ECONOMICALLY IMPORTANT SUNFLOWER PATHOGENS IN THE ROMANIAN WESTERN PLAIN

Csép N.

*University of Oradea, Faculty of Environmental Protection, 26 Gen. Magheru St., 410048 Oradea; Romania, e-mail m_csep@yahoo.com

Abstract

Sunflower has a great importance in Romanian crop production as the most important vegetable edible oil source.

A large number of hybrids are registered in Romania. Twenty of them are the result of Romanian sunflower breeders and more than twenty-five of them are foreigners.

The yield stability and the agronomic and economic efficiency of sunflower cultivation depend on the influence of genotype, the level of applied technology, and the presence of an important number of diseases caused by the attack of parasitic fungi.

In order to remove the harmful effects caused by the occurrence of major diseases, it is very important to identify the role of different agri-ecological, biological and agrotechnical factors. The application of a complex of cultural practices (growing resistant hybrids, crop rotation, optimal sowing time, plant density, chemical fertilization, weed control) can ensure a satisfactory level of sunflower protection against dominant parasites.

Application of fungicides during the growing season, based on forecasting method for the evolution of infection, adapted to individual conditions can increase the efficiency of treatments and yield stability [2,3].

Key words: sunflower diseases, integrated pest management

MATERIALS AND METHODS

In order to evaluate the influence of different genotypes and years on the degree of different fungal infections, comprising inbred lines, single and three - way hybrids developed at the Research Institute for Cereals and Industrial Crops Fundulea, in the period of 1981-2005 special screening tests were organized at the Agricultural Research and Development Station from Oradea.

The role of different agrotechnical elements in occurrence of major diseases was also examined in small and large plot trials: different sowing times (early, optimal and late), plant density values (45-60,000 plants/ha), N-fertilizer level (N_{80}-N_{120}) in tolerant and sensitive genotypes, the influence of previous plant, tillage methods, weed control and others.

In the performed tests, a large number of systemic and protective fungicide combination were included, recommended initially in treatments at the stage of 6-8 pairs of leaves and at the beginning of flowering. After the development of the forecasting method, the locally applied prognosis based on the effective sum of temperature and humidity necessary for ascospore dispersion of *Diaporthe helianthi* was recommended.

RESULTS

The dominant parasites in sunflower in this part of the country are presented in Table 1.

Table 1

Important sunflower diseases in the Western Plain of Romania, 1981-2005

Disease	Causal agent	Importance
Downy mildew	*Plasmopara halstedii*	***
Stem canker	*Diaporthe helianthi* *c.f. Phomopsis helianthi*	***
White rot	*Sclerotinia sclerotiorum*	**
Grey mould	*Botrytis cinerea*	**
Charcoal rot	*Sclerotium bataticola*	*
Black spot	*Phoma macdonaldii*	**
Brown spot	*Alternaria spp.*	**

The first appearance of the symptomps of stem canker caused by *Diaporthe helianthi* was reported in 1981 in the western part of the country (Iliescu, Csep,1982) . Nowadays, the parasite is frequent in all sunflower - growing areas and often causes serious crop losses. The level of the attack and the yield losses are very important after a rainy hot period before flowering (June - middle of July).

Occurrence and severity of *Diaporthe* stem canker, beside of pathogen virulence depends largely on the genetic resistance of the cultivated hybrid, on environmental and agrotechnical factors. The level of production losses depends on the starting data of the first infection. The early infections before flowering can cause the most important damages recorded up to now in this part of the country. The genetic response of sunflower breeding material to the attack of different parasites, registered in one of the most naturally infected area (ARDS. Oradea) in the mentioned period, indicated an important genetic variability and allowed to foresee the possibility of a succesful genetic control of *Diaporthe helianthi.* The developed hybrids, like Felix, Select, Super, Favorit, Alex u.a., under good agrotechnical condition have a satisfactory field resistance to stem canker. Resistant hybrids were also introduced in commercial production in Yugoslavia (created in Novi Sad), Hungary (created at Szeged, Iregszemcse), Bulgaria (Gen. Toshevo) [2,8,9,10,11].

The introduction of resistant hybrids cannot solve all phytopathologycal problems. The advantageous agriecological conditions, favorable for sunflower growing and the use of complex cultural practices can ensure a satisfactory of sunflower production.

Only the crop rotation was practically ineffective against *Diaporthe helianthi*, because the spores of this parasite are transmitted by wind. Our results show that sowing time can influence the intensity of infection. Early sowing (beginning of April) was generally more intensively infected in most years, because the sensitive stage in plant development coincided with the spreading time of ascospores (Table 2).

Table 2

Relationship between sowing time and Diaporthe helianthi infection in sunflower, ARDS. Oradea, 1983-2005

Sowing time	Genotype	Infection index %	
		max.	min.
beginning of April	tolerant	10,9	2,8
	sensitive	65,7	15,7
middle of April	tolerant	5,1	1,0
	sensitive	30,5	7,4
beginning of May	tolerant	3,5	0,4
	sensitive	15,3	3,4

In our agrotechnical and ecological conditions it is recommended to use the lower limit of the plant density optimum. The higher plant density (upper than 55.000 harvested plants/ha) was favourable to the infection of *Diaporthe helianthi, Alternaria helianthi* and other pathogens (Table 3) and affected significantly the yield obtained.

Table 3

Influence of plant density on occurrence of pathogens in sunflower, ARDS, Oradea, 1983-2005

Plant density	Genotype	Infection index %					
		***Diaporthe h.* (stems)**		***Sclerotinia s.* (stems)**		***Alternaria h.* (leaves)**	
		max.	min.	max.	min.	max.	min.
45000	tolerant	3,0	1,5	8,0	0,0	5,0	3,0
	sensitive	12,0	2,0	15,0	1,5	15,0	5,0
65000	tolerant	7,5	3,0	12,8	3,0	10,5	5,0
	sensitive	47,5	5,0	20,0	5,5	30,0	10,5

The sensitivity to the pathogens was increased by high doses of nitrogen fertilizer (Table 4). This negative influence was more visible in case of the sensitive genotypes.

Table 4

Relationship between fertilization level and occurrence of pathogens in sunflower, ARDS, Oradea, 1983-2005

Fertilization level	Genotype	Infection index %					
		Diaporthe h. (stems)		**Sclerotinia s. (stems)**		**Alternaria h. (leaves)**	
		max.	min.	max.	min.	max.	min.
$N_{80}P_{80}K_{80}$	tolerant	5,0	0,0	8,0	0,0	10,5	3,0
	sensitive	20,0	3,0	20,0	1,5	35,0	5,0
$N_{120}P_{80}K_{80}$	tolerant	10,0	1,5	14,0	3,5	15,0	5,0
	sensitive	30,0	6,0	35,0	5,0	50,0	10,0

Downy mildew of sunflower caused by *Plasmopara halstedii*, occurs in most countries where sunflower is commercially grown. Like in some neighbouring countries and in Europe in general, in the last years local downy mildew race populations have been diversified with new races, partially arised indigenously or being imported from outside [9]. The re-evaluation of our domestic hybrids and the foreigners as well, the identification of new resistance genes became absolutely necessary.

The combination of a new resistence, with efficient seed dressing using new systemic fungicides will ensure the protection of the crop against this harmful pathogen.

In dry and warm summers and on sandy soils like those from the northern part of Bihor county, sunflower was more intensively attacked by charcoal rot caused by *Sclerotium bataticola* [2,3,6,7]. In late July and throughout August, the low level of precipitation and the high temperatures are favourable for germination of microsclerotia which infects the sunflower rots. The waterstress make plants maturation and premature wilting. All cultural practices which can improve the vitality of the crop, like crop rotation, irrigation, will at the same time serve the purpose of controlling this pathogen.

Crop rotation is a particularly important measure, because with this practice it's possible to regulate effectively the population of soilborne pathogens (*Sclerotium bataticola, Sclerotinia sclerotiorum, Plasmopara halstedii*) (Table 5)

White rot caused by *Sclerotinia sclerotiorum* is a very important disease of many crops (sunflower, sojabean, carrot, rape u.a.) and can cause important crop losses in the years with abundant rainfall. The various symptoms can appear during the vegetation period like collar rot, seedling dieback, stalk rot, white rot, plant wilting and head rot. An adequate crop rotation can reduce the quantity of inoculum in the soil, and the use of fungicides in seed dressing ensure the seed and seedlings' protection. The head rot, appeared in sunflower in the second half of the growing season as a result of abundant rainfalls, can cause large damages. The use of dessicants and fungicides can reduce the damages, but increases the cost of production.

The biological control measures using antagonistic fungi in seed dressing (*Trichoderma viride, T. harzianum, Coniothyrium minitans*) also trialled against the main seed - and soil - borne fungal pathogens and can offer in the future a non - polluting alternative in the developement of IPM - technology of the sunflower [2,3,6].

Table 5. Agrotechnical, biological and chemical measures used in integrated protection of sunflower against dominant parasites

Measures	Diaporthe helianthi	Plasmopara halstedii	Sclerotinia sclerotiorum	Botrytis cinerea	Alternaria spp.	Phoma macdonaldii	Scl. bataticola
Agrotechnical measures							
- tillage	+++	+	+	+		+	+
- previous plant	+	++	+++	+		+	+++
- crop rotation	+	++	+++	++		+	+++
- sowing time	+++		+++	+++		++	+
- fertilization practice	++		++	++	+++	++	++
- plant density	+++	+	+++	++	++	++	+
- volunteers control	++	++	+	+		+	+
- weed control	+	+	++	++	++	+	+
Biological measures							
- resistant/tolerant hybrids	+++	+++				++	+
- biofungicides			+	+			+
Chemical measures							
- seed dressing		+++	++	+	+		++
- fungicide treatments	+++	+	++	++	++	++	+
- signalization	+++	+	++	+	+	+	

CONCLUSIONS

Only the correct application of a complex of cultural practices (crop rotation, sowing in middle of April, using a hybrid - adapted low density level, moderate N - doses, chemical weed control, irrigation), growing resistant hybrids, seed disinfection and efficient control of major parasites by fungicides (based on forecasting the evolution of fungal infection and signalisation for optimal timing of treatments) can provide the yield stability, the agronomical and economical succes of sunflower cultivation.

REFERENCES

1. Asdrubal Aponte, 2005, Enfermedad del girasol detectados en Venezuela. FONAP- CENIAP.Instituto de Investigatione Agronomica. www. cenicap.gov.ve/publica.

2. Csép, N., 1993, Research on the complex of plant pathogenic agents inducing necrosis, stem lodging and head rot of sunflower; development of integrated control method (in Romanian). Universitatea de Stiințe Agricole Cluj-Napoca, Fac. Agricultura, Doctor thesis, 175 pp.

3. Csép, N., 2005, Protecția eficientă şi sigură a plantelor față de boli. (Effective and seif plant protection against diseases). Phare-CBC Project. Ed.Universității din Oradea, pp.226+append.

4. Csép, N. - Ciobanu, Gh. - Domuța, C., 2000, Environment-Friendly Control of Sunflower Diseases in the Western Plain of Romania. Linking Environment and Agriculture in Research. Debrecen - Nyiregyháza, 30-39.

5.Iliescu, H-Csép, N., 1982, - Notă privind starea fitosanitară a culturilor de floarea soarelui în Câmpia de Vest în anul 1981 .(note about the phytosanitary status of the sunflower in the Romanian Western Plain in 1981), Probl. de prot. plantelor. X.1. p. 90-91.

6. Sesan, Tatiana - Oprea, Maria- Csép, N. - Oance F., 1999, Biocontrol of Botrytis cinerea and Sclerotinia sclerotiorum. 6-th Mycological Congress Israel. Phytoparasitica. 27, 1, 66.

7. Sinclair, J.B. - Backman, P.A., 1989, Compendium of Soybean Diseases. American Phytopathological Society. INC. 3-rd edition.

8. Skoric, D. (1985): Sunflower Breeding for Resistance to Diaporthe-Phomopsis Helianthi. Munt. - Cvet. et al Helia,8,21-24.

9.Virányi,F., 1999, Miért kell ismét beszélni a napraforgó peronoszpórá- ról? Agrofórum. X, 4, 64-67.

10. Vranceanu, A.V. - Csép, N. - Parvu, N. - Stoenescu, F.M., 1983, Genetic Variability of Sunflower Reaction to the Attack of Phomopsis helianthi Munt. - Cvet. et al. Helia, 6, 23-25.

11. Vranceanu, A.V. -Craiciu, D. - Soare Gabriela, 1998,"Stay- green " trait of stem in sunflower.Proc. of 2 nd Balkan Symposium on Field Crops, Novi Sad,Yugoslavia, I, 95-99.