RESUMEN

Panicum coloratum es una especie C_4 perenne originaria del Sur de África, que fue introducida a nuestro país en la década del 90´a partir de pocos eventos no debidamente registrados. A pesar de sus buenos atributos como forrajera ha sido escasamente difundida en los sistemas ganaderos. Sin embargo, existe hoy una tendencia a aumentar su uso debido a su potencial y a su adaptación a condiciones marginales que es donde se sitúa predominantemente la actividad ganadera en la actualidad. En los últimos años se han dado a conocer varios trabajos que estudian diversos aspectos del crecimiento y de la adaptación de la especie a estreses abióticos, a la vez que se han instituido planes de mejoramiento con el fin de obtener nuevos cultivares para afrontar la creciente demanda de esta especie. *P. coloratum* está constituida principalmente por dos variedades botánicas, var. *makarikariense* y var. *coloratum*. En esta tesis en particular se describe detalladamente las características morfo-fisiológicas de la var. *makarikariense* de una colección del INTA EEA Rafaela, y se la compara con una accesión de la var. *coloratum* de la misma colección. Esta información sumada a la caracterización de la variación molecular presente en la colección son de suma importancia para la conservación de los recursos genéticos presentes en la colección a la vez que resultan muy informativos para el planteo de estrategias a seguir en el programa de mejoramiento que se está siguiendo en INTA. En el desarrollo de esta tesis se trabajó con cinco accesiones, 15 materiales clonales y un material comercial de la var. *makarikariense* y una accesión de la var. *coloratum* que se estudiaron utilizando descriptores fenotípicos asociados a producción de forraje y semillas y marcadores moleculares ISSR y SSR. Se identificaron accesiones superiores en cuanto a su potencial forrajero y de producción de semillas, con rendimientos en algunos casos por encima del material comercializado en el país. La variabilidad genética encontrada por medio del uso de marcadores ISSR y SSR tanto dentro como entre accesiones, se visualizó a través de bandas y alelos únicos por accesión. Con respecto al material actualmente comercializado en el país, la variabilidad genética existente, nos indicaría que se trata de una población estabilizada que no ha sido objeto de procesos de selección definidos. La accesión de la var. *coloratum* fue diferenciada morfológica y genéticamente de la var. *makarikariense*,

detectándose loci y alelos que diferencian ambas variedades. La baja correlación entre la distancia morfológica y molecular indicaría que cada set de datos provee información diferente y complementaria para la caracterización y evaluación de los materiales. Dentro de la var. *makarikariense*, se encontraron accesiones que difieren entre sí y en sus niveles de diversidad, pudiéndose tratar de materiales que han sufrido algún proceso de diferenciación. La evaluación del número cromosómico y modo reproductivo de los materiales, mostró que se trataría de accesiones tetraploides. Por otra parte, la diferenciación en cuanto a la producción de mayor número de semillas llenas con respecto a vanas y la supervivencia diferencial de las plántulas cuando las semillas se obtienen bajo polinización libre en comparación a la autofecundación, asegura que se trata de una especie cuyo modo reproductivo preferencial es la alogamia. El análisis de test de progenie con marcadores SSR mostró que el 100% de la progenie presenta recombinación genética y el 83% presenta alelos paternos, lo que refuerza las evidencias sobre la naturaleza principalmente alógama de la especie. Las estimaciones de los componentes de varianza sobre familias de medias hermanas mostraron que más del 80% de la variación reside dentro de familias mientras que sólo una baja proporción de la variación estaría entre familias. Asimismo fue posible diferenciar entre familias de medias hermanas para varios de los caracteres evaluados. Se lograron hacer estimaciones de heredabilidad, aunque las mismas resultaron en general con valores moderados a bajos. Estas estimaciones se utilizaron para predecir ganancias genéticas a obtenerse después de un ciclo de selección con una presión del 15% en caracteres morfo-fisiológicos asociados a producción de forraje y semillas. Los métodos utilizados para estimar heredabilidad mostraron similar tendencia entre variables y una concordancia entre ellos, lo que nos indicaría que cualquiera de ellos sería un método apropiado para la estimación de estos parámetros. Se estudiaron relaciones entre caracteres, coheredabilidades y ganancias por selección indirecta entre rasgos relacionados que pudieran ser útiles en programas de selección. Estos resultados adicionan nuevos conocimientos sobre la diversidad genética, biología reproductiva y niveles de ploidía en materiales disponibles de *P. coloratum*, brindan información pertinente a la vez que abren nuevas perspectivas para el programa de mejoramiento de la especie lo que

permitirá la planificación y desarrollo de metodologías de cruzamientos y de utilización de los materiales para ser manipulados de forma práctica y eficiente.

ABSTRACT

Panicum coloratum is a perennial C_4 grass native from South Africa, that has been introduced to this country in the 90's in a series of not well documented events. Even though it is considered a good quality forage, it has not been extensively used in range cattle operations. However, its usage has been increased given its potential forage quality and its capacity to thrive in marginal environments, where the cattle rise operations are displaced today. In the last few years a series of papers showed several aspects of the growing system and the adaptation to several abiotic stresses and, at the same time, the number of breeding efforts in the country has arisen given the increasing interest in the species. *P. coloratum* is composed by two botanical varieties, var. *makarikariense* y var. *coloratum*. This thesis reports in detail morpho-physiological characteristics of the collection of var. *makarikariense* at INTA EEA Rafaela, and compares it with one accession of var. *coloratum* of the same collection. This information, plus the molecular characterization of the genetic resources present in the collection, are very interesting for the layout of new strategies to follow up in the breeding program that is going on at INTA. In the development of this thesis we worked on five accessions, 15 clonal materials and one commercial material of var. *makarikariense* plus one accession of var. *coloratum*. All the materials were described by means of phenotypic characteristics related to the forage and seed production and by molecular markers ISSR and SSR. Superior accessions regarding their forage and seed production potential were identified, with yields sometimes over the one of the material that is currently commercialized in the country. Both between and within accessions genetic variability was observed using ISSR and SSR markers, both bands and unique alleles per accession were found. Taking into account the genetic variability reported for the material that is currently commercialized in the country we propose that is a stabilized population that has not been through a clear process of breeding selection. The accession from var. *coloratum* was clearly differentiated from the variety *makarikariense* by means of loci and alleles not common between them. The slight correlation between the morphological and molecular distance shows that each data set

gives different and complementary information for the characterization and evaluation of the materials. Within var. *makarikariense*, it was possible to identify accessions that differ in their levels of genetic diversity, suggesting that they were materials that have gone through a process of differentiation. The evaluation of the chromosome number and the reproductive mode of the materials demonstrated that we are dealing with tetraploid accessions. On the other hand, the observed differentiation regarding the production of empty and full seeds as well the differential survival of seedlings resulting from seeds produced either under open pollination or selfing, reveals that the species reproduction is mainly by allogamy. The progeny tests performed with molecular SSR markers showed that 100% of the progeny went through genetic recombination and 83% present paternal alleles, which support the idea of outcrossing as the preferential mode of reproduction of the species. Variance components were estimated in an arrangement of half sib families and showed that more than 80% of the variation existed within families while only a small proportion of the variation was among families. In addition, it was possible to distinguish among half sib families for several characters. Estimations of heritabilities with moderate to low values were obtained. Heritability estimates were further used to predict genetic gains to be attained after one cycle of selection of 15% intensity in characters related to forage and seed production. Several methods were used to estimate heritability and all of them show the same trend so that any of them would be useful in parameter estimation under these conditions. Relationships among certain characters were studied and co-heritabilities estimated. Indirect genetic gains were calculated for characters that might be useful to implement in breeding programs. Overall, results add knowledge about genetic diversity, reproductive biology and ploidy levels in materials available at the collection of *P. coloratum* at INTA Rafaela. This information would be very useful for possible new outcomes and opens new perspectives for the developing of new breeding programs or the implementation of new crossing techniques to be used in a way practical and efficient.

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