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Short Communication

Influence of weather factors on the development of leaf spot of betel vine caused by colletotrichum capsici

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Betel vine *(Piper betle L.)* is an important cash crop in India, Bangladesh, Malaysia, Sri Lanka, Pakistan, Mauritius and Myanmar. Plants of betel vine are cultivated in conservatories under shady and humid condition that favours the development of many diseases (Chattopadhayay and Maiti, 1990). Leaf spot caused by *Colletotrichum capsici* is one of the major disease of the crop (Bhale *et al.* 1987) that in severe condition lead to death of the plants producing up to 25-90 percent losses of the crop in different parts of India (Dastur, 1935; Chattopadhayay and Maiti, 1990). This disease of betel vine was first identified by (Roy, 1948) and it is also known as anthracnose of 'Pan' (vernacularly called as 'Jhalma'). The epidemic form of the disease in the country has also been reported by (Basak *et al.* 1992) and (Hossain *et al.* 1986), causing 10-60 percent yield loss (Singh and Joshi 1971, Maiti and Sen 1982). It reduces market value of the crop (Maiti and Sen, 1971). Environmental factors play an important role on the development of disease as they help the pathogen for growth, dissemination and infection as well as influences on expression of susceptibility/ resistance of the host plant after infection (Walker, 1965). Among the environmental factors, temperature, humidity and rainfall are the most crucial for the development of leaf spot of betel vine (Maiti and Sen 1982). So, the present study was undertaken to find the effect of weather factors on the development of the disease severity and to formulate suitable prediction equation.

The field experiment on betel vine was conducted in the betel vine garden during the year 2009, 2010 and 2011 at Baliapal block of Balasore district in coastal belt of Odisha. Five betel vine cultivars viz. Bangla, Chandrakona, Balipan, Aima Bangla and Sanchi were planted in the garden. Young cuttings of vines of each cultivar were used as planting materials. The cuttings were planted in 3.0 x 3.0 m plots maintaining 45 cm (R×R), 15 cm (P×P) and 1.0 m plot to plot distance. After establishment of the cutting the field was fertilized with only mustard oil cake and neem cake @ 16q ha^{-1} per year. The oil cake was applied in equal splits during the months of May and September. All the agronomic and cultural practices such as weeding, watering, earthing up, pruning, tieing, vine lowering and other operations were done as and when necessary to maintain congenial environment for proper growth and development of the plants. Shed was provided with a thin roof made of straw and bamboo sticks. Normally betel vine growers of Balasore district raise their betel vine garden exclusion of chemical fertilizers. So, no chemical fertilizers were used in experimental field. The experiment was laid out in a 4x3 factorial in randomized complete block design with three replications. To study the development of leaf spot observations were taken in betel vine garden during three consecutive years viz.2009, 2010 and 2011. Every year plants of all five cultivars were checked regularly with 10 days interval during January to December to record severity of the disease. Severity was indexed on a subjective scale based on leaf area diseased. The severity of the disease was computed following a modified 0-5 rating scale (Basak *et al.* 1992), where 0= healthy, 1= up to 5%, 2= 6-15%, 3= 16-30%, 4= 31-50% and 5=>50% diseased leaf area. It was expressed as Percent Disease Index (PDI), which was computed using a standard formula (Basak *et al.* 1992) as shown below:

$$PDI = \frac{\text{Sum of all numerical ratings}}{\text{Total numbers of leaves counted } \mathbf{X} \text{ Maximum rating}} \times 100$$

For studying the multiple effects on the dependent variables the multiple regression analysis was done. The monthly average temperature (X_1), average relative humidity (X_2) and total rainfall (X_3) were recorded every month during the study period. The meteorological data was collected from 'Meteorological office, Chandanmahal, Sunhat, Baleswar'. Before analysis the data, square root transformation of PDI value was calculated. To predict the disease development, multiple regression equations were computed for each cultivar by using SPSS computer

Table 1: Severity of leaf spot of betel vine *(Colletotrichum capsici)* on five cultivars during 2009-2011

Cultivar	Percent Disease Index (PDI)*			
	2009	2010	2011	Pooled mean
Bangla	3.9	3.2	2.9	3.3
Chandrakona	5.6	5.2	5.5	5.4
Balipan	4.6	4.4	4.3	4.4
Aima Bangla	3.3	3.0	3.4	3.2
Sanchi	2.0	2.3	1.3	1.9

* Average of 12 months (January to December)

Table 2: Multiple regression equation and co-efficient of determination (R^2) computed using severity of betel vine leaf spot*(Colletotrichum capsici)* on five cultivars and three weather factors (monthly average temperature, relative humidity and total rainfall) recorded during 2009-2011.

Cultivar	Regression equations	Coefficient of (R^2) determination	Adjusted (R^2)	Std. Error of the Estimate
Bangla	Y= -1.47+0.175 T_{mean}	0.553**	0.540	0.619
Chandrakona	Y= -6.08+0.233 T_{mean} +0.045 RH	0.738**	0.722	0.549
Balipan	Y= -0.525+0.165 T_{mean} +0.004 Rain	0.752**	0.736	0.572
Aima Bangla	Y= -5.19+0.193 T_{mean} +0.045 RH	0.722**	0.705	0.615
Sanchi	Y= -2.36+0.156 T_{mean}	0.555**	0.541	0.550

** = Significant at I% level of probability

software. Coefficient of determination (R^2) was also calculated and tested for significance at 1% level of probability.

The pooled data obtained from betel vine on leaf spot disease severity for the three consecutive years showed that the mean PDI values of leaf spot on five betel vine cultivars namely Bangla, Chandrakona, Balipan, Aima Bangla and Sanchi were 3.3,5.4, 4.4,3.2 and 1.9, respectively. Each year the highest incidence of the disease was recorded on Chandrakona followed by Balipan, Bangla, Aima Bangla and Sanchi (Table 1). Similar type of findings was recorded by Goswami *et al*. (2002).

To develop the prediction equation of leaf spot of betel vine multiple regression equation was computed for taking into account the disease severity of each cultivar and the three weather parameters (Table 2). In these equations predicted severity (dependent variable) was calculated by using weather parameters i.e. average monthly temperature, average RH and total rainfall as independent variables. The goodness of fit of the equation was evaluated by coefficient of determination (R^2), adjusted coefficient of determination (R^2 adj.) and error mean square.

The predicted disease severity depicted for the five cultivars showed different prediction equations (Table 2). In case of cultivars Bangla and Sanchi it was observed that among the three weather parameters only average temperature was positively and significantly affected the disease severity. Coefficient of determination (R^2) value indicated that the predicted value of PDI can be explained 55.3 percent and 55.5 percent of the total variation in the PDI in case of Bangla and Sanchi respectively.

On the other hand, it was observed that the disease severity of the cultivars Chandrakona and Aima Bangla depended upon both average temperature and RH positively and significantly. The coefficient of determination (R^2) and adjusted coefficient of determination showed that among the two equations Chandrakona were good fit and it was confirmed high coefficient of determination (R^2=0.738) and low adjusted coefficient of determination and standard error estimate.

Average temperature and total rainfall were significantly and positively correlated with the disease severity for the cultivar Balipan and here coefficient of determination (R^2) value showed highest variation in disease severity that can be explained upto 75 percent with combined effect of weather variable (Table 2). Similar type of experiment on stem rot of betel vine under close conservatory condition was carried out by Datta *et al.*(2009) and on Phytophthora wilt of betelvine by Singh (1996).

PDI of leaf spot recorded on five betel vine cultivars through out the year (January to December) revealed considerable prevalence of the disease in the month of May which increased gradually up to August (Fig 1). The highest peak of disease severity obtained during August, when all the three weather factors (especially, temperature and rainfall) were higher as compared to other months of the year. In all the three experimental years, maximum rainfall obtained in the month of July - August without much variation in the average temperature so the disease severity found to be at par in these two months then declined up to the month of November. This finding was supported by Das Gupta and Sen (1985). They found that 92 percent RH was the critical moisture level for severe leaf spotting and heavy losses in betel vine. Disease pressure was not appreciable in the month of November, December and January. Basak *et al.*(1992) reported under dry weather the progress in disease severity was slow whereas during moist weather leaf spot enlarges rapidly causing rottening of whole leaf. Observing the disease situation along with the weather prevalence – fact revealed that the monthly average temperature and RH remained low in November to January and both the weather factors increase gradually from February up to August but maximum rainfall obtained in the month of June to August. These finding presented (Fig 1) clearly showed that the severity of leaf spot of betel vine was directly influenced by the three weather factors. Similar results were reported by Goswami *et al.* (2002).

Research findings of the present investigation indicated that among the five predominant cultivars of betel vine in coastal belt of North Odisha Chandrakona showed maximal and Sanchi showed minimal leaf spot disease severity caused by *Colletotrichum capsici* and the degree of which was greatly influenced by the three weather factors i.e. temperature, relative humidity and rainfall. Maximum disease severity was observed during July-August, when all the three weather factors were higher in comparison to other months of the year. Roy (1948) also recorded severe leaf spotting of betel vine due to anthracnose when rainfall was high. Multiple regression equation computed revealed positive correlation with the weather factors. However, the co-efficient of determination was highly significant in case of cultivar Chandrakona, Balipan and Aima Bangla (73.8 percent, 75.2 percent and 72.2 percent respectively).

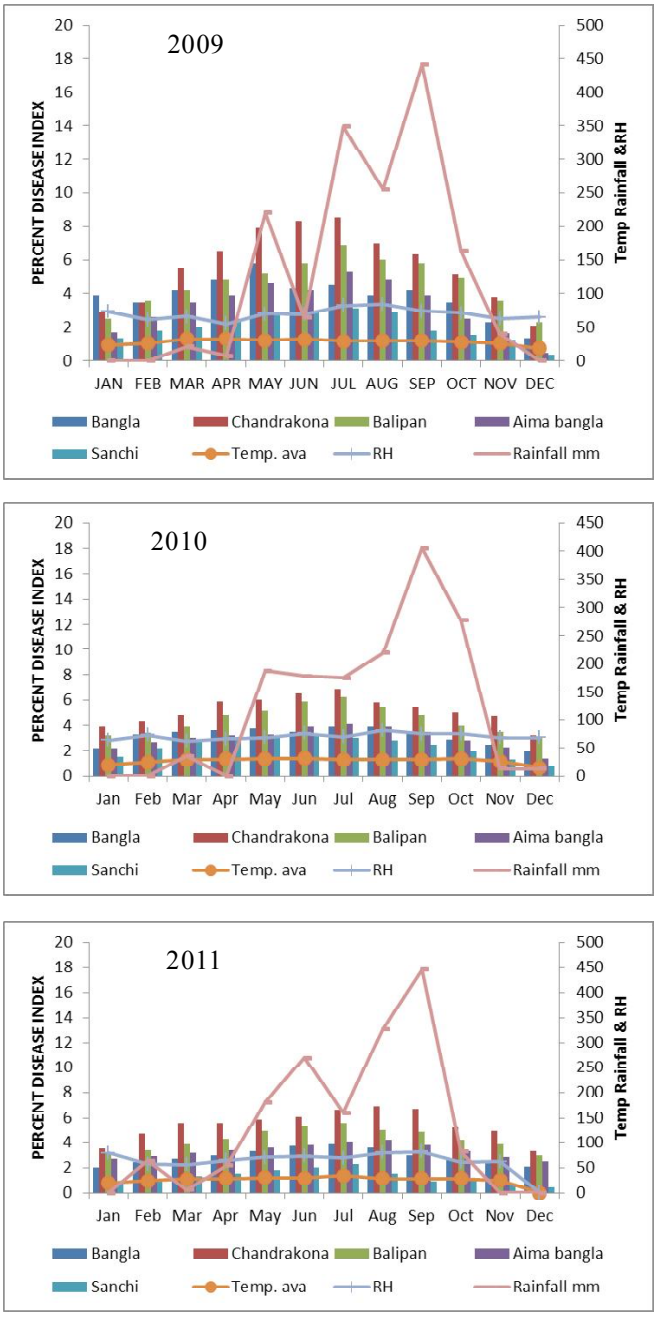

Fig 1: Percent disease index of leaf spot of betel vine *(Colletotrichum capsici)* on five cultivars as influenced by the three weather factors during three consecutive years 2009-2011

REFERENCES

Basak, A. B., Mridha , M A. U. and Jalil , M. A.(1992).Studies on the leaf spot disease of *Piper betle* L.caused by *Colletotricum piperis* Petch. ChittagongUniversity Studies, Part II: Science, Vol. 16**(2)**: 87-91.

Bhale, M. S., Khare, M. N., Nayak, M. L. and Chaurasia,R. K. (1987). Diseases of betel vine (*Piper betle* L.) and their management. *Rev. Trop. Plant Pathol.,* **4**:199-220.

Chattopadhayay,S.B. and Maiti,S. (1990). Diseases of betel vine and spices. ICAR, New Delhi, India. 160 pp.

Das Gupta, B. and Sen, C. (1985). Relationship of inoculums density of *Colletotricum capsici* and moister on leaf spot development in betel vine. *Indian Phytopathol.*, 38**(2)**:364.

Dastur, J.F. (1935). Dieases of 'Pan' *(Piper betle L.)* in central provinces. *Proc. Indian Acad. Sci. Sec. B*, **1**: 778-815.

Data,P., Das Gupta, B., Sen Gupta, C. and Sen Gupta, D.K.(2009). Epidemiological studies of stem rot of betelvine caused by Phytophthora parasitica under closed conservatory in West Bengal. Journal of Crop and Weed., 5**(1)**: 258-260.

Goswami, B. K., Kader, K. A., Rahman, M. L., Islam, M. R. and Malaker, P. K. (2002). Development of leaf spot of betel vine caused by *colletotrichum capsic*. *Bangladesh J. Plant Pathol.*, 18**(1)**: 39-42

Hossain, A. K. M. A., Elias, S.M. and Mian, M. I. H. (1986).Report of the Committee on Betel leaf Cultivation in Bangladesh. Bangladesh Agri. Res. Inst. Joydebpur, Gazipur. pp. 12-16.

Maiti, S. and Sen, C. (1979). Fungal diseases of betel vine. PANS 25**(2)**:150-157.

Maiti, S. and Sen, C. (1982). Incidence of Major diseases of betel vine in relation to weather. *Indian Phytopathol.*, 35**(1)**:14-17.

Roy, T. C. (1948). Anthracnose diseases of *Piper betle(L.)* caused by *Colletotricum dasturi* Roy. J. *Indian Bot. Soc.*, **27**:96-100.

Singh, B. P. and Joshi, L. K. (1971). Studies on the diseases of betel vine. *Indian J. Mycol. Plant Pathol.*, 1**(2)**: 150-151.

Singh, D. (1996). Epidemiological factors in relation to occurrence of Phytophthora wilt of betel vine (Piper betle L.). *Recent-Horticulture*. 1996; 3(1): 143-146

Walker, J. C. (1965). Use of environmental factors inscreening for disease resistance. *Ann. Rev. Phytopathol.,* **3**:197-208.

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