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Long-Term Grazing Effects on Genetic Variability in Mountain Rough Fescue

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Abstract

Festuca campestris Rydb. (mountain rough fescue) is a dominant grass species in the montane grasslands of western Canada. Little is known about the genetic diversity of this plant and the effects of long-term grazing on the genetics of populations. The amplified fragment length polymorphism (AFLP) technique was applied to compare the genetic diversity of fescue plants at adjacent grazed and protected areas for 3 populations spread across a longitudinal range: Stavely in the foothills, Milroy in the Rocky Mountain trench, and Goose Lake on the interior plateau. Five AFLP primer pairs were used to screen the tiller samples of about 39 plants in each grazed (or ungrazed) area, and 139 polymorphic AFLP bands were scored for each individual sample. These scored bands had frequencies ranging from 0.03 to 0.98 with an average of 0.56. About 81% of the total AFLP variation resided within the populations. The Goose Lake population had the lowest level of AFLP variation, but genetically was the most distinct. Four AFLP bands were possibly associated with chromosomal segments significant for grazing resistance. Comparisons of AFLP variation between grazing and nongrazing samples revealed variable and relatively small impacts of the long-term grazing on the genetic diversity of the grazed populations. The AFLP variation of grazed samples was 1.5% lower at Goose Lake, 2.2% higher at Milroy, and not different at Stavely. If developing diverse germplasm for rangeland seedings is desired, one should sample across geographic space rather than combining materials with and without historical grazing pressure.

Resumen

Festuca campestris Rydb. ("Mountain rough fescue") es una especie de gramínea dominante de los pastizales montañosos del oeste de Canadá. Poco se sabe acerca de la diversidad genética de esta planta y los efectos del apacentamiento a largo plazo sobre la genética de las poblaciones. Se aplicó la técnica de polimorfismo de la longitud de los fragmentos amplificados (AFLP) para comparar la diversidad genética de plantas de "Fescue" de áreas adyacentes apacentadas y sin apacentar (protegidas) para tres poblaciones distribuidas a lo largo de un gradiente longitudinal: Stavely en el pie de la montaña, Milroy en la trinchera de las Montañas Rocallosas y Goose Lake en la meseta interior. Cinco pares de primers AFLP fueron usados para examinar las muestras de hijuelos de aproximadamente 39 plantas de cada área, apacentada y sin apacentar y en cada muestra individual 139 bandas polimórficas AFLP fueron calificadas. Estas bandas calificadas tuvieron frecuencias que variaron de 0.03 a 0.98, con un promedio de 0.56. Aproximadamente 81% de la variación total de AFLP residió dentro de las poblaciones. La población de Goose Lake tuvo el menor nivel de variación de AFLP, pero genéticamente fue la mas distinta. Cuatro bandas AFLP posiblemente estuvieron asociadas con segmentos cromosómicos significativos para la resistencia al apacentamiento. Comparaciones de la variación de AFLP entre muestras apacentadas y no apacentadas revelaron impactos, variables y relativamente pequeños, del apacentamiento de largo plazo en la diversidad genética de las poblaciones apacentadas. La variación de AFLP de las muestras apacentadas fue 1.5% más bajo en Goose Lake, 2.2% más alto en Milroy y si diferencia en Stavely. Si se desea desarrollar germoplasma diverso para siembras de pastizales, uno debe muestrear a través del espacio geográfico en lugar de combinar materiales con y sin historial de presión de apacentamiento.

Key Words: native grass, *Festuca campestris*, cattle grazing, genetic diversity, AFLP

INTRODUCTION

Festuca campestris Rydb. (mountain rough fescue) is a grass with a caespitose growth form, having only basal leaves and few flowering tillers (Aiken and Darbyshire 1990). It occurs in the foothills of the Rocky Mountains in Alberta and Montana and in the river valleys and interior plateau of southern British Columbia and northern Washington. This grass is highly productive, but it can lose vigor rapidly if heavily grazed during the growing season (Willms et al. 1985). For example, the plant density was 0.8 plants$\cdot m^{-2}$ in a heavily grazed paddock and 1.4 plants$\cdot m^{-2}$ in a less heavily grazed paddock (W. Willms, unpublished data, 2004). Thus, grazing may have generated selection pressure.

Investigations of grazing effects in grazed populations have focused more on morphological, physiological, and reproductive adaptations (e.g., Caldwell et al. 1981; Hodgkinson and Williams 1983; Kalkner and Casler 2000), and less on genetic variability and structure of grass populations (Carman and Briske 1985; Tomás et al. 2000; Matlaga and

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