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Registration of Seven Orobanche Resistant Sunflower Germplasms

Seven sunflower (*Helianthus annuus* L.) germplasm lines were released by the USDA-ARS, Fargo, ND, the Dirección General de Investigación y Formación Agroalimentaria, Consejería de Agricultura y Pesca, Junta de Andalucía, Sevilla, Spain, and the North Dakota Agricultural Experiment Station, Fargo, ND. R-185 (Reg. no. GP-230, PI 607920), R-188 (Reg. no. GP-231, PI 607921), R-190 (Reg. no. GP-232, PI 607922), R-201 (Reg. no. GP-233, PI 607923), R-202 (Reg. no. GP-234, PI 607924), R-206 (Reg. no. GP-235, PI 607925), and R-207 (Reg. no. GP-236, PI 607926) were released in 1997 and provide improved resistance to Orobanche (caused by *Orobanche cernua* Loefl. syn: *Orobanche cumana* Wallr.). Orobanche, commonly known as broomrape, is a parasitic angiosperm infecting the roots of sunflower causing severe crop losses in Spain and other countries of southern Europe, as well as in many of the countries of the former USSR, the Middle East, and China. These lines exhibited excellent seed and oil potential in the United States and Spain as well as resistance to Orobanche. Orobanche testing was conducted in greenhouse and field trials by the Agricultural Research Centre, C.I.F.A., Córdoba, Spain. The germplasm lines are available for use by sunflower industry and public researchers to create sunflower hybrids with improved Orobanche resistance and increased genetic diversity.

R-185 and R-188 are F_6-derived F_7 germplasm lines selected from the cross RHA 801/Odessa Hybrid Bulk. RHA 801 is an oilseed restorer line released by the USDA and the North Dakota Agricultural Experiment Station in 1980 (1). The Odessa Hybrid Bulk was a bulk of pollen collected from the hybrids Odessa 105, Odessa 106, Odessa 122, Odessa 123, and Odessa 128. The Odessa hybrids were developed by Dr. V.V. Burlov, All-Union Institute of Breeding and Genetics, Odessa, Ukraine.

R-190 is an F_6-derived F_7 germplasm selected from the cross RHA 274/Turbo. RHA 274 is an oilseed restorer line released by the USDA and the Texas and North Dakota Agricultural Experiment Stations in 1973 (2). Turbo is a hybrid from the 1988 Food and Agricultural Organization (FAO) Sunflower Subnetwork Hybrid Trial that was obtained through an Office for International Cooperation and Development (OICD) germplasm exchange program with the Research Institute for Cereals and Industrial Crops, Fundulea, Romania.

R-201, R-202, R-206, and R-207 are F_6-derived F_7 germplasms selected from the cross RHA 274/Edirne 87. RHA 274 is an oilseed restorer line released by the USDA and the Texas and North Dakota Agricultural Experiment Stations in 1973 (2). Edirne 87 is a hybrid from the 1988 Food and Agricultural Organization (FAO) Sunflower Subnetwork Hybrid Trial that was developed by the Agricultural Research Institute, Edirne, Turkey.

R-185, R-188, R-190, R-201, R-202, R-206, and R-207 appear to be homozygous for resistance to race E of Orobanche in Spain. The germplasms are homozygous for resistance to race 2 downy mildew [caused by Plasmopara halstedii (Farl.) Berl. & De Toni in Sacc.]. The seven germplasms have upper stem branching conditioned by a recessive gene. R-185, R-188, R-206, and R-207 are homozygous for fertility restoration of the PET1 cytoplasmic male sterility. R-190, R-201, and R-202 are heterozygous for fertility restoration of the PET1 cytoplasmic male sterility.

Hybrids were produced by crossing the seven restorer lines with three cytoplasmic male sterile (CMS) lines, cmsHA 89, cmsHA 821, and cmsHA 384 and planted at Córdoba, Spain and Casselton, ND in 1995 and at Tomejil and Córdoba and Casselton in 1996. Plant height of hybrids with the R-185, R-188, R-190, R-201, R-202, R-206, and R-207 restorer lines averaged over the three CMS tester lines were 1.73, 1.48, 1.80, 1.83, 1.81, 1.78, and 1.71 m, respectively. Days to 50% flowering of hybrids with the seven restorer lines averaged over the three CMS tester lines were 73, 72, 74, 76, 77, 78, and 77 d, respectively. Oil concentration of hybrid seed (dry weight basis) averaged 470, 484, 473, 464, 475, 453, and 471 g kg^{-1}, respectively, for the seven restorer lines crossed to the three CMS tester lines. The restorer lines R-185, R-202, and R-206 appeared to be more adapted to environments in Spain than the north central United States, whereas R-188, R-190, and R-207 appeared to be more adapted to the north central United States environments than Spain. The shortest hybrids were produced by the R-188 restorer.

Seed of these germplasms will be maintained and distributed by the authors. We ask that appropriate recognition be made if these germplasm lines contribute to the development of a hybrid or a new breeding line.

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Registration of 11 Isogenic T1BL.1RS Chromosome Translocation and 11 Chromosome 1B Durum Germplasms

Commercially grown tetraploid durum wheat (2n=4x=28, AABB) (*Triticum turgidum* L. var. *durum* Desf.) cultivars are homozygous for chromosome 1B. The T1BL.1RS chromosome translocation was transferred to the durum wheat cultivar Altar 84 from which we derived 11 chromosome 1B germplasms, "extracted" lines, and 11 T1BL.1RS translocation line germplasms. Each line has the cross identification CIGM number (Table 1) (Reg. no. GP -572 to GP-593, PI 610760 to PI 610781). 'Seri M82' (*T.aestivum* L.) was the T1BL.1RS pollen donor for the F_1 generation. The pentaploid F_1 (2n=5x=35, AABBD; 1B+T1BL.1RS) was used to pollinate Altar 84 to yield the first backcross (BC_1) derivative. Heterozygous 1B, T1BL.1RS BC_1 plants with 28 chromosomes were identified by GPI electrophoresis and Giemsa C-banding (6). These BC_1F_1 heterozygotes were backcrossed to Altar 84 to yield BC_2 derivatives, which were similarly advanced to BC_7 and then self-pollinated. From the selfed progeny, plants homozygous for chromosomes 1B and T1BL.1RS were identified biochemically and cytologically. Homozygous plants were then grown, selfed, and observed for phenotypic resemblance

Table 1. Agronomic characteristics of *Triticum turgidum* L. cv. Altar 84 germplasm with and without the T1BL.1RS substituted chromosome.

Germplasm pedigree and cross numbers	PI Number	Plant height	Days to anthesis	Days to physiological maturity	1000-Kernel weight	Grain volume
		cm			g	Kg hl-1
Extracted 1B derivatives						
Altar 84*8/Seri M82 CIGM91.347-1†	PI 610760	87	84	133	46.2	82.0
Altar 84*8/Seri M82 CIGM91.347-2	PI 610761	86	83	131	46.0	82.4
Altar 84*8/Seri M82 CIGM91.347-3	PI 610762	87	84	132	46.9	82.2
Altar 84*8/Seri M82 CIGM91.347-4	PI 610763	90	84	132	49.6	84.4
Altar 84*8/Seri M82 CIGM91.347-5	PI 610764	91	83	131	47.5	82.4
Altar 84*8/Seri M82 CIGM91.347-6	PI 610765	90	84	132	48.7	84.4
Altar 84*8/Seri M82 CIGM91.347-1	PI 610766	87	84	132	47.1	82.4
Altar 84*8/Seri M82 CIGM91.347-2	PI 610767	88	84	132	48.4	82.4
Altar 84*8/Seri M82 CIGM91.347-3	PI 610768	87	84	132	47.3	82.0
Altar 84*8/Seri M82 CIGM91.347-4	PI 610769	85	85	132	46.0	82.2
Altar 84*8/Seri M82 CIGM91.347-5	PI 610770	89	86	133	47.3	82.0
T1BL.1RS Substitution Derivatives						
Altar 84*8/Seri M82 CIGM91.347-7	PI 610771	88	88	137	51.4	83.9
Altar 84*8/Seri M82 CIGM91.347-8	PI 610772	86	87	134	53.4	84.4
Altar 84*8/Seri M82 CIGM91.347-9	PI 610773	86	87	134	50.7	83.9
Altar 84*8/Seri M82 CIGM91.347-10	PI 610774	85	87	134	53.4	84.4
Altar 84*8/Seri M82 CIGM91.347-11	PI 610775	91	87	136	52.6	82.2
Altar 84*8/Seri M82 CIGM91.347-12	PI 610776	91	88	135	53.8	84.4
Altar 84*8/Seri M82 CIGM91.347-13	PI 610777	92	88	135	56.4	84.6
Altar 84*8/Seri M82 CIGM91.347-6	PI 610778	84	87	134	48.5	84.0
Altar 84*8/Seri M82 CIGM91.349-7	PI 610779	86	88	135	49.3	84.4
Altar 84*8/Seri M82 CIGM91.349-8	PI 610780	84	88	135	48.7	84.4
Altar 84*8/Seri M82 CIGM91.349-9	PI 610781	86	88	135	49.5	84.4
Altar 84 (Parental 1B, 1B line)		90	83	133	45.6	84.7
LSD 0.05		2	3	2	1.2	1.5

† CIGM = Cruza Intergenerica mexicana (Intergeneric cross in Mexico).

to Altar 84. From these plants, 11 chromosome 1B homozygous and 11 chromosome T1BL.1RS homozygous plants were selected, seed increased and agronomically characterized (Table 1). Data on the Altar 84 original Breeder line were included for comparison. Germplasm descriptions for various parameters of each line are means of field planting observations conducted at the Mexican Institute of Forestry, Agriculture, and Livestock (INIFAP), and Campo Agricola Experimental Valle del Yaqui (CAEVY) Research Station, Sonora, Mexico, during the 1992–1993, 1993–1994, and 1994–1995 crop cycles. Each of the T1BL.1RS germplasms possesses biotic stress resistance genes *Lr26*, *Sr 31*, *Yr9*, and *Pm8* located on the rye arm 1RS(4).

The 1B "extracted" lines are anticipated to differ from the parent Altar 84 for the recombination events occurring on the 1BL chromosome arm of the T1BL.1RS translocation and the other 26 chromosomes during the backcross procedure (5) because a bread wheat cultivar Seri M82 was involved in the F_1 pentaploid bridge.

There is one earlier T1BL.1RS line developed in durum wheat from the Cando/Veery F_2 cross segregation (1,2). This line is registered as KS91WGRC14 (3). The development of the present germplasm is unique in that a high-yielding commercial cultivar is used, with seven backcrosses making the germplasms nearly isogenic. Because of the 1B "extracted" component, a critical assessment of the T1BL.1RS contribution effect can be made. Priority areas will be yield potential, quality, and performance across different environments, areas where T1BL.1RS contributions are noteworthy for bread wheats (6).

Seed samples (5 g) of each germplasm will be distributed upon written request. Requests should be directed to the Genetic Resources Bank, Wheat Program, CIMMYT, Lisboa 27, Apartado Postal 6-641, 06600 Mexico, D.F., Mexico.

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