Response of *Pisum sativum* Germplasm Resistant to *Erysiphe pisi* to Inoculation with *Erysiphe baeumleri*, a New Pathogen of Pea

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Abstract

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Cultivars, homozygous sources and lines of pea (*Pisum sativum* L.) resistant to *Erysiphe pisi* had recently been attacked by another powdery mildew species, *Erysiphe baeumleri,* in the field and in glasshouse conditions. Inoculation with *E. baeumleri* was carried out in the glasshouse to evaluate the level of resistance of 16 pea genotypes. Susceptible pea lines produced abundant conidia and cleistocarps on petioles and leaves. Only the genotype Tudor (Cebeco 4119) was found to be completely resistant to *E. baeumleri*. Nineteen pea genotypes (with gene *er-1*) were tested to natural infection by *E. baeumleri* in field screening trials. Only few of them demonstrated a high level of resistance (Fallon, AC Melfort and Joel). Consort R, SGL 2024, SGL 1977 and Franklin were very susceptible to *E. baeumleri*. Cleistocarps with 1–4× dichotomously branching apices of appendages were formed only on susceptible and very susceptible plants of genotypes SGL 444/2185, Consort R, SGL 2024, SGL 1977, LU 390-R2, Lifter, Highlight, Cebeco 1171 and Carneval R in the field and glasshouse. Susceptible control genotypes without gene *er-1* (Komet, Adept and Gotik) were attacked in the trials by *E. pisi* only.

Keywords: pea; pea germplasm; powdery mildew of pea; natural infection; resistance; field and glasshouse screening; Czech Republic

Until a few years ago only one powdery mildew species, *Erysiphe pisi* DC., had been known to attack pea, *Pisum sativum* L. (Braun 1985, 1987; Tiwari *et al*. 1997b; Fallon *et al*. 2001). Great attention has been paid to breed peas resistance to powdery mildew (*E. pisi*) in Canada, USA, the Netherlands and the Czech Republic (Heringa *et al*. 1969; Tiwari *et al*. 1997b; Ondřej *et al*. 2003). At the beginning of the 1990ies only a limited number of sources for resistance had been available, but most came with a range of undesirable traits (low yield potential, low TSW, susceptibility to lodging – e.g. cvs/lines Highlight, Tara, AC Tamor and Lu 390-R2). A relatively better assortment of resistant peas is available today that also carry other good traits, e.g. high yield potential, high TSW, lodging resistance, root rot resistance – these include the cvs/lines Tudor, Mozart, Carneval R, SGL 1977 and SGL 2024.

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Unchecked, the disease reduces yield, size and quality of pea seeds, often very drastically (Heringa *et al*. 1969; Tiwari *et al*. 1977a, b; Singh *et al*. 1978; Kraft & Kaiser 1993; Fallon *et al*. 2001). The use of resistant cultivars of peas can be considered as the most practical and economical way of keeping powdery mildew caused by *E. pisi* under control.

However, all resistant sources to *E. pisi* were attacked by natural infection of another powdery mildew species, *Erysiphe baeumleri* (Magnus) U. Braun et S. Takam, at the locations Rapotín and Temenice in field trials during the years 2001–2003. The first record of *E. baeumleri* powdery mildew on pea in the Czech Republic was in 2001 (on cv. Highlight, at Rapotín, district Šumperk, North Moravia).

The objective of this research was to find genetic resources of pea that are resistant to *E. baeumleri* powdery mildew, which should then be used to develop new genotypes with resistance to both fungal pathogens, *E. pisi* and *E. baeumleri*.

MATERIAL AND METHODS

Plant material. Sources of resistance of pea (*P. sativum,* with gene *er-1*) to powdery mildew (*E. pisi*) were included in comparative glasshouse and

Table 1. Survey of pea genotypes used for powdery mildew resistance study

Resistance sources	Gene	Origin	EN	Growth type
Highlight	*er-1*	Sweden	L01-00953	semi-leafless
Mozart	*er-1*	Canada	L01-00954	semi-leafless
AC Melfort	*er-1*	Canada	L01-00952	semi-leafless
Fallon	*er-1*	US	–	normal leaf type
Joell	*er-1*	US	–	normal leaf type
Lifter	*er-1*	US	–	normal leaf type
Franklin	*er-1*	US	–	semi-leafless
Cebeco 1171	*er-1*	Holland	–	semi-leafless
Tudor (Cebeco 4119)	*er-1*	Holland	–	semi-leafless
Cooper (Cebeco 1081)	*er-1*	Holland	–	semi-leafless
Lu 390 – R2	*er-1*	CR	–	semi-leafless
SGL 1977	*er-1*	CR	L01-00948	semi-leafless
SGL 2024	*er-1*	CR	L01-00646	semi-leafless
SGL 444/2185	*er-1*	CR		semi-leafless
Carneval R	*er-1*	Canada		semi-leafless
Consort R	*er-1*	GB		semi-leafless
Control varieties				
Adept	without *er-1*	CR	L01-00762	normal leaf type
Komet	without *er-1*	CR	L01-00736	normal leaf type
Gotik	without *er-1*	CR	L01-00865	semi-leafless
Hybrid combinations				
(Komet × R2) × Melfort	*er*-1	CR	–	semi-leafless
(Gotik × Highlight) × Cebeco 1171	*er*-1	CR	–	semi-leafless
Komet × R2	*er*-1	CR	–	semi-leafless
(Komet × R2) × Highlight	*er*-1	CR	–	semi-leafless
Lu70 × Melton	*er*-1	CR	–	semi-leafless
Gotik × Highlight	*er*-1	CR	–	semi-leafless

field trials (Table 1). Seed of them was obtained from the AGRITEC Pea Collection, from the Plant Breeding Station, Lužany near Přeštice (SELGEN, a.s., Prague) and from abroad (Dr. F. Muehlbauer, WSU, USA). Resistant hybrid combinations were prepared at AGRITEC Šumperk: (Komet × R2) × AC Melfort, (Gotik × Highlight) × Ceb. 1171, Komet × R2, (Komet × R2) × Highlight. The susceptible varieties Komet, Adept and Gotik (without gene *er-1*) were used as control varieties. All tested pea genotypes were represented by semi-leafless or normal leaf types of field pea.

***Microscopic examination of** Erysiphe baeumleri.* Cleistocarps and conidia were removed by needle from the surface of leaves and stipules of pea plants infected with powdery mildew in the glasshouse and field conditions. Cleistocarps and conidia were transferred to a drop of water on a slide and covered with a cover glass. Taxonomic characteristics were examined under alight microscope at 450× magnification. Size of conidia, cleistocarps, appendages of asci and ascospores (mean values, extreme values) were measured with the use of a micrometer. Species determination was carried out according to Braun (1985) as cited in Table 2, and the taxonomy according to Braun and Takamatsu (2000).

Maintenance of inoculum and inoculation method. Inocula of *E. baeumleri* and *E. pisi* were maintained and multiplied under field conditions (location Vikýřovice) on gradually sown pea plots (June 2003) of resistant cvs. Highlight and SGL 1977 (with gene *er-1*) and susceptible cv. Adept (without gene *er-1*). Pea plants heavily infected with *E. baeumleri* (isolate RAP-HIG/03) or *E. pisi* (isolate EP-RAP-AD/03) were collected (September and October 2003) from the field. Plants in the glasshouse (planted in August 2003) were inoculated twice (before and at flowering) with fresh conidia of *E. baeumleri* or *E. pisi* from infected plants by dusting onto the plants. The glasshouse trials were maintained at conditions favourable for growth of both powdery mildews (18–26°C, 12 h photoperiod at 70–90% r.h.). Pea plants in field conditions (location Temenice) were grown under natural infection pressure of both *E. pisi* and *E. baeumleri*.

Glasshouse and field resistance screening. Seeds were planted into a soil bed in the glasshouse (August 2003). Seeds were treated with the fungicide MAXIM XL 035 FS (fludioxonil 25 g/l + metalaxyl M 10), and 15 seeds sown in a row 1 m long.

In field conditions (location Temenice), 60 treated seeds (Maxim XL 035 FS) were sown (April 2003) in trial plots 1.5 m long and 1 m wide in four replications. The experiment was arranged as a randomised complete block design with four replications. A field test was carried out to evaluate the yield potential, dry seed yield (g/plant), TSW (in g), stem length and occurrence of *E. baeumleri* and *E. pisi* on the 13 resistant sources, 6 hybrid combinations and 3 susceptible varieties (without gene *er-1*).

Evaluation of disease intensity. The degree of infection in the glasshouse was scored at maturity of the plants (December 2003) and on a 1–5 scale:

Table 2. Comparison of dimensions of morphological structures of *Erysiphe trifolii, E. astragali* and *E. baeumleri* with those of *E. pisi* (according to Braun 1985)

Diagnostic trait	*Erysiphe*			
	trifolii	*astragali*	*baeumleri*	*pisi*
Conidia (µm)	15–45 × 6–9	30–50 × 8–10	30–38 × 13–19	15–70 × 6–10
Cleistocarps (µm)	80–180	80–155	70–130	80–150
Cleistocarps cells (µm)	8–30	6–20	6–20	8–25
Length of appendages (µm) (multiple of cleistocarps mean)	2–12×	2–12×	3–10×	0.5–4×
Number of appendages septa	1–(6)	1–(3)	2–(3)	0–1
Dichotomous branching	1–2 (3)×	1–3×	1–3 (5)×	–
Asci (µm)	45–80 × 25–50	50–80 × 25–50	40–70 × 25–45	40–75 × 25–55
Spores (µm)	18–30 × 10–16	15–24 × 10–5	15–25 × 9–15	15–28 × 10–16

1 = no visible symptoms or infection degree of 1–5% on the plant surface, necrosis or yellowing on the petioles and leaves, no or very low conidia production;
2 = infection degree 6–20%, conidia production only on some petioles and leaves;
3 = infection degree 21–30%, abundant conidia production on petioles and leaves, production of cleistocarps low and very rare;
4 = infection degree 31–75%, very abundant conidia and cleistocarp production on petioles and leaves;
5 = infection degree 76–100%, very abundant conidia and cleistocarp production on petioles, leaves, stems and pods; plants die prematurely.

Disease index (DI) was also calculated as the weighted average of the disease by the equation:

$$DI = (1a + 2b + 3c + 4d + 5e)/n$$

where: a, b, c, d, e – number of plants in the diseased class (1–5)
n – total number of plants assessed

The degree of infection in the field trials was evaluated close to maturity (July 2003) from the occurrence of *E. baeumleri* and *E. pisi* on the plots (disease incidence, mean value – %). Which of the two species had caused the infection was determined microscopically (Table 2) according to Braun (1985). Glasshouse and field trials were evaluated by modified LSD interval method, with 95% and 98% significance level.

RESULTS

Determination and description of *E. baeumleri*

The occurrence of powdery mildew (disease intensity 1 to 2 of a 5-point scale) on pea genotypes (Lu 390-R2 and Highlight) resistant to powdery mildew (*E. pisi*) was observed for the first time in the Czech Republic in l998 and 1999 at the Plant Breeding Station Lužany near Přeštice (Kreuzman – person. comm.). At AGRITEC Šumperk, a severe occurrence of powdery mildew (disease intensity 3 to 4) was repeatedly recorded on the stipules of resistant cv. Consort R in 2000 to 2002 in glasshouse resistance screening tests. Under field conditions, the first light occurrence of powdery mildew (disease intensity 1) on genotypes resistant to *E. pisi* and new breeding lines was found in 2000 (locations Rapotín, Vikýřovice and Temenice). In 2001, all resistant pea genotypes (including resistant lines B99/98-118 provided by Prof. N. Weeden) were heavily infected (disease intensity 2 to 3, sporadically also 4) in both field and glasshouse conditions. In 2004, the occurrence of powdery mildew on the resistant pea genotypes was very rare (disease intensity 1 on sporadic plants). Due to the fact that infection of particular plants was not homogenous and varied in disease intensity rate from 1 to 3, we originally suspected that the observed occurrences had been the result of non-rigorous selection of resistant plants under conditions of low infection pressure, or that the selection had been carried out with *E. pisi* isolates

Table 3. Recorded diagnostic traits of two collected samples of *Erysiphe baeumleri* (location Rapotín and Temenice) and one sample of *E. pisi* (location Smržice)

Diagnostic trait	*Erysiphe baeumleri*		*Erysiphe pisi* location Smržice (see Fig.1)
	location Rapotín (see Fig. 2)	location Temenice	
Conidia (µm)	18–33 × 9–20	20–30 × 10–18	20–60 × 8–20
Cleistocarps (µm)	60–110	50–120	60–185
Cleistocarp cells (µm)	6–18	6–20	8–26
Length of appendages (µm)	40–520	50–320	10–120
(multiple of cleistocarps mean)	(ø 197.5)	(ø 160.0)	(ø 66.2)
Number of appendages septa	0–2 (3)	0–2(3)	0–1
Dichotomous branching	1–4×	1–3×	–
Asci (µm)	40–60 × 20–32	30–50 × 18–35	40–65 × 22–62
Spores (µm)	10–28 × 8–15	16–24 × 8–13	16–30 × 9–15

with lower virulence. Another possible explanation would be the appearance of a new race of powdery mildew (*E. pisi)* with virulence to gene *er-1*, or the occurrence of another powdery mildew species which is able to colonise peas after transfer from other, but wild-growing members of the family *Fabaceae*. The fruiting stage (cleistocarps) of the pathogen was abundantly formed on the infected (and supposedly resistant) pea genotypes both in glasshouse and field conditions. Microscopic determination of morphological traits (length and branching of cleistocarp appendages) and metric evaluation (size of cleistocarps, appendages, asci and ascospores) (Table 3) made clear that the pathogen was indeed another powdery mildew from the genus *Erysiphe*. Comparisons of recorded microscopic data on samples of this other *Erysiphe* species (collected at Rapotín and Temenice) with data on *E. pisi* samples (collected at Smržice) and with published descriptions (Braun 1985), showed correspondence only with *E. baeumleri*, a parasite of the genus *Vicia* (Tables 2 and 3, Figures 1 and 2).

Resistance screening in glasshouse

To evaluate their reactions, 16 pea genotypes (with resistance gene *er-1*) and one susceptible control genotype were artificially inoculated with *E. baeumleri* powdery mildew (inoculum: conidia from Highlight + SGL1977, location Vikýřovice) and *E. pisi* (inoculum: conidia from Adept, location Vikýřovice) under glasshouse conditions (Table 4). None of the genotypes resistant to *E. pisi (*with *er-1)* was infected by *E. pisi* powdery mildew. On the genotypes most susceptible to *E. baeumleri,* visible symptoms developed within 15–20 d after inoculation (SGL 444/2185, SGL 2024 and Consort R; all with *er-1*). We observed delayed infection symptoms (25–30 d after inoculation) by *E. baeumleri* in genotypes apparently moderately resistant (Highlight, Lifter, Cebeco 1171 and Carneval R) to this pathogen. The susceptible control genotype Adept (without gene *er-1*) showed visible symptoms of *E. pisi* 8–10 d after inoculation, but was not attacked by *E. baeumleri.* Thus, early and quick colonisation of all plant parts by *E. pisi* powdery mildew antagonistically prevented the infection and development of *E. baeumleri* powdery mildew.

Plants (with *er-1*) susceptible to *E. baeumleri* exhibited a progressive yellowing of petioles or leaves from the base upwards with abundant production of both conidia and cleistocarps. Disease symptoms in moderately resistant pea genotypes (with *er-1*) were expressed on petioles or leaves only, rarely on stems and pods. Only one pea cultivar, Tudor (Cebeco 4119), was completely resistant to *E. baeumleri*.

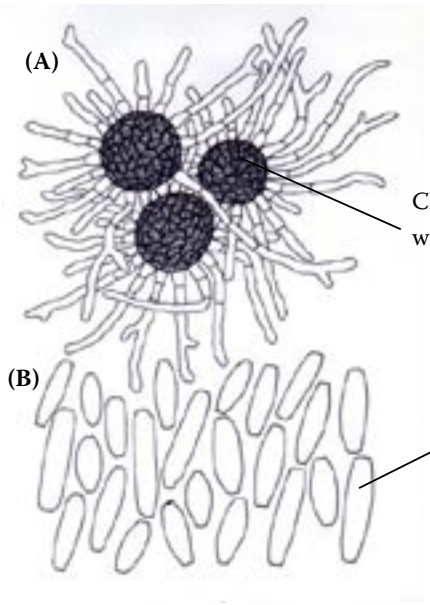

Figure 1. *Erysiphe pisi*

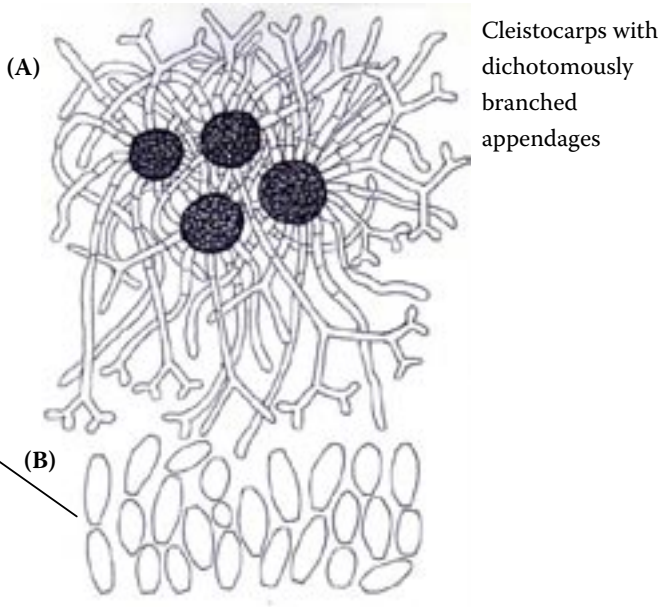

Figure 2. *Erysiphe baeumleri*

(A) bar represents 100 μm; (B) bar represents 30 μm (Ondřej *et al.* 2004)

Table 4. Evaluation of incidence of *Erysiphe baeumleri* on sources resistant to *E. pisi* (with gene *er-1*) under glasshouse conditions (artificial inoculations)

Genotype	Disease index (mean value)	99%	95%	Occurrence of cleistocarps on petioles or leaves
With gene *er-1*				
Tudor (Cebeco 4119)	1.097	A	A	–
Cooper (Cebeco 1081)	1.632	A	B	–
Melfort	2.712	B	C	–
Fallon	2.815	B	CD	–
Joel	2.862	BC	CD	–
Cebeco 1171	3.230	BC	DE	+
Carneval R	3.235	BC	DE	+
Mozart	3.397	C	E	+
SGL 1977	3.947	D	F	++
Lifter	3.965	D	F	++
Highlight	3.995	D	F	++
Lu 390-R2	4.177	DE	F	++
SGL 444/2185	4.290	DE	FG	++
SGL 2024	4.330	DE	FG	++
Franklin	4.380	DE	FG	++
Consort R	4.577	E	G	+++
Control – without gene *er-1*				
Adept	4.865*			

Statistic evaluation of DI (disease index) by modified LSD interval method with 95% and 98% significance level; Cleistocarps occurrence: – = no occurrence; + = low; ++ = abundant; +++ = very abundant; A, B, C, D, F, G = homogenous subsets; *only *E. pisi*

Resistance screening on the field

The reactions of 19 pea genotypes (with gene *er-1*) to natural infection by *E. baeumleri* powdery mildew were investigated in field screening trials at Temenice in 2003 (Table 5). Few of them were highly resistant (Fallon, AC Melfort and Joel). The most susceptible genotypes were Lifter, Franklin, SGL 2024, SGL 1977 and Consort R (disease infestation 30–35%). The standard susceptible varieties Komet, Adept and Gotik (without gene *er-1*) were attacked by *E. pisi* only.

None of the resistant genotypes (with gene *er-1*) was attacked by *E. pisi* under field conditions. On these genotypes *E. baeumleri* progressed relatively slowly, and was expressed only on petioles and leaves, but rarely on stems and pods. The results from field trials confirmed the low yield potential of the genotypes Highlight, AC Melfort, Consort R, Lu 390-R2 and Lu70 × Melton. Genotypes (with *er-1*) Fallon, Carneval R, Mozart, SGL 2024 and SGL 1977 reached the same dry seed yield as the standard commercial cultivar Gotik or even surpassed it. The powdery mildew species (*E. pisi, E. baeumleri*) on infected pea plants were distinguished from each other microscopically, based on the dimensions of conidia and cleistocarps (Tables 2 and 3).

DISCUSSION

Genotypes of pea resistant (with gene *er-1*) to *E. pisi* powdery mildew were naturally infected by another species of powdery mildew (*E. baeumleri*) at the locations Rapotín, Temenice and Vikýřovice in the field trials of 2000–2003. Symptoms of infec-

Table 5. Evaluation of incidence of *Erysiphe baeumleri* on genotypes resistant to *E. pisi* (with gene *er-1*) under field conditions (natural infection, Temenice 2003)

Genotype	Disease incidence (%)	99% S.L.	95% S.L.	Dry seed yield per plant (g)	TSW (g)	Stem length (cm)
With gene *er-1*						
Fallon	6.25	A	A	5.4	210	50.8
Melfort	8.25	A	AB	4.2	190	45.2
Joel	8.50	A	AB	5.0	190	89.8
Carneval R	11.25	AB	ABC	5.7	192	67.3
Mozart	13.50	ABC	ABCD	5.9	196	53.4
(Komet × R2) × Melfort	14.75	ABCD	ABCDE	5.5	180	70.6
Cebeco 1171	17.50	ABCDE	BCDEF	5.2	196	47.2
(Gotik × Highlight) × Ceb. 1171	20.25	BCDE	CDEFG	5.6	185	57.7
Komet × R2	21.00	BCDEF	CDEFG	4.5	150	63.2
(Komet × R2) × Highlight	21.75	BCDEFG	DEFGH	5.0	170	67.6
R2-Lu 390	23.00	CDEFGH	DEFGH	3.7	130	47.0
Lu70 × Melton	24.25	CDEFGH	DEFGHI	3.3	150	71.6
Gotik × Highlight	26.25	DEFGH	EFGHI	4.5	165	60.0
Highlight	27.25	EFGH	EFGHI	3.8	148	54.8
Lifter	29.50	FGH	FGHI	4.5	180	69.9
Franklin	31.75	FGH	GHI	4.5	170	48.6
SGL 2024	33.00	GH	HI	5.5	235	65.2
SGL 1977	33.50	H	I	6.0	240	68.7
Consort R	34.25	H	I	4.1	235	53.2
Control – without gene *er-1*						
Komet	52.00*			5.8	205	70.0
Adept	84.25*			5.4	210	73.4
Gotik	64.00*				200	69.2

Statistic evaluation of disease occurrence – % by modified LSD interval method with 95% and 98% significance level (S.L.); A, B, C, D, F, G, H, I – homogeneous subsets; *only *E. pisi*

tion started with a yellow speckling of the lower leaves and petioles, and spread gradually upwards to the upper leaves or petioles. Brown lesions at harvest time are dotted with small brown-black fruiting bodies, the cleistocarps. Affected plants are yellow and die prematurely.

Microscopic observations determined the basic characters of the pathogen: conidia are singly formed, ellipsoid 18–30 (33) × 9–20 µm, cleistocarps have 1–3 (4) dichotomously branched apices of appendages, branching is often deeply cleft (Figure 2). There are 20–30 appendages with 0–3 septa, 40–520 × 3–8 µm. Cleistocarps are 60–100 (120) µm in diameter, have 4–6 asci of 30–60 × 18–35 µm, each with 2–6 ascospores 10–28 × 8–15 µm. These data correspond to the described species *Erysiphe baeumleri* Magn. (Ber. Deutsch. Bot. Ges. 17: 148, 1899 on *Vicia* spp., Europe and Asia common, in North America rare, Braun 1985, 1987) except for the size of conidia. The species is very well characterised though difficult to separate from other species of *Erysiphe* (sect. *Microsphaera*) on *Fabaceae*.

Powdery mildew is a very complicated taxa on the family *Fabaceae*, including the often confusing complex of *Erysiphe* (sect. *Erysiphe* and sect. *Mi-*

crosphaera). *Erysiphe pisi* is the central species of the *Erysiphe* complex in the *Fabaceae*, it is widely cosmopolitan, colonising numerous genera of the *Fabaceae* (*Pisum, Astragalus, Lathyrus, Lens, Lotus, Lupinus, Medicago, Melilotus, Phaseolus, Trifolium* and *Vicia*). The appendages of the cleistocarps are mostly simple or, infrequently, irregularly branched. The *Erysiphe* sect. *Microsphaera* on the *Fabaceae* (*E. trifolii, E. baeumleri*, and *E. astragali*) is a complex of closely allied species. The appendages in mature samples are relatively frequently (1–5×) dichotomously branched in *E. baeumleri*. Apical dichotomous branching (1–3×) of the appendages in *E. trifolii* and *E. astragali* develop rather late and are rare. *Erysiphe trifolii* with horizontally spread and coloured appendages is easily distinguished from *E. baeumleri.* In contrast, *E. astragali* is hard to separate from *E. baeumleri*, it is well characterised by strongly fasciculated appendages (Braun 1985, 1987).

The new *E. baeumleri* powdery mildew of peas so far caused relatively slow powdery mildewing in field conditions only on pea genotypes resistant to *E. pisi* (with gene *er-1*), but has not been found on susceptible genotypes (without gene *er-1*).

The new process of specialisation of *E. baeumleri* powdery mildew on peas is likely to begin with gradually increasing aggressiveness. In glasshouse and field conditions, cleistocarps were formed only on susceptible and very susceptible plants of genotypes Consort R, SGL 444/2185, SGL 2024, SGL 1977 etc.). The genotype Tudor (Cebeco 4119) was determined in glasshouse inoculation test as a source of complete resistance to *E. baeumleri*. It was recommended to combine resistance to both *E. baeumleri* and *E. pisi* in future genotypes produced in breeding programs. By necessity, the work is being conducted in the glasshouse where disease pressure is severe and thus convenient for finding sources of resistance to *E. baeumleri* powdery mildew and for eliminating susceptible lines. Under field conditions, however, yield is considered to be the main selection criterion. More work needs to be done on determining the genes responsible for resistance to *E. baeumleri* powdery mildew in pea.

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Souhrn

Ondřej M., Dostálová R., Odstrčilová L. (2005): **Reakce genových zdrojů hrachu** (*Pisum sativum*) **s rezistencí vůči druhu** *Erysiphe pisi* **na inokulaci druhem** *Erysiphe baeumleri*, novým patogenem hrachu. Plant Protect. Sci., **41**: 95–103.

V polních a skleníkových podmínkách byly homozygotně rezistentní zdroje a linie hrachu (*Pisum sativum* L.) proti druhu *Erysiphe pisi* DC. napadeny druhem *Erysiphe baeumleri*. Ve skleníkových podmínkách inokulace bylo hodnoceno 16 genotypů hrachu s genem *er-1* (*E. pisi* DC.) na náchylnost k druhu *E. baeumleri*. Na řapících a listech citlivých genotypů se hojně tvořily konidie a kleistocarpy. Jako zcela rezistentní zdroj proti *E. baeumleri* byl ve skleníku zjištěn pouze genotyp Tudor (Cebeco 4119). V polních pokusech bylo zařazeno 19 genotypů hrachu s genem *er-1* (*E. pisi* DC.). Z nich měly vyšší stupeň odolnosti proti přirozené infekci *E. baeumleri* (Fallon, AC Melfort, Joel) pouze některé. K nejnáchylnějším genotypům v polních podmínkách patřily: Consort R, SGL 2024, SGL 1977 a Franklin. Kleistocarpy s 1–4× dichotomicky rozvětvenými vrcholky přívěsků se tvořily ve skleníkových a polních pokusech pouze u náchylných a velmi náchylných genotypů (SGL 444/2185, Consort R, SGL 2024, SGL 1977, LU 390-R2, Lifter, Highlight, Cebeco 1171 a Carneval R). Kontrolní genotypy bez genu *er-1* (Komet, Adept a Gotik) byly v pokusech napadeny pouze druhem *E. pisi*.

Klíčová slova: hrách; genetické zdroje hrachu; padlí hrachu; přirozená infekce; rezistence; polní a skleníkový screening; Česká republika

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