

HYBRIDIZATION AND INTROGRESSION BETWEEN *ELYMUS CANADENSIS* AND *ELYMUS VIRGINICUS* (POACEAE)

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Sympatric populations of *Elymus canadensis* and *Elymus virginicus* in southcentral Oklahoma revealed numerous plants with intermediate morphology, thus suggesting hybridization and introgression of the two species. Eight characters of the inflorescence, glumes, and lemmas of 140 plants were measured and the variation patterns analyzed. Analysis suggests individuals identifiable as *E. virginicus* var. *glabriflorus* and F₁ hybrids or backcrossed and introgressed types.

INTRODUCTION

Familiar in Oklahoma are populations of *Elymus canadensis* L. and *Elymus virginicus* L., which are distributed throughout the state. *Elymus canadensis* (Canada wildrye) generally occurs in prairies and disturbed sites, while *E. virginicus* (Virginia wildrye) is found in woods or at wood margins. The two species are ordinarily readily distinguishable in the field and differ in features of the inflorescence, supporting peduncle, glumes, and lemmas. The nodding two-sided spike of *E. canadensis* is borne on a peduncle 45-60 cm long. At each node of the rachis, there are two or three spikelets each with two or three florets. The glumes are narrowly lanceolate, long awned, straight, flat at the base, not indurate, and 2.5-4.5 cm long (Figure 1A). A number of varieties have been described, primarily on the basis of the glume and lemma awn features. In the taxon *E. virginicus*, an erect spike terminates a rather short peduncle, 10-25 cm long and again there are two or three spikelets per rachis node with each spikelet having two or three florets. The glumes are generally shorter, 2-3 cm long, distinctly bowed, generally yellowish, definitely indurate, and markedly terete at the base (Figure 1B). Variation within *E. virginicus* is much more complex.

Frequently these two perennial species occur together, often along highway rights-of-way. In such populations, some plants are readily identifiable as either *E. canadensis* or *E. virginicus*. Other plants are intermediate, but usually can be identified as one of the varieties or forms of *E. virginicus*. Other immediate plants cannot be identified with certainty.

In the summer of 1975, a number of such populations were observed in southern Oklahoma near the University of Oklahoma Biological Station on Lake Texoma. Two of these populations were subsequently studied in an attempt to determine if interspecific hybridization was occurring between *E. canadensis* and *E. virginicus*. The results and interpretations of this study are presented below.

METHODS

One flowering culm from each of 50 randomly selected tufts of *Elymus* were collected from a population in southern Marshall County (R4E, T7S, Sec 13, NM¹/₄; 500 m W of Briar Cr bridge on Powell Rd; along a borrow ditch and fence-row). The population comprised several hundred individuals; the majority were intermediate, and distinct subpopulations of *E. canadensis* or *E. virginicus* could not be discerned. A second large population with three distinct subpopulations was sampled in the same area (R5E, T7S, Sec 18, SW¹/₄; 100 m W. of OK Hwy 99 on Powell Rd; along a borrow ditch). Culms were collected from 30 randomly selected plants in each subpopulation. The subpopulations were composed of individuals readily identifiable as *E. canadensis*, *E. virginicus* var. *virginicus*, and *E. virginicus* var. *glabriflorus*. Voucher specimens were deposited in the Oklahoma State University Herbarium (OKLA).

Eight features of each culm were examined. They included number of nodes, length of each successive internode below

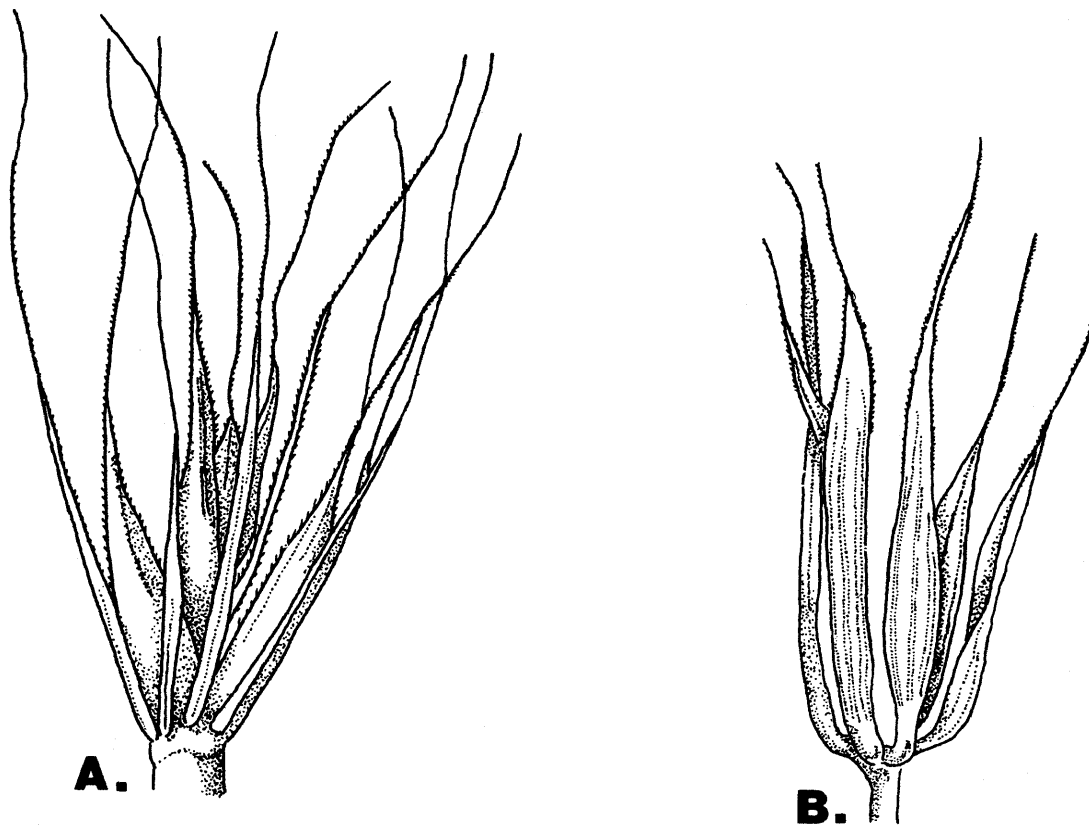


FIGURE 1. Morphology of *Elymus* spikelets. A. *Elymus canadensis* spikelet showing straight, narrowly lanceolate glumes. B. *Elymus virginicus* spikelet showing bowed glumes with terete bases.

the peduncle, peduncle length, spike length excluding the lemma awns, glume width, glume length including the awn, lemma length excluding the awn, and lemma awn length. Width and length values employed were the average of three (glume) or five (lemma) measurements; the organs being selected from spikelets in the middle of the spike.

Of the eight characters examined, two — node number and internode length — exhibited little contrast and thus were of no discriminatory utility. They were omitted from subsequent analyses. The other six characters did vary considerably. For each, morphological classes were established and symbols designated for each class. The variation of these characters within the two populations was expressed by means of pictorialized scatter diagrams (1, 2).

RESULTS AND DISCUSSION

The variation in the morphological characters examined for each culm and each population is presented in Figures 2 and 3. Figure 2 depicts the population with three distinct subpopulations. Individuals with longer awns and peduncles are readily identifiable as *E. canadensis* and appear to be relatively homogeneous genetically. Individuals with shorter awns and peduncles are *E. virginicus* var. *virginicus* and also show a high degree of homogeneity as revealed by the rather tight cluster. The intermediate individuals are identifiable as variety *glabriflorus* and may represent F_1 hybrids.

In contrast, the scatter diagram of the large population without distinct subpopulations (Figure 3) exhibits a continuum of variation from strongly canadensoid individuals in the upper right corner to strongly virginicoid individuals in the lower left. Even those individuals which are strongly virginicoid possess some features of *E. canadensis*. We suggest that this population is a hybrid swarm of parental *E. canadensis* individuals, a few F_1 hybrids,

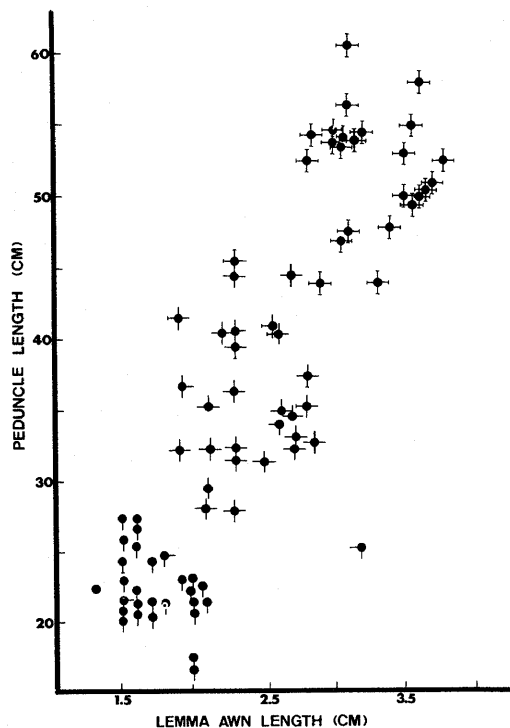


FIGURE 2. Scatter diagram of *Elymus* population with three distinct subpopulations. Character classes are designated: glume length (mm), 10-19 = ●, 20-29 = ◐, 30-39 = ◑; lemma length (mm) 6-8.5 = ●, 9-11 = ◐, 12-14 = ◑; glume width (mm), 1.9-1.5 = ●, 1.4-1.0 = ◐, 0.9-0.5 = ◑; spike length (cm), 6.5-9.5 = ●, 9.6-13.0 = ◐, 13.1-16.5 = ◑.

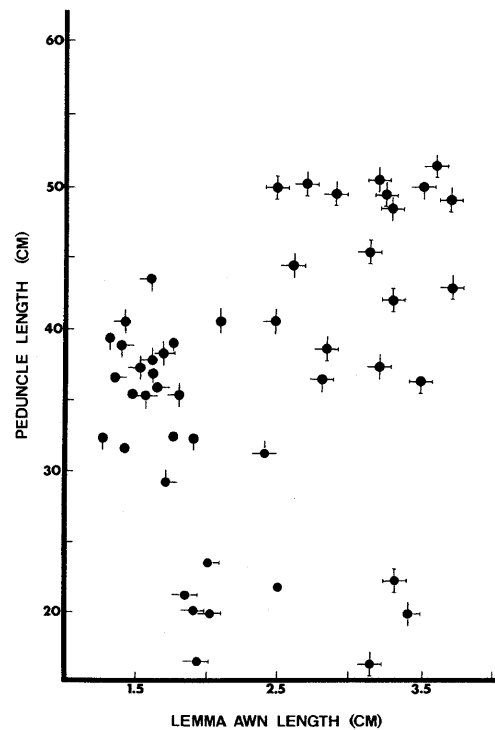


FIGURE 3. Scatter diagram of large *Elymus* population without distinct subpopulations. Character classes are designated: glume length (mm), 10-19 = ●, 20-29 = ◐, 30-39 = ◑; lemma length (mm), 6-8.5 = ●, 9-11 = ◐, 12-14 = ◑; glume width (mm), 1.9-1.5 = ●, 1.4-1.0 = ◐, 0.9-0.5 = ◑; spike length (cm), 6.5-9.5 = ●, 9.6-13.0 = ◐, 13.1-16.5 = ◑.

and numerous backcrossed or segregating individuals. These putative F_1 's and backcrosses fall within the taxonomic circumscription of *E. virginicus* in the broadest sense.

These data present additional evidence that hybridization between *E. canadensis* and *E. virginicus* frequently occurs, with some of the varieties of the latter having been established through introgression of genes from *E. canadensis* and other species (3). Naturally occurring populations exhibiting similar patterns of variation have been discovered in Iowa and Texas (4, 5). Artificial hybrids exhibit intermediate morphologies similar to those of the putative natural hybrids (3, 5, 6). In addition, both *E. canadensis* and *E. virginicus* hybridize with other species of the genus (5, 6, 7, 8). Although the two taxa cross freely and the F_1 's are vigorous, fertility of the hybrids is low, ranging from 0-15% (3, 4, 5).

Hybridization and introgression therefore appear to be major factors of the complex variation pattern exhibited by *E. virginicus* and *E. canadensis*.

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