Seed Size and Shape and Lemma Color Polymorphism in *Oryzopsis hymenoides* (Roem. & Schult.) Ricker[1]

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Abstract

Production of seed polymorphisms on different plants within a population is a common feature of Indian ricegrass [*Oryzopsis hymenoides* (Roem. & Schult.) Ricker], especially in the southern and eastern Great Basin region of the western U.S.A. Small elongate morphs were about twice as frequent and small globose morphs half as frequent in the Montane province as in the 384-morph overall sample, which encompassed an area from Alberta to Arizona and Washington to Colorado in western North America.

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Introduction

The distribution of Indian ricegrass extends form the Nebraska, U.S.A. sandhills west to the eastern slopes of the Cascade and Sierra-Nevada ranges and from Mexico to Canada at elevations up to 3,000 m (Booth et al., 1980). It is the dominant perennial grass of the low-elevation salt desert range of the sagebrush (*Artemisia*) vegetation zone (Young and Evans, 1984). Seed polymorphism has been recognized since Huntamer (1934) reported that a Washington, U.S.A. seed source included "small dark" and "large dark" seeds borne on separate plants. The observation of greater dormancy or a greater requirement for acid scarification in large seeds suggested a relationship between seed size and germination response both within individual populations (Huntamer, 1934; Shaw, 1976; Young and Evans, 1984) and among populations from a wide geographical area (Stoddart and Wilkinson, 1938' Toole, 1940). However, Plummer and Frischknecht (1952) found no association between seed dormancy and seed size. Zemetra and Cuany (1984) found that lemma thickness better indicated the need for acid scarification than seed size. Our objective was to determine where the various polymorphisms are more commonly geographically located. This information should be useful when the ecological significance of seed polymorphism is better understood.

Materials and Methods

The 318 accessions examined were collected from Slave Lake, AB, Canada south to Kingman, AZ, U.S.A. and from Goldendale, WA, U.S.A. east to LaJunta, CO, U.S.A. Conspicuous polymorphisms were separated and categorized by seed size (small, large or jumbo), seed shape (predominantly globose, elongate or mixed), and lemma color (brown, amber or beige). Collections were classified according to land resource region (LRR) and major land resource area (MLRA) based on USDA-SCS (1981) or ecoregion based on Strong and Leggat (1992). From these classifications 4 provinces and 11 subprovinces were delineated (Fig. 1). Provinces were num-

Table 1. Seed morphs of 318 Indian ricegrass accessions from 11 subprovinces.

					Seed size and shape				
	LRR/MLRA or			P'morphic	Small			Large	Jumbo
Subprovince description	AB Ecoregion†	Acc's	Morphs	Acc's	Elongate	Mixed	Globose	Globose	Globose
		no.		%	% of morphs				
1A N.W. Columbia River Drainage	B6-8,10	6	7	17	29	57	0	14	0
1B S.E. Columbia River Drainage	B11,13	5	5	0	0	0	20	80	0
2A N.W. Great Basin	D24-27	27	29	7	45	24	24	3	3
2B S.E. Great Basin	D28A,28B,29	91	122	34	23	20	27	24	6
2C Wyoming Basin, Colorado Plateau	D32,34-37,39	103	125	18	16	29	18	30	7
2D Mojave Desert	D30	10	10	0	20	30	40	10	0
3A Wasatch, Uinta, N. Rocky Mtns.	E43,47;AB 5	30	34	13	50	18	6	26	0
3B S. Rocky Mtns.	E48A,48B,49,51	29	34	15	53	21	12	6	9
4A Canadian Parkland, Forest	AB 4,11	4	4	0	75	25	0	0	0
4B N.W. Great Plains	G58A;AB 1,2,3	8	8	0	38	25	38	0	0
4C S.W. Great Plains	G69,70;H77	5	6	20	0	0	33	33	33
Total		318	384	21	28	24	21	22	6

†LRR = land resource region, MLRA = major land resource area, AB = Alberta.

bered from west to east: 1 Columbia River drainage, 2 Basin and Range, 3 Montane and 4 Eastern; and subprovinces were lettered from north to south: A, B and sometimes C and D. Frequencies of morphs between provinces and subprovinces within a province were compared using the x^2 statistic.

Results and Discussion

Twenty-one % of the 318 accessions examined displayed conspicuous polymorphism in seed size or shape or lemma color (Table 1). Additional accessions may be polymorphic, but these were not obviously so and were not considered as such here. Thus our estimates of polymorphism are likely conservative. Province 2B (S.E. Great Basin) had the highest percentage of polymorphic accessions (34%). Most morphs were small (72%) with significant minorities of large (22%) and jumbo (6%). Large morphs were found in all subprovinces except 4A and 4B, the northeastern portion of the species' distribution. Jumbo morphs were found in several subprovinces. The Montane province (3) was significantly different ($P<0.01$) from the overall mean of the 384-morph sample with about double the frequency of small elongate morphs and about half the frequency of small globose morphs. None of the other provinces differed from the overall sample. The northern and western portions of the Great Basin (subprovince 2A) had twice the small elongate but only one-seventh the large morphs as the Basin and Range province (2) ($P<0.05$). The southwestern Great Plains (subprovince 4C) had no elongate morphs but three times the number of large and jumbo morphs as the Eastern province (4) ($P<0.10$). Then morphs (3%) examined were amber in lemma color, 4 from subprovince 2B (S.E. Great Basin) and 6 from 2C (Wyoming Basin, Colorado Plateau). Two morphs (1%) were beige, 1 each from 2B and 2C. Both amber and beige morphs were always found together with the typical brown-colored lemmas (97%).

We have found a positive correlation between seed dormancy and seed size polymorphism. For example, T-593 (Star Lake, NM) includes small elongate (low dormancy), small globose (moderate dormancy) and jumbo (high dormancy) morphs. This suggests that natural selection has operated simultaneously in different directions to generate morphs of varying levels of seed dormancy. The high degree of self-pollination in Indian ricegrass (Jones and Nielson, 1989) maintains the distinctive morphs. This within-population diversity in seed dormancy may help the seed bank against variable environmental conditions.

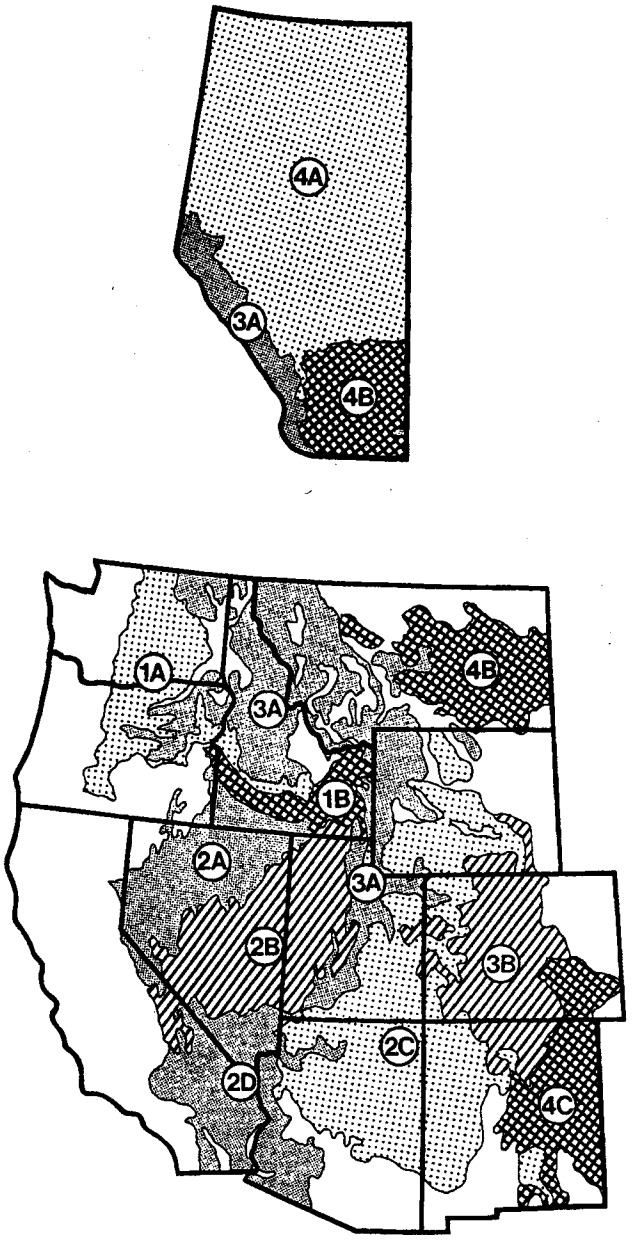

Figure 1. Four provinces and 11 subprovinces in Albert, Canada (above) and the United States (below), derived from Strong and Leggat (1992) and USDA-SCS (1981), where seed collections of Indian ricegrass originated.

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