Heterosis and Combining Ability of Morphological and Forage Quality Predictors of Silage Corn Incentral Valley of Mexico

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Key words : silage corn ,heterosis ,GCA ,SCA ,heritability ,variance correlation ,Mexican races

Introduction The livestock feeding in the Highland Valleys of Central Mexico is based on harvest , grazing and annual forage conservation , being forage maize the most important silage crop (Cervantes et al., 1978) . Even though forage maize is extensively bred in Europe , USA and Asia since 1900's , this started in Mexico in the 1960's , and little is known about the genetic characterization in both agronomic and nutritive value traits . Our breeding program goals are to adapt temperate and tropical germplasm to Central Mexico , analyze combining ability of biomass and quality predictors and to study the genetic relationship of inbred lines between lowland tropical and temperate races using both genetic and molecular approaches .

Materials and Method Eight inbred populations (IPs) originated by single crosses from the tropical races : Chapalote , Celaya , Tuxpeno , Comiteco , Oloton ,Zapalote Grande , Reventador , Vandeno , and tropical composites . The single crossbred Mexican IPs were recombined up to F_{13} , and self pollinated up to S_7 (Cervantes et al., 1978) . In 2005 , the IPs were hand crossed in a partial diallel design and field established in 2006 in a RCB with four replications . Agronomic and quality traits were evaluated when the kernel 2/3 milklined . 27 SSR markers covering the entire genome were used to estimate genetic similarities among IPs , and to compute a discriminatory analysis . The genetic components of variance , genotypic correlations and heritability were estimated by MANOVA and SE computed by the delta method (Lynch and Walsh ,1998) .
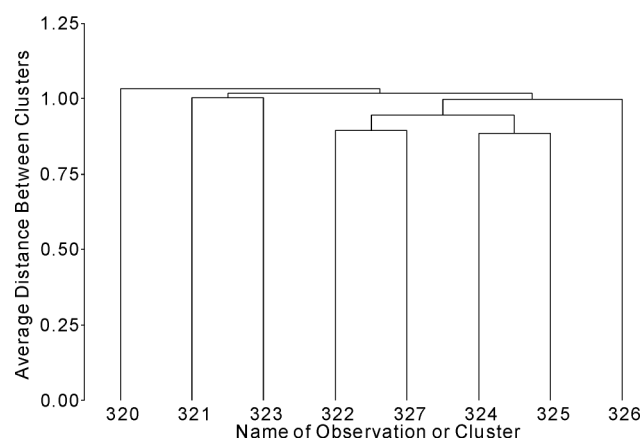
Results The SSR markers amplified 117 alleles ranging from 2 to 7 alleles per locus (PIC= 0.74±0.04) . Based on the marker polymorphic information , the eight IPs were clustered into four groups arranged by Mexican race : a) tropical composite ; b) tuxpeno and chapalote ; c) comiteco ; d) chapalote , reventador and zapalote grande ; and e) oloton (Figure 1) .

High parent heterosis across environments was 120% , 145% , 123% and 112% for stem , ear biomass , plant height , and grain yield , respectively , and no significant heterosis was identified for total biomass , ear number , and forage quality predictors (crude protein , *in vitro* DM digestibility , NDF , ADF , and soluble carbohydrates) . IP TuxpenoxOloton (326) showed the highest GCA for plant height and silage biomass , considered as a good tester for Central Valley in both local and adapted populations . SCA was higher for the Comiteco and TuxpenoxOloton cross in all silage biomass traits , and no heterosis was identified for forage quality . Genetic distances based on SSR primers classified the IPs into four main clusters , and were positively correlated with high-parent heterosis and combining ability in grain yield and ear number , but no correlation was found with silage biomass components and forage quality estimators .

Figure 1 *UPGMA's dendogram of eight IPs based on 27 SSRs , with 117 alleles clustered into four groups .*

Conclusions Selection of tropical races based on the proposed breeding scheme accomplished the adaptation of tropical IPs to Central Valley of Mexico at 2350 masl , which was expressed on plant health and grain yield . Biracial crosses of tropical and temperate Mexican races improved plant height , stem and total biomass , but no heterosis was found for other traits . A high correlation with SSR markers clustering IPs and genotypic data was identified , indicating markers can be useful in helping to define heterotic groups .

References

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