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Seasonal influence on leaf spot disease in amaranth

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ABSTRACT
Ten amaranth genotypes were evaluated in the field for one year in randomized block design with three replications to study the seasonal influence on leaf spot disease. Result of the study revealed that two genotypes namely A-227 and A-204 were immune to the disease since no disease symptoms were noticed throughout the year. Other eight amaranth genotypes showed differential response to the changing environmental conditions with presence and absence of disease in certain months. Disease incidence and severity were maximum in the month of July due to the prevalence of low temperature (28^{0}C), high relative humidity (89.6%) and high rainfall (891 mm.). Leaf spot disease was absent in these genotypes in December, January and February months due to the occurrence of high temperature, low relative humidity and absence of rainfall. This study clearly indicates that environmental factors play a pivotal role in disease development and severity.

Key words : Leaf spot, Amaranth, Environment, Season.

INTRODUCTION

Amaranth is the most important leafy vegetable consumed and cultivated in Southern India. Among the various biotic and abiotic factors which limit the production of amaranth, vulnerability to leaf spot diseases is the most serious. The conventional plant protection measures for the control of diseases are undesirable from the point of view of human health and environmental problems. The most accepted alternative to combat the disease is the use of leaf spot resistant varieties. Hence in the present study, ten amaranth genotypes were evaluated for their response to leaf spot disease for one year.

MATERIALS AND METHODS

Ten amaranth genotypes were raised in the field at monthly interval for one year starting from May 1997 to April 1998 to find out the seasonal effect on incidence of leaf spot disease.Three weeks old seedlings were transplanted in the plots of 1.5x1.5m size with a spacing of 30cm between rows and 15cm between plants. The field experiment was laid out in a Randomised Block Design with three replications.There were 50 plants per replication and all the cultural operations were done as per the Package Of practices, Recommendations (KAU,1996).

Observations on disease incidence and severity/intensity were recorded at fortnightly intervals after transplanting. Five plants per genotype from one replicate were selected for scoring the disease. Five leaves starting from the top 3rd to 7th leaf towards the base were recorded each time. The percentage disease incidence was calculated by using the formula

$$\text{Percentage disease incidence} = \frac{\text{Number of plants infected}}{\text{Total number of plants observed}} \times 100$$

Disease severity/intensity (PDI) was calculated using the formula of Wheeler, 1969.Based on percentage disease severity, the accessions were grouped into five categories as suggested by Rajkumar *et al* (1995) which are as follows.

Disease severity (%)	Category
0	Immune
1-10	Highly resistant
10.1-25	Moderately resistant
25.1-50	Moderately susceptible
>50	Highly susceptible

RESULTS AND DISCUSSIONS

Observations made on the disease incidence (DI) and disease severity(DS) at 45 days after transplanting(DAT) are presented in Table. All the genotypes were free from the disease in December, January and February planting .Absence of disease in these months may be due to the prevalence of high temperature, low relative humidity and absence of rain which are the conditions unfavourable for the growth and development of the fungi. No disease symptoms were noticed in two genotypes namely A-227 and A-204 throught the year and they were found to be immune to the disease. The genotype A-3 was free from disease from November to April months and in other months, disease severity of this genotype was very low ranging from 0.03 to 5.70 percent. Since DS is less than 10 percent, this genotype is classified as resistant to this disease. Among the other seven genotypes, maximum DI &DS at 45 DAT was for A-189 (DI-73%; DS-49%) and A-182 (DI-74%; DS-53%) and minimum for A-225 (DI-32%;DS-18%) and A-210 (DI-37%;DS-17%). Disease incidence and severity of all the genotypes were maximum in July with DI ranging from 12 to 100% and DS ranging from 5.7 to 81%.This may be due to the prevalence of low temperature (28.8^{0}C), high relative humidity(89.6%) and high rainfall (891.2mm)(Fig 1, 2 &3) which are the optimal weather conditions favourable for disease development and dispersal of fungal spores as revealed by Sukumar and Ramalingam in 1989.

Genotypes showed differential response to the changing environmental conditions. A.225 is found to fall in the class 'Resistant' in the months of March and April (DI 8.67 to 11.03% and DS 3.40 to 3.90%), 'Moderately resistant' in May, June, September, October and November and 'Moderately susceptible' in July and August.

Genotype A.210 was found to be resistant to the disease in November 1997, March and April 1998; moderately resistant in May, September and October 1997 and moderately susceptible in June, July and August 1997.

In the genotype A.6, the highest value of DI (100 %) was recorded in July and August and it was highly susceptible to the disease in June, July and August 1997; moderately susceptible in September and October 1997; moderately resistant in May and November 1997 and resistant in March and April 1998.

The genotype A.191 belonged to resistant class in March and April planted crop, moderately resistant in May crop, moderately susceptible in September, October and November crop and highly susceptible in June, July and August.

The two accessions A.189 and A.182, were resistant in April; moderately resistant in March crop and moderately susceptible in May crop. A-182 was highly susceptible in the rest of months namely June, July, August, September, October and November. However, A.189 was found moderately susceptible in November and highly susceptible during June-October. Seasonal influence on the incidence of many diseases in vegetables have already been reported by

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Fig. 1 : Influence of monthly maximum temperature on disease incidence in six amaranth accessions

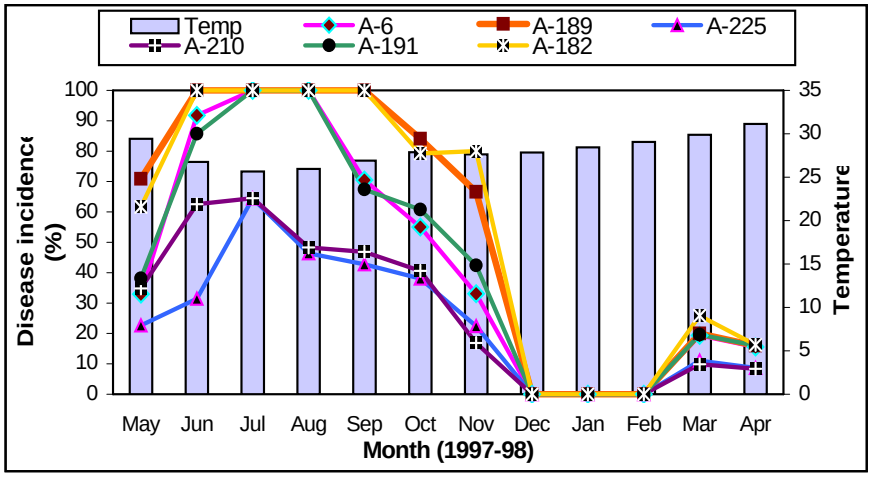

Fig.2 : Influence of RH on disease incidence in six amaranth accessions

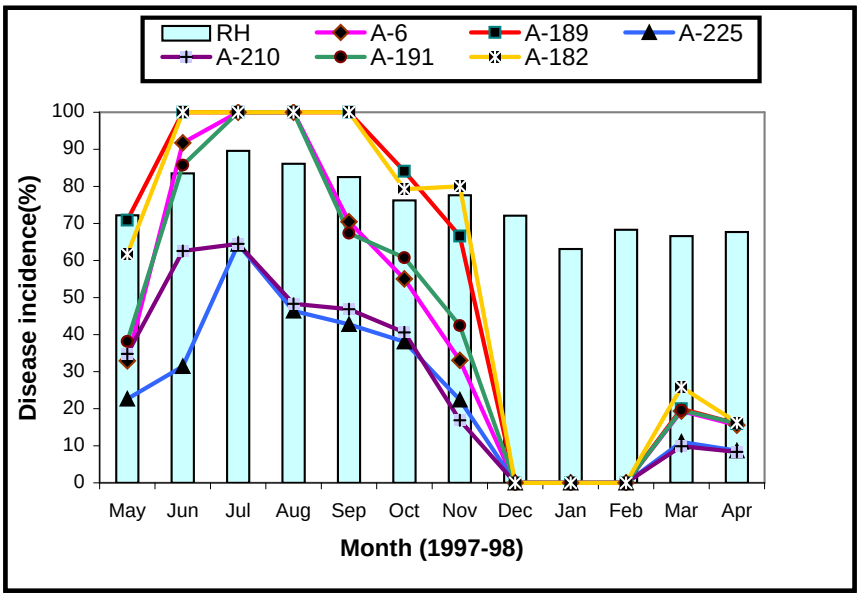

Fig. 3 : Influence of rain on disease incidence in six amaranth accesions

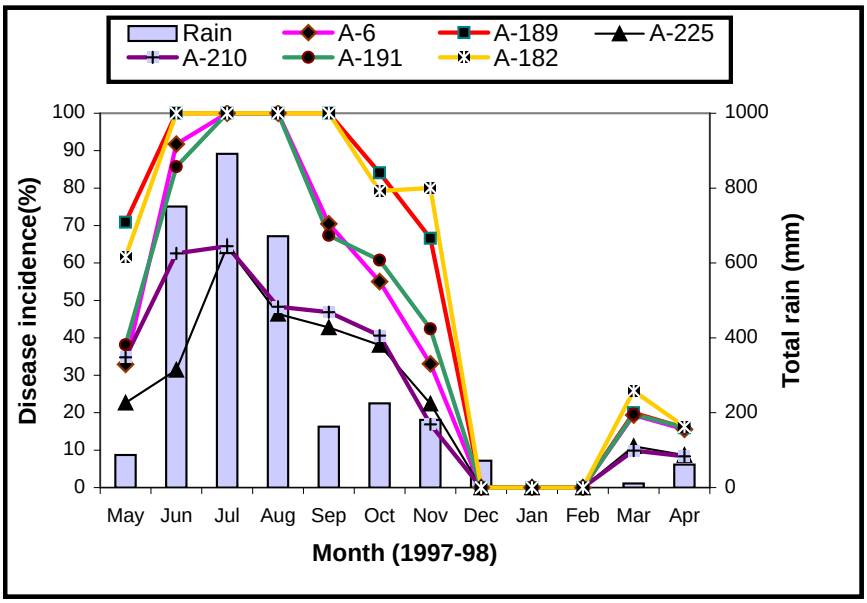

Table : Seasonal influence on leaf spot disease in ten amaranth accessions (45 days after transplanting)

Genotypes		May	June	July	August	September	October	November	December	January	February	March	April	Pooled Mean
A.227	DI %	0	0	0	0	0	0	0	0	0	0	0	0	0
	DS %	0	0	0	0	0	0	0	0	0	0	0	0	0
A.204	DI %	0	0	0	0	0	0	0	0	0	0	0	0	0
	DS %	0	0	0	0	0	0	0	0	0	0	0	0	0
A.3	DI %	3.13 D	10.80 D	12.60 D	8.77 D	2.43 E	2.03 E	0	0	0	0	0	0	0
	DS %	0.70 E	3.93 G	5.70 F	1.73 E	0.50 E	0.03 E	0	0	0	0	0	0	0
A.194	DI %	9.33 D	24.30 D	39.30 C	26.57 C	26.03 D	16.00 D	19.87 E	0	0	0	0	0	0
	DS %	7.40 DE	9.47 F	19.37 E	11.63 D	9.40 D	6.17 D	5.20 F	0	0	0	0	0	0
A.225	DI %	22.63 b	31.43 c	64.43 b	46.40 b	42.77 c	38.07 d	22.40 d	0	0	0	11.03 a	8.67 a	31.98 c
	DS %	11.23 b	22.57 c	35.03 c	27.97 c	24.23 c	18.10 bc	11.53 d	0	0	0	3.40 a	3.90 a	17.55 c
A.210	DI %	34.80 b	62.57 b	64.50 b	48.30 b	46.87 c	40.60 d	16.87 d	0	0	0	9.87 a	8.37 a	36.97 c
	DS %	17.07 b	28.03 c	29.10 c	25.53 c	21.13 c	14.60 c	9.37 d	0	0	0	2.63 a	4.50 a	16.89 c
A.6	DI %	32.93 b	91.77 a	100.00 a	100.00 a	70.47 b	55.03 cd	33.07 cd	0	0	0	19.37 a	15.57 a	57.58 b
	DS %	18.27 b	56.80 b	62.40 b	51.37 b	47.03 b	28.40 bc	21.70 cd	0	0	0	6.57 a	6.10 a	33.18 b
A.191	DI %	38.13 b	85.70 a	100.00 a	100.00 a	67.37 b	60.77 bc	42.20 bc	0	0	0	19.60 a	16.03 a	59.53 b
	DS %	23.00 b	52.90 b	69.13 ab	54.53 b	45.93 b	32.37 b	26.10 c	0	0	0	9.00 a	9.03 a	35.78 b
A.189	DI %	70.87 a	100.00 a	100.00 a	100.00 a	100.00 a	84.07 a	66.57 ab	0	0	0	19.97 a	15.97 a	73.05 a
	DS %	48.90 a	75.43 a	72.73 ab	69.40 a	60.87 a	52.87 a	44.20 b	0	0	0	10.70 a	9.63 a	44.94 a
A.182	DI %	61.67 a	100.00 a	100.00 a	100.00 a	100.00 a	79.23 ab	80.03 a	0	0	0	25.83 a	16.27 a	73.67 a
	DS %	43.43 a	76.83 a	81.40 a	72.47 a	63.77 a	57.03 a	58.03 a	0	0	0	12.03 a	8.20 a	52.58 a

Superscripts in capital letters indicate individual analysed data
Superscripts in small letters indicate pooled analysis data

some workers (Mohitsingh and Shukla,1986 in brinjal and Praveenkumar,1999 in cowpea).

Thus in the present study it was revealed that the environmental factors have a pivotal role on disease development and severity. Amaranth genotypes belong to different classes in different months and this is due to difference in weather parameters prevalent in different months. This shows that a susceptible variety can be successfully grown by change of season. Seasonal influence on the incidence of many diseases in vegetables have already been reported by some workers (Mohitsingh & Shukla, 1986 in brinjal and Praveenkumar,1999 in cowpea).

SUMMARY

Studies on seasonal influence on leaf spot disease in ten amaranth lines revealed that two lines namely A 227 and A 204 were immune to the disease. Amaranth lines showed differential response to the changing environmental conditions and disease incidence and severity were maximum in the month of July due to the prevalence of low temperature (28^{0}C), high RH (89.6%) and high rainfall (891mm).

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