Rhodora

JOURNAL OF THE
NEW ENGLAND BOTANICAL CLUB

Vol. 93 July 1991

RHODORA, Vol. 93, No. 875, pp. 205–225, 1991

ISOZYME EVIDENCE AND PHENETIC RELATIONSHIPS AMONG SPECIES IN *ASTER* SECTION *BIOTIA* (ASTERACEAE)

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ABSTRACT

Aster section *Biotia* is an eastern North American group of asters having a base chromosome number of $x = 9$. Phenetic analyses of isozyme gene frequency data show that the species native to the eastern deciduous forest region, *Aster divaricatus* ($2n = 18$), *A. chlorolepis* ($2n = 36$), *A. schreberi* ($2n = 54$), and *A. macrophyllus* ($2n = 72$) are very closely related and perhaps form an increasing polyploid series. Isozyme data reveal that the two species whose ranges are restricted to the Piedmont, *A. mirabilis* ($2n = 18$) and *A. jonesiae* ($2n = 54$), are very closely allied and are more distantly related to the previous group. The endemic and midwestern *A. furcatus* ($2n = 18$) is isozymically most unlike the other species in the section. Isozyme data do not rule out the possibility that the hexaploids, *A. schreberi* and *A. jonesiae*, originated by retrogressive polyploidy rather than by progressive (increasing) polyploidy. The hypothesis that *A. chlorolepis* arose from *A. divaricatus* by autopolyploidy is supported by the electrophoretic data. The relationships of the diploids to one another and the mode of origin of *A. macrophyllus* are not clarified by the isozyme analyses.

Key Words: *Aster* section *Biotia*, isozymes, electrophoresis, phenetics, eastern North America

INTRODUCTION

The North American species of *Aster* form a large, taxonomically difficult and evolutionarily complex assemblage (Allen, 1984, 1986; Dean and Chambers, 1983; Gray, 1880, 1882, 1884; Jones,

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1980a, 1980b; Semple and Brouillet, 1980a, 1980b; Shinners, 1941; Torrey and Gray, 1841). Taxonomic difficulties in the genus mostly involve species delimitations (Allen, 1984, 1986; Jones, 1980b, 1984), but even in cases where species are well defined, relationships between them are not. Hybridization and introgression (Avers, 1953; Wiegand, 1928, 1933), polyploidy (Dean and Chambers, 1983), and phenotypic plasticity (Jones, 1978a, 1978b) have been cited as the primary contributors both to blurring of species boundaries and to uncertainty about phylogenetic relationships.

From all other *Aster* groups, the eastern North American *Aster* L. section *Biotia* DC. ex Torrey and A. Gray can be distinguished by the following combination of characteristics: long-petiolate basal and lower cauline leaves with cordate-based, toothed blades; upper cauline leaves with toothed margins; mature cypselas that are fusiform with 7 or more prominent ribs; heads with the outermost phyllaries densely ciliolate and obtuse to rounded at the apex; capitulescences corymbiform; and base chromosome number $x = 9$. Judging by morphology, the most closely related groups are subgenus *Aster* subsection *Spectabiles* A. Gray and subgenus *Doellingeria* (Nees) A. Gray from eastern North America, and subgenus *Aster* section *Radulini* (Rydberg) A.G. Jones from western North America (Jones, 1980a; Jones and Young, 1983).

Aster section *Biotia* comprises three diploids: *A. divaricatus* L., *A. furcatus* Burgess in Britton and Brown, and *A. mirabilis* Torrey and A. Gray; one tetraploid: *A. chlorolepis* Burgess in Small; two hexaploids: *A. jonesiae* Lamboy and *A. schreberi* Nees; and one octoploid: *A. macrophyllus* L. Three of these species, *A. divaricatus, A. schreberi,* and *A. macrophyllus,* are common in New England (Lamboy, 1990, Ph.D. dissertation, University of Illinois, Urbana; Seymour, 1969), and *A.* ×*herveyi* A. Gray, a hybrid between *A. macrophyllus* and *A. spectabilis* Aiton, is endemic to New England and New York.

The seven members of *Aster* section *Biotia* and the one hybrid may be distinguished by means of the following taxonomic key.

KEY TO *ASTER* SECTION *BIOTIA* AND ONE SYMPATRIC HYBRID

1. Plants with stipitate-glandular hairs on the phyllaries and peduncles 2