STUDIES ON OCCURRENCE AND INTENSITY OF PEA RUST

(Uromyces fabac pers.de Bary) disease in Manipur, India.

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ABSTRACT

The investigation on the occurrence and intensity of peas rust (Uromyccs fabac) pers de Bary disease was carried out for two crop season (September 2013 to March 2015). The determination of pustules percentage possible coverage, rate of infection has been discussed. The average area of postule were calculate as 0.0308 cm^2 (1^{st} crop) and 0.0306 cm^2 (2^{nd} crop) during two crop seasons size of pustule was inversely proportional to the density of pustule. Percentage possible disease coverage was determined as 85.47% (1^{st} crop) and 85.49%. (2^{nd} crop) The rate of rust disease infection was calculated as 0.047 percent unit per day for 1^{st} crop season. And 0.047 percent per day for 2^{nd} crop season. The present investigation would be useful for further study in order to understand the full knowledge of disease intensity and disease occurrence.

Key words: *Uromyces fabac,* rate of infection, intensity

INTRODUCTION

The quantitative analysis of the density of pustules or spots on the respective crops for determining the rate of apparent disease infection, disease assessment, disease forecasting and disease rersistantability and susceptibility and percentage loss [20,10,15] Major role in the dissemination of *Uromyees* during active season is played by aeciospores which form secondary aecia after infection of leaves [13] The disease is of systematic infection. Thus emphasis are be on the size of the lesion where multiplication rates are concerned a systematically disease plant is a single large lesion extending over the whole infectible part of the plant. Size of lesion is one of the factors that determines the course and character of an epidemic

[19]. The determination of postules number helps in ascertaining probable loss due to disease, assessment of disease satisfactory disease, forecasting system and also in analyzing the resistance ability of the crop [10, 4, 15, 9, 8, 14]. Importance of studies on postule numbers per leaf or stem was emphasized in determining disease severity rate of infection and epidemiology by many workers 1000 postules per leaf or stem as equivalent to 100% severity and converting the value to logit [1] reported that there was significant correlation between yield loss and area under wheat stem rust and leaf rust progress curves [6] estimated that 1% rust (i.e X= 0.01) on the modified Cobb's scale as equivalent to 10 pustules per culm. The incidence of serious disease on the pea crop in India is very high and their damage to production and nutrition is reported to be quite high during favourable weather conditions. So, detailed studies have been made on pea disease in Manipur with the following aspects – i) to analyse quantitatively the density of *Uromyces fabac* (pers) de Bary pustules on pea leaves and ii) testimate the logarithmic infection rate of *Uromyes fabac* on pea leaves.

MATERIALS METHODS

The infected leave and the member of rust pustules on each leaf were recorded at random in different spots of the pea field of Manipur during crop season of November 2013 to February 2015. The area of the leaves and spots of the pustules of the disease were drawn in tracing paper and determined respective area by using –

1) percentage possible coverage = d^2 /(size of leaf/no. of pustule)x100

Where, d= square root of ($\frac{size\ of\ leaf}{No\ of\ pustule}$)

2. Measurement of pustule

Area of pustule = K.a.b

Where, a =one half the length of major axes

b= one half the length of minor axes

k= constant

3. Rate of infection- Rate of infection of pea rust caused by *Uromyces fabae* was determined by counting pustules per leave in different dates following the method described by Ajoi 1960. Disease readings were made at 30 November 2013 when plants were at the pre flower stage. The conversion was found to be nearly identical to values obtained using

the modified Cobb's scale for disease assessment [7].

The first disease assessment was delayed until the epidemic was well established. Then all the finding were substituted in the equation for determining the infection rate of the disease as [7] stress the concept of disease increased as a function of time. By this method, the rate (r) of the disease (X) increase in time (t) corrected for decreasing amount of healthy tissues (1-X) is given by

$$r = \frac{1}{t_2 - t_1}\left(\log_e \frac{x_2}{1 - x_2} - \log_e \frac{x_1}{1 - x_1} \right)$$

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

Where the subscripts denote the beginning and end points of the time interval for which "r" is calculated

Table.1 Disease incidence and infection rates of *Uromyees fabac* on pea Pisum Sativum L. Local Variety) through the course of an epidemic during 2013 – 2015.

1st Crop season				
Date of observation	Postule per leaf	Percentage	X	'r' (apparent in factor rate)
30 Nov 2013	10	1	0.010	
30 Dec. 2013	46	4.6	0.46	0.051
30 Jan 2014	287	28.7	0.287	0.082
28 Feb 2014	565	56.5	0.565	0.196
2nd Crop season				
30 Nov. 2014	15	1.5	0.015	
30 Dec. 2014	50	5.0	0.50	0.055
30 Jan. 2015	304	30.4	0.304	0.097
28 Feb. 2015	593	59.3	0.593	0.198

0.051 represents 'r' value for the period of 30 Nov. to 30 Dec. 0.082 for the period of 30 Jan to 28 Feb.

Table 2: Disease incidence and infection rates of *Uromyses fabac* on pea (Pisum sativum L. Local var.) through the course of an epidemic 2013-15.

1st Crop season				
Date of observation	% of disease	X	Log e$(\frac{1}{1-x})$	Log $_{10}(\frac{x}{1-x})$
30 Nov. 2013	1	0.010	0.010	-2.004
20 Dec. 2013	4.6	0.046	0.047	-2.683
30 Jan. 2014	28.7	0.287	0.338	-1.605
28 Feb. 2014	56.5	0.565	0.832	+0.114
2nd Crop season				
30 Nov. 2014	1.5	0.015	0.015	-2.011
30 Dec. 2014	5.0	0.50	0.52	-2.689
30 Jan. 2015	30.4	0.304	0.35	-1.601
28 Feb. 2015	59.3	0.593	0.846	+0.110

Table.3 Meteorological parameters of two crop season i.e. Nov. 2013 – Feb. 2015.

1st Crop Season						
Date of observation	Mean temperature (OC)		RH% (mean)		Rainfall	Sunshine
	Max	Min	700 h	1300 h	(mm)	(mean)
Nov. 2013	27.6	9.6	85.0	49.5	00	8.5
Dec.2013	22.7	5.6	87.7	49.1	0.0	7.4
Jan. 2014	24.0	4.6	87.8	41.7	0.0	8.3
Feb. 2014	23.8	6.7	86.1	46.1	1.1	7.1
2nd Crop Season						
Nov. 2014	28.8	11.7	85.2	53.9	0.0	8.0
Dec.2014	23.4	6.2	89.3	56.3	0.0	7.0
Jan. 2014	22.7	7.4	87.2	51.0	1.5	7.5
Feb. 2015	24.7	6.7	85.6	73.8	0.6	6.9

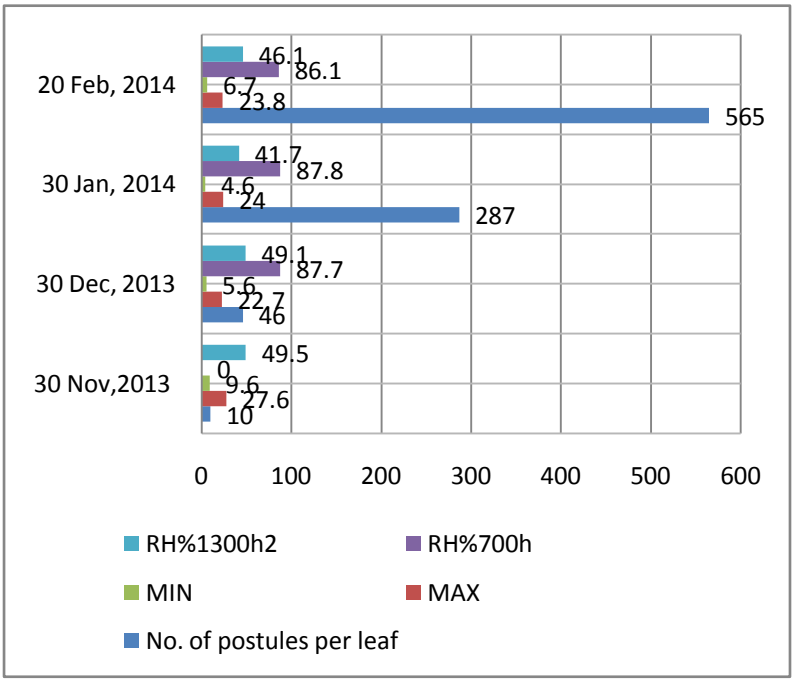

Fig. 1. The total no.of Postules per leaf in relation to Metrological parameters during Oct., 2013 to March 2014

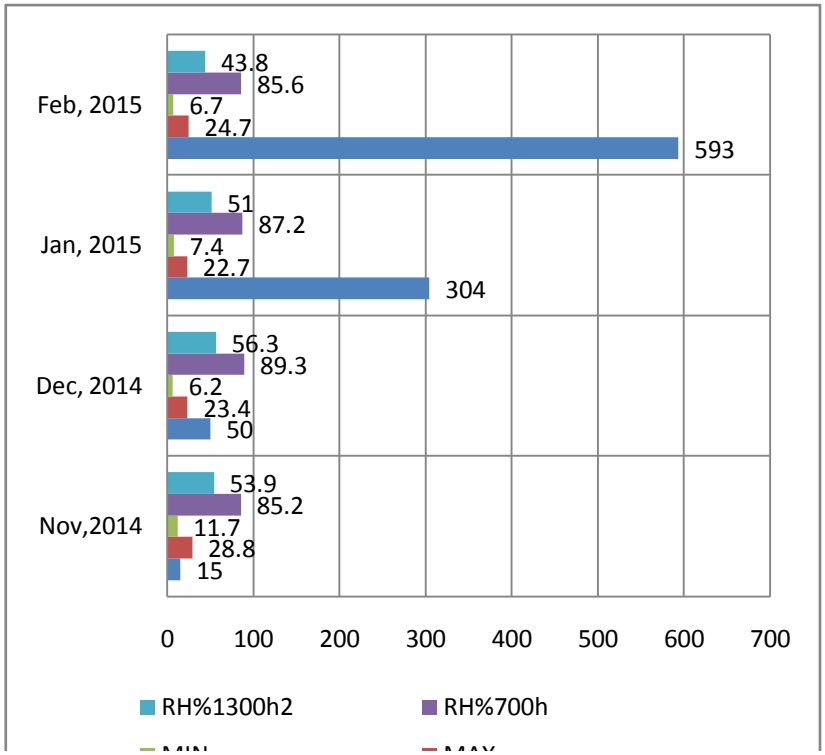

Fig. 2. The total no. of Postules per leaf in relation to Metrological parameters during Oct., 2014 to March 2015

RESULTS AND DISCUSSION

Table 1 revealed that disease incidence and infection rates of *Uromyces fabac* on pea (Pisum sativum L. Local variety) during 2013-2015. The apparent infection rates (r) of Uromyces rust of pea from November 30, 2013 to December 30, 2013 was 0.051. The value of 'r' from 30 December 2013 to 30 January 2014 was observed as 0.082. The value of 'r' from January 30, 2014 to February 28, 2014 was determined as 0.196 fluctuation. Berger (1973) reported the rate of infection in early blight *(Cereospora appii Fres)* on Celery on the same pattern. The determined value of infection rates (r) of Uromyces rust of pea from November 30, 2014 to December 30, 2014 was observed as 0.055. The value of r from December 30, 2014 to 30 January 2015 was accord as 0.097. The value of 'r' from January 30, 2015 to February 28, 2015 was recorded as 0.198. The determined value of 'r' for pea rust disease was initially very small both the 2014 and 2015 as 0.051 and 0.055 respectively. It shows that the rate of infection per unit per day was very slow. It increases slightly in next month and finally reached 0.196 and 0.198 per unit per day during 2014 and 2015 various intervals involving the disease progress curve of 2014-2015 were begins from negative values of -2.004 and -2.011. (Table 2)

On November 30, 2013 there were an average of 10 postules of rust per leaf of pea. The corresponding meteorological parameters of temperatures 27.6^0C in maximum and 9.6 ^{0}C in minimum temperature, relative humidity 85% to 49.5% and sunshine 8.5 hours. (Table 1, 3 and Fig. 1) On December 30, 2013 there were 46 pustules per leaf. The corresponding meteorological parameters of temperature 22.7 ^{0}C in maximum and 5.6^0C in minimum temperatures, relative humidity 87.7% to 49.1%, rainfall 0.0 mm and 7.4 hours of sunshine. On January 30, 2014 the postule per leaf were 287. The corresponding meteorological parameters of temperatures 24^0C in maximum and 4.6^0C in minimum, relative humidity 87.8% to 41.7% and sunshine 8.3 hours respectively. February 28, 2014 the pustule per leaf were 565 and corresponding meteorological parameters of temperatures are 23.8^0C in maximum and 6.7^0C in minimum, relative humidity 86.1% - 46.1% , rainfall 1.1mm and sunshine 7.1 hours respectively. (table, 2,3, Fig. 1)

During (2^{nd} crop) 30 November 2014 there were an average of 15 postules

of rust per leaf of pea. The corresponding meteorological parameters of temperatures are 28.0^0C in maximum and 11.7^0C in minimum temperature, relative humidity 85.2% to 53.9% and sunshine 8 hours respectively. On December 30, 2014 there were 50 postules of rust per leaf. The corresponding Meteorological parameters of temperatures are 23.4^0 in maximum and 6.2^0c in minimum, relative humidity 89.3% to 56.3% and 70 hours of sunshine. On January 30, 2015 there was an average of 304 postules. The corresponding meteorological parameters of temperatures are 22.7^0C in maximum and 7.4^0C in minimum, relatives humidity 87.2% to 51% rainfall 1.5 mm and 7.5 hours of sunshine. During 28 February 2015 there were 593 postules of rust per leaf of pea. The corresponding meteorological parameters of temperatures are 24.7^0 C in maximum and 6.7^0C in minimum, relative humidity 85.6% to 43.8%, rainfall 0.6 mm and 6.9 hours of sunshine (Table 1, 3 Fig. 2) From the above discussion it shows that favours rapid disease spread of postules was correlated with corresponding meteorological parameters. Variation of fungal spores was correlated with meteorological parameters [2, 3, 11, 17, 16]. The apparent infection rates (r) of *Uromyces* rust of pea from November 30, 2013 to December 30, 2013 was 0.051. The value of (r) from December 30, 2013 to January 30, 2013 was 0.082. The rate slightly increases from the initial infection rate. Finally the value of 'r' from January 30 2014 to February 28, 2014 was determined as 0.196 fluctuation. In case of second crop season starting from 30 November 2014 to December 30, 2014 was 0.55. The value of (r) from December 30, 2014 to January 30, 2015 was recorded as 0.097. From January 30, 2015 to February 28. 2015 was accord as 0.198.

The rate slightly increases from the initial infection rate. Finally the value of 'r' was determined as fluctuation both two crop seasons [2] reported the rate of infection in early blight *(Cercospora appii Fres)* on celery on the same pattern.

The determined value of 'r' for pea rust disease was initially very small (0.051 in 1^{st} crop season and 0.055 in 2^{nd} crop season) It shows that the rates of infection per unit per day was very slow. It increase slightly in next month and finally reach 0.196 per unit per day for 1^{st} crop season and 0.198 per unit per day for 2^{nd} crop season. Various intervals involving the disease progress curve of 1^{st} crop season were begins from negative value (-2.004) likewise in 2^{nd} crop season also begins from negative value (-2.011) [5]. (Table 2) stated that negative values resulted from

$\log_{10}\left(\frac{x}{1-x}\right)$ shows the rapid host growth which reduced the cumulative proportion of disease (x) The present findings agrees with their result starting from (-2.00 4 to +0.114 for 1st crop and -2.011 to +0.110 for 2nd crop (Table 2)

CONCLUSION

The study reveals that the apparent infection rate (r) is depends on the factors like spore production, spore deposition, meteorological parameters as well as these factors enhanced the disease spreading. Further studies of disease intensity and disease occurrence will also be a great importance.

Acknowledgement

We wish to thank the Principal, Kakching Khunou College, for research facilities and also Station Director Gramin Krishi Mausam Seva ICAR Research Complex for NEH region, Manipur Centre, Lamphelpat Imphal for providing meteorological data. The senior author (P.M.) is grateful to UGC, North Eastern Regional office Guwahati for financial assistance.

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