

BIOLOGICAL CONTROL OF THE PATHOGEN *ALTERNARIA CAPSICI* IN BELL PEPPER CROP IN GREENHOUSE

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ABSTRACT

Romanian agricultural research gives special importance to the development of technologies for the cultivation of vegetables grown in ecological agriculture.

This paper presents the biological control of *Alternaria capsici* pathogen on bell pepper cultivated in greenhouse, using Cavaler 600SL (microorganisms *Bacillus pumillus* and *Bacillus subtilis*) 0.3 %; Amulet (microorganisms *Bacillus thuringiensis*, *Bacillus subtilis*, *Bacillus megatherium*) 40 l/ha; Zytron (citrus seed extract 20 %) 0.15 %; Mimoten (*Mimosa tenuifolia* 80 % extract) 0.3 %. The efficacy of biological products varied between 68.08% (Zytron 1,5 l/ha) and 94.38 % (Amulet 40 l/ha) in controlling this pathogen on leaves. It is recommended biological products in case of low attack or preventive when conditions are favorable for the attack.

INTRODUCTION

In recent years, agriculture has been subjected to excessive use of chemicals, which has caused significant damage to the planet's soil, climate, water and global ecosystem (Barcanu et al., 2023), with negative effects including risks to human health and the environment (Radwan et al., 2005; Shim et al., 2023). Organic agriculture is a dynamic sector in Romania that has seen an upward evolution in recent years. Romanian agricultural research gives special importance to the development of technologies for the cultivation of vegetables grown in conventional and/or ecological agriculture. Good results were obtained in biological control of diseases and pests on tomatoes (Bratu et al., 2015, Hogeă S.S., 2020), pepper (Calin et al., 2017, 2020), eggplants (Iosob and Cristea, 2022), cucumbers (Cenusa et al., 2016), melons and zucchini (Sovarel et al., 2024).

MATERIAL AND METHODS

The biological material is represented by two hybrids of bell pepper (Marbella F1, Barbie F1), which were planted in greenhouse on May 5, 2025, ensuring a density of 33,400 plants/ha. The planting scheme was 2 rows per furrow, at a distance of 50cm and 40 cm, mulched with black foil, the distance between the strips was 1m.

The experience includes 5 experimental variants, to which 3 treatments were applied: May 23 (T1), August 25 (T2) and September 1 (T3), as follows:

1: Cavaler 600SL (microorganisms *Bacillus pumillus* and *Bacillus subtilis*) 0.3 %;

- 2: Amulet (microorganisms *Bacillus thuringiensis*, *Bacillus subtilis*, *Bacillus megatherium*) 40 l/ha;
- 3: Zytron (citrus seed extract 20 %) 0.15%;
- 4: Mimoten (*Mimosa tenuifolia* 80 % extract) 0.3 %;
- 5: Untreated control.

The optimal time for applying treatments to control pathogens was identified in the third decade of May, when 6 days of precipitation were recorded in Vidra, totaling 98 l/sq.m. The fallen precipitation caused an increase in atmospheric humidity of over 95% in greenhouse and an average temperature of 18.81 °C, creating favorable conditions for the emergence and evolution of pathogens.

Observations and determinations were made on the leaves (5 plants/variant) regarding the frequency and severity of the *Alternaria capsici* pathogen, based on which the efficacy of the products was calculated.

RESULTS AND DISCUSSIONS

In the biological control of the pathogen *Alternaria capsici*, good results were obtained to the treated variants, with an efficacy between 68.08 % (Zytron 1,5 l/ha) and 94.38 % (Amulet 40 l/ha) in controlling this pathogen on leaves (table 1).

The products Cavaler 3 l/ha and Amulet 40 l/ha are the best efficacy on *Alternaria* spp. on both bell pepper cultivated. The lowest efficacy was obtained on Zytron 1.5 l/ha with 77.3 % on Marbella F1 and 68.08% on Barbie F1.

Table 1

The efficacy of products to control the pathogen *Alternaria* sp.,
in bell pepper crops

Var.	The control product	Dose / ha (L/ha)	Attack frequency (%)	Attack intensity (%)	Attack degree (%)	Efficacy (%)
Bell pepper Marbella F1						
1	Cavalier	3.0	15.0	10.0	1.5	88.76
2	Amulet	40.0	15.0	5.0	0.75	94.38
3	Zytron	1.5	20.0	15.0	3.0	77.53
4	Mimoten	3.0	20.0	10.0	2.0	85.02
5	Untreated control	-	50.0	26.7	13.35	-
Bell pepper Barbie F1						
1	Cavalier	3.0	20.0	10.0	2.0	82.97
2	Amulet	40.0	15.0	10.0	1.5	87.23
3	Zytron	1.5	15.0	15.0	3.75	68.08
4	Mimoten	3.0	25.0	10.0	1.5	87.23
5	Untreated control	-	50.0	23.5	11.75	-

The yield is influenced by phytosanitary treatments applied for the control of the pathogen *A. capsici* on bell pepper yield (table 2, fig. 1). From the variants treated with the products that assured the best efficacy we are obtained the best yield 3,01 kg/sq/m (Cavalier 0.3 %) and 2.9 kg/sq/m (Amulet 40 l/ha) on Marbella F1).

Table 2

Influence of phytosanitary treatments for the control of the pathogen
A. capsici on bell pepper yield

Var.	The control product	Dose / ha (L/ha)	No. Fruits/plant	Fruits weight (g)	Yield (kg/sq.m.)
Bell pepper Marbella F1					
1	Cavaler	3.0	9.2	98	3.011 ^c
2	Amulet	40.0	10.4	84	2.917 ^c
3	Zytron	1.5	10.1	72	2.429 ^b
4	Mimoten	3.0	9.7	74	2.397 ^b
5	Untreated control	-	7.4	76	1.878 ^a
Bell pepper Barbie F1					
1	Cavaler	3.0	12.9	52	2.240 ^b
2	Amulet	40.0	13.2	49	2.160 ^b
3	Zytron	1.5	11.3	50	1.887 ^a
4	Mimoten	3.0	12.4	50	2.071 ^{ab}
5	Untreated control	-	10.7	51	1.823 ^a

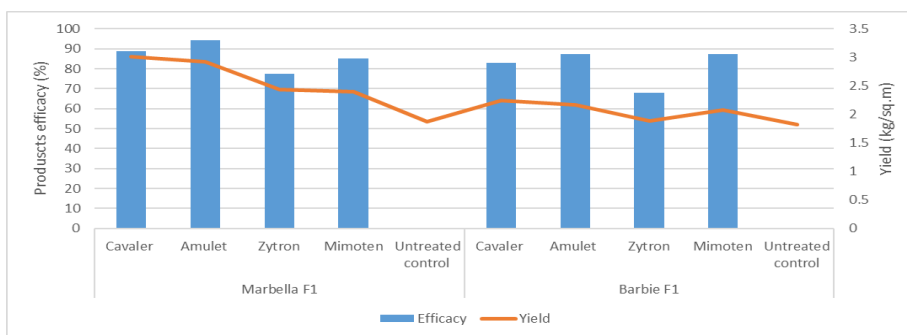


Figure 1. The influence of phytosanitary treatments for the control of the pathogen *A. capsici* on bell pepper yield

CONCLUSIONS

Biological products (Cavaler 600SL 3 l/ha, Amulet 40 l/ha, Zytron 1.5 l/ha and Mimoten 3 l/ha) have an efficacy of between 68.08 and 94.38 % in the control of the pathogens *Alternaria capsici*, as a result their use is recommended in case of a low attack or preventive when conditions are favorable for the attack.

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REFERENCES

Barcanu, E., Agapie, O., Gherase, I., Tanase, B., & Dobre, G. 2023. Evaluating cultivars for organic farming: tomatoes, peppers and aubergine in south Romania. Agriculture & Food, Vol. 11, ISSN 1314-8591.

Bratu, E., Petcuci, A. M., & Sovarel, G. 2015. Efficacy of the product Spinosad an insecticide used in the control of tomato leafminer (*Tuta absoluta*-Meyrick, 1917), Bulletin of University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca, Horticulture, 72 (1).

Călin Maria, T.O. Cristea, P.M. Brezeanu, S. Ambarus, C. Brezeanu, S.P. Muscalu, F. Sova, C.A. Antal, M. Prisecaru, M. Costache, G. Sovarel, L. Bratu, F. Burnichi, G. Sbîrciog .2020. Biological control of pepper pests in organic agriculture – Proc. IHC 2018 Symposium 28 – II Int. Symp. on Innovative Plant Protection in Horticulture, Turcia, Acta Hortic.1269.22

Călin, M., Cristea, T. O., Ambăruș, S., Brezeanu, C., Brezeanu, P. M., Costache, M., ... & Bratu, L. 2017. Biological control of two-spotted spider mite in pepper and melon crops cultivated in tunnels. Scientific Papers, Series B. Horticulture, volume LXI, UȘAMV București.

Cenușă, A. E., Șovărel, G., Costache, M., Bratu, E., & Velea, M. (2016). Effect of some" bio-insecticides" used against two spotted spider mites (*Tetranychus urticae* Koch.) in the cucumbers crop under plastic tunnel conditions. Scientific Papers, Series B. Horticulture, volume LX, UȘAMV București.

Hogea, S. Ș. (2020). *Tuta absoluta* (Meyrick)(Lepidoptera: Gelechiidae)–biology, ecology, prevention and control measures and means in greenhouse tomato crops. A review. Current Trends in Natural Sciences, 9(17);

Iosob, G. A., & Cristea, T. O. 2022. The study of *Perillus bioculatus* F. (Heteroptera, Pentatomidae) population as a potential key factor in the development of biological management strategies for *Leptinotarsa decemlineata* Say at *Solanum melongena* L. Romanian Journal of Horticulture, 3;

Radwan, M.A., Abu-Elamayem, M.M., Shiboob, M.H., & Abdel-Aal, A. 2005. Residual behavior of profenofos on some field-grown vegetables and its removal using various washing solutions and household processing. Food Chem. Toxicol., 43, 553–557.

Shim, J.-H., Eun, J.-B., Zaky, A.A., Hussein, A.S., Hacimüftüoglu, A., & Abd El-Aty, A.M. 2023. A Comprehensive Review of Pesticide Residues in Peppers. Foods, 12, 970.

Șovarel G., Scurtu I., Hogea S., Sbirciog G. (2024) Biological and conventional control of *Sphaerotheca fuliginea* pathogen on zucchini crops. Scientific Papers. Series B, Horticulture, Vol. LXVIII, Issue 2

Șovarel G., Scurtu I., Hogea S., Sbirciog G. (2024) Biological control of main diseases and pests on melon crops in the field. Scientific Papers. Series B, Horticulture, Vol. LXVIII, Issue 1;