A4 - Phylogenetic Relationship and Correlations Between Genetic Distances Using RAPD Markers and Specific Combining Ability in 28 Tropical Open Pollinated Maize Varieties

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Introduction

The active maize breeding germplasm collection used at the Brazilian National Maize and Sorghum Research Center (CNPMS/EMBRAPA) comprises 28 open pollinated varieties. Based on the Brazilian experience the most useful heterotic patterns are Tuxpeño x Caribbean Flints and Swan. A more detailed identification of heterotic groups in these populations were conducted using diallel crosses (Santos et al. 1994). RAPDs have been used in many crops to assess phylogenetic relationships. They have also been used to study genetic variation among open pollinated varieties of red clover (Kongkiatngam et. al. 1996). Correlations between molecular marker estimated genetic distance and heterosis are generally low, when the whole dataset is used (Lee et al. 1989; Melchinger et. al. 1990). Recently, Lanza (1996) showed that the use of principal component analysis to assign parents to heterotic groups could increase these correlations. The objectives of this study were: a) to compare phylogenetic relationships among tropical open pollinated maize varieties using RAPDs and pedigree data; and b) to verify the relationship between genetic distance estimated with RAPDs and specific combining ability obtained from 5 and 10 environments.

Methods

Twenty-eight open pollinated varieties were used as parents of a diallel. The 28 parents and their 378 F_1 crosses were evaluated at five locations and two years in Brazil. Specific combining ability (SCA) was estimated for five locations in one year (Santos et al. 1994) and for 10 environments (Pacheco 1997). The SCAs from the 10 environments were used to obtain two heterotic groups: Group I (BR106, BAIII Tuson, Sint. Elite and CMS50) and Group II (BR105, CMS14C, BR111, CMS04N, ND and CMS04C).

The 28 open pollinated varieties were genotyped using RAPDs. A bulk of 100 seedlings was used to obtain the DNA from each variety. Up to now we have screened 30 primers which generated a total of 92 polymorphic bands. This RAPD data were used to obtain a distance matrix from which an UPGMA we generated a dendrogram for the 28 varieties. Genetic distances obtained with RAPDs markers for the whole dataset and for the two heterotic groups were correlated with: a) SCAs obtained from one year and five locations; and b) SCAs obtained from the 10 environments.

Results

Phylogenetic data agreed with the known pedigree data. Flint and semi-flint genotypes tended to be grouped separately from the dent germplasm. However several clusters were observed in the dent germplasm (Figure 1). Correlations between genetic distances for each pair of parents and SCAs for the 378 F_1s in 10 environments was low and positive (r=0.15**). Correlations between genetic distances and SCA were higher (r=0.61**), when only the two heterotic groups were considered and the SCA data were obtained from 10 environments.

Conclusions

RAPD marker can be used to assess phylogenetic relationships among maize open pollinated varieties. The quality of SCA estimators can influence the relationship between SCA and genetic distances; the correlation increases as with the number of environments.

3093

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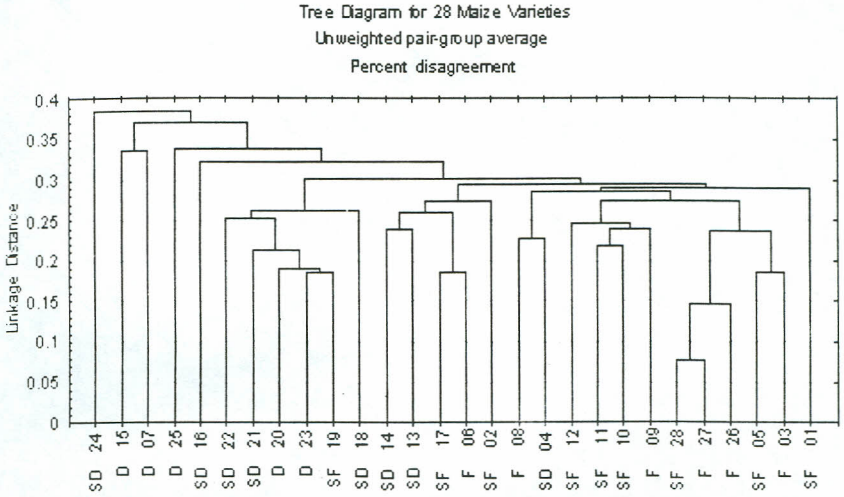

Key to figure:

	Genotype	Origin		Genotype	Origin
1	CMS-01	Mezcla Amarillo	**15**	BR-126	Dentado Composto
2	CMS-02	Antígua x Vera Cruz	**16**	CMS-28	Tuxpeño Amarelo
3	CMS-03	Amarillo Cristalino	**17**	CMS-29	Amar. del Bajio x Templados
4	CMS-4N	Amarilo Dentado Normal	**18**	CMS-30	Composto Amplo
5	CMS-4C	Amarilo Dentado Cerrado	**19**	BR-136	Sintético Cerrado
6	BR-105	Suwan DMR	**20**	CMS-39	Sintético Híbridos Brasileiros
7	BR-106	Composto Tuxpeño	**21**	CMS-50	Vega Precoce
8	BR-107	Composto Cateto	**22**	SINT. ELITE	Sint. / CNPMS Elite Inbreds
9	BR-111	Pool 21	**23**	CUNHA	Tuxpeño Brasileiro
10	BR-112	Pool 22	**24**	PH4	Variedade da Africa do Sul
11	CMS-14C	Pool 25	**25**	BAIII - Tusón	Tusón Brasileiro
12	CMS-15	Pool 26	**26**	SARACURA	Composto tolerante a encharcamento
13	CMS-22	Amarillo del Bajio	**27**	NITROFLINTE	Composto selecionado para eficiência a nitrogênio
14	CMS-23	Ant. x Rep. Domin.	**28**	NITRODENTE	Composto selecionadao para eficiência a nitrogênio