and rate of necrosis due to helminthosporol toxin. The number of spots that developed did not significantly differ between the cultivars tested. However, the rate of necrosis development differed initially between cultivars.

A total of 560 genotypes of wheat and triticale were analyzed by Singh *et al.* (2003) for resistance to foliar blight. Entries were tested at 15 multilocation hot spots in India. Data were recorded on flag leaf and one leaf below the flag leaf at 71-77 stage on Zadok's scale on double digit scale and satisfactory coincidence of data obtained from the evaluation of type 0 reaction of seedlings and disease severity.

Hexaploid wheat lines derived from *T. durum* and *T. tauschii* were screened by Mikhailova *et al.* (2004) for resistance to spot blotch *Bipolaris sorokiniana* using field and laboratory tests. The highly and moderately resistant wheat samples were determined.

Shahidullah (2006) carried out an experiment on varietal screening and management of leaf blight of wheat caused by *Bipolaris sorokiniana*. He evaluated 14 wheat germplasms under natural infection pressure of *Bipolaris* leaf blight. Among them 3 germplasms were found to be resistant and 1 moderately resistant to this disease.



Chapter 3

Materials and Methods

MATERIALS AND METHODS

Subsequently three experiments were conducted in the Seed Pathology Laboratory, net house and experimental field of Sher-e Bangla Agricultural University, Dhaka, Bangladesh during the period from October 2005 to April 2006 to study the varietal reaction of leaf blight of wheat caused by *Bipolaris sorokiniana*. This chapter includes major information regarding materials and methods that were used conducting the experiment. It consists of a short description of locations of the experimental site, characteristics of soil, climate, materials used for the experiments, treatment of the experiments, layout and design of the experiment, land preparation, manuring and fertilizing, intercultural operations, harvesting, data collection procedure, statistical analysis etc. The details regarding materials and methods of the experiments are presented below under the following headings -

3.1. Laboratory experiment

The experiment was conducted at the seed health laboratory of the Department of Plant Pathology, Sher-e Bangla Agricultural University, Dhaka, Bangladesh during the period from October to November 2005.

3.1.1. Collection of seeds

The wheat seeds varieties Sonalika, Kanchan, Barkat, Shatabdi, Aghrani, Pavon-76, Akbar, Gourav, Sourav and Protiva were collected from Bangladesh Agricultural Research Institute (BARI), Gazipur. After collection, the seeds were kept in a plastic container and were stored in normal room temperature in laboratory of Plant Pathology Department of Sher-e-Bangla Agricultural University.

3.1.2. Determination of seed health status

The blotter method (ISTA, 1996) was used for conducting this trial. Four hundred seeds were randomly taken from the seed samples under each treatment. Twenty-five seeds were placed on three layers of moist blotter paper contained in each 9 cm diameter glass petridish. The petri-plates were then placed in incubation chamber under NUV (12/12 hours) at 24⁰ C. After 7 days of incubation data on germination was recorded. Then incubated seeds were examined under stereobionocular microscope for the detection of *Bipolaris sorokiniana* that grew on the seeds.

3.1.3. Determination of the number of conidia/seed of *Bipolaris sorokiniana* by deep freezing blotter method (Limonard, 1968)

B. sorokiniana associated with the seeds of different varieties were detected by following the Deep Freezing Blotter Method (Limonard, 1968). Two hundred seeds from each variety were examined by placing them on three layered moist filter paper contained in 9 cm diameter glass petridishes. Twenty five seeds were placed in each petridish. Then the petri-plates were incubated for 24 hours under NUV (12/12 hours) at 24-25⁰C. After incubation the seeds were kept in refrigerator at -18⁰C for 6 days.

For determination of number of conidia, ten conical flasks were taken and each was filled with 30 ml sterilized water and then the flasks were marked by marker. Seeds of each variety were taken separately into the water contained in each conical flask very carefully without loss of conidia. Then the volume was made 50 ml with water and one drop of Tween-20 was added in each flask and stirred for 15 minutes with the help of magnetic stirrer. Then the number of conidia/sample was determined with the help of Haemocytometer.

3.1.4 Determination of lesion size of inoculated roots of different wheat varieties

Wheat seeds of different varieties were allowed to germinate on moist filter paper. When the roots were about 2 mm long, seeds were then transferred to filter paper sheet (25 × 25 cm²). Another paper sheet with a poly ethylene sheet layer was placed on top, and the resulting sandwich was rolled together with the lower end of the roll placed in distilled water. Inoculum *B. sorokiniana* was prepared on PDA medium, where 5 mm agar disk was used as inoculum. When the roots were about 15 cm long, the paper rolls were then opened, and the fungal inocula were placed on the roots 5 cm below the seed. Ten plants were used for each replication, maintaining three replications per treatment. The extent of the disease symptoms, indicated by a brown discoloration, was measured on infected roots at 10 days after inoculation.

3.1.5 Assessment of % leaf segment diseased due to the inoculation of *Bipolaris sorokiniana*

The seeds of different varieties were sown in pots (50 seeds/pot), where the pot soil contains soil and compost in 4:1 ratio. Seedlings at 3-leaf stage were inoculated with a spore suspension (12×10^3 spore/ml) of *Bipolaris sorokiniana* using a self compressed hand sprayer (Hossain and Azad, 1992). The pots were covered with previously moistened polyethylene bags for 24 hrs in darkness. Then inoculated leaves were cut into pieces (8 cm) and were tested following detached leaf method (Hossain and Schlosser, 1993). The cut pieces were placed on Benzimidazole agar medium (150 mg Benzimidazole/1000 ml of 1% water agar) and incubated at 25⁰C for 5 days. After inoculation on Benzimidazole agar, percent leaf segment diseased measured.

3.2. Pot Experiment

3.2.1. Preparation of pot for seed sowing

The soil was collected from Agronomy field of Sher-e-Bangla Agricultural University. After drying and cleaning the soil, decomposed cowdung was mixed with collected soil (1:1) and earthen pots of 30 cm diameter were filled two third portions with the mixture. Chemical fertilizers were not used in the pot soil.

3.2.2. Sowing of seeds

The wheat seeds were sown on 25 December 2005. Total number of 50 seeds were sown in each pot.

3.2.3. Determination of germination percentage

Germination of seedlings was counted and germination percentages were calculated.

3.2.4. Intercultural operation (irrigation and drainage)

The wheat plant in pots were irrigated were necessary. Drainage system also looks after for preventing damage of plant.

3.2.5. Recording of disease severity

The data were recorded for disease reaction in four growth stages of the plant namely panicle initiation stage, flowering stage, milking stage and hard dough stage. Plants for each pot were selected for collection of data on percent Leaf area diseased (% LAD). LAD of flag leaf, second leaf (2nd from the top) and 3rd leaf (3rd from the top) were counted. The grading of the leaves were done followed 0-5 rating scale as used by Hossain and Azad (1992) and the CIMMYT method (Gilchrist, 1984).

3.2.6. Harvesting

The crop was harvested on 5st April, 2006 at full ripening stage. The crop was harvested by cutting the plants just at the soil level and bundled separately. The

bundles were threshed mechanically by hand and individual bundles of straw were weighted and recorded.

3.2.7. Data recording

Data on different yield and related to yield contributing characters were recorded and presented under the following headings-

- i. Days required for booting
- ii. Days required for heading
- iii. Days required for flowering
- iv. Days required for milking
- v. Days required for maturity
- vi. Plant height (cm)
- vii. Ear length (cm)
- viii. Distance between the point of flag leaf initiation and base of ear (cm)
- ix. Number of spikelets/ear
- x. Number of healthy spikelets/ear
- xi. Number of diseased spikelets/ear
- xii. Number of grains/ear
- xiii. Number of healthy grains/ear
- xiv. Number of diseased grains/ear
- xv. Weight of grains/ear
- xvi. Weight of healthy grains/ear
- xvii. Weight of diseased grains/ear
- xviii. 1000 seed weight (g)
- xix. Grain yield/pot (g)
- xx. Straw yield/pot (g)

3.3. Field Experiment

3.3.1. Experimental site

The present piece of research work was conducted in the farm of Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka, Bangladesh. The location of the site in 23^o74' N latitude and 90^o35' E longitude with an elevation of 8.2 meter from sea level (Anon, 1989).

3.3.2. Experimental period

The experiment was carried out during the period from November, 2005 to April 2006.

3.3.3. Soil type

The soil of the experimental area was non-calcareous dark grey and belongs to the Modhupur Tract (UNDP, 1988) under AEZ 28. The selected plot was medium high land and the soil series was Tejgaon (FAO, 1988). The experimental site was a medium high land and pH of the soil was 5.6. The characteristics of the soil under the experimental plot were analyzed in the SRDI, Soil testing Laboratory, Khamarbari, Dhaka and details of the soil characteristics are presented in Appendix I.

3.3.4. Climate

The geographical situation of the experimental site was under the subtropical climate, characterized by three distinct seasons, the monsoon or rainy season from November to February and the pre-monsoon period or hot season from March to April and monsoon period from May to October (Edris *et al.*, 1979). The total annual rainfall of the experimental site was 218 mm and average monthly maximum and minimum temperature were 29.45^oC and 13.86^oC, respectively. Details of the metrological data of air temperature, relative humidity, rainfalls and sunshine during the period of the

experiment was collected from the Bangladesh Meteorological Department (Climate Division) and presented in Appendix II.

3.3.5. Crop

Wheat seed collected from BARI was used in this study.

3.3.6. Treatments

In the experiment ten different varieties of wheat were used for determination of reaction of wheat leaf blight caused by *Bipolaris sorokiniana*. The varieties were Sonalika, Kanchan, Barkat, Shatabdi, Aghrani, Pavon-76, Akbar, Gourav, Sourav and Protiva.

3.3.7. Layout of the experiment

The experiment was laid out in one factor Randomized Complete Block Design (RCBD) with three replications. The layout of the experiment was prepared for distributing the wheat varieties into the every plot of each block. Each block was divided into 10 plots where 10 varieties were allotted at random. There were 30 unit plots altogether in the experiment. The size of the plot was 1.0 m × 1.00 m. The distance maintained between two blocks and two plots were kept 1.0 m and 0.5 m, respectively.

3.3.8. Land preparation

The land was thoroughly prepared by ploughing and cross ploughing with a power tiller followed by laddering. The clods were broken and the soils were leveled until the desired tilth was obtained for sowing the wheat seeds. During land preparations weeds and stubbles of the previous crops were collected and removed from the field.

3.3.9. Manure and fertilizer application

Well decomposed cowdung manure was applied in the time of final land preparation at the rate of 10 t/ha. The sources of fertilizers used for N, P, K and S were urea, TSP,

MP and Gypsum. The entire amounts of TSP, MP, Gypsum, Zinc sulphate and borax @ 150, 60, 80 kg/ha were applied during the final preparation of land. Urea 200 kg/ha was applied in three equal installments at 15, 30 and 45 days after sowing.

3.3.10. Sowing of seed

Seeds were sown in line on 20 October 2005 at the rate of 120 kg /ha.

3.3.11. Intercultural operation

3.3.11.1. Irrigation

The field plots were irrigated three times. First irrigation was done at 25 days after sowing; Second irrigation was done at 55 days after sowing and third irrigation was done at 75 days after sowing.

3.3.11.2. Weeding

Weeds growing out in the plot during the growing period of the crop. First weeding was done at 25 days after sowing and another at 60 days after sowing.

3.3.12. Recording of disease severity

The data were recorded for disease reaction in four growth stages of the plant namely panicle initiation stage, flowering stage, milking stage and hard dough stage. Twenty-five plants per plot (5 plants per row) were selected for collection of data on percent Leaf area diseased (% LAD). LAD of flag leaf, second leaf (2nd from the top) and 3rd leaf (3rd from the top) were counted. The grading of the leaves were done followed 0-5 rating scale as used by Hossain and Azad (1992) and the CIMMYT method (Gilchrist, 1984).

3.3.13. Harvesting of crop

The crop was harvested on 5th April 2006 at full ripening stage. The twenty five selected tagged plants of each plot were harvested separately. The crop was harvested

by cutting the plants just at the soil level and bundled separately. The bundles were threshed mechanically by hand and individual bundles of straw were weighted and recorded.

3.3.14. Data recording

Data on different yield and related to yield contributing characters were recorded and presented under the following headings-

- i. Days required for booting
- ii. Days required for heading
- iii. Days required for flowering
- iv. Days required for milking
- v. Days required for maturity
- vi. Plant height (cm)
- vii. Ear length (cm)
- viii. Distance between the point of flag leaf initiation and base of ear (cm)
- ix. Number of spikelets/ear
- x. Number of healthy spikelets/ear
- xi. Number of diseased spikelets/ear
- xii. Number of grains/ear
- xiii. Number of healthy grains/ear
- xiv. Number of diseased grains/ear
- xv. Weight of grains/ear
- xvi. Weight of healthy grains/ear
- xvii. Weight of diseased grains/ear
- xviii. 1000 seed weight (g)
- xix. Grain yield/plot (g)
- xx. Straw yield/plot (g)

3.15. Statistical Analysis

The data obtained for different characters were statistically analyzed and the treatment means were compared by DMRT (Duncan's Multiple Range Test) at 5% level of probability (Gomez and Gomez, 1984).

3.16 Pathogen isolation and identification

Wheat plant leaves with typical leaf spot disease symptom were collected from the experimental site by using polythylene bag and were taken to the Laboratory of the Division of Plant Pathology, Sher-e Bangla Agricultural University, Dhaka. The diseased leaves were then cut into small pieces (about 0.5 cm) with diseased portion and surface sterilized with HgCl_2 solution (0.01%) for 30 second. The cut pieces were then washed in water at three times and were placed into PDA media in petridish. The plates were then incubated at $25\pm 1^\circ\text{C}$ for 7 days. Later the pathogen was purified using hyphal tip culture method and grown on PDA media at $25\pm 1^\circ\text{C}$ for 2 week and identified as *B. sorokiniana* (Plate 1)

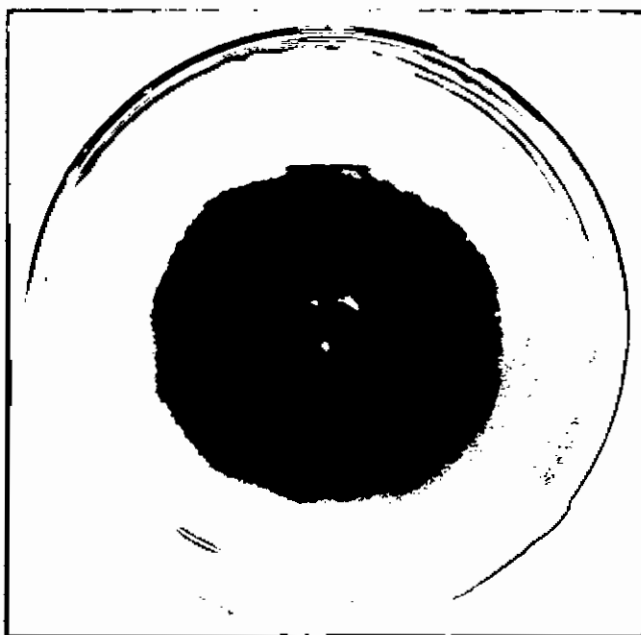


Plate 1. Pure culture of *Bipolaris sorokiniana* on PDA media



Chapter 4

Results

Chapter IV

RESULTS

4.1. Laboratory Experiment

4.1.1 Number of conidia/seed

Number of conidia/seed by deep freezing blotter method on different variety of wheat seed showed significant variation (Table 1). The maximum number of conidia (320) was recorded in the variety Sonalika which was closely followed by variety Kanchan (280). On the other hand minimum number of conidia/seed (100) was recorded in variety Shatabdi which was closely followed by the variety Gourav (150).

Table 1. Number of conidia/seed of *Bipolaris sorokiniana* by deep freezing blotter method on different variety in laboratory condition

Variety	Number of conidia/seed
Sonalika	320 a
Shatabdi	100 f
Akbar	220 cd
Gourab	150 e
Sourav	230 cd
Pavon-76	220 cd
Kanchan	280 b
Protiva	210 d
Aghrani	250 bc
Barkat	210 d
LSD _(0.05)	31.53

In a column means having similar letter(s) are statistically identical and those having dissimilar letter(s) differ significantly as per 0.05 level of probability

4.1.2 Lesion length in root and % leaf segment diseased of wheat varieties

The lesion length in root differed significantly from one variety to another (Table 2). Lesion length varied from 0.00 to 11.67 mm. Maximum lesion lengths (11.67 mm) was recorded in the variety Sonalika, Sourav and Kanchan. No lesion i.e. infection (0.00 mm) was recorded in the varieties Shatabdi, Akbar, Pavon-76 and Protiva and which was closely followed by the variety Aghrani (5.00 mm). Statistically significant variation was recorded in respect of % leaf segment diseased on leaf under the present trail. Maximum % leaf segment diseased (96.67%) was recorded in the variety Sonalika (Table 2) which was closely followed by the variety Kanchan (76.67). No lesion was found on the leaf of the variety Shatabdi.

In a column means having similar letter(s) are statistically identical and those having dissimilar letter(s) differ significantly as per 0.05 level of probability

Data in parenthesis are Arcsine transformed value

Table 2. Lesion length in root and % leaf segment diseased of wheat varieties due to the inoculation of *Bipolaris sorokiniana* in laboratory condition

Variety	Lesion length (mm)	% Leaf segment diseased
Sonalika	11.67 a	96.67a (72.45)
Shatabdi	0.00 d	0.00h (0.00)
Akbar	0.00 d	70.00c (58.7)
Gourab	8.33 b	61.30d (51.5)
Sourav	11.67 a	15.00f (22.8)
Pavon-76	0.00 d	5.00g (14.6)
Kanchan	11.67 a	76.67b (60.6)
Protiva	0.00d	61.30d (51.5)
Aghrani	5.00 c	75.60b (60.4)
Barkat	5.66c	50.50e (45.3)
LSD _(0.05)	0.898	4.858

In a column means having similar letter(s) are statistically identical and those having dissimilar letter(s) differ significantly as per 0.05 level of probability

4.1.3 Seed germination and incidence of *Bipolaris sorokiniana*

% Seed germination of different wheat varieties varied significantly (Figure 1). Maximum % germination (92%) was recorded from the variety Shatabdi, Sourav and Aghrani. Lowest percentage of germination (72%) was recorded in the variety Sonalika was statistically significant different. In respect of the percentage of *B. sorokiniana* on seed of different variety under the present study. Maximum % *B. sorokiniana* (37%) on seed was recorded from the variety Sonalika (Figure 2) which was closely followed by the variety Gourab (34%). On the other hand the minimum (17%) incidence was recorded in the variety Shatabdi.

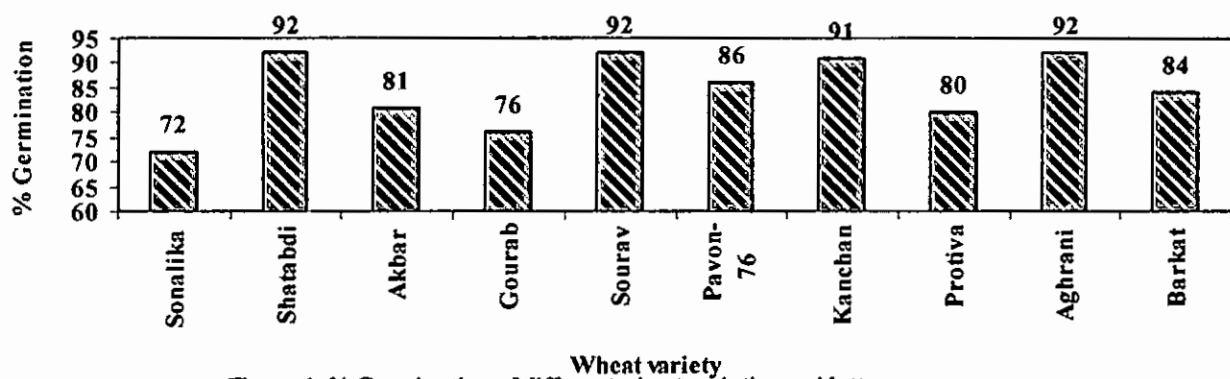


Figure 1. % Germination of different wheat varieties on blotter

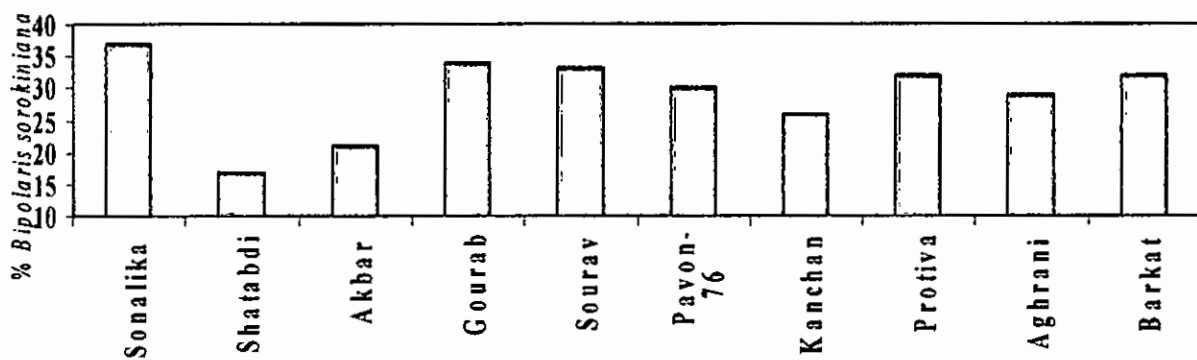


Figure 2. Incidence of *Bipolaris sorokiniana* on seed of different wheat varieties

4.2. Pot Experiment

4.2.1 Germination of seed

Percentage of seed germination varied significantly among the wheat varieties tested (Table 3). Among the variety Shatabdi attained maximum germination (88.67%) after 21 DAS. The minimum germination (75.33%) was recorded in the variety Gourab.

37338 A. 14 ~~23/09/07~~ 23/09/07

Table 3. Germination of different wheat varieties in pot

Variety	Germination (%)		
	7 Days after sowing	14 days after sowing	21 days after sowing
Sonalika	37.33 f	62.67 b	80.00 cd
Shatabdi	48.00 a	68.67 a	88.67 a
Akbar	46.67 b	60.67 c	79.33 d
Gourab	35.33 g	57.33 d	75.33 e
Sourav	43.33 cd	63.33 b	79.33 cd
Pavon-76	37.33 f	60.00 c	78.33 cd
Kanchan	44.67 c	58.33 d	81.33 c
Protiva	40.67 e	60.00 c	84.00 b
Aghrani	42.67 d	58.67 d	77.00 de
Barkat	44.67 c	61.33 b	79.00 cd
LSD _(0.05)	2.025	1.895	2.152

In a column means having similar letter(s) are statistically identical and those having dissimilar letter(s) differ significantly as per 0.05 level of probability

4.2.2. Disease severity at panicle initiation stage and flowering stage

Disease severity at panicle initiation stage was estimated on flag leaf, 2nd and 3rd leaf of different wheat variety were used in this trail and found to differ statistically (Table 4). In flag leaf maximum disease severity was recorded in the variety Akbar (0.28) which was closely followed by the variety Sonalika (0.22) and no infection was recorded in the variety Shatabdi, Sourav, Pavan-76, Kanchan, Protiva and Barkat. In 2nd leaf maximum disease severity (1.00) was recorded in the variety Sonalika and minimum in the variety Shatabdi (0.05). In 3rd leaf maximum disease severity was recorded in the variety Sonalika (2.97) and the minimum (0.19) was recorded in the variety Shatabdi.

Leaf blight severity of wheat varieties varied significantly on flag leaf at flowering stage (Table 4). In flag leaf maximum disease severity was recorded in the variety Sonalika (0.55) and no infection was recorded in Shatabdi. In 2nd leaf maximum disease severity (1.67) was recorded in the variety Sonalika and the minimum infection (0.35) was recorded in the variety Shatabdi but the variation was non significant. In 3rd leaf maximum disease severity (3.09) was recorded in the variety Sonalika and the minimum (1.97) was recorded in the variety Shatabdi.

Table 4. Leaf blight severity of wheat varieties at panicle initiation stage and flowering stage

Variety	Disease severity					
	Panicle initiation stage			Flowering stage		
	Flag leaf	2 nd leaf	3 rd leaf	Flag leaf	2 nd leaf	3 rd leaf
Sonalika	0.22 a	1.00 a	2.97 a	0.55 a	1.67	3.09
Shatabdi	0.00 b	0.05 d	0.19 d	0.00 c	0.35	1.97
Akbar	0.28 a	0.43 c	1.55 bc	0.39 ab	0.97	2.55
Gourab	0.07 b	0.19 cd	0.67 cd	0.17 bc	0.61	2.02
Sourav	0.00 b	0.21 cd	0.69 cd	0.04 c	0.71	2.31
Pavon-76	0.00 b	0.27 cd	1.35 bc	0.05 c	0.41	2.04
Kanchan	0.00 b	0.79 b	1.73 b	0.19 bc	0.87	2.95
Protiva	0.00 b	0.10 d	1.41 bc	0.03 c	1.54	2.67
Aghrani	0.08 b	0.28 cd	1.41 bc	0.21 bc	0.54	2.61
Barkat	0.00 b	0.20 cd	1.27 bc	0.00 c	0.45	2.87
LSD _(0.05)	0.139	0.258	0.917	0.252	NS	NS

In a column means having similar letter(s) are statistically identical and those having dissimilar letter(s) differ significantly as per 0.05 level of probability

NS = Not Significant

4.2.3 Disease severity at milking stage and hard dough stage

Statistically non significant variation was recorded in respect of disease severity at milking stage on flag leaf and 2nd leaf of different wheat variety (Table 5). In flag leaf maximum disease severity was recorded in the variety Sonalika (0.52) and minimum (0.02) in Shatabdi. In 2nd leaf maximum disease severity (1.84) was recorded in the variety Sonalika and the minimum (0.59) was recorded in the variety Shatabdi but the difference was non significant. In 3rd leaf maximum disease severity (3.87) was recorded in the variety Sonalika and the minimum (2.69) was recorded in the variety Shatabdi but the variation was statistically significant. Statistically non significant variation was recorded in respect of disease severity at hard dough stage on flag leaf and 2nd leaf of different wheat variety (Table 5). In flag leaf maximum disease severity was recorded at hard dough stage in the variety Sonalika (1.45) and minimum infection (0.72) was recorded in the variety Akbar. In 2nd leaf maximum disease severity (2.92) was recorded in the variety Sonalika and the minimum infection (1.48) was recorded in the variety Shatabdi. In 3rd leaf maximum disease severity (4.89) was recorded in the variety Sonalika which was statistically similar with the variety Kanchan (4.69) and Protiva (4.55) and the minimum (4.11) was recorded in the variety Shatabdi but the variation was significant.



Table 5. Leaf blight severity of wheat varieties at milking stage and hard dough stage

Variety	Disease severity					
	Milking stage			Hard dough stage		
	Flag leaf	2 nd leaf	3 rd leaf	Flag leaf	2 nd leaf	3 rd leaf
Sonalika	0.52	1.84	3.87 a	1.45	2.92	4.89 a
Shatabdi	0.02	0.59	2.69 b	1.05	1.48	4.11 b
Akbar	0.25	1.72	2.88 ab	0.72	2.77	4.58 ab
Gourab	0.50	1.15	3.11 ab	1.21	2.25	4.38 ab
Sourav	0.13	0.78	2.82 b	0.88	2.18	4.42 ab
Pavon-76	0.25	1.25	3.38 ab	0.95	2.48	4.45 ab
Kanchan	0.16	1.35	3.55 ab	0.97	1.92	4.69 a
Protiva	0.09	1.48	3.82 ab	0.77	2.07	4.55 a
Aghrani	0.14	1.14	2.79 b	1.12	2.35	4.61 ab
Barkat	0.31	1.42	3.35 ab	0.95	2.47	4.47 ab
LSD _(0.05)	NS	NS	1.002	NS	NS	0.488

In a column means having similar letter(s) are statistically identical and those having dissimilar letter(s) differ significantly as per 0.05 level of probability

NS = Not Significant

4.2.4 Days to attain different growth stage

Days to attain particular growth stage of different wheat varieties are shown in Table 6. The variety Pavon-76 required maximum days (55.00) for booting which was closely followed by the varieties Kanchan (49.00 days). On the other hand Sonalika required the minimum days (35.00) for booting. Pavon-76 and Kanchan required maximum days (64.00) to attain heading stage which was closely followed by the varieties Gourab (51.67 days) and the variety Sonalika required the minimum days (42.00) for heading. The variety Pavon-76, Kanchan, Protiva, Aghrani and Barkat showed the maximum days (78.00) for flowering which was closely followed by the varieties Gourab and Sourav (64.00 days). On the other hand Sonalika required the minimum days (49.00) for flowering. Pavon-76, Kanchan, Protiva, Aghrani and Barkat showed the maximum days (88.00) for milking stage which was closely followed by the varieties Gourab and Sourav (78.00 days) and the variety Sonalika, Shatabdi and Akbar required the minimum days (64.00) for milking. The variety Pavan-76, Protiva and Aghrani required maximum days (110.0) to get maturity. On the other hand variety Sonalika, Shatabdi and Akbar showed the minimum days for maturity (87.00 days).

Table 6. Growth performance of different wheat varieties in pot

Variety	Days required for booting	Days required for heading	Days required for flowering	Days required for milking	Days required for maturity
Sonalika	35.00 d	42.00 c	49.00 d	64.00 c	87.00 c
Shatabdi	42.00 c	49.00 b	55.00 c	64.00 c	87.00 c
Akbar	42.00 c	49.00 b	55.00 c	64.00 c	87.00 c
Gourab	42.00 c	51.67 b	64.00 b	78.00 b	101.3 b
Sourav	42.00 c	49.00 b	64.00 b	78.00 b	101.0 b
Pavon-76	55.00 a	64.00 a	78.00 a	88.00 a	109.0 a
Kanchan	49.00 b	64.00 a	78.00 a	88.00 a	110.0 a
Protiva	42.00 c	49.00 b	78.00 a	88.00 a	110.0 a
Aghrani	42.00 c	49.00 b	78.00 a	88.00 a	110.0 a
Barkat	42.00 c	49.00 b	78.00 a	88.00 a	109.0 a
LSD _(0.05)	3.754	3.692	3.074	3.214	2.294

In a column means having similar letter(s) are statistically identical and those having dissimilar letter(s) differ significantly as per 0.05 level of probability

4.2.5 Plant growth and spikelet formation of wheat varieties

Wheat varieties showed significant variation in respect of plant height under the present experiment. Plant height varied from 93.16 cm to 100.19 cm (Table 7). The taller plants (100.19 cm) were produced by the variety Sourav which was closely followed by the variety Shatabdi (99.75 cm). The shortest plants (91.20 cm) were recorded in the variety Sonalika which was closely followed by the variety Barkat (93.16 cm).

No significant variation was found in respect of ear length. Ear length among the varieties ranged from 12.52 to 14.37 cm. Maximum ear length (14.37 cm) was recorded in the variety Sourav (Table 7). The shortest ear length (12.52 cm) was recorded in the varieties Protiva which was closely followed by the variety Kanchan (12.58 cm). Wheat varieties did not showed non significant variation in consideration of distance between the point of flag leaf initiation and base of ear. The maximum length between flag leaf and base of ear (10.73 cm) were produced by the variety Sourav (Table 7) and the minimum (8.40 cm) was recorded in the variety Shatabdi.

The highest number of spikelets/ear (29.00) was recorded in the variety Akbar (Table 7) and the lowest number of spikelets/ear (23.56) was recorded in the variety Pavan-76. Number of healthy spikelets/ear varied from 21.00 to 27.67. The highest number of healthy spikelets/ear (27.67) was recorded in the variety Shatabdi (Table 7). The lowest number of healthy spikelets/ear (21.00) was recorded in the variety Sonalika. The number of diseased spikelets/ear varied significantly and ranged from 0.67 to 3.22 (Table 7). The highest number of diseased spikelets/ear (3.22) was recorded in the variety Sonalika. The minimum number of diseased spikelets/ear (0.67) was recorded in the variety Shatabdi.

Table 7. Plant growth and spikelet formation of wheat varieties

Variety	Plant height (cm)	Ear length (cm)	Distance between the point of flag leaf initiation and base of ear (cm)	Number of spikelets/ear	Number of healthy spikelets/ear	Number of diseased spikelets/ear
Sonalika	91.20 ab	13.71	9.55	24.22 bc	21.00 c	3.22 ab
Shatabdi	99.75 c	13.61	8.40	28.34 a	27.67 a	0.67 c
Akbar	97.19 bc	14.02	9.76	29.00 a	26.33 d	2.67 abc
Gourab	98.34 ab	14.04	10.29	27.04 ab	23.37 bc	3.67 a
Sourav	100.19 a	14.37	10.73	25.89 abc	24.33 bc	1.56 abc
Pavon-76	98.57 bc	13.01	10.29	23.56 c	22.00 bc	1.56 abc
Kanchan	99.58 bc	12.58	8.47	25.89 abc	23.00 c	2.89 bc
Protiva	96.85 bc	12.52	9.75	28.99 a	26.67 a	2.32 abc
Aghrani	96.25 ab	14.31	9.22	24.77 bc	23.33 bc	1.44 abc
Barkat	93.16 ab	14.18	10.04	26.89 ab	25.33 bc	1.56 c
LSD _(0.05)	8.755	NS	NS	2.951	2.352	2.089

In a column means having similar letter(s) are statistically identical and those having dissimilar letter(s) differ significantly as per 0.05 level of probability

NS = Not Significant

4.2.6 Grain formation and grain yield of wheat

Wheat varieties showed statistically non significant variation in consideration of number of grains/ear. Number of grains/ear varied from 33.55 to 36.95. The maximum number of grains/ear (36.95) was recorded in the variety Shatabdi (Table 8) and the minimum number of grains/ear (33.55) was recorded in the variety Aghrani. Wheat varieties showed statistically non significant variation on number of healthy grains/ear. Number of healthy grains/ear varied from 31.67 to 36.43. The maximum number of healthy grains/ear (36.43) was recorded in the variety Shatabdi and the lowest number of healthy grains/ear (31.67) was recorded in the variety Gourab. Number of diseased grains/ear varied significantly and ranged from 0.52 to 3.22 (Table 8). The highest number of diseased grains/ear (3.22) was recorded in the variety Sonalika and the lowest number (0.52) was recorded in the variety Shatabdi.

Wheat varieties showed statistically non significant variation in terms of weight of grains/ear. Weight of grains/ear varied from 1.42 g to 1.52 g. The maximum weight of grains/ear (1.52 g) was recorded in the variety Shatabdi (Table 8) and the lowest weight of grains/ear (1.42 g) was recorded in the variety Sourav. In pot experiment wheat varieties showed statistically non significant variation in terms of weight of healthy grains/ear. Weight of healthy grain/ear varied from 1.31 g to 1.42 g. The maximum weight of healthy grains/ear (1.42 g) was recorded in the variety Shatabdi (Table 8) and the lowest weight of healthy grains/ear (1.31 g) was recorded in the variety Sourav. The weight of diseased grains/ear varied from 0.11 g to 0.15 g (Table 8). The highest weight of diseased grains/ear (0.15 g) was recorded in the variety Gourab and the lowest weight (0.10 g) was recorded in the variety Shatabdi. No significant variation among the varieties was found in respect of 1000 seed weight. Weight of 1000 seeds varied from 35.56 to 43.10 g. The highest weight of 1000 seeds (43.10) was recorded in the variety Gourav (Table 8). The lowest weight of 1000 seeds

(35.56 g) was recorded in the variety Protiva. In pot experiment wheat varieties showed non significant variation in respect of grain yield/pot. But grain yield/pot varied from 4.40 to 5.97 g. The highest yield/pot (5.97 g) was recorded in the variety Gourab (Table 8) and the lowest yield/pot (4.40 g) was recorded in the variety Pavon-76. Wheat varieties showed significant variation in respect of straw yield. Straw yield/pot varied from 9.10 to 14.13 g. The highest straw yield/pot (14.13 g) was recorded in the variety Barkat (Table 8) which was closely followed by the variety Sonalika (12.80 g). The lowest straw yield (9.10 g) was recorded in the variety Shatabdi which was closely followed by the variety Kanchan (10.63 g).

Table 8. Grain formation and grain yield of wheat

Variety	Number of grains/ear			Weight of grains/ear (g)			1000 seed weight (g)	Grain yield/ pot (g)	Straw yield /pot (g)
	Total	Healthy	Diseased	Total	Healthy	Diseased			
Sonalika	36.22	33.00	3.22 ab	1.52	1.39	0.13	41.52	4.70	12.80ab
Shatabdi	36.95	36.43	0.52 c	1.52	1.42	0.10	42.55	4.60	9.10 b
Akbar	36.34	33.67	2.67 abc	1.52	1.38	0.14	42.55	5.23	11.63 ab
Gourab	35.34	31.67	3.67 a	1.49	1.34	0.15	43.10	5.97	11.53 ab
Sourav	33.56	32.00	1.56 abc	1.42	1.31	0.11	37.54	5.17	12.77 ab
Pavon-76	36.89	35.33	1.56 abc	1.47	1.35	0.12	36.28	4.40	11.13 ab
Kanchan	33.56	32.67	0.89 bc	1.47	1.34	0.13	39.03	5.17	10.63 ab
Protiva	35.15	33.78	1.37 c	1.49	1.38	0.11	35.56	5.40	11.63 ab
Aghrani	33.55	32.11	1.44 abc	1.52	1.37	0.15	37.02	5.67	12.47 ab
Barkat	35.83	34.67	1.16 c	1.45	1.33	0.12	39.21	5.13	14.13 a
LSD _(0.05)	Ns	NS	2.089	NS	NS	NS	NS	NS	3.490

In a column means having similar letter(s) are statistically identical and those having dissimilar letter(s) differ significantly as per 0.05 level of probability

NS = Not Significant

4.3 Field Experiment

4.3.1 Disease severity at panicle initiation stage and flowering stage

Disease severity at panicle initiation stage was estimated on flag leaf, 2nd and 3rd leaf of different wheat variety were used in this experiment and found to differ statistically (Table 9). In flag leaf maximum disease severity was recorded in the variety Sonalika (0.30) which was closely followed by the variety Aghrani (0.10) and no infection was recorded in the variety Shatabdi, Sourav, Pavan-76, Kanchan, Protiva and Barkat. In 2nd leaf maximum disease severity (1.00) was recorded in the variety Sonalika and no infection was recorded in the variety Shatabdi. In 3rd leaf maximum disease severity was recorded in the variety Sonalika (2.83) and the minimum (0.17) was recorded in the variety Shatabdi.

Leaf blight severity of wheat varieties varied significantly on flag leaf at flowering stage (Table 9). In flag leaf maximum disease severity was recorded in the variety Sonalika (0.50) and no infection was recorded in the variety Shatabdi, Protiva, Barkat. In 2nd leaf maximum disease severity (1.37) was recorded in the variety Sonalika and the minimum infection (0.30) was recorded in the variety Shatabdi but the variation was non significant. In 3rd leaf maximum disease severity (3.50) was recorded in the variety Sonalika and the minimum (1.93) was recorded in the variety Shatabdi (1.73) and Pavan-76 (1.93).

Table 9. Leaf blight severity of wheat varieties at panicle initiation stage and flowering stage

Variety	Disease severity					
	Panicle initiation stage			Flowering stage		
	Flag leaf	2 nd leaf	3 rd leaf	Flag leaf	2 nd leaf	3 rd leaf
Sonalika	0.30 a	1.00 cd	2.83 a	0.50 a	1.37	3.50
Shatabdi	0.00 b	0.00 d	0.17 d	0.00 c	0.30	1.73
Akbar	0.07 b	0.73 b	1.53 bc	0.03 c	0.83	2.23
Gourab	0.07 b	0.17 cd	0.67 cd	0.18 bc	0.65	2.11
Sourav	0.00 b	0.17 cd	0.69 cd	0.18 bc	0.57	2.59
Pavon-76	0.00 b	0.10 d	1.81 b	0.17 bc	0.43	1.93
Kanchan	0.00 b	0.27 cd	1.83 b	0.03 c	0.94	3.28
Protiva	0.00 b	0.27 cd	1.44 bc	0.00 c	0.96	2.43
Aghrani	0.10 a	0.43 c	1.43 bc	0.33 ab	0.60	2.60
Barkat	0.00 b	0.20 cd	1.73 b	0.00 c	0.87	3.03
LSD _(0.05)	0.144	0.249	0.925	0.266	NS	NS

In a column means having similar letter(s) are statistically identical and those having dissimilar letter(s) differ significantly as per 0.05 level of probability

NS = Not Significant

4.3.2 Disease severity at milking stage and hard dough stage

The varieties significant variation did not show in respect of disease severity at milking stage on flag leaf and 2nd leaf of different wheat variety (Table 10). In flag leaf maximum disease severity was recorded in the variety Sonalika (0.50) and minimum (0.03) in Shatabdi and Sourav. In 2nd leaf maximum disease severity (1.53) was recorded in the variety Sonalika and the minimum (0.53) was recorded in the variety Shatabdi but the difference was non significant. In 3rd leaf maximum disease severity (3.93) was recorded in the variety Sonalika and the minimum (2.77) was recorded in the variety Sourav and Aghrani but the variation was significant.

Statistically non significant variation was recorded in respect of disease severity at hard dough stage was estimated on flag leaf and 2nd leaf of different wheat variety (Table 10). In flag leaf maximum disease severity was recorded at hard dough stage in the variety Sonalika (1.13) and minimum (0.65) was recorded in the variety Protiva. In 2nd leaf maximum disease severity (2.89) was recorded in the variety Sonalika and the minimum (1.40) was recorded in the variety Shatabdi. In 3rd leaf stage the varieties showed significant difference giving maximum disease severity (4.73) in the variety Barkat which was statistically similar with the variety Kanchan (4.66) and Protiva (4.62) and the minimum (4.07) was recorded in the variety Shatabdi.



Table 10. Leaf blight severity of wheat varieties at milking stage and hard dough stage

Variety	Disease severity					
	Milking stage			Hard dough stage		
	Flag leaf	2 nd leaf	3 rd leaf	Flag leaf	2 nd leaf	3 rd leaf
Sonalika	0.50	1.53	3.93 a	1.13	2.89	4.53 ab
Shatabdi	0.03	0.53	2.86 ab	0.93	1.40	4.07 b
Akbar	0.47	1.47	2.82 ab	1.13	2.63	4.57 ab
Gourab	0.50	1.01	3.07 ab	1.08	2.13	4.43 ab
Sourav	0.03	0.67	2.77 b	0.80	2.07	4.38 b
Pavon-76	0.17	1.17	3.33 ab	0.83	2.20	4.40 ab
Kanchan	0.11	1.23	3.47 ab	0.94	1.86	4.66 a
Protiva	0.07	1.39	3.80 ab	0.65	2.12	4.62 a
Aghrani	0.10	0.97	2.77 b	1.03	2.26	4.57 ab
Barkat	0.27	1.37	3.30 ab	0.87	2.33	4.73 a
LSD _(0.05)	NS	NS	1.002	NS	NS	0.488

In a column means having similar letter(s) are statistically identical and those having dissimilar letter(s) differ significantly as per 0.05 level of probability

NS = Not Significant

4.3.3 Days to attain different growth stage

Days to attain particular growth stage at different wheat varieties are shown in Table 11. Variety Barkat required maximum days (54.00) to attain at booting stage which was statistically identical with the varieties Protiva (53.33 days). On the other hand Pavan-76 required the minimum days (44.00) to attain at booting stage.

Protiva and Barkat required maximum days (62.67) to attain heading stage which was statistically similar with the varieties Shatabdi (62.00 days) and the variety protiva required the minimum days (52.00) for heading. Variety Sourav and sonalika required the minimum days (60.00) for flowering and Shatabdi, Akbar, Gourav, Kanchan, Protiva, Agrani, and Barkat required the maximum days (68.00) for flowering. Wheat variety Gourav showed the maximum days (80.00) for milking and the variety Pavan-76 required the minimum days (68.00) for milking. The variety Sonalika required maximum days (110.00) for maturity which was closely followed by the varieties Gourav (103.0 days) and the variety Pavan-76 required the minimum days (93.00) for maturity.

Table 11. Growth performance of wheat varieties in the field

Variety	Days required for booting	Days required for heading	Days required for flowering	Days required for milking	Days required for maturity
Sonalika	45.00 ab	53.33 b	60.00 b	68.33 b	110.00 a
Shatabdi	51.00 ab	62.00 a	68.00 a	71.00 b	98.00 c
Akbar	51.33 ab	60.00 ab	68.00 a	71.00 b	98.00 c
Gourab	50.00 ab	60.00 ab	68.00 a	80.00 a	103.00 b
Sourav	50.33 c	52.00 ab	60.00 b	70.67 b	98.00 c
Pavon-76	44.00 b	53.33 b	60.00 b	68.00 b	93.00 d
Kanchan	52.00 ab	60.00 ab	68.00 a	71.00 b	98.00 c
Protiva	53.33 a	62.67 a	68.00 a	70.67 b	98.00 c
Aghrani	45.00 ab	53.33 b	68.00 a	70.67 b	98.00 c
Barkat	54.00 a	62.67 a	68.00 a	71.00 b	98.00 c
LSD _(0.05)	8.008	6.191	7.194	3.557	3.945

In a column means having similar letter(s) are statistically identical and those having dissimilar letter(s) differ significantly as per 0.05 level of probability

4.3.4 Plant growth and spikelet formation of wheat varieties

Wheat varieties showed significant variation in respect of plant height under the present experiment. Plant height varied from 97.00 cm to 107.50 cm. The taller plants (107.50 cm) were recorded by the variety Sourav (Table 12) which was statistically identical with the variety Aghrani (107.35 cm). The shortest plants (97.00 cm) were recorded in the varieties Sonalika. Statistically significant difference was found in respect of ear length under the present experiment in field condition. All the varieties used in the experiment as treatment performed maximum ear length among the varieties ranged from 13.09 to 16.69 cm. Maximum ear length (16.69 cm) was recorded in the variety Kanchan (Table 12) which was statistically identical with the variety Sourav (15.44 cm). The shortest ear length (13.09 cm) was recorded in the variety Aghrani.

Wheat varieties showed non significant variation in consideration of distance between the point of flag leaf initiation and to base of ear. The maximum length between flag leaf and base of ear (8.57 cm) were recorded by the variety Shatabdi (Table 12) and the minimum distance (6.64 cm) was recorded in the variety Protiva. Number of spikelets/ear varied from 24.57 to 29.44. The highest number of spikelets/ear (29.44) was recorded in the variety Shatabdi (Table 12). The lowest number of spikelets/ear (24.57) was recorded in the variety Pavon-76. Number of healthy spikelets/ear varied from 22.00 to 26.77. The highest number of healthy spikelets/ear (26.77) was recorded in the variety Shatabdi (Table 12). The lowest healthy number of spikelets/ear (22.00) was recorded in the varieties Provon-76. The number of diseased spikelets/ear varied significantly and ranged from 2.27 to 3.10 (Table 12). The highest number of diseased spikelets/ear (3.10) was recorded in the variety Sonalika (Table 12). The minimum number of diseased spikelets/ear (2.27) was recorded in the variety Gourab.

Table 12. Plant growth and spikelet formation of wheat varieties

Variety	Plant height (cm)	Ear length (cm)	Distance between the point of flag leaf initiation and base of ear (cm)	Number of spikelets/ear	Number of healthy spikelets/ear	Number of diseased spikelets/ear
Sonalika	97.00 e	13.40 d	7.43	25.25	22.15	3.10
Shatabdi	100.00 d	15.32 b	8.57	29.44	26.77	2.67
Akbar	100.33 c	14.96 c	6.77	27.12	24.35	2.77
Gourab	102.00 c	12.31 e	8.05	27.57	25.30	2.27
Sourav	107.50 a	15.44 b	8.37	26.21	23.65	2.56
Pavon-76	102.00 c	14.39 c	7.53	24.57	22.00	2.57
Kanchan	100.45 d	16.69 a	8.11	25.89	23.00	2.89
Protiva	105.00 b	15.29 b	6.64	28.99	26.67	2.32
Aghrani	107.35 a	13.09 d	8.00	25.77	23.33	2.44
Barkat	102.70 c	13.70 d	8.43	27.89	25.33	2.56
LSD _(0.05)	1.810	1.435	NS	NS	NS	NS

In a column means having similar letter(s) are statistically identical and those having dissimilar letter(s) differ significantly as per 0.05 level of probability

NS = Not Significant



4.3.5 Grain formation and grain yield of wheat

Wheat varieties showed significant variation in consideration of number of grains/ear (Table 13). Number of grains/ear varied from 34.23 to 38.66. The maximum number of grains/ear (38.66) was recorded in the variety Shatabdi (Table 13) and the lowest number of grains/ear (34.23) was recorded in the variety Kanchan. Number of healthy grains/ear varied significantly and ranged from 32.12 to 37.41. The maximum number of healthy grains/ear (37.41) was recorded in the variety Shatabdi and the lowest number of healthy grains/ear (32.12) was recorded in the variety Kanchan. The number of diseased grains/ear varied significantly and ranged from 1.25 to 3.67 (Table 13). The highest number of diseased grains/ear (3.67) was recorded in the variety Gourab and the minimum number of diseased grains/ear (1.25) was recorded in the variety Shatabdi.

Weight of grain/ear varied from 1.42 g to 1.57 g. The maximum weight of grains/ear (1.57 g) was recorded in the variety Shatabdi (Table 13) and the lowest weight of grains/ear (1.42 g) was recorded in the variety Sourav. In pot experiment wheat varieties showed statistically non significant variation in terms of weight of healthy grains/ear. Weight of healthy grain/ear varied from 1.31 g to 1.45 g. The maximum weight of grains/ear (1.45 g) was recorded in the variety Shatabdi (Table 13) and the lowest weight of grains/ear (1.31 g) was recorded in the variety Sourav. The weight of diseased grains/ear varied from 0.10 g to 0.18 g (Table 13). The highest weight of diseased grains/ear (0.18 g) was recorded in the variety Sonalika and the lowest weight (0.10 g) was recorded in the variety Shatabdi.

Table 13. Grain formation and grain yield of wheat

Variety	Number of grains/ear			Weight of grains/ear (g)			1000 seed weight (g)	Grain yield/plot (g)	Straw yield/plot (g)
	Total	Healthy	Diseased	Total	Healthy	Diseased			
Sonalika	37.87	34.22	3.65 a	1.57	1.39	0.18	40.34	239.35 bc	590.41 bc
Shatabdi	38.66	37.41	1.25 d	1.55	1.45	0.10	42.12	391.77 a	973.17 a
Akbar	36.56	34.25	2.31 b	1.52	1.38	0.14	41.15	283.00 abc	700.02 abc
Gourab	36.00	32.33	3.67 a	1.49	1.34	0.15	41.33	357.33 ab	885.47 ab
Sourav	34.41	32.85	1.56 cd	1.42	1.31	0.11	39.24	383.33 a	959.17 a
Pavon-76	36.56	35.00	1.56 cd	1.47	1.35	0.12	38.82	188.33 c	478.08 c
Kanchan	34.23	32.12	2.11 bc	1.47	1.34	0.13	38.93	273.00 abc	678.85 abc
Protiva	34.68	32.71	1.97 bc	1.49	1.38	0.11	37.96	304.00 abc	754.80 abc
Aghrani	34.96	33.14	1.82 bc	1.52	1.37	0.15	39.15	183.08 c	458.55 c
Barkat	35.7	34.25	1.45 cd	1.45	1.33	0.12	38.38	286.07 abc	704.20 abc
LSD _(0.05)	NS	NS	0.458	NS	NS	NS	NS	113.6	274.8

In a column means having similar letter(s) are statistically identical and those having dissimilar letter(s) differ significantly as per 0.05 level of probability

NS : Not Significant



Chapter 5

Discussion

Chapter V

DISCUSSION

The present research work was carried out to determine the varietal reaction of wheat to leaf blight caused by *Bipolaris sorokiniana*. The selected wheat varieties were Sonalika, Kanchan, Shatabdi, Aghrani, Pavon-76, Akbar, Gourab, Sourav Barkat and Protiva.

In the laboratory significant variation in respect of conidia production of *B. sorokiniana* per seed was observed among different varieties. The maximum number of conidia/seed (320) was recorded for the variety Sonalika which was closely followed by variety Kanchan (280) and the minimum number of conidia/seed (100) was recorded in variety Shatabdi which was closely followed by the variety Gourab (150). Statistically significant variation among the variety was recorded in respect of % leaf segment diseased under the present trail. Maximum % leaf segment diseased (96.67%) was recorded in from the variety Sonalika and the minimum (0.00) was recorded in the variety Shatabdi. Lesion length inoculated roots was also found to differ significantly from one variety to another. Highest lesion (11.67 mm) was recorded in the variety Sonalika, Sourav and Kanchan and No lesion i.e. infection (0.00 mm) was recorded in the varieties Shatabdi, Pavon-76 and Protiva. All the varieties used in the experiment as treatment showed different % germination. Maximum % germination (92%) was recorded from the variety Shatabdi, Sourav and Aghrani. Lowest percentage of germination (72%) was recorded in the variety Sonalika. Statistically significant difference was recorded in respect of % seed yielding *B. sorokiniana*. Maximum % *B. sorokiniana* (37%) was recorded from the variety Sonalika which was closely followed by the variety Gourab (34%). On the other hand minimum (17%) incidence was recorded in the variety Shatabdi.

In pot experiment the highest disease severity was recorded in the variety Sonalika and lowest severity was recorded in Shatabdi in all the counting periods. Similar results were also found in field condition. In field condition maximum disease severity (4.53) was recorded in the variety Sonalika and the minimum (4.07) was recorded in the variety Shatabdi in hard dough stage. Lesion of wheat germplasms to *B. sorokiniana* depends on genetical constituents of germplasm. Moreover, the fungus *B. sorokiniana* is polycyclic in nature, so there is possibility to break up the resistance easily. For instance, Kanchan is very popular variety in Bangladesh context. It was released as resistant variety but at present the variety is highly susceptible to *Bipolaris* leaf blight. Wheat Research Centre, BARI, Gazipur has already suggested for with drawn of Kanchan from cultivation. Now BADC (Bangladesh Agricultural Development Corporation) has cut the seed production area of Kanchan and inspiring the growers to cultivate Shatabdi instead of Kanchan. Throughout the world massive researchers are being done to achieve *Bipolaris* leaf blight resistant varieties but little success has been obtained (Fader *et al.*, 1989; Sinha *et al.*, 1991). Hossain and Azad (1992) evaluated 533 wheat germplasms against leaf blight (*B. sorokiniana*) and none of the materials were found to be free from the disease. Reza *et al.* (2004) evaluated 30 wheat genotypes against leaf blight of wheat caused by *B. sorokiniana* and they found 4 genotypes resistant, 3 moderately resistant, 6 moderately susceptible 12 susceptible and 5 highly susceptible to the disease. Ahmed *et al.* (2005) evaluated 529 entries of wheat against *B. sorokiniana* in the field under natural condition and among 529 entries only 42 showed resistant to moderately susceptible reaction. The finding of the present study is also supported by Shahidullah (2006). He evaluated 14 wheat genotypes against leaf blight (*B. sorokiniana*). Among 14 materials 3 found to be resistant to the disease which were Shatabdi, Chirya-7 and BAW-966. In the present study disease severity was higher in third leaf followed by second leaf and first leaf which was supported by Bazlur Rashid *et al.* (1988). They estimated

disease severity caused by *Drechslera sorokiniana* on the top 3 leaves (Flag leaf, second leaf and third leaf) of wheat on 3 occasions and found that lower leaves became significantly more infected than the flag leaves.

Days required for booting is a varietal characteristic, but it may be regulated by different cultural and management practices and also climatic factors, such as, disease severity influence days required for booting. From the results it was decided that the leaf blight infested variety showed the lowest number of days for booting. Early booting is the resultant effect of incomplete growth and development and as well as lowest yield. Duveiller and Gilchrist (1994) also reported the same result from their experiment earlier. Days required for heading is also a varietal characteristic, but disease severity influence days required for heading. Leaf blight susceptible variety showed the lowest number of days for heading. Early heading is the consequential effect of imperfect growth and development and as well as minimum yield. Days required for flowering is also a varietal characteristic, but it may be regulated by different factors. Disease severity is one of the most effective among the other factors for days required for flowering. Fakir (2000) reported the same results. Days required for maturity is a also varietal character, but it may be regulated by different cultural and management practices and also climatic factors, such as, low temperature delay maturity, where as high temperature enhances maturity period (Rahim and Gaffer, 1991). Maturity period greatly influences the different yield contributing characters as well as yield (Mayeenuddin, 1995)

The results indicated that in case of pot culture wheat plant perform different plant height for different variety. Plant height is a hereditary character, and it is expected that the different variety would have different plant height. Ear length is a hereditary character, and it is predictable that the different variety would have different ear length but disease incidence may regulate it. Khan and Hossain (1993) also reported highest ear length in fungicidal treated condition where as in control

condition recorded the lowest length of ear. Proper growth and development ensure the maximum growth of panicle which also ensures the maximum number of spikelets/ear. On the other hand disease incidence hinders the plant growth resulted minimum number of spikelets/ear. Proper growth and development ensure the maximum growth of panicle which also ensures the maximum healthy spikelets/ear and ultimate result is the highest weight of 1000 seeds. Proper growth and development ensure the maximum growth of plant which also ensures the health panicle, maximum number of spikelets/plant as well as maximum ear and the ultimate result is the highest yield. The findings of the present study is supported by Shahidullah (2006).

The highest yield/pot (5.97 g) was recorded in the variety Gourab and the lowest yield/pot (4.40 g) was recorded in the variety Pavon-76. In field condition wheat varieties showed statistically significant variation in respect of grain yield/plot. The highest yield/plot (391.77 g) was recorded in the variety Shatabdi and the lowest yield/plot (183.08 g) was recorded in the variety Aghrani. Disease free condition ensures the proper growth and development which also ensures the maximum number of spikelets /ear, total number of ear as well as highest yield. On the other hand disease infection plants hinders the plant growth as well as low yield. The findings of the present study corroborate with the findings of Shahidullah (2006). He obtained highest grain yield (531.9 g/plot) in the variety Shatabdi among the 14 wheat variety tested.



Chapter 6

Summary and Conclusion

Chapter VI

SUMMARY AND CONCLUSION

Subsequently three experiments were conducted in the Seed Pathology Laboratory, net house and experimental field of Sher-e Bangla Agricultural University, Dhaka, Bangladesh during the period from October 2005 to April 2006 to study the varietal reaction of leaf blight of wheat caused by *Bipolaris sorokiniana*. The wheat seeds varieties Sonalika, Kanchan, Barkat, Shatabdi, Aghrani, Pavon-76, Akbar, Gourab, Sourav and Protiva were collected from Bangladesh Agricultural Research Institute (BARI), Gazipur that were used in this experiment.

The maximum number of conidia/seed (320) was recorded for the variety Sonalika and minimum number of conidia/seed (100) was recorded in variety Shatabdi. Maximum lesion length (11.67 cm) was recorded in the variety Sonalika. No lesion i.e. infection (0.00 cm) was recorded in the variety Shatabdi. Maximum seed germination (92%) was recorded in the variety Shatabdi, Sourav and Aghrani and minimum (72%) was recorded in the variety Sonalika.

In pot experiment disease severity at panicle initiation stage was estimated on flag leaf, 2nd and 3rd leaf of different wheat variety. In flag leaf maximum disease severity was recorded in the variety Akbar (0.28) and no infection was recorded in the variety Shatabdi, Sourav, Pavan-76, Kanchan, Protiva and Barkat. In 2nd and 3rd leaf maximum disease severity (1.00 and 2.97, respectively) was recorded in the variety Sonalika. At flowering stage in flag leaf maximum disease severity was recorded in the variety Sonalika (0.55) and no infection was recorded in Shatabdi. In 2nd and 3rd leaf maximum disease severity (1.67 and 3.09, respectively) was recorded in the variety Sonalika. At milking stage maximum disease severity was recorded in the variety Sonalika and minimum in Shatabdi. Similar results were also found regarding disease severity in hard dough stage where minimum severity was recorded in the variety Shatabdi and maximum severity was recorded in the variety Sonalika.

The taller plants (100.19 cm) were produced by the variety Sourav and the shortest plants (91.20 cm) were recorded in the variety Sonalika. The maximum ear length (14.37 cm) was recorded from the variety Sourav and shortest ear length (12.52 cm) was recorded in the variety Protiva. The highest number of healthy spikelets/ear (27.67) was recorded in the varieties Shatabdi and lowest (21.00) in the variety Sonalika. The highest number of diseased spikelets/ear (3.67) was recorded in the variety Gourab and minimum number of diseased spikelets/ear (0.67) was recorded in the variety Shatabdi. The maximum number of healthy grains/ear (36.43) was recorded in the variety Shatabdi and the lowest (31.67) was recorded in the variety Gourab. On the other hand the highest number of diseased grains/ear (3.67) was recorded in the variety Gourab and the lowest (0.52) in the variety Shatabdi. Highest weight of 1000 seeds (42.55 g) was recorded in the variety Shatabdi and Akbar and the lowest weight of 1000 seeds (35.56 g) was recorded in the variety Protiva. The highest yield/pot (5.97 g) was recorded in the variety Gourab and the lowest yield/pot (4.40 g) was recorded in the variety Pavon-76.

Disease severity at panicle initiation stage was estimated on flag leaf, 2nd and 3rd leaf of different wheat variety in the field and in flag leaf maximum disease severity was recorded in the variety Sonalika (0.30) and no infection was recorded in the variety Shatabdi, Shurav, Pavan-76, Kanchan, Protiva and Barkat and in 2nd leaf maximum disease severity (1.00) was recorded in the variety Sonalika and no infection was recorded in the variety Shatabdi. Again in 3rd leaf maximum disease severity was recorded in the variety Sonalika (2.83) and the minimum (0.17) was recorded in the variety Shatabdi. In flag leaf maximum disease severity was recorded at flowering stage in the variety Sonalika (0.50) and no infection was recorded in the variety Shatabdi, Protiva and Barkat. In 2nd leaf maximum disease severity (1.37) was recorded in the variety Sonalika and in 3rd leaf maximum disease severity (3.50) was recorded in same variety. In milking stage maximum disease was recorded in the variety Sonalika and the minimum infection was recorded in the variety Shatabdi. In

hard dough stage maximum severity was recorded in the variety Sonalika the minimum infection was recorded in the variety Shatabdi.

The taller plants (107.50 cm) were produced by the variety Sourav and shortest plants (97.00 cm) were recorded in the varieties Sonalika. Maximum ear length (15.32 cm) was recorded from the variety Shatabdi. The highest number of spikelets/ear (29.44) was recorded in the variety Shatabdi. The highest number of diseased spikelets/ear (3.10) was recorded in the variety Sonalika. The maximum number of healthy grains/ear (37.41) was recorded in the variety Shatabdi and the lowest (32.12) was recorded in the variety Kanchan. The highest number of diseased grains/ear (3.65) was recorded in the variety Sonalika and the minimum number of diseased grains/ear (1.25) was recorded in the variety Shatabdi. The highest weight of 1000 seeds (42.12 g) was recorded in the variety Shatabdi. The highest yield/plot (391.77 g) was recorded in the variety Shatabdi and the lowest yield/plot (183.08 g) was recorded in the variety Aghrani. Based on the present study it has been found that leaf blight severity was comparatively lower in the variety Shatabdi which may be advocate for cultivation by growers.



Chapter 7

References

REFERENCES

- Adlakha, K. L., Wilcoxson, R. D. and Raychaudhuri, S. P. (1984). Resistance of wheat to leaf spot caused by *Bipolaris sorokiniana*. *Plant. Dis.*, 68 : 320-321.
- Ahmed, F. (2001). Studies on pathogenicity of *Bipolaris sorokiniana* and its effect on grain filling of wheat in BD. A Ph D. thesis submitted in the department of plant path. BAU, Mymensingh. Bangladesh.210p.
- Ahmed, F., Rahman, M. M. and Hossain, M. M. (2005). Source of resistance of wheat genotypes to leaf blight caused by *Bipolaris sorokiniana*. *Bangladesh J. Plant Path.*, 21 (1&2): 49-52.
- Akram, M., Amerika, S. and Singh, A. (2003). Screening and host response characterization of wheat against *Bipolaris sorokiniana*. *Indian Phytopath.*, 2003. 56 (2) : 201-204.
- Alam, K. B., Malaker, R. K., Shasheed, M. A., Ahmed, M. U., Ahmed, F. and Haque, M. S. (1995). Yield loss assessment of wheat due to *Bipolaris* leaf blight in Bangladesh J. Pl. Path. 11(1-2): 35-37.
- Alam, K. B., Shaheed, M. A., Ahmed, A. U. and Malaker. P. K. (1994). *Bipolaris* leaf blight (spot Blotch) of wheat in Bangladesh. In D. A., Sunders, and G. P. Hattel, eds. 1994. Wheat in heat stressed environment: Irrigated, dry areas and rice-wheat farming systems. Mexico, D. E. CIMMYT. 339-342 pp.
- Ali, A. A. and Fakir, G. A. (1992). Control of some selected seed-borne fungal pathogen of jute by seed treatment with garlic extract. Proc. BAU, Research Prog. 6:176-180

- Anonymous. (1989). Annual Report 1987-88. Bangladesh Agricultural Research Institute. Joydebpur, Gazipur. p. 133.
- BARI (Bangladesh Agricultural Research Institute). (1984). Annual Report. (1982-1983). BARI, Gazipur. 413 p.
- Bazlur Rashid, A. Q. M., B. P. Lahiri and Islam, T. (1994). Effect of *Bipolaris sorokiniana* leaf blight on some yield components and seed quality of wheat. *Bangladesh J. Agric Sci.*, 21 (1): 185-192.
- Bazlur Rashid, A. Q. M., Bahadur Meah and Jalal Uddin. (1987). Effect of leaf blight caused by *Drechslera sorokiniana* Subram and Jain. On some yield component of wheat. *Crop Protection*. 6 (4): 256-260.
- Bazlur Rashid, A. Q. M., M. B. Meah and M. Jalaluddin. (1988). Effect of leaf blight caused by *Drechslera sorokiniana* on some yield components of wheat. *Crop Prot.*, 6: 256-260.
- BBS (Bangladesh Bureau of Statistics). (2005). Monthly Statistical Bulletin, Bangladesh. Statistics Division. Ministry of Planning. Government of the Peoples Republic of Bangladesh. Dhaka. pp. 57.
- Beukema, H. P. and Vander Zaag. (1979). Crop Improvement: Some factors and facts. International Agricultural Centre, Wageningen. The Netherlands. 52 p.
- Broers, L. H. M. (1997). Components of quantitative resistance to yellow rust in ten spring bread wheat cultivars and their relations with field assessments. *Euphytica*. 96: 215-223.



- Cristaldo, R. M., Carvalho, F. D. and Kohli, M. M. (1997). Relationship between in vitro and seedling selection for resistant to spot blotch. *Pesquisa Agropecuaria Gaucha*. 1997, 3 (2): 147-152.
- Cunfer, B. M., David, E., Stooksburry and Jerry W. Johnson. (1988). Components of partial resistance to *Leptosphaeria nodorum* among seven soft red winter wheats. *Euphytica*. 37 : 129-140.
- Dewey, H. J. and Albrechtsen, M. V. (1997). The status of wheat disease and disease research in warmer areas. In: wheat for the Non-traditional, warmer Areas. Proceedings of International seed testing association. 31 :41-51.
- Dubin, H. J. and M. V. Ginkel (1991). The status of wheat diseases and disease research in warmer areas. In D. A. Saunders ed., wheat for the non traditional, warm areas, Mexico D. F. CIMMYT. 125-145 pp.
- Duveiller, E. and Gilchrist, L. (1994). Production constraints due to *Bipolaris sorokiniana* in wheat: Current situation and prospects. Wheat in heat stressed environment: Irrigated, dry areas rice wheat farming system. Maxico, DF. CIMMYT. 343-352.
- Edris, K. M., Islam, A. T. M. T., Chowdhury, M. S. and Haque, A. K. M. M. (1979). Detailed Soil Survey of Bangladesh Agricultural University Farm, Mymensingh, Dept. Soil Survey, Govt. People's Republic of Bangladesh. 118 p.
- Fader, A. K, Shahzad, S. and Ellis, M. B. (1989). Dematiaceous Hyphomycetes. Commonwealth Mycol. Inst. Kew, Surrey, England, 608. Environment-A proceedings of the international symposium Sept. 24-28.

- Fakir, G. A. (2000). Estimation of yield loss of Major Crops of Bangladesh caused by diseases. Seed Pathology Centre Dept. of plant pathology, BAU, Mymensingh. 85 pp.
- Fakir, G. A. and Khan, A. A. (1992). Control of some selected seed-borne fungal pathogen of jute by seed treatment with garlic extract. Proc. BAU, Research Prog. 6:176-180
- FAO. (1988). Production Year Book. Food and Agricultural of the United Nations. Rome, Italy. 42: 190-193.
- FAO. (1997). Production Yearbook. Food and Agriculture Organization of the United Nations, Italy, Rome, 62 p.
- FAO. (2000). Production Yearbook. Food and Agriculture Organization of the United Nations, Italy, Rome, 62p.
- Gilchrist, L. I. (1984). CIMMYT Methods for screening wheat for *Helminthosporium sativum* Resistance. In: wheat for more tropical. Center for Agrochemical Research, SPIC Science Foundation, Madras, India 26(2): 109-116.
- Gomez, K. A. and Gomez, A. A. (1984). Statistical Procedure for Agricultural Research (2nd edn.). Int. Rice Res. Inst., A. Willey Int. Sci., Pub. pp. 28-192.
- Hossain I. and Azad, A. K. (1992). Reaction of wheat to *Helminthosporium sativum* in Bangladesh. *Hereditas*. 116: 203-205.
- Hossain, I. and Azad, A. K. (1994). *Bipolaris sorokiniana*, its reaction and effect on yield of wheat. Prog. Agric. 5(2): 63-69.

- Hossain, I. and Schlosser, F. (1993). Control of *Bipolaris sorokiniana* in wheat with neem extracts. *Bangladesh J. Microbiol.* 10 (1): 39-42.
- Hossain, I., Mahamud, H. and Ashrafuzzaman, H. (1997). Effect of plant extracts on fungi (*Bipolaris sorokiniana* and *Bipolaris solani*) and okra Mosaic disease. *Ecoprint* 4(1):35-42.g
- ISTA, (1996). International Rules of Testing Association. Proc. Int. Seed Test. Assoc. 180. P.
- Khan, M. H. H. and Hossain, I. (1993). Antifungal Activity of Crude Plant Extracts Against *Bipolaris sorokiniana*. Paper presented 5th Biennial conference. Bangladesh phytopathological society, 27-28 June-1993. BAU, Mymensingh. 10p.
- Limonard, T. (1968). Ecological aspects of seed health testing. Proceedings of International seed testing association. 33 : 343-513.
- Majumder, A. R. (1991). Assessment of yield loss caused by common root rot in wheat a cultivar in Queensland (*Bipolaris sorokiniana*). *Australian. J. of Agril. Res.* (Australia). 13(3): 143-151.
- Malaker, T. Y., H. L. Wang and Luxin. X. U. (1994). Effect of grain black point disease of wheat and pathogenic fungi. *Acta Phytophylacica sinica.* 17 (4):313-316.
- Mayeenuddin, G. M. (1995). Experience of tuberlet production from TPS by BADC. Proceedings of the Workshop on National Program for TPS in Bangladesh. BARC, Dhaka. p. 38.
- Meisner, G. B. Menamara R. B. and Tinline. R. D. (1994). Assessment of yield loss caused by common root rot in wheat a cultivar in Queensland

- (*Bipolaris sorokiniana*). *Australian. J. of Agril. Res. (Australia)*. 43(3):43-58.
- Miah, A., M. U. Ahmed., N. R. Sharma and S. A. Mia. (1990). Antifungal activity of some plant extracts. *Bangladesh J. Botany*. 19 (1) : 5-20.
- Mikhailova, L. A., Gogoleva, G. S. and Gulyaeva, E. I. (2002). The interactions of *Bipolaris sorokiniana* strains and wheat sample. *Mikologiya Fitopatologiya*. 2002. 36 (2): 63-66.
- Mikhailova, L. A., Sun, L., Gogoleva, S. G. and Gulyaeva, E. I. (2004). Sources and donors of resistance to wheat spot blotch caused by *B. sorokiniana*. *Archives Phytopath. Plant Prot.*, 2004, 37 (3): 161-167.
- Molan, Y., Doss, A. A. Hussieni, S and Moustafa, K. A. (2001). Evaluation of wheat genotypes against *Bipolaris sorokiniana* causing spot blotch. *Alexandria J. Agril. Res.* 2001, 46 (3): 99-105.
- Muyanga, S., Tanner, D. G. and Mwangi, W. J. (1992). Breeding for disease resistance in rainfed wheat in Zambia. *In* Seventh regional wheat workshop for eastern, central and southern Africa held on 16-19, September, 1991, Nakuru, Kenya, p. 148-153.
- Nene, S. A. and Saxena, Y.K. (1971). Assessment of yield loss caused by common root rot in wheat a cultivar in Queensland (*Bipolaris sorokiniana*). *Australian. J. of Agril. Res. (Australia)*. 13(1):14-51.
- Pidoplichko, K. J. and Andreeva, Y. Y. (1980). Antifungal activity of crude extracts of plants against *Rhizoctonia solani* and *Bipolaris sorokiniana*. *Res. News Letter*. 12(2): 28.

- Rahim, M. A. and Gaffer, M. A. (1991). Effect of spacing on the yield of Wheat. *Bangladesh J. Sci. Ind. Res.* 26 (1-4): 225-262.
- Rahman, M. (1997). Components of resistance of wheat seedlings to *Bipolaris sorokiniana*. A thesis submitted to Institute of Postgraduate Studies in Agriculture in partial fulfillment of the requirements for the M. S. degree. Department of Plant Pathology. IPSA.
- Rashid, A. Q. M. B., Meah, M. B. and Fakir, G. A. (1992). Importance and distribution of seed borne *B. sorokiniana* in wheat in Bangladesh. *Bangladesh J. Plant Path.* 1992, 8 (1-2): 5.7.
- Rashid, M. A., Rovesti, L., Marco, D. S. and Tancald, D. (1997). Effect of Neem Kernel extract on some phytopathogenic fungi under green house conditions. *Zeitschrift-fure-pflanjenk Yankhitenund-pftanjen schutj* (Germany, F. R.) 99 (3) P. 293-296.
- Rashid, M. H. (1996). Evaluation of some wheat materials and allied species against *Bipolaris sorokiniana*. M. Sc. thesis. Dept. Pant Path., Bangladesh Agril. Univ., Mymensingh.
- Razzaque, M. A. and A. B. S. Hossain. (1991). The wheat development program in Bangladesh. "Wheat for the non traditional warm areas" edited by D. A. Saunders. Proc. International conf. held in July 29 to August 3, 1990. in Foz do Iguacu, Brazil.
- Razzaque, M. A. Tancald, D. and Hossain A. B. S. (1992). The wheat development programme in Bangladesh "Wheat for the nontraditional warm areas" edited by D.A. Saunders. Proc. Intl.Conf. held in July 29 to Aug. 3, 1990 in Foz dolguacu Brazil CIMMYT. Pp. 44-54.

- Reza, M. M. A., Malaker, P. K. Shaheed, M. A. and Barma, N. C. D. (2004). Evaluation of wheat genotypes against leaf blight caused by *Bipolaris sorokiniana*. *Bangladesh J. Plant Path.* 20 (1&2): 35-41.
- Shahidullah. (2006). Screening and management of leaf blight of wheat caused by *Bipolaris sorokiniana*. MS Thesis. SAU, 2006.
- Sharif, O. (1998). Components of resistance of wheat to *Bipolaris sorokiniana* under natural condition. A thesis submitted to Institute of Postgraduate Studies in Agriculture in partial fulfillment of the requirements for the M. S. degree. Department of plant pathology. IPSA.
- Singh, D. P., Chand, R., Dodan, D. S., Amerika, S. and Singh, K. P. (2003). *Indian Phytopath.* 2003, 56 (4): 473-475.
- Singh, D. P., Maraitte, H., Duveiller, E., Diego, M. and Renard, E. (2003). Comparison of host resistance to *Bipolaris sorokiniana*, the casual agent of leaf blotches and its toxin in wheat. Proceedings of Fourth International Wheat Tan Spot and Spot Blotch Workshop, Bemidji, USA. 21-24 July. 2002: 74-78.
- Singh, R. V., Singh, B. N., Singh, A. K., Dinesh, Singh, V. B. and Singh, D. (1995). Screening of wheat genotypes against foliar blight caused by *Helminthosporium sativum*. *Plant Dis. Res.* 10 (1): 88-90.
- Sinha Govindachari, T. R., Suresh, Gopalakrishnan, G., Banumathy, B. and Masilamani, S. (1991). Identification of antifungal compound from the seed oil of *Azadirachta indica*. Center for Agrochemical Research, SPIC Science Foundation, Madras, India 26(2): 109-116.

- Suratuzzaman, M. (1995). Studies on the seed-borne fungi of soybean and its control, M Sc Ag. Thesis. Dept.of Pl. Pathol. BAU, Mymensingh, Bangladesh.58.p.
- UNDP. (1988). Land Resources Appraisal of Bangladesh for Agricultural Development. Report 2: Agro-ecological Regions of Bangladesh, FAO, Rome. pp. 212, 577.
- Wildermuth, G. B. Menamara R. B. and Tinline. R. D. (1992). Assessment of yield loss caused by common root rot in wheat a cultivar in Queensland (*Bipolaris sorokiniana*). *Australian. J. of Agril. Res. (Australia)*. 43(3):43-58.



Chapter 8

Appendices

APPENDICES

Appendix I. Results of mechanical and chemical analysis of soil of the experimental plot Mechanical analysis

Constituents	Percent
Sand	33.55
Silt	60.20
Clay	6.15
Textural class	Silty loam

Chemical analysis

Soil properties	Amount
Soil pH	6.07
Organic carbon (%)	1.32
Total nitrogen (%)	0.08
Available P (ppm)	20
Exchangeable K (%)	0.2

Appendix II. Monthly average temperature, relative humidity and total rainfall of the experimental site during the period from October 2005 to April 2006

Month	Air temperature (^o C)			RH (%) 9 am	Total rainfall (mm)	Sunshine (hrs/day)
	Maximum	Minimum	Mean			
October 05	30.97	23.31	27.14	75.25	208	208.9
November 05	29.45	18.63	24.04	69.52	00	233.2
December 05	23.85	16.23	21.54	70.61	00	210.5
January 06	20.80	15.55	18.45	81.45	13	215.8
February 06	20.12	14.25	17.45	87.50	20	220.5
March 06	31.25	21.55	26.25	85.55	25	235.8
April 06	33.74	23.87	28.80	81.00	38	231.2

শেহেরবাংলা কৃষি বিশ্ববিদ্যালয় গাজীপুর
সংযোজন নং: 18/06/13
তারিখ: 22/06/13
P. Path.

37338
১০/১২/১৩