

GENETIC VARIATION AMONG AND WITHIN FOUR *PHALARIS* SPECIES

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Objective

To determine the amount of genetic variation among and within four annual *Phalaris* species: *P. canariensis*; *P. minor*; *P. paradoxa*; and *P. angusta*, using five morphological traits.

Introduction

Canaryseed (*P. canariensis*) is the only cultivated annual *Phalaris* species in Canada. Western Canada is a major world producer and exporter of canaryseed, which is grown for bird feed. This crop can potentially be grown for human consumption due to its high protein content. Only two canaryseed cultivars are commercially available and no attempt has been made to develop new cultivars.

Determining genetic variability among and within *Phalaris* species will enable plant breeders to select the breeding method through which cultivated canaryseed can be improved.

Materials and methods

118 accessions of four annual *Phalaris* species were studied. Five individuals per accession were grown in 15 cm pots. The accessions were evaluated in two greenhouse experiments. Growing conditions for the first experiment were 23°C (day) and 17°C (night), a 16 h photoperiod with a light intensity of 144 $\mu\text{mol m}^{-2} \text{s}^{-1}$. The second experiment had a temperature of 24°C (day) and 18°C (night), a 18 h photoperiod with a light intensity of 250 $\mu\text{mol m}^{-2} \text{s}^{-1}$. Pots were randomized every two weeks to limit positional effects.

Morphological data was collected for plant height, panicle length and width, and caryopsis length and width. An analysis of variance and an unpaired t-test were performed on all traits.

Results

The analysis of variance indicated that environment had a significant effect on plant height, and caryopsis width. Species differed significantly for all traits. A significant accession within species interaction was observed for all traits, except panicle width. A significant species x environment interaction for panicle length and width, and caryopsis length was observed. However, these were non-crossover interactions; consequently, no changes in ranking was observed for these traits. (Table 1)

An unpaired t-test indicated that means for each trait were significantly different for each species, except caryopsis length in *P. minor* and *P. paradoxa* (Table 2).

Range values indicated that variability within species existed for height and panicle length. Variability for the other traits was limited (Table 3).

Table 1. Levels of significance for five traits of four Phalaris species grown in two green house experiments.

Source of variation	Height	Panicle length	Panicle width	Caryopsis length	Caryopsis width
Environment	**	NS	NS	NS	**
Species	*	*	*	**	**
Accession within species	**	**	NS	*	**
Species x Environment	NS	**	**	**	NS

*, ** Significant at the **0.05** and 0.01 levels of probability, respectively.

Table 2. Means of five traits of four Phalaris species grown in two greenhouse experiments.

Species	N	Height (cm)	Panicle length (cm)	Panicle width (cm)	Caryopsis length (mm)	Caryopsis width (mm)
<i>canariensis</i>	48	77.93 c	3.21 d	1.26 a	4.17 a	1.69 a
<i>minor</i>	48	86.99 b	4.82 c	1.07 b	2.39 b	1.33 b
<i>paradoxa</i>	19	65.93 d	5.87 b	0.86 c	2.41 b	1.04 c
<i>angusta</i>	3	96.07 a	8.15 a	0.77 d	1.57 c	0.76 d

N, number of accessions

a-d Values for each trait, followed by the same letter are not significantly different at P=0.01, based on an unpaired t-test.

Table 3. Ranges of five traits of four Phalaris species grown in two greenhouse experiments.

Species	N	Height (cm)	Panicle length (cm)	Panicle width (cm)	Caryopsis length (mm)	Caryopsis width (mm)
<i>canariensis</i>	48	48.5	1.4	0.4	0.9	0.6
<i>minor</i>	48	80.4	4.0	0.5	0.6	0.5
<i>paradoxa</i>	19	72.1	4.2	0.5	0.7	0.2
<i>angusta</i>	3	6.2	1.1	0.2	0.2	0.2

N, number of accessions

Discussion

The limited variation within *P. canariensis*, and the large extent of variation among species indicates that improvement may have to rely on interspecific hybridization. This has limited potential in the short term due to reproductive barriers. Thus, these limitations will force plant breeders to use metagenesis to improve *P. canariensis*

Conclusion

The five morphological traits tested indicated that genetic variation was greatest among species, and limited within species.