

RESEARCH REGARDING THE RESPONSE OF RAPESEED HYBRIDS TO PATHOGENS

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Abstract

One of the major factors which play a limiting role in rapeseed culture is represented by a number of pathogens that attack under favourable conditions (provided by abiotic factors), resulting in lower production. Five hybrids were tested: Elite, Elvis, ES Hydromel, ES Artist and ES Saphir, and observations were made under natural contamination in non-treatment variants, in order to analyze the reaction of the hybrids to major pathogens in 2009, 2010 and 2011. The results of the tests carried out during the three years of research on the five hybrids showed that the main diseases of rape, in order of economic importance, were: a) White rot on rape (*Sclerotinia sclerotiorum* Lib. De Bary); b) Early blight of rape (*Alternaria brassicae* Berk-Sacc.); c) Dry rot and canker of crucifers (*Phoma lingam* Tode ex Schw. Desm.); d) Powdery mildew of rape (*Erysiphe communis* Wallr.-Link). Research was conducted in the experimental fields of a private farm located at Fundulea. From the analysis of the data concerning the behaviour of rapeseed hybrids to pathogens investigated during the three years of study, we concluded that the order of pathogen occurrence in the field was: *Phoma lingam*, *Alternaria brassicae*, *Erysiphe communis* and *Sclerotinia sclerotiorum*; the most favourable conditions for most diseases were recorded in 2011, excepting common powder mildew (2009). From the present paper, it can be concluded that phytosanitary factors are among the main limiting factors of the rapeseed crop, particularly the attack produced by the fungi *Sclerotinia sclerotiorum*, *Alternaria brassicae*, *Phoma lingam* and *Erysiphe communis*.

Key words: hybrids, pathogens, rapeseed.

INTRODUCTION

One of the major factors which play a limiting role in rapeseed culture is represented by a number of pathogens that attack under favourable conditions (provided by abiotic factors), resulting in lower production [4].

Given the growing importance of rape crop in Romania, the study of pathogens that attack the crop has a particular importance in obtaining top quality and high quantity yields.

Two of the most important diseases of rape are white rot and early blight.

In rainy years, white rot on rape causes great damage in large European countries that grow rapeseed.

In Romania, the disease is found in plants alone or in small hearths in rapeseed crops [3].

Early blight of rape is a common mycosis in rape crops [1]. *Alternaria brassicae* is transmitted from one year to another through the seed produced by diseased plants and the plant remains left on the field after harvest.

Primary infections are produced by the conidia present in the plant remains on the field or the diseased seed.

The environmental conditions favour the growth and development of phytopathogenic agents, the evolution of the disease and plant resistance to various infection pathogens. Soil can be a source of inoculum for different phytopathogenic agents, for example the sclerotia of *Sclerotinia sclerotiorum* are further sources of infections and epidemics [5].

This paper presents the behaviour of five rapeseed hybrids to the pathogens attack.

MATERIAL AND METHOD

Visual observation is the fastest method of identifying a disease based on signs and symptoms shown by infected plants; it involves a high degree of subjectivity, depending largely on the diagnosing person's level of knowledge. The scoring attack for a disease has a particular importance for the rapeseed culture in establishing the need for chemical treatments during the vegetation period [2].

The attack value is represented by frequency (F%), intensity (I%) and attack degree (AD%). Frequency is the percentage of plants attacked to all cases examined. Attack intensity indicates the degree to which the plant is attacked under examination. Intensity was noted directly in percentage.

The attack degree referred to the severity of disease in the crop and was calculated using frequency and intensity. The intensity of the pathogen attack was evaluated by using the quarter method.

The determination of the seed fat content (Soxhlet method) under the influence of *Sclerotinia sclerotiorum* attack was in accordance with the quality standards used in the laboratory for the determination of total lipids from seeds and other vegetable products (SR-ISO-7970/2001) with the Soxhlet apparatus-SER 148.

We also performed the analysis of productivity. The hybrids used for the tests were produced by Rustica.

Their tolerance to pathogenic agents was estimated according to the Björling scale.

The experimental lots were established as one-row blocks. The harvesting area of one lot was 20 square metres. For all the experimental years observations were made at the end of June.

RESULTS AND DISCUSSIONS

Five hybrids were tested: Elite, Elvis, ES Hydromel, ES Artist and ES Saphir, and observations were made under natural contamination in non-treatment variants, in order to analyze the reaction of the hybrids to major pathogens in 2009, 2010 and 2011.

Research was conducted in the experimental fields of a private farm located at Fundulea.

Table 1 presents the data on the behaviour of the hybrids investigated.

One can notice that all hybrids recorded a similar behaviour to the intensity degree of the dry rot attack; frequency was the factor that made the difference. The evolution of the attack during the three experimental years was increasing from the lowest values in 2009 to the highest attack in 2011. Thus, in 2011, Elite and ES Hydromel hybrids recorded an attack degree of 29.75% and 19.5%, respectively, Elvis and ES Saphir 21.0%, while ES Artist hybrid showed the highest tolerance to *Phoma lingam*, with an attack degree of 17.5%. The symptoms typical of the pathogen *Phoma lingam* occurred almost simultaneously in all hybrids at the same in the three years of research, i.e. the first decade of April.

Concerning the powdery mildew attack (Table 2), the hybrids recorded an almost identical behaviour in the intensity of attack, varying between 15.0% and 20.0%, which shows differences in the mean frequency of the mildew attack. In this case, powdery mildew recorded a reverse trend, compared with the dry rot attack, as the highest values occurred in 2009, then decreased by 2011.

The highest values of the degree of attack by *Erysiphe communis* were found in the hybrid Elite, while the hybrid ES Saphir proved to be the most tolerant. Powdery mildew symptoms appeared in the rape crop in late April and were present only in the lower half of the plant leaves.

Early blight of rape was the second disease after dry rot which appeared in the crop in mid-April. The degree of attack decreased from ES Hydromel, Elite, Elvis, ES Artist to ES Saphir. Based on relatively constant intensity but different frequency values of the early blight attack from one year to another, we found a progressively increasing attack degree during the three years of research (Table 3). The five hybrids investigated showed typical symptoms early blight only in the siliques.

Table 1. Response of rapeseed hybrids to *Phoma lingam*

Hybrid	Average attack								
	F (%)			I (%)			A.D. (%)		
	Year								
	2009	2010	2011	2009	2010	2011	2009	2010	2011
ELITE	65	75	85	30	35	35	19.5	26.25	29.75
ELVIS	50	60	65	30	30	30	15.0	18.0	19.5
ES HYDROMEL	70	80	85	35	35	35	24.5	28.0	29.75
ES ARTIST	45	45	50	30	35	35	13.5	15.75	17.5
ES SAPHIR	55	55	60	30	30	35	16.5	16.5	21.0

Table 2. Response of rapeseed hybrids to *Erysiphe communis*

Hybrid	Average attack								
	F (%)			I (%)			A.D. (%)		
	Year								
	2009	2010	2011	2009	2010	2011	2009	2010	2011
ELITE	35	30	25	20	20	20	7.0	6.0	5.0
ELVIS	30	30	25	15	15	15	4.5	4.5	3.75
ES HYDROMEL	30	25	25	15	15	15	4.5	3.75	3.75
ES ARTIST	30	30	20	20	20	15	6.0	6.0	3.0
ES SAPHIR	25	20	20	15	15	15	3.75	3.0	3.0

Table 3. Response of rapeseed hybrids to *Alternaria brassicae*

Hybrid	Average attack								
	F (%)			I (%)			A.D. (%)		
	Year								
	2009	2010	2011	2009	2010	2011	2009	2010	2011
ELITE	60	65	70	20	20	25	12.0	13.0	17.5
ELVIS	55	60	70	15	15	20	8.25	9.0	14.0
ES HYDROMEL	65	70	75	20	20	25	13.0	14.0	18.75
ES ARTIST	50	55	65	10	10	15	5.0	5.5	9.75
ES SAPHIR	50	55	60	10	10	15	5.0	5.5	6.0

Table 4. Response of rapeseed hybrids to *Sclerotinia sclerotiorum*

Hybrid	Average attack								
	F (%)			I (%)			A.D. (%)		
	Year								
	2009	2010	2011	2009	2010	2011	2009	2010	2011
ELITE	20	25	32	15	20	25	.	5.0	8.0
ELVIS	20	25	30	15	25	35	3.0	6.25	10.5
ES HYDROMEL	18	24	30	15	25	30	2.7	6.0	9.0
ES ARTIST	18	30	32	15	20	30	2.7	6.0	9.6
ES SAPHIR	16	25	30	15	15	20	2.4	3.75	6.0

Table 5. The influence of *Sclerotinia sclerotiorum* pathogen on quantitative and qualitative components of rape crop production (Elvis hybrid)

Specification	Number of siliques	Size of siliques (mm)	Number of seeds/silique	Seeds weight (g)	TGW (g)	Sclerotia weight (g)	Humidity at harvest (%)	Dry matter (%)	Seed fat content (% dry matter)
Healthy plants	857	7.12	27.95	76.2	5.45	0	5.9	96.32	49.01
Diseased plants	496	5.45	13.07	23.12	3.94	0.47-0.81	5.9	96.5	44.55
Difference	361 (42.12%)	1.67 (23.46%)	14.88 (54.0)	53.08 (69.7)	1.51 (27.7%)	0.47-0.81 (47.0-81.0%)	0	-0.18	4.46 (9.1%)

The first symptoms of white rot occurred in early June. The data shows that, during the three years of experiments, the weather conditions in 2011 were more favourable to its occurrence while the lowest values were recorded in 2009 (Table 4). The hybrid ES Saphir showed the highest degree of tolerance to *Sclerotinia sclerotiorum* (6.0% degree of attack). The decreasing order in terms of hybrid rapeseed tolerance to white rot was the following: Elite, ES Hydromel, ES Artist and the most sensitive was Elvis with an attack degree of 10.5%. Apart from the inconvenient agricultural technique (rape must not be grown in crop rotations that include soybean and sunflower), *Sclerotinia sclerotiorum* creates problems related to the quality and amount of the yields (Table 5).

Thus, in the hybrid Elvis, we observed: The average number of siliques decreased in the diseased plants by about 42.12%, compared with the healthy ones. The siliques size of the plants attacked by *Sclerotinia sclerotiorum* was lower (23.46% on average), compared with the siliques of the uninfected plants. The average number of seeds/silique decreased by 54.0% in the diseased plants, compared with the healthy plants. The reduced size and number of seeds/silique of the diseased plants compared with the healthy ones automatically reflected negatively on the average weight of the infested seed/plant. This was 69.7% lower than the mass of seeds from healthy plants. The Thousand Grain Weight (TGW) of the diseased plants decreased by 27.7%, compared with the healthy plants. The weight of the sclerotia infected plants ranged from 0.47 to 0.81 g. Seed humidity at harvest time was not affected neither in the diseased plants nor in the healthy ones. The dry matter content was lower in the seeds of the healthy plants, compared with the dry matter content of the seeds of the rape plants infected with *Sclerotinia sclerotiorum*. The seed fat content of the diseased plants was on average 9.1% lower, compared with the seed fat content of the healthy plants. The data above show that the pathogen *Sclerotinia sclerotiorum* drastically affects the good quality and high amount of rapeseed yield, resulting in smaller siliques, less and smaller seeds, lower fat content of the seeds. This can be explained by

the fact that, unlike other pathogenic agents, *Sclerotinia sclerotiorum* needs to create its specific resistance organs (sclerotia) in order to survive.

CONCLUSIONS

One of the major factors which play a limiting role in rapeseed culture is represented by a number of pathogens that attack under favourable conditions (provided by abiotic factors), resulting in lower production.

The results of the tests carried out during the three years of research show that the main diseases of rape, in order of economic importance, are the following: the white rot of rape (*Sclerotinia sclerotiorum*), the early blight of rape (*Alternaria brassicae*), dry rot and canker of crucifers (*Phoma lingam*), and the powdery mildew of rape (*Erysiphe communis*). The hybrid ES Saphir showed the highest degree of tolerance to the pathogen *Sclerotinia sclerotiorum* (6.0% degree of attack).

The order of pathogens occurring in the field was: *Phoma lingam*, *Alternaria brassicae*, *Sclerotinia sclerotiorum* and *Erysiphe communis*.

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