

# Pathogens Attack in Two Potato Varieties in Absence of Fertilization in Specific Climatic Conditions

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## Abstract

One of the main crops, which continues to be appreciated for its multiple uses, in Romania, is potato. The most significant potato pathogens are *Phytophthora infestans* (Mont.) de Bary and *Alternaria solani* Sorauer. The aim of the research is to identify the *Phytophthora infestans* (Mont.) de Bary and *Alternaria solani* Sorauer attacks on two potato varieties in specific climatic conditions of North-West Romania. The experiment was developed in 2022, in specific climatic conditions of Gilău commune, (46°45'20"N, 23°23'21"E). Two potato varieties were considered, Redsec and Roclas. No fertilization was administered, but treatments were performed conventionally (metiram 80%), and unconventionally (2% *Allium cepa* aqueous extract, and 4% *Allium cepa* aqueous extract). The results of our trial emphasize the climatic conditions of the experimental site in 2022. The highest attack degrees of the monitored pathogens are observed when no treatment and no fertilization were applied, with the highest value by the entire trial of 42.40%, reported for *Alternaria solani* Sorauer in Redsec variety. The lowest attack degree is observed for *Phytophthora infestans* (Mont.) de Bary in Roclas when conventional treatment is applied, of 15.50%.

**Keywords:** *Allium cepa*, alternariosis, aqueous extract, downy mildew, metiram.

## 1. Introduction

In Romania, potato is one of the main crop, which continues to be appreciated for its multiple uses, for centuries [4]. The most significant potato pathogens are *Phytophthora infestans* (Mont.) de Bary and *Alternaria solani* Sorauer, responsible for the diseases commonly referred to as downy mildew and alternariosis [1, 5].

*Phytophthora infestans* (Mont.) de Bary, the causative agent of potato downy mildew, while not the earliest known plant disease, has profoundly influenced the fields of biology and agriculture. This pathogen is a widespread challenge in most potato-growing systems and can lead to severe yield losses if left unmanaged. The disease manifests on potato leaves as water-soaked lesions, often accompanied by a fluffy white halo

of sporangia that emerge from leaf stomata on sporangiophores [2, 3].

*Alternaria solani* Sorauer, on the other hand, affects the aerial parts of potato plants. It typically begins as small brown spots that develop into larger lesions, primarily appearing on older leaves and progressing upwards. Under favorable environmental conditions, the lesions enlarge into concentric rings, each encircled by a distinctive yellow halo. Factors like nitrogen deficiency, high humidity, suitable temperatures, and frequent rainfall increase the likelihood of an *Alternaria* outbreak, which can occur rapidly and on a large scale. While infected plant debris in the soil can harbor *Alternaria solani* Sorauer over the winter, the pathogen predominantly spreads through the air [2, 3].

Climatic conditions affect in great extent the attack of *Phytophthora infestans* (Mont.) de Bary

The aim of the research is to identify the *Phytophthora infestans* (Mont.) de Bary and *Alternaria solani* Sorauer attacks on two potato varieties in specific climatic conditions of North-West Romania.

## 2. Material and Method

The experiment was developed in 2022, in specific climatic conditions of Gilău commune, (46°45'20"N, 23°23'21"E). Two potato varieties were considered, Redsec and Roclas. *Phytophthora infestans* (Mont.) de Bary and *Alternaria solani* Sorauer attack degrees were recorded together with daily temperature, precipitations, air humidity and wind velocity, in vegetation period, using a mobile meteorological station with specific sensors. The intensity and frequency of the targeted pathogens attack were recorded two times a week, in order to calculate the attack degrees [2]. No fertilization was administered,

and *Alternaria solani* Sorauer attacks on potato, function of their intensity of manifestation [6].

but treatments were performed conventionally (metiram 80%), and unconventionally (2% *Allium cepa* aqueous extract, and 4% *Allium cepa* aqueous extract).

## 3. Results and Discussions

During the experimentation period that refers to the monthly interval March - July corresponding to the year 2022, the climatic parameters show characteristic evolutions of the experimental site that have been processed statistically (Tables 1 - 4). Thus, in the experimental site, the temperature has a specific evolution, with the greatest average in June, (Table 1). During the experimentation period that refers to the monthly interval March - July corresponding to the year 2022, the precipitations regimen and relative air humidity characteristic evolutions of the experimental site that have been processed statistically (Tables 2 and 3).

Table 1. The basic statistics for environmental temperature reported in the experimental field, April - July, 2022 (°C)

Month	N	X	Min.	Max	s
March	31	9.55	1.00	15.00	6.69
April	30	11.02	2,00	19,00	5.39
May	31	14.23	8,00	17,00	7.32
June	30	18.57	10,00	25,00	6.21
July	31	21.92	14,00	24,00	5.33

Table 2. The basic statistics for environmental temperature reported in the experimental field, April - July, 2022 (mm)

Month	N	X	Min.	Max	s
March	31	3.65	43.80	0.50	17.00
April	30	5.26	89.42	0.50	20.00
May	31	5.43	81.45	0.50	15.00
June	30	6.25	118.75	0.50	27.00
July	31	3.22	45.08	0.50	6.00

Table 3. The basic statistics for relative air humidity reported in the experimental field, April - July, 2022 (%)

Month	N	X	Min.	Max	s
March	31	76.00	49.00	80.00	9.23
April	30	75,00	47.00	82.00	8.17
May	31	79.40	52.00	85.00	8.23
June	30	80.30	61.00	90.00	11.82
July	31	74.20	62.00	80.00	6.38

Table 4. The basic statistics for wind velocity reported in the experimental field, April – July, 2022 (km/h)

Month	N	X	Min.	Max	s
March	31	7.20	2.30	14.00	6.23
April	30	6.20	3.00	14.50	5.23
May	31	9.36	4.20	14.20	6.91
June	30	6.65	2.20	13.20	4.30
July	31	5.41	3.15	12.80	5.18

The wind speed, recorded during the experimental period, is characterized by specific values both for the months in which it was monitored and for the location of the study in the field (Table 4).

The *Phytophthora infestans* (Mont.) de Bary attack degrees in absence of fertilization with different treatments in Redsec potato variety had

values within 16.30% corresponding to conventional treatment – 38.40% corresponding to control (Table 5). The *Alternaria solani* Sorauer attack degrees in absence of fertilization with different treatments in Redsec potato variety had values within 17.70% corresponding to conventional treatment – 42.40% corresponding to control (Table 6).

Table 5. The basic statistics for the attack degrees of *Phytophthora infestans* (Mont.) de Bary in absence of fertilization with different treatments in Redsec potato variety

Treatment	N	X	s	CV%
Control	10	38.40a	1.78	4.63
Metiram	10	16.30b	1.77	5.83
2% <i>A.cepae</i> solution	10	20.00c	1.89	6.98
4% <i>A.cepae</i> solution	10	17.70b	1.77	5.09

Means with the same letters have no significant differences at statistical threshold 5%.

Table 6. The basic statistics for the attack degrees of *Alternaria solani* Sorauer in absence of fertilization with different treatments in Redsec potato variety

Treatment	N	X	s	CV%
Control	10	42.40d	1.17	2.77
Metiram	10	17.70b	1.34	3.85
2% <i>A.cepae</i> solution	10	19.50b	1.43	4.55
4% <i>A.cepae</i> solution	10	20.00c	1.05	2.70

Means with the same letters have no significant differences at statistical threshold 5%.

The *Phytophthora infestans* (Mont.) de Bary attack degrees in absence of fertilization with different treatments in Roclas potato variety had values within 15.50% corresponding to conventional treatment – 39.40% corresponding to control (Table 5).

The *Alternaria solani* Sorauer attack degrees in absence of fertilization with different treatments in Roclas potato variety had values within 22.10% corresponding to conventional treatment – 38.50% corresponding to control (Table 6).

Table 7. The basic statistics for the attack degrees of *Phytophthora infestans* (Mont.) de Bary in absence of fertilization with different treatments in Roclas potato variety

Treatment	N	X	s	CV%
Control	10	39.40a	1.17	2.98
Metiram	10	15.50b	0.71	2.32
2% <i>A.cepae</i> solution	10	17.20b	1.69	5.58
4% <i>A.cepae</i> solution	10	16.10b	2.13	5.91

Means with the same letters have no significant differences at statistical threshold 5%.

Table 8. The basic statistics for the attack degrees of *Alternaria solani* Sorauer in absence of fertilization with different treatments in Roclas potato variety

Treatment	N	X	s	CV%
Control	10	38.50a	3.63	9.42
Metiram	10	22.10c	1.45	3.91
2% <i>A.cepae</i> solution	10	24.90c	1.37	3.82
4% <i>A.cepae</i> solution	10	23.80c	1.75	4.19

Means with the same letters have no significant differences at statistical threshold 5%.

No statistical significant differences are observed between attack degrees corresponding to control in majority of cases. The exception is observed for *Alternaria solani* Sorauer in Redsec variety which is the highest attack degree, by the entire trial (AD = 42.40%). Also, no statistical significant differences are observed between the attack degrees of both monitored pathogens in Roclas variety when treatments are conventionally and unconventionally performed, even though best performances are reported when conventional treatment and 4% *A.cepae* aqueous solution were used. There were recorded attack degrees of 15.50% when conventional treatment was applied and 16.10% when 4% *A.cepae* aqueous solution was used, for *Phytophthora infestans* (Mont.) de Bary attack, and 22.10% when conventional treatment was applied and 23.80% when 4% *A.cepae* aqueous solution was used, for *Alternaria solani* Sorauer.

#### 4. Conclusions

The results of our trial emphasizes the climatic conditions of the experimental site expressed by the averages of the temperature, precipitations regimen, relative air humidity, and wind velocity reported monthly by the experimental period of 2022. The highest attack degrees of the monitored pathogens are observed when no treatment and no fertilization were applied, with the highest value by the entire trial of 42.40%, reported for *Alternaria solani* Sorauer in Redsec variety. The lowest attack degree is observed for *Phytophthora infestans* (Mont.) de Bary in Roclas when conventional treatment is applied, of 15.50%. No statistical significant differences are observed between attack degrees corresponding to control in majority of cases. The exception is observed for *Alternaria solani*

Sorauer in Redsec variety which is the highest attack degree, by the entire trial. Also, no statistical significant differences are observed between the attack degrees of both monitored pathogens in Roclas variety when treatments are conventionally and unconventionally performed, even though best performances are reported when conventional treatment and 4% *A.cepae* aqueous solution were used.

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