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EFFECT OF A GAMETOCIDE ON THE INDUCTION OF HAPLOIDS IN TRITICUM AESTIVUM

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Introduction

Genotype and environment have an important influence on the induction of androgenesis in wheat. We have at our disposal several wheat lines with a good androgenetic response. The main objective is to induce the ability to produce haploids by anther culture, independent of the genetic background of the breeding material. The genotype/environment interactions are numerous; we want to develop a method which utilizes all those factors which will have a positive influence on the induction of androgenesis.

Out of a series of anther culture in wheat with an average of 6.7 embryos and 0.1 plant per 100 cultured anthers, one male sterile genotype was striking with 69 embryos and 5 plants per 100 anthers. Working with male sterile tobacco lines (1), the number of haploid plants was higher than with normal tobacco plants. One reason for this is the increase in certain types of microspores which seem to be more able to induce androgenesis. We therefore started to work with gametocides which could have the advantage of inducing male sterility and androgenesis on all of the interesting genotypes.

Results and Discussion

The following results form a part of preliminary studies which have not yet been completed.

a) Variation of gametocide (CGA) concentrations in the potato-2-medium. Details of anther culture methods are described in (2). Best results were obtained with combinations of 2,4-D and CGA but without kinetin (Tab. 1). The induction of androgenesis, shown by the number of embryos formed, was high in the combination 1.5 mg/l 2,4-D and 1.0 mg/l CGA. Treatments with 3.0 mg/l 2,4-D combined with several CGA concentrations resulted in an essentially lower percentage of embryos (18.1 %) as compared with 1.5 mg/l 2,4-D (52.7 %). The number of anthers

cultured was low; in spite of this fact we observed a great variation among the petri dishes within the same treatments, indicating that many unknown interactions with the gametocide influence the success of anther culture.

Table 1. Induction of Androgenesis by a Gametocide (CGA) Combined with 2,4-D in Addition to the Potato-2-medium with Two Spring Wheat Genotypes (Dadora and 83Z118.32).

			CGA concentration (mg/l)						
			0.5	0.75	1.0	1.5	2.0	3.0	control
Dadora	1.5 mg/l 2,4-D	1 : No. anthers	604	821	1462	643	-	258	1670
		2 : No. embryos	55	54	10	0	-	0	4
		3 : 2/1 %	9.1	6.6	0.7	0	-	0	0.2
83Z118.32		1 : No. anthers	409	-	220	-	206	113	686
		2 : No. embryos	120	-	266	-	63	51	18
		3 : 2/1 %	29.3	-	120.9	-	30.6	45.1	2.6

For example, the best petri dish in the treatment with 1.5 mg 2,4-D and 1.0 mg CGA formed 212 embryos from 46 cultured anthers; the poorest petri formed only 19 embryos from 62 cultured anthers.

b) The gametocide was applied to the anther donor plants (run-off treatment, spike length: 2cm) in order to synchronize and optimize all factors leading to the induction of androgenesis and to obtain more information about the reaction of the gametocide. Because of the limited material in these preliminary studies, the small differences between the treatments are difficult to explain. Best results were obtained by applying the gametocide when the spike had reached 2 cm in length. The concentration 0.1 mg CGA/ plant resulted in a good embryo as well as in good plant production (Tab. 2). The gametocide has a positive effect on the precondition of the donor plant and thus on the induction of androgenesis.

Table 2. Induction of Androgenesis by the Application of a Gametocide (CGA) to the Anther Donor Plant of the Spring Wheat Genotype 83Z118.32.

CGA (mg/plant)	No. anthers	No. embryos	$\frac{\text{No. embryos}}{\text{No. anthers}}$ %	No. plants	$\frac{\text{No. plants}}{\text{No. anthers}}$ %
0.1	637	193	30.3	44	6.9
1.0	325	56	17.2	12	3.7
2.0	458	143	31.2	13	2.8
5.0	238	70	24.7	18	6.4
Control	686	18	2.6	3	0.4

c) A cytogenetical analysis was made to determine the effect of the gametocide on the possible change in the type of microspores. The aim of this study was to

find out if a correlation exists between the p-pollen (with high androgenetical potential) and the induction of androgenesis. The addition of CGA to the medium did not lead to a higher number of p-pollen, but only to the expected increase in t-pollen (dead pollen). In the trial with the application of CGA to the donor plants, we did not observe a positive correlation between p-pollen and the number of embryos formed. Further experiments are needed to determine whether the gametocide has an effect on the type of microspore which could cause an increase in the induction of androgenesis.

d) The gametocide induces male sterility and may have a positive influence on the induction of androgenesis. In addition, it has an effect on female development which could be utilized to induce gynogenesis. We looked for a gametocide treatment which would result in the induction of haploids through androgenesis and gynogenesis simultaneously; preliminary studies are under way. Haploids from male and female parts of the same flower are of interest to wheat breeders.

Conclusions

A gametocide added to the potato-2-medium can lead to a higher number of embryos as compared with the control (2,4-D, kinetin, without CGA). CGA combined with low concentrations of 2,4-D (1.5 mg/l) showed the best effect. Direct application of the gametocide to the anther donor plants resulted in good haploid induction, possibly due to a preconditioning effect.

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References

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