Scientific Papers. Series A. Agronomy, Vol. LXIX, No. 1, 2026
ISSN 2285-5785; ISSN CD-ROM 2285-5793; ISSN Online 2285-5807; ISSN-L 2285-5785

RESEARCH ON DOWNY MILDEW ATTACK IN *Camelina sativa* UNDER FIELD CONDITIONS IN DRACEA, TELEORMAN COUNTY IN 2025

Nicușor NĂSTASE, Ștefana JURCOANE, Beatrice IACOMI, Stelica CRISTEA

University of Agronomic Sciences and Veterinary Medicine of Bucharest, 59 Marasti Blvd, District 1, 011464, Bucharest, Romania

Corresponding author email: nicusor-viorel.nastase@doctorat.usamv.ro

Abstract

Camelina sativa has attracted increasing scientific interest due to the valuable composition of its oil and its high adaptability to different pedoclimatic conditions. The main objective of this research was to evaluate the level of downy mildew (Peronospora camelinae) attack in camelina crops under field conditions. The research was conducted in 2025, in Dracea, Teleorman County. The experiment included two camelina cultivars, Mădălina and Camelia. Phytosanitary assessment was carried out by determining the frequency, intensity of attack, and degree of attack for each analyzed cultivar. The results highlighted a downy mildew attack value of 21% in the Mădălina cultivar, while the Camelia cultivar recorded a higher attack level of 29%.

Key words*: Camelina sativa, downy mildew, Peronospora camelinae, genotype.*

INTRODUCTION

Camelina sativa (L.) Crantz is an oilseed species belonging to the Brassicaceae family, native to the regions of Eastern Europe and Western Asia, and is recognized for its agronomic value and its wide range of industrial applications (Vollmann & Eynck, 2015; Blume et al., 2023). At present, this crop is attracting increasing interest in both research and the economic sector, particularly in Europe and North America, due to its adaptability to diverse ecological conditions, its low cultivation-input requirements, and the potential for utilizing its oil in numerous fields, including biofuels, aviation fuel, and oleochemical compounds (Zanetti et al., 2017; Larsson, 2013; Neupane et al., 2022; Montero-Muñoz et al., 2023; Sydor et al., 2022; Clavijo-Bernal et al., 2024). *Camelina sativa* oil obtained from seeds cultivated in Romania has been characterized by a high fatty acid content, predominantly linolenic acid, while the differences among the analyzed varieties were minimal (Popa et al., 2019). These findings indicate that *Camelina sativa* oil possesses therapeutic and regenerative potential, with possible applications in the pharmaceutical and cosmetic industries (Crăciun et al., 2019).

From an agronomic perspective, camelina is considered a hardy and relatively undemanding species, capable of performing under less favorable growing conditions compared with other oilseed crops (Dobre et al., 2014; Putnam et al., 1993; Jiang et al., 2016). *Camelina sativa* is recognized as a raw material with high potential for biofuel production, which justifies the growing interest in breeding more productive cultivars with increased oil content (Matei et al., 2017; Nadakuduti et al., 2023). However, the success of its cultivation also depends on maintaining an appropriate phytosanitary status, as the occurrence of pathogens may significantly affect plant development and yield level (Podgoreanu et al., 2015; Séguin-Swartz et al., 2009). Although *Camelina sativa* naturally exhibits a high degree of tolerance to numerous diseases and pests specific to other species within the Brassicaceae family (Putnam et al., 1993; Vollmann et al., 2001; Jiang et al., 2016), field-grown crops have nevertheless been reported to be affected by various pathogens. Among these, *Peronospora camelinae*, the causal agent of downy mildew, is considered one of the most important diseases reported in this crop (Vollmann et al., 2001; Séguin-Swartz et al., 2009; Babiker et al., 2012).

Downy mildew is caused by an obligate biotrophic pathogen that develops exclusively on living tissues and depends entirely on the host plant for its survival and multiplication (Turk, 2002, as cited in Jiang et al., 2016). The characteristic symptoms of the disease include the appearance of a grayish-white mycelial growth on the abaxial surface of the leaves, as well as on the internodes and developing siliques; these symptoms may be accompanied by chlorosis or visible discoloration on the upper side of the leaf blade (Séguin-Swartz et al., 2009; Jiang et al., 2016). In cases of severe infection, plants may exhibit pronounced growth abnormalities, including deformation, twisting, or bending of the aerial organs, which can negatively affect both vegetative development and crop productivity (Vollmann et al., 2001; Jiang et al., 2016). The occurrence of *Sclerotinia sclerotiorum* in cultivated camelina also highlights the need for increased attention to crop management practices, breeding strategies, and phytosanitary protection measures (Cristea & Jurcoane, 2016). In this context, the present study was conducted to analyze the effect of *Peronospora camelinae* infection on two *Camelina sativa* cultivars under environmental conditions characterized by a temperate thermal regime and limited water availability. The aim of the study was to evaluate the occurrence and expression of the disease, with particular emphasis on downy mildew as the main disorder identified in the crop, and to highlight the relationship between disease severity and the overall performance of the plants.

MATERIALS AND METHODS

Aim of the research

The objective of this research was to investigate the occurrence and effect of the pathogen *Peronospora camelinae* on *Camelina sativa* crops under the specific conditions of Dracea locality, Teleorman County. In addition, the study aimed to evaluate the influence of row spacing and seeding rate on the severity of downy mildew infection in camelina.

In Romania, the pathogen was reported in camelina crops in 2014 in the Bucharest area, a finding that highlighted the increasing importance of downy mildew for this crop under the conditions of southern Romania (Cristea & Manole, 2014). In this context, the results obtained in the present study may contribute to the optimization of cultivation technology and to the improvement of phytosanitary management in camelina under the pedoclimatic conditions of southern Romania.

Experimental site and experimental conditions

The research was conducted during the spring of 2025 in the experimental field located in Dracea, Teleorman County. The experiment was established under field conditions using a randomized complete block design (RCBD), with each block measuring 48 m in length.

Two main experimental factors were evaluated in the study: row spacing and seeding rate. Row spacing was tested at two levels, 13 cm and 25 cm. The seeding rate also had two levels: 6 kg/ha, corresponding to 525 germinable seeds/m², and 8 kg/ha, equivalent to 700 germinable seeds/m².

Variant V1 consisted of a seeding rate of 6 kg/ha combined with a row spacing of 13 cm. Variant V2 was established at the same row spacing of 13 cm, but with a higher seeding rate of 8 kg/ha, resulting in increased crop density. In the case of Variant V3, the seeding rate of 8 kg/ha was combined with a row spacing of 25 cm. Variant V4 included a seeding rate of 6 kg/ha at a row spacing of 25 cm, representing the lowest-density configuration.

Biologic material

The biological material used in this study consisted of two Romanian camelina cultivars adapted to the environmental conditions of Romania. The cultivar Mădălina was developed at the University of Agronomic Sciences and Veterinary Medicine of Bucharest (Dobre P. et al., 2014), whereas the cultivar Camelia was developed at the National Agricultural Research and Development Institute Fundulea (Toncea et al., 2013).

Experimental design

The experimental layout was established in a mirrored arrangement for the two cultivars within a randomized complete block design. The selection of this experimental design aimed to reduce the effects generated by field heterogeneity and to increase the precision of comparisons among the studied variants. By

including all factorial combinations within each block and randomizing them inside the blocks, the influence of soil variation, microclimatic conditions, and other local factors on the experimental results was minimized. Consequently, the differences observed among variants can be attributed, to a greater extent, to the factors under investigation rather than to the non-uniformity of the experimental environment.

General characterization of the thermal and pluviometric regime during 2025 growing season

During the period March-June 2025, the climatic conditions were characterized by a progressive increase in both air and soil temperatures, accompanied by a reduced and unevenly distributed precipitation regime. At the beginning of the growing season, in March, minimum air temperatures were low, approaching 0°C and (Figure 1), in isolated cases, slightly below freezing, while mean temperatures remained within the range typical of early spring. Soil temperature at a depth of 10 cm showed a more stable pattern, with values ranging approximately between 8 and 14°C.

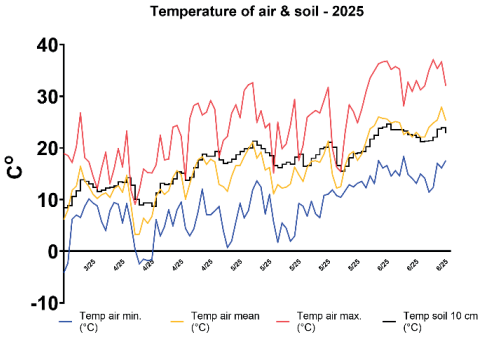

Figure 1. Air and soil temperature

In April and during the first part of May, both air and soil temperatures increased gradually. Mean air temperatures frequently ranged between 10 and 18°C, while soil temperature progressively increased to approximately 15-20°C. This pattern indicates a relatively balanced thermal regime during the first part of the growing season.

In the second half of May, and especially during June, the thermal regime intensified significantly. Maximum air temperatures frequently exceeded 30°C, reaching 35-37°C on some days, while mean air temperature rose above 20°C. During the same period, soil temperature at a depth of 10 cm generally remained within the range of 20-25°C. Compared with air temperature, soil temperature showed lower variability, maintaining a more uniform upward trend throughout the entire period analyzed.

From a pluviometric standpoint (Figure 2), the growing season was characterized by low precipitation amounts and an uneven distribution of rainfall. Water input from precipitation was episodic, with relatively long intervals lacking significant rainfall, while the most notable precipitation events were recorded during the second half of May. Overall, the climatic pattern of 2025 was marked by a season onset with moderate temperatures, followed by a pronounced increase in temperature toward the end of the analyzed period, under conditions of a modest precipitation regime.

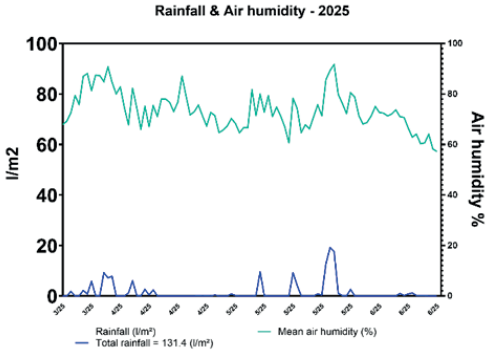

Figure 2. Precipitation and air humidity conditions in 2025

Assessment of downy mildew infection

Downy mildew infection was assessed at two distinct stages during the growing season. The first evaluation was performed before flowering, at BBCH stage 6, corresponding to the maximum development of the leaf canopy, while the second assessment was carried out during seed formation and maturation, at BBCH stage 8. Disease assessment under field conditions was conducted using the "N" sampling pattern method in order to ensure a representative evaluation of each experimental plot. A total of 100 plants were analyzed, with 25 plants collected from each observation point established in the field. This method allowed for a rigorous estimation of both infection frequency and symptom intensity under field conditions.

Phytosanitary indicators analyzed

Attack frequency (F%) was calculated as the ratio between the number of symptomatic plants (n) and the total number of evaluated plants (N), expressed as a percentage, according to the following equation:

$$F\ (\%) = (n \times 100) / N$$

Attack intensity (I%) was determined by estimating the surface area affected by symptoms, using a percentage scale ranging from 0 to 100% of the plant surface. It was calculated according to the following formula:

$$I\ (\%) = \Sigma\ (i \times f) / n$$

where: i represents the assigned percentage of infection, f the number of plants included in the respective category, and n the total number of infected plants analyzed.

Degree of attack (DA %) was used to express disease severity at the crop level by correlating attack frequency with attack intensity, according to the following equation:

$$DA\ (\%) = (F \times I) / 100$$

Statistical analysis

The experimental data obtained were statistically processed using analysis of variance (ANOVA) in order to evaluate the significance of the differences among the experimental variants. Data processing and statistical analysis were performed using R and GraphPad Prism.

RESULTS AND DISCUSSIONS

Identification of *Peronospora camelinae* infection

The identification of infection caused by *Peronospora camelinae* was based on the characteristic symptomatology observed on the aerial organs of the plants (Cristea & Manole, 2014) (Figure3).

Figure 3. Downy mildew attack 2025

At the level of the leaves and the upper portion of the stem, discoloration spots were observed on the adaxial surface, which gradually developed into necrotic areas, indicating the progressive deterioration of the tissues. On the abaxial surface of the leaves, corresponding to these lesions, a fine, powdery layer ranging in color from whitish to grayish-white was observed (Figure 3), representing the asexual sporulation of the pathogen. As the intensity of the infection increased, the symptoms became more pronounced and were accompanied by deformation of the vegetative organs. Severely affected plants exhibited the characteristic stem-twisting phenomenon, considered a typical symptom of downy mildew in camelina (Vollmann J., 2001). Overall, the association of chlorotic and necrotic lesions on the upper leaf surface, whitish sporulation on the lower surface, and stem deformation allowed the clear identification of *Peronospora camelinae* infection in *Camelina sativa* plants.

Table 1. The influence of seeding rate per hectare and row spacing on downy mildew incidence in camelina (2025) at Dracea, Teleorman location

Variety	Variant*	BBCH6 / 2025			BBCH8 / 2025		
		F (%)	I (%)	DA (%)	F (%)	I (%)	DA (%)
Mădălina	V1	6	21	1.26	14	36	5.0
	V2	14	38	5.3	28	52	14.6
	V3	9	31	2.8	20	43	8.6
	V4	4	18	0.7	10	28	2.8
Camelia	V1	9	29	2.61	18	42	7.6
	V2	18	44	7.9	34	60	20.4
	V3	12	35	4.2	25	49	12.3
	V4	6	22	1.3	13	33	4.3

*V1 – 6 kg/ha & 13 cm; V2 – 8 kg/ha & 13 cm; V3 – 8 kg/ha & 25 cm; V4 – 6 kg/ha & 25 cm;

Table 2. Results of the analysis of variance (ANOVA)

Source of variation	df	Sum of squares (SS)	Mean square (MS)	F value	*p*-value
Variety (A)	1	48.27	48.27	9.84	0.015*
Variant (B)	3	212.91	70.97	14.47	0.002**
Phenological stage (C)	1	356.14	356.14	72.65	<0.001***
A × B	3	24.62	8.21	1.67	0.231
A × C	1	19.74	19.74	4.03	0.079
B × C	3	68.38	22.79	4.65	0.034*
A × B × C	3	11.26	3.75	0.76	0.542
Error	16	78.41	4.90	—	—
Total	31	819.73	—	—	—

Note: A = cultivar; B = technological variant; C = phenological stage; df = degrees of freedom; SS = sum of squares; MS = mean square; F = Fisher's test value; *p < 0.05; **p < 0.01; ***p < 0.001.

Dynamics of the frequency, intensity, and degree of attack of *Peronospora camelinae* in 2025

The data obtained in 2025 highlight variations in the frequency (F), intensity (I), and degree of attack (DA) of *Peronospora camelinae* depending on cultivar, phenological stage, and the applied technological variant. The values of these indicators were lower at the BBCH6 stage and increased significantly by BBCH8, indicating disease progression throughout the growing season.

At the BBCH6 stage, attack frequency ranged from 4% to 14% in the cultivar Mădălina and from 6% to 18% in Camelia, while attack intensity ranged from 18% to 38% in Mădălina and from 22% to 44% in Camelia. Consequently, the degree of attack recorded relatively low values at this stage of crop development, ranging from 0.72% to 5.32% in Mădălina and from 1.32% to 7.92% in Camelia. These results indicate that primary infections were already present in the crop, although symptom severity remained limited during the early stages of plant development.

At the BBCH8 stage, disease severity increased markedly. Attack frequency reached values ranging from 10% to 28% in Mădălina and from 13% to 34% in Camelia. Attack intensity also increased, reaching 28-52% in Mădălina and 33-60% in Camelia. As a result, the degree of attack reached maximum values of 14.56% in Mădălina and 20.40% in Camelia under variant V2. This pattern reflects disease progression as the crop developed a larger leaf canopy, which favored the maintenance of a humid microclimate within the stand. A comparison of the two cultivars shows that Camelia exhibited higher values for all phytosanitary indicators, suggesting greater susceptibility to Peronospora camelinae infection compared with Mădălina, which displayed relatively higher tolerance under the same conditions.

The technological variant clearly influenced disease severity. The highest values of frequency, intensity, and degree of attack were recorded in variant V2 (8 kg/ha and 13 cm), where the higher plant density and reduced row spacing favored the formation of a humid microclimate within the crop and limited air circulation. Variant V3 (8 kg/ha and 25 cm) showed intermediate levels of infection, indicating that wider row spacing may partially reduce the conditions favorable for disease development, even under high-density conditions. The lowest values of the degree of attack were observed in variant V4 (6 kg/ha and 25 cm), where the combination of lower density and wider row spacing contributed to limiting pathogen development by improving air circulation and reducing the persistence of moisture at the leaf level.

The results of the analysis of variance (ANOVA) confirm these observations. Phenological stage had the strongest influence on degree of attack ($F = 72.65$, $p < 0.001$), indicating a significant increase in disease severity from BBCH6 to BBCH8. The technological variant also had a significant effect on degree of attack ($F = 14.47$, $p = 0.002$), demonstrating that crop density and row spacing can alter the microclimate within the crop canopy and may either favor or limit pathogen development. Cultivar also showed a significant effect ($F = 9.84$, $p = 0.015$), confirming genetic differences in the response to *Peronospora camelinae* infection.

The interaction between technological variant and phenological stage was significant ($p < 0.05$), indicating that the differences among variants became more pronounced as the crop advanced toward the reproductive stages. In contrast, the interactions between cultivar and variant, as well as the three-way interaction, did not show statistically significant differences (Figure 4).

Overall, the results suggest that the severity of *Peronospora camelinae* infection in 2025 was determined by the interaction between climatic conditions favorable to disease development and crop architecture shaped by the sowing technology. Variants characterized by higher plant density and narrower row spacing favored the development of a humid microclimate within the crop, leading to higher values of attack frequency and severity.

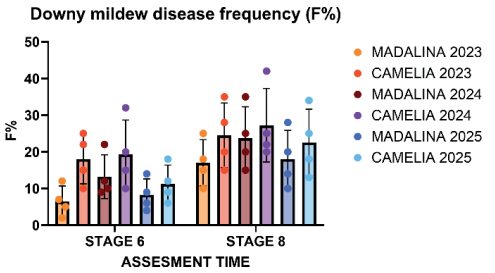

Figure 4. Comparison of the frequency of *Peronospora camelinae* infection over the three experimental years

The graph highlights an increase in the frequency of downy mildew infection from phenophase BBCH 6 to BBCH 8, regardless of cultivar or year, indicating a progressive expansion of the infection throughout the growing season. In all years included in the comparison, the cultivar Camelia exhibited higher frequency values than Mădălina, suggesting greater susceptibility to *Peronospora camelinae* infection. At the same time, 2024 was distinguished by the highest frequency values, particularly in the cultivar Camelia, at both BBCH 6 and BBCH 8, whereas 2023 showed intermediate values. The data for 2023 and 2024 were taken from the study conducted by Năstase et al. (2025), and their comparison with the data obtained in 2025 highlights the persistence of the same general trend, namely the increase in attack frequency at more advanced stages of vegetation and the contrasting behavior of the two cultivars. Overall, the cultivar Camelia proved to be more susceptible to *Peronospora camelinae* infection than Mădălina across most of the analyzed variants (Năstase et al., 2025).

CONCLUSIONS

The results obtained in the present study on Peronospora camelinae infection in Camelina sativa crops highlight the combined influence of climatic conditions and cultivation technology on the occurrence and progression of the disease. The analysis of the phytosanitary indicators, namely attack frequency (F), attack intensity (I), and degree of attack (DA), demonstrated that disease severity increased throughout the growing season, with higher values recorded at phenological stage BBCH8 compared with BBCH6.

The climatic conditions during the 2025 growing season favored the occurrence and development of Peronospora camelinae infection. The moderate temperatures recorded during the first part of the growing season, together with rainfall events and high relative air humidity, created favorable conditions for the establishment of primary infections. As the crop developed and the leaf canopy became denser, these conditions allowed the disease to spread further, resulting in increased frequency and severity of symptoms during the reproductive stages of the crop.

The differences observed between the cultivars revealed a higher susceptibility of the cultivar Camelia to *Peronospora camelinae* infection compared with Mădălina, which consistently showed lower values of attack frequency, attack intensity, and degree of attack across all analyzed technological variants. This finding suggests the existence of genetic differences in tolerance to the pathogen between the two camelina genotypes.

Cultivation technology also played an important role in disease development. The variant characterized by high plant density and reduced row spacing (8 kg/ha and 13 cm) recorded the highest values of the phytosanitary indicators, indicating that greater crop density favors the formation of a humid microclimate within the canopy and reduces air circulation, thereby creating favorable conditions for pathogen

development. In contrast, the variant with a lower seeding rate and wider row spacing (6 kg/ha and 25 cm) showed the lowest values of degree of attack, suggesting that a more open crop structure may limit disease development.

The results of the statistical analysis (ANOVA) confirmed the significant influence of phenological stage, technological variant, and cultivar on the severity of *Peronospora camelinae* infection. In particular, phenological stage had the strongest effect on disease progression, indicating a significant increase in disease severity from BBCH6 to BBCH8. In addition, the interaction between technological variant and phenological stage showed that the differences among variants became more pronounced during the advanced stages of crop development.

Overall, the results of this study underline the importance of technological crop management in reducing the risk of downy mildew occurrence and development in camelina. Adjusting seeding density and row spacing may represent an effective agronomic strategy for limiting pathogen pressure, especially under climatic conditions favorable to disease development. At the same time, the selection of more tolerant genotypes, such as the cultivar Mădălina, may contribute to reducing the phytosanitary impact of the pathogen and to improving yield stability under the pedoclimatic conditions of southern Romania.

REFERENCES

Babiker, E. M., Hulbert, S. H., & Paulitz, T. C. (2012). *Hyaloperonospora camelinae* on *Camelina sativa* in Washington State: Detection, Seed Transmission, and Chemical Control. *Plant Disease*, 96*(11), 1670–1674.*

Blume, R. Y., Kalendar, R., Guo, L., Cahoon, E. B., & Blume, Y. B. (2023). Overcoming genetic paucity of *Camelina sativa*: Possibilities for interspecific hybridization conditioned by the genus evolution pathway. *Frontiers in Plant Science*, 14, Article 1259431. https://doi.org/10.3389/fpls.2023.1259431

Clavijo-Bernal, E. J., Martínez-Force, E., Garcés, R., Salas, J. J., & Venegas-Calerón, M. (2024). Biotechnological Camelina platform for green sustainable oleochemicals production. OCL, 31, 11. https://doi.org/10.1051/ocl/2024007

Crăciun, L. M., Dumitriu, B. G., Olariu, L., Jurcoane, Ș., Cristea, S., Adil, A., Rosoiu, N., & Papacocea, R. (2019). Regenerative and scare healing potential of active compounds from *Camelina sativa* oil and grape pomace. *Romanian Biotechnological Letters*, 24(6), 1075–1082

Cristea, S., & Jurcoane, Ș. (2016). *Sclerotinia sclerotiorum* (Lib.) De Bary – First report on cultivated *Camelina sativa* in Romania. Romanian *Biotechnological Letters*, 21(4), 11682–11683.

Cristea, S., & Manole, M. S. (2014). Downy mildew (*Peronospora camelinae* Gaum. syn. *Peronospora parasitica* (Pers.) Tul.) – first recorded on camelina (*Camelina sativa*) in Bucharest area. Romanian Biotechnological Letters, 19(2).

Dobre, P., Jurcoane, Ș., et al. (2014). Breeding low temperature resistant *Camelina sativa* for biofuel production, *New Biotechnology*, 31, S93.

Jiang, Y., Caldwell, C. D., Falk, K. C., & Lada, R. R. (2016). Effect of nitrogen fertilization on camelina seed yield, yield components, and downy mildew infection. *Canadian Journal of Plant Science*, 96(1), 17–26.

Larsson, M. (2013). Cultivation and processing of *Linum usitatissimum* and *Camelina sativa* in southern Scandinavia during the Roman Iron Age. *Vegetation History and Archaeobotany*, 22(6), 509–520. https://doi.org/10.1007/s00334-013-0413-3

Matei, F., Sauca, F., Farcas, N., Dobre, P., Matei, B., Cornea, C. P., Ciuca, M., Cristea, S., & Jurcoane, Ș. (2017). Breeding new variety of Camelina sativa adapted to temperate continental climate. *In Proceedings of the 25th European Biomass Conference and Exhibition* (pp. 249–252). ETA-Florence Renewable Energies.

Montero-Muñoz, I., Mostaza-Colado, D., Capuano, A., & Mauri-Ablanque, P. V. (2023). Seed and straw characterization of nine new varieties of *Camelina sativa* (L.) Crantz. Land, 12(2), 328. https://doi.org/10.3390/land12020328

Nadakuduti, S. S., Laforest, L. C., Tachev, M., Decker, A. N., Egesa, A. O., Shirazi, A. S., Begcy, K., Sarnoski, P. J., & Buell, C. R. (2023). Heat stress during seed development leads to impaired physiological function and plasticity in seed oil accumulation in *Camelina sativa*. *Frontiers in Plant Science*, 14, 1284573. https://doi.org/10.3389/fpls.2023.1284573

Năstase, N., Jurcoane, Ș., Iacomi, B., & Cristea, S. (2025). Evaluation of the downy mildew attack (*Peronospora camelinae*) in camelina (*Camelina sativa* (L.) Crtz.) during 2023-2024, Dracea, Teleorman County. *Scientific Papers. Series A. Agronomy*, 68(2), 645–652.

Neupane, D., Solomon, J. K. Q., McVay, K., Radosevich, M., & Auger, M. (2022). Realizing the potential of Camelina sativa as a bioenergy crop for a changing global climate. *Plants*, 11(6), 772. https://doi.org/10.3390/plants11060772

Podgoreanu, E., Jurcoane, Ș., Dănăilă, S., Guidea, M., Roșu, A., Saucă, F., Moraru, A., & Cristea, S. (2015). Studies on the effect of genotype on growth and seed yield in some *Camelina sativa* L. varieties cultivated under controlled environmental conditions. *AgroLife Scientific Journal*, 4(1), 131–136.

Popa, A.-L., Drumea, V., Niță, R.-A., Florea, M.-A., Olariu, L., Jurcoane, Ș., & Cristea, S. (2019). A physico-chemical characterization of oil from *Camelina sativa* seeds grown in Romania. *Romanian*

Biotechnological Letters, 24(5), 776–782. doi:10.25083/rbl/24.5/776.782

Putnam, D. H., Budin, J. T., Field, L. A., & Breene, W. M. (1993). Camelina: A promising low-input oilseed. In J. Janick & J. E. Simon (Eds.), New crops (pp. 314–322). Wiley.

Séguin-Swartz, G., Eynck, C., Gugel, R. K., Strelkov, S. E., Olivier, C. Y., Li, J. L., Klein-Gebbinck, H., & Falk, K. C. (2009). Diseases of *Camelina sativa* (false flax). *Canadian Journal of Plant Pathology*, 31(4), 375–386. https://doi.org/10.1080/07060660909507612

Sydor, M., Kurasiak-Popowska, D., Stuper-Szablewska, K., Rogozinski, T., & Nawrocka, A. (2022). *Camelina sativa*: Status quo and future perspectives. *Industrial Crops and Products*, 187, 115531. https://doi.org/10.1016/j.indcrop.2022.115531

Turk, H. B. (2002). A taxonomical study of parasite fungi on plants in the Antalya city. Akdeniz University, Institute of Natural Sciences, Antalya, Turkey.

Toncea, I., Necseriu, D., Prisecaru, T., Bălint, L. N., Ghilvacs, M. I., & Popa, M. (2013). *The seed's and oil composition of Camelia – first Romanian cultivar of camelina (Camelina sativa* L. Crantz*). Romanian Biotechnology Letters*, 18(5), 8594–8602.

Vicente, J. G., Günter, C., & Bennett, R. A. (2012). Genetics of resistance to downy mildew in Brassica oleracea and breeding towards disease-resistant crops. *Plant Pathology*, 61(4), 600–613. https://doi.org/10.1111/j.1365-3059.2011.02539.

Vollmann, J., & Eynck, C. (2015). Camelina as a sustainable oilseed crop: Contributions of plant breeding and genetic engineering. *Biotechnology Journal*, 10(4), 525–535. https://doi.org/10.1002/biot.201400200

Vollmann, J., Steinkellner, S., & Glauninger, J. (2001). Variation in resistance of camelina (*Camelina sativa* [L.] Crtz.) to downy mildew (*Peronospora camelinae* Gäum.). *Journal of Agronomy and Crop Science*, 187(2), 121–126.

Zanetti, F., Eynck, C., Christou, M., Krzyżaniak, M., Righini, D., Alexopoulou, E., Stolarski, M. J., Van Loo, E. N., Puttick, D., & Monti, A. (2017). Agronomic performance and seed quality attributes of camelina (*Camelina sativa* L. Crantz) in multi-environment trials across Europe and Canada. *Industrial Crops and Products*, 107, 602–608. https://doi.org/10.1016/j.indcro