BREEDING PROGRAMS FOR DISEASE RESISTANCE UNDERWAY AT THE FOUNDATION FOR AGRICULTURAL PLANT BREEDING (SVP), WAGENINGEN, THE NETHERLANDS

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Research programs aimed at breeding for disease resistance to three fungal pathogens and the northern root knot nematode were initiated at the SVP in 1986. The first step is to identify resistance sources in the pea collection available in The Netherlands and in material obtained from gene banks. These sources will subsequently be exploited in crosses with desirable cultivars.

Fusarium and Phoma resistance

A hydroponic culture setup proved to be a satisfactory screening method. It allows visual inspection of root systems and developing symptoms of pathogen attack at any moment without damaging the roots. Hydroponic culture also allows a controlled and reproducible root nutrition. Besides, chemical, physical, and microbial parameters can easily be manipulated.

A comparison of different methods of inoculation demonstrated the possibility to shorten the duration of resistance tests. In the past a dip inoculation of roots of two-week-old plants into a spore suspension of known concentration was applied. However, seed inoculation yielded satisfactory differentiation of resistance levels and shortened resistance tests by two weeks. Both Fusarium solani and Phoma medicaginis can be inoculated successfully in this way (2).

Variation in virulence between pathogen isolates was investigated in more detail. Fusarium isolates clearly differed in pathogenity. Pea genotypes differed in resistance in accordance with literature data. No interactions between pea genotypes and pathogen isolates were found. Maintenance of Fusarium solani isolates as chlamydospores in silversand and subsequent propagation on either Czapek Dox- or PDA-agar resulted in loss of virulence. Fusarium solani isolates were obtained from diseased roots of Pisum sativum, Phaseolus vulgaris, and Vicia faba plants grown in soils that had been continuously cropped with these respective leguminous species. By cross inoculation experiments a forma specialis pisi of Fusarium solani could be identified. With Phoma medicaginis only minor differences in virulence were noted between 12 isolates. Virulence remained stable using the maintenance and propagation procedures described.

Screening of the pea collection of the Centre for Genetic Resources of The Netherlands under greenhouse conditions was started. This screening is carried out separately for both pathogens. Thirty pea accessions were also screened in a field nursery. In both greenhhouse and field screenings significant differences in resistance were established. The most resistant accessions, however, still showed a degree of susceptibility that prevents them from being utilized as resistance sources.

Continuation of screenings to identify resistance sources have priority. These putative sources will subsequently be used in breeding programs. Special attention will be paid to the recombination of forms of resistance that may be based on different mechanisms to be able to increase the resistance level.

Downy mildew resistance

In three experiments a glasshouse screening method was developed using young pea plants in growth stage 104 (1). Using the method, 28 pea varieties were tested with fysio 7 for differences in partial resistance. Significant differences were found for the characters percentage of sporulating leaves and the average percentage of sporulating leaf area.

In a field experiment 52 pea varieties were screened with fysio 5. Significant differences between varieties were found for the characters percentage of plants affected, time of the beginning of sporulation, size of the lesions, and intensity of sporulation.

Crosses have been made and are being made between interesting sources of resistance.

Research has been started on the induction of oospores. When inoculated plants, grown at 15C, are transferred from 15C to 22C at the end of the latent period and kept dry, oospores are induced. By this method inoculum can be produced for screening for resistance to primary systemic infection.

Meloidogyne hapla resistance

In an experiment on J-2 larvae production, Calendula officinalis L. gave the highest multiplication rate of ML hapla, followed by tomato and lettuce. When the roots with egg masses were gathered 7 weeks after inoculation significantly fewer hatched larvae were found compared with gathering after 8 or 9 weeks. Larvae were hatched out of an egg suspension on a 25 mkm sieve in water at 25C. Fourteen days after the beginning 40-95% of the larvae were hatched.

The screening method was developed further. Seeds are sown in pvc tubes filled with silversand. Prehatched larvae are used for inoculation 14 days after sowing. The best growth of the plants and an optimal level ol infection were found using 96 ml tubes and 300 larvae per plant. Seedcoating with benomyl or thiram and inoculation with Phoma medicaginis did not affect the number of knots per plant. Forty varieties were screened for resistance for M. hapla. No high level of resistance was found. Only small differences occurred which were difficult to reproduce. A rapid screening of the CGN and SVP pea collections has been started.

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