



## **EFFECT OF CLIMATIC FACTORS ON THE INCIDENCE OF LATE BLIGHT DISEASE OF POTATO PLANTS TREATED WITH WEED EXTRACT**

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### **ABSTRACT**

The course of development of late blight disease in potato was studied in the district of Lakhimpur, Assam, where potato is extensively cultivated on a commercial basis. The study was made in experimental plots treated with extracts of three weed plants, also utilized by the native people for food and medicine. Environmental factors influenced the incidence of the disease to a great extent. Once the pathogen gets a suitable climate of mild rainfall, with high humidity and low temperature, it takes epidemic form. Extracts of *Alternanthera sessilis* and *Commelina benghalensis* reduced the intensity of the disease to a considerable extent.

### **INTRODUCTION**

Potato is a major food crop of Assam, and is extensively cultivated in almost all areas of Assam during the winter season starting from the month of October. Lakhimpur is a plain district of Assam, situated at the north bank of the mighty river Brahmaputra at the foothills of Arunachal Pradesh at the far east of North East India. The region is habitat of a large number of different ethnic tribes with different status and way of living. Potato is the principal earning source of all the tribes, and hence, the crop is extensively cultivated all over the district. The potato crop is affected by several fungal diseases and cause heavy losses to the crop either directly or indirectly. The late blight alone causes losses as heavy as 70-80 percent in potato crop (Nagaich 1983). Control of late blight disease has been a major issue in front of the workers, because till date full eradication of the pathogen by using chemicals in the form of fungicides, has not been confirmed. Now a days, in view of the toxicity of various chemicals used during storage and also during the time of cultivation to check infection by pathogens, there is an increasing awareness to switch over to certain eco-friendly strategies, such as use of plant products, parasitoids, predators and pathogens (Rajappan et al. 1997). Certain metabolites of several higher plants are known to have toxic effects against spore germination and mycelial growth of phytopathogenic fungi (Pinto et al. 1997). The present study aims at investigating the pattern of incidence and development of late blight disease of potato crop as affected by climatic conditions of Assam using tubers treated with some common weed plant extracts available in the potato cultivated areas.

### **MATERIALS AND METHODS**

The study was made in four thoroughly ploughed experimental plots, making three replications, measuring 5m long and 4m wide. Healthy potato seed tubers were hand planted in the base of ridges of rows of 70cm apart with 20cm spacing in between the tubers. A total of 110 seed tubers of average size of potato cultivar 'Khasigaro' were planted in each plot on 28<sup>th</sup> September, 2006. After the plants were about 7cm tall, earthing was done. The plants were examined from time to time for the appearance of late blight by visual estimation. Few seed tubers did not grow, and hence,

discarded. Records of soil temperature, pH, relative humidity, air temperature and rainfall data were recorded during the entire period of investigation.

Leaf extracts from three weeds, frequently found in the potato fields, namely *Alternanthera sessilis* R.Br., *Boerhavia diffusa* L. and *Commelina benghalensis* L. were prepared by the method of Parihar & Bohra (2000). The above plant species were selected because they grow profusely in the potato cultivation areas of Assam and also utilized by the native tribes for medicinal purpose. 5g of fresh plant parts were washed 2-3 times with tap water and then surface sterilized with 90% alcohol. Subsequently, the materials were grounded in 50mL acetone. The acetone macerates were kept for 24h at room temperature to evaporate the acetone. In the remaining residue, 50 mL distilled water was added. Macerates were squeezed through double layered muslin cloth and filtered through filter paper. After filtration, aliquots were centrifuged at 10,000 rpm for 20 min. The supernatants were filtered through Whatman No. 1 filter paper and then sterilized by passing through 0.2 micron disposable filters. The extracts (10%), thus obtained, were used for the studies.

## RESULTS AND DISCUSSION

From the study of the course of development of late blight in potato crop in both the controlled and treated plots, it is seen that once the disease appeared in the plants, the process of infection continued till most of the plants get infected. Closer inspection of the first appearance of blight infection reveals that initial infection occurs at the terminal leaflets of the plants, and gradually the disease migrated to the lower leaves and stems, which suggest emergence of the disease from an initial airborne inoculum coming probably from other infected plots.

Initial infection in leaves occurred on 25<sup>th</sup> November, 06 in the control and the plot treated with extract of *Boerhavia diffusa*, when the plants were 58 days old. The infection gradually spread to other plants in the vicinity and within a period of 7 weeks, the disease took an epidemic form thereby infecting almost all plants of the plots, with however, differences in the intensity of infection depending on treatment. Observation made on 5<sup>th</sup> January, 2007, revealed 100% blight intensity in the plots where no fungicidal or plant extract treatment was applied. Similar destruction of plants was also revealed with the plots where extract of *B. diffusa* was applied, indicating no antifungal property of this extract.

In the plots treated with extracts of *Alternanthera sesillis* and *Commelina benghalensis*, a significant delay in the emergence of the disease (Table 1) was observed. In these plots first appearance of blight was almost a week after their emergence in the controlled plot. The percent blight intensity in the plots treated with these extracts was sufficiently low as compared to other plots. Both these plants have considerable medicinal potential, as these are utilized by the native people and the different ethnic tribes of the region for the cure of a number of diseases (Sarmah 2003). It reveals that these plants have some antifungal or inhibitory substances in the form of allelochemicals, which delays the emergence and development of the late blight pathogen.

Environmental factors seem to play a vital role in the emergence and development of late blight disease. It is interesting to note that initial blight lesions were noticed during the day preceding a mild rainfall on 23<sup>rd</sup> November, resulting in increased humidity and a temperature conducive for disease development. Spread of lesions also were more frequent during rainy days and cloudy weather. The soil pH was in the range of 4.76 -6.97, which was also reported to be an ideal condition for late blight development (Dutt 1964).

Table 1: Effect of climatic factors on the course of development of late blight disease in potato plants treated with weed extract.

Treatment	No. of tubers	Symptom	Days of observation, 2006-07						
			25 <sup>th</sup> Nov	1 <sup>st</sup> Dec.	8 <sup>th</sup> Dec.	15 <sup>th</sup> Dec.	22 <sup>nd</sup> Dec.	29 <sup>th</sup> Dec.	5 <sup>th</sup> Jan.
Control	102	I	0.12	0.12	07.12	14.52	32.34	69.43	83.42
		II	-	-	04.39	21.32	26.57	58.42	91.32
		III	0.02	0.02	04.42	15.54	33.21	76.54	100.00
Extract 1	98	I	-	02.54	03.76	06.64	09.24	20.06	24.28
		II	-	02.00	05.23	06.32	06.42	24.86	42.87
		III	-	02.63	04.87	06.44	10.12	34.65	68.00
Extract 2	104	I	0.09	04.00	07.02	07.23	16.72	47.32	78.65
		II	0.04	0.12	03.00	03.52	21.56	61.06	76.67
		III	0.04	03.42	06.20	05.69	32.22	74.62	92.00
Extract 3	107	I	-	0.06	04.21	04.92	12.43	30.32	36.23
		II	-	-	02.00	07.87	16.85	26.73	40.54
		III	-	N.S.	02.00	06.94	12.67	32.45	52.86
Total weekly rainfall (mm)			00.53	00.39	00.65	12.92	06.92	18.44	12.26
Av. weekly humidity (%)			77.62	74.86	72.13	81.00	81.00	87.56	86.92
Av. weekly temperature (°C)			21.32	21.95	20.54	19.24	19.12	16.54	16.72
Soil pH (av.)			6.62	6.12	6.97	4.76	4.65	5.32	5.86
Av. weekly soil temp. (°C)			18.67	17.46	18.23	16.52	16.00	15.78	14.36

C.D. for treatment at 5% = 0.063; N.S. Not significant; I = Percentage of plants bearing lesion on leaves;

II = Percentage of plants bearing lesions on both stem and leaves; III = Percent blight intensity

Control = without plant extract; Extract 1 = *Alternanthera sessilis*; Extract 2 = *Boerhavia diffusa*;

Extract 3 = *Commelina benghalensis*

Late blight disease of potato is by far the most serious disease of potato in Assam and causes significant damage to the crop every year despite sincere efforts made by researchers and agricultural experts throughout the state. The environmental factors, which prevail during the potato growing season, most probably become suitable for the emergence and outbreak of the disease as has been seen from the present investigation.

Every growing plant produces compounds, known as allelochemicals, which show either stimulatory or inhibitory effect on other plants (Rahman & Achariya 1998). The antifungal as well as stimulatory or inhibitory effect of a number of higher plants against crop plants and pathogens have been reported (Chitra & Kanabiran 2001). Phukan (2004) obtained inhibition of growth of *Phytophthora infestans* by using extracts of fern plants like *Adiantum reniforme*, *Dryopteris filix mas* and *Polypodium decorum*. Bohra & Purohit (2002) obtained inhibition of *Aspergillus flavus* by using extracts of *Azadirachta indica*.

Management of plant diseases with measures other than use of fungicides has been drawing attention since last three decades, because of severe ill effects of the chemicals on the overall health of both the producers and consumers. Chemical pollution of the environment as a result of uncontrolled applications of these compounds has been creating a serious problem to everyone's livelihood. The toxic effects of agricultural and other commodities treated with chemicals and preservatives are well known. Hence, workers all over the world, at present, are in search of some alternative measures, free from such problems, which may be exploited for the betterment of the society as well as increased productivity of essential commodities. The severe loss in yield of agricultural crop has been a global concern, and alternative measure for controlling plant disease, other than polluting

chemicals has been the subject of concern for everybody. Allelopathy, if properly applied, may be a suitable alternative to solve such problems in near future.

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