CHARACTERIZATION OF METEOROLOGICAL VARIABLES CONducive TO LENTIL GREY MOLD DISEASE DEVELOPMENT

Muhammad Intizar-ul-Hassan*, Muhammad Aslam Khan**, Nazir Javaid** and M. Mumtaz Khan***

*Pulses Research Institute, Faisalabad.
**Department of Plant Pathology, University of Agriculture, Faisalabad, Pakistan
*** Institute of Horticulture Sciences, University of Agriculture, Faisalabad, Pakistan

ABSTRACT

The lentil line 88529 and two varieties Masoor- 85 and Masoor-93 were sown under natural conditions to study the relationship of environmental conditions with the development of Botrytis grey mold (Botrytis cinerea) development during 2008 and 2009 in the research area of Pulses Research Institute and Plant Pathology Section, Ayub Agricultural Research institute, Faisalabad, respectively. Natural inoculum of Botrytis grey mold (BGM) was relied upon for infection. Disease severity of BGM recorded on the basis of disease rating scale and the environmental parameters consisting of maximum and minimum (°C) air temperature (°C), relative humidity (%) at 8 am and 5 pm, wind velocity (km/h) at 8 am and 5 pm and sun shine (hours) were analysed through regression. Maximum disease severity was developed at temperature of 23-26 °C and 18-24 °C. BGM disease increased more rapidly when the relative humidity (%) at 8 am was 55-75% and at 5 pm 36-56% and wind velocity of 3-4 km/h and 3-5 km/h at 5 pm during the both years. This information generated on the critical ranges of maximum and minimum (°C) air temperature, relative humidity (%) at 8 am and 5 pm, wind velocity (km/h) at 8 am and 5 pm and sun shine (hours) for the severity of lentil grey mold can be useful in future for the lentil growers to take management decisions about the disease.

Key words: Lentil, Botrytis cinerea, meteorological variables, regression.

INTRODUCTION

In Pakistan, lentil (Lens culinaris Medik) is the second most oldest and popular food legumes. It is locally known as masoor and is cultivated to the cooler zones and marginal land of low fertility. Area under the lentil cultivation is 30.9 thousand hectares with total production of 14.4 thousand tons having average yield of 466 kg/ha (Anon. 2009). This is an extremely low yield, almost one half of that in the world and this low yield can be attributed to various biotic and abiotic constraints (Ilyas, 1993). Under conducive conditions, the diseases caused by fungi, bacteria, viruses and nematodes singly, or collectively can cause a significant reduction in both grain yield and quality. Among diseases Botrytis Grey Mold (BGM) is a major constraint to lentil production and has the potential to occur in all areas where lentils are grown depending upon the environment conditions. The fungus Botrytis cinerea Pers. ex. Fr is a grey powdery mold and also a serious pathogen of several commercial crops; including lettuce, grapes, strawberries, tomato and tobacco; identified on more than 200 plants. BGM first appears either on flowers and pods, or lower in the crop canopy of the lentil plant. Discrete cream colored lesions on lower leaves of the infected lentil plants may be observed which later enlarge and coalesce resulantly whole leaflets fall to the ground unlike. Now tiny, black fruiting bodies (pycnidia) can be seen within the lesions like Ascochyta blight. A humid micro climate is produced under the canopy of crop when it reaches at its closure (Lindbeck and Horsham, 2008). The infected seeds may be discolored and shriveled, but do not always show clear symptoms. Infected seedlings from contaminated seeds are yellow and stunted with the grey fungal growth on the stem at the soil line and usually die (Morrell, 1997) after 1 or 2 weeks. Pods which become infected are covered in a grey mold growth, rot, and turn brown when dried out. Seeds within these pods fail to fill properly and are discolored and shriveled (Bayaa and Erksine, 1998; Davidson et al 2004). When infected seeds are sown seedling blight can occur. Seedling blight is characterized by the appearance of grey mycelial growth on the stem at the soil level (Ilyas et al 2007).

Areas where lentils are grown can be infected by B. cinerea. Losses due to disease can range from minor to very serious, depending on the variety grown, locations of the crop, time of infection and amount of rainfall. Unprotected crop can lose 30 to 50% grain yield.
The study of meteorological variables are required to determine conducive ranges of air temperature maximum and minimum (°C), relative humidity (%) at 8 am and 5 pm, wind velocity (km/h) at 8 am and 5 pm and sun shine (hours) etc., to manage the disease. Very little is available regarding meteorological studies of BGM in Pakistan in this context. For timely deployment of management strategies characterization of environmental conditions conducive for the B. cinerea disease development under field conditions will help to provide some baseline information to develop a forecasting system in future. Objectives of this study was to find out the relationship of environmental conditions conducive to BGM disease development on three lentil varieties/line under natural conditions.

MATERIALS AND METHODS

During winter season of 2007-08 and 2008-09 One thousand two hundred and seventy varieties/limes of lentil received form Pulses Research institute Faisalabad, NIAB, Faisalabad and PARC Islamabad were sown in the research area of Pulses Research institute, Faisalabad in 2007-08 and during 2008-09 in Plant Pathology Research institute Faisalabad respectively.

The experiment was laid out in Augmented Design. Each test line was sown during second week of November, with 3 meter long and 30 cm apart row. A highly susceptible line AARI L- 9410 was sown after every two test entries as a disease spreader. In addition to that, two rows of susceptible check AARI L- 9410 were also sown around the research trial to increase the inoculum pressure of B. cinerea under natural conditions. The lentil crop was raised by following recommended agronomic practices.

Environmental data were collected from Agromet center AARI, Faisalabad 100-150 meter far from the both experimental sites of Pulses research institute (PRI) and Plant Pathology Section of Plant Pathology Research Institute (PPRI) Faisalabad. Maximum and minimum air temperature, relative humidity % at 8 am and at 5 pm, rain fall (mm), wind velocity (km/h) at 8 am and 5 pm and sun shine (hours) were recorded on daily basis from mid February to first week of April 2008 and 2009 and the weekly average, were collected. The relationship of environmental factors (maximum and minimum air temperature, relative humidity % at 8 am and 5 pm, rain fall (mm), wind velocity (km/h) at 8 am and 5 pm and sun shine (hours)) with B. cinerea disease severity was determined through regression (Steel and Torrie, 1980).

RESULTS AND DISCUSSION

Out of 1270 varieties/limes during 2007-08 & 2008-09 there was no line found to exhibit immunity against Botrytis grey mold. Nine hundred and seventy varieties/lines exhibited moderately resistant response against Botrytis grey mold. Two hundred and ninety three varieties/lines exhibited susceptible response to Botrytis grey mold; while seven varieties/lines 050207, 050208, 88529, 89515, 050206, E 15-2 and 87525 exhibited highly susceptible response against Botrytis grey mold. The lentil line 88529 and two varieties Masoor- 85 and Masoor-93 were selected to study the relationship of environmental conditions with the development of Botrytis grey mold disease development during 2008 and 2009. The environmental factors were best explained by linear regression models as indicated by higher r values. There was increasing trend in Botrytis grey mold disease development with increasing maximum air temperature 25-33 °C and 23-26 °C during 2008 and 2009 (Figure.1). Varieties/limes showed increasing trend in disease development with minimum temperature 12-18 °C and 18-24 °C during 2008 and 2009 (Figure.1). Disease development during the year 2008 decrease when the relative humidity (%) at 8 am 65-81% and at 5 pm 32-46% (Figure. 2), as compared to 2009. whereas severity of Botrytis grey mold during 2009 was greater when the relative humidity relative humidity (%) at 8 am 55-75% and at 5 pm 36-54% (Fig. 1). During 2008 data showed that there was no rain recorded during March and April and hence there was no increasing or decreasing trend of disease development. In 2009, varieties showed increasing trend in botrytis grey mold development with 0-3 rain fall (Fig. 3). Decreasing trend of disease development was noted with wind speed of 1-4 km/h at 8 am during 2008 (Fig 3), but during 2009 increasing trend of disease development was recorded with wind speed of 1-4 km/h (Fig. 3). Similarly increasing trend of disease development was noted with wind speed of 3-4 km/h and 3-5 km/h at 5 pm during both years 2008 and 2009 (Fig. 4).

Increasing trend of disease development was observed with sun shine 8-10 (hours) and decreasing trend 6-10 hour (Fig. 4) disease severity was between 2-2.9 mm pan evaporation. These results are in conformity with the results of Harrison (1979), Tripathi and Rathi (1992) Rewal and Grewal (1989). They claimed that temperature ranging from 15-25 °C, RH more than 95 % and rainfall were the main factors responsible in Botrytis grey mold development.
Fig 1: Relationship of maximum, minimum air temperature (°C), with Botrytis grey mold severity on 88529 (y₁), Masoor-85 (y₂) and Masoor-93 (y₃) during 2008 (A) and 2009 (B) respectively.
Fig 2: Relationship of relative humidity (%) at 8am and 5pm, with Botrytis grey mold severity on 88529 ($y_1$), Masoor-85 ($y_2$) and Masoor-93 ($y_3$) during 2008 (A) and 2009 (B) respectively.
There was no rain in 2008.

y1 = 1.143 x1 + 4.43; r = 0.57
y2 = 1.29 x2 + 4.9; r = 0.97
y3 = 1.86 x3 + 2.6; r = 0.86

y1 = -0.33 x1 + 6.3 r = 0.36
y2 = -0.67 x2 + 5.7; r = 0.25
y3 = -0.167 x3 + 5.7; r = 0.36

Fig 3: Relationship of rain fall (mm) and wind speed (km/h) at 8am, with Botrytis grey mold severity on 88529 (y1), Masoor-85 (y2) and Masoor-93(y3) during 2008 (A) and 2009 (B) respectively.
Fig 4: Relationship of wind speed (km/h) at 5am and sun shine (hours), with Botrytis grey mold severity on 88529 (y_1), Masoor-85 (y_2) and Masoor-93(y_3) during 2008 (A) and 2009 (B) respectively.
REFERENCES


