

Allelopathy Activity in Aqueous Extract of *Ascophyllum nodosum* Algae on Wheat Seeds

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Abstract

Wheat is a cereal of great agricultural importance, in view of its vast worldwide consumption, however, a productivity increase is welcomed by the new technological findings. The present work aimed to verify the *Ascophyllum nodosum* Algae effect on the germination phase *in vitro* of wheat seeds. The adopted experimental outline was the one entirely randomized, carrying out four repetitions. The treatments were the following: concentrations of 1, 2.5, 5 e 10% of algae aqueous extract and witness with distilled water. The experiment has been conducted with germitest paper containing 50 seeds of wheat per roll, under temperature of 27°C. The parts of the plant that have been evaluated were the aerial length, root length, germination percentage, vigor and average speed of germination. The averages were compared by the Tukey Test ($P \leq 0,05$), using the computerized application WinSTAT. One can realize that the aqueous extract of the algae affected negatively the assessed variables, reducing considerably as the concentration increased.

Keywords: Alga, plântula, VMG, comprimento radicular

INTRODUCTION

Wheat is a cereal of significant importance in the global economy, as it is the second biggest consumed cereal in the world. In Brazil, it is grown in the Mid-West, Southwest and Southern regions, with prospects in consumption increase on a rate of 1,31.25% yearly (Mapa, 2016).

Nowadays, in agriculture, one seeks to produce more not needing exploitation of new areas for cultivation. New technology in agriculture aiming for more productivity of cultures are welcome, being one of the ways to use manure, correct seeding, adequate phytosanitary control, among others.

According to Casto e Vieira (2011), an alternative way is through the application of natural or synthetic substances in plants, and it may occur that the increase on production of culture, once those substances contribute in rooting, germination and flowering.

The auxins and cytokines assist in the development of the embryonic axis, considering that the gibberellins involved in the transition, cytokines in the genetic translation and the auxins on the permeability of the membranes. Auxins and cytokines can be found in algae extracts, yet there is still doubt about the direct relationship between the levels of cytokine in algae and levels of it in the plant tissue that receive the extract (Rodrigues, 2008).

Thus, the present work aimed to verify the effect of the *Ascophyllum nodosum* Algae in *in vitro* germination of wheat seeds.

MATERIAL AND METHODS

The experiment has been conducted in the Laboratório de Sementes da Universidade Tecnológica Federal do Paraná, Campus Dois Vizinhos (UTFPR-DV).

The *Ascophyllum nodosum* algae were used, and in the formulation of extract concentrations, 10% weight/volume has been used, that is, 100mL of algae/1L water. It was starting from the standard solution, and the solutions were carried out with distilled water, having obtained the other concentrations that composed the treatments.

The treatments were composed by the concentrations of 1.25%, 2.5%, 5% and 10% of the extract, besides the witness (distilled water). The solution was held static during 24 hours, and at the end of this period, they have been strained with the aid of the paper filter.

In order for the test to be implemented, 50 seeds per roll of germiest paper have been used and humidified with the extract, according to treatments, with 2,5 times the paperweight following the RAS (Brasil, 2009).

The adopted experimental outline was the one entirely randomized, with four repetitions. The seeds were allocated in a germination chamber under the constant temperature of 25°C and 12 hours of light/darkness.

The daily count of germinated seedlings has been carried out for eight days. After this time, the following variables have been evaluated: Emergency speed index (IVG) calculated by the equation $IVG = \sum (ni / ti)$, where: ni = number of in-time germinated seeds 'I'; ti = time after the test implementation; $I = 1 \rightarrow 8$ days, according to the methodology proposed by Maguire (1962), the height of aerial part, root length, percentage of germination (G%), vigour and average speed of germination (VMG);

Percentage of germination (G%), calculated by the equation $G = (N/100)$, where: N = number of germinated seeds at the end of the test. The average speed of germination (VMG/days), calculated by the equation $VMG = 1/t$ where: t = average time of germination (Maguire, 1962).

After eight days of the evaluation, the seedlings aerial part and root lengths have been obtained by using a graph paper. The aerial part and the root system of the seedling were dried out under 65°C for 72 hours until the constant weight, and with the use of an analytical scale, the dry mass matter of the seedlings has been obtained.

The data were submitted to the Lilliefors normality test, not having the need of transformation, the averages were compared by the Tukey Test ($P \leq 0,05$), through the computerized application WinSTAT® (Machado E Conceição, 2002).

RESULTS AND DISCUSSION

For the variables of vigour, germination and average speed of germination (VMG), by observing Table 1, one can notice the a decrease in the figures as the concentration of extract increased, being that in the last concentration of 10% of extract did not occur any germination of wheat seeds.

Table 1: Effect of different concentrations of algae extract on the vigour (%vigor), germination percentage (G%) and Average Speed of Germination (VMG) of wheat. UTFPR-DV, 2016.

Concentrations (%)	Vigor	G%	VMG
0.0	89.5 a*	98.5 a*	0.037 c*
1.25	70.0 b	89.5 ab	0.040 bc
2.5	45.5 c	80.5 b	0.047 b
5.0	0.0 d	51.0 c	0.107 a
10	0.0 d	0.00 d	0.0 d
Average	41.0	63.9	0.05
DMS	8.7	10.4	0.011
CV (%)	9.7	7.5	10.5

* Averages with distinct letters differ by the Tukey test to the level of 5% of probability.

DMS: Significant average differences

Haber et al. (2006), in an experiment testing the allelopathy effect of *Ascophyllum nodosum* in the germination of carrots and tomatoes, verified a positive effect of the extract on the indexes of germination of tomato seeds, occurring a more significant germination development in treatments based on the algae extract. The same has been observed by Silva et al. (2006), in testing the effect of the algae in the bell pepper germination (*Capiscum annuum*), contacting its favourable effect in the variables of germination percentage, germination speed index and vigour of seedlings.

This negative effect of the aqueous extract of algae on the seedlings length, as well as the germination of wheat seeds, maybe due to the acidic pH of the extract (pH 4,3), since lower levels than 4,5 and higher than 7,0 of pH can cause a growth and development standstill of seedlings (MURASHIGE, 1974).

By observing Table 2, one can realize that there has been significant interaction between the variable of the height of the aerial part and root length in the studied treatments. The more significant the dosages of the aqueous extract of algae. In addition, the more significant influence in the plant's size reduction.

In the biggest concentration, there has been a death of the seeds, while in the smallest dosage of the algae extract, the reduction was of 36,5% of the aerial part and 50,6% of root length, compared to the witness.

Table 2: Effect of different concentrations of algae extract on the height of the aerial part (PA) and root length (CR) of wheat in a lab. UTFPR-DV, 2016.

Concentrations (%)	PA (cm)	CR (cm)
0	17.5 a*	15.4 a*
1.25	11.1 b	7.6 b
2.5	5.3 c	5.7 c
5	3.4 d	3.4 d
10	0.0 e	0.0 e
Averages	7.5	6.4
DMS	1.3	2.3
CV (%)	7.8	5.5

* Averages with distinct letters, differ by the Tukey test to the level of 5% of probability.

DMS: Significant average differences

In a similar study conducted by Gheling et al. (2014), there has been an increase in root length of wheat seedlings, not occurring any significant differences in the length of an aerial part variable through the application of algae extract *Ascophyllum nodosum* (L.). According to Neto et al. (2010), the algae extract *Ascophyllum nodosum* presented itself as a good biostimulant for the maze culture, obtaining a positive response for the variables of productivity.

CONCLUSIONS

It is possible to observe that the aqueous extract of *Ascophyllum nodosum* algae, affected unfavourably the variables of aerial and root part lengths, as well as the indexes: vigour percentage, germination and average speed of germination in the wheat seeds.

FUTURE WORKS

Based on the obtained results, the effect of the algae on other species in different pHs, verifying its possible allelopathy activity on the agronomical interest species, will be sought after.

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