Comparison of winter wheat and triticale genotypes for high callus induction and plant regeneration from mature embryo cultures

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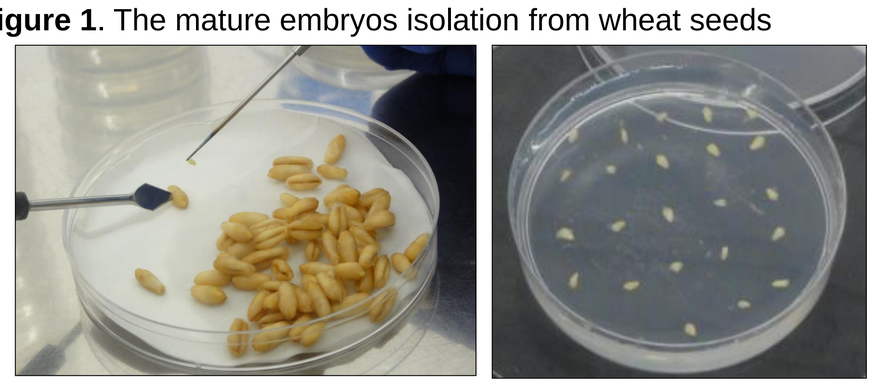
INTRODUCTION

Triticale and wheat belong to the three most important cereal crops of the world and is grown under a wide variety of climatic and agricultural conditions. These plants are the most common species of food and feed crops and these are is a fundamental nutrient source of human calories worldwide. Over the last few decades, researches still strive to improve agronomic traits and among those quality and disease resistance in to biotic and abiotic stresses. Conventional methods are increasingly supported by the biotechnological tools e.g. somatic embryogenesis.

The ability of triticale and wheat callus induction and plant regeneration are influenced by culture medium. Mature embryos were started to use as an alternative to immature embryos. During study were observed remarkable advantages: mature embryos are easy to handle, there is no time limitation and they are available in bulk quantities. Figure 1 was showed isolation of wheat mature embryos.

The main goal of the study was to compare somatic embryogenesis efficiency of winter wheat and triticale lines.

Figure 1. The mature embryos isolation from wheat seeds



PLANT MATERIAL

Seventeen wheat genotypes (six cultivars and eleven diallel crosses) and twenty six winter triticale lines (five cultivars and twenty one diallel crosses) were used to select genotypes with a high regeneration capability (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	

SUMMARY

In conclusion, we have demonstrated significant effects of genotypes on embryogenic callus formation and plant regeneration from mature embryo cultures of wheat and triticale lines. We were selected few genotypes with a high regeneration capability. These plants can be used for future practical application of mature embryo culture for breeding, transformation and other biotechnological studz. In the future work an effort will be undertaken to improve the somatic embryogenesis efficiency for wheat lines.

EXPERIMENTAL PROCEDURE

1. Mature wheat and triticale grains surface-sterilization using 70% ethanol and 10% sodium hypochlorite.
2. Seeds imbibition in sterile water overnight at 4°C in the dark.
3. Sterilization of slightly germinated seeds in 70% ethanol and $HgCl_2$.
4. Isolation of mature embryos from seeds and transfer on to the surface of standard MS medium (Murashige-Skoog) with dicamba (Figure 2A.).
5. Plates with embryos incubation at 25°C in the dark for 4 weeks for callus induction (Figure 2B.).
6. Transfer embryogenic callus on regeneration medium at 25°C in the light for differentiation process for 3 weeks (Figure 2C.).
7. Analysis of the somatic embryogenesis and plant regeneration efficiency for wheat and triticale.

Figure 2. Somatic embryogenesis diagram. A. Embryos isolation, B. Callus induction, C. Plants regeneration

RESULTS

Callus induction was observed for all studied genotypes (Table 2.). The rate of embryogenic callus (EC) formation was generally better for cultivars and F1 hybrids of winter triticale. Explants that developed embryogenic calli ranged from 25.00% for SE62 to 83.33% for SE69, while for winter wheat genotypes the embryogenic callus rate was lower (ranged 7.32% for SE98 87.23% for SE104).

Plants were regenerated for 17 triticale lines and only for 10 wheat genotypes. The genotypes with a relatively high regeneration capability were: SE85 for wheat (61 plants were obtained) and SE67 (92 plants were received).

Table 2. Somatic embryogenesis efficiency for triticale and wheat

Triticale cultivar	No of embryos	No of EC	No of plants	% of EC	% of planlets
SE56	31	14	3	45.16	9.68
SE57	136	72	26	52.94	19.12
SE58	78	53	5	67.95	6.41
SE59	216	160	15	74.07	6.94
SE60	49	32	-	65.31	-
SE61	49	40	-	81.63	-
SE62	4	1	-	25.00	-
SE63	180	88	17	48.89	9.44
SE64	111	48	16	43.24	14.41
SE65	197	139	16	70.56	8.12
SE66	99	56	14	56.57	14.14
SE67	539	317	92	58.81	17.07
SE68	151	93	24	61.59	15.89
SE69	18	15	-	83.33	-
SE71	51	35	-	68.63	-
SE72	293	170	64	58.02	21.84
SE73	132	90	15	68.18	11.36
SE74	251	160	46	63.75	18.33
SE75	340	240	33	70.59	9.71
SE76	34	24	3	70.59	8.82
SE77	57	24	-	42.11	-
SE78	69	54	-	78.26	-
SE79	95	78	-	82.11	-
SE80	80	60	-	75.00	-
SE81	225	120	41	53.33	18.22
SE82	297	203	25	68.35	8.42
MEAN	3781	2385	455	61.88	8.38

Wheat cultivar	No of embryos	No of EC	No of plants	% of EC	% of planlets
SE83	227	148	8	65.20	3.52
SE84	24	11	-	45.83	-
SE85	764	356	61	46.60	7.98
SE86	380	138	10	36.32	2.63
SE87	355	169	6	47.61	1.69
SE88	269	73	-	27.14	-
SE89	199	77	-	38.69	-
SE90	106	67	2	63.21	1.89
SE93	37	15	1	40.54	2.70
SE98	41	3	-	7.32	-
SE99	90	50	-	55.56	-
SE100	61	48	2	78.69	3.28
SE101	65	51	4	78.46	6.15
SE102	52	40	-	76.92	-
SE103	70	54	-	77.14	-
SE104	94	82	11	87.23	11.70
SE105	69	53	12	76.81	17.39
MEAN	2903	1435	117	55.84	3.47

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