Indian J. Pl. Genet. Resources 2 (1): 21-24, 1989

Genetic Divergence in Flue-Cured Tobacco (*Nicotiana tabacum* L.)

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Twenty four promising varieties of flue-cured tobacco were studied for their genetic divergence by D^2 statistics with a set of seven characters related to yield and quality of the leaf. The study revealed that genetic divergence has little relevance to geographical origin of the varieties. The maximum divergence was observed for quality of leaf, bright leaf and TBLE followed by number of leaves per kg. The varieties, MC 1 and Speight G 33, when crossed with McNair 14 and Jayasree are likely to yield segregants with high yield coupled with better quality in subsequent generations.

Several flue-cured tobacco (FCT) producing countries, have been evolving new varieties to meet their requirements and acquisition of these varieties has become easier now than ever before due to increased international co-operation. The CTRI has been acquiring the germplasm of *N. tabacum* (L.) through NBPGR, New Delhi. In majority of cases, the germplasm obtained from different countries is used as donor parents. Therefore, the study of genetic diversity in the material is of paramount importance so as to select suitable parents in the hybridization programme.

Various methods are in vogue for classifying the material, for example, morphological characters, key diagnostic characters and semigraphical method Metroglyph analysis outlined by Anderson (1957). Mahalanobis D^2 was used to study the divergence in flue-cured tobacco and white-burley tobacco (Lakshminarayana *et al.*, 1970). The present paper reports the result of genetic divergence among 24 high yielding varieties of flue-cured tobacco.

MATERIALS AND METHODS

The experimental material comprised 24 varieties selected from amongst 56 varieties evaluated during 1979-80 under dryland conditions. These included Coker 213, Coker 411, Florida 22, McNair 135, Oxford 1-181, Va 45, NC 13, Speight G41, V71 Meadows Giant, Speight G33, and Speight G41 (USA), F 207, F 210, Hicks 104, and MC1 (Japan), Kazimerski 640 (Poland), Kauka 427 (New Zealand), M 43-strain 94 (Rhodesia), Rila 9 (Bulgaria), EC 11083 (Yemen Arab Republic) and CTRI Special, Jayasree, Line 2178 and Cock Tobacco (India). The net plot had 28 plants and the rows and plants were spaced at 80 cm and 60 cm respectively. The data were recorded on cured leaf yield (CLY), bright leaf yield (BLY) and total bright leaf equivalent (TBLE) as well as plant height (HT),

number of economic leaves (EL), flowering time (FT) and number of leaves per kg (LW). Cured leaf was graded into three broad categories as bright, medium and low grades. Medium grades are priced, on an average, 0.465 of bright grades as such the medium grades are converted to bright leaf equivalents by multiplying them with 0.465, the resultant figure being added to bright leaf to yield TBLE. (Anon., 1957-58). The genetic divergence as measured by D^2 statistics was calculated following standard methods using variance and co-variance matrix obtained from the error component.

RESULTS AND DISCUSSION

The varieties differed significantly among themselves for all the characters (Table 1). The 24 varieties were grouped into eleven clusters; the intra and inter cluster D^2 values are presented in Table 2. The inter cluster values of D^2 for

TABLE 1. SIGNIFICANT OF VARIABILITY IN CHARACTERS FOR DIFFERENT VARIETIES OF FLUE CURED TOBACCO

Variety	CL	BL	TBLE	EL	HT	FT	LW
G.M.	62.9	13.6	29.9	18.6	133.3	77.7	230.1
C.V. (%)	9.6	31.9	15.6	7.1	6.9	3.9	14.9
C.D. 5%	9.9	7.2	7.7	2.1	15.2	5.0	56.6
C.D. 1%	13.2	9.6	10.2	2.9	20.3	6.7	75.6

TABLE 2. INTRA AND INTER-CLUSTER D^2 VALUES FOR 24 VARIETIES OF FCT

Clusters	Varieties	I	II	III	IV	V	VI	VII	VIII	IX	X	XI
I	8, 9, 10, 18, 22	5.9	26.0	15.7	25.4	19.7	18.0	35.4	27.5	13.0	48.9	25.7
II	6, 7, 12, 16, 21, 23		7.0	26.9	16.7	24.8	42.4	17.3	15.9	54.5	15.9	14.5
III	13, 17			5.5	20.6	27.0	13.4	17.6	43.2	18.8	40.3	15.8
IV	1, 2				7.6	37.4	21.0	29.9	25.5	48.3	19.5	23.1
V	5, 15, 20					7.2	49.3	34.3	19.4	26.6	50.9	11.8
VI	3,							42.2	55.5	20.2	55.2	41.4
VII	11,								46.8	54.3	31.0	12.2
VIII	14,									53.3	22.0	21.4
IX	19,										83.8	35.6
X	24,											26.69
XI	4,											

Varieties included; 1. Cock tobacco; 2. Coker 213; 3. Coker 411; 4. EC 11083; 5. Florida 22; 6. F 206; 7. 207; 8. Hicks-104; 9. Kasimierski-640; 10. Kwaka 427; 11. McNair 14; 12. McNair 135; 13. MCl 14; 14. M 43 Strain 94; 15. Oxford-1-181; 16. Rila-9; 17. Speight G-33: 18. Speight G-41; 19. V 71 Meadows Giant; 20. Va 45; 21. L. 2178; 22. NC-13; 23. CTRI Special; 24. GSH 3.

clusters II, IV and V were about 7.0, while the same for clusters I and III were low (5.88 and 5.52 respectively). The inter-cluster distance between IX and X was the maximum (83.80). The distances were higher between cluster I and

X, I and VII than between I and IX, I and III, I and VI. Cluster II had greater distance from Cluster IX as compared to others. Similar was the case with respect to cluster III and X, III and VIII. Cluster VI, was farther apart from Cluster VII, VIII, IX and X.

Marked differences between different clusters in respect of bright leaf, total bright leaf equivalent (TBLE) and number of leaves per kg were observed. Cluster VII had the highest means of 27.261 and 41.904 for bright leaf and TBLE yields respectively, while the least values were recorded by cluster IX for both these characters. The clusters VII and IX had the least number of leaves per kg.

The material utilised in the present study originated from eight countries of different geographical regions. The majority of the varieties (11) were from USA, the major tobacco producing country in the world. The varieties in cluster I originated from USA, Newzealand, Japan and Poland. The varieties in cluster II also originated from USA, Japan and Bulgaria. Varieties McNair 135, Coker 213, Florida 22, Coker 411 although from USA were grouped in different clusters. Similar observations were made by Murty and Pavate (1962) with their limited material of 13 genotypes and genetic divergence estimated only on four characters. The studies showed that there was no relationship between geographical origin and genetic diversity (Arunachalam and Ram, 1977; Narasinghani *et al.*, 1978; Singh *et al.*, 1979).

TABLE 3. GROUPING OF 24 VARIETIES OF TOBACCO IN DIFFERENT CLUSTERS

Cluster No.	No. of Varieties	Name of the Varieties	
1	5	Kwaka-427	New Zealand
		Speight G-41	USA
		NC-13	USA
		Kazimierski 640	Poland
		Hicks 104	Japan
5	6	F 207	Japan
		McNair 135	USA
		Rila-9	Bulgaria
		F 210	Japan
		L-2178	India
		CTRI Special	India
3	2	MC1	Japan
		Speight G-33	USA
4	2	Cock Tobacco	India
		Coker 213	USA
5	3	Florida-22	USA
		Oxford-1-181	USA
		Va-45	USA
6	1	Coker-411	USA
7	1	McNair-14	USA
8	1	M 43 Strain 94	Rhodesia
9	1	V 71 Meadows Giant	USA
10	1	GSH 3	India
11	1	EC 11083	Yemen Arab Republic

In FCT, the leaf is valued on the basis of colour. Bright coloured tobacco always fetches more price per kg than other shades like brown, etc. Varieties giving higher quantities of bright leaf and TBLE are preferable. The varieties Jayasree (Cluster X) and McNair 14 (Cluster VII) were similar in bright leaf and TBLE yields while MC1 and Speight G. 33 (III) were high cured leaf yielders. Hybridization between the varieties of Cluster X and VII with those of III are likely to yield segregants with higher yield and better quality. The other character of importance was the number of leaves per kg. It is considered that number of leaves was advantageous as the production costs of tobacco could than be reduced, while realising higher yields. The varieties in Cluster IX, VII, III and I satisfied this criterian. However, the varieties of cluster III, being common for high yeild and less number of leaves per kg, may be chosen for hybridization with those of cluster VII for beneficial results.

The diagnostic characters in tobacco are plant habit, internodal length and leaf characters. When these characters are considered for grouping the varieties, the variety Speight G-41 stands distinct from the others as its leaves are highly puckered compared to the other four varieties of the same group (Cluster I). Similarly the varieties F-207, F-210 and McNair 135 are distinct from CTRI Special and line 2178 of cluster II, the latter two varieties have light green leaves and are early maturing.

Thus, the D^2 analysis proved to be an effective tool for measuring divergence among various genotypes.

ACKNOWLEDGEMENTS

The authors express their gratitude to d Dr. N. C. Gopalachari for his encouragement in carrying out this investigation. The material from different countries was procured through NBPGR whose assistance is also acknowledged.

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