Table 1. Rice grain lysine level and associated seed and plant fertility characteristics of in vitro-selected lines advanced for germplasm registration. Values represent means from seeds collected in the greenhouse (Beltsville, MD) and three field locations (Beaumont, TX; Biggs, CA; and Stuttgart, AR).

Designations						
PI no. or parent	Line or cultivar	Analyses	Lysine content†	Relative protein content‡	100-seed wt.	Relative fertility§
		no.	%	μmol mg^{-1} seed	g	%
PI 564784	2K41	25	3.9	0.62	1.89	67
PI 564785	2K539	59	3.8	0.68	1.92	65
PI 564786	2K(C193)	8¶	3.9	0.70	1.89	no data
PI 564787	2K497	48	3.8	0.74	1.73	43
PI 564788	2K601	98	3.6	0.43	2.39	51
Parent 1	Calrose 76	55	3.4	0.62	2.14	100
Parent 2	M-101	25	3.5	0.68	2.17	100

† Percent of total amino acids in acid hydrolyzates of half-seed brown rice.
‡ Total amino acids in acid hydrolyzates of half-seed.
§ Percent fertility relative to parent.
¶ Each determination represents a composite of 10 dehulled half-seeds.

seed analyses. Plants are semidwarf and flower in 112 d after seeding. Seed is small, at 17.3 mg seed^{-1} of brown rice, and fertility is reduced to <50%. Under suboptimal temperatures, flowers are abnormal and frequently display incomplete development with narrow glumes and open florets. Though the pistils and stamens are frequently exposed, there is little evidence from amino acid analyses for spontaneous outcrossing. Segregation for lysine levels in selfed material is infrequent. As in other enhanced-lysine types the endosperm is soft and opaque. Germplasm may be constitutive for some stress related proteins expressed in tissue culture as increased extracellular β-1,3-glucanase activity (4) in the absence of heat shock or biochemical stress.

5. 2K601 represents germplasm (PI 564788) from a cross of an in vitro–derived mutant to pollen of M-101, which later outcrossed spontaneously in the greenhouse with Assam 5 (PI 353705), a near-*indica* subspecies (5). This material was selfed to the F_4 generation after the outcross. Grains originally segregated for opaque and vitreous endosperm. Some vitreous seed had intermediate lysine levels. Since this line exhibits 3.6% lysine in protein hydrolyzates, it should be useful for the restoration of vitreous endosperm in lysine-enhanced lines. Plants are semidwarf, flower in <80 d, and produce large seeds (weighing 23.9 mg seed^{-1}). Plants have open loose panicles, and florets are ≈50% fertile. Germplasm may be suitable for some subspecies bridge crosses.

All accessions are recorded in the Germplasm Resources Information Network (GRIN), and 25 to 50 seeds are available from the authors for 5 yr after registration. After 5 yr, seed will be available from the National Small Grains Collection, USDA-ARS, Box 307, Aberdeen, ID 83210.

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Registration of Nine Sorghum Lines with Resistance to Sorghum Midge: ICSV 692, ICSV 729, ICSV 730, ICSV 731, ICSV 736, ICSV 739, ICSV 744, ICSV 745, and ICSV 748

Nine sorghum [*Sorghum bicolor* (L.) Moench] lines: ICSV 692, ICSV 729, ICSV 730, ICSV 731, ICSV 736, ICSV 739, ICSV 744, ICSV 745, and ICSV 748 (Reg. no. GP-374 to GP-382, PI 576123 to PI 576131) with resistance to sorghum midge (*Contarinia sorghicola* Coq.) were developed at the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, Andhra Pradesh, India. These lines were derived from crosses between midge-resistant sources DJ 6514, IS 2579C, PM 7348, and PM 11344 (ICSV 197), and lines Diallel 50-1-1 ALS, IS 3443, SPV 351, SPV 394, and A 6250 (Table 1). The segregating material (F_2 to F_5) was screened under the infester row technique at ICRISAT Center, and Dharwad (Karnataka, India) (1). The selected lines were tested under the headcage (no-choice) technique over several seasons. Lines showing resistance under headcage testing were also screened over several seasons and locations in India, Africa, and Latin America.

These lines are diverse in plant height (74–282 cm), days to 50% anthesis (59 to 81 d), and 1000-grain weight (18 to 31 g 1000-grain^{-1}) (Table 1). Plant color is tan, except for ICSV 729, which is non-tan. Leaves are broad, thick and drooping, except for ICSV 730, ICSV 731 and ICSV 745, which have medium and erect leaves. The panicle is compact and elliptic for ICSV 729, ICSV 730, ICSV 731, ICSV 736, and ICSV 744, and compact at the base and semi-loose at the top for ICSV 692 and ICSV 745. Grain and endosperm color is creamy-white and white, respectively. Glume color is red-tan for ICSV 729, ICSV 731, ICSV 736 and ICSV 739; brown for ICSV 744 and ICSV 745; and straw for ICSV 692 and ICSV 730.

Over 5 to 10 seasons of testing at ICRISAT Center, these lines showed a midge damage rating (DR) of 2.9 to 3.8 under natural infestation and 2.2 to 4.3 under no-choice headcage testing, compared with a DR of 8.4 and 9.0 in CSH 1 under natural infestation and headcage testing, respectively (DR 1

Table 1. Origin, pedigree, agronomic characteristics, yield potential and percentage midge damage in nine sorghum lines resistant to sorghum midge (ICRISAT Center, Patancheru, India).

Origin, pedigree	Plant height	Days to 50% anthesis	1000-grain wt.	Overall grain yield†	Midge damage	
					Natural	Headcage
	cm	d	g	t ha^{-1}	%	
ICSV 692 (DIALLEL-50-1-1 ALS 7 × DJ 6514)-12-1-1-1-1	129	59	19	2.53	21	18
ICSV 729 (IS 3443 × IS 2579C)-2-1-2-1-1	74	66	28	1.77	21	16
ICSV 730 (PM 7348 × SPV 351)-2-6-1-1	130	78	23	2.38	18	15
ICSV 731 (PM 7348 × SPV 351)-4-1-1-1	140	72	29	3.04	22	27
ICSV 736 (PM 11344 × SPV 351)-10-1-1-1-7	239	76	20	2.24	18	13
ICSV 739 (PM 11344 × SPV 394)-3-1-1-1-6	241	70	18	4.31	22	28
ICSV 744 (PM 11344 × A 6250)-3-2-2-4	282	77	22	2.97	22	8
ICSV 745 (PM 11344 × A 6250)-4-1-1-1	215	71	31	4.68	18	22
ICSV 748 (PM 11344 × A 6250)-8-5-6-1	279	81	24	2.22	12	15
Susceptible controls						
CSH 1	152	58	26	2.87	90	94
SE	±8.6	±1.1	±0.6	±0.20	±6.7	±4.8

† Average of three to five trials.

Table 2. Midge damage ratings of nine sorghum lines resistant to midge across five locations (1989–1990).

Cultivar	Dharwad	Patancheru		Bhavanisagar	Warangal	Average
		Rainy season	Post-rainy season			
ICSV 692	3†	3.5	2.0	5	6	3.90
ICSV 729	2	2.5	2.0	3	4	2.70
ICSV 730	2	2.0	2.0	5	5	3.20
ICSV 731	3	4.0	3.0	5	5	4.00
ICSV 736	3	3.0	3.0	6	4	3.80
ICSV 739	1	2.5	1.0	3	4	2.30
ICSV 744	3	3.0	3.5	3	5	3.50
ICSV 745	2	1.0	1.5	5	3	2.50
ICSV 748	4	2.5	2.5	5	3	3.40
Resistant check						
DJ 6514	2	1.0	1.5	2	1	1.50
Susceptible check						
CSH 1	9	8.0	9.0	8	8	8.40
SE	±0.21	±0.16	±0.18	±0.21	±0.18	–

† Damage rating: 1 = <10%, 2 = 11–20%, 3 = 21–30%, 4 = 31–40%, 5 = 41–50%, 6 = 51–60%, 7 = 61–70%, 8 = 71–80%, 9 = >80% midge damage.

= <10% spikelets with midge damage, and 9 = >80% spikelets with midge damage) (1). Across four test locations in India, these lines suffered a DR of 2.3 to 3.9, compared with a DR of 8.4 in the susceptible commercial hybrid CSH 1 (Table 2). These lines have also shown stability of resistance to sorghum midge in Australia, Africa (except Kenya), and Central America.

ICSV 692, ICSV 739, and ICSV 745 are less susceptible to rust (caused by *Puccinia purpurea* Cooke) and leaf blight [caused by *Exserohilum turcicum* (Pass.) K.J. Leonard & E.G. Suggs] than the commercial cultivar M 35-1. All lines (except ICSV 744 and ICSV 748) are less susceptible than M 35-1 to zonate leaf spot (caused by *Gloeocercospora sorghi* Bain & Edgerton ex Deighton). ICSV 739 and ICSV 745 are also less susceptible to ergot (caused by *Sphacelia sorghi* McRae) compared with M 35-1. ICSV 692, ICSV 729, ICSV 730, ICSV 739, and ICSV 745 showed <25% downy mildew [caused by *Peronosclerospora sorghi* W. Weston & Uppal) C.G. Shaw] incidence compared with 74% in DMS 652. These lines are as susceptible to shoot fly (*Atherigona soccata* Rondani) and spotted stem borer (*Chilo partellus* Swinhoe) as the commercial cultivar CSH 1.

Seeds of these lines will be distributed by the Genetic Resources Program of ICRISAT, Patancheru, Andhra Pradesh 502 324, India.

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Registration of BARC-12, a Low Linolenic Acid Soybean Germplasm Line

Soybean [*Glycine max* (L.) Merr.] germplasm line BARC-12 (Reg. no. GP-169, PI 578058), released in 1993, was developed by the USDA-ARS at Beltsville, MD, as a strain with reduced linolenic acid (18:3) in the oil for subsequent cycles of improvement and for genetic studies on the inheritance of 18:3 concentration in soybean oil.

BARC-12 was developed from the cross made at Beltsville in 1986 between two sibs, N85-2176 × N85-2124, with low 18:3 concentration (1). The F_1 generation was grown at the ARS winter nursery in Puerto Rico in 1986–1987. The F_2 plants were produced at Beltsville in the 1987 growing season, and the F_3 through F_6 generations were produced at Beltsville in successive growing seasons, via single-pod descent. All fatty acid ester analyses were made by the National Center for Agricultural Utilization Research at Peoria, IL, from 7- to 10-g samples of seed, via gas chromatography.

In 1990, seed oil of 35 F_5 plants from the cross N85-2176 × N85-2124 ranged from 2.0 to 6.9% 18:3, and BARC-12 traces to the F_5 plant with 2.0% 18:3. In 1991, BARC-12, evaluated as the F_6 line MD91L-048, exhibited 2.7% 18:3. In a 1992 field test at Beltsville with two replications, BARC-12 exhibited 3.1% 18:3, compared with 3.7% for N85-2176 and 3.9% for N85-2124 [LSD (0.05) = 0.6%]. The 18:3 determinations in this test for other low 18:3 germplasm sources A5 (2), C1640 (3), and N85-2131 (1) were 3.7, 5.1, and 4.6%, respectively. In 1993 field tests at Beltsville and at Landisville, PA, BARC-12,