Comparison of androgenesis efficiency of winter wheat and winter triticale genotypes studied by use of anther culture technique

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INTRODUCTION

Plant breeding aims to develop new cultivars, more fertile, resistant to diseases and with improved end use characteristics. Successful plant regeneration from cells, tissues and organs is one of the important steps in the application of biotechnology to agronomic traits improvement and among those quality and disease resistance to biotic and abiotic stresses. Inbred lines production in Triticeae with the conventional breeding procedure is a difficult and time consuming task. In cereals it may take 10 to 12 years to develop a new cultivar. Wheat and triticale are most common species of food and feed crops and it is a fundamental nutrient source of human calories worldwide. Researchers still strive to optimize the callus induction procedures and efficiency of plant regeneration for these species.

OBJECTIVE

The main goal of the study was to support conventional methods of breeding using the biotechnology tools, androgenesis to obtain doubled haploid plants (Figure 1.).
The present work aimed to compare androgenesis efficiency of winter wheat and triticale lines.

Figure 1. A. Pollen grains of various developmental stages B. *In vitro* culture of anthers. C. Plant

MATERIALS

Six wheat genotypes and their F1 diallel crosses (n_w=18), seven triticale lines and their F1 diallel crosses (n_t=22) were investigated. In total, the parental cultivars and F1 crosses constituted 53 genotypes studied (Table 1.)

Table 1. Wheat and triticale cultivars using for cross

WHEAT CULTIVARS	TRITICALE CULTIVARS
Arkadia	Algoso
Astoria	Borowik
Bamberka	Borwo
Muza	Cyrkon
Ostroga	Meloman
Wydma	Tomko
	Panteon

ANDROGENESIS PROCEDURES

1. Pre-treatment of spikes in darkness (4°C ± 2°C) for 21 days
2. Spikes sterilization using 70% ethanol and 5% sodium hypochlorite.
3. Isolation of anthers from spikes and transfer on the surface of induction media (Figure 2.).
4. Incubation of plates with anthers in the dark (25°C ± 2°C) for 6-8 weeks.
5. Transfer the explants with calli on regeneration medium.
6. Analysis of the androgenesis efficiency.

Figure 2. Anther isolation from spikes

RESULTS AND SUMMARY

All studied genotypes gave rise to embryogenic callus, out of which 25 plants were regenerated. Results showed significantly higher efficiency of callus induction and plant regeneration for cultivars and F1 hybrids of winter triticale. Triticale anthers that developed embryogenic calli ranged from 0.22 for DH112 to 12.51 for DH62, while for winter wheat genotypes rate of anthers forming embryogenic callus was lower (ranged 0.06-2.49). Plants were regenerated for 21 triticale lines and only for 4 wheat genotypes (Table 2.).

It is to conclude, that wheat lines used in this study showed lower ability to regenerate plants from anthers plated in *in vitro* culture. In the future work an effort will be undertaken to improve the androgenesis efficiency for this species.

Table 2. Androgenesis efficiency for triticale and wheat

Triticale cultivar	No of anthers inoculated	No of calli produced	No of plants	Trait CA/100 A	Trait GR/100 A
DH56	1936	54	9	2,79	16,67
DH57	2946	191	53	6,48	27,75
DH58	2501	114	8	4,56	7,02
DH59	2359	31	-	1,31	-
DH60	3295	190	45	5,77	23,68
DH61	2199	275	74	12,51	26,91
DH62	2921	85	9	2,91	10,59
DH63	4356	117	16	2,69	13,68
DH64	3127	44	4	1,41	9,09
DH65	2944	86	-	2,92	-
DH66	2244	41	3	1,83	7,32
DH67	2712	59	11	2,18	18,64
DH68	2165	41	-	1,89	-
DH69	1383	63	13	4,56	20,63
DH70	806	8	8	0,99	100,00
DH71	2470	76	10	3,08	13,16
DH72	1061	15	-	1,41	-
DH73	874	15	-	1,72	-
DH74	1988	74	1	3,72	1,35
DH75	2608	50	-	1,92	-
DH76	3353	41	1	1,22	2,44
DH77	1712	30	4	1,75	13,33
DH78	3559	146	-	4,10	-
DH79	2120	28	1	1,32	3,57
DH80	2311	28	1	1,21	3,57
DH81	2311	36	4	1,56	11,11
DH82	2170	33	-	1,52	-
DH111	2489	20	1	0,80	5,00
DH112	2320	5	1	0,22	20,00
MEAN	**69240**	**1996**	**277**	**2,77**	**12,26**

Wheat cultivar	No of anthers inoculated	No of calli produced	No of plants	Trait CA/100 A	Trait GR/100 A
DH83	3488	22	-	0,63	-
DH84	4280	54	-	1,26	-
DH85	2920	18	-	0,62	-
DH86	3772	52	-	1,38	-
DH87	4641	66	-	1,42	-
DH88	4905	14	-	0,29	-
DH89	5740	18	-	0,31	-
DH90	4220	60	-	1,42	-
DH91	4733	118	-	2,49	-
DH92	3896	14	-	0,36	-
DH93	5445	44	-	0,81	-
DH94	5084	76	-	1,49	-
DH95	2771	29	1	1,05	3,45
DH96	4695	63	-	1,34	-
DH97	3851	44	-	1,14	-
DH98	3474	85	1	2,45	1,18
DH99	3881	20	-	0,52	-
DH100	2716	5	1	0,18	20,00
DH101	4188	27	-	0,64	-
DH102	3481	9	1	0,26	11,11
DH103	2720	44	-	1,62	-
DH104	3349	2	-	0,06	-
DH105	3945	92	-	2,33	-
DH106	5905	78	-	1,32	-
MEAN	**98100**	**1054**	**4**	**1,06**	**1,49**

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