EVALUATION OF ALTERNATIVE ASSESSMENT OF RESISTANCE IN TESTS OF PEAS WITH FUSARIUM OXYSPORUM f. sp. PISI

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For resistance tests of peas with Fusarium oxysporum f. sp. pisi (Lindf.) Snyder & Hansen race 1 and 2 normally the degree of wilting is recorded. The wilt index proposed by Ebbels (2) is widely used. Trying to establish this test we had considerable difficulty in distinguishing between resistant and susceptible reactions. Physiological wilting occurred due to the high temperature necessary for infection, and sometimes the susceptible cultivars did not develop typical symptoms like greyish green foliage and downward curling of leaves. Furthermore, the resistant cultivars also had significantly higher wilt indices than the non-infected controls. Therefore we evaluated additional or alternative characteristics to determine resistance or susceptibility.

Five resistant and five susceptible lines were used: the six host differentials New Season, New Era, Dark Skin Perfection, WSU 28, WSU 23 and Little Marvel, and the cultivars Rondo, Zem, Birte and Dik Trom.

Isolates were maintained in the refrigerator in dry soil. In order to prevent changes of the fungus in culture a pea extract (150 g peas/l) with a low sugar content (5 g glucose/l) was used as solid and liquid medium to prepare inoculum. The liquid culture was filtered after five days of shaking at 100-120 rpm and adjusted to an inoculum concentration of 10^6 propagules/ml, mainly microconidia. Peas were grown in vermiculite for 10 days at a room temperature of 22°-24°C and a substrate temperature of 24°-26°C and 16 h light. 10-15 ml of inoculum were added to each plant after the roots had been stabbed by inserting a scalpel into the substrate around each plant (1).

Symptom development was assessed 18 days after inoculation. Per experiment 24 plants in two replicates were scored. Visible wilt symptoms were recorded on the key proposed by Ebbels (2) and an average wilt index was calculated. The vascular discoloration was observed. Stems of 8 plants were surface sterilized and cuttings of nodes 1, 4, 5 and 6 (including scale nodes) were incubated on agar plates for three days at 25°C and the number of colonies formed was determined. Plant length and number of nodes of all plants were measured and the mean values calculated.

The results of these tests are presented in Tables 1 and 2. Although the correlation coefficient was very high for the wilt indices determined in the two replicates ($r = 0.94$), some lines showed different reactions. The relatively high amount of wilting after infection in the resistant lines cannot be explained. Vascular discoloration was less influenced by environmental conditions and it was only observed in the susceptible cultivars. Growth of colonies in stem sections of the upper nodes (4-6) incubated on agar plates was only observed in the susceptible lines, whereas in cuttings of node 1 colonies were also formed in the resistant lines to a certain extent. Stunting of the infected plants lead to the formation of at least two nodes less and a reduction of about 20% in plant length. The number of nodes showed less variation within and between the replicates.

Of the characters tested the absence or presence of Fusarium oxysporum

in the upper stem regions seems to give the most clear-cut decision on resistance/susceptibility.

Isolate 20379 of race 1 was kindly provided by Dr. M. Gerlagh, IPO, Wageningen, and the tester set by Dr. P. Matthews, JII, Norwich.

1. Dixon, G.R. and J.K. Doodson. 1970. J. Nat. Inst. Agric. Bot. 12: 130-135.
2. Ebbels, D.L. 1967. Ann. Appl. Biol. 60:391-398.

Table 1. Comparison of wilt indices and additional observations after infection of 10 pea lines with Fusarium oxysporum race 1.

Cultivar		Wilt index			Vascular discoloration	Colonies at nodes 4-6
		R1	R2	Control		
New Season	R	41.7	31.7	10.0	—	
New Era	R	50.0	47.3	16.7	-	-
DSP	R	53.3	36.7	15.0	-	-
WSU 28	R	53.3	13.3	15.0	-	-
WSU 23	R	58.3	38.3	8.3	-	-
Little Marvel	S	99.3	100.0	16.4	+	+
Rondo	S	100.0	100.0	20.3	+	+
Zem	S	100.0	90.0	15.0	+/-	+
Birte	S	98.3	99.2	31.7	+	+
Dik Trom	S	100.0	96.4	0	+	+

Table 2. Number of nodes and plant length of 10 pea lines after infection with Fusarium oxysporum race 1.

Cultivar		Number of nodes			Plant length		
		R1	R2	Control	R1	R2	Control
New Season	R	12.7	11.7	12.1	18.5	14.6	13.6
New Era	R	11.8	11.1	11.7	17.9	13.9	16.2
DSP	R	11.5	10.5	10.8	15.1	11.8	12.7
WSU 28	R	12.2	11.1	9.9	18.9	17.3	14.7
WSU 23	R	11.4	10.8	10.8	16.8	14.2	13.9
Little Marvel	S	8.7	8.0	10.7	5.8	4.4	6.7
Rondo	S	8.8	8.4	11.7	7.5	5.4	10.3
Zem	S	7.3	7.1	9.9	7.7	6.2	13.8
Birte	S	9.8	9.5	12.6	10.5	9.7	13.4
Dik Trom	S	7.8	7.0	10.0	6.6	3.4	7.3

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