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FOLIAR DISEASES OF *PISUM SATIVUM* L. IN POLAND

ABSTRACT

Influence of weather conditions on downy mildew and Ascochyta blight development on 12 pea genotypes, cultivated in Central Poland was examined in 1990–2000. Plants were somewhat more infected by *Peronospora viciae* f.sp. *pisi* than by *Ascochyta* complex fungi. Standard cultivars were less infected than breeding lines. Two periods of higher (1990, 1991 and 1995–1997) and two of lower (1992–1994 and 1998–2000) disease intensity were noted during 11 years of testing.

Key words: Ascochyta blight, disease intensity, downy mildew, peas

INTRODUCTION

Field observations carried out since 1985 on *Pisum sativum* L. plots and plantations at several localities of different regions (Marcinkowska 1996a, 1996b) and observations of pea pathogens (Filipowicz 1993) have shown that *Ascochyta* complex fungi (the causes of Ascochyta blight) are commonly occurring pathogens on leaves, pods and stems of peas in Poland concomitantly with *Peronospora viciae* (Berk.) Casp. f. sp. *pisi* Syd. (responsible for downy mildew) (Marcinkowska 1996c, 1997b). *Uromyces pisi* (DC) Otth and *Erysiphe pisi* Syd., the other specific fungal pathogens of this plant, occurred rather sporadically. While *Botrytis cinerea* Pers. causing gray mold on many plant species appeared more often. The appearance of this fungus was especially frequent during wet seasons and on pea genotypes susceptible to *P*.viciae f.sp. *pisi*, as a second invador on the tissue infected by the last fungus. No bacterial disease has been found at any fields and viral diseases have usually been visible occasionally but symptoms of Pea Enation Mosaic Virus dominated (Marcinkowska 1996a, 1996b, 1996c, 1997a, 1997b). Since development of any disease depends on environment conditions (Hagedorn 1974, Marcinkowska

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1996b, 1997b) affecting a host–plant – pathogen interaction, the ob–jective of this presenation was to recapilutate changes in intensity of Ascochyta complex disease and downy mildew, the main foliar diseases of peas, during 11 years in Central Poland.

MATERIAL AND METHODS

Evaluation of infection by *Ascochyta* complex fungi (*Ascochyta pisi* (Lib.), *Mycosphaerella pinodes* (Berk. and Blox.) Vester. anamorph *Ascochyta pinodes* L.K.Jones and *Phoma pinodella* (L.K.Jones) Mor–gan–Jones et Burch) and *Peronospora viciae* (Berk.) Casp. f. sp. *pisi* under natural field conditions was performed on pea plots of Plant Breeding and Acclimatization Institute (Radzików) and/or its Experi–mental Station (Łaźniew), both located co Warsaw. Observations were done from 1990 to 2000, each year at the most intensive disease devel–opment, usually in the last decade of June and the first decade of July. Notes were taken on 4 plots of each genotype. Intensity of both diseases was assessed on leaves, stems and pods of 12 genotypes grown for dry seeds. Each tested group consisted of 9 standard cultivars and 3 new breeding lines but their set differed in the consecutive years of obser–vation (Table 1). The severity of both diseases was evaluated using 6–grade score (from 0–5) (Marcinkowska *et al.* 1982) and additionally for downy mildew according to Ryan (1971). Statistical calculations were performed using the Statgraphics Plus programme. Data of in–fection degree (id.) were subjected to the analysis of variance and the Tukey muliple range test.

RESULTS

Development of downy mildew and Ascochyta blight on peas varied depending on year and the genotype (Tables 1, 3). Two periods of more intensive and two of lower diseases intensity were evident (Fig. 1): in–tensity of both diseases was higher in 1990, 1991, 1995, 1996, 1997 than in the remaining 6 years of testing. Generally, intensity of downy mildew was a little higher (during 9out of 11 tested years) than that of Ascochyta blight (Figure 1). When evaluated as means over years and genotypes, line R–125 was the most infected by *P.viciae* f.sp. pisi and intensity of downy mildew was the highest in 1990 (Table 1). The tested lines represented also the most infected genotype group, from 1.31 infection degree (id.) for R–50 to 1.35 for R–125 and they also showed the highest infection degree in 1995 (Table 1). The least in–fected by this pathogen, evaluated over years, was cv. Ramir (Table 2), and to the same group belonged cvs: Kwestor (id. 0.81), Tambo, Diament, Agra, Ergo and Elektron (id. 0.93). The lowest intensity of both diseases, estimated over genotypes, was observed in 2000 (Tables 2, 4).

Table 1.

Intensity of downy mildew on 12 pea genotypes during 1990 – 2000 (averages from 4 plots using a 0–5 scale)

Rok	Genotypy											
	Elektron	Ergo	Diament	Ramir	Kwestor	Agra	R–48	R–50	Rubin	R–125	Tambo	Piast
1990	3.5	3	3	3.3								
1991	3	2.5		3								
1992	1.5	1.5	1	0.8	1							
1993			1.3	0.8	1.3							
1994			1		1	1	1.5	1.5				
1995					1.3	1.3	4	3.9	2.3	4		
1996					2.4	2.3			3.1	3.8		
1997					1.8	1.8			3	3.5	1.5	
1998					1.3	1			1.3			1
1999					0.8	1					1.3	2
2000					0	0.5					0.3	0.5

Table 2.

Analysis of variance and multiple range tests of infection degree caused by *Peronospora viciae* f.sp. *pisi* on 12 pea genotypes in 1990 – 2000

Source of variance	D.f.	Mean square	No of grs1	Range of mean values
genotype2	11	0.428	5	0.75 for Ramir – 1.35 for R–125
year3	10	1.440	5	0.33 for 2000 – 1.55 for 1990

D. f. – Degrees of freedom
[1] Number of groups of the same susceptibility in theTukey multiple range test; [2] mean infection over years; [3] mean infection over genotypes

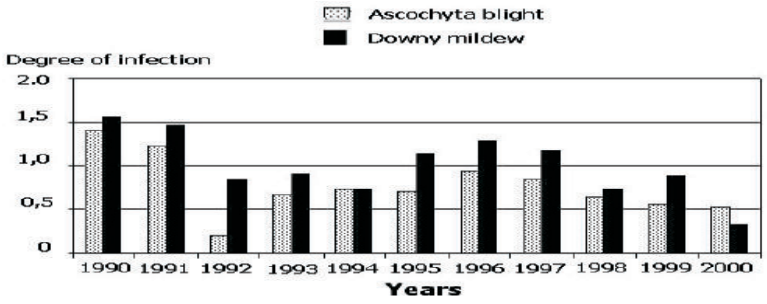

Fig. 1 Intensity of *Ascochyta* blight and downy mildew

Intensity of *Ascochyta* blight occurrence was the highest for cvs Elektron and Ergo in 1990 and 1991 (Table 3), but when evaluated over years and genotypes, cv. Rubin proved to be the most infected (Table 4). The least infected was cv. Diament (Table 4) and cvs: Agra (id. 0.65),

Ramir, and Kwestor (id. 0.69) were the members of the same susceptibility group. The differences in genotypes susceptibility to *Ascochyta* complex fungi were very small (Table 3) since the least infected cultivar showed 0.63 i.d. and the most infected 0.85 (Table 4). The response to *P. viciae* f.sp. *pisi* was more pronounced (Table 1), as the infection degree varied from 0.75 to 1.35. During growing seasons of 1995–1997, favourable for diseases development, infection of: Agra, Kwestor, and also Rubin cvs was lower to infection shown by the three tested lines, especially by *P.viciae* f.sp. *pisi* (Tables 1, 3).

Table 3

Intensity of Ascochyta blight on 12 pea genotypes during 1990–2000 (averages from 4 plots useing a 0–5 scale)

Year	Genotypes											
	Elektron	Ergo	Diament	Ramir	Kwestor	Agra	R–48	R–50	Rubin	R–125	Tambo	Piast
1990	3.5	3.3	1.3	2.8								
1991	3	2.5		2								
1992	0.3	0.3	0.3	0.3	0.3							
1993			0.8	1	1							
1994			1		1	1	1.3	1				
1995					1	1	1	1	1.3	1		
1996					1.5	1.6			1.6	1.8		
1997					1.8	1			2	1.5	1	
1998					1	0.8			1.3			1.3
1999					0.5	0.8					1	1
2000					0	0					0	0.3

Table 4

Analysis of variance and multiple range tests of infection degree caused by *Ascochyta* complex fungi on 12 pea genotypes in 1990 – 2000

Source of variance	D.f.	Mean square	No of grs[1]	Range of mean values
genotype[2]	11	0.072	3	0.63 for Diament – 0.85 for Rubin
year[3]	10	2.038	5	0.03 for 2000 – 1.40 for 1990

D. f. – Degrees of freedom
[1] Number of groups of the same susceptibility in theTukey multiple range test; [2] mean infection over years; [3] mean infection over genotypes

DISCUSSION

Importance of weather conditions on development of diseases on above ground plant part, was univocally pointed out by the presented results. Intensity of pea downy mildew and Ascochyta blight was higher in growing periods with high precipitations, eg. 1997,1996, when total rainfalls in May and June were nearly three times higher in July 1997 than the mean for the whole 1990–2000 period (Table 5). Rainy weather

Table 5

Meteorological data for seasonal months and years

Year	Daily average air temperature [°C]				Monthly total rainfall [mm]			
	April	May	June	July	April	May	June	July
Mean[1]	9.5	14.9	18.3	19.8	33.1	44.8	60.8	82.0
1990	8.9	14.0	17.5	17.2	47.2	35.8	42.0	49.1
1991	8.3	10.8	15.8	19.3	14.9	68.3	66.0	94.0
1992	7.4	14.2	18.3	20.2	23.8	17.6	47.3	55.8
1996	9.4	16.4	18.2	17.5	0	69.4	66.8	132.6
1997	6.1	12.9	18.1	19.1	19.4	56.0	84.3	227.7
2000	14.9	17.0	20.0	18.1	0.5	33.2	14.4	77.0

[1]Mean values for 11 years (1990–2000)

is often combined with lower air temperatures, as in 1997 and 1991. Also not very wet but cooler season in 1990 resulted in high development of the diseases as well. Thus two periods favourable for the development of the diseases occurred. Very dry seasons, especially in spring, in 1992 and extreme hot in 2000, inhibited plant infection. Although development of both diseases was influenced by weather conditions, and especially rainfalls, downy mildew was more sensitive to humidity due to specific biology of *P. viciae* f. sp. *pisi*. In consequence the progress of downy mildew was extremally fast during very wet periods, which took place in Poland in early summer of 1996 and 1997 (Marcinkowska 1997b), and caused an epiphytotic outbreak of the disease which was earlier observed in different regions of temperate zone, e.g. in the USA (Snyder 1934, Hagedorn 1974) and Europe (Olofsson 1966, Hubbeling 1975, Stegmark 1988). The presented results support also earlier investigations (Ryan 1971, Hubbeling 1975, Stegmark 1988, Filipowicz 1993, Marcinkowska 1996a, 1996b, 1997b) on the relationship between disease intensity and the genotype response to pathogens. The data showed lower susceptibility of recently established standard cultivars as compared to other cultivars and the lines included in the experiment. However, the results would be more complete if all 12 genotypes were tested during the whole experimental period and not only 4–6 of them during 3 years favouring development of the diseases. Since the observations were done on breeders plots changing of the set of genotypes was not possible, and in consequence, intensity of the diseases had to be presented over genotypes and years.

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