Medicago arborea Traits of Interest in Alfalfa Breeding

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Medicago arborea is a tetraploid woody shrub native to the islands and areas around the Mediterranean Sea. It can grow to a height of four meters, and is remarkably drought resistant, although its hexaploid subspecies M. citrina is even more drought resistant (Lefi et al. 2012). Moreover, M. arborea and it subspecies are the longest lived Medicago species. Whereas old growth is woody, the young growth is relished by livestock. History records cultivation for livestock feed before Roman Times, and it is still cultivated on some Greek Islands. The chromosome number of both alfalfa and M. arborea is 2n=4x=32, and selected male sterile alfalfa clones have been hybridized with M. arborea by making large numbers of crosses at the University of Wisconsin USA, (Bingham 2005) and University of Queenland AU (Armour et al. 2008). Fertility of hybrid derivatives has been adequate to cross with alfalfa and initiate genetic and breeding research. It is interesting that hybrid derivatives are winter active in Queensland, and relatively winter hardy in Wisconsin. In Queensland, effort has been directed towards identifying M. arborea genotypes with resistance to the fungal pathogens Colletotrichum trifolii and Phytophthora medicaginis. Both pathogens are relatively host specific and occur on both species, indicating M. arborea and M. sativa have shared a relatively recent common ancestor. Resistant genotypes have been identified, and the resistance to C. trifolii transferred from M. arborea to M. sativa (Armour et al. 2008). Hybrid derivatives have shown good heterosis for forage yield in testcrosses with adapted M. sativa cultivars in the subtropics at Gatton, Queensland. Work is now directed towards identifying chromosomal regions transferred from M. arborea which are responsible for this increased forage yield. At Wisconsin, the breeding focus is on backcrossing robustness and yield into alfalfa, and identifying traits with potential for restructuring alfalfa. Traits of interest include: biomass/yield, longevity, large seeds, decreased pod shattering, and resistance to disease, lodging, drought, salt, and perhaps other stress factors. Other traits that appear neutral or negative for breeding include: restructured root, crown, and shoot morphology, woodiness, erratic flowering, and variable plant color. Negative traits can be minimized or eliminated by backcrossing (barring linkage drag); however, some apparent negative traits my find specialized uses. In conclusion, the gene pool available for alfalfa breeding has been expanded.

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