Field testing and sensitivity of winter rapeseed to pathogens *Phoma lingam* and *Sclerotinia sclerotiorum*

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Abstract
Two field tests for assessment of cultivar health status in oilseed rape materials were established in two localities - Opava and Chlumec nad Cidlinou. The first test for evaluation of the relation between the locality and occurrence of phoma stem canker (blackleg) caused by *Leptosphaeria maculans* and sclerotinia stem rot caused by *Sclerotinia sclerotiorum* was conducted for two years (2009-2010). The correlation between phoma stem canker and locality was confirmed. In the next field test established in 2010 in Chlumec nad Cidlinou the relation between fungal diseases occurrence and yield was evaluated. The correlation between sclerotinia stem rot and yield level was confirmed.

Keywords: fungal diseases; field test; *Leptosphaeria maculans*; *Sclerotinia sclerotiorum*; winter oilseed rape

Introduction

Phoma stem canker (*Phoma lingam*) and sclerotinia stem rot (*Sclerotinia sclerotiorum*) are important diseases of oilseed rape all over the world and the Czech Republic as well. Development of oilseed rape resistant to these two diseases is one of the main breeding goals.

Materials and Methods

Material of winter oilseed rape with different sensitivity to two fungal patogens - *P. lingam* (LEPTMA) a *S. sclerotiorum* (SCLESC) was selected according to the results of the preliminary field assessment and the published results. The latter parameter for selection of these materials was seed quality – content of erucic acid (EA) and glucosinolates (GSL). The selected materials were canola quality (00) or with very low content of EA and GSL. Seed quality evaluation was conducted by NIRS (Near Infrared Spectroscopy) screening method. The total number 36 materials comprises advanced breeding materials, commercial cultivars registered in the Czech Republic, cultivars included in Common catalogue of varieties of agricultural plant species and restricted cultivars. Three materials were later excluded. List of materials is in Table 1. The field verification was conducted from sowing in 2008 to harvest in 2010 in two localities – in Opava (Loc. 49°54´34.832´´N, 17°5424.847´´E) and Chlumec nad Cidlinou (Loc. 50°8´49.325´´N, 15°28´38.774´´E). The both localities lie in warmer regions of the Czech Republic. The field experiment have three replications and size of plots was 3.75 m^2 in Opava and 10 m^2 in Chlumec nad Cidlinou.

In the next test, which was conducted in the period 2009 -2010 in only one locality - Chlumec nad Cidlinou was evaluated correlation between yield and diseases (LEPTMA, SCLESC) occurence and the mean health status. The total number of evaluated materials was 25 (Table 2). The materials were included to the test according to results of previous tests of their drought and freezing tolerance. Seed quality parameters were detected, but materials with lower quality were not restricted.

Diseases occurrence was scored on a 1-9 scale for the percentage of necrotic area. For phoma stem canker the rate 1 means that more than 50 % of plants have at least one spot on the main stem, most of spots fill more than 80 % of stem. In case of sclerotinia stem rot more than 50 % of plants have at least one spot on the main stem or lateral branch, the most of spots fill more than 80 % of perimeter of stem or branch. Rate 9 means no occurrence of the both diseases (Methods UKZUZ - Central Institute for Supervising and Testing in Agriculture, 2005). The occurrence of LEPTMA, SCLESC diseases before harvest time was evaluated in details. The evaluation of yield level (seed moisture 12 %) was included in the second experiment in Chlumec nad Cidlinou (Table 2).

Correlation between disease occurrence and locality and correlation between yield and individual disease occurrence were counted by means of software Microsoft Office Excel 2007. The critical values ($P_{0,05}$, $P_{0,01}$) for N 32 are 0.3494 and 0.4487, for N 22 are 0.4227 and 0.5368 (Rod and Vondracek 1975).

Results and Discussion

The mean value of the occurrence of phoma stem canker in locality Opava and Chlumec nad Cidlinou before harvest in 2009 and 2010 are in the Table 1. The positive correlation between occurrence of phoma stem canker and locality was confirmed in both localities. The counted correlation coefficient was 0.53. In phoma stem canker before harvest was an average occurrence rate in 2009 and low in 2010. Susceptibility of the individual materials to *P. lingam* pathogen in the assessed localities and years was very similar. The only difference was in intensity of infestation depending on year and locality. The materials with different sensitivity to pathogen *Phoma lingam* were selected (Table 1). The correlation between occurrence of sclerotinia stem rot and locality was not confirmed. The correlation between sclerotinia stem rot and yield level was confirmed. The occurence of sclerotinia stem rot before harvest in 2009 was low and average or high in 2010. Two years assessment demonstrated that sensitivity of oilseed rape plants of the same materials was different in individual years and localities. It could by cased by low infestation with *S. sclerotiorum in* 2009 and by different occurrence in assessed localities in 2010. The occurrence of the pathogen could be influenced by the specific microclimate due to different size of experimental parcels.

The results of field experiments with 25 materials in Chlumec nad Cidlinou in 2010 are in Table 2. The correlation between sclerotinia stem rot and yield level with correlation coefficient 0.75 and correlation between the average health status and yield, correlation coefficient 0.69, were confirmed. The average health status significantly influenced the occurrence of sclerotinia stem rot. Different cultivar sensitivity was observed in phoma stem canker and sclerotinia stem rot.

In addition the occurrence of *Peronospora parasitica* was investigated in autumn and in the beginning of flowering. The occurrence was low in autumn and high during flowering (Table 2.).

The results of the field experiments verified the sensitivity of selected breeding materials and cultivars to pathogens *Phoma lingam.* The collection of winter oilseed rape materials with different resistance to *P. lingam* was developed.

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Table 1. The mean occurrence of phoma stem canker (blackleg) on plants before harvest in two localities Chlumec nad Cidlinou and Opava during years 2009-2010

Cultivar or breeding material	Chlumec n. C.	Opava	Mean
OP-4906/07	7.50	7.00	7.25
OP-4773/07	8.17	7.50	7.83
SL-732	6.67	6.65	6.66
SL-744	8.00	7.00	7.50
C 513	7.17	6.65	6.91
C 567	7.67	7.00	7.33
C 7405	7.67	7.00	7.33
Atlantic	7.59	6.35	6.97
Baros	5.75	5.60	5.68
Belevue	7.17	6.15	6.66
Cadeli	6.50	6.40	6.45
Californium	7.00	6.85	6.93
Catana	6.75	7.00	6.88
ES Bourbon	5.75	7.00	6.38
Labrador	7.00	7.15	7.08
Ladoga	7.17	7.25	7.21
Liprima	7.09	7.15	7.12
Mirage	6.67	7.85	7.26
NK Cicero	6.34	5.90	6.12
NK Fair	6.84	7.65	7.24
NK Speed	6.84	6.60	6.72
Remy	7.09	7.25	7.17
Robust	7.34	8.00	7.67
Siska	6.75	6.75	6.75
Vectra	7.17	6.90	7.03
Aviso	7.50	7.50	7.50
Caracas	7.67	6.65	7.16
DH 1488/2	7.17	7.50	7.33
DH 1540/2	5.67	5.75	5.71
DH 1600/4	6.00	6.15	6.08
Odila	5.84	6.85	6.34
Smart	8.00	7.65	7.77
Winner	7.34	7.65	7.49
Counted correlation		0.53	

1-9 scale for the percentage of necrotic spots on plants (1-highly susceptible. 9–immune)

Table 2. Results of the field test in Chlumec nad Cidlinou 2009/2010

Cultivar or breeding material	Yield t/ha	Peronospora brassicae **Autumn 2009**	Peronospora brassicae **27.4.**	***Phoma lingam* 14.7.**	***S. sclerotiorum* 24.6.**	Mean health status
Californium	4.95	8.0	7.7	7.0	6.0	6.9
Navajo	3.32	8.0	6.7	6.8	3.3	5.6
Viking	3.11	8.0	4.3	6.7	2.0	4.3
Grizzly	3.99	8.0	7.7	6.3	3.0	5.7
Cadeli	3.79	8.0	7.3	7.0	5.0	6.4
Labrador	4.88	8.0	6.3	7.2	6.7	6.7
OP 4947/07	4.60	8.0	5.8	8.0	7.5	7.1
CZL 20	3.59	8.0	8.8	7.2	5.2	7.1
Mickey	4.23	8.0	8.0	7.7	6.3	7.3
NK Fair	4.39	8.0	6.0	7.5	4.7	6.1
Ronaldo	3.47	6.0	7.0	7.3	4.3	6.2
Chagall	3.74	7.0	7.2	7.0	4.5	6.2
Benefit	4.69	7.0	7.0	7.5	6.0	6.8
Ladoga	4.69	7.0	8.3	7.3	5.8	7.2
Winner	3.69	6.0	7.5	6.7	4.7	6.3
C 567/08	4.79	7.0	8.7	7.0	5.0	6.9
C 542/09	5.13	8.0	8.3	7.5	7.0	7.6
C 547/09	4.75	8.0	5.3	6.0	7.3	6.2
SL 737	5.55	8.0	8.8	7.0	6.8	7.6
DH 4729/09	3.83	8.0	7.2	8.0	6.3	7.2
DH 4736/09	4.05	7.0	7.5	7.5	5.2	6.7
Dangal	3.59	7.0	6.0	7.7	4.5	6.1
Dar Laniv	3.53	6.0	5.3	7.3	5.0	5.9
Sveta	3.93	6.0	6.3	7.7	5.0	6.3
Zhongshuang DH	x	8.0	x	x	x	x
Mean	4.18					
Correlation coeficient between yield and individual disease occurence			0.403	0.037	0.7506	0.6919

1-9 scale for the percentage of necrotic spots on plants (1-highly susceptible. 9–immune)