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EVALUATION OF THE INCIDENCE OF POWDERY MILDEW (*Sphaerotheca fuliginea*) ON BOTTLE GOURD

Sashiyangba* and L.Daiho

Department of Plant Pathology, School of Agricultural Sciences and Rural Development, Medziphema-797106, Nagaland, India

**E-mail: Sashiyangba@yahoo.co.in*

ABSTRACT: Powdery mildew caused by Sphaerotheca fuliginea on local cultivars of bottle gourd was found greatly influenced by the natural epiphytotic condition both from the farmers' fields and experimental plot at Research and Demonstration Farm Ruzaphema, Nagaland (India). The maximum intensity ranges from 51.45 – 86.90 per cent in local cultivar at 95DAP during the peak month of June 2005 with average temperature (29.25 ºC), dew point (27.4 ºC), relative humidity (84.7 %) and rainfall (3.78 mm), respectively. Disease intensity and per cent plant infection were non significantly correlated with the relative humidity, rainfall, temperature and humidity at (P =0.05).However, per cent of infection and disease intensity was found significant and positively correlated with dew point in both the fields. Due to genetically adopted factors with the host cultivars significant difference on the yield records from both the fields ranged between 20.18 - 24.55 t/ha under Nagaland condition and can be used for future breeding programme for developing resistant variety.

Keywords: *Bottle gourd, Sphaerotheca fuliginea, screening, correlation.*

Powdery mildew is a serious disease caused by a fungus Sphaerotheca fuliginea. Which occurs more commonly in almost all the cucurbits growing areas of the world (Ballantyne, 1).Bottle gourd (*Lagenaria siceraria* (Molina) standl.), commonly known as "Lao", is an important vegetable grown almost in all parts of Nagaland. Fruits are traditionally used in general tonic, diuretic, aphrodisiac antidote to certain poisons and bronchial disorders-especially syrup prepared from the tender fruits (Sivarajan and Balchandran, 12; Nadkarni, 8; Duke, 2). This disease expressed its symptoms initially a powdery gray or white coating appeared superficially on the plant parts and spread rapidly over a wide area causing premature killing of the foliage and subsequently results in poor quality of fruits and unfit for processing. Under favourable environmental conditions the powdery mildew disease cause significant destruction and ultimately yield losses exceeding 30 per cent in the crop (Tisserat, 11). They are generally favoured by relatively dry atmospheric conditions, moderate temperature, reduced light and luxurious plant growth (Yarwood, 13). The combination of climatic factors i.e. air temperature, humidity, sunlight, wind and rain fall play a vital role for dissemination and germination of conidia, mycelia growth and sporulation. In view of the wide prevalence and continuous occurrence of this disease, a study was taken up to examine the naturally occurring virulent strains of powdery mildew with the influence of weather parameter and its effect on yield under Nagaland condition.

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MATERIALS AND METHODS

Screening for disease resistance of seven local bottle gourd cultivars (Table 1) was done both in the farmers' field and experimental plot during the year 2005 under natural epiphytic condition of Nagaland. A survey was conducted in farmers' field by random sampling, mostly in the main production areas of four districts viz. Mon, Mokokchung, Kohima and Dimapur in the state of Nagaland (India) and the experimental plot at Research and Demonstration Farm Ruzaphema, Nagaland situated at 25º44'N and 93º48'E with an average altitude of 309 m above the mean sea level. Seeds were planted in pit at 2 m apart at a distance of 2.5 m in the first week of March during 2005 with plot size of 6m x 3m (18 sqm.) following randomized complete block design (RCBD) replicated thrice under rainfed condition of Nagaland. Recommended package of practices of bottle gourd was adopted for maintaining growth and vigour of the plant. Influence of weather parameters (relative

humidity, temperature, dew point and rainfall) of the development and spread of powdery mildew disease was recorded at 45, 70, 95 and 120 days after planting. Observations were made on the basis of 10 randomly selected leaves per plant from each cultivar using 0 -5 visual disease rating scale according to Lebeda (6), where 0 = No symptom –Immune (I); 1 = 1-20% infection – Resistant (R); 2 = 21-40 % area infected – moderately resistant (MR); 3 = 41-60% area infected – moderately susceptible (MS); 4 = 61-80% area infected – susceptible (S); 5 = > 80 % area infected – Highly susceptible (HS). Marketable fresh fruit yield was calculated on plot basis and converted into tone per hectare.

All the data were statistically analyzed by standard analysis of variance technique for randomized complete block design (RCBD) as suggested by Gomez and Gomez (3). Wherever treatment differences were found significant based on results of F-test, critical differences were calculated at 5% level of probability.

RESULTS AND DISCUSSION

Disease development on host cultivars

Incidence of powdery mildew under natural epiphytotic condition (Table 1) and weather parameters (Fig.1) revealed that the initial symptom appeared at 45 days after planting during the month of April and gradually raises along with the growth stage of the crop till the peak of period 95 DAP (in the month of June) with maximum disease intensity recorded in all the cultivars viz. Mesü (i) with 86.90 per cent followed by Mepfü (k) 82.26 per cent, Maikok (m) 81.48 per cent, Aüm (k) 61.39 per cent, Aüm (m) 60.78 per cent, Lao (d) 60.21 per cent and Mepfu (r) 51.45 per cent with the corresponding figures of an average mean temperature of 29.25 ºC, average dew point (27.4 ºC) relative humidity (84.7 %) and rainfall (3.78 mm), respectively. Thereafter, the disease intensity declined slowly towards the maturity of the crop 120 DAP (in the month of July) with minimum disease intensity recorded in cultivar Mepfü (r) 51.44 per cent followed by Lao (d) 58.04 per cent , Aüm (k) 58.46 per cent , Aüm (m) 59.23 per cent, Maikok (m) 81.83 per cent , Mepfü (k) 81.86 per cent with the corresponding figures of average temperature (28.7 ºC), average dew point (27.1 ºC) relative humidity 86.4 (%) and rainfall (5.46 mm), respectively Thus, it is clear from the present investigation that the pathogen was greatly influenced by the favourable environmental condition in all the stage of the different host cultivars.

The results obtained with respect to powdery mildew incidence and intensity is in agreement with the findings of Schnathorst (10) and Molot and Lecoq (7). Jahn *et al.* (5) had also reported that different races have the potential to attack several powdery mildew tolerant or resistant cucurbit crops if specific environmental conditions are favourable for fungal infection and spread.

Disease reaction on bottle gourd cultivars

Collected bottle gourd cultivars and their disease reactions (Table 2) revealed that among seven local cultivars screened, none of the host cultivars were immune or completely resistant to powdery mildew disease. However, cultivar Mepfü (r) with 45.23-46.87 per cent infection was found moderately susceptible to the disease signifying high yielding genotype. Susceptible reaction to disease incidence ranging from 58.22-59.33 per cent infection was Lao (I); followed by Aüm (m) with 59.73-60.39 per cent infection, Aüm (k) with 59.07-60.18 per cent infection, Mepfü (k) with 71.24-72.07 per cent infection and Maikok (t) with 71.06-71.61 per cent infection. Highest infestation was recorded in cultivar Mesü with 74.03-74.63 per cent. This might be due to genetically adopted factors with the host cultivars.

CORRELATION STUDIES

The perusal of correlation studies (Table 3) revealed that weather parameter has significant effect on disease development. It is evident that the weather parameter at dew point (r = 0.956) exhibited significant and high positive correlation with the disease severity. Per cent plant infection and disease intensity were negative but none significantly correlated with relative humidity (r = -0.374) whereas temperature (r = 0.875), and rainfall (r = 0.517) with disease intensity was found to be non significant. Jarvis et al. (4) has reported that due to intensive dews on leaf surface, the severity of the disease was enhanced.

Table 1: Reaction of different host cultivars of bottle gourd to powdery mildew disease.

Cultivars	Disease intensity (%)	Disease reactions
Mepfü (k) $-V_1$	71.24 – 72.07	Susceptible
Maikok (m) $-V_2$	71.06 – 71.61	Susceptible
Mepfü (r) $-V_3$	45.23 – 46.87	Moderately susceptible
Lao (d) $-V_4$	58.22 – 59.33	Susceptible
Mesü (i) $-V_5$	74.03 – 74.63	Susceptible
Aüm (k) $-V_6$	59.07 – 60.18	Susceptible
Aüm (m) $-V_7$	59.73 – 60.39	Susceptible

Table 2: Evaluation of disease incidence on host cultivars of bottle gourd at farmer's field and experimental plot.

Cultivars	Natural disease incidence on the growth stage of the cultivars											
	45 DAP*		Mean	70 DAP*		Mean	95 DAP*		Mean	120 DAP*		
	Farmers field	Expt. Plot		Farmers field	Expt. Plot		Farmers field	Expt. Plot		Farmers field	Expt. Plot	Mean
Mepfu (k)	61.02	61.17	61.10	61.34	62.00	61.67	81.21	83.31	82.26	81.39	81.83	81.86
Maikok (m)	60.22	61.14	60.68	62.02	62.05	62.04	81.07	81.89	81.48	80.92	81.34	81.83
Mepfü (r)	34.95	35.39	35.17	45.76	46.56	46.16	51.02	51.88	51.45	49.19	53.68	51.44
Lao (d)	57.50	58.10	57.80	58.64	59.45	59.05	59.24	61.18	60.21	57.50	58.58	58.04
Mesu (i)	62.31	63.15	62.73	64.91	65.54	65.23	86.69	87.11	86.90	82.21	82.72	82.47
Aüm (k)	58.28	58.97	58.63	59.72	60.28	60.00	59.99	62.80	61.39	58.28	58.64	58.46
Aüm (m)	58.88	59.25	59.06	60.14	62.25	61.20	60.54	61.01	60.78	59.37	59.08	59.23
CD(P=0.05)	6.29	4.08		6.24	6.31		7.96	6.32		6.13	5.29	

DAP = Days after planting, Expt. = Experimental plot, *Average of three replication.

Table 3: Correlation coefficient of weather parameters with disease intensity during 2005.

Weather parameters	N	Mean	Std. Dev	Sum	Minimum	Maximum	Correlation Coefficient
Relative humidity	5	90.14	4.38	450.70	84.70	94.80	-0.374
Average dew point	5	24.50	3.23	122.50	19.40	27.40	0.956*
Total rain fall	5	3.19	1.44	15.96	1.99	5.46	0.517 NS
Temperature	5	25.53	3.56	127.65	20.65	29.50	0.875 NS
Disease	5	50.25	28.64	251.27	0.00	69.21	

NS-Non significant, *Significant at P = 0.05

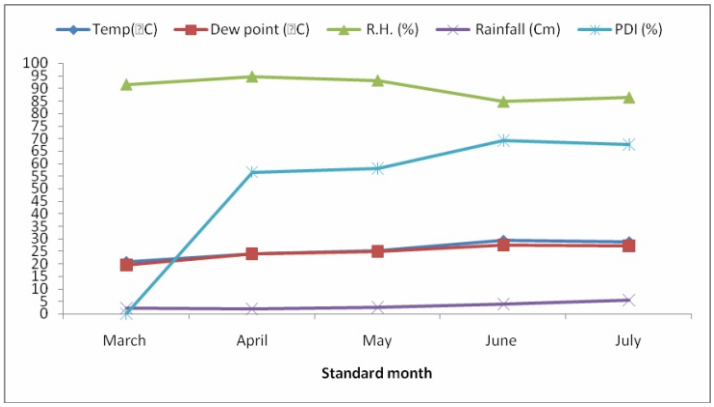

Fig. 1 : Effect of environmental factors on powdery mildew development of bottle guard.

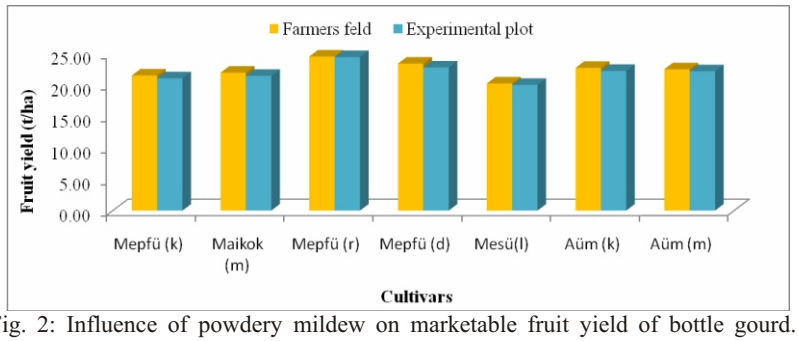

Fig. 2: Influence of powdery mildew on marketable fruit yield of bottle gourd.

The present results also corroborate the findings of Lebeda (6). Thus, it clearly indicates that total dew point favoured the disease development in both the field.

YIELD POTENTIAL

Powdery mildew disease had a profound influence with reduced yield of marketable fruit (Figure 2). It is evident that the local cultivars exhibited significant difference on the yield of marketable fruit. This might be due to genetically adopted factors with the host cultivars. Highest yield recorded both from the farmers field and experimental plot was cultivar Mepfü with 24.55 t/ha with moderately susceptible reaction followed by Lao 23.15 t/ha, Aüm(m) 22.54 t/ha, Aüm 22.40 t/ha, Maikok (t) 21.76 t/ha, and Mepfü 21.34 t/ha. Lowest yield was recorded in cultivar Mesü with 20.18 t/ha. These results of present study have confirmed the reports of Protologue (9) as in both field had a similar yield which can be used in future breeding programme.

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