BEET (*Beta vulgaris* L.)
WILD BEET (*Beta vulgaris* ssp. *maritima*)
SUGAR BEET (*Beta vulgaris* ssp. *vulgaris*)
Rhizoctonia crown and root rot; *Rhizoctonia solani*

L. Panella, A. L. Fenwick, A. L. Hill, T. Vagher, K. M. Webb;
USDA-ARS, Sugar Beet Research Unit, Crops Research Lab,
1701 Centre Ave., Fort Collins, CO 80526-2083

Rhizoctonia crown and root rot resistance of *Beta* PI from the USDA-ARS NPGS, 2009.

Beta vulgaris plant introductions (PI) were screened for Rhizoctonia root and crown rot, at the USDA-ARS Fort Collins, CO Research Farm. The nursery was planted as a randomized complete-block design with five replications in one-row plots (76 cm row spacing) 4 m long. The field had been planted to sugar beet in 2001 and fallowed in following years with the exception of barley in 2004. The soil (Garrett loam, 0 to 1 % slope, pH 7.8) was fumigated with Telone® II[z] in late Oct 08 for control of soilborne diseases and pests. Manure was applied and roller harrowed in Nov 08. The field was leveled and bedded in May 09. Planting occurred on 22 May, fertilized with 13.6 kg A^{-1} of ESN® (Agrium Advanced Technologies, Sylacauga, AL), and furrow irrigated as needed. The field was thinned (20-25 cm spacing) and hand weeded 26-28 Jun, and again on 9 Aug. Cultivations occurred on 30 Jun and 21 Jul. Inoculum of *R. solani* isolate R-9 (AG-2-2), colonized to dry barley and course ground, was applied to the crown of plants on 22-23 Jul at a rate of 4.8 g m^{-1}. A Gandy® applicator was used to apply inoculum and the field cultivated afterwards to place soil onto plant crowns. On 18 Sep beets were lifted and each root rated on a scale of 0 (no damage) to 7 (dead plant with root completely rotted). Average disease severity was determined to create a disease index (DI) for each entry. Analyses of variance (PROC ANOVA/GLM) were performed on plot disease indices, % healthy roots (classes 0 and 1 combined) and % roots in classes 0 through 3 (harvestable roots). Data in DI classes 0-1 and 0-3 were transformed using arcsine square root to normalize the data for analyses (AP 0-1 and AP 0-3, respectively).

This was an unusual year for rainfall with 10 cm of rain occurring between 1 Jan and planting providing a full profile at planting. Above average rainfall occurred through Jun and into Jul providing an additional 17.6 cm precipitation. Daytime temperatures remained at sufficient levels for disease development (25-35°C). Rhizoctonia crown and root rot pressure was high and disease development on resistant and susceptible checks was as expected. All experiments in the nursery had significant differences among DI with the most resistant line in the test (which included 7additional trials than the one reported here) having a DI of 1.8 (data not shown), and the most susceptible line a DI of 7.0. This year, a DI of less than 5.0 is considered to indicate some resistance to Rhizoctonia crown and root rot. Next year selections from within those populations will be made and the resistant plants crossed to sugar beet germplasm.

Seed Source	Subspecies	Donor's ID	DI[y]	% 0-1	% 0-3	AP 0-1	AP 0-3
PI 540679	*maritima*	WB 933, Denmark	4.2	6	45	10.7	42.2
PI 504209	*maritima*	Wild beet, Italy	4.4	6	44	11.4	40.7
PI 504240	*maritima*	Wild beet, Italy	4.6	0	41	0.0	36.5
PI 232888	*vulgaris*	IDBBNR 5404,Hungary	4.7	8	21	8.8	20.0
PI 546401	*maritima*	IDBBNR 5634, Italy	4.7	6	32	6.5	32.8
PI 540583	*maritima*	WB 837, France	4.8	5	31	8.2	30.6
PI 604509	*maritima*	IDBBNR 2207, Italy Sicily	4.9	2	28	3.7	28.5
PI 504208	*maritima*	Wild beet, Italy	5.1	0	25	0.0	24.0
PI 540580	*maritima*	WB 834, France	5.2	0	23	0.0	25.3
PI 540678	*maritima*	WB 932, Denmark	5.2	2	13	3.5	18.6
PI 604508	*maritima*	IDBBNR 2193, Greece Peloponnese	5.2	0	29	0.0	26.3
PI 540639	*maritima*	WB 893, France	5.4	0	23	0.0	25.0
PI 540671	*maritima*	WB 925, Denmark	5.5	0	25	0.0	23.5
PI 546402	*maritima*	IDBBNR 5599, UK England	5.5	3	14	6.8	22.0
PI 540675	*maritima*	WB 929, Denmark	5.6	0	21	0.0	21.1
PI 355965	*vulgaris*	ULADOVSKAJA 97, Ukraine	5.7	0	0	0.0	0.0
PI 535842	*maritima*	JANAHILL, Poland	5.7	0	8	0.0	10.6
PI 540668	*maritima*	WB 922, Denmark	5.7	4	14	5.0	19.7
PI 540689	*maritima*	WB 943, Belgium	5.7	0	6	0.0	11.4
PI 546405	*maritima*	IDBBNR 5602, Denmark	5.7	3	6	4.2	9.1
PI 518412	*maritima*	IDBBNR 5906, Ireland	5.8	5	12	10.3	16.2
PI 540692	*maritima*	WB 946, France	5.8	0	9	0.0	11.4
PI 550718	*maritima*	IDBBNR 5636, Ireland	5.8	7	23	7.0	20.0
PI 504207	*maritima*	Wild beet, Italy	5.9	0	15	0.0	15.3
PI 518328	*maritima*	IDBBNR 5822, UK England	5.9	0	13	0.0	16.3
PI 546404	*maritima*	IDBBNR 5601, Netherlands	5.9	0	9	0.0	10.9
PI 518423	*maritima*	IDBBNR 5917, UK England	6.0	7	7	9.7	9.7
PI 540628	*maritima*	WB 882, UK	6.0	2	9	3.7	13.3
PI 251042	*vulgaris*	IDBBNR 5412, Serbia	6.1	4	4	5.3	5.3
PI 518315	*maritima*	IDBBNR 5809, UK England	6.1	0	12	0.0	14.9
PI 518332	*maritima*	IDBBNR 5826, UK England	6.1	5	12	8.2	13.0
PI 540590	*maritima*	WB 844, France	6.1	0	14	0.0	17.6
PI 540682	*maritima*	WB 936, Denmark	6.1	2	11	3.7	16.3
PI 546414	*maritima*	IDBBNR 5608, France	6.2	0	15	0.0	17.6
PI 504211	*maritima*	Wild beet, Italy	6.3	0	6	0.0	9.0
PI 540690	*maritima*	WB 944, France	6.3	0	7	0.0	11.8
PI 518363	*maritima*	IDBBNR 5857	6.4	0	6	0.0	8.7
PI 540688	*maritima*	WB 942, Belgium	6.4	0	2	0.0	3.9

Seed Source	Subspecies	Donor's ID	DI[y]	% 0-1	% 0-3	AP 0-1	AP 0-3
PI 562593.....	*maritima*	IDBBNR 9744, Egypt Matruh	6.4	0	0	0.0	0.0
PI 504192.....	*maritima*	Wild beet, Italy	6.5	0	3	0.0	4.9
PI 518373.....	*maritima*	IDBBNR 5867.....	6.5	4	6	7.6	10.9
PI 198348.....	*maritima*	IDBBNR 5662, Spain.....	6.6	0	4	0.0	7.0
PI 504214.....	*maritima*	Wild beet, Italy	6.6	0	10	0.0	11.9
PI 518310.....	*maritima*	IDBBNR 5804, UK England	6.6	3	3	4.4	4.4
PI 518417.....	*maritima*	IDBBNR 5911, Ireland	6.6	0	3	0.0	6.8
PI 540691.....	*maritima*	WB 945, France.....	6.6	2	4	3.5	5.0
PI 518312.....	*maritima*	IDBBNR 5806, UK England	6.7	0	3	0.0	6.6
PI 518371.....	*maritima*	IDBBNR 5865.....	6.7	0	0	0.0	0.0
PI 546392.....	*maritima*	IDBBNR 5633, US California	6.7	0	0	0.0	0.0
PI 540695.....	*maritima*	WB 949, France.....	6.8	0	4	0.0	5.6
PI 546434.....	*maritima*	IDBBNR 5648, Greece	6.8	0	0	0.0	0.0
PI 518402.....	*maritima*	IDBBNR 5896, Ireland	6.9	0	0	0.0	0.0
PI 599349.....	*maritima*	N499, US California.....	6.9	0	0	0.0	0.0
PI 604507.....	*maritima*	IDBBNR 1469, UK.....	6.9	0	0	0.0	0.0
PI 518401.....	*maritima*	IDBBNR 5895, Ireland	7.0	0	0	0.0	0.0
PI 590754.....	*vulgaris*	*FC705/1- Highly Resistant Check*.....	*2.5*	*36*	*78*	*33.6*	*68.6*
PI 590656.....	*vulgaris*	*FC703 - Resistant Check*.....	*3.4*	*28*	*49*	*31.3*	*44.4*
19941025	*vulgaris*	*FC901/C817- Susceptible Check*.....	*5.2*	*0*	*19*	*0.0*	*22.8*
		LSD (P=0.05)	1.13			9.65	18.47
		Trial Mean[x]	5.7	4	16	4.3	16.7

[z] Mention of trade names or commercial products in this article is solely for the purpose of providing specific information and does not imply recommendation or endorsement by the U.S. Department of Agriculture

[y] DI = Disease index on a scale of 0 (no damage) to 7 (plant death), % 0-1= % roots in class 0 and 1 combined, % 0-3 = % roots in class 0 to 3 combined, AP is the arcsine-square root transformation of percentages of roots in classes 0-1 and 0-3 to normalize the data for analyses.

[x] Because of varied rates of germination among the wild beet accessions, the number of roots per accession that were rated, ranged from 5 to 70, with an average of 41.6 (with one missing plot).