THE INCORPORATION OF RESISTANCE TO GLOBODERA PALLIDA INTO SOLANUM TUBEROSUM GERMPLASM ADAPTED TO NORTH AMERICA

B. B. Brodie, R. L. Plaisted, and M. M. de Scurrah

Abstract

Potato seeds of 24 families consisting primarily of *Solanum tuberosum* ssp. *andigena* with some *S. vernei* germplasm that were segregating for resistance to potato cyst nematodes (*Globodera pallida* races P4A and P5A and *G. rostochiensis* race R1A) were obtained from the International Potato Center. These seeds produced 468 clones with sufficient tubers for evaluation for resistance to *G. pallida* races P4A and P5A in pot tests at the International Potato Center. Twenty-six of these clones, selected for a high degree of resistance to *G. pallida* races P4A and P5A, were crossed with neotuberosum × *Solanum tuberosum* hybrids that had been selected for resistance to *G. rostochiensis* race R1A (golden nematode) and the viruses PVX and PVY. The resultant progenies possessed a high degree of resistance to all three races of the potato cyst nematode. From these progenies, 23 clones were selected for resistance to the three races (*G. pallida* P4A and P5A, *G. rostochiensis* R1A) of potato cyst nematodes. The better adapted clones with resistance to the 3 races of potato cyst nematodes will be used in the next cycle of backcrossing.

Compendio

Se obtuvo del Centro Internacional de la Papa semillas de papa de 24 familias consistentes principalmente de *Solanum tuberosum* ssp. *andigena* con algún germoplasma de *S. vernei* que segregaban para resistencia al nematodo del quiste de la papa (*Globodera pallida*, razas P4A y P5A y *G. rostochiensis*, raza R1A). Estas semillas produjeron 468 clones con suficientes tubérculos para la evaluación de resistencia a *G. pallida*, razas P4A y P5A en pruebas en macetas en el Centro Internacional de la Papa. Veintiséis de estos clones, seleccionados por un alto grado de resistencia a *G. pallida*, razas P4A y P5A en pruebas en macetas en el Centro Internacional de la Papa. Veintiséis de estos clones, seleccionados por un alto grado de resistencia a *G. pallida*, razas P4A y P5A fueron cruzados con neotuberosum × híbridos *Solanum tuberosum* que habían sido seleccionados para resistencia a *G. rostochiensis*, raza R1A (nematodo...
dorado) y a los virus PVX y PVY. Las progenies resultantes tuvieron un alto grado de resistencia a las tres razas del nematodo del quiste de la papa. De estas progenies, veintitrés clones fueron seleccionados para resistencia a las tres razas (G. pallida P₄A y P₅A, G. rostochiensis R₁A) del nematodo del quiste de la papa. Los clones mejor adaptados, con resistencia a las tres razas de nematodos del quiste de la papa, serán utilizados en el próximo ciclo de retrocruzamiento.

Introduction

The potato cyst nematodes (PCN) Globodera rostochiensis (Woll.) Behrens and G. pallida (Stone) Behrens originated in the South American Andes and have spread to several major potato growing countries of the world (1, 8, 9). Both species occur in North America but only G. rostochiensis has been found in the United States (2, 8). In North America, G. rostochiensis exists only in a limited area of New York State in the USA and on Vancouver Island and in Newfoundland in Canada (1, 2). Only G. rostochiensis race R₁A (= Rol) has been found in New York and Vancouver whereas Newfoundland has infestations of both G. rostochiensis and G. pallida (16). In the USA, G. rostochiensis is successfully controlled by resistant potato cultivars containing the major gene H₁ bred from Solanum tuberosum ssp. andigena (2, 7).

In countries where G. pallida occurs, potato breeding programs have predominately used diploid species of Solanum to breed for resistance to this species of PCN (4, 6). The most commonly used species has been S. vernei (3, 4, 6, 10). However, the tetraploid S. tuberosum ssp. andigena is currently being utilized in some breeding programs as a source of resistance to G. pallida (12). Although no single major gene has been identified that confers resistance to specific races of G. pallida, some success has been realized in breeding for resistance to this nematode (5, 10). Perhaps the most notable success is the recent release in Peru of the cultivar Maria Huanca that is highly resistant to two widespread races of G. pallida, P₄A and P₅A (11). The G. pallida race P₄A, which is similar but not identical to European pathotype Pa3, is predominant throughout the Andean region of South America. The race P₅A (=Pa3) is prevalent in South America and is also the predominant race of G. pallida in Europe (9).

Although G. pallida has not been found in the USA, there is a constant threat that it could be accidentally introduced through world commerce. If there is a new introduction of PCN other than G. rostochiensis R₁A into the USA it most likely will be either race P₄A or P₅A of G. pallida. Due to the complex nature of resistance to G. pallida (3, 6), it is realistic to expect that 20 years of breeding would be required to produce a resistant cultivar of commercial value. In the meantime, the primary control of G. pallida would be either long-term crop rotation which is expensive or the use of pesticides which is expensive and also hazardous to the environment.