Registration of Three Sunflower Germplasms with Quantitative Resistance to Race F of Broomrape

Three sunflower (Helianthus annuus L.) germplasms with quantitative resistance to race F of broomrape (caused by Orobanche cumana Wallr.) were jointly developed and released by the Institute for Sustainable Agriculture (CSIC) and the Center of Agricultural Research and Development (CIFA-IFAPA, Junta Andalucía) at Córdoba, Spain, in 2004. The resistance genes of AM-1 (Reg. no. GP-302, PI 641057), AM-2 (Reg. no. GP-303, PI 641058), and AM-3 (Reg. no. GP-304, PI 641059) were derived from cultivated sunflower accessions. These germplasms will provide sunflower breeders quantitative genetic resistance to race F of broomrape.

Broomrape is a parasitic angiosperm that infects sunflower roots, causing severe crop losses in many areas, particularly in southern Europe and the Black Sea region (Melero-Vara, 1999). Until recently, commercial hybrids cultivated in Spain were resistant to races A through E of broomrape. Resistance to races A through E has been reported to be monogenic and dominant (Vranceanu et al., 1980). A new race F was first reported in 1995 in Spain and it is now present in vast areas of southern and central regions of the country (Alonso et al., 1996). Several sources of resistance to race F of broomrape have been identified in wild and cultivated sunflower and released (Jan et al., 2002; Fernández-Martínez et al., 2004). Resistance to race F has been found to be controlled by a gene (Pérez-Vich et al., 2002) or two major genes (Rodríguez-Ojeda et al., 2001; Akhtouch et al., 2002). Breeding programs conducted in Spain in recent years have devoted many resources to incorporating genetic resistance to race F into elite inbred lines. Despite such efforts, new broomrape populations have been found to overcome the recently developed resistance to race F (Molinero-Ruiz and Melero-Vara, 2005). Sunflower breeding for resistance to broomrape has been nearly exclusively based on the utilization of major genes conferring quantitative or vertical resistance, which is rapidly overcome by the parasite. The combination of vertical and horizontal resistance has been proposed for a more efficient disease control and development of durable resistance in sunflower (Yar, 2005).

AM-1 through AM-3 were selected from cultivated sunflower germplasm that initially exhibited segregation for resistance to race F of broomrape. AM-1 was selected from the USDA-ARS accession PI 307941, which corresponds to the Russian cultivar VNIIMK 6540. AM-2 was developed from the USDA-ARS accession PI 431521, which corresponds to the Russian cultivar Romsun V-1352. AM-3 was derived from the USDA-ARS accession AMES 3429, which corresponds to the Russian cultivar VIR 101.

Plants of the accessions PI 307941 and AMES 3429 were evaluated for broomrape race F reaction in greenhouse pots in 1997 and 1998 (Fernández-Martínez et al., 2000). Plants of the accession PI 431521 were evaluated under similar conditions in 1998 and 1999. Since the three accessions showed both symptomless and infected plants, the latter having emerged or resprouted after first being infected, the differentials were classified according to the number of infected plants. After five cycles of selection, indicating the presence of quantitative resistance mechanisms rather than qualitative ones. After five cycles of selection, AM-1 through AM-3 were formed in 2004 by bulking seeds from AM-1 through AM-3.

The three germplasms were evaluated in the original populations for reaction to race F of broomrape in a replicated field trial conducted in 2005 using susceptible inbred line P1380 (Fernández-Martínez et al., 2001) and C.C. Jan as check, showing an incidence of 11.7 broomrape stalks per plant.

These germplasms will be useful as genetic sources of quantitative genetic resistance to race F of broomrape. Limited quantities of seed are available on request to the corresponding author for the first 5 yr. Inquiries for quantities of seed may be obtained from the National Plant Germplasm System (NPGS). Recipients of such inquiries will make appropriate recognition of the source if the germplasm if it is used in the development of a new cultivar or as a parent stock. U.S. Plant Variety Protection will not be requested for these germplasms.


References


