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Epidemiological Studies on Powdery Mildew of Pea

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A B S T R A C T

The influence of environmental factors on the development of pea powdery mildew (*Erysiphe pisi*) was studied under field conditions. Epidemiological studies revealed that the apparent rate of disease development was high during 50% flowering to pod initiation stage. Powdery mildew severity showed positively and significantly correlated with maximum temperature and sunshine hours. The correlation was non-significant with minimum temperature and relative humidity.

Introduction

Pea *(Pisum sativum* L.*)* is an important pulse as well as vegetable crop (*Trebuchet et al.*, 1953) having growing season of at least five months duration. Pea occupies a position of considerable importance because of its palatability in the form of vegetable curry along with other vegetables and also widely used as pulses in daily diet. Powdery mildew possess a continuous threat to its successful cultivation in crop growing areas of the Chhattisgarh state. This disease usually appear late in the season, reaching maximum intensity during the pod formation stage. In a crop badly affected by powdery mildew, the reduction in number of pod plant^{-1} is estimated to be 28.6% (Rathi and Tripathi, 1994). Various environmental factors play a significant role in the development of disease under field conditions. Quantitatively knowledge of critical environmental factors like temperature and relative humidity responsible for disease development is much need to control the disease by effective control measures.

Materials and Methods

The field experiment was conducted at the chickpea pathology field, IGKV, Raipur, during the *Rabi* seasons of 2009-2010. Field pea variety, Arkel (highly susceptible to powdery mildew) was sown on 15 December, 2009 in a randomized block design with three replication and plot size was of 4 x 5 meter. The observation on appearance of powdery mildew was carefully recorded. Thereafter,

progress of the disease was recorded at seven days interval and continued until disease severity reaches maximum upto physiological maturity of the crop. Observations of powdery mildew were recorded in the term of percent disease severity.

The effects of climatic factors *viz.* temperature, humidity and sunshine on disease severity were also studied.

The meteorological data were collected from meteorology department, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G). Correlation co-efficient between disease severity and meteorological parameters were determined by Karl Pearson's formula and tested individually for their significance at 5% probability level by using following formula.

$$t = \frac{r\sqrt{n-2}}{\sqrt{1-r^2}}$$

Where,

t = test of significance
r = correlation co-efficient
n = number of observations

The rate of disease development/ unit / day was estimated according to the method given by Vanderplank (1963). The apparent infection rate (r) for total period was:

$$r = \frac{1}{t_2 - t_1} \log_e \left[\frac{X_2 (1- X_1)}{X_1 (1-X_2)}\right]$$

Where,

r = rate of disease development
t_1 = date of first observation
t_2 = date of second observation
X_1 = disease severity on first observation
X_2 = disease severity on second observation

Results and Discussion

The spread of powdery mildew was dependent on the susceptibility of host variety and crop growth stages. The powdery mildew appeared at 33 days after sowing. The disease severity increased from flower initiation and aggravated between 50 per cent flowering to pod initiation stage and reached maximum at pod filling stage, which remained upto maturity. Similarly, the apparent rate of disease development (r) was maximum between 50 per cent flowering and pod initiation stage (0.004, Table 1.1). The growth stage of the plant appears to be an important factor for powdery mildew development as observed by Sivaprakasam *et al.,* (1981) and Sharma (1992) corroborating with the present findings. This might be due to increase respiration and metabolic activity of host plant. During this period complex compound breakdown into simpler forms, which can be easily available to pathogen for their nutrition, facilitate the rapid multiplication of inoculum and hence more disease severity results.

In powdery mildew disease development, maximum temperature and sunshine play an important role in appearance and buildup of disease between the flower initiation and pod initiation stage, During the flowering initiation and pod initiation stage, mean weekly maximum temperature was 27.8-28.6 ^{o}C and sunshine hours was 7.0-9.5. This temperature and sunshine regimes favoured the onset and rapid development of powdery mildew, because in this period per cent disease severity increased and apparent rate of disease development (r) was also more. Mittal and Sharma (1992) found an average maximum temperature of around 28.8 ^{o}C to be most favourable for powdery mildew development. However, higher temperature of 32-33^{o}C were reported by Saxena and Moly (1991) as being optimum for rapid disease development.

Table.1 Periodical observation and apparent rate of disease development (r) of powdery mildew

S. No.	Date of observation	Disease severity (%)*	Apparent rate of disease development (r)
1.	18 January	5	-
2.	26 January [a]	20	0.001
3.	03 February [b]	40	0.001
4.	10 February[c]	80	0.004
5.	16 February[d]	100	0.003
6.	24 February	100	0.000
7.	01 March [e]	100	0.000

Average of three replications
a: Flower initiation, b : 50% flowering, c : Pod initiation, d : Pod filling & e : Maturity.

Table.2 Correlation coefficient between powdery mildew and meteorological parameters

S. No.	Meteorological parameters	Correlation coefficient (r)
1.	Maximum Temperature (^{o}C)	0.9643*
2.	Minimum Temperature (^{o}C)	0.4378
3.	Relative humidity (%)	0.8316
4.	Sunshine (Hours)	0.9856*

* Significant at 5% level.

The correlation study between powdery mildew disease severity and meteorological parameters revealed that the disease severity was positively and significantly correlated with maximum temperature and sunshine hours. The correlation was non-significant with minimum temperature and relative humidity (Table 1.2). Thakur and Agrawal (1995) reported that a positive correlation occurred between powdery mildew severity and temperature and wind velocity. Highly significant and positive correlation between temperature and disease severity and non-significant correlation between relative humidity and disease severity recorded by Banyal and Tyagi (1998).

Khare *et al.*, (1998) reported that disease severity was positively correlated with maximum temperature and non-significant correlation between disease severity and relative humidity. Kumar and Gupta (2006) also reported that highly significant and positive correlation was observed between temperature and disease severity. Abbaiah (1989) and Saxena and Moly (1993) reported a negative correlation between powdery mildew and relative humidity. Findings of present investigation are in line with the findings of earlier workers.

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