DOI: https://doi.org/10.53040/cga12.61 UDC: 632.937:632.76:633.854.78

STUDY OF THE EFFICIENCY OF SUNFLOWER BEETLE CONTROL METHODS IN THE CONTEXT OF INTENSIFICATION AND EXPANSION OF CULTIVATION AREAS

Ion PALADI, ORCID: 0009-0009-4398-9481

Institute of Genetics, Physiology and Plant Protection of the State University of Moldova, Chisinau, Republic of Moldova

Abstract. *The sources propose a multitude of strategies within the control and combat methods of sunflower blight. Some of them emphasize the valorization of the genetic potential of resistance, giving it major importance. Just as the strategies for preventing and controlling sunflower blight in the organic farming system differ, so do those within the conventional system. Research conducted during the agricultural years 2022-2024 in repetition of 3 consecutive years on the same land in the southern area of the Republic of Moldova, Cahul district, Iujnoe village. During the vegetation period, the development and evolution of the crop as well as diseases, including sunflower blight, were recorded. For each variant, one hundred plants were chosen on the diagonal of the plot. The recording and analysis of the manifestation of sunflower blight consisted of collecting data in order to calculate the intensity and frequency of the attack generated. The tendency of increasing the frequency values and the intensity of the pathogen attack is due to the intensification of the sunflower cultivation process. The organic preparation Trichodermin-SC shows high biological efficacy in controlling sunflower scab and is considered to be suitable for use in an organic protection system. The fungicide Unical,SC, showing high biological efficacy in controlling sunflower powdery mildew.*

Keywords: sunflower, phytosanitary status, genetic factor, Trichodermin-SC, Unical,SC.

INTRODUCTION

Sunflower blight caused by the pathogen *Plasmopara halstedii* is considered to be the most widespread disease throughout the sunflower cultivation area. It was first reported in our country in 1948 [1]. Source [2] is of a similar opinion, determining it as the main and most widespread disease in the country, and in rainy years the development of the disease becomes vertiginous. The background of the increase in the average annual temperature by +1℃ causes the reduction of the attack frequency from 56.8% to 32.3% and the intensity from 5.4% to 4.3%. The same influence on the spread of the disease is also exerted by the temperature fluctuations within each season, in summer the increase in the average temperature from +19.15℃ to 21.02℃ causes the reduction of the attack frequency by two times. The increase in the amount of precipitation from 405 mm to 560 mm causes

the increase of the attack frequency from 25% to 51.7% and the intensity of the attack from 4.9% to 6.1% [3].

Although five forms of sunflower mange development are known, the second and fifth forms pose the greatest danger [1]. In the case of the first form of development, the plants remain dwarf, rarely exceeding 100 cm, with thick nodes and short internodes. The foliar apparatus in comparison with the plant's height has a luxuriant appearance, with the presence of discoloration spots on the upper side and felt-like conidial fructification on the lower side. The attacked plants form small calatidia with rare insertion of the achenes. The fifth form is characterized by partial necrosis of the formed calatidia or total necrosis of the floral bud [4]. The use of infected seed material and the neglect of effective weevil control are considered to be the decisive factors in field contamination and crop compromise[5].

The sources propose a multitude of strategies within the control and combat methods of sunflower blight. Among these sources, various strategies within the ecological methods based on the use of environmentally friendly biopreparations and strategies within the chemical methods based on the application of chemical products can be identified. Some of them emphasize the valorization of the genetic potential of resistance, giving it major importance.

Major importance in the protection of sunflower from mange plays the genetic resistance of many hybrids induced by selection [6]. Highlighting the resistance genes was the basis for the creation of resistant hybrids, allowing the control of the disease by genetic method [7]. Currently, every latest generation hybrid in its portfolio of characteristics has resistance to the latest races of sunflower mange [8]. This leads [1] to state that sunflower mange is of no practical interest in the Republic of Moldova in recent years. Source [9] is more skeptical in this regard, considering that sowing large areas based only on the resistance of the hybrid may have unpredictable effects.

The strategies proposed within the ecological method of control and protection of sunflower blight are diverse. In his work [10] noting the effectiveness of biopreparations based on hyperparasitic fungi *Coniothyrium minitans* and *Gliocladium catenulatum* on the sclerotia of the fungus *Plasmophara halstedii*, he considers their use in phytosanitary treatments to be effective. The effectiveness of biopreparations based on the fungus *Coniothyrium minitans* is also mentioned in the source [1]. A strategy for controlling sunflower blight in vegetation according to [11] consists of using the preparation Trichodermin-SC in a dose of 0.5 l/ha, especially when treating seed material and in the form of treatment in vegetation. The effect of this preparation on a number of sunflower diseases, including blight, is demonstrated. As mentioned by [6], the high efficacy of organic preparations based on the fungus *Trichoderma spp.* in the organic control of the fungus Plasmophara halstedii is worth exploiting. According to [12], in addition to exploiting the potential of the fungi *Trichoderma spp.*, the potential of the

bacterium *Bacillus subtilis* can also be exploited in the control of parasitic fungi.

Agrotechnical and phytotechnical disease prevention and control strategies also differ depending on the source. As mentioned by [9], the cheapest method of preventing and combating sunflower blight is to strictly observe the rotation, the time interval between two sunflower crops of at least 5 years. As mentioned by [13], the presence of blight-resistant hybrids on the market is not a valid reason for ignorance of the principles of crop rotation and rotation. As a measure to prevent and combat the disease, [6] pays attention to the location of the crop, avoiding low and over-wetted lands and soil texture, in addition to these, mentioning the need to maintain the field in an impeccable condition from an agrotechnical point of view.

Just as the strategies for preventing and controlling sunflower blight in the organic farming system differ, so do those within the conventional system. As mentioned [8], products based on azoxystrobin, difenoconazole, cyproconazole, and tebuconazole are considered effective. High efficiency is shown by the use of the products Apron Gold 35 EW, Sumilex 50 WP, Protexil 350 FS for seed treatment and the fungicides Aliette 80 WP, Ronilan WG for vegetation treatments [3]. In the control of sunflower blight, it is considered reasonable to comparative test the efficiency of the preparations Trichodermin-SC and Unical, SC under the conditions of intensification of sunflower cultivation processes in the southern part of the country. The agro-climatic and economic situation in which agricultural producers are placed requires the identification of cheap and effective solutions in order to be able to face the challenges.

MATERIALS AND METHODS

Research conducted during the agricultural years 2022-2024 in repetition of 3 consecutive years on the same land in the southern area of the Republic of Moldova, Cahul district, Iujnoe village. Observations were made within the framework of the trifactorial experience which in turn includes three variants in three repetitions. The first factor is considered the ecological protection scheme in which the Trichodermin-SC preparation was used, the second factor is considered the chemical protection scheme in which the Unical,SC preparation was used and the third factor is represented by the genetic resistance of hybrids to diseases including sunflower blight.

The ecofungicide Trichodermin-SC 1% suspension based on the fungus Trichoderma lignorum was used within the framework of the ecological protection scheme, administered for seed treatment, spraying of plants in the 6-leaf phase and in the phase of floral bud emergence. The fungicide Unical,SC based on tebuconazole 250 g/l was used in the chemical protection variant at a dose of 0.5 l/ha administered in identical terms to the application of the ecological product. The study of the genetic factor consisted of testing three sunflower hybrids, considered

to be the most current on the market, the hybrids P64LE25, P64LP130, LG5377, in the description of which the manufacturer mentions the presence of a high degree of resistance to diseases, including sunflower blight.

During the vegetation period, the development and evolution of the crop as well as diseases, including sunflower blight, were recorded. For each variant, one hundred plants were chosen on the diagonal of the plot. The recording and analysis of the manifestation of sunflower blight consisted of collecting data in order to calculate the intensity and frequency of the attack generated.

As mentioned by [13], the application of a plant protection product requires the achievement of three indicators, including biological efficiency.

RESULTS AND DISCUSSIONS

Table 1 shows the dynamics of sunflower blight over three years, two of which were in monoculture conditions. It shows both the dynamics of the frequency and intensity of the attack and the biological efficacy of the preparations Trichodermin-SC and Unical,SC in controlling sunflower blight.

Table 1. Efficacy of Trichodermin-SC and Unical,SC preparations in controlling sunflower blight.

Variant	Repetition	2022			2023			2024		
		F,(%)	I,(%)	E,(%)	F,(%)	I,(%)	E,(%)	F,(%)	I,(%)	E,(%)
Control	**R_1** P64LE25	4,4	3,8	-	13,0	4,25	-	26,0	7,5	-
	R_2 P64LP130	5,2	4,25	-	10,0	3,25	-	22,0	6,5	-
	R_3 LG5377	4,5	2,84	-	14,0	4,5	-	28,0	8,0	-
Unical,SC	**R_1** P64LE25	2,8	1,67	**56,05**	6,0	2,25	**47,05**	12,0	4,25	**43,33**
	R_2 P64LP130	2,0	1,48	**65,17**	5,0	1,75	**46,15**	10,0	3,25	**50,0**
	R_3 LG5377	4,0	1,8	**36,61**	7,0	2,75	**38,88**	14,0	4,5	**43,75**
Trichodermin-SC	**R_1** P64LE25	3,0	1,63	**57,1**	7,0	2,5	**41,17**	19,0	5,75	**23,33**
	R_2 P64LP130	2,7	1,61	**62,11**	7,0	2,5	**23,07**	19,0	5,5	**15,38**
	R_3 LG5377	4,2	2,01	**29,22**	10,0	3,5	**22,22**	25,0	7,25	**9,37**

From the analysis of the data in the table, it is found that the directly proportional influence of the process of intensification of sunflower cultivation on the degree of spread of the pathogen Plasmophara halstedii is observed. The tendency of increasing the frequency values and the intensity of the pathogen attack is due to the intensification of the sunflower cultivation process.

In general, experience shows a 14-fold increase in attack frequency from the minimum value per experience of 2.0% in 2022 to the maximum value per experience of 28% in 2024. The intensity of the attack also increases significantly by about 5 times from the minimum value of 1.48% to the maximum value of 8.0%.

The results obtained in the experiment demonstrate the importance of the

genetic factor in the control of sunflower blight. In the present case, the most resistant hybrid to blight is P64LP130, showing itself superior to the hybrids P64LE25 and LG5377 over the years of experience. The identification in the experiment of a different degree of resistance of sunflower hybrids to blight leads to agreement with the sources [6; 8] in what concerns the rational use of the genetic factor. On the other hand, the results of the experiment partially contradict the source [1] in what concerns the statement regarding the unimportance of sunflower blight in the context of hybrid resistance. Because analyzing the hybrid P64LP130, we agree, and analyzing the hybrid LG5377, we reach a dissonance with the statement of the previously mentioned source.

In the agricultural year 2022, the variant in which the Trichodermin-SC product was applied, the lowest values of the intensity and frequency of the disease are observed in the P64LP130 hybrid, the product shows a biological efficacy of 62.11%. The biological efficacy of 57.1% is also shown by the preparation in the P64LE25 hybrid. The lower biological efficacy of the preparation is manifested in the LG5377 hybrid in the amount of 29.22%, this hybrid also shows itself to be the most subject to attack. In the agricultural year 2023, the presence of a high background of infection determines the increase in the values of the frequency and intensity of the attack in all hybrids, reduces the biological efficacy which oscillates between the maximum value of 41.17% in the P64LE25 hybrid and the minimum value of 22.22% in the LG5377 hybrid.

The agricultural year 2024, in which the even more intensive background of infection determines the increase in the frequency and intensity of the attack values compared to the values of the previous year, the biological efficacy of the preparation decreases considerably in all three hybrids, it oscillates between the maximum value of 23.33% obtained in the P64LE25 hybrid and the minimum value of 9.37% obtained in the LG5377 hybrid. In general, a good biological efficacy of the Trichodermin-SC preparation in the control of sunflower blight is observed. In the context of intensification of sunflower cultivation, the biological efficacy of the preparation decreases considerably. The research results demonstrate the efficacy of the Trichodermin-SC product and determine it as suitable for the control of sunflower blight within the ecological system. It also reaches agreement with the sources [6; 11] regarding the effectiveness of products based on the fungus *Trichoderma spp.*, in the effective control of sunflower blight.

In 2022, when applying the Unical,SC product, a biological efficiency that is not significantly higher than the level of effectiveness of the organic product is observed. The highest value of biological efficiency of 65.17% was obtained for the P64LP130 hybrid, followed by the P64LE25 hybrid with a value of 56.05% and the LG5377 hybrid with 36.61%. In 2023, the given preparation shows superior biological efficiency compared to that of the organic product, this being the value of 47.05% obtained for the P64LE25 hybrid, followed by 46.15% for the P64LP130

hybrid and the minimum value of 38.88% obtained for the LG5377 hybrid. In the agricultural year 2024, on an even higher background of infection, the Unical,SC fungicide shows significantly superior biological efficiency compared to the efficiency of the Trichodermin-SC preparation. The highest value of biological efficacy is found in the hybrid P64LP130 in the amount of 50.0% followed by the hybrids LG5377 and P64LE25 with almost identical values of 43.75% and 43.33%. It can be noted that the biological efficacy of the product Unical,SC is observed under conditions of intensification of crop cultivation. The increase in the infection background shows maximum efficiency in 2024 in all three hybrids. The application of the preparation significantly reduces the frequency and intensity of the attack compared to the values in the control and organic variants.

Throughout the experiment, an increase in the aggressiveness of sunflower blight is observed in the context of intensification of crop cultivation. Although the years 2022, 2023, 2024 were considered dry, arid and unfavorable for the spread of diseases, sunflower blight did not reduce the degree of spread. The results of the experiment contradict the findings of the source [3], such as increasing temperatures and decreasing precipitation in the summer season significantly reduce the risk of spreading the disease. That is, it can be firmly said that the aridification of the climate against the background of high infection does not reduce the degree of spread of the *Plasmopara halstedii* fungus.

CONCLUSIONS

Within the experience of the hybrid P64LP130, P64LE25 demonstrates increased resistance to sunflower blight, considering themselves suitable for cultivation in both conventional and organic systems. The hybrid LG5377 in the context of intensification of sunflower cultivation is considered less suitable. The aggressive phytopathological background demonstrated the importance of correctly exploiting the genetic factor in improving the phytosanitary status of sunflower crops.

The organic preparation Trichodermin-SC shows high biological efficacy in controlling sunflower scab and is considered to be suitable for use in an organic protection system. The aggressive phytopathological background generated by the intensification of crop cultivation makes it less suitable. In order to reduce the chemical load in agriculture, it is reasonable to integrate the preparation Trichodermin-SC into the conventional sunflower protection system.

The fungicide Unical,SC, showing high biological efficacy in controlling sunflower powdery mildew, can be considered suitable for use in conditions of intensification of sunflower cultivation in a conventional system. The high biological efficacy, low cost and accessibility position this fungicide among the most promising fungicides in the current economic context.

REFERENCES

1. BĂDĂRĂU, S. Fitopatologie Generală și Agricolă. Chișinău: Tipografia Print-Caro, 2012, 592 p. ISBN 978-9975-56-046-7.
2. DUCA, M., CLAPCO, S., PORT, A., DOMENCO, R., MUTU, A., BOIAN, I., BIVOL, I., BURCOVSKI, I. Cultura De Floarea-Soarelui În Contextul Schimbărilor Climatice. Chișinău: CEP USM, 2023, 148 p. ISBN 978-9975-3430-8-4.
3. VRONSCHIH, M. Protecția Plantelor: Culturile de cîmp. Chișinău: Tipografia Centrală, 2011, 120 p. ISBN 978-9975-78-957-8.
4. POPESCU, G. Tratat De Patologia Plantelor Vol.2. Timișoara: Editura Eurobit, 2005, 634 p. ISBN 973-620-169-4.
5. PARASCHIVU, I., AURELIAN, M. Combaterea Integrată a Patogenilor și Dăunătorilor la Principalele Culturi de Cîmp. Craiova: Editura SITECH, 2011, 409 p. ISBN 978-973-746-792-8.
6. BÎLTEANU, G. Fitotehnie. Vol II Oleifere, Tuberculifere Și Rădăcinoase. București: Ceres,1993, 547 p. ISBN 973-40-0262-7.
7. DAVIDESCU, D., CALANCEA, L., DAVIDESCU, V. Protecția Chimică în Agricultură. București: Editura Academiei Române, 1992, 448 p. ISBN 973-27-0290-7.
8. GUMOVSCHI, A. Manualul Fermierului Pentru Culturile de Cîmp. Chișinău: Editura Notograf Prim SRL, 2024, 270 p. ISBN 978-9975-84-207-5.
9. STARODUB, V. Fitotehnie. Chișinău: Tipografia Print- Caro SRL, 2011, 600 p. ISBN 978-9975-4187-6-8.
10. BAICU, T., SĂVESCU, A. Sisteme de Combatere Integrată a Bolilor și Dăunătorilor pe Culturi. București: Editura Ceres, 1986, 264 p.
11. VOLOȘCIUC, L. Agricultura Ecologică: aspecte teoretice și valențe practice. Chișinău, 2021, 288 p. ISBN 978-9975-62-451-0.
12. BOINCEAN, B., VOLOȘCIUC, L., RURAC, M., HURMUZACHI, I., BALTAG, G. Agricultura Conservativă: Manual Pentru Producători Agricoli și Formatori. Chișinău: Tipografia Print-Caro, 2020, 203 p. ISBN 978-9975-56-744-2.
13. GULII, V., PAMUJAC, N. Protecția Integrată a Plantelor: Material didactic pentru studenții și elevii instituțiilor de învățămînt cu profil agrar. Tradus din Limba Rusă de SPÎNU, E. Chișinău: Universitas, 1992, 528 p. ISBN 362-00973-7.