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Parthenogenetic capability of three species in *Poa pratensis* L. aggregation

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ABSTRACT Parthenogenesis, as an asexual reproductive method gives rise to a new prospect in agricultural production: the opportunity to establish genetically stable, seed-propagating clones of crops, which can perpetuate themselves across countless sporophytic generations. Apomictic processes of *Poa pratensis* has been extensively discussed by several studies. We studied the parthenogenesis capability of species in *Poa pratensis* L. aggregation collected from seminatural habitats by auxin-test. The article presents that this asexual mode of reproduction occurs in two other species of the *Poa pratensis* group, in *Poa angustifolia* and *Poa humilis* too. The results add more information to the reproductive behavior of these *Poa* species and could be useful in plant breeding. **Acta Biol Szeged 49(1-2):147-148 (2005)**

KEY WORDS

Poa species
apomixis
parthenogenesis
auxin-test

The examined three species of *Poa pratensis* L. aggregation are widely used for forage and turf (*Poa angustifolia* L., *Poa humilis* Ehrh. Ex. Hoffm., and specially *Poa pratensis* L.). Most of the existing varieties of *Poa pratensis* originated as individual apomictic plant selections collected from natural habitats. *Poa pratensis* reproduces mainly aposporous apomixis (Müntzing 1940). Aposporous apomixis is functionally composed of two processes: apospory and parthenogenesis (Albertini et al. 2001a). Apomixis were found at this species to be under strong genetic control, that is it dominant over the obligatory fertilization (Matzk 1991b; Barcaccia et al. 1997; 1998; Albertini et al. 2001a, 2001b). It has potential for agriculture but methods to manipulate apomixis are needed for future greeding progress (Matzk et al. 1997, 2003; Barcaccia et al. 1997, 1998; Albertini et al. 2001a,b).

The great morphological plasticity of these grass species is the response to the environmental variation (Keeler and Davis 1999; Kiss et al. 2000; K Szabo et al. 2004). The high versatility of the mode of reproduction and the retention of a pollen recognition system are the factors responsible for the extreme complexity of the genome in *Poa pratensis* group (Porceddu et al. 2002). By auxin-test, individuals of *Poa pratensis* can be classified rapidly and reliably as to whether they are capable or incapable of parthenogenesis (Matzk 1991a). We studied the parthenogenesis capability in the populations of three species in *Poa pratensis* L. aggregation collected from seminatural habitats.

Materials and Methods

The samples of the three species (*Poa pratensis*, *Poa angustifolia*, *Poa humilis*) poplulations were collected from different habitats nearby the following settlements in East Hungary:

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P. pratensis: Bagamér: 1., 2. populations (*Astragalo-Festucetum*), Hajdúbagos: 3., 4. populations (*Caricetum acutiformis*), Mikepércs: 5., 6. populations (*Agrostio-Alopecuretum*); *P. angustifolia*: Martinka: 1., 2. populations (*Poëtum angustifoliae*), Zsáka: 3., 4. populations (*Agrostetum albae*), Hajdúbagos: 5., 6. populations (*Astragalo-Festucetum*); *P. humilis*: Józsa: 1., 2. populations (*Cynodonti-Poëtum angustifoliae*), Pallag: 3., 4. populations (*Trifolio-Lolietum*), Mikepércs: 5., 6. populations (*Lolietum perennis*).

The plants were grown in experimental field from April 2005 to June 2005.

For identification of plants being either incapable or capable of parthenogenesis, auxin-test is used (Matzk 1991a, 1991b). It is based on the finding that in Poaceae a simple application of synthetic auxins at anthesis induces grain formation without fertilization. Both the embryo and the endosperm are weekly developed and without function in such auxin-induced caryopses of obligate sexual plants. Apomictic plants, however, form caryopses with differentiated embryos and without endosperms (Matzk 1991a, 1991b). The auxin were applied by spraying panicles and leaves and dipping inflorescens into, aqueous solutions of 2,4-Dichlorophenoxy acetic acid (2,4-D) in concentrations of 100 ppm 1 or 2 days before anthesis.

About 15 days after anthesis the developing caryopses were examined under a dissecting microscope. A hundred grains without endosperms were analysed per population. Grains with embryo and endosperm, being the result of fertilization, were left out from analyses. For statistics Tukey-test was used.

Results and Discussion

In populations of *P. pratensis*, *P. angustifolia*, *P. humilis* the

Table 1. Degree of embryo differentiation as % of grains without endosperm.

	Poa prat.						*Poa hum.*						*Poa ang.*					
population	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
embryo %	94	98	80	71	0	21	8	0	20	0	8	14	54	88	0	0	0	2

Table 2. Result of Tukey-test on species parthenogenetic capacity.

(I) SPECIES	(J) SPECIES	Mean Difference (I-J)	Std. Error	Sig.	99% Confidence Interval	
					Lower Bound	Upper Bound
1	2	52.333	18.711	0.034	-11.650	116.316
	3	36.666	18.711	0.156	-27.316	100.650
2	1	-52.333	18.711	0.034	-116.316	11.650
	3	-15.666	18.711	0.686	-79.650	48.316
3	1	-36.666	18.711	0.156	-100.650	27.316
	2	15.666	18.711	0.686	-48.316	79.650

grain formation without fertilization was induced by applying 2,4-D. The results show the sensitivity of these species to the 2,4-D at the applied concentration. The results of treatments are summarized in Table 1.

There were no significant differences between the species considering the number of mature embryos after treatment with 2,4-D ($p=0.01$; Table 2).

Grains with mature embryos without endosperms are found only in plants with genetically established parthenogenesis (Matzk 1991a). Our data indicate that these close relative species have similar genetic inheritance considering capability of this apomictic reproductive type. The development of apomictic processes in *Poa pratensis* have been extensively discussed by several author (Pessino et al. 1999; Matzk et el. 2000). However this article presents that this asexual mode of reproduction occurs in two other species of the *Poa pratensis* group, in *Poa angustifolia* and *Poa humilis* too. These results add more information about the reproductive behavior of these *Poa* species.

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