

ESTIMATION METHODS AND RESISTANCE OF WINTER RAPE CULTIVARS
TO THE DRY ROT AND STEM CANKER /*Phoma lingam*;
Leptosphaeria maculans/ IN A GREENHOUSE TEST AND IN FIELD
TRIALS RESEMBLING NATURAL INFECTION CONDITIONS

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INTRODUCTION

These studies were conducted as a continuation of re-
search programme of fungal diseases occurring in Polish
winter rape cultivation conditions in the aspect of their
economic problem and plant resistance breeding /Frencel
1983/. The aim of the present part of the studies was to
investigate the cultivar differences in the "field" resis-
tance to *Phoma lingam*/*Leptosphaeria maculans*, as well as
to work out a greenhouse test suitable for early selection
of plant breeding materials. It was also intended to veri-
fy and correlate the two different resistance estimation
methods, as we stress that the reliability of the experi-
mental infection under artificial inoculation at the seed-
ling and/or the young plant stage used in routine resis-
tance breeding tests should be well documented.

MATERIALS AND METHODS

I. Field trials.

P l a n t s . The studies were carried out on 16 winter
oilseed rape cultivars: Beryl, Brink, Doral, Emil,
Górczański, Herkules, Janpol, Jet Neuf, Jupiter, Librador,
Ligora, Marinus, Primor, Quinta, Skrzyszowicki, Start.

In the experiments the method of random blocks was used with $2m^2$ plots, each in four replications. The sowing date as a rule was the end of the second decade of August /1982, 1983, 1984/ and the sowing rate was 6 kg/ha.

The field trials were carried out in the north-western Poland, one of the intensive winter rape cultivation regions, with a high potential of Phoma - disease incidence under natural condition. Moreover, in autumn, at the leaf-rosette stage of plants, a preliminary infection was provoked by dispersing post-harvest rape straw from the infected plantation, approximately at about 1 fragment/ $15-20cm^2$ of the experimental field.

Estimation of cultivar susceptibility and resistance /infection degree/. Each time throughout the vegetation period three to four general observations and one main - immediately prior to harvesting - were made. Disease lesions on the stems were classified according to a grade scale 0 - 6 /healthy plant - the highest infection/.

II. Greenhouse experiments.

Plants. The following 8 winter rape cultivars were used in greenhouse investigations: Doral, Jet Neuf, Jupiter, Górczański, Primor, Skrzyszowski, Start, Quinta.

Inoculum. The inoculum consisted of three week fungus cultures, maintained on the solid sandy-oat medium /52g sand + 45g gravel + 37,5g rough-grinded oat meal + 37,5ml water/. Three isolates /Ph₀, Ph₁, Ph₂/ of *Phoma lingam* /Tode ex Fr./ Desm., stad. gener. *Leptosphaeria maculans* /Desm./ Ces. et de Not., differing in pathogenicity were used as pathogens. Single-spore pathogen cultures were originated from *Leptosphaeria* /Ph₀ and Ph₂/ or from *Phoma* /Ph₁/. Immediately before using, the outgrown mycellium - culture medium was disintegrated.

Inoculation method. The inoculum was introduced into the soil in pots /50cm³ per pot/, after which rape seeds were sown into the infected soil.

Three different concentrations of the inoculum were

compared: 1/ the standard culture = nondiluted, 2/ sandy-diluted 1 : 1, 3/ sandy-diluted 1 : 2.

15 seeds per pot were inoculated. Each experiment was performed in three parallel replications and in three individual series during the spring time /March - April/ in a greenhouse, where the temperature ranged from about 22°C /day/ to 16°C /night/, under the satisfied humidity.

Three weeks after seed emergence and plant growth they were estimated for their response to experimental infection. Plants were taken out of the soil, washed and the infection degree was estimated on the 0 - 3 grade scale /healthy plant to the highest infection/. The plants were weighed and their dry mass was also taken as a response parameter against the control /healthy noninoculated plants/.

RESULTS AND DISCUSSION

I. Field trials.

During the same vegetative season particular rape cultivars differed in the Phoma infection degree. Simultaneously, the analysis of variance documented the existence of statistically significant intercultural differences in the vegetation season of 1982/83 and 1983/84. In 1984/85 the statistical significance for intervarietal differences was not proved, nevertheless the same hierarchy of the infection degree between the cultivars was maintained /tab. 1/. Highly significant correlation coefficients of the cultivar infection were found in different years of the trials /tab. 2/.

II. Greenhouse experiments.

Because of a short form of this report, a detailed documentation of the results will be published elsewhere. In general, on the basis of the statistical analyses it may be inferred that dry mass of inoculated plants / in % of the control/ better differentiated individual cultivars than the mean infection degree as response parameter, according to the grade scale of disease symptoms. The ana-

lysis of variance also showed a significant influence of different isolates of *Phoma lingam* interacting with different cultivars. Also, the severity of disease symptoms on the investigated cultivars appeared to be highly correlated with the inoculum concentration, as indicated by highly significant correlation coefficients for the dry mass as a response parameter.

On the basis of the correlation coefficients between the infestation degree of cultivars under "natural" infection /in field trials/ and under the experimental infection /artificial inoculation in greenhouse test/ it may be suggested, that the both estimation methods of disease response are principally comparable /table 2/.

CONCLUSIONS

The results of differences of cultivar responses to *Phoma lingam* under the field "natural" high potential infection conditions were found to be statistically significant. In general, the Polish conditions of rape cultivation appeared to be comparable to those of West European countries regarding susceptibility and resistance response of rape cultivars. Like in other countries, Jet Neuf and Doral, for instance, are the most resistant, whereas Primor, Quinta, Marinus, Start are the most susceptible /Krüger 1983/. The most resistant and the most susceptible cultivars were more stable in their response to infection during each year of experiment. Cultivars of "medium" response deviated more or less in their susceptibility/resistance responses.

In the years of the performed experiments no visible symptoms of early infection /autumn/ and disease phase of leaf spot were found. Infection on plants became manifest usually from spring onward throughout the vegetative season. In observations during early spring, immediately after overwintering and onset of vegetation, only sporadic local infection patches with a large intensity of disease symptoms, suggesting the effects of autumn infection of plants, were detected.

There were some statistically significant coefficients between the results of glasshouse experiments and field trials for the infection degree as the reaction parameter. It suggests, that the resistance tests, at least at the young plant level, if they are not at the seedling stage, are reliable and may be used in plant breeding selection, instead of the resistance tests conducted on grown plants. Further studies intending to standardization of resistance breeding tests are under way.

REFERENCES

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2. Krüger W., 1983. Bekämpfung von Rapskrankheiten. I. Verringerung des Befalls mit *Phoma lingam* bei Raps und Methoden zur Bestimmung der Anfälligkeit von Sorten. Phytopathologische Zeitschrift, 108, 106-113.

Table 1: Infection degree /in %^x/ of winter rape cultivars under natural high potential infection of *Phoma lingam*/*Leptosphaeria maculans* in field trials. Results of the experiments in 1982/83, 1983/84 and 1984/85

Cultivar	vegetative season		
	1982/83	1983/84	1984/85
Doral	6,67	10,50	9,83
Jet Neuf	7,50	7,17	12,67
Beryl	7,50	9,83	14,50
Górczański	14,17	14,83	13,30
Primor	29,17	31,33	17,33
Brink	15,00	17,17	-
Quinta	21,67	-	17,67
Janpol	22,50	-	-
Start	44,17	-	-
Jupiter	-	12,83	10,00
Skrzeszowicki	-	15,50	15,33
Herkules	-	13,17	-
Marinus	-	30,50	-
Librador	-	16,67	-
Ligora	-	17,50	-
Emil	-	-	16,67

x/

$$\text{Infection degree in \%} = \frac{\sum /n \cdot v/ \cdot 100}{V \cdot N}$$

where:

- n = number of plants in the particular infection degree /0-6/
 N = the whole number of plants studied
 v = the particular infection degree
 V = the highest infection degree

Table 2: Correlation coefficients between the infection degree /*Phoma lingam*; *Leptosphaeria maculans*/ of winter rape cultivars. Comparisons of results in "natural" field infection and artificial inoculation in glasshouse experiments

Parameter	Field trials			Glasshouse tests - pathogen isolates		
	82/83	83/84	84/85	Ph ₁	Ph ₀	Ph ₂
82/83	-	0,988***	0,867	0,819*	0,722	0,650
83/84	-	-	0,761*	0,863**	0,509	0,691
84/85	-	-	-	0,894**	0,887**	0,861**
Ph ₁	-	-	-	-	0,659	0,847**
Ph ₀	-	-	-	-	-	0,778*

*** P = 0,1 %

** P = 1 %

* P = 5 %