Incidence of Anthracnose in Indigenous Germplasm of *Dioscorea alata* L.

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The incidence of anthracnose in indigenous germplasm collection of *Dioscorea alta* L. from different agro-ecological regions of peninsular India were scored on a 0-9 subjective scale under the field epiphytotic condition and percentage infection index was calculated. The study indicated that different morphotypes of *D. alata* varyingly responded to this disease. Analysis of correlation between disease incidence, number of stomata, stomatal size index and average yield/plant showed negative correlation between disease incidence and number of stomata, between number of stomata and stomatal size index and between disease incidence and average yield/plant indicating reduction in yield with the higher incidence of anthracnose. Frequency class distribution of intensity of disease incidence showed a slightly abnormal curve indicating a discontinuous and fragmented genetic variability exisitng in the collection with respect to resistance/susceptibility to anthracnose incidence.

Key Words: Anthracnose, *Dioscorea alata*, Evaluation, Morphotypes

Greater yam or Water yam (*Dioscorea alata* L.) of the family Dioscoreaceae is an important tuber crop under the subsistence farming system in tropics. In India, considerable variability occurs (Muralidharan and Velayudhan, 1985) and both morphological and biometrical techniques have been used by various workers for classification of vast variability (Burkill, 1917). Anthracnose caused by *Colletotrichum gloeosporioides* is a widespread disease in greater yam. This has been reported to have effected yield losses of greater than 80% in cultivars of *D. alata* and found that higher K content and lower content of micro-nutrients are characteristic features of tolerant cultivars (Nwankiti *et al.*, 1987). The intensity of disease incidence varies from place to place and collection to collection in relation to various factors influencing the epidemology of the disease.

To assess the field tolerance of 172 collections belonging to different morphotypes under the field epiphytotic condition, an attempt has been made to observe the intensity of anthracnose incidence for three years in the maintenance plots. The disease incidence has been correlated with average yield/plant and an attempt has also been made to correlate the number of stomata on leaf surface and stomatal size index with the disease incidence of anthracnose in *D. alata* L.

Materials and Methods

Based on the subjective morphotypic classification of *D. alata* L. (Velayudhan *et al.*, 1991), 172 different accessions collected from different agro-ecological regions of Peninsular India were observed in maintenance plots during the years 1994, 1997 and 2000. The experimental plants were raised in augmented design with three controls. Package of practices as recommended by Kerala Agricultural University were followed (Anon. 1996).

During the years 1994 and 1997, the intensity of anthracnose infection was scored on a subjective scale of 0-9 during September-October when the crop attained maximum vegetative growth. During the year 2000, the disease rating was done on the basis of percentage infection of individual accessions using the formula:

$$\% \text{ infection index} = (\text{sum of all disease ratings/leaves}) \times 100/(\text{Total number of ratings/leaves}) \times \text{maximum disease grading}$$

and then converting to 0-9 disease rating scale. Zero indicated complete absence of any symptom of the disease and 9 with an extreme infection of 90-100%. Grades of disease intensity were recorded on the basis of the percentage leaf area covered by the incidence, *viz.* 0% leaf area as 0, 1% as 1, 10% as 3, 25% as 5, 50% as 7 and more than 50% as 9. The observed values were computed and average yield of individual collections were calculated on the basis of mean yield for the three years. Analysis of correlation between disease incidence and yield/plant, between incidence and stomatal size index and between incidence and stomatal number were also studied.

Results and Discussion

The disease incidence scored on subjective 0-9 scale in 172 accessions belonging to 19 different morphotypes of *D. alata* showed the range of incidence from 2-9 with a mean value of 5.47. The yield/plant ranged from

0.58 kg to 4.33 kg with a mean of 2.10 kg. The details of disease incidence, % infection index recorded and average yield of different morphotypes are given in Table 1.

The critical observation on disease incidence in different morphotypes during October, 2000 showed that the maximum susceptibility to the disease was shown by the accessions in M16 (94.24%), M19 (96.22%) and M15 (92.0%). The accessions IC 87387 (13.78%) and IC 266645 (16.22%) in M6 and IC 87372 A (12.28%) in M12 were found comparatively more tolerant to anthracnose. At the same time 100% susceptibility was shown by many accessions in M16, *viz.* IC number 46068, 87330, 87337, 87345 and 87350.

The analysis of correlation between disease incidence and yield/plant showed negative correlation indicating a decrease in yield/plant in relation to increase in disease incidence. The correlation coefficient of -0.217 was significant between disease incidence and yield at 1% level (Table. 2).

Table 1. Anthracnose incidence in *D. alata* morphotypes

Morphotype No.	Morphotype name	No. of accessions	Range	Mean	SD	Mean yield /plant	% infection Index
1.	Chorakkachil	27	3.0-5.67	4.82	0.73	1.98	62.72
2.	Parakkachil	8	3.44-6.0	5.25	0.61	2.35	57.50
3.	Rosakampankachil	5	6.0-6.0	6.00	0	2.20	77.33
4.	Kappakachil	2	5.00	5.00	0	1.83	55.45
5.	Mudiyankachil	1	5.67	5.67	-	1.69	74.22
6.	Thonielayankachil	15	2.67-6.33	4.80	0.98	2.85	52.61
7.	Kuttikkachil	4	3.67 - 5.33	4.75	0.73	2.38	54.95
8.	Muzhayankachil	1	5.67	5.67	0	1.32	67.56
9.	Neelankachil	1	6.0	6.00	0	1.19	68.00
10.	Neendilakachil	4	4.3306.67	5.75	1.55	2.36	66.33
11.	Kaiyyankachil	8	4.0 - 6.67	5.37	0.78	2.22	72.62
12.	Kulambukachil	18	2.67-7.0	4.44	1.31	1.82	51.21
13.	Thalavannankachil	39	3.0-6.67	4.98	0.78	2.21	71.87
14.	Aanikachil	5	2.0-4.67	3.40	1.18	2.24	62.58
15.	Pachamullankachil	3	6.33 - 8.0	7.44	0.96	1.39	92.00
16.	Vattayilakachil	24	4.33 - 9.0	8.25	1.06	1.72	94.24
17.	Chuvannamullankachil	1	4.33	4.33	0	0.89	51.11
18.	Karimpachamullankachil	4	4.67 - 7.67	5.83	1.45	2.34	80.33
19.	Thalikayilakachil	2	7.33-7.67	7.50	0.24	1.98	96.22

Table 2. Analysis of correlation

	Mean yield/plant	No. of Stomata	Stomatal size index	Mean disease incidence
Mean yield/plant	1.000			
No. of stomata	0.332	1.000		
Stomatal size index	0.248	**-0.109**	1.000	
Mean disease incidence	**-0.127**	**-0.219**	0.182	1.000

Fig. 1 depicts the frequency distribution of *D. alata* accessions in 0-9 scale grading and higher frequency was recorded between mean disease incidence of 4 and 6. The incidence of anthracnose in different morphotypes as given in Fig. 2, clearly indicate variations in disease ratings. The same morphotype showed differential responses during the three years and this may be due to the changes in environmental factors that persisted during the cropping seasons over these years. However, morphotypes 15, 16 and 19 had higher incidence in all these years and M6, M8 and M9 had lowest during 1994 and 1997. The presence of the abnormal curve indicates a very complicated nature of the disease incidence. This also shows a high degree of susceptibility of the collections to the disease. It appears that the genetic variability existing in the collections with respect to anthracnose resistance/susceptibility is very discontinuous and fragmented.

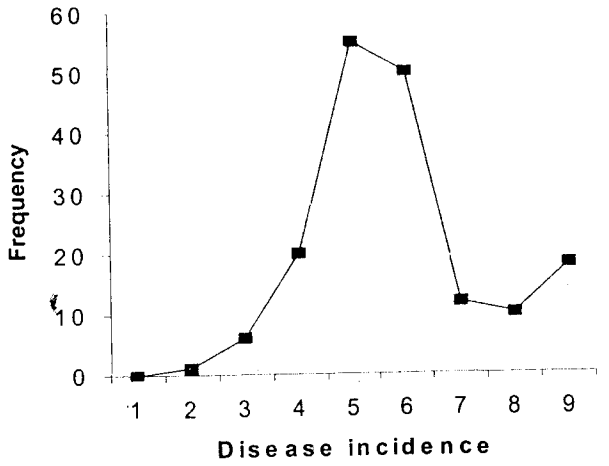

Fig. 1. Incidence of anthracnose in D. alata

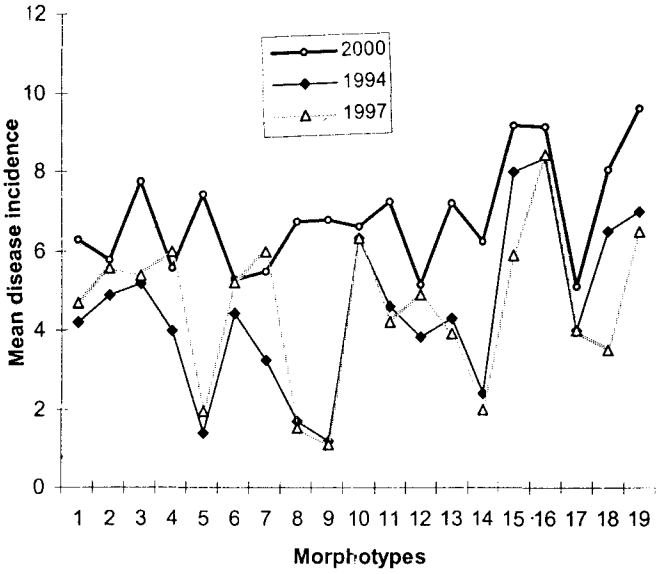

Fig. 2. Differential incidence of anthracnose in morphotypes of D. alata

It has been reported that thicker cuticle, shorter stomata and surrounding cells of stomata with sclerenchyma like cells are characteristic features of resistant lines to Anthracnose blotch disease in *D. alata* (Nwankiti and Okpala, 1984). In the morphotypes of *D. alata* under consideration, leaf epidermal features have earlier been reported (Velayudhan, *et al.*, 1991) and in none of the morphotypes, cell wall thickening or stomata were present on dorsal surface on the leaves. The number of stomata/unit area ranged from 23.70 (M9) to 44.3 (M5). Stomatal size index ranged from 1.42 (M12) to 2.34 (M10). The analysis of correlation between disease incidence, number of stomata and stomatal size index in the morphotypes showed negative correlations between number of stomata and stomatal size index and between number of stomata and mean disease incidence Table 2. This shows that reduction in stomatal size results in increase in the number of stomata/unit area. Even though the number of stomata increases the presence of disease incidence decreases because of the reduction in stomatal size. In conclusion, it was found that there is morphotypic variability in anthracnose incidence and this disease incidence influence the yield significantly.

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