Genetic divergence of *Cirsium scariosum* in eastern and western Canada

Joanne L. GOLDEN, Department of Biological Sciences, University of Lethbridge, Lethbridge, Alberta T1K 3M4, Canada.
Peter ACHUFF, Ecological Integrity Branch, Parks Canada, Waterton Lakes National Park, Waterton Park, Alberta T0K 2M0, Canada.
John F. BAIN\(^2\), Department of Biological Sciences, University of Lethbridge, Lethbridge, Alberta T1K 3M4, Canada, e-mail: Bain@uleth.ca

Abstract: *Cirsium scariosum* is a native western North American thistle that is disjunct in the Mingan Archipelago of Quebec. The presence of these Mingan individuals is thought to be the result of either an eastern migration during the Pleistocene or of a contemporary anthropogenic introduction. Our molecular analysis of Mingan and western individuals of *C. scariosum* showed that the Quebec individuals harbour the highest percentage of unique alleles and the lowest percentage of polymorphic loci. They differ from western individuals by a total of 2(-4) base pairs in the ETS/ITS combined region. Western *C. scariosum* is more similar to *C. hookerianum* from the same region than it is to Mingan *C. scariosum*. These data favour a Pleistocene origin hypothesis for the Mingan populations and suggest either that hybridization among western species has had a homogenizing effect or that Mingan *C. scariosum* originated from *C. scariosum* populations genetically different from those found in Alberta.

Keywords: *Cirsium minganense*, *Cirsium scariosum*, ETS, genetic divergence, ISSR, ITS.

Résumé: *Cirsium scariosum* est un chardon originaire de l’Ouest de l’Amérique du Nord ayant une distribution disjointe dans l’archipel de Mingan au Québec. On croit que la présence de ces individus à Mingan est le résultat d’une migration vers l’est durant le Pléistocène ou d’une introduction anthropogénique contemporaine. Notre analyse moléculaire des individus *C. scariosum* de Mingan et de l’Ouest a montré que les individus du Québec possèdent la pourcentage le plus élevé d’allèles uniques et le pourcentage le plus faible de loci polymorphes. Ils diffèrent des individus de l’Ouest par un total de 2 (-4) paires de bases de la région combinée ETS/ITS. *C. scariosum* de l’Ouest est plus proche de *C. hookerianum* de la même région que de *C. scariosum* de Mingan. Ces données pointent vers l’hypothèse d’une origine Pleistocène pour les populations de Mingan et suggèrent soit que l’hybridation de l’espèce de l’Ouest a eu un effet homogénéisateur ou que *C. scariosum* de Mingan provient de populations de *C. scariosum* génétiquement différentes de celles de l’Alberta.

Mots-clés: *Cirsium minganense*, *Cirsium scariosum*, divergence génétique, ETS, ISSR, ITS.


Introduction

*Cirsium scariosum* is a rare plant in Canada (Argus & Pryor, 1990; NatureServe, 2006) that occurs in southwestern Alberta and adjacent British Columbia and is disjunct in the Mingan Islands region of Quebec. The status of both eastern and western populations was the subject of recent analyses (Golden & Bain, 2003; Nantel & Cantin, 1998); however the relationships among the eastern and western populations remain obscure. The designation of the eastern populations as a distinct species, *C. minganense* (= *C. foliosum* var. *minganense*), originally proposed by Marie-Victorin (1925), has not been supported in recent floras (e.g., Scooggan, 1979; Keil, 2006). However, Morisset (1971) cites differences in breeding system and habitat in support of his recognition of it as a “sibling” species distinct from *C. scariosum*. The time of introduction for the Mingan Islands *C. scariosum* populations has also been a source of disagreement. Although most Gulf of St. Lawrence–Cordilleran disjunctions are thought to be of Pleistocene origin and related to glaciation (Morisset, 1971), Moore and Frankton (1967) suggested that the Mingan Islands populations of *C. scariosum* (= *C. minganense*) may have resulted from a chance introduction sometime between 1915 and 1924. Bayer, Denford, and Packer (1989), in a study employing flavonoid and isozyme data, found Mingan and western populations were very similar, with only 2 alleles (at loci PGM-2 and PGM-3) lacking in the Mingan populations. They reached no clear conclusions concerning either the history or the taxonomic status of the plants in the 2 regions.

In an effort to shed light on the evolutionary relationships between the eastern and western populations of *C. scariosum* in Canada we undertook a comparative genetic analysis of individuals from both regions. We endeavoured to generate data that would allow the amount of divergence among species and regions to be compared with what is known about molecular divergence among other *Cirsium* species and also to generate data that provide insights into the genetic structure of the individual regions. That is, we