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Registration of Seven *Barley yellow dwarf virus* Tolerant Oat Germplasm Lines

Seven spring oat (*Avena sativa* L.) germplasm lines (Reg. no. GP-87 to GP-93, PI 641965 to PI 641971) with a very high level of *Barley yellow dwarf virus* (BYDV) tolerance were developed and released by the Illinois Agricultural Experiment Station of the University of Illinois and the USDA-ARS. The lines released in 2003 were selected on the basis of tolerance to BYDV and other desirable traits. BYDVs infect a wide range of host species and cause economic losses in small grain cereal crops around the world (D'Arcy, 1995; Lister and Ranieri, 1995). Symptoms of BYDV infection in oats include chlorosis, blasting of florets, stunting, and reduction in root growth (Jensen and D'Arcy, 1995; Kolb et al., 1991a). Host plant resistance or tolerance (as defined by Cooper and Jones, 1983) is an important control strategy for reduction of losses due to the BYDVs. Many researchers have contributed to the development of oats with tolerance or resistance to BYDVs (Burnett et al., 1995; Kolb et al., 1991b).

A population from a four-way cross was used to develop the BYDV tolerant oat germplasm lines. The four-way cross involved four BYDV tolerant parents: IL86–1156, IL86–5698, IL86–6404, and 'Ogle'. Two of the parents (IL86–5698 and IL86–6404) were released as BYDV tolerant germplasm lines (Kolb et al., 1991b), and Ogle (Brown and Jedlinski, 1983) is a well-known spring oat cultivar with BYDV tolerance. An F_1 plant of IL86–5698/IL86–1156 was crossed with an F_1 plant of Ogle/IL86–6404. F_2 plants were grown in the greenhouse, and one seed was harvested from each F_2 plant. The F_3 populations were space-planted in the field and inoculated at Feekes GS 1 using viruliferous aphids [*Rhopalosiphum padi* (Linnaeus)] carrying BYDV-PAV-IL. Plants that exhibited BYDV symptoms were destroyed. About 780 of the most tolerant plants (based on lack of symptoms) were harvested individually. The following season a single hill of each $F_{3:4}$line was evaluated for BYDV tolerance in a BYDV-PAV-IL inoculated field nursery, and 139 lines were selected on the basis of the absence of visible symptoms. The 139 lines (plus the parents and checks) were evaluated twice in the field using three replications of paired control and BYDV-PAV inoculated hills in each evaluation. Only BYDV-PAV was used for the evaluations. In our environment, BYDV-PAV is the most common of the BYDVs and causes the most severe symptoms. Because these lines exhibit little or no BYDV symptoms, BYDV tolerance was evaluated on the basis of virus titer using ELISA, percent stunting (height difference between control and inoculated hills), and percent yield loss (grain yield difference between control and inoculated hills). An increase ($F_{3:5}$) of each of the lines was also produced. Sixty-two lines were selected from the 139 lines for further evaluation, and these 62 lines were evaluated for agronomic performance in a replicated experiment using six row plots with three replications at one location. In addition to BYDV tolerance, lines were selected for further evaluation on the basis of high grain yield in infected and uninfected conditions, high test weight, good kernel morphology, and absence of awns. Of the sixty-two lines, 42 BYDV tolerant lines were evaluated further a second year in replicated trials at two locations (Urbana and DeKalb, IL).

Two cycles of selection in the F_3 and F_4 were effective in eliminating BYDV susceptible plants from this population. The lines still under evaluation varied in amount of stunting and yield loss (Table 1), but under our environmental conditions, most lines exhibited only minor chlorosis or other symptoms due to BYDV. ELISA values of plants with little or no symptoms indicated that virus replication was reduced in some plants without symptoms but not in others (Table 1). For the 139 lines tested, ELISA values ranged from 0.311 to 1.989.

Table 1. BYDV tolerance of 7 spring oat germplasm lines from a 4-way cross population and checks evaluated in inoculated hills.

	Stunting†			Yield Loss†		
	Year 1	Year 2	2 yr	2 yr		
			average		ELISA	BYDV rating
	%					0–9‡
BYDV tolerant lines						
IL2815 (PI 641965)	3.7	1.7	2.7	11.8	0.461	1.5
IL2838 (PI 641966)	6.0	2.0	4.0	0	0.628	1.0
IL2858 (PI 641967)	4.7	3.3	4.0	0	0.552	1.0
IL2901 (PI 641968)	7.3	0	3.1	0	1.375	1.0
IL3303 (PI 641969)	3.0	2.0	2.6	6.8	0.507	2.5
IL3555 (PI 641970)	13.0	0.3	6.7	10.3	0.838	3.0
IL3587 (PI 641971)	5.7	1.7	6.3	8.7	0.568	1.5
Parents						
Ogle (CI 9401)	6.7	7.3	7.0	21.0	0.912	4.5
IL86–5698–3 (PI 539875)	11.3	2.7	3.4	20.6	0.388	4.5
IL86–1156–1 (–)	8.0	1.7	7.0	23.5	1.170	2.0
IL86–6404–1 (PI 539874)	6.7	3.0	4.8	3.2	1.186	4.0
LSD (0.05)	6.6	4.3	ns	15.4	–	–

† Stunting or yield loss of inoculated hill compared to a paired control hill.
‡ 0 = no symptoms, 9 = severe symptoms.

On the basis of all of the criteria used for selection, the seven lines were selected for release as BYDV tolerant germplasm lines. These lines differ somewhat in height, maturity, ELISA virus titer, and resistance to crown rust (*Puccinia coronata* Cda. f. sp. *avenae* Eriks.). Several of the lines are approximately equal to Ogle for grain yield (Table 2).

Small quantities of seed (≤5 g) of each germplasm line are available for research and parental purposes on request to the corresponding author. The source of the germplasm should be appropriately recognized if a germplasm line contributes to the development of new germplasm, a cultivar or a publication. Seed will be maintained by the Department of Crop Sciences for at least 5 yr, and seed has been deposited in the USDA-ARS National Plant Germplasm System.

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Table 2. Agronomic performance of 7 BYDV tolerant spring oat lines and checks evaluated in three environments in the field in Illinois.

	Yield	Test weight	Heading date	Height	Crown rust
	kg ha^{-1}	kg hL^{-1}	Days after 1 January	cm	0–9†
BYDV tolerant lines					
IL2815 (PI 641965)	4430	38.1	134	115	6.3
IL2838 (PI 641966)	3699	40.0	138	126	3.5
IL2858 (PI 641967)	3699	38.7	139	119	5.1
IL2901 (PI 641968)	3656	41.2	139	132	3.9
IL3303 (PI 641969)	4136	39.9	137	124	2.5
IL3555 (PI 641970)	4462	41.3	134	127	3.4
IL3587 (PI 641971)	4167	41.3	135	116	3.4
Parents and Don Check					
Ogle (CI 9401)	4039	38.0	137	119	4.1
IL86–5698–3 (PI 539875)	3021	39.4	137	119	3.3
IL86–1156–1 (–)	2767	34.2	141	124	5.2
IL86–6404–1 (PI 539874)	3910	39.3	139	121	3.7
Don (PI 498423)	4412	42.2	134	109	6.1
LSD (0.05)	640	2.8	1	5	1.7
No of environments	3	3	1	1	1

† 0 = no lesions, 9 = severe.

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