Romanian Journal for Plant Protection, Vol. XVIII, 2025
ISSN 2248 – 129X; ISSN-L 2248 – 129X

DISEASES INCIDENCE AND THEIR CONTROL IN GRAPEVINE IN DOBROUDJA

Daniel Jalobă[1], Marga Grădilă[1], Valentin-Marius Ciontu[1], Raluca Monica Cristea[1], Dana Cotigă[2], Cornelia Dragomir [3]*

[1]Research-Development Institute for Plant Protection, Bucharest
[2]Bogdan Estate Constanța
[3]Fruits-Grapes Growing Farm Canlia Constanța

*correspondence address:
Research-Development Institute for Plant Protection
8 Ion Ionescu de la Brad 013813, Bucharest, Romania
Phone: + 40 21269 32 31
Fax: + 40 21269 32 39
E-mail: daniel.jaloba@icdpp.ro

Doi: http://www.doi.org/10.54574/RJPP.18.10

Abstract: This study investigates the incidence and control of two major cryptogamic diseases of grapevine, namely powdery mildew (*Erysiphe necator*) and black rot (*Guignardia bidwellii*), in the Dobroudja viticultural region. Assessments were conducted in two vineyards located in Murfatlar (organic system) and Ostrov-Oltina (conventional system). Disease development was assessed visually and microscopically on leaves and grape clusters across key phenological stages. Treatment schemes adapted to the genetic material and applied at critical infection periods showed high efficacy (76.32-89.09%) against both pathogens. Results highlighted an increased pressure of black rot and an earlier onset of powdery mildew infections compared to previous decades. Climatic factors and local inoculum sources strongly influenced disease incidence. The applied control strategies significantly reduced degree of attack and prevented major yield losses. Overall, effective disease management remains essential for sustaining grape wine production in Dobroudja under changing climatic conditions.

Keywords: *powdery mildew, black rot, control, treatments*

INTRODUCTION

The grapevine is one of the world's oldest cultivated plants and the world's most widespread fruit plant throughout all continents, excepting Antarctica **(**Dejeu, 2010). European viticulture is a highly diversified branch, a key source of agricultural income for many regions and significant part of final agricultural production in many member states such as Italy, France, Spain, Portugal or Greece (Stroe, 2022). In Romania, grapevine growing has also ancient roots as historians and archaeologists assert and that has continued to nowadays as a primary traditional occupation in the specific areas. Therefore, in 2024, vineyards covered a surface of 161930 hectares with a yield of 4348.5 kg/ha (FAOSTAT, 2024).

Grape cultivation throughout the world is threatened by various diseases among which some fungal diseases, powdery mildew, downy mildew, black and grey rot or anthracnose pose serious constraints in getting desired yields of good quality (Thind et al., 2004). Besides, the existing climate change is likely to affect pathogens biology and incidence so that farmers are expected to evolve in response to the increase and/or decrease of disease development in the vineyard.

The region of Dobroudja is located in South East of Romania and is boundered from north, west and east by Danube and Black Sea. It is one of driest and warmest region and host many historical vineyards. With the emergence of pathogens of the American continent in 19th

century, vinegrowers here are also facing a series of problems, the most notable of which recently have been powdery mildew and black rot.

Powdery mildew is caused by *Erisyphe necator* Schwein., a polycyclic disease with two distinct phases: primary infections are caused by sexual spores (ascospores) and secondary infections are determined by asexual spores (conidia) (Bois et al., 2017; Volpi et al., 2021; Gadoury & Pearson, 1988), on all green tissues of grapevines, mainly leaves and berries (Gadoury et al., 2001; Caffi et al., 2011; Morando et al., 2020). This fungus is an obligate parasite (Gheorghieș & Geamăn, 2011), meaning it can only survive by infecting host plants, mainly grapevines of the genus *Vitis*. The most harmful attack is on the grapes, which eventually crack, causing the juice to leak out and creating conditions for infection with *Botrytis* or other pathogens. Out of the infected plots, small quantity of must is obtained which is unfit for high quality wine producing.

Black rot is caused by the ascomycete *Guignardia bidwellii* (Ellis) Viala & Ravaz (anamorph: *Phyllosticta ampelicida* (Englem.) var der Aa). Recently, this pathogen has been increasingly prevalent in the vineyards of Dobroudja, possibly due to global warming but also to changes in cultivation technology over time. The disease may affect leaves and petioles, shoots and bunches (Hoffman et al., 2004) and can lead to total crop losses at a severe attack (Molitor & Beyer, 2014) in vineyards located in warm and humid climates. It is capable for several infection cycles per season and the inoculum produced in one season can be carried over to the next one, leading to the accumulation of inoculum over the years (Szabó et al., 2023). The pathogen is favored by long periods of rainfall in spring with air humidity above 85%. Best temperatures are between 22-28°C (Ullrich et al., 2009). Berries are most susceptible to infections between flowering and bunch closure and consequently, fungicide applications against black rot need to focus on this period (Molitor & Beyer, 2014). Black rot poses a threat to both yield and wine quality.

Considering these issues, this paper aims to present results on powdery mildew and black rot control in grapevine in Dobroudja area, where this pathogen continues to cause damage every year.

MATERIALS AND METHODS

The research was conducted between November 2024 and October 2025 in two vineyards located in Peștera village and Canlia village, both in Constanța county:

(I) at Peștera (Murfatlar area, Figure 1), a vineyard planted with Merlot grafted on Kober 5BB, was studied during the growing season. This hand-pruned plantation was planted in 2011 at 2.5x 1.2 meters and trained in spurred cordon. The vines were grown under ecological system. Merlot is a French black grape variety that was imbreeded by crossing Cabernet Franc and Magdeleine Noire des Charentes and is a amedium sensitive variety to powdery mildew and grey and black rot.

(II) at Canlia (Ostrov-Oltina area, Figure 2) a vineyard planted with Fetească Neagră variety grafted on Berlandieri x Riparia Teleki and trained on Guyot system, was taken into account. They were planted in 2009 at 2 x 1.5 meters and grown in conventional manner. The Fetească Neagră grapevine is a native variety, with ancient origins. The vines grow very vigorously, with strong vegetative growth and low fertility, 35-40% fertile shoots (Cotea & Cotea, 1996, Rotaru, 2009). It is relatively sensitive variety to climatic conditions and the technological level applied (Constantinescu et al., 2024). It has very good resistance to frost (-22°C -24°C) and drought, is sensitive to downy mildew and powdery mildew, and has medium resistance to gray mold, moths and mites. Full ripening occurs in September, depends

on region. Its productivity ranges from year to year, 5-19 t/ha and can accumulate sugars between 200-240 g/l.

Figure 1. Peștera vineyard

Figure 2. Canlia vineyard

The trials were conducted using the randomized complete blocks method in four repetitions. Experimental plot treated with fungicides consisted of 100 vines and the untreated control plot had 60 plants. Seven phytosanitary treatments were carried out by the farmers, scheduled according to the vine critical stages, from dormancy (BBCH 00) to leaf fall (BBCH 95). A number of 100 leaves and 50 bunches per plot were assessed before each spray and after ten days until the latest treatment by visually rating to evaluate the pathogens attack. The last assessement was at harvest time on bunches. Assessments were performed on the frequency (F% or Pest Incidence) and the intensity (I% or Pest Severity) of pathogen attack and the degree of attack (DA%) and efficacy (E%) were calculated. DA% = F x I/100 and E% (Abbott`s formula) = (DA in untreated control - DA in treated plot)/ DA in untreated control x 100. All data were subjected to statistical analysis provided by ARM-9 (P= .05 Student Newman Keuls sofware (Jalobă et al., 2021).

The maintainance of the vineyards consisted on autumn tillage carried out by ploughing on the intervals between rows. Pruning works for growth and bearing control were carried out, before the beginning of the growing season. Prunned branches were chopped by a shreder. Specific cultural practices for vineyards were performed including tasks done by hand (shoot, bud and leaves canopy management), maintenance, fertilization, drip irrigation (at Canlia) and pests control.

At Peștera nine biodynamic preparations designed to enhance the soil's natural properties were applied. These are naturally prepared based on specific recipes, from mineral substances as silicon, cow manure, cow horns, and medicinal plants (yarrow, chamomile, nettle, oak acorns, dandelion and valerian). A quantity of 500 liters/m^2 in Canlia of water was applied by drip irrigation to the vineyard from April until mid-august.

The protection strategy for Peștera vineyard included seven treatments with copper and sulfur-based products, authorized for use in organic farming (Table 1) and a classic formula for phytosanitary protection of vines was adopted in Canlia vineyard (Table 2).

Table 1. Treatments schedule at Peștera

Tr. No.	Product	Active substance	Conc. (g/kg, g/l)	Formulation	Dose (kg,l/ ha)	Pathogen/Pest	Applic. time (BBCH) Month, decade
1	Bouillie Bordelaise type MIF Copper Sulfate type MIF	Copper from Bordeaux mix 24.5% Copper, 11.5% Sulfur, 1% Sodium Lauryl Sulfonate	200 370	WDG WP	5 5	*Plasmopara viticola, Guignardia bidwellii, Pseudopeziza tracheiphila*	End of leaf fall (BBCH 95) Nov. I

2	Polisulf type MIF	S (15%) + Ca (4%) + C (2%)	210	SL	20	*Erysiphe necator*	Beginning of bud burst (BBCH 07), Apr. I
3	Bouillie Bordelaise type MIF Sulphur 80 WG	Copper from Bordeaux mix Sulph	200 800	WDG WG	7.5 3	*P. viticola,* *E. necator*	Shoots 10 cm, first leaf unfolded (BBCH 11), Apr. III
4	Thiovit Jet 80 WG Airone SC	Sulph Copper	800 272	WG SC	3 2,5	*E. necator, acarians, G. bidwellii, P. tracheiphila, P. viticola*	End of flowering (BBCH 69), May III
5	Bouillie Bordelaise type MIF Cosavet 80 DF	Copper from Bordeaux mix S (15%) + Ca (4%) + C (2%)	200 800	WP WG	7.5 5	*P. viticola* *E. necator*	Berries begin to touch (BBCH 77), June II
6	Cuproxate Flowable Sulphur 80 WG	Copper Sulph	190 800	SC WG	4.5 3	*P. viticola, G. bidwellii, P. tracheiphila, E. necator,* mites	Majority of berries touching (BBCH 79), July II
7	Curenox 50 Kumulus DF	Copper (from copper oxychloride) Sulph	500 800	WG WG	2 4.5	*P. viticola, G. bidwellii, P. tracheiphila, E. necator,* mites	Beginning of ripening: berries begin to develop variety-specific colour (BBCH 81), Aug. III

All phytosanitary treatments were carried out using modern professional spraying equipments towed by vineyard tractors equipped with electronic navigation systems. Each treatment was carried out on warning, taking into account the critical phenophases of the vines and the weather forecast. The equipment was operated by qualified personnel with extensive experience in viticulture. The treatments were applied in accordance with Good Agricultural Practices when temperatures did not exceed 26°C, there were no water droplets on the leaves, and there was no imminent danger of precipitation.

Table 2. Treatments schedule at Canlia

Tr. No.	Product	Active substance	Conc. (g/kg, g/l)	Formulation	Dose (kg,l/ha)	Pathogen/Pest	Applic. time (BBCH) Month, decade
1	Bouillie Bordelaise type MIF	Copper from Bordeaux mix	200	WDG	7.5	*Plasmopara viticola, Guignardia bidwellii, Pseudopeziza tracheiphila*	End of leaf fall (BBCH 95) Nov. I
2	Bouillie Bordelaise type MIF Horticultural oil + Krima 20 SG	Copper from Bordeaux mix Paraphine oil Acetamipride	200 800 200	WDG EC SG	7.5 7.5 0.25	*P. viticola* Mites, leafhoppers, fleas *Tetranychus urticae*	Dormancy (BBCH 00) Feb. II
3	Folpan 80 WDG Azoxycare Kusabi 300 SC Invert 1,8 EW	Folpet Azoxistrobin Pirifenona Abamectine	800 250 300 18	WG SC SC EC	1.25 1 0.2 0.5	*P. viticola* *G. bidwellii, P. viticola* *E. necator* *Tetranychus urticae*	End of flowering (BBCH 69) May I
4	Folpan 80 WDG Flint Max 75 WG Ysayo Karathane Gold 350 EC Ninja	Folpet Tebuconazole+ trifloxistrobin Ciazofamid Meptildinocap Lamba-cihalotrin	800 750 25 350 50	WG WG SC EC SC	2 0.15 4 0.5 0.15	*P. viticola* *E. necator, G. bidwellii* *P. viticola* *E. necator* *Lobesia botrana*	Young fruits begin to swell, remains of flowers lost (BBCH 71) May II
5	Zorvec Zelavin Flovine Azoxycare Dynali Krima 20 SG	Oxatiapiproline 100g/l Folpet Azoxistrobin Difenoconazole+ciflufenamid Acetamiprid	100 800 250 90 200	EC WG SC DC SG	0.2 1.6 1 0.65 0.25	*P. viticola* *P. viticola* *G. bidwellii, P. viticola* *E. necator, G. bidwellii* *Tetranychus urticae*	Berries groat-sized, bunches begin to hang (BBCH 73) June II

6	Zorvec Zelavin Flovine Talendo Karathane Gold 350 EC Azoxycare Coragen	Oxatiapiproline Folpet Proquinazid Meptildinocap Azoxistrobin Clorantraniliprole	100 800 200 350 250 200	EC WG EC EC SC SC	0.2 1.6 0.225 0.5 1 0.175	*P. viticola* *P. viticola* *E. necator* *E. necator* *G. bidwellii, P. tracheiphila, P. viticola* *Lobesia botrana, Eupoecilia ambiguella*	Berries pea-sized, bunches hang (BBCH 75) June III
7	Curzate Max Thiovit Jet 80 WG Cyflamyd 5 EW Cantus Krima 20 SG	Cimoxanil + folpet Sulf Ciflufenamid Boscalid Acetamiprid	528 800 50 500 200	SC WG EW WG SG	2.5 3 0.4 1 0.25	*P. viticola* *E. necator* *E. necator* *Botrytis cinerea* *Tetranychus urticae*	Berries beginning to touch (BBCH 77) July II

RESULTS AND DISCUSSIONS

Assessment of the *Guignardia bidwellii* pathogen in the Peștera and Canlia vineyards and degree of attack

As Dobroudja region is an area of great viticultural potential, pathogens are carefully monitored by farmers who assess the level of attacks by compiling and recording annual databases of each pathogen and pest. Although the typical phytosanitary challenges encountered by vinegrowers in previous years were mainly related to downy mildew and gray rot and less to powdery mildew, recently there has been an upward and increasingly threatening trend of the black rot, both on leaves and bunches, as well as the persistence of powdery mildew.

In Peștera vineyard, the black rot attack on the leaves occurred in May, coinciding with the end of flowering stage, and then progressed over the season on both leaves and clusters. As one can see in untreated plot (Figure 3a) the degree of attack reached 3.5% while in treated sample it was just 0.5% at the end of assessments. The degree of attack on the leaves of the untreated sample increased by 2.5 times, while in the variant where phytosanitary protection was applied, it increased by 8.75 times.

The infection on clusters (Figure 3b) appeared at BBCH 79 (majority of berries touching) on the second decade of July. The infection on the clusters gradually increased, reaching 0.2 to 1.75% in untreated plot. The treated plot had only 0.4% degree of attack.

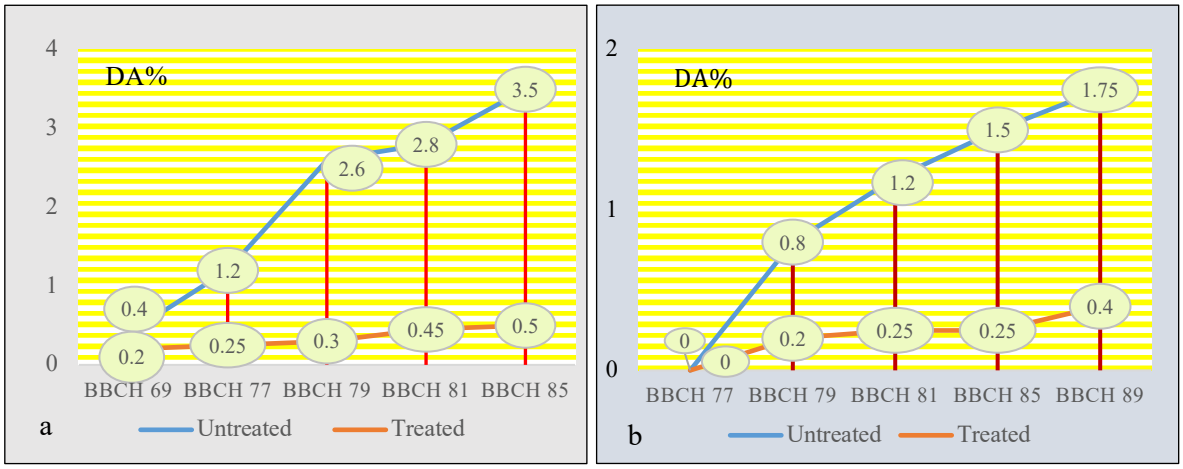

Figure 3. Degree of attack (%) of black rot on leaves (a) and on bunches (b) in Peștera vineyard (P-value=0.014< 0.05 (Anova); LSD 0.05=1.058; P-value= 0.029 < 0.05 (Anova); LSD 0.05=0.57)

The symptoms of the black rot disease on Merlot in vineyard of Peștera noted during the assessments are showed in figure 4. On the leaves symptoms as small yellow spots appeared (Figure 4a). Then, they developed into enlarged spots (lesions) which had a dark brownish-red border with tan to dark brown centers. These dots are fungal structures (pycnidia), which contain thousands of spores (conidia) that can infect new tissue over growing season. On the fruit in untreated plot, brown spots were formed and then the clusters started to shrivel and turn black (Figure 4b). The berries have eventually shrivelled into hard raisin-like structures called mummies. The mummies usually remained attached to the cluster. These remnants could represent the source of inoculum for future infection next season.

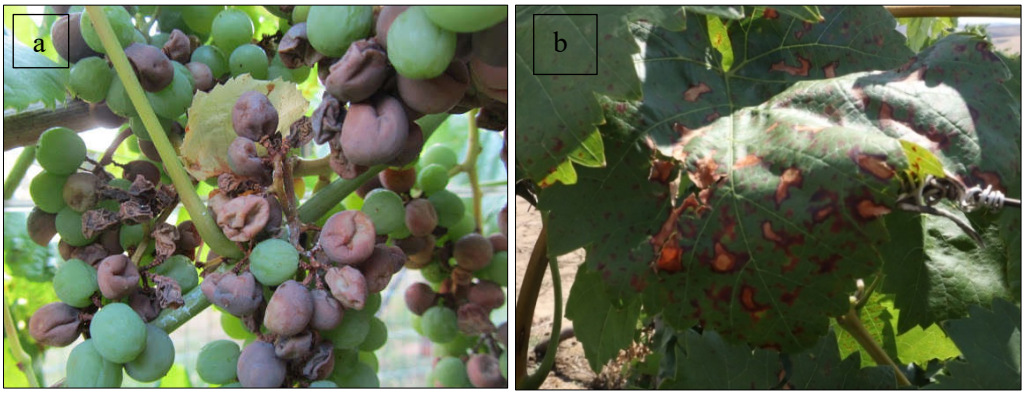

Figure 4. Symptoms of the black rot on Merlot (a) on leaves (b) on bunches in Peștera vineyard

In the vineyard of Canlia, the Fetească Neagră variety in untreated sample had a DA on leaves of 0.6% at the end of flowering which reached 6.25% at stage of majority of berries touching (BBCH 79) (Figure 5a). On the other hand, in fungicides-protected plot, DA went from 0.25 to just 0.8% at the same stage of assessment. Similarly, in the untreated plot, the infection transmitted from leaves to berries (Figure 5b) showed a progressive evolution from berries pea-sized, bunches hang (BBCH 75) to ripening stage (BBCH 89), reaching 6.75 from 0.4%. Protected plot recorded a DA evolving from 0.07 to only 1.4%.

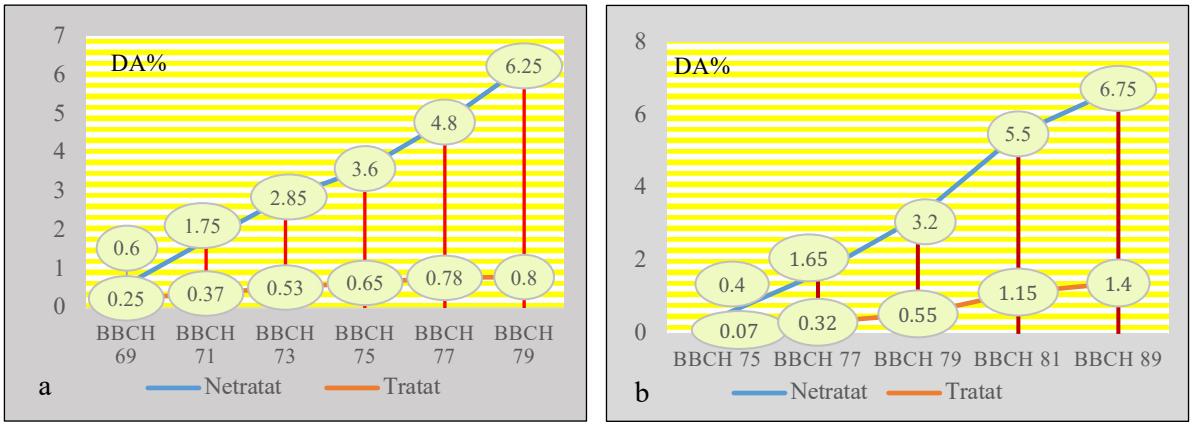

Figure 5. Degree of attack (%) on leaves (a) and on bunches (b) in Canlia vineyard
(P-value=0.008< 0.05 (Anova); LSD 0.05=1.52; P-value=0.046< 0.05 (Anova); LSD 0.05=2.22

Statistical indicator (P-value and LSD) shows significant differences between the untreated and treated samples.

Vineyard of Canlia is located in the south-west of Dobroudja in the very neighbourhood of Danube (Ostrov Branch) and Bugeac Lake. It benefits from higher thermal resources, shelter from the wind provided by the terraces, strong water albedo which ensures more intense sunshine and the thermoregulating effect of the water masses which increase atmospheric humidity (Chira et al., 2008). This fact may influence the occurring of some specific diseases in vineyards. Local farmers have noted with concern that a pathogen that posed very little problem in the past was becoming a potential hazard year on year for their vineyards, in addition to the other threats already present.

The symptoms of the black rot disease noted during the assessments on Fetească Neagră in vineyard of Canlia are showed in figure 6.

Figure 6. Symptoms of the black rot on Fetească Neagră (a) on young leaves, (b) on basal leaves (c) on bunches in Canlia grapevine

Assessment of the *Erysiphe necator* pathogen in the Peștera and Canlia vineyards and degree of attack

Powdery mildew is a very harmful disease due to its widespread infection on all green organs on the vines, especially on clusters and berries, adversely affecting production and the winemaking process. It occurs in almost grapevine areas in Romania and every phytosanitary protection program must include treatments against this disease. Immediately after or almost simultaneously with the period coinciding with the end of the flowering stage of the vine, it was noted the disease outbreak.

In the two vineyards assessed, the degree of disease attack on the leaves shows clear differences between the treated and untreated plots. In Peștera, DA on leaves (Figure 7a) increased in the control plot from 3.75 to 18.3% at the end of the observations, while the ecological treatments reduced the attack to only 2.5%. In Canlia trial, where a conventional protection treatments system was applied, the attack of powdery mildew on leaves (Figure 8a) in the control plot reached 20.75%, being limited to 2.3% in the treated variant.

The evolution on the clusters was similar: in Peștera (Figure 7b), DA reached to 11.4% in the control and only 2.7% in the treated plot, while in Canlia (Figure 8b) the values increased from 3 (BBCH 75) to 13.75% in the control plot, being reduced to 1.5% under treatment. In comparison, Canlia shows higher levels of attack on both leaves and clusters, highlighting the greater pressure of the pathogen in this grapevine plantation.

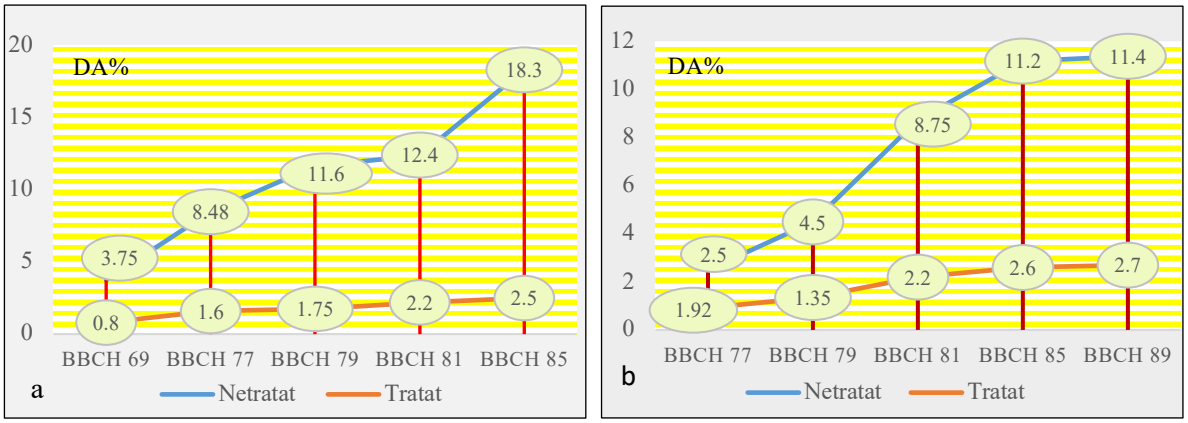

Figure 7. Degree of attack (%) of powdery mildew (a) on leaves and (b) on bunches at Peștera
(P-value=0.0052< 0.05 (Anova); LSD 0.05=4.48; P-value= 0.013< 0.05 (Anova); LSD 0.05=3.39)

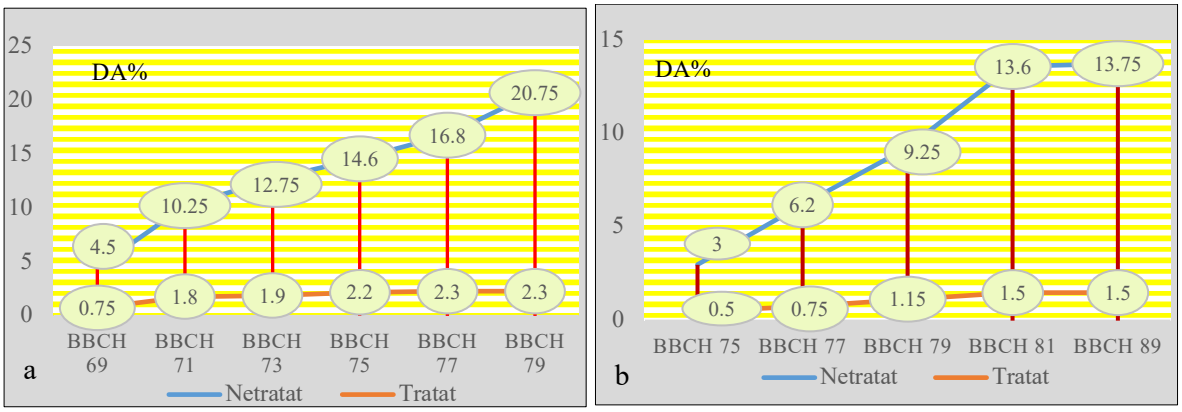

Figure 8. Degree of attack (%) of powdery mildew (a) on leaves and (b) on bunches at Canlia
(P-value= 0.0005< 0.05 (Anova); LSD 0.05=4.16; P-value= 0.004< 0.05 (Anova); LSD 0.05=3.90)

The powdery mildew attack showed a distinct evolution between the two vineyards, reflecting both the sensitivity of the varieties and the type of technology applied. At Peștera (Merlot, organic system), DA% on leaves recorded moderate values in the control plot, while the treatments applied significantly reduced according to statistically significant differences (LSD 0.05 = 4.48). On the clusters, the evolution of powdery mildew was similar, with the untreated variant showing visibly higher levels of attack than the treated plot (LSD 0.05 = 3.39). In Canlia (Fetească Neagră, conventional system), the pathogen pressure was more intense, both on the leaves and on the clusters, as confirmed by the higher LSD thresholds (4.16 and 3.90).

The differences between the two locations show that, although conventional treatments visibly moderate the development of the disease, the sensitivity of the variety and the favorable pedoclimatic conditions led to a higher DA% in Canlia compared to Peștera. Overall, powdery mildew was more aggressive in the Canlia plantation, significantly affecting the green organs and justifying the need for rigorous monitoring and adapted treatments.

Usually, powdery mildew attack was beginning in June, but in 2025 it occurred unexpectedly early, in the third decade of May. Many grapevine growers have noticed this phenomenon. This is an aspect that can be attributed to ongoing climate change. Symptoms on Merlot and Fetească Neagră assessed throughout vegetation are shown in figures 9 and 10.

Figure 9. Symptoms on Merlot (a) on leaves (b) on bunches at Peștera

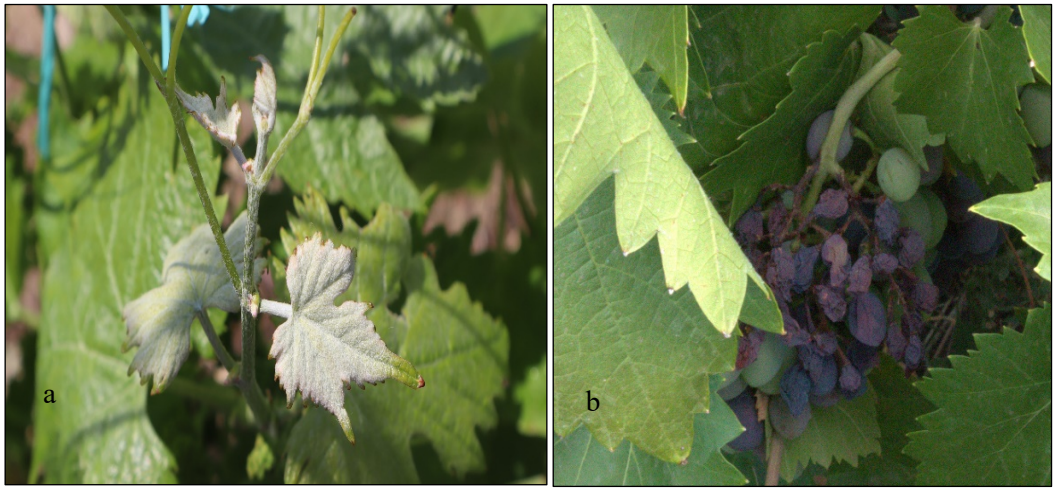

Figure 10. Symptoms on Fetească Neagră (a) on young leaves (b) on bunches at Canlia

Efficacy on *Guignardia bidwellii* and *Erysiphe necator* pathogens in the Peștera and Canlia vineyards

Vineyards represent one of the most chemically intensive agricultural systems due to their high degree of specialization and management intensification, which increase susceptibility to fungal diseases such as powdery mildew (*E. necator*) and black rot (*G. bidwellii*), as well as to stress factors associated with climate change. The rational use of plant protection products, applied at optimal doses and phenological stages, is essential to ensure effective disease control while limiting adverse environmental impacts.

In the two vineyards under study, disease assessments were carried out based on the degree of attack (%) which reflects the overall infection of powdery mildew and black rot infections. Treatment efficacy was determined by comparing DA% values between treated and untreated plots by Abbott`s formula after each application. The results of these assessments are presented in Figures 11 and 12.

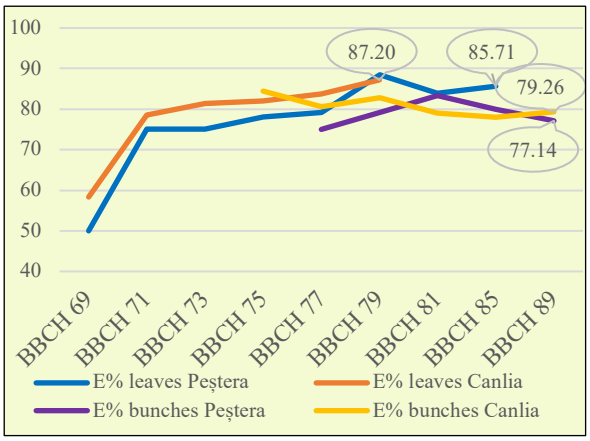

Figure 11. Efficacy against black rot
P-value= 0.88>0.05 (Anova); LSD 0.05=37.53

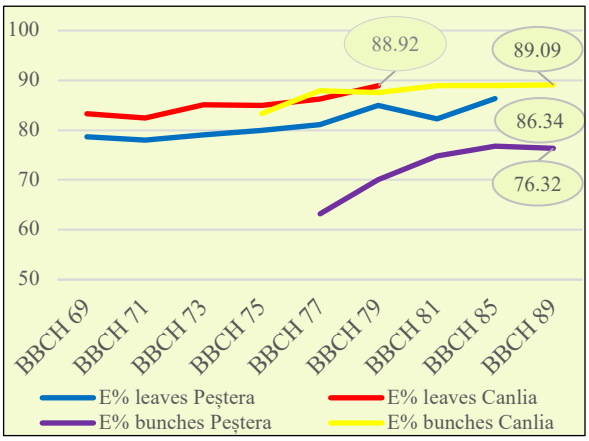

Fig. 12. Efficacy against powdery mildew
P-value= 0.0000017<0.05 (Anova); LSD 0.05=14.72

The efficacy of the two treatment programs differs noticeably between locations and diseases controlled, but statistical comparison highlights clear advantages for both schemes. In the case of black rot, the reduction in DA on leaves was from 3.5 to 0.5% in Peștera (≈ 86% efficacy) and from 6.25 to 0.8% in Canlia (≈ 87% efficacy), values very close between the two locations. On bunches, the efficacy at Peștera (DA% from 1.75 to 0.4%) reached approximately 77%, compared to about 79% at Canlia (DA%from 6.75 to 1.4%), confirming almost similar control.

For powdery mildew, the differences are even more consistent: on leaves, the organic scheme at Peștera reduced the attack from 18.3 to 2.5% (≈ 86%), and the conventional scheme at Canlia from 20.75 to 2.3% (≈ 89%). On bunches, the effectiveness ranged from 76 (Peștera from 11.4% to 2.7%) to 89% (Canlia from 13.75 to 1.5%). Statistically, the conventional scheme has a slight advantage, but both programs demonstrated high levels of efficacy, maintaining DA at very low values in the treated variants. It should be noted, however, that efficacy never exceeded 90%.

Overall, both treatments programs were effective, but the conventional scheme controlled disease progression more firmly under high pressure conditions, and the ecological scheme proved sufficient in a moderate-risk area.

CONCLUSIONS

Both treatments scheme applied in the two vineyards significantly reduced the GA% of the two diseases, but the maximum efficacy% did not reach 90%, indicating high pathogen pressure in both locations.

In the organic system (Bogdan Estate), black rot control was very good, with efficacies of 77-86%, appropriate for an area with medium risk.

The conventional system applied at Canlia achieved similar values for black rot (79-87%) confirming that both grids can effectively manage the disease when treatments are applied at the optimal time.

Powdery mildew on leaves showed greater differences between locations: the conventional scheme offered slightly higher efficacy (89%) compared to the organic scheme (86%).

On bunches, conventional treatments controlled powdery mildew more rigorously (89%) compared to organic treatments (76%), under conditions of more intense infection pressure at Canlia.

Variety, sensitivity and climatic conditions influenced the final attack degree with the Canlia plantation being much more exposed.

Although effective, organic treatments have not been able to completely eliminate infections during critical periods, but have maintained attack degree at acceptable levels for wine grape production.

The conventional scheme offers a concrete yield in years with increased pathogen pressure, and the organic scheme is viable and sustainable in areas with medium risk.

The integration of agrotechnical measures is essential to enhance the efficacy of both treatment programs. Key actions include improving soil drainage and moisture management, optimizing canopy aeration through pruning and defoliation, identifying overwintering inoculum sources, applying accurate disease forecasting to optimize treatment timing, and ensuring careful early diagnosis, particularly in dusty vineyard areas where powdery mildew symptoms may be masked.

REFERENCES

BOIS, B., ZITO, S., CALONNEC (2017). Climate vs grapevine pests and diseases worldwide: the first results of a global survey. *OENO One,* 51, 2. https://doi.org/10.20870/oeno-one.2017.51.2.1780

CAFFI T., ROSSI, V., LEGLER S.E., BUGIANI R. (2011). A mechanistic model simulating ascosporic infections by Erysiphe necator, the powdery mildew fungus of grapevine. *Plant Pathology*, 60, 522-531.

CONSTANTINESCU, G., DUȘA, D., HEIZER, R., HEIZER, M., DOBREI, A., NISTOR, E., DOBREI A. (2024). Feteasca neagră: a successful Romanian wine – tradition and future perspectives. *Journal of Horticulture, Forestry and Biotechnology*, 28, 2, 309-317.

COTEA, V., COTEA, V.V. (1996). Viticultură, ampelografie și oenologie. *Ed. Didactică și Pedagogică*, București, 64p.

DEJEU, C. L. (2010). Viticultură. *Ed. Ceres*, București, 431p.

FAOSTAT (2024). FAO statistical database. Food and Agriculture Organization of the United Nations. Retrieved from https://www.fao.org/faostat/en/#data/QCL

GADOURY, D.M., PEARSON, R.C. (1988). Initiation, development, dispersal, and survival of cleistothecia of Uncinula necator in New York vineyards. *The American Phytopathology Society*, l, 78, 11, 1413-1421. DOI:10.1094/Phyto-78-1413.

GHEORGHIEȘ, C., GEAMĂN, I. (2011). Bolile plantelor horticole. *Ed. Universitas Company* București, 325p.

HOFFMAN, L.E., WILCOX, W.F., GADOURY, D.M., SEEM, R.C., RIEGEL, D.G. (2004). Integrated Control of Grape Black Rot: Influence of Host Phenology, Inoculum Availability, Sanitation, and Spray Timing. *Phytopathology*, 94, 641-650.

JALOBĂ, D., PETRE, G., CRISTEA, S. (2021). Growing of apple genotypes with genetic resistance to diseases - an efficient method to mitigate pesticide pollution in the Voinești apple growing area. *Scientific Papers. Series B, Horticulture*, 65, 1, 139-148.

MOLITOR, D., BEYER, M., (2014). Epidemiology, identification and disease management of grape black rot and potentially useful metabolites of black rot pathogens for industrial applications – a review. *Annals of applied biology*, 165, 305-317.

MORANDO, A., LAVEZZARO, S., FERRO, S., RUARO, P., SOLDI, G. (2020). La difesa integrata contro Oidio e Muffa grigia. Ministero delle politiche agricole alimentari e forestali. *Quaderni di aggiornamento viticolo*, 2, 16.

ROTARU, L. (2009). Soiuri de viță-de-vie pentru struguri de vin. *Ed. Ion Ionescu de la Brad*, Iași, 181p.

STROE, M. (2022). Materialul săditor agricol – autenticitate, puritate, control. *Ed. Ex Terra Aurum*, București, 251p.
SZABÓ, M., CSIKÁSZ-KRIZSICS, A., DULA, T., FARKAS, E., ROZNIK, D., KOZMA, P., DEÁK, T. (2023). Black Rot of Grapes (*Guignardia bidwellii*) - A Comprehensive Overview. *Horticulturae*, 9, 130.
THIND, T.S., ARORA, J.K., MOHAN, C., RAJ, P. (2004). Diseases of Fruits and Vegetables. Volume I, Diagnosis and Management, Chapter - Epidemiology of Powdery Mildew, Downy Mildew and Anthracnose Diseases of Grapevine. *Kluwer Academic Publisher*, 621-638.
ULLRICH, C.I., KLEESPIES, R.G., ENDERS, M., KOCH, E. (2009). Biology of the black rot pathogen, Guignardia bidwellii, its development in susceptible leaves of grapevine *Vitis vinifera*. *Journal für Kulturpflanzen*, 61, 3, 82-90.
VOLPI, I., GUIDOTTI, D., MAMMINI, M., MARCHI, S. (2021). Predicting symptoms of downy mildew, powdery mildew, and gray mold diseases of grapevine through machine learning. *Italian Journal of Agrometeorology*, 2, 57-69.