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Epidemiology of Stemphylium Blight of Lentil

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Abstract

Among the atmospheric factors maximum and minimum temperature, relative humidity ranging from 20.5-29.0^{O}C (mean 23.7^{O}C), 5.4-13.3^{O}C (mean 14.2^{O}C) and 78.0-84.5% (mean 81.0%), 48.0-63.0% (mean 55.5%) respectively are the predisposing factors for disease initiation. Whereas the maximum and minimum temperature, relative humidity ranging from 20.5-35.0^{O}C and 13.0-21.0^{O}C, 78.0 - 100.0% and 48.0-80.2% respectively and rainfall 1.2-14.6mm are favorable for disease development. The trends of disease development among the sowing dates were similar. The lowest and the highest severity were noted on November 01 and December 30 respectively.

Key words: Epidemiology, Stemphylium blight, Lentil and Meteorological factor.

Introduction

Stemphylium blight of lentil (*Lens culinaris*. Medik.) caused by *Stemphylium botryosum* Wallr. is one of the major diseases of much economic importance. The disease was recorded in Bangladesh by Bakr and Zahid (1986), Sen and Das (1964), Nene *et al*. (1984) in India, Kaiser (1972) in Iran and Simay (1990) in Hungary. In Indian sub-continent the disease has been continued to be a serious threat to the successful cultivation of lentil (Sinha and Singh, 1991). The disease can infect the crop severely. The necrotrophic fungus, *Stemphylium botryosum* has been reported to over summer on dead plant parts-during non-crop season. Afterwards it multiplies and spreads by wind. The disease is increasing tremendously in the recent years and continued to be a serious threat to the successful cultivation of lentil. Because of the increase in severity, the disease has already gained much more importance and reported to incur 80-92.35% crop loss (Bakr and Ahmed., 1992). In India, the intensity of the disease was 82.55% and the loss was recorded as 93.4% (Singh *et al.*, 1990). The incidence and development of the disease during the crop season is influenced by various meteorological factors such as atmos-

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pheric temperature, relative humidity, rainfall, number of cloudy cover etc. (Bakr and Ahmed, 1992).

However, to study the forecasting of the disease during the crop season and to study the onset of disease in relation to atmospheric temperature, relative humidity, cloudy cover and different micro-climatic factors the present experiment has been designed.

Materials and Methods

Disease development with relation to different sowing dates during 1998 -2001

The experiment was conducted during rabi of 1998-1999, 1999-2000 and 2000-2001 at Regional Agricultural Research Station, Rahmatpur, Barisal. The experiment was laid out in a well managed piece of land using Completely Randomized Block Design having three replications. The unit plot size was 4m x 3m with 25cm row to row spacing. Continuous seed sowing was done in the rows. The chemical properties and nutritional status of the experimental field was determined. The texture of soil of the experiment al plot was clay loam with low organic matter content (0.98-1.21) and acidic nature with pH 6.8. A susceptible genotype L - 81124 was sown on different dates, viz., November 01, 10, 20, 30, December 10, 20 and 30. After completion of the sowing, the experiment was kept under constant watch from sowing up to harvest. The data on meteorological factors such as atmospheric temperature, relative humidity, rainfall and cloudy cover with corresponding sowing dates were recorded. The disease data were recorded from 25 randomly tagged plants/plot on the basis of 1-9 scoring scale. The Percent Disease Index (PDI) was computed on the basis of the recorded data according to the formula described (Wheeler, 1969)

$$\text{PDI} = \frac{\text{Sum of numerical values}}{\text{No. of plant parts observed}} \times \frac{100}{\text{Maximum disease rating}}$$

Apparent infection rates (r) were calculated from Percent Disease Index (PDI) at 10 days intervals of plant growth from the day of first appearance of disease, using the formula (Van der plank, 1963)

$$r = \frac{2.3}{t_2 - t_1} \log_{10} \frac{x_2 (1- x_1)}{x_1 (1 - x_2)}$$

Where, r = apparent infection rate (infection rate per unit per day), x_1 = percent disease index at initial time t1, x_2 = Percent Disease Index at subsequent interval time t_2 and t_2-t_2 = time interval between two observations. All data were analyzed statistically and the means of treatment effect were separated for DMRT (Steele and Torrie, 1980). All percent data were subjected to arcsine transformation before statistical analysis.

Disease development with relation to different meteorological factors during 1998-2001

Influence of meteorological factors, viz., atmospheric temperature, relative humidity, rainfall and cloudy cover on disease development was studied for three consecutive years (1998-1999, 1999-2000 and 2000-2001). The meteorological data were collected from the meteorological center at the research station. Disease development was recorded by making visual observation on severity of 25 tagged plants/plot from the first appearance of disease at 10 days interval, which was correlated with the meteorological factors.

Results and Discussion

Disease development in relation to different sowing dates during 1998-2001

Among the seven sowing dates of 1998-1999 the lowest PDI was observed in November 01sowing followed by November 10 (Fig.1). The treatments differed statistically from each other. The highest PDI (85.5) was found in December 30 sowing and statistically similar with those of December 20 and December 10. A trend of progress in PDI was observed with the advancement of sowing dates from early November to late December.

During 1999-2000, the lowest incidence (23.5) was recorded in November 01sowing followed by November 10 and November 20. The highest PDI (78.4) was noted in December 30. The November 01 and November 10 sowing dates were statistically similar and differed from that of 1998-1999. Disease severity in relation to sowing dates during 1998-2001 is shown below in Fig. 1.

In 2000-2001, the lowest PDI was shown by November 01 sowing followed by November 10 and November 20 sowing and similar to those of 1998-1999 and 1999-2000. The results of the first and second sowing were statistically similar like those of the previous years. December 20 showed

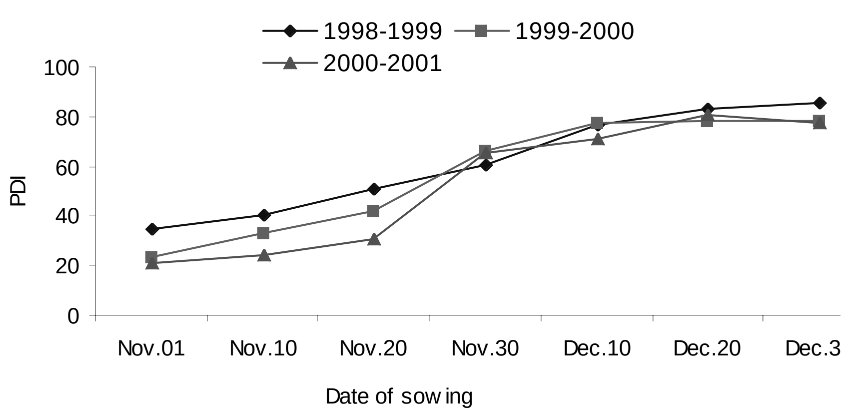

Fig.1 Disease development in relation to sowing date

Similar trend of disease progress was observed in 2000-2001. However, it is revealed from the study that the disease could be avoided significantly by sowing lentil before November 20.

From the findings of three consecutive years, it was also observed that the rate of apparent infection per unit per day (r) was high in the middle stage of the development of disease and onwards for the crop, sown on November 20, 30, December 10 and 20 and 30. The infection rate increased during the crop period because the potentials of the infection spores increased with the necrotization of plant tissues.

In 1998-1999 the apparent infection rate per unit per day were 0.0498, 0.0920, 0.1659 and 0.2478 for the disease observed on February 10, 20, March 01 and March 10 respectively of all the sowing dates at interval of 10 days (November 01- December 30). Similarly, in 1999-2000, the infection rates were recorded as 0.0728, 0.1254, 0.1731 and 0.2695 observed during January 30 - March 10 at an interval of 10 days of the sowing dates. In the year of 2000-2001, the infection rates recorded were 0.0305, 0.0951 and 0.2375 per unit per day on February 20, March 01 and March 10, respectively. The highest rates were recorded in 1999-2000 during the period of study.

Time of sowing for any crop is a very important factor for growth and reproduction of plant pathogens. Lentil as winter crop is highly sensitive to variation of climatic condition (Jian *et al*. 1987). This is one of the predisposing factors for building up of different diseases of a crop. Sowing time has marked effect upon the levels of disease incidence where with the manipulation of sowing dates incidence of disease may be avoided (Hedge and Anahusor, 1994). It is evident from the study that the incidence of Stemphylium blight could be avoided when lentil is sown early, i.e., within second week of November.

This observation was in close agreement with that of (Gupta, 1985) who reported that early sown crop suffered less whereas late sown crop suffered maximum because of inoculum pressure in the atmosphere. In mustard progressive increase in infection rate and decrease in yield was found in delay sowing (Howlider *et al.* 1989) which is in close agreement of the present findings. Delayed sowing greatly increased the incidence of anthracnose of French bean (Sindhan and Bose, 1981)

Disease development with relation to different meteorological factors during 1998-2001

Disease development with relation to different meteorological factors during 1998-1999 has been shown in Fig. 2. Data on PDI at 10 days interval, 10 days average data of atmospheric temperature (^{O}C), relative humidity (%), rainfall (mm) and extent of cloudy cover were recorded.

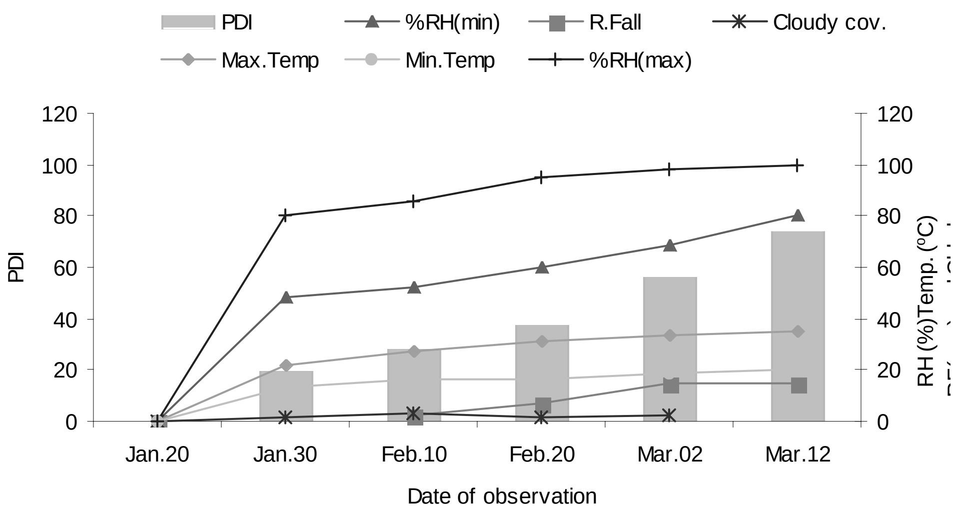

Fig. 2 Disease development in relation to meteorological

It may be seen in figure 2 that in 1998-1999 the disease initiated first on January 30 when the maximum and minimum temperatures were 21.7^{O}C and 13.3^{O}C with corresponding relative humidity of 80.5% and 48%, respectively. The highest disease index was observed on March 12 when the prevailing average maximum and minimum temperatures were 34.9^{O}C and 20^{O}C with corresponding relative humidity 100% and 80.2% respectively. The disease severity was increasing significantly with the increase in relative humidity, temperatures and average rainfall (14.8mm).

Disease development with relation to meteorological factors during 1999-2000 was shown in Fig.3. Data on PDI at 10 days inter-

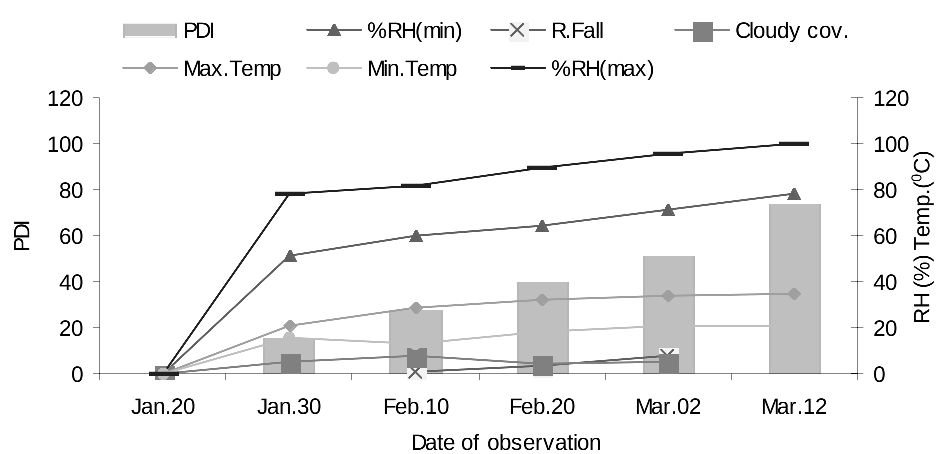

Fig. 3 Disease development in relation to metereological factors during 1999-2000

val, 10 days average data of atmospheric temperature (°C), relative humidity (%), rainfall (mm) and extent of cloudy cover were recorded.

It is revealed from Fig.3 that during 1999-2000 the disease initiation occurred in the last week of January (January 30) when average maximum and minimum relative humidity were 78% and 51% with corresponding maximum and minimum temperature 20.5°C and 15.4°C respectively.

The highest PDI (73.6) was recorded on March 12 when maximum and minimum relative humidity were 100% and 78% with corresponding temperature 35°C and 21°C respectively. The disease index showed gradual increasing trend with increasing relative humidity and temperatures.

Disease development with relation to meteorological factors during 2000-2001 was hown in Fig. 4. Data on PDI at 10 days interval, 10 days average data of atmospheric temperature (°C), relative humidity (%), rainfall (mm) and extent of cloudy cover were recorded.

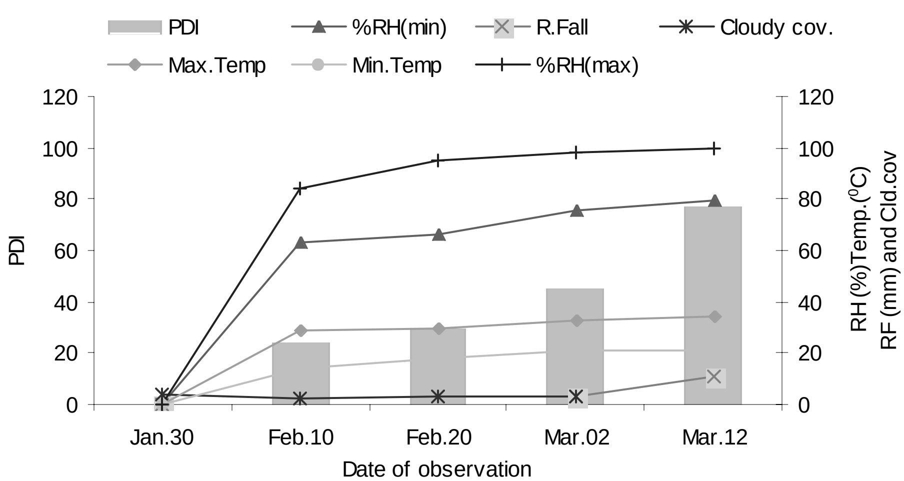

Fig.4 Disease development in relation to meteorological factors during 2000-2001

It is found in Fig. 4. that in the year of 2000-2001 the disease first appeared during the second week of February (10 February) when maximum and minimum relative humidity were 84.5% and 63% with corresponding maximum and minimum temperature 29°C and 14°C respectively. The highest PDI (77.3) was recorded in the second week of March (March 12) when average maximum and minimum relative humidity were 100% and 79.8% with corresponding maximum and minimum temperature 34°C and 21°C, respectively and average rainfall

(10.6mm). It is evident that progressive development of disease was influenced dominantly by humidity and rainfall rather than temperature.

It is revealed from the study that the PDI increased significantly along with the sowing time at 10 days interval from November 01 to December 30 and the progress of the disease. Different meteorological factors, viz., atmospheric temperature, relative humidity, rainfall, etc. have influence on spread, infection and development of various diseases. The effect of meteorological factors on disease over the years indicated that relative humidity and periodic rainfall were the predisposing conditions for initiation of disease. The maximum and minimum temperatures, relative humidity and periodic rainfall ranging from 20.5-35^{O}C and 13-21^{O}C, 78-100% and 48-80.2% and 1.2-14.8mm, respectively were the most favourable for the development of Stemphylium blight of lentil. Moreover, for disease initiation maximum and minimum temperature, maximum and minimum relative humidity ranging from 20.5-29^{O}C (mean 23.7^{O}C), 13.3-5.4^{O}C (mean 14.2^{O}C), 78-84.5% (mean 81%) and 48-63% (mean 54%), respectively were favourable. In India some workers (Bhargava and Khare. 1988) opined that maximum and minimum temperature, relative humidity and periodic rainfall were the most favourable factors for development of Alternaria blight of chickpea. As regards the development of Stemphylium blight of lentil (Sinha and Singh, 1991) observed that the favourable temperature and relative humidity were 18± 2 ^{O}C and 85-90%, respectively along with number of cloudy and foggy days.

Conclusion

The present findings differed from the observation of (Sinha and Singh, 1991) because, among the years the mean PDI was the highest in 1998-1999 when number of cloudy days was less, whereas in 1999-2000 the numbers of cloudy days was more but the mean PDI was low. However, number of cloudy days did not have influence on disease development under Bangladesh condition. Prevailing higher relative humidity because of the periodic rainfall and ambient temperature during crop season (November 01-December 30) were responsible for disease appearance and development under Bangladesh condition. In India it was found that relative humidity and precipitation were more important than temperature (Sindhan and Bose, 1981). Present findings were also in support of this opinion.

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