SUGAR BEET (*Beta vulgaris* ssp. *vulgaris*) SEA BEET
(*Beta vulgaris* ssp. *maritima*)
        Beet curly top; *Beet severe curly top virus*

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**Beet curly top resistance in USDA-ARS Plant Introductions, 2012.**

    One sugar beet (*Beta vulgaris* subsp. *vulgaris* L.) and twenty-nine sea beet (*Beta vulgaris* subsp. *maritima* (L.) Arcang) accessions from the *Beta* collection of the USDA-ARS National Plant Germplasm System were screened for resistance to *Beet severe curly top virus* (BSCTV) and closely related *Curtovirus* species in 2012. Commercial cultivars Monohikari (susceptible) and HM PM90 (resistant) and Betaseed, Inc. germplasm line G6040 (resistant) were included as checks. The curly top evaluation was conducted at the USDA-ARS North Farm in Kimberly, ID which has Portneuf silt loam soil and had been in alfalfa in 2011. The field was plowed in the fall and in the spring, fertilized (90 lb N and 110 lb $P_2O_5$/A) on 16 Apr 12, sprayed with Ethotron (2 pt/A), and roller harrowed. The germplasm was planted (density of 142,560 seeds/A) on 21 May. The plots were planted in double rows 10 ft long with 22-in row spacing and arranged in a randomized complete block design with three replications. The fields were sprinkler irrigated and hand weeded as necessary. Plant populations were thinned to about 47,500 plants/A on 19 Jun. Plants were inoculated at the four to six leaf growth stage on 22 Jun with six viruliferous beet leafhoppers per plant. The beet leafhoppers were redistributed twice a day (immediately after sunrise and just before sunset) for one week by dragging a tarp through the field to disrupt settled/feeding leafhoppers. The plants were sprayed with Lorsban 4E (1.5 pints/A) on 4 Jul to kill the beet leafhoppers. The plots were rated for foliar symptom development on 10 Jul using a scale of 0-9 (0 = healthy and 9 = dead; Mumford 1974), with disease index (DI) treated as a continuous variable. Data were analyzed using the general linear models procedure (Proc GLM-SAS), and Fisher's protected least significant difference was used for mean comparisons.

    Curly top symptom development was uniform and no other disease problems were evident in the plot area. The disease pressure in the test was moderate with good disease development in the most susceptible lines. Most of the lines were not significantly different from the most resistant control. These accessions will be retested and, if the resistance is confirmed, entered into USDA-ARS breeding programs to enhance sugar beet germplasm with increased resistance to *Beet severe curly top virus* (BSCTV) and closely related *Curtovirus* species. These results will be accessible to interested parties through entered into the USDA-ARS, NPGS GRIN database (http://www.ars-grin.gov/npgs/index.html).

| Seed source | Description | CT rating[y] |
|---|---|---|
| ...................... | *Monohikari (susceptible control) - B.v.v.*.................................. | **6.50 a** |
| PI 604524 ............... | *Beta vulgaris* subsp. *maritima*, Portugal, Lisboa ........................ | 6.08 ab |
| PI 604522 ............... | *Beta vulgaris* subsp. *maritima*, Greece........................................ | 6.00 a-c |
| PI 604544 ............... | *Beta vulgaris* subsp. *maritima*, France, Morbihan ...................... | 6.00 a-c |
| PI 604535 ............... | *Beta vulgaris* subsp. *maritima*, Former Serbia and Montenegro... | 6.00 a-c |
| PI 604520 ............... | *Beta vulgaris* subsp. *maritima*, Spain, Alicante ........................... | 5.96 a-c |
| PI 604523 ............... | *Beta vulgaris* subsp. *maritima*, Greece........................................ | 5.92 a-d |
| PI 604547 ............... | *Beta vulgaris* subsp. *maritima*, Germany..................................... | 5.84 a-e |
| PI 604528 ............... | *Beta vulgaris* subsp. *maritima*, Spain, Baleares........................... | 5.75 a-f |
| PI 604518 ............... | *Beta vulgaris* subsp. *maritima*, Greece........................................ | 5.67 a-g |
| PI 604521 ............... | *Beta vulgaris* subsp. *maritima*, Germany..................................... | 5.58 b-h |
| PI 599349 ............... | *Beta vulgaris* subsp. *maritima*, USA, CA..................................... | 5.50 b-i |
| PI 604525 ............... | *Beta vulgaris* subsp. *maritima*, Spain ......................................... | 5.50 b-i |
| PI 604542 ............... | *Beta vulgaris* subsp. *maritima*, France, Morbihan ...................... | 5.42 b-i |
| PI 604541 ............... | *Beta vulgaris* subsp. *maritima*, Portugal, Aveiro ........................ | 5.42 b-i |
| PI 599352 ............... | *Beta vulgaris* subsp. *maritima*, USA, CA..................................... | 5.33 b-j |
| PI 604527 ............... | *Beta vulgaris* subsp. *maritima*, Spain, Balearic Islands............... | 5.25 b-j |
| PI 504189 ............... | *Beta vulgaris* subsp. *maritima*, Italy............................................ | 5.25 b-j |
| PI 604526 ............... | *Beta vulgaris* subsp. *maritima*, Portugal, Madeira Islands .......... | 5.25 b-j |
| PI 604519 ............... | *Beta vulgaris* subsp. *maritima*, Italy, Sicily................................. | 5.25 b-j |
| PI 604529 ............... | *Beta vulgaris* subsp. *maritima*, Spain, Baleares........................... | 5.25 b-j |
| PI 604517 ............... | *Beta vulgaris* subsp. *maritima*, Greece........................................ | 5.17 c-j |
| PI 504274 ............... | *Beta vulgaris* subsp. *maritima*, France ........................................ | 5.13 c-j |
| PI 604534 ............... | *Beta vulgaris* subsp. *maritima*, Netherlands ................................ | 5.04 d-j |
| PI 604539 ............... | *Beta vulgaris* subsp. *maritima*, Portugal...................................... | 4.96 e-j |
| *1996A008* ............... | *Beta G6040 – resistant control - B.v.v.* .................................... | **4.92 f-j** |
| PI 518353 ............... | *Beta vulgaris* subsp. *maritima*, UK, England............................... | 4.88 f-j |
| PI 518298 ............... | *Beta vulgaris* subsp. *maritima*, UK, England............................... | 4.88 f-j |
| PI 546423 ............... | *Beta vulgaris* subsp. *maritima*, UK, England............................... | 4.79 g-j |
| PI 274394 ............... | *Beta vulgaris* subsp. *vulgaris*, Poland, Warszawa........................ | 4.71 h-j |
| ....................... | *HM PM90 (resistant control) - B.v.v.* ...................................... | **4.63 ij** |
| PI 540639 | *Beta vulgaris* subsp. *maritima*, France ........................................ | 4.50 j |
| PI 604516 | *Beta vulgaris* subsp. *maritima*, Greece....................................... | 4.50 j |
| Overall mean . | ................................... ..................... ......... ............... | 5.34 |
| *P* > F[x] ........... | ................................... ..................... ......... ............... | 0.0007 |
| LSD (*P* ≤ 0.05) | ................................... ..................... ......... ............... | 0.90 |

[z] All lines tested were *Beta vulgaris* subsp. *maritima* except PI 274394. Three entries were check cultivars: Monohikari, Beta G604, and HM PM90 (*Beta vulgaris* subsp. *vulgaris*).

[y] CT rating = curly top was rated using a scale of 0-9 (0 = healthy and 9 = dead), with disease index (DI) treated as a continuous variable.

[x] *P* > F was the probability associated with the F value. LSD = Fisher's protected least significant difference value. CT rating means followed by the same letter did not differ significantly based on Fisher's protected LSD.