

RESEARCH ON THE REACTION OF SOME BEAN GENOTYPES TOWARDS PATHOGENIC AGENTS DETECTED, UNDER IRRIGATED CULTIVATION CONDITIONS, IN THE BALTA-ALBĂ AREA, BUZĂU COUNTY

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Abstract

The aim of this work is to highlight the reaction of bean genotypes to specific pathogens under conditions of natural infection and irrigated cultivation. The observations were carried out under the conditions of 2025, within S.C. BioVitAgro, Balta-Albă, Buzău County. The biological material used was represented by the bean varieties: Elba, Sonesta, Supernano Giallo and Canellino. The diseases detected were: bean common mosaic (Bean common mosaic virus), bacterial blight of bean (*Xanthomonas phaseoli* pv. *phaseoli*), fusarium wilt of bean (*Fusarium oxysporum* f. sp. *phaseoli*) and angular leaf spot of bean (*Pseudocercospora griseola*). Observations were made regarding the incidence and intensity of the attack in the control and fungicide-treated variants. The degree of attack and the effectiveness of the applied treatments were calculated. The highest attack values were determined in the control variant, in which the frequency of attack by *Pseudocercospora griseola* was 59.5%, and the lowest in the attack by *Fusarium oxysporum* f. sp. *phaseoli* (8.25%). The application of treatments had an effectiveness ranging between 63.6% and 96.25% in combating the monitored diseases.

Key words: pathogens, diseases, attack, effectiveness.

INTRODUCTION

Common beans are one of the longest-cultivated plants.

Genetic analyses of the common bean *Phaseolus* show that it originated in Mesoamerica, and subsequently spread southward, along with maize and squash, traditional companion crops (Bitocchi et al., 2012).

Common beans are still an important part of world agriculture and are an essential part of a balanced diet in many countries.

In Romania, beans are cultivated on approximately 35.000 ha. (https://insse.ro/cms/files/GAC/tabele/AUTOREP_8.HTM), of which, in Buzău County in 2023, 307 ha were cultivated (https://buzau.insse.ro/wp-content/uploads/2025/05/Anuar-DJS_BZ-editia-2024.pdf).

The nutritional values of 100 g of *Phaseolus vulgaris* L. - genus *Phaseolus*, family *Fabaceae*, order *Fabales*, class *Angiospermae*, phylum

Magnoliophyta, kingdom *Plantae* (<https://gd.eppo.int/taxon/PHSVX>), dried, boiled, without salt are: carbohydrates - 25.1 g; fats - 0.35 g; proteins - 9.73 g; a series of vitamins: thiamine (B1) - 0.118 mg, riboflavin (B2) - 0.046 mg, niacin (B3) - 0.14 mg, pantothenic acid (B5) - 0.229 mg, vitamin B6 - 0.093 mg, folic acid (B9) - 81 µg, vitamin E - 0.94 mg, vitamin K - 3.5 µg; minerals: Ca - 90 mg, Fe - 3.7 mg, Mg - 63 mg, Mn - 0.636 mg, P - 113 mg, K - 561 mg, Na - 6 mg, Zn - 1.38 mg; choline - 35.1 mg and water - 63.1 g (<https://fdc.nal.usda.gov/food-details/175203/nutrients>).

Consumption of common beans along with cereals, through the supply of essential amino acids and other nutrients, contributes to the prevention of cardiovascular diseases, diabetes and certain types of cancer (Broughton et al., 2003; Thompson et al., 2017; Viguiliouk et al., 2017).

Cultivation peculiarities of the species *Phaseolus vulgaris* L.: altitude: 50-3000 m; daytime temperature: 14-26°C; mean annual precipitation: 400-1600 mm/year; duration of growth cycle from start to end of harvest: 70-330 days; yield potential in tropical areas: 400-5000 kg/ha (<https://hort.purdue.edu/beans.html>).

Biotic factors of phytopathological nature cause the decrease in bean production (Wani et al., 2023).

Of the 20 bean diseases mentioned worldwide (https://en.wikipedia.org/wiki/List_of_diseases_of_the_common_bean), in the present experience the following were detected: bean common mosaic (*Bean common mosaic virus*), bacterial blight of bean (*Xanthomonas phaseoli* pv. *phaseoli*), fusarium wilt of bean (*Fusarium oxysporum* f. sp. *phaseoli*) and angular leaf spot of bean (*Pseudocercospora griseola*).

Common bean (*Phaseolus vulgaris* L.), is susceptible to infection with one of the most widespread and damaging viruses in the *Potyviridae* family: bean common mosaic virus-BCMV (Morales, 2006).

Yield losses as a result of bean common mosaic virus-BCMV and bean common mosaic necrosis virus-BCMNV can reach 100% (Li et al., 2014). Bacterial blight of bean-*Xanthomonas phaseoli* pv. *phaseoli* (Smith) Constantin, Cleenwerck, Maes, Baeyen, Van Malderghem, De Vos, Cottyn, a systemic, seed-transmitted (Aggour et al., 1989), in areas with warm weather, causing yield reductions of up to 40% (Singhet al., 1999).

Fusarium wilt of bean-*Fusarium oxysporum* f. sp. *phaseoli* J.B.Kendrick & W.C.Snyder, first identified in common beans in the USA in 1929 (Xue et al., 2015), leads to the death of infected plants (Batista et al., 2017).

Angular leaf spot of bean-*Pseudocercospora griseola* (Sacc.) Crous & Braun, considered the second most important fungal disease after anthracnose, can cause yield reductions of up to 80% when the disease triangle is favored by all factors (Schwartz et al., 1981; Rava Seijas et al., 1985).

Irrigation is a particularly important link in bean cultivation, for obtaining high yields. Although beans have moderate moisture requirements, the critical phases for water are: seed germination, flowering, grain setting and growth.

Among the mentioned phases, beans are very sensitive to moisture deficits in the flowering and grain formation phenophases, due to the short interval between these phenophases (Coadă et al., 2021).

MATERIALS AND METHODS

The experimental field was established within the BioVitAgro farm, in Balta-Albă commune (45°17'50.1"N, 27°17'5.6"E), Buzău County.

The climate in the experimental fields Balta-Albă, according to the Köppen-Geiger classification, is of the Dfb type (Peel et al., 2007). D: continental climate with hot summers and cold winters; f: wetter summers than winters; b: temperature of the warmest month >22°C and temperature of the coldest month below -4°C.

The main climatic parameters are shown in Figure 1.

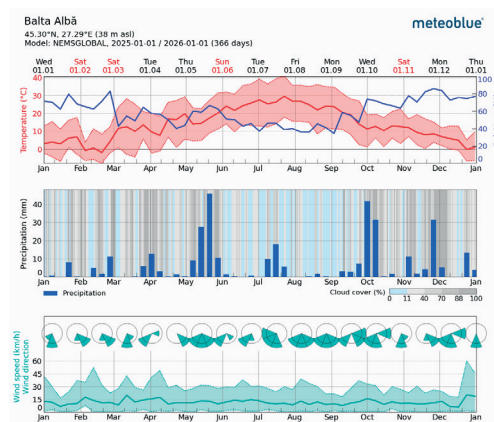


Figure 1. Climatic parameters - Balta-Albă, 2025
(source:https://www.meteoblue.com/ro/vreme/historyclimate/weatherarchive/balta-alba_romania_685575?fcstlength=1y&year=2025)

Bacterial blight of bean is favored by temperatures of 25-30°C and high humidity (Severin and Iliescu, 2006).

Angular leaf spot of bean is favored by temperatures of 25-30°C and high humidity alternating with dry conditions (<https://www.greenlife.co.ke/bean-angular-leaf-spot/>).

Fusarium wilt of bean is favored by high temperatures and drought (Garcés-Fiallos et al., 2017).

The beans were drip-watered three times: the first to help the emergence (25 mm), the second in the growth stage (25 mm): first flower buds enlarged - BBCH55 (Feller et al., 1995), and the third in the growth stage (25 mm): beginning of pods development - BBCH71.

A uniform agrotechnics was applied in all variants in terms of pre-plant: corn, ploughed to a depth of 25 cm, fertilizing (NPK 15:15:15 - 200 kg/ha), preparation of the germination bed, sowing (April 8, 2025), herbicide with Basagran® SL - 2 l/ha, in the phenophase of weeds with 2-4 leaves (BBCH 12-14); two treatments were applied with the insecticides Faster Delta-0.25 l/ha and Mospilan 20 SG-0.1 kg/ha.

The distance between the rows of common beans was 70.0 cm, and the distance between the beans/row was 8 cm.

Abiotic factors, especially precipitation and temperature, play an important role in the development and pathogenicity of pathogens that cause diseases in agricultural crops (Lipianu et al., 2023; Zală et al., 2023).

The biological material used in the experiments was represented by 4 varieties of common beans: Elba, Sonesta, Supernano Giallo and Canellino.

The experiments were placed using the randomized block method (Săulescu & Săulescu, 1967). There were four repetitions for each of the four varieties of beans (Figure 2.). Area of one variant - 14 m² (4 rows 5 m long).



Figure 2. Aspects from the experimental field with common beans (foto: Cristina Bălașu)

Experimental variants: V1 - control, V2 - 1 treatment applied in the phenophase of the first enlarged flower buds, with Alcupral 50 WP - 2.5 kg/ha; V3 - 1 treatment applied in the phenophase of the beginning of the development of the first pods, with Ortiva Top - 1 l/ha; V4 - 2 treatments, with both fungicides in the same phenophases.

Observations on the efficacy of fungicides were made 10 days after the application of the last treatment.

Visual inspection is the fastest method of identifying diseases based on the typical symptoms presented by infected bean plants.

The attack value is represented by frequency-F% (incidence of the disease), intensity-I% (severity) and attack degree (AD%).

Frequency represents the number of leaves/plants attacked out of 100 leaves/plants examined. Visually estimated intensity (in percent) indicates the degree to which the leaf or plant is attacked.

The attack degree of a disease in bean crop was calculated using frequency and intensity using the formula:

$$AD (\%) = \frac{F (\%) \times I (\%)}{100}$$

The effectiveness of treatments with fungicides was calculated according to the Abbott (1925) formula, based on the recorded attack degrees:

$$E (\%) = \frac{AD \text{ control} - AD \text{ treated}}{AD \text{ control}} \times 100$$

RESULTS AND DISCUSSIONS

Results regarding the symptomatology of the detected diseases

Bean common mosaic virus (BCMV) is of particular importance in warm areas with average rainfall that favors the growth of vector aphid populations, responsible for the spread of the virus.

The virus manifested itself on infected leaves with typical mosaic symptoms (green-yellowish spots alternating with healthy green tissue) and wrinkling of the leaf blade (Figure 3.).

Bacterial blight of bean- *Xanthomonas phaseoli* pv. *phaseoli* starting as small, water-soaked spots on leaves that turn brown with distinctive lemon-yellow halos, leading to large dead areas, and a "burned" look (Figure 4.).



Figure 3. Leaflet with typical symptoms of bean common mosaic virus infection (foto: Cristina Bălașu)

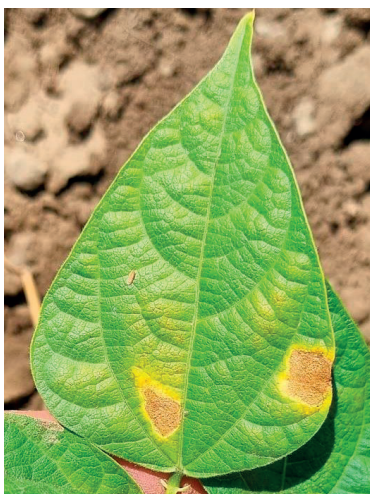


Figure 4. Leaflet with typical symptoms of bacterial blight (foto: Cristina Bălașu)

Fusarium wilt of bean-*Fusarium oxysporum* f. sp. *phaseoli* caused stunting, chlorosis and complete wilting of infected bean plants (Figure 5.).

Angular leaf spot of bean - *Pseudocercospora griseola*, one of the most devastating diseases of common beans in tropical and subtropical production areas (Nay et al., 2019), manifested itself due to the high temperatures recorded in the summer months in the research area.

Angular spot of beans manifested itself on the leaves through small, angular, brown spots, limited by veins (Figure 6.).

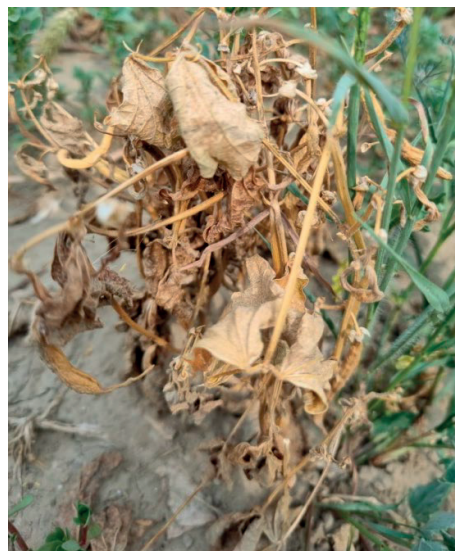


Figure 5. Dried plant as a result of infection with the fungus *Fusarium oxysporum* f.sp. *phaseoli* (foto: Cristina Bălașu)



Figure 6. Leaflets with typical angular leaf spot attack (foto: Cristina Bălașu)

Results regarding attack scoring and treatment efficacy

Bean common mosaic virus was only found in the Supernano Giallo and Canellino varieties. The average frequency was 8% in the Supernano Giallo variety and 9% in the Canellino variety, and the average intensity was 5% in the other varieties.

The frequency of bacterial blight (Table 1) varied in the control variant from 14.75% in the Supernano Giallo variety to 10.5 in the Canellino variety. The application of a treatment with the fungicide Alcupral 50 PU (variant V2) contributed to the reduction of the frequency to 2.55 in the Sonesta and Canellino varieties and to 3.0% in the Supernano Giallo variety. The application of two treatments with Alcupral 50 WP (V4) contributed to the reduction of the frequency to 1.5 in the Sonesta and Canellino varieties and to 1.75% in the Supernano Giallo variety.

The intensity of the bacterial blight attack varied between 2 and 6%. The highest degree of bacterial blight attack, 0.9%, was recorded in the control variant of the Supernano Giallo variety, and the lowest, 0.03%, in the V4 variant of the Sonesta and Canellino varieties.

The Elba variety did not show any bacterial blight attack.

Angular leaf spot of bean only appeared in the Supernano Giallo and Canellino varieties. The highest frequency value, 59.5%, was recorded in V1 of the Supernano Giallo variety, and the lowest, 2.5%, in V4 of the Canellino variety. The intensity varied between 2 and 5%. The degree of attack was the highest, 8.93%, in V1 of the Supernano Giallo variety and the lowest, 0.05%, in v4 of the Canellino variety.

Fusarium wilt of bean only occurred in the Canellino variety. In variants V1 and V2 the attack frequency was 8.25%. The attack intensity was 100% in all experimental variants. The attack degree decreased from 8.25% in V1 and V2 to 3% in V3, respectively to 1.25% in V4.

Regarding the effectiveness of treatments with Alcupral 50 WP, this ranged from 85% in the Canellino variety when one treatment/vegetation was applied (V2), to 96.25% in the Sonesta variety, when two treatments were applied (V4). Ortiva top is not effective against bacterial blight of bean.

Applying a single treatment with Ortiva Top (V3), against leaf scorch, had an effectiveness of 72.7% in the Supenano Giallo variety and 82.1% in the Canellino variety. Applying two treatments with Ortiva Top (V4) had an effectiveness of over 98% on both varieties.

The effectiveness of Ortiva Top fungicide against fusarium wilt was 63.6% in the variants

with one treatment and 84.8% in the variants with two treatments.

Alcupral 50 WP is not effective against angular leaf spot in beans nor against fusarium wilt.

Research on the effectiveness of the treatments applied provides data on the possibility of introducing them into crop management schemes (Chiriac and Cristea, 2021; Toth and Cristea, 2020).

Table 1. Scoring of bacterial blight, angular leaf spot and fusarium wilt attack; calculating the effectiveness of the treatments applied

Variety	Variant	Frequency (%)	Intensity (%)	Attack degree (%)	Effectiveness (%)
Bacterial blight of bean					
SONESTA	V1	14.25	5.5	0.8	-
	V2	3.25	2.5	0.08	90.0
	V3	13.75	5.0	0.7	12.5
	V4	1.5	2.0	0.03	96.25
SUPERNANO GIALLO	V1	14.75	6.0	0.9	-
	V2	3.5	3.0	0.1	88.9
	V3	14.5	5.2	0.8	11.1
	V4	1.75	2.0	0.04	95.6
CANELLINO	V1	10.5	4.1	0.4	-
	V2	2.25	2.5	0.06	85.0
	V3	10.0	4.0	0.4	0.0
	V4	1.5	2.0	0.03	92.5
Angular leaf spot of bean					
SUPERNANO GIALLO	V1	59.5	15.0	8.93	-
	V2	58.25	15.0	8.74	2.13
	V3	30.5	8.0	2.44	72.7
	V4	5.75	2.0	0.12	98.7
CANELLINO	V1	44.75	10.0	4.48	-
	V2	44.75	10.0	4.48	0.0
	V3	20.0	4.0	0.8	82.1
	V4	2.5	2.0	0.05	98.9
Fusarium wilt of bean					
CANELLINO	V1	8.25	100.0	8.25	-
	V2	8.25	100.0	8.25	0.0
	V3	3.0	100.0	3.0	63.6
	V4	1.25	100.0	1.25	84.8

CONCLUSIONS

The common bean mosaic virus only manifested itself on the upper leaves.

Bacterial blight of beans manifested itself only on the lower leaves as a result of the favorable microclimate created by drip irrigation. Symptoms appeared after the first pods formed. Angular leaf spot of bean manifested itself towards the end of the growing season, especially on the leaves in the upper half of the plants.

All four detected diseases manifested only on the leaves.

The application of plant protection products for the management of fungal and bacterial diseases is one of the successful methods in terms of

preventing and combating them and obtaining high and quality bean production.

ACKNOWLEDGEMENTS

This article was financed by the Faculty of Agriculture, University of Agronomic Sciences and Veterinary Medicine of Bucharest.

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