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

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Rhizoctonia crown and root rot resistance of *Beta* PIs from the USDA-ARS National Plant Germplasm System, 2010

    Thirty wild beet (*Beta vulgaris* subsp. *maritima* (L.) Arcang) plant introduction (PI) accessions from the *Beta* collection of the USDA-ARS National Plant Germplasm System were screened for resistance to Rhizoctonia root and crown rot, at the USDA-ARS Fort Collins, CO Research Farm. The Rhizoctonia screening nursery in 2010 was 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 sugarbeet in 2006 and summer fallowed since then. The soil (Garrett loam, 0 to 1 % slope, pH 7.8) was fumigated with Telone[®] II[1] in late Oct 2008, for control of soil borne diseases (esp. rhizomania) and pests. Manure was applied 4 days later and the field was roller harrowed in Nov 2008. Field was land leveled March 2010, and bedded a month before planting. Seed was planted on 25 May to moisture, fertilized with 44.7 kg ha^{-1} of ESN[®] (Agrium Advanced Technologies, Sylacauga, AL) and furrow irrigated as needed. Only pre-plant (22 May, glyphosate 1.48 l a.i. ha^{-1} and clopyralid 247 ml a.i. ha^{-1}) and pre-emergence herbicides (29 May, glyphosate 1.48 l a.i. ha^{-1} and clopyralid 247 ml a.i. ha^{-1}) were used this year. The field was thinned (20 - 25 cm spacing) and hand weeded 18 to 20 Jun, and hand weeded again 3 to 4 Jul and 24 Jul. Inoculation with dry, ground, barley grain colonized with *Rhizoctonia solani* isolate R-9 (AG-2-2 IIIB) was applied to the crown of the plants on 15 Jul at a rate of 6.9 g m^{-1} row. A Gandy[®] electrically driven applicator was used to apply the inoculum and the plots were cultivated afterwards to place soil onto the plant crowns. Beets were harvested from 16 to 18 Aug, with a single row lifter (pulled and cleaned by hand) and each root was rated for rot on a scale of 0 (no damage) to 7 (dead plant with root completely rotted) (Hecker, R. J., and E. G. Ruppel. 1977. Rhizoctonia root-rot resistance in sugar beet: breeding and related research. J. Am. Soc. Sugar Beet Technol. 19: 246-256). Average disease severity per plot was determined to create a disease index (DI) for each entry. Analyses of variance (PROC ANOVA/GLM) were performed on disease indices DI, % healthy roots (classes 0 and 1 combined) and % roots in classes 0 through 3 (harvestable roots). Data in 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).

    2010 had a cool spring with good early season rainfall in Fort Collins, CO. Between 1 Jan and planting we had about 15 cm of rain allowing us to plant to moisture. The crop grew well and was inoculated 15 Jul (about a wk earlier than 2009). In Jul and Aug, daytime temperatures remained high and there was an excellent infection and severe epiphytotic. There was good separation of disease severity between the highly resistant and highly susceptible lines. Weed pressure was light and, although we saw very little curly top in the field, we noted heavy leaf hopper pressure and sprayed lorsban (chlorpyrifos 531 ml a.i. ha^{-1}) and mustang (S-cyano, dimethylcyclopropane carboxylate 47 ml acre[-1]) on 30 Jun. Four of the PIs had a DI score of 4.6, which was not significantly different from the highly resistant control. Two more PIs were rated with a DI under 5.0. There was segregation for resistance in these accessions with some of the roots looking very clean on evaluation. There may be resistance genes in these accessions and they will be reevaluated to confirm resistance to Rhizoctonia root and crown rot. These data will be entered into the USDA-ARS, NPGS GRIN database (http://www.ars-grin.gov/npgs/index.html)

Seed Source	[z]Subspecies	Donor's ID	DI[y]	% 0-1	% 0-3	AP 0-1	AP 0-3
PI 540634	*maritima*	WB 888, United Kingdom	4.6	10	20	14.6	21.3
PI 540674	*maritima*	WB 928, Denmark.	4.6	9	25	8.6	26.2
PI 540677	*maritima*	WB 931, Denmark.	4.6	13	34	18.8	35.1
PI 546412	*maritima*	IDBBNR 5607, Denmark.	4.6	3	24	5.8	25.6
PI 540621	*maritima*	WB 875, France	4.7	15	23	17.7	25.3
PI 599350	*maritima*	R423, United States	4.8	1	9	2.9	13.4
PI 540579	*maritima*	WB 833, France	5.0	25	38	22.5	33.8
PI 540648	*maritima*	WB 902, France	5.1	12	20	17.2	25.4
PI 546406	*maritima*	IDBBNR 5635, Denmark.	5.1	9	21	15.0	23.8
PI 540624	*maritima*	WB 878, France	5.3	4	16	7.1	22.9
PI 540673	*maritima*	WB 927, Denmark.	5.4	1	11	3.1	19.2
PI 540586	*maritima*	WB 840, France	5.5	0	8	0.0	12.6
PI 540622	*maritima*	WB 876, France	5.5	8	14	7.9	13.4
PI 540655	*maritima*	WB 909, France	5.5	3	9	4.3	10.9
PI 540593	*maritima*	WB 847, France	5.6	0	10	0.0	14.2
PI 540687	*maritima*	WB 941, Belgium	5.6	3	7	6.5	14.1
PI 540659	*maritima*	WB 913, France	5.7	3	5	4.1	8.3
PI 540688	*maritima*	WB 942, Belgium	5.8	3	5	5.9	10.1
PI 540693	*maritima*	WB 947, France	5.8	0	12	0.0	17.7
PI 540700	*maritima*	WB 954, France	5.9	0	2	0.0	3.5
PI 540672	*maritima*	WB 926, Denmark.	6.0	8	9	7.6	10.5
PI 540601	*maritima*	WB 855, France	6.1	2	3	3.2	4.6
PI 540694	*maritima*	WB 948, France	6.1	2	14	3.4	18.8
PI 540697	*maritima*	WB 951, France	6.1	2	2	3.7	3.7
PI 540685	*maritima*	WB 939, Denmark.	6.2	3	7	6.2	11.5
PI 540696	*maritima*	WB 950, France	6.2	3	7	6.1	12.0
PI 540607	*maritima*	WB 861, France	6.3	4	4	5.1	5.1
PI 540699	*maritima*	WB 953, France	6.4	1	4	2.9	7.1
PI 540587	*maritima*	WB 841, France	6.7	1	1	2.9	2.9
PI 518400	*maritima*	IDBBNR 5894, Ireland	6.9	0	0	0.0	0.0
PI *590754*	*vulgaris*	*FC705/1- Highly Resistant Check*	2.5	31	83	33.2	71.5
PI *590656*	*vulgaris*	*FC703 - Resistant Check*	3.8	9	27	15.4	30.4
PI *599668*	*vulgaris*	*FC709-2 - Highly Resistant Check*	2.6	39	72	37.7	59.4
19941025	*vulgaris*	FC901/C817- Susceptible Check	5.3	0	9	0.0	11.1
		LSD (P=0.05)	1.10			14.45	17.71
		Trial Mean[x]	5.4	7	16	8.4	18.3

[z] All entries were *Beta vulgaris* and either subspecies *vulgaris* (domesticated) or subspecies *maritima* (wild)

[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 6 to 77, with an average of 63.5 (with one missing plot).

[1]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