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# Simple Sequence Repeat Markers from *Cercis canadensis* Show Wide Cross-species Transfer and Use in Genetic Studies

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**ABSTRACT.** There are 11 recognized *Cercis* L. species, but identification is problematic using morphological characters, which are largely quantitative and continuous. Previous studies have combined morphological and molecular data to resolve taxonomic questions about geographic distribution of *Cercis* species, identifying botanical varieties, and associations between morphological variation and the environment. Three species have been used in ornamental plant breeding in the United States, including three botanical varieties of *C. canadensis* L. from North America and two Asian species, *C. chingii* Chun and *C. chinensis* Bunge. In this article, 51 taxa were sampled comprising eight species of *Cercis* and a closely related species, *Bauhinia faberi* Oliv. Sixty-eight polymorphic simple sequence repeat markers were used to assess genetic relationships between species and cultivars. For all samples the number of alleles detected ranged from two to 20 and 10 or more alleles were detected at 22 loci. Average polymorphic information content was 0.57 and values ranged from 0.06 to 0.91 with 44 loci 0.50 or greater. Cross-species transfer within *Cercis* was extremely high with 55 loci that amplified at 100%. Results support previously reported phylogenetic relationships of the North American and western Eurasian species and indicate suitability of these markers for mapping studies involving *C. canadensis* and *C. chinensis*. Results also support known pedigrees from ornamental tree breeding programs for the widely cultivated *C. canadensis* and *C. chinensis* species, which comprised the majority of the samples analyzed.

*Cercis canadensis*, a leguminous tree, is native to North America and cultivated widely as an ornamental. Flowers emerge directly from the stem or trunk before the leaves early in the spring. Petal colors range from purple to pink to red or white. A double-flowered cultivar is available. Growth habits include weeping forms, dwarf types, and small- to medium-sized types. Leaves can be glossy to pubescent and leaf color from green to purple or variegated. There are more than three dozen *C. canadensis* cultivars commercially available in the United States that encompass the major phenotypic variants. Ornamental traits are usually simply inherited, and novel combinations of traits are expected from breeding and selection (Werner, 2006).

There are three recognized botanical varieties of *C. canadensis*, which account for the high degree of morphological variation in the cultivated forms (Isley, 1975). *C. canadensis* var. *canadensis* is found in the eastern United States and is noted for dull green leaves with acute apices. It has glabrous branchlets and leaves that can be glabrous or pubescent. *C. canadensis* var. *texensis* (S. Watson) M. Hopkins grows in Texas and Oklahoma and has thick, glossy leaves and branchlets that are also glabrous. *C. canadensis* var. *mexicana* (Rose) M. Hopkins is found in northern Mexico and southern Texas. Leaves are thick and shiny with rounded apices with branchlets that are pubescent. In an effort to resolve the phylogeny, several taxonomic studies were previously conducted with morphological characters and DNA sequences (Davis et al., 2002). Most of the morphological characters are continuous over the geographic ranges, and variation, particularly in leaf morphology, may be a response to different climatic regions (Davis et al., 2002). Characters such as pubescence are thought to have evolved along temperature and moisture clines (Fritsch et al., 2009). DNA studies support geographic distributions, but internal transcribed spacer (ITS) sequence data have low resolution within the populations sampled (Davis et al., 2002; Fritsch and Cruz, 2012).

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