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Resistance Evaluation of Monosomic Lines of "Poros-monos" x "M30" against *Erysiphe graminis DC. f sp. tritici* Marchal

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Abstract: In this experiment the screening material has been divided into three categories: I) Nine monosomic lines (1A, 1D, 2A, 2D, 3B, 4A, 4B, 5B, 7D) have shown resistance against powdery mildew, but still some plants were attacked by this disease. ii) Five monosomic lines (2B, 3D, 4D, 5D, 6A) have indicated susceptibility against this disease, but still some resistant plants were there. iii) The third group has included the monosomic line 7B, where all the plants were attacked by disease. The line 7B and the variety "poros" exhibited a 100 % susceptibility against powdery mildew, where all the plants (7B-119 and poros-200) tested were attacked by this disease. "M30" has shown a 100 % resistance against this disease, where all the plants (200) responded positively to this disease.

Key words: Monosomic lines, poros. M30, powdery mildew (*Erysiphe graminis tritici Marchal*)

Introduction

Powdery mildew, is divided into seven groups: four on cereals, *hordei, tritici, avenae* and *secalis*, and three on grasses, *agropyri, bromi*, and *poae* (Hiura, 1978). During the growing seasons the powdery mildew population is exposed to selection pressures from resistance genes in the host populations that favor the corresponding virulence genes, and from fungicides that favor fungicide-resistant powdery mildew genotypes. Studies in Europe (Limpert and Schwarzbach, 1981; Jorgensen, 1983; Wolfe, 1983) show a close association between the extent to which resistant genes and fungicides are used in cereal growing, and the frequency of corresponding virulence genes and fungicide-resistant genotypes in the powdery mildew population. Very little is known about the genetics. One of the reasons for lack of knowledge is inexpensive methods for monitoring genes for virulence and fungicide resistance are relatively new and that methods for monitoring fitness factors are yet to be developed. Moreover, the complexity of the 'open' natural populations make it difficult to correctly interpret results. The number of chromosomes in the haploid Genome of *Erysiphe graminis* is unknown; it has been reported to be two and at least six. The chromosomes are very small, < 0.5 (m and therefore, difficult to detect by conventional cytological techniques (Jorgensen, 1988). Innes (1992) screened about 50 million live conidia of barley powdery mildew, but analysis of virulent mutants failed to confirm their mutational origin. In wheat powdery mildew Simmonds (1991b) reported four mutants for virulence; corresponding to three resistance genes simultaneously. Adult plant resistance of c.v. "Moldwyn" has been investigated very intensively. At the seedling stage the oat plants show moderately susceptibility towards powdery mildew (Jones and Hayes, 1971). In general resistance of the variety "Diplomat" is brought about by genes located on 14 chromosomes (Chae and Fischbech, 1979). Ellingboe (1981) reported that mildew resistance of "Genesee" could be traced back to one dominant gene. Sperling (1985) analyzed the resistance of "M30" x "Strubes Dickkopf" at seedling stage inside the green house. She concluded that the resistance of plants is controlled by two independent dominant genes (15:1). Zedler (1990) reported a horizontal resistance in "M30" x "Carston v". Horizontal resistance in "M30" and susceptibility of "poros" against powdery mildew is also reported by Khan and Bluethner (1994). The main objective of this project was to screen the wheat genotypes against powdery mildew at seedling stage.

Materials and Methods

Project was conducted at the Cytogenetics Laboratory, Plant Protection Department, Martin-Luther-University, during a 3-months visit program to, Federal Republic of Germany. A wide range of techniques have been devised for studies on cereal powdery mildew, although primarily

Table 1: Infection grade assessment scale for powdery mildew (Nover, 1941)

Type-0	A high percentage of resistance, no symptoms visible
Type-1	Resistant, presence of necrotic or chlorotic symptoms
Type-2	Medium resistance, very little pustules present on leaves
Type-3	Partially susceptible, presence of pustules in large numbers
Type-4	Susceptible, spores building

Table 2: Screening of wheat seedlings against powdery mildew inside the green-house

Genotypes	Number of Plants	Scale 0	1	2	3	4	Resistant (0-2)	Susceptible (3-4)	Ratio	X^2 (for 3:1)
1A	117	8	22	26	27	34	56	61	0.92:1	45.95
1B	not-Investigated	--------	--------	---------	--------	--------	--------	--------	---------	---------
1D	118	18	40	16	14	30	74	44	1.68:1	9.50
2A	114	1	19	18	30	46	38	76	0.50:1	105.55
2B	114	21	46	18	18	11	85	29	2.93:1	0.01
2D	117	10	37	13	27	30	60	57	1.50:1	35.10
3A	116	25	33	16	31	11	74	42	1.76:1	7.77
3B	120	8	39	18	20	35	65	55	1.18:1	27.78
3D	120	26	43	19	10	22	88	32	2.75:1	0.18
4A	117	27	26	19	18	27	72	45	1.60:1	11.31
4B	120	10	31	16	27	36	57	63	0.90:1	48.40
4D	113	32	48	5	12	16	85	28	3.40:1	0.03
5A	120	18	47	15	17	23	81	39	2.02:1	4.19
5B	110	13	28	12	29	28	53	57	0.93:1	42.19
5D	119	25	45	18	10	21	88	31	2.84:1	0.07
6A	117	41	32	13	16	15	86	31	2.77:1	0.14
6B	Not-investigated	---------	---------	---------	---------	--------	---------	---------	---------	---------
6D	Not-investigated	---------	---------	---------	---------	--------	---------	---------	---------	---------
7A	96	7	44	12	22	11	63	33	1.91:1	4.50
7B	119	0	00	00	00	119	00	119	---	---------
7D	120	19	28	22	24	27	71	49	1.39:1	18.37
Total	2087	309	608	276	352	542	1196	891	1.34:1	---------
Poros	140	000	000	000	000	140	0000	140	--------	---------
M30	200	000	200	000	000	000	0200	000	--------	---------

$\propto$= 5% X^2-3.84 *Schmalz, 1989

for elucidating host resistance of the gene-for-gene type. In this project 120 F2 seeds/line were sown in plastic trays inside the green house. Twelve days older seedlings were inoculated by shaking heavily the diseased plants of variety "Strubes Dickkopf" over the seedlings (Hiura, 1978). For artificial infection the Race 2000 (Pm 2- Frauenstein *et al*., 1983) was used and screening of plants against the disease was done by using the assessment scale 0-4 (Table 1).

Results and Discussion

As a result of artificial infection and spores inoculation the genotypes under observation have responded in three different ways: The first group being separated as a result of artificial inoculation include all those monosomic lines which carry resistant genes against powdery mildew and those lines are 1A, 1D, 2A, 2D, 3B, 4A, 4B, 5B, and 7D. The second group of plants is actually the combination of susceptible genotypes, and they are, 2B, 3D, 4D, 5D, and 6A. The third group includes only monosomic line 7B. In case of 7B 119 plants were tested against powdery mildew, which indicated 100% susceptibility to this disease. This line has got 100% similarity with variety "poros", because "poros" is also susceptible to powdery mildew. Table 2 indicates that 140 "poros" plants were tested against this disease and all the plants were attacked by this disease. "M30" has shown complete resistance against this disease. Similar type of results were reported by Sperling (1985). She crossed "M30" with "Strubus Dickkopf" and concluded that two independent dominant genes (Pm 2 and Pm 6) are responsible for the resistance inheritance. These findings are in close agreement to those reported by Khan (1991), who identified chromosomes 2B, 4D, 5A, and 6A as a resistant and 1A, 2A, 3A, 4B, and 7D as susceptible to this disease. JHA (1969a) and (1969b) examined the variety "Lerma Rajo" and concluded that resistant genes are located on chromosome 6B in seedling and 2B, 3A, 3B, 4B and 5A in adult stage.

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