

Genetic diversity in colonial bentgrass (*Agrostis capillaris* L.) revealed by *EcoRI/MseI* and *PstI/MseI* AFLP markers

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Abstract

To conserve and study the existing genetic resources of colonial bentgrass for use in breeding, genetic diversity was investigated using amplified fragment length polymorphism (AFLP) markers. Ten *EcoRI/MseI* and six *PstI/MseI* AFLP primer combinations produced 181 and 128 informative polymorphic bands, respectively. Cluster analysis of genetic similarity estimates revealed a high level of diversity in colonial bentgrass species with averages of 0.51 (*EcoRI/MseI*) and 0.63 (*PstI/MseI*). Greater genetic diversity was detected by the *EcoRI/MseI* AFLP primer combinations. A significant positive correlation ($r=0.44$, $p=0.0099$) between the two Jaccard similarity matrices from *EcoRI/MseI* and *PstI/MseI* enzyme combinations was obtained by the Mantel test. Commercial cultivars of colonial bentgrass showed a narrow genetic background.

Introduction

Colonial bentgrass species (*Agrostis capillaris* L.) is a potential genetic resource for improvement of other bentgrass species (*Agrostis* spp.) with regard to resistance to environmental stresses and diseases. Transferring resistance from colonial to other bentgrass species is a promising goal in turfgrass breeding programs (Belanger, 2003). Assessment of genetic diversity among accessions of colonial bentgrass species will contribute to eliminate undesirable duplications in the germplasm collection and increase the efficiency of research efforts. AFLP analysis has been applied increasingly for genetic diversity research, and is suitable for evaluating genetic diversity among turfgrass species in which the genetic information is limited.

The objectives of this study are:

- To investigate the genetic similarity (GS) of colonial bentgrass species by using AFLP markers (*EcoRI/MseI* and *PstI/MseI* enzyme combinations).
- To compare the correlation between estimates of genetic similarity derived from these two enzyme combinations.

Materials and methods

- Twenty-two different accessions of colonial bentgrass collected from 11 countries were obtained from the USDA Regional Plant Introduction Station (Pullman, Washington). Another fourteen colonial bentgrass accessions were collected from northern Spain. Three commercial colonial bentgrass cultivars ‘Golfin’, ‘SR 7150’, ‘Tiger’ were also included in this study (Fig. 1).
- The polymorphic bands produced from AFLP analysis (*EcoRI/MseI* and *PstI/MseI* enzyme combinations) were scored.
- Genetic diversity analyses were conducted using Numerical Taxonomy and the Multivariate Analysis system (Exter Software Co., New York).
- Correlation between the two matrices obtained with two marker sets was estimated by means of the Mantel matrix correspondence test.



Fig. 1. 39 colonial bentgrass accessions

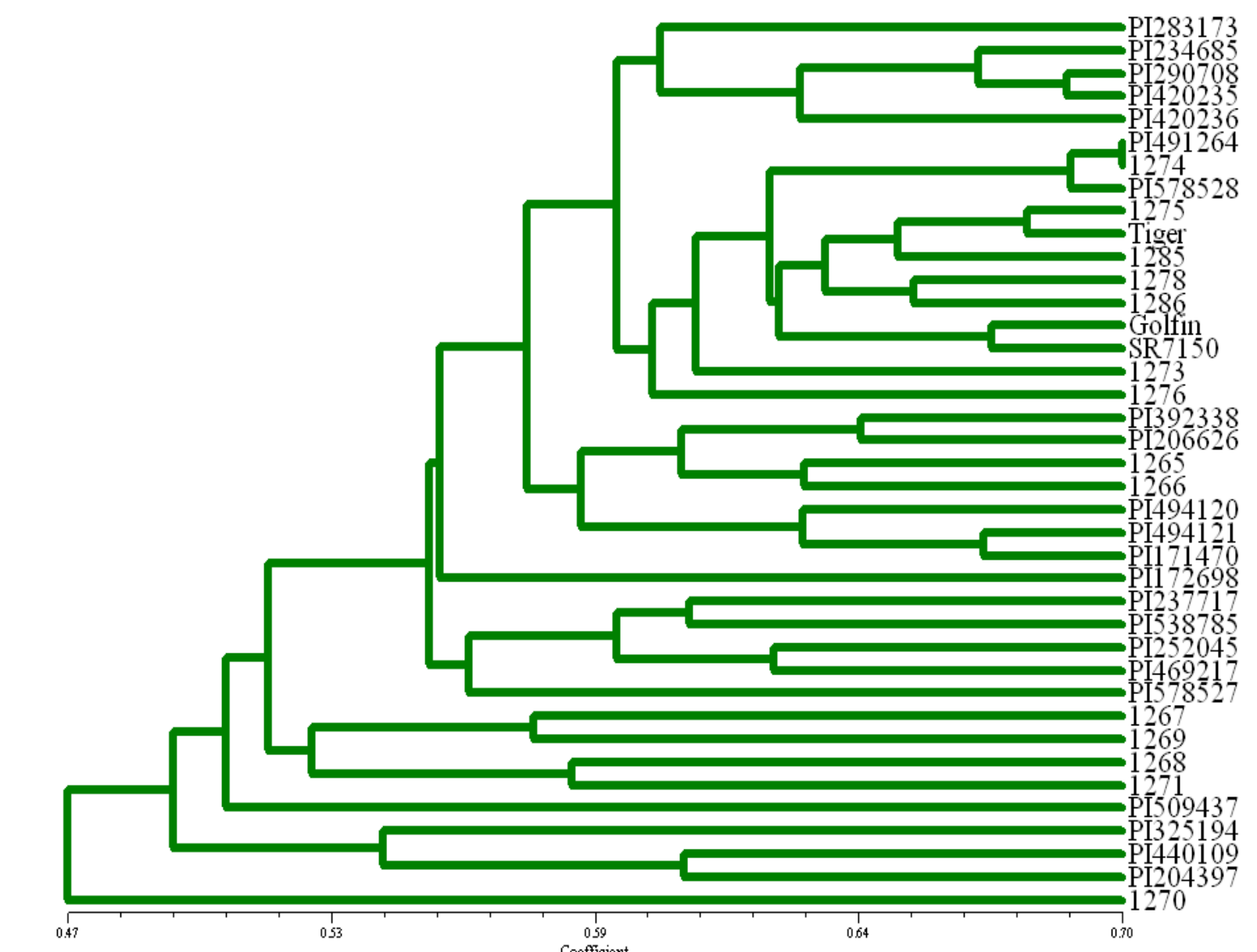


Fig. 2. UPGMA dendrogram of 39 accessions revealed by *EcoRI/MseI* AFLP markers

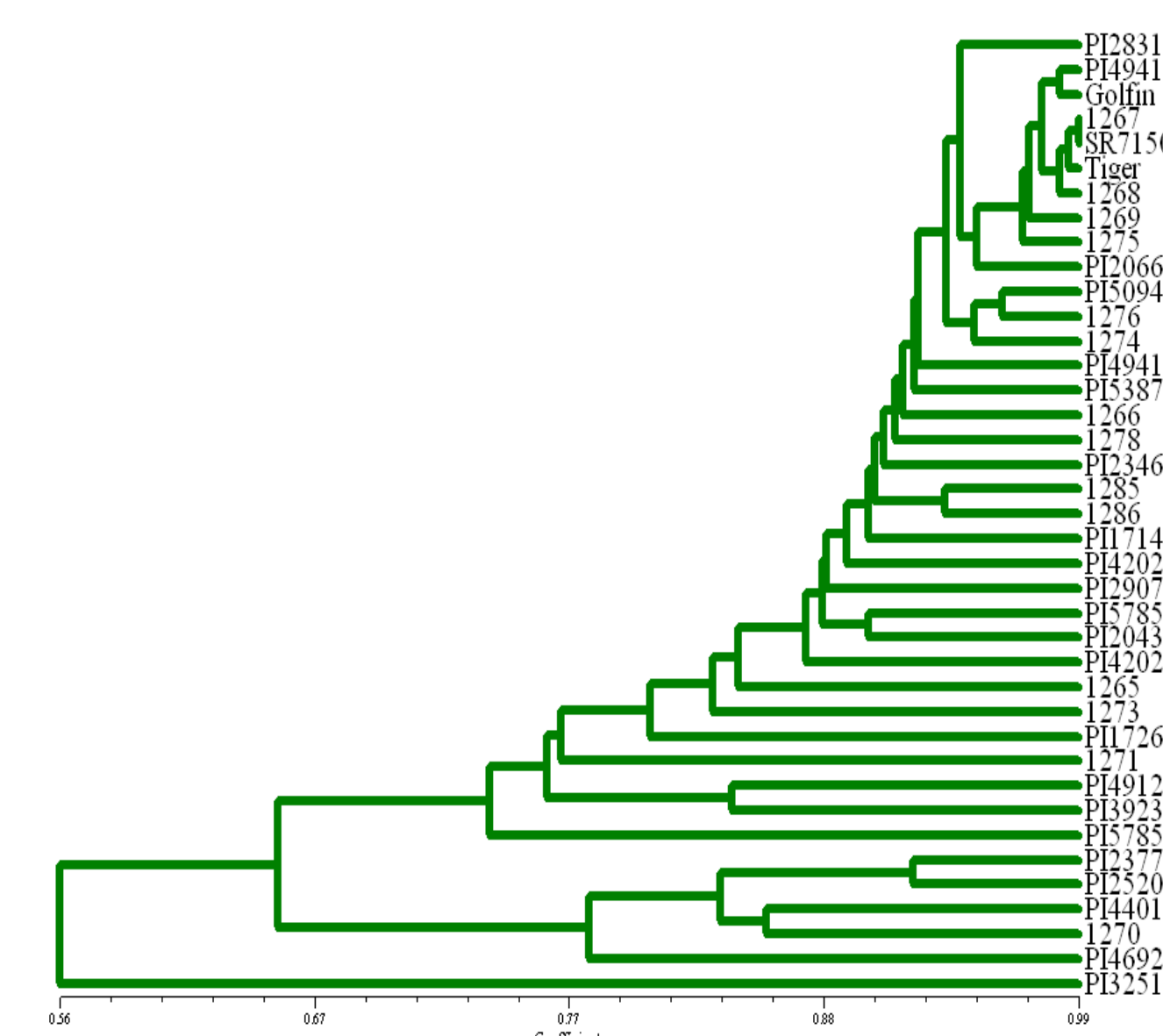


Fig. 3. UPGMA dendrogram of 39 accessions revealed by *PstI/MseI* AFLP markers

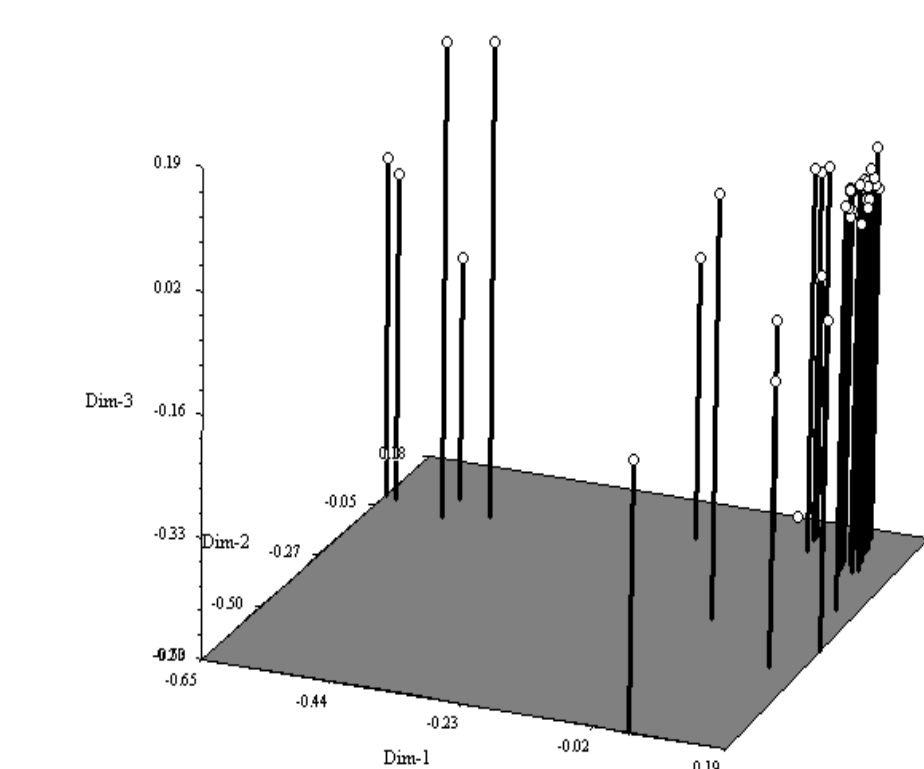


Fig. 4. Three-dimensional plot of principal component analysis with 128 amplified fragment length polymorphism markers and 39 colonial bentgrass accessions defining three groups marked as 1, 2, and 3 from the CPCA and plot options of NTSYS v. 2.1

Results

- A total of 181 unequivocally recognizable polymorphic bands were obtained from *EcoRI/MseI* AFLP analysis. The genetic similarity (Jaccard) coefficients (GS_j) ranged from 0.34 to 0.70 with a mean of 0.51. A dendrogram among 39 colonial accessions based on their cluster analysis of GS_j coefficients showed that no major ‘ball cluster’ was found (Fig. 2).
- 128 polymorphic bands were scored from *PstI/MseI* AFLP analysis. Values of GS_j ranged from 0.45 to 0.99 (Fig. 3). With CPCA subroutine programs of NTSYS, a rotated PCA with the AFLP markers as observations was used to determine the number of groups based on Eigen values. Three groups were formed with an average $GS_j = 0.63$ (Fig. 4).

Conclusions

- A high level of diversity in colonial bentgrass species was demonstrated with averages of 0.51 (*EcoRI/MseI*) and 0.63 (*PstI/MseI*)(GS_j).
- Greater genetic diversity was detected by *EcoRI/MseI* AFLP primer combinations because of genome region difference (hypermethylated vs. hypomethylated regions).
- A positive correlation ($r=0.44$, $p=0.0099$) between the two Jaccard similarity matrices was obtained by a Mantel test.

References

Belanger FC, Meagher TR, Day PR, Plumley K, Meyer WA (2003) Interspecific hybridization between *Agrostis stolonifera* and related *Agrostis* species under field conditions. *Crop Sci.* 43:240–246