REACTION OF PEA INTRODUCTIONS TO ASCOCHYTA FOOT ROT AND POWDERY MILDEW[1]

S.T. Ali-Khan, R.C. Zimmer, and E.O. Kenaschuk

Abstract

Twelve hundred introductions of peas from a world collection were evaluated for their reaction to foot rot caused by *Ascochyta pinodes* and powdery mildew caused by *Erysiphe polygoni*. None of the introductions showed a high level of resistance to *A. pinodes*; 18 lines showed a light or moderate reaction to powdery mildew in field tests. Only a moderate degree of resistance to powdery mildew was noted.

Introduction

Field peas (*Pisum sativum* L. var. *arvense* Poir.) is an important non-cereal crop in Manitoba. Annually, this crop is grown on approximately 50,000 acres, constituting about 75% of the total Canadian acreage. Symptoms of blight and foot rot incited by *Ascochyta pinodes* L. K. Jones (perfect state, *Mycosphaerella pinodes* (Berk. & Blox.) Vestgrn.) occur each year in field peas (1). Elsewhere *A. pinodes* has been shown to cause yield losses as high as 45% (2). Powdery mildew caused by *E si he polygoni* DC. ex Merat is another ———— occurring commonly on peas in Manitoba.

This report presents the results of a seedling test of 1200 pea introductions for resistance to *A. pinodes* and a field evaluation for resistance to powdery mildew.

Materials and methods

In 1964, seed of 1200 introductions (PI) from 14 countries, was obtained from the Regional Plant Introduction Stations at Ames, Iowa, and Geneva, New York. In 1965, these introductions were grown at the Research Station, Morden, Manitoba, for seed increase and observation. Seed from these plots was used to assess disease reaction to *A. pinodes* and *E. polygoni*.

Ascochyta pinodes

To test for resistance to *Ascochyta pinodes*, plants were grown in perlite at 16-20°C with diurnal illumination of 18 h at 1200 f-c. Ten plants from each of 20 introductions were inoculated in each test. Twelve to 14 days after seeding, a 5 ml aliquot of a distilled water spore suspension containing 2.0×10^5 conidia per ml was placed beside each stem at the surface of the perlite. The suspension contained a mixture of conidia from four cultures of *A. pinodes* isolated originally from peas grown in different areas in Canada. Single-spore isolates were maintained on an oatmeal agar medium. This medium was used also for inoculum production.

Disease ratings were made 14 days after inoculation and were based on the size of lesions on the region of the epicotyl below the surface of the perlite, as follows:

1 - Lesions 3 mm or less in length.

2 - Lesions 4-9 mm in length.

3 - Lesions 10-15 mm in length.

4 - Lesions 16-20 mm in length.

5 - Lesions larger than 20 mm.

After an initial screening (Test 1), 20 plants from several promising introductions were retested (Test 2). Some tolerant and susceptible plants from these introductions were selected and their progenies evaluated (Test 3) for disease reaction. In Test 3, 12 to 30 plants were used for most introductions; four introductions had less than 10 plants, and for one promising introduction, PI 272157, 104 plants were tested.

Powdery mildew

A visual estimation of severity of powdery mildew was based on natural infection in the field in 1965 and 1966. Severity of infection was rated as:

Light - up to 10% of leaf area infected.

Moderate - 10 to 50% of leaf area infected.

Severe - 50 to 100% of leaf area infected, 50 to 100% of the pods infected.

[1] Contribution No. 118, Research Station, Agriculture Canada, Morden, Manitoba.

Results and discussion

Ascochyta pinodes - Of the 1200 introductions examined for reaction to foot rot, 29 gave a mean disease rating (MDR) of 1.0-1.9, 541 of 2.0-2.9, 554 of 3.0-3.9, and 76 of 4.0-4.9. One hundred and twelve introductions with an MDR in the range 1.0-2.9 were retested; of these, 85 had an MDR of less than 2.5.

The results presented in Table 1 show the MDR's of 25 introductions selected for subsequent testing on the basis of their performance in the initial test. Upon retesting (Test 2), the MDR value of most introductions was appreciably higher except in those that initially had an MDR of over 3.0. The MDR's of Test 3 agreed closely with those of Test 2 (Table 1).

Table 1. Disease reaction of selected pea introductions to epicotyl inoculation with *Ascochyta pinodes*

Disease category	PI No.	Mean disease rating* Test 1	Test 2	Test 3	Mean
Moderately susceptible	272157	1.9	2.6	2.8	2.4
	272216	1.5	2.9	3.0	2.5
	180867	2.0	2.9	2.8	2.6
	164523	1.7	3.0	3.0	2.6
	244127	1.8	3.1	3.0	2.6
	272156	1.9	2.9	3.1	2.6
	219706	2.1	2.8	2.8	2.6
	171814	2.3	2.8	3.1	2.7
	174923	2.1	2.9	3.0	2.7
	194340	2.1	2.7	3.2	2.7
	272215	2.0	2.8	3.3	2.7
	269773	1.6	3.1	3.4	2.7
	164285	2.2	2.9	3.3	2.8
	166188	2.2	3.1	3.0	2.8
	180868	2.1	3.1	3.5	2.8
	244125	2.1	3.1	3.1	2.8
	193840	2.1	3.4	3.1	2.9
	Mean	1.9	2.9	3.0	2.6
Susceptible	210565	3.1	3.2	3.1	3.1
	216045	2.7	3.3	3.3	3.1
	263010	2.3	3.6	3.8	3.2
	269805	3.3	3.1	3.6	3.3
	272163	2.9	3.5	3.5	3.3
	272211	2.6	3.4	3.9	3.3
	164838	2.7	3.6	3.8	3.4
	272187	3.2	3.5	3.5	3.4
	Mean	2.8	3.4	3.5	3.2

* Based on a scale of 1-5, with 1 = very light infection and 5 = severe infection.

In most instances introductions in the "moderately susceptible" category (overall MDR <3.0) showed low to moderate ratings throughout the three tests. Similarly, lines in the "susceptible" disease category (MDR >3.0) showed high ratings throughout the three tests. correlation coefficients between the MDR's of Tests 1 and 2 and between those of Tests 2 and 3 were 0.51 and 0.61, respectively; which were significant at the 5% level of probability. The Mann-Whitney U-Test showed that the differences between the MDR's of the two disease categories were significant in the three tests.

These results indicate that the differences in disease reaction can be distinguished and that they are also transmitted to the progeny. Therefore it should be possible to select PI's and individual plants within them to use in breeding for resistance to *A. pinodes*.

Some difficulty in reproducing a disease reaction upon retesting was experienced. Factors which may have contributed to this difficulty are genetic heterogeneity within introductions and environmental variations between tests.

Powdery mildew - Due to poor stands in 1965, only 1054 introductions could be rated for mildew resistance. Infection was severe on 865, moderate on 165, and light on 24 lines. In 1966, 183 introductions selected for desirable agronomic characters were retested, with severe mildew infection occurring on 150, moderate infection on 30, and light infection on 3.

PI 201497 gave a light reaction in 1965 and 1966, while PI's 109865, 119795, and 122175 gave a light reaction in 1965 and a moderate reaction in 1966. PI 201391 gave a moderate reaction in 1965 and light reaction in 1966. Moderate reactions in both years occurred in PI's 124480, 162567, 164690, 167205, 171813, 173057, 179451, 183140, 183334, 184130, 195404, 244112, and 244258.

The results indicate that the germ plasm in the world collection shows diversity of disease reaction which appears to be inherited. This offers an opportunity for selection in breeding for increased resistance to ascochyta foot rot and powdery mildew.

Acknowledgments

The plant introductions were kindly supplied by U.S.D.A. Plant Introduction Stations at Geneva, New York, and Ames, Iowa.

Literature cited

1. Ali-Khan, S. T., and R. C. Zimmer. 1972. Growing field peas. Canada Dep. Agr. Publ. 1493.

2. Wallen, V. R. 1965. Field evaluation and the importance of Ascochyta complex on peas. Can. J. Plant Sci. 45:27-33.