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Testing the Anti-Fungal Effect of Aqueous Extract of *Allium cepa* L. in Potato

CĂTUNA (PETRAR) Tatiana, Antonia ODAGIU*, Claudia BALINT, Cristian MĂLINAȘ, Daniela BORDEA, Sorina DĂRJAN

University of Agricultural Sciences and Veterinary Medicine, Manastur Street 3-5, 400372 Cluj-Napoca, Romania

* Corresponding author e-mail: antonia.odagiu@gmail.com

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Abstract

According to FAO-STAT data updated until 2020, worldwide, Europe ranks first in terms of the proportion of potato production at global level (41.90%), followed by Asia (39.60%), America (12.70%), Africa (5.30%) and Oceania, which only has a contribution of 0.50% in the world potato production. The present study aims to emphasize the effect of aqueous extract of *Allium cepa* L. in fight against *Alternaria solani* Sorauer in potato. Over the entire experimental period, the best results were obtained with the conventional and non-conventional treatments performed with metiram 80% aqueous solution of 4% *Allium cepa* L. (GA = 12.20%, and GA = 13.80%), and the weakest (but much lower compared with the untreated control) under the conditions of treatment with 2% *Allium cepa* L. aqueous solution (GA = 15.90%).

Keywords: attack degree, phytosanitary treatment, best results.

1. Introduction

Allium cepa L. is a well-known vegetable with antibacterial, and antifungal actions [1, 2, 3], which has demonstrated effects on plants pathogens attacks [4].

According to FAO-STAT data [5] updated until 2020, worldwide, Europe ranks first in terms of the proportion of potato production at global level (41.90%), followed by Asia (39.60%), America (12.70%), Africa (5.30%) and Oceania, which has only a contribution of 0.50% in the world potato production (Fig. 1, Table 1).

The highest yields of potato production, between 1989 and 2020, were recorded in Oceania, followed by America, while the lowest values of potato production are characteristic of the African continent.

The purpose of the present study is to test the antifungal effect of extracts of *Allium cepa* L. on potato culture. *Allium cepa* L. extracts were used in two different concentrations, namely: 2% and 4%, respectively. Antimycotic effect of *Allium cepa* L. extracts on potato culture are tested against *Alternaria solani* Sorauer.

2. Material and Method.

The experiment took place in 2022, and a bifactorial scheme was followed, with three repetitions (Fig. 1), following an experimental scheme implemented according to the randomized block method. The layout of the plots is done differently for the three repetitions, for the potato variety under study, respectively Redsec – Re, depending on the control and the experimental variants corresponding to the treatments tested against the fungi *Alternaria solani* Sorauer. The experiment was installed in a private vegetable farm intended for potato cultivation in Cluj County, in an experimental device organized within it.

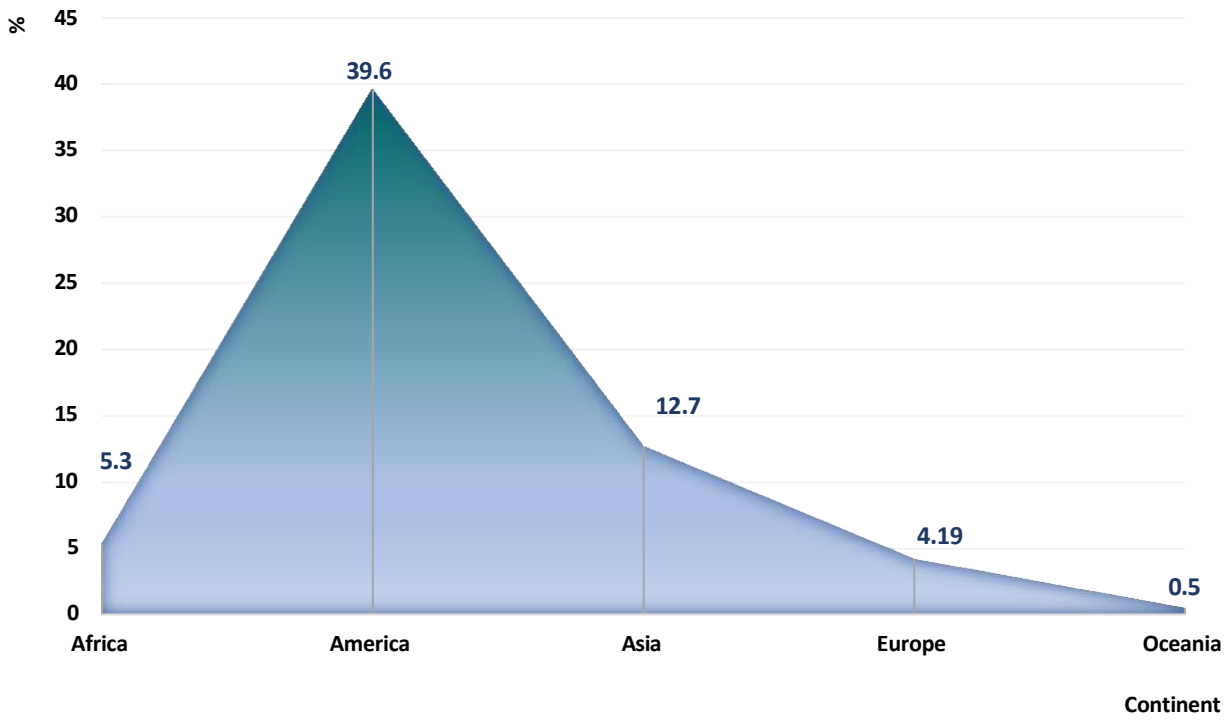


Figure 1. Proportion of worldwide potato production, by continent, 1993 – 2020 [5]

Re-R1	V1	V2	V3	V4
Re-R2	V3	V1	V4	V2
Re-R3	V4	V3	V2	V1

Note 1: Re – Redsec. Note 2: R – repetition; V1 – control; V2 – conventional treatment with metiram 80%; V3 – treatment with extract 2% *Allium cepa* L.; V4 – treatment with extract 4% *Allium cepa* L.

Figure 1. The experimental pattern

The monitoring of the alternariosis attack is carried out according to a diagonally crossed scheme, on an area of one hectare, on which the potato culture is installed and exploited.

The monitoring points are placed on an area of 1 m^2. The temperature and rainfall regime evolutions throughout the experimental period were obtained with the help of an automated, mobile weather station, placed in the experimental device.

The biological material is represented by the indigenous Redsec potato. This is a semi-late variety, created at the Târgu Secuiesc Potato Culture Research Station. Fertilization was performed with N_{14}:P_7:K_{28} (AZOMUREȘ). Conventional treatments were carried out with Polyram DF (Bayer)with active substance 80% metiram. The non-conventional foliar treatments consisted of 2% and 4% *Allium cepa* L aqueous extracts. The results obtained were statistically analyzed through descriptive statistical analysis, respectively: the averages of the degree of attack, the averages of the productions recorded in the *Solanaceae* crops taken in study, standard errors of the mean, standard deviations and coefficients of variability.

3. Results and Discussions

In the Redsec potato variety, in the experimental conditions characterized by the pedo-climatic regime in the area of Cluj County, specific to the Transylvanian Plain, with aqueous solutions of *Allium cepa* L. and *Allium c*epa L. enriched in organic selenium, in different concentrations, during the experimental period between April and August 2022, led to the achievement, following the performance of the majority of treatments, of lower levels of attack than the control variant (Table 1, Fig. 2).

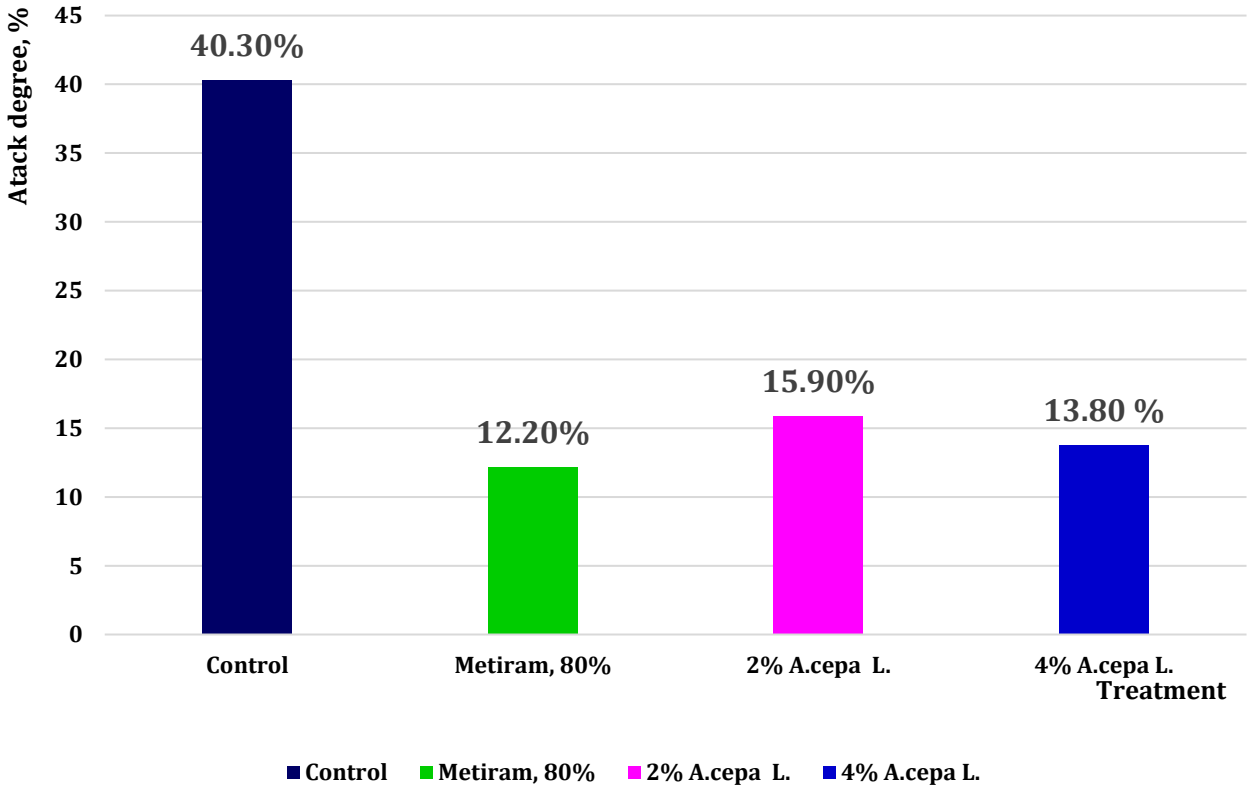
The analysis of the average attack degrees obtained for each experimental variant (Table 1, Fig. 3), highlights the effectiveness of the treatments carried out with conventional treatment and *A. cepa* L. solutions in the highest concentrations administered (4%), the best results being represented by the lowest attack degrees, AD = 12.20% (conventional) and AD = 13.80% (4% *Allium cepa* L. solution).

The variability of the attack degrees ranges between CV = 2.85% (conventional treatment), and CV = 12.5% (unconventional treatment performed with 2% *A.cepa* aqueous extract).

Table 1. Means and dispersion parameters of the degree of attack (GA) of *Alternaria solani* Sorauer in the Redsec potato variety according to the applied treatment, 2022

Experimental variant	n	X	±	sx	s	Min.	Max.	CV (%)
1, Control	28	40.30	±	1,25	1.57	37.72	41.43	3,89
2	28	12.20	±	0.95	0,92	11,36	14.84	2,85
3	28	15.90	±	0.93	0,88	6.86	22.75	12,50
4	28	13.80	±	0.28	1,40	7.86	19.75	9,45

V1 – control; V2 – conventional treatment with metiram 80%; V3 – treatment with extract 2% *Allium cepa* L.; V4 – treatment with extract 4% *Allium cepa* L.



V1 – control; V2 – conventional treatment with metiram 80%; V3 – treatment with extract 2% *Allium cepa* L.; V4 – treatment with extract 4% *Allium cepa* L.

Figure 2. Evolution of the average degree of attack of *Alternaria solani* Sorauer on the Redsec potato variety depending on the treatment applied, 2022

4. Conclusions

For the Redsec potato variety, the calculation of the basic statistical parameters highlights over the entire experimental period, the treatment with metiram 80% and 4% *A.cepa* aqueous solution lead to the lowest average attack degrees of *Alternaria solani* Sorauer (AD = 12.20% and AD = 13.80%, respectively) and the treatment with 2% *A.cepa* aqueous solution with the lowest performances, leading to the recording of an average attack degree of (AD = 15.90%), which is much lower compared to the untreated control (AD = 40.30%).

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