Reproductive Mode of Apomixis in National Plant Germplasm System *Poa* Accessions

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Introduction

Apomixis is widespread among *Poa* (the bluegrasses) and creates a breeding barrier to move novel traits from various *Poa* species into the commonly used *Poa pratensis*. However, if apomixis is harnessed correctly it is a desirable trait because it creates uniformity in progeny and maintains genotypes. Flow cytometry methods developed by Matzyk et al (2000) identify reproductive methods by measuring ploidy levels in seeds. A greater knowledge of the presence of apomixis in *Poa* will assist breeding programs and possibly lead to the genetic control of apomixis.

Reproductive methods were determined by the ratios of the embryo and endosperm peaks.

- Sexual reproduction and double fertilization result with a 2C embryo and a 3C endosperm (figure 1).
- During pseudogameous apomixis the egg cell and both polar cells are unreduced.
- A sperm fertilizes the united polar cells resulting in a 2C embryo and a 5C endosperm.
- During autonomous apomixis embryogenesis takes place with out the sperm cell and a 2C and 4C peak are formed.

Methods

Poa species were collected from the National Plant Germplasm System from warmer and drier climates.

* 40-60 seeds chopped in nuclei extraction buffer, filtered, and stained with DAPI-CyStain ® UV Precise P.

* Cells were analyzed for relative DNA content using a Partec PA-II Flow Cytometer with an HBO (ultraviolet light source) lamp.

•The mean value of the various peaks were divided by each other to determine the ratio and nucleic content of the embryo an endosperm

- •Example of sexual (peak 2) / (peak 1) = 1.5
- •Example of apomictic (peak 2) / (peak 1) = 2.5

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Center for Water-Efficient Landscaping

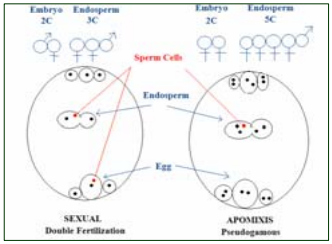

Figure 1. Diagram of egg and endosperm development during sexual reproduction and apomixis in *Poa*

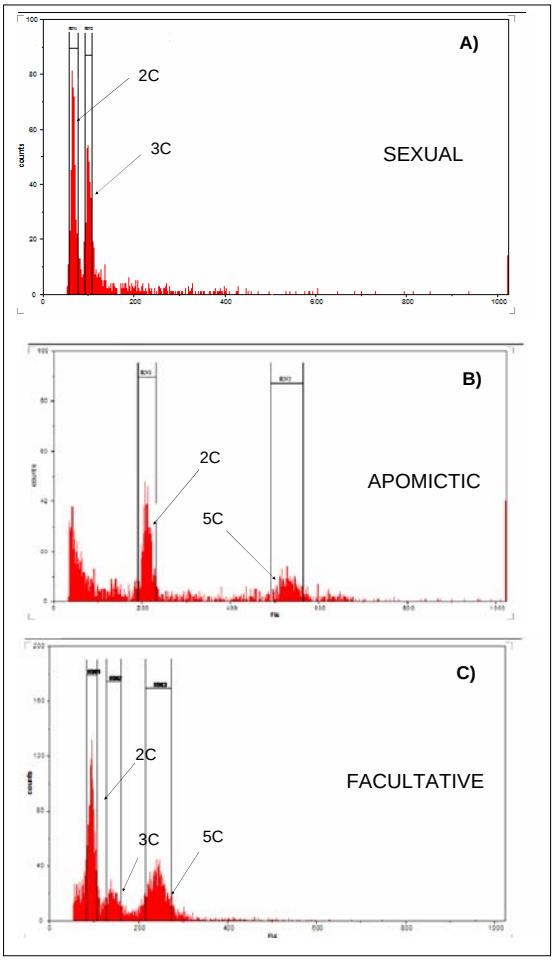

Figure 2a-2c. Flow Cytometry results of a) sexual species b) apomictic species and c) facultative apomictic species (both). Ratios of peak means are used to determine embryo and endosperm composition.

Poa species	Location	C values	Repoductive method
attenuata W94081	Mongolia		facultative
attenuata X93117	Xinjiang, China		apomicitic
arachnifera TX 46-90	Texas, United States		sexual
arachnifera TX 4-88	Texas, United States		sexual
arida RENO	Kansas, United States		sexual
bactriana	Iran	2+4	apomictic
binata 2147	South Africa		facultative
chaixii	Greece		apomictic
compressa	Yugoslavia		sexual
compressa	Turkey		facultative
compressa	Turkey		apomictic
compressa	Argentina		facultative
compressa	Ontario, Canada		apomictic
compressa	Ontario, Canada		apomictic
densa 69	Iran		facultative
diversifolia	Turkey		sexual
erinacea	Argentina		apomictic
glauca 22	Turkey		apomictic
glauca 462	Iran		facultative
hybrida	Greece		facultative
iberica S-301	Stavropol, Russian Federation		sexual
interior	Canada		apomictic
lanuginosa	Argentina		sexual
lanuginosa	Argentina		sexual
nemoralis CPI 22319	Former Soviet Union		apomictic
nemoralis	Yugoslavia		apomictic
nemoralis	Turkey	2+3+5+6	apomictic
nemoralis	Turkey		apomictic
nemoralis	Turkey		apomictic
nemoralis	Czech Republic		apomictic
nervosa	United States	2+4	apomictic
nervosa	AZ,CA,CO,ID,UT,WY		apomictic
palustris X97-027	Xinjiang, China		facultative
palustris 1714	Former Soviet Union		apomictic
palustris	Yugoslavia		apomictic
palustris	Yugoslavia		facultative
palustris	AZ,CA,CO,ID,UT,WY		apomictic
palustris 96S-28	Mongolia	2+3+4	sexual
psilolepis TP00-01-004	Xinjiang, China		apomictic
secunda	Maryland, United States		apomictic
secunda	AZ,CA,CO,ID,UT,WY		sexual
secunda	United States	2+6	unknown
secunda	AZ,CA,CO,ID,UT,WY		apomictic
sibirica 1669	Former Soviet Union		facultative
sieberiana	Austr. Capital Terr., Australia		sexual
sieberiana	Austr. Capital Terr., Australia		sexual
sieberiana	Western Australia, Australia	2+3+4	sexual
sinaica	Iran		sexual
sinaica	Afghanistan		sexual
sterilis	Iran		apomicitic
sterilis	Iran		apomictic
sterilis	Iran		apomictic
sterilis	Iran	2+4+5	apomictic
sterilis	Afghanistan		apomictic
sterilis	Turkey		apomictic
subfastigiata E94241	Mongolia		sexual
trivialis	Iran		sexual
trivialis	Turkey		sexual

Table 1. Sampled *Poa* species collection locations and flow cytometry results