

COLLECTION AND EVALUATION OF THE SECTION *PLATYCARPE* FROM THE PEOPLES REPUBLIC OF CHINA

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ABSTRACT

The Peoples Republic of China is the center of origin of several species of the section *Platycarpae*, which could contain genes for drought and cold tolerance that would be of significant benefit to cultivated alfalfa (*Medicago sativa* L.) Of particular interest are *Medicago archiducis-nicolai* Sirjaev, *M. edgeworthii* Sirjaev, and *M. ruthenica* (L.) Ledebour. Of 105 *M. ruthenica* accessions collected from 15 diverse environments in Inner Mongolia, 50 were evaluated in the field at Beltsville MD (USA) in 1993 and 1994 on an acid soil (pH 6.4) deficient in boron and potassium. Significant variation was noted for stand retention, reaction to environmental stress (possibly boron deficiency), and seven other agronomic characters. Germplasm collected from *Platycarpae* in future PRC explorations will be evaluated in a similar manner. Analyses indicate that *M. ruthenica* may have the potential to become a new forage crop and/or provide genes that could be of considerable benefit to cultivated alfalfa.

KEYWORDS

Alfalfa, *Medicago archiducis-nicola*, *Medicago edgeworthii*, *Medicago ruthenica*, *Medicago sativa*, Peoples Republic of China, *Platycarpae*, stress

INTRODUCTION

Medicago archiducis-nicolai Sirjaev, *M. platycarpa* (L.) Trautv, *M. popovii* (E. Kor.) Sirjaev, and *M. ruthenica* (L.) Ledebour are indigenous to the former USSR and/or the Peoples Republic of China (PRC), and form a cohesive core of the section *Platycarpae*. *Medicago edgeworthii* Sirjaev is found in India and the PRC and is less closely related to this core group. Balabaev (1934) identified *Medicago ruthenica* and *M. platycarpa* as “new and untapped” species which had excellent prospects as new forage species in cold, dry regions of the USSR. These species appear to be remnants of a very ancient Arcto-Tertiary complex of flora that once occupied a very large area before the Mediterranean sea receded (Balabaev, 1934; Sinskaya, 1961).

Because *M. ruthenica* had never been collected extensively, and because it had potential for use in low-input agricultural systems or as a source of genes for improving cultivated alfalfa, we collected seed from 105 *M. ruthenica* populations in temperate steppes and temperate desert steppes in Inner Mongolia. This paper discusses a two-year agronomic evaluation of the 50 available new accessions in the humid eastern USA under low to moderate soil fertility. Germplasm collected from *Platycarpae* in future PRC explorations will be evaluated in a similar manner.

Methods

Germplasm Collection. An exploration for *M. ruthenica* was conducted from 22 Aug 1991 to 14 Sept 1991. Populations within 15 sites were sampled; environments ranged from sand dunes with sparse vegetation to lush grassland; pH ranged from 6.4 to 7.3. Most of the sites appeared to have undergone moderate to intensive grazing. Local farmers indicated that the species was preferred by their animals over other indigenous forage.

Agronomic Evaluation. Scarified, inoculated seeds (200 plot⁻¹) were planted 25 May, 1993 at the Beltsville Agricultural Research Center

(BARC) in 2 m, single-row plots in an Iuka sandy loam (coarse-loamy, siliceous, acid, thermic, Aquic Udigluvent) with a 0 to 2% slope and pH 6.4. Locally adapted alfalfa cultivars were included as checks. Experimental design was a randomized complete block with four replications. Boron and K were considerably below recommended levels for optimizing alfalfa yields (Lanyon and Griffith, 1988). No lime or fertilizer was applied for the duration of the experiment, and no pest control was exercised. The experiment was not irrigated, however, no drought stress symptoms were noted for any entries.

RESULTS AND DISCUSSION

There was considerable genetic variation among entries (Table 1). Clearly, there is considerable opportunity for selection within the collection to produce populations with desirable agronomic traits such as a semi-upright growth habit for hay production or a procumbent growth habit to improve grazing tolerance. However, there was a significant, positive relationship between uprightness and narrow leaves. Spring vigor in the accessions was observed to be considerably below that of the alfalfa checks (data not taken). Yellowing typical of boron deficiency (Lanyon and Griffith, 1988) was significantly less in *M. ruthenica* than in alfalfa. A severe winter resulted in the death of greater than 50% of the *M. ruthenica* plants, suggesting that the species may be less resistant to cold stress under humid conditions than to those encountered in its native habitat. Alfalfa tillered earlier, was more upright and taller, had broader leaves, and incurred less winter damage. Yields were superior for alfalfa, except for regrowth yield taken in 1994, where yields were comparable for the two species, perhaps as a result of the prolonged stress imposed on the alfalfa.

Medicago ruthenica may have the potential to become a new forage crop, especially for low input systems, and/or as a source of genes to improve cultivated alfalfa. Other species in the section *Platycarpae* may have similar potential.

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Table 1

Univariate statistics from a two-year evaluation of *Medicago ruthenica* accessions collected in Inner Mongolia.

Trait	Year					
	Mean	1993		1994		
		Range	CV	Mean	Range	CV
			%			%
Yellowing 1993 ^z	3.0	1-9	53.9	-	-	-
Days from seeding to tillering ^y		46.0	36-70	14.0	-	-
-						
Days from seeding to flowering ^x	81.0	69-91	6.7	-	-	-
Dry matter Aug 1994 (g) ^w	-	-	-	45.7	0-198.5	
106.9						
Dry matter Sept (g) ^w	22.7	0.1-182.8	116.2	78.1	0-379.7	
84.6						
Growth Habit ^v	5.4	1-9	36.2	4.5	1-9	48.5
Leaf shape ^u	2.9	1-8.3	48.7	2.5	1-6.6	46.3
Plant height (cm) ^t	10.7	2.5-22.0	37.5	14.1	2.9-31.0	42.0
Plant width (cm) ^t	25.3	4.7-57.7	34.6	50.0	15.2-129.5	32.0
No. of Plants ^s	22.9	1-67	59.8	8.8	0-31	65.6
Stand Retention (%)	-	-	-	46.8	0-100	62.9

^z Scored from 1 to 9 on 31 Aug 1993; 1=no damage, 9=severe yellowing.

^y50% of plants producing basal shoots.

^x50% of plants in flower.

^wHarvested 13 Sept 1993; and 25 Aug, and 30 Sept 1994.

^vScored from 1 to 9 on 31 Aug 1993, and 30 Sept 1994; 1=procumbent, 9=erect.

^uCenter leaflet length/center leaflet width; measured 31 Aug 1993, and 24 Aug 1994.

^tMeasured 31 Aug 1993, and 20 Aug 1994.

^sCounted approximately 25 June 1993 and 1994.