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The bactericidal effect of aqueous and alcoholic extracts of selenium enriched garlic in potato

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Introduction

- **Because of importance of the potato crops in Romanian agriculture, the control of diseases of this species, bacterial disorders mainly, are a permanent challenge for potato producers and processors.**
- **The classical treatments against bacteriosis often collide with increasing resistance rate of target bacteria species, produced as a consequence of different factors.**

The treatments based on natural products are increasingly used due to their efficacy but also because are environmentally friendly.

One of the most common pathogen associated with potato bacterial diseases is *Erwinia carotovora.*

The soft rot disease. The mechanism of disease development, involving potato vegetal tissue degradation is catalyzed by specific enzymes, pectinases.

Selenium is a trace element with high importance in human, animal and vegetables nutrition.

Even lot of literature concerning the use of *Allium sativum* L., as antibacterial agent, is available, the effect of *Allium sativum* L. enriched in organic selenium upon bacteria is not yet demonstrated.

The aim

Emphasizing the effect of different solvents extracts of organic selenium enriched garlic (*Allium sativum* L.) upon potato associated *Erwinia carotovora* bacteria.

Material and Method

Aqueous and alcoholic *Allium sativum* L. extracts preparation

- Fresh bulbs of *Allium sativum* L. and organic selenium enriched *Allium sativum* L.
- Ethanol (Et), methanol (Met), and water (Aq)

20% *Allium sativum* L. dilutions.

Bacteria isolation

- diseased samples of potato
- rotten potato tubers
- bacteria isolates → 1.0 - 1.5 µm width,
  ↳ 2 - 2.5 µm length
- microscopic, biochemical, and morphological tests

All tests confirm the identity of *Erwinia carotovora*.

Antibacterial activity testing

- disc diffusion method
- agar enriched in Luria Bertani media
- sterile discs with 15 mm diameter were placed on media, in Petri dishes
- 150 µl of 10% and 20% concentrations of enriched and pure *Allium sativum* L. in solutions
- incubation at 37 ^{0}C for 24 hours

- no antibacterial activity
  - ↳ < 7 mm diameter
- 100% zone of inhibition
  - ↳ 14 mm diameter

Statistics

The MathLab soft was used for basic statistics, and testing the significance of differences between experimental variants.

Results and Discussions

Results

- **confirm the antibacterial activity of *Allium sativum* L. against potato associated bacteria emphasized by literature**
- **show the enhanced antibacterial activity of selenium enriched *Allium sativum* L.**

Table 1. Antibacterial activity of different 20% *Allium sativum* L. extracts on *Erwinia carotovora* cultures expressed in zone of inhibition (%)

Extract	Repetition					
	1	2	3	4	5	6
Aqueous	+	+	+	+	-	+
Methanolic	-	-	+	-	-	+
Ethanolic	+	++	+	++	+	++

Both 20% ethanolic extracts (garlic and selenium enriched garlic) show the best inhibitory action against *Erwinia carotovora* bacteria, followed by 20% aqueous extract (table 1). The basic statistics emphasizes superiority of inhibitory activity of selenium enriched *Allium sativum* L. (table 2).

Table 2. Antibacterial activity of different 20% selenium enriched *Allium sativum* L. extracts on *Erwinia carotovora* cultures expressed in zone of inhibition (%)

Extract	Repetition					
	1	2	3	4	5	6
Aqueous	++	+	++	+	+	++
Methanolic	-	-	-	-	-	-
Ethanolic	++	+++	++	++	++	+++

For the 20% methanolic extract low inhibitory or no activity is reported.

Table 3. The basic statistic analyze of inhibition zone produced by *Allium sativum* L. in *Erwinia cartovora* cultures

Issue	n	Mean mm/%)	Variance	Std. Dev.	St. Error
Zone of inhibition *A. sativum* L. (aq)	6	4.20 (30%)	0.37	0.61	0.25
Zone of inhibition *A. sativum* L. (MeOH)	6	0.56 (4%)	0.01	0.12	0.05
Zone of inhibition *A. sativum* L. (EtOH)	6	9.80 (70%)	4.97	2.23	0.91
Zone of inhibition Se *A. sativum* L. (aq.)	6	5.60 (40%)	0.66	0.81	0.33
Zone of inhibition Se *A. sativum* L. (MeOH)	6	1.40 (10%)	0.08	0.29	0.12
Zone of inhibition Se *A. sativum* L. (EtOH)	6	11.20 (80%)	5.76	2.40	0.98

- 20% ethanolic extract of *Allium sativum* L.
  - ↳70% effective in mycelia growth inhibition,
- 20% ethanolic extract of Se *Allium sativum* L.
  - ↳ 80% effective
- 20% aqueous solution of *Allium sativum* L.
  - ↳ 4.20 mm diameter of inhibition,
- 20% aqueous solution of Se *Allium sativum* L.
  - ↳ 5.60 mm diameter of inhibition (table 3).

Table 4. Significance of differences between inhibition zones produced by different *Allium sativum* L. extracts in *Erwinia cartovora* cultures

Issue	DF	Difference (mm)
Zone of inhibition *A. sativum* – Se *A. sativum* L. aq.	11	- 1.40*
Zone of inhibition *A. sativum* – Se *A. sativum* L. MeOH	11	- 0.84**
Zone of inhibition *A. sativum* – Se *A. sativum* L. EtOH	11	- 1.40*

* - $p < 0.05$; ** $p < 0.01$

The difference between aq. and EtOH extracts was statistically significant at $p < 0.05$, in advantage of 20% selenium enriched *Allium sativum* L. for both solutions, while for MeOH extracts it was statistically distinct significant at $p < 0.01$ in advantage of 20% *Allium sativum* L. solution (table 4).

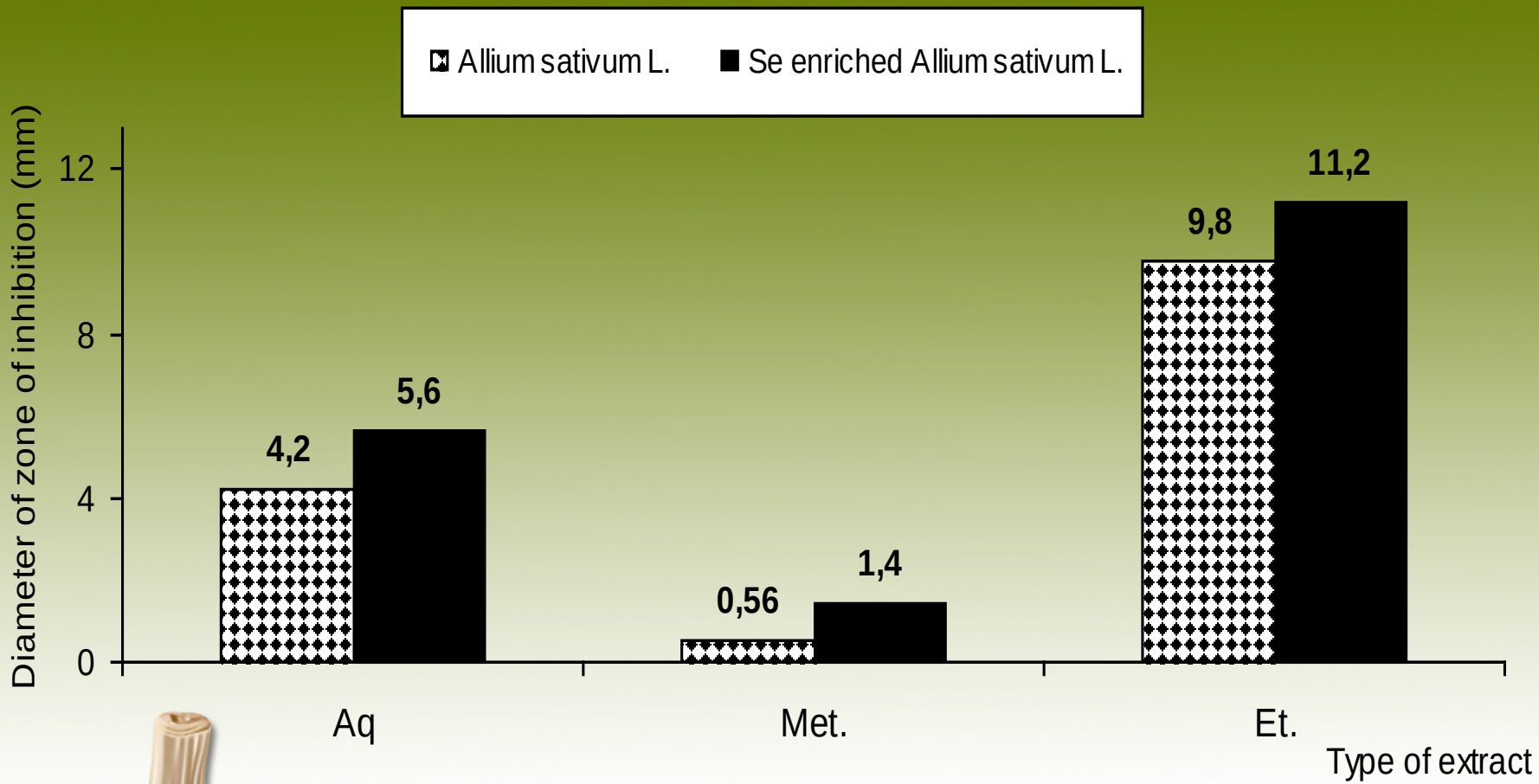
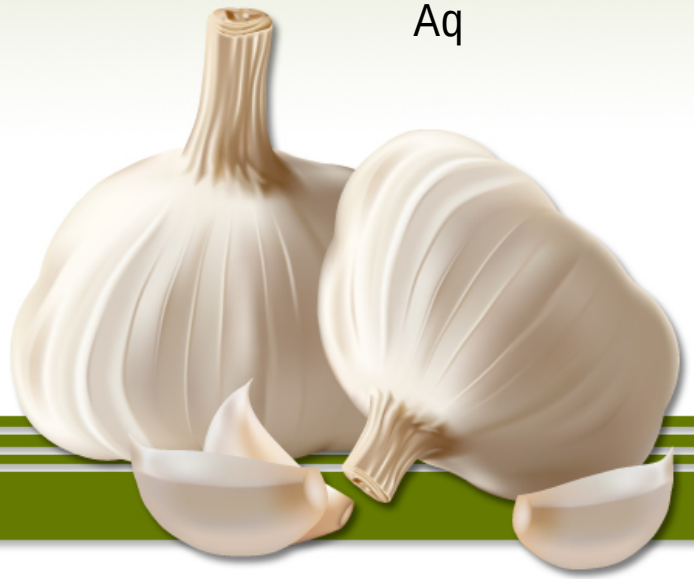


Figure 1. Activity of *Erwinia cartovora* inhibition of different *Allium sativum* L. solutions



Conclusions

Ethanol extracted sample from Se *Allium sativum* L. showed:

- **the highest activity against *Erwinia carotovora* (80% zone of inhibition),**
- **followed by water (40%) and**
- **methanol (10%).**

***Allium sativum* L. lower activity against *Erwinia carotovora* was emphasized, as follows:**

- **ethanol extraction agent (70% zone of inhibition),**
- **water extraction agent (30% zone of inhibition)**
- **methanol extraction agent (4% zone of inhibition).**

We consider that our results

- may contribute to the development of new bio-control compounds based on *Allium sativum* L. matrices enriched in selenium,

- as alternative strategies to protect vegetal food supplies that can be suitable host for *Erwinia carotovora* attack.

THANK YOU FOR YOUR ATTENTION