Cytogenetic Investigations of Non Dormant Alfalfa Germplasm Sources.

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A cytogenetic investigation was conducted on the four historically putatively distinct non dormant alfalfa germplasm sources, African (PI 536539) , Chilean (PI 536534), Peruvian (PI 536535) and Indian (PI 536536) tetraploid alfalfa (*Medicago sativa* ssp. *sativa*; 2n=4x=32). We used chromosome C-banding, image analysis as described by Bauchan et al. (and cluster analysis to test the hypotheis that chromosome structure and hetrochromatic DNA differed among the four non dormant alfalfa populations. Cytogenetic analyses revealed polymorphisms for heterochromatic DNA abundant variability in the number, intensity and location of constitutive heterochromatic DNA was observed both within and among genotypes. However, this variability did not prevent recognition of homologous chromosomes. Karyotypes of African, Chilean, Peruvian and Indian populations were developed. The reference 'African' population was used to compare the karyotypes. The karyotype of 'Chilean' and 'Peruvian' chromosomes are similar, however, they have fewer C-bands than the 'African' germplasm source. 'Indian' chromosomes have the fewest number of bands when compared to the other non-dormant sources especially on the long arms of the chromosomes. Cluster analysis based on all eight alfalfa genome chromosomes yielded no clear separation of the non dormant alfalfa populations. If these populations represent distinct non dormant alfalfa types, there should be better separation between populations. A number of explanations can account for these results. First, the original germplasm sources may have not been very distinct when introduced into the U.S. Although alfalfa was first cultivated nearly 9000 years ago, most of the distribution was from southeastern Asia to other regions of the world within the past 500 years. The initial populations were heterogenous and intercrossing and thus may not have undergone major selective changes, or, if they did, selections only affected a small subset of the loci prior to introduction into the U.S. Second, the four germplasm sources may not faithfully represent the original germplasm sources because of outcrossing, selection, and genetic drift during seed increase. After the germplasm was introduced into the U.S., the sources were maintained in different collections and in many of these collections, open-pollination was used to maintain the collection. Thus, out-crossing would have occurred to homogenize the various germplasm sources. Third, the populations had some common ancestral backgrounds. An example is the cultivar Lew, one of the parental African sources. The pedigree of 'Lew' includes both African and Indian germplasm sources (USDA, National Plant Germplasm System, Germplasm Resources Information Network). Therefore, the inability to differentiate among the four non dormant types of alfalfa could be due to similar genetic backgrounds of the initial introductions, intercrossing of the different sources and/or genetic drift during maintenance, or common genetic backgrounds of the parental sources used to develop the broad based populations. We recommend that for future studies of the nine alfalfa germplasm sources the original parental germplasm sources used by Melton et al. (1990) should be utilized rather than the subsequent populations developed in that study.

References

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