

INVESTIGATION OF THE EFFECT OF MICROWAVES ON CORN SEEDS FERTILITY

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Nowadays, experimental study of pre-sowing treatment of seeds is the subject of many researches. Among a variety of physical methods, exposition by microwaves of seeds of many cultures is a highly effective one. It is experimentally found that the microwaves of certain ranges and power stimulate the seed germination that in turn results in more productivity. Microwaves have ability to produces changes in the cell membrane's permeability. It also affects the cell growth rate as well as interaction with ions and organic molecules, like proteins. Physical methods of treatment offer good opportunities for substitution of chemical ones [1-3]. They are convenient for organic agriculture. The aim of present work is to enlarge previous experiments on stimulation effect of microwave treatment for on corn seeds fertility and investigation biochemical changes during this proses.

Groups of 50 seeds were subjected to each microwave treatment, for chosen exposure times and analogous groups were used as control. In order to estimate the influence of the microwave treatment on *Zea maize* seeds next criteria have been chosen: 1. Germination (G) of seeds in%, determined on 7th day as a ratio of the number of germinated to the total number of seeds; 2. Chromatographic analysis of the stems (SL) and roots (RL) components was performed using an Agilent 6850 gas chromatograph with a mass detector (GC/MS). Qualitative analysis was based on a comparison of the mass spectra of the components of methanol extracts with the corresponding data from the NIST0.5a library of mass spectra.

The results of the experiments for three varieties of cornseeds have been presented in Table 1 for microwave irradiation with output powers and time.

Table 1 – Germination of corn' seeds, exposed to microwave irradiation %

Sample	Daria	Polessky 103	Polessky 101
Control	93,3±2,0	68,6±3,0	52,4±2,0
Mode 1.1.	96,3±1,3	82,4±2,0	62,3±3,0
Mode 1.2.	94±0,3*	84,3±2,0	66,3±3,3*
Mode 1.3.	93,6±1,3	84,3±2,0	62,3±2,0
Mode 2.1.	95,3±0,7*	80,0±1,3*	64,0±3,0
Mode 2.2.	100±0,3*	88,6±1,3*	66,3±2,0*
Mode 2.3.	93,3±2,0*	80,0±2,0	68,6±2,0*
Mode 3.1.	93,3±2,0*	68,6±1,3*	60,1±,03
Mode 3.2.	93,3±2,0*	70,0±2,0	58,6±3,0
Mode 3.3.	93,3±2,0*	68,0±,03	52,4±3,3*

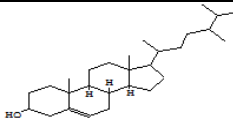
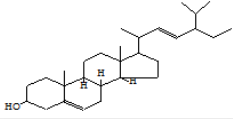
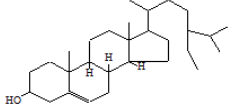
Superscript * corresponds to GD 1%, ns – not significant

Results are presented as average value ± standard error. The significance of differences GD P% is marked on the data in the table as a superscript. Data in Table 1

show the influence of microwave treatment on the first stages of plant development. It can be noticed that for microwave treatment with Mode 2.1. and 2.2. render the highest results for G of the studied varieties. This exposure time and power has shown stimulation effect. All data were significantly different from control.

Gas chromatography-mass spectrometry analysis of root extracts from germinating corn seedlings revealed a blend of 20 compounds from a variety of chemical classes, including small sugars, diacids, amino acids, inorganic compounds, and free fatty acids. The predominant group was steroid substances. Table 2 presents the number of steroid compounds in the roots of corn on the 12th and 14th day of growth after microwave seeds treatment.

Table 2 – The content of steroid nature metabolites in the corn roots on the 12th and 14th day of growth after pre-sowing seeds treatment with microwave

Formula	Metabolite	12 th day of growth			14 th day of growth		
		Control	Mode 2.2	%	Control	Mode 2.2	%
	campesterol CAS 474-62-4	6,0	6,5	+6,9	1,3	2,3	+66,7
	stigmasterol CAS 83-48-7	5,1	5,3	+3,6	2,3	4,3	+89,5
	g-stigmasterol CAS 83-48-7				1,3	2,2	+64,2

The investigation showed an increase of content of steroid substances in corn roots. Plant sterols and steroid hormones are compounds that exert a wide range of biological activities. They are essential for plant growth, reproduction, and responses to various abiotic and biotic stresses [4]. Therefore, it can be assumed that the stimulation of the growth of maize seedlings is due to the substantial accumulation of steroids. This result correlates with the observation in present work, having found that the treatment with lower output power demonstrates better stimulation of seed development and accumulation of steroids.

References

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