## Selected References using Alfalfa Clone 6-4ms in Research

6-4ms is from a 'Saranac' X Saranac cross, and was discovered in row six, plant four, in a field nursery at Arlington, Wisconsin in 1972. Clone 6-4ms has trifoliolate leaves, and purple flowers (next page) that are male sterile, but have normal female fertility. It is fall dormant, bacterial wilt resistant, easy to clone by cuttings, and it regenerates from tissue cultures.


Pfeiffer, T.W. and E.T. Bingham. 1983. Improvement of fertility and herbage yield by selection within two-allele populations of tetraploid alfalfa. Crop Science 23: 633-636. *(6-4ms was used as a tester)*

McCoy, T.J. and L.Y. Smith. 1983. Genetics, cytology, and crossing behavior of an alfalfa mutant resulting in failure of the post-meiotic cytokinesis. Can. J. Genet. Cytol. 25:390-397. *(6-4ms was used as a tester)*

Brown, D.E. and E.T. Bingham. 1984. Hybrid alfalfa seed production using a female sterile pollinizer. Crop Science 24: 1207-1208. *(6-4ms was used as a male sterile parent of a hybrid)*

Groose, R.W. and E.T. Bingham. 1984. Variation in plants regenerated from tissue culture of tetraploid alfalfa heterozygous for several traits. Crop Science 24: 655-658. *(6-4ms was crossed with a white-flowered, multifoliolate plant to produce heterozygous material for tissue culture. A white-flowered mutant, WFM, was discovered in this research that produced purple revertants when passed through tissue culture and regeneration)*

Groose, R.W. and E.T. Bingham. 1986. An unstable anthocyanin mutation recovered from tissue culture of alfalfa (*Medicago sativa*). Plant Cell Reports 5: 104-107. *(6-4ms was one parent of WFM that had a high frequency of reversion from white to purple flowers in tissue culture and regeneration. The action of a transposable element was suggested)*

Veronesi, F., Mariani A., and E.T. Bingham. 1986. Unreduced gametes in diploid *Medicago* and their importance in alfalfa breeding. Theor. Appl. Genet. 72: 37-41. *(6-4ms was used as a tester)*

Havey, M.J., and D.P, Maxwell. 1988. Transfer of disease resistance from diploid to tetraploid alfalfa by unreduced female gametes. Plant Disease 72: 603-604. *(6-4ms was used for pollination control in the second step of the transfer)*

Lee, D.J., T.K. Blake, S.E. Smith, E.T. Bingham, and T.W. Carroll. 1989. Chloroplast genome mapping and plastid ultrastructure analysis of chloroplast deficient mutants in alfalfa. Crop Science 29:190-196. *(6-4ms was used as a tester)*

Forsthoefal, N.R., H.J. Bohnert, and S.E. Smith. 1992. Discordant inheritance of mitochondrial and plastid DNA in diverse alfalfa genotypes. J. of Heredity 83: 342-345. *(6-4ms was used in the study. The paper reports that the mitochondrial DNA is maternally transmitted, whereas the plastid DNA is usually biparentally transmitted)*

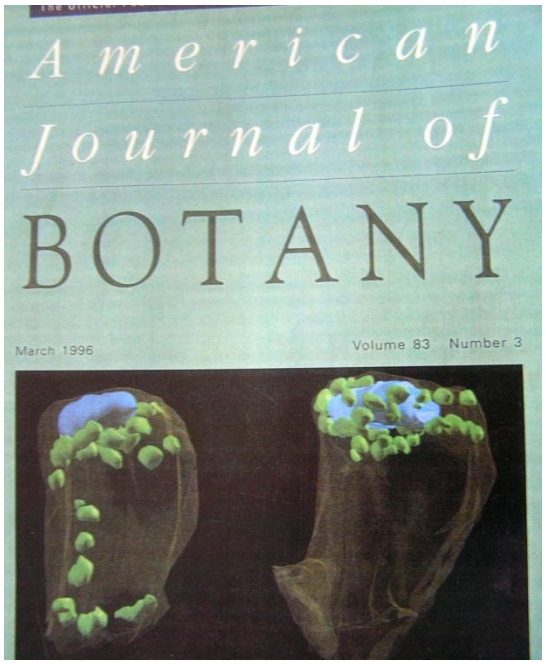
Mogensen, H.L. 1996. The hows and whys of cytoplasmic inheritance in seed plants. Am. J. Botany 83: 383-404. *(The cover of the issue (below) featured a three dimensional reconstruction of the egg cells where 6-4ms was used as an example of a strong female plastid transmitter. The egg cell of 6-4ms is on the right with plastids clustered around the nucleus ensuring plastid transmission. The egg cell on the left where plastids are scattered is from CUF-B, a weak female plastid transmitter.)*

Dilkova, M. and E.T. Bingham. 2004. Microsporogenesis of alfalfa cultivars and selected genotypes. Medicago Genetic Reports, Vol. 4. www.medicago-reports.org *(Microsporogenesis in 6-4ms was regular up to the tetrad stage whereupon many irregularities occurred presumably due to the onset of male sterility)*

Bingham, E.T. 2005. The Wisconsin Medicago arborea project. Medicago Genetics Reports, Vol. 5. www.medicago-reports.org *(6-4ms X M. arborea crosses were made several times over a ten year period. No hybrids were obtained, but 6-4ms was kept in the program as an embedded check for stray pollen in the winter greenhouse)*

Irwin, J.A.G., D.J. Armour, P.M. Pepper, and K.F. Lowe. 2010. Heterosis in Lucerne testcrosses with Medicago arborea introgressions and Omani landraces and their performance in synthetics. Crop and Pasture Science 61: 450-463. *(6-4ms is in the pedigree of experimental cultivar UQL 13)*

Clone 6-4ms will be 40 years old in 2012. It has survived in field nurseries until nurseries were rotated, usually ca five years. It has been cloned when needed, but not every year. No changes in vigor or fertility have been observed over time. Evidently, there has been no buildup of alfalfa mosaic virus, or other stress factors. Rooted cuttings are still available.




Flower color of 6-4ms