

# Evaluation of chosen winter rapeseed genotypes resistance to *Fusarium* spp. using in vitro methods

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## Abstract

Every year rapeseed is attacked by different kinds of pathogens. The most dangerous are fungal diseases that depending on climatic condition and genetic factors made less or more significant yield losses. There are a lot of different agents that affect process of infection. Possibility of early recognition of the pathogen on the crop as well as knowledge of seasonal changes of disease risk is very important from breeding point of view. In Polish weather conditions the most dangerous pathogens are: *Leptosphaeria* spp., *S. sclerotiorum* and *Fusarium* spp. Fungus *Fusarium* spp. that causes foot root disease of seedlings is very often observed on agar medium during health tests of sowing seed as well in field condition. Two species: *Fusarium oxysporum* (Schlecht) and *Fusarium culmorum* (W.G. Smith) Sacc., were used for inoculation different double zero winter rapeseed material. Among examined objects the most resistant to *F. oxysporum* were: Extrem, Pomorzani, Amor, Idol DH-1 and Bojan, which was the best. Yellow-seeded strains 305z, 308z, 310z and varieties Kronos and Spencer occurred the most susceptible to the pathogen. Regarding *F. culmorum* - the most resistant were: Spencer, Bosman, Bojan, Californium, Idol, Czek, Bolko and strains DH-1 and 308z. The most susceptible occurred yellow-seeded strain 305z and line DH-2. Variety Bojan and Idol as well as line DH-1 were the most resistant to both pathogen species *F. oxysporum* and *F. culmorum*. Differences between tested objects were statistically significant. Statistical analysis using t-Student test showed that pathogen species also differed in their pathogenicity. *F. oxysporum* was more aggressive to *F. culmorum*.

**Key words:** Oilseed rape, resistance to *Fusarium* spp., in vitro methods

## Introduction

Every year in Poland rapeseed is attacked by different kinds of pathogens. The most dangerous are fungal diseases. There are a lot of different agents that affect process of infection. Some of them can be controlled by agrotechnics, using resistant varieties or proper plant protection. Ability of early recognition of the pathogen as well as knowledge of seasonal changes of disease risk is very important from breeding point of view. In Polish weather conditions the most dangerous pathogens are (Starzycki M. 1998, Starzycki M. et al. 2003, Starzycka E. et al. 2002.):

- *Leptosphaeria maculans* (Desm.) Ces. et de Not., conidial stage *Phoma lingam* (Tode ex Fr.) Desm.
- *Sclerotinia sclerotiorum* (Lib.) de Bary.
- *Alternaria* spp.
- *Pyrenopeziza brassicae* (Raw.), conidial stage *Cylindrosporium concentricum* (Grev.).
- *Verticillium dahliae* Kleb. i *Verticillium albo-athrum* Reinke et Berth.
- *Botrytis fuckeliana* (de Bary) Whetzel, conidial stage *Botrytis cinerea* Pers.
- *Fusarium* spp.
- *Peronospora brassicae* Gam.
- *Erysiphe cruciferarum* Opiz ex Junel.
- *Mycospora capsella* sp. nov., conidial stage *Pseudocercospora capsella*.

Fungus *Fusarium* spp. that causes foot root disease of seedlings is very often observed on agar medium during health tests of sowing seed. In field condition there is also often observed necrotic effect on hypocotyls caused by the pathogen (Desjardins A.E., Hohn T.M. 1997, Bottalico A., Perrone G. 2002).

## Materials and Methods

In the research work the resistance of 13 strains and 5 varieties of winter rapeseed plants in seedling stage was evaluated in vitro by mycelium test (Starzycki M. 1998). Two species of pathogen: *Fusarium oxysporum* (Schlecht) (received from Bank of Pathogen of Plant Protection Institute) and *Fusarium culmorum* (W.G. Smith) Sacc., (which was isolated in field conditions in Malyszyn) were used for inoculation.

In order to establish diagnostic procedures there were also done DNA-RAPD analysis by using primers that amplified fragments of different length of base pairs (Doyle J.J., Doyle J.L. 1998):

- Analysis of double haploid line DH-II - non-inoculated control forms
- DNA analysis of mycelium of *Fusarium oxysporum* (Schlecht)
- DNA analysis of mycelium of *Fusarium culmorum* (W.G. Smith) Sacc.
- Analysis of DNA received from plants infected by *Fusarium oxysporum* (Schlecht)

- Analysis of DNA received from plants infected by *Fusarium culmorum* (W.G. Smith) Sacc.

The specific procedure of DNA analysis, after construction of specific primers, will be helpful for identification of the pathogen on infected rapeseed seedlings.

## Results

**Table 1. *F. oxysporum* i *F. culmorum* Infection Index (IP) of varieties and strains of winter rapeseed:**

STRAIN VARIETY	INFECTION INDEX (IP, %)	
	<i>F. oxysporum</i>	<i>F. culmorum</i>
Bojan	0,0	12,0
Extrem	5,0	17,5
Idol	5,0	10,0
DH I	5,0	17,5
Pomorzanin	7,5	37,5
Amor	12,5	35,0
Lisek	20,0	42,5
DH II	25,0	50,0
Bolko	27,5	15,0
305z	30,0	37,5
Kaszub	30,0	22,5
308z	32,5	20,0
Mazur	32,5	27,5
Bosman	35,0	7,5
Cazek	37,5	12,5
310z	42,5	35,5
Californium	52,5	7,5
Kronos	72,5	40,0
Spencer	92,5	7,5

$$IP = \frac{\sum(n \cdot v)}{V \cdot N}$$

IP – Infection Index

*n* – number of plants in specific classes of infection severity

*v* – infection severity degrees

*V* – the lowest infection severity degree

*N* – total number of plants

Variety Bojan and Idol as well as line DH-1 were the most resistant to both pathogen species *F. oxysporum* and *F. culmorum*. Differences between tested objects were statistically significant. Statistical analysis using t-Student test showed that pathogen species also differed in their pathogenicity. *F. oxysporum* was more aggressive than *F. culmorum*.

## Conclusions

The most resistant to *F. oxysporum* rapeseed strains and varieties tested in reported research were: Extrem, Idol, DH-1, Pomorzianin, Amor and Bojan. Variety Bojan stood out by the highest level of resistance. Very strong infected were: Kronos, Californium and yellow-seeded strains 305z, 308z, 310z. The most susceptible to the pathogen variety was Spencer. Among the same varieties infected by *F. culmorum* the most resistant ones turned out: Spencer, Bosman, Californium, Idol, Bojan and Cazek, whereas strains DH-2 and yellow-seeded 310z as well as varieties Lisek, Kronos and Pomorzianin were susceptible to the pathogen. The highest resistance to both pathogen species (*F. oxysporum* and *F. culmorum*) expressed by Infection Index (IP) showed varieties: Bojan, Idol, Extrem and strain DH-1. IP differences between tested objects were statistically significant. Statistical analysis using t-Student test showed that IP of pathogen species also differed in their pathogenicity. *F. oxysporum* was more aggressive to *F. culmorum*.

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## References

- Bottalico A., Perrone G. 2002. Toxigenic *Fusarium* species and mycotoxin associated with head blight in small-grain cereals in Europe. *Europ. J. Plant Pathol.*, 108:611-642.
- Desjardins A.E., Hohn T.M. 1997. Mycotoxins in plant pathogenesis. *Mol. Plant Microbe Int.*, 10 (2): 147-152
- Doyle J.J., Doyle J.L., 1990. Isolation of plant DNA from fresh tissues. *Focus*, 12: 13-15.
- Starzycki M., 1998. Study on resistance of winter oilseed rape (*Brassica napus* L.) to *Leptosphaeria maculans* (Des.) Ces. et de Not. / *Phoma lingam* (Tode ex Fr.) Desm., Pathogen causing stem canker of *Brassicac*s. *Monografie i Rozprawy Naukowe IHAR*, nr 1.
- Starzycka E., Kachlicki P., Starzycki M. 2002. Diversity of Polish and Chinese isolates of *Sclerotinia sclerotiorum* (Lib.) de Bary and their ability to oxalic acid production. *Rosliny Oleiste – Oilseed Crops*, Tom XXIII: 385-390.
- Starzycki M., Starzycka E., Pszczola J. 2003. Research in rapeseed resistance breeding – progress made in recent years. *Rosliny Oleiste – Oilseed Crops*, Tom XXIV:363-372.