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AND

UNIVERSITY OF CALIFORNIA
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**NOTICE OF RELEASE OF RH14-1156, RH14-1157, and RH14-1158, ICEBERG
LETTUCE BREEDING POPULATIONS**

The Agricultural Research Service, United States Department of Agriculture and the University of California, Davis, announce the release of three F2:4 breeding populations of iceberg lettuce (*Lactuca sativa* L.). The breeding populations combine the *cor* and Verticillium resistance 1 (*Vr1*) genes to confer resistance to the soil borne diseases corky root and Verticillium wilt race 1. The breeding populations, designated RH14-1156, RH14-1157, and RH14-1158, were selected from the cross RH09-0689 × Telluride. The populations are genetically fixed for disease resistance and all progeny descending from these populations are expected to be resistant. These populations should be used to select commercially useable inbred iceberg lettuce cultivars adapted to environments where corky root and Verticillium wilt race 1 are prevalent.

Introduction

Corky root and Verticillium wilt are prevalent soil borne diseases that constrain commercial lettuce production in coastal California and host resistance is the most sustainable control method for both diseases. Germplasm combining resistance to both diseases is not known. Corky root is a root system deterioration that leads to reduced head size, resulting in less marketable heads. The recessive gene *cor* confers incomplete resistance to many pathogen strains causing the disease. Verticillium wilt causes leaf wilting, plant collapse and ultimately death. Resistance to race 1 isolates of the Verticillium *dahliae* fungus causing the disease is conferred by the dominant Verticillium resistance 1 (*Vr1*) gene. Race 1 currently predominates in coastal California and *Vr1* provides effective control in field sites where the gene has been tested. Here, we report the release of three early generation iceberg breeding populations that combine resistance to Verticillium wilt and corky root.

Pedigree and materials used in testing

The F2:4 (F2 derived F4) breeding populations being released are numbered RH14-1156, RH14-1157, and RH14-1158, and are derived from the cross RH09-0689 × Telluride. 'Telluride' is a commercially available iceberg cultivar with the *cor* gene that is cataloged as PI 632993 in the

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National Plant Germplasm System (NPGS) (<https://npgsweb.ars-grin.gov/gringlobal/accessiondetail.aspx?id=1644842>). The USDA F3:4 iceberg breeding line RH09-0689 was the source of Vr1. A descendant from RH09-0689 was released in 2015 and is available from NPGS as PI 673091 (<https://npgsweb.ars-grin.gov/gringlobal/accessiondetail.aspx?id=1921390>).

Development

A combination of the pedigree and bulk breeding methods were used to develop RH14-1156, RH14-1157, and RH14-1158. Forty-five F2:3 families were developed by growing F2 plants in a non-disease-infested field site, selecting plants for iceberg type horticultural characters, and allowing the selected plants to flower and self-pollinate. The resulting F2:3 families were evaluated in a field site artificially infested with race 1 of *Verticillium dahliae* and naturally infested with corky root pathogen. Based on evaluation of root and foliar symptoms, three families were identified as uniformly resistant to *Verticillium* wilt and corky root. The following season 90 plants of each family were reevaluated along with check cultivars for *Verticillium* wilt disease incidence and corky root severity (rated as 0 = no disease to 9 = severe disease). *Verticillium* wilt disease incidence in the susceptible checks ‘Salinas’, ‘Quest MT’, and ‘Telluride’ ranged from 88 percent to 90 percent. The F2:3 families had <3 percent symptomatic plants. ‘Salinas’ had a corky root severity mean of 7.8, which was significantly higher than all three F2:3 families (means <5.9) and the corky root resistant checks ‘Quest MT’ (mean = 6.2) and ‘Telluride’ (mean = 6.4). More than 90 plants from each F2:3 family were greenhouse grown and allowed to self-pollinate. Seed was massed to create the F2:4 families designated RH14-1156, RH14-1157, and RH14-1158.

Horticultural characters

RH14-1156, RH14-1157, and RH14-1158 were planted in three field experiments with the checks ‘Telluride’, ‘Glacier’, and ‘Salinas’ to evaluate horticultural characters. The breeding populations were generally similar to the cultivars for head firmness at harvest and head diameter (approximately 15 to 17 cm). Differences in head height were minimal, though the three breeding populations were slightly taller than ‘Glacier’ (13 cm), similar to ‘Salinas’ (14 cm), and shorter than ‘Telluride’ (16 cm). The head weights of RH14-1156 (621 g), RH14-1157 (760 g), and RH14-1158 (711 g) were similar or better than ‘Salinas’ (612 g), ‘Telluride’ (653 g), and ‘Glacier’ (595 g). RH14-1157 had the shortest cores (6 cm), while RH14-1158 had the tallest (11 cm). RH14-1156 (7 cm), ‘Telluride’ (8 cm), ‘Glacier’ (7 cm), and ‘Salinas’ (7 cm) were intermediate. The incidence of the physiological defect tipburn was variable across experiments and lines, ranging from 7 percent to 62 percent. Regardless, RH14-1157 generally had lower incidences compared to the other populations and cultivars within an experiment.

Plant-to-plant genetic variation within a population indicates that further improvement for horticultural traits can be achieved through selection. Significant plant-to-plant genetic variation was commonly detected for core length, particularly in breeding population RH14-1158. RH14-1157 exhibited significant genetic variation for head weight in two field experiments. Significant variation was intermittently detected across locations and breeding populations for head firmness and head height.

Use and availability

This germplasm is being released as F2:4 populations and likely contains sufficient genetic variation for horticultural traits to enable further performance improvements or development of unique inbred lines. Lettuce breeders should use these populations to select plants and eventual inbred lines for adaptation to environments where corky root and Verticillium wilt are prevalent problems. The resulting inbred lines are expected to be resistant to both diseases.

Limited seed samples of these breeding populations are available for distribution to all interested parties for research purposes. RH14-1156, RH14-1157, and RH14-1158 are being publically released with no intellectual property protection for the development and commercialization of new cultivars by seed companies, universities, non-governmental organizations or other bona fide private or public research organizations. It is requested that appropriate recognition be made if these populations contribute to research or the development of new germplasm, breeding lines, or cultivars. Written requests for seed can also be sent to Dr. Ivan Simko, USDA-ARS, 1636 E. Alisal St., Salinas, CA 93905 or sent through email (Ivan.Simko@ars.usda.gov).

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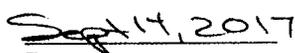
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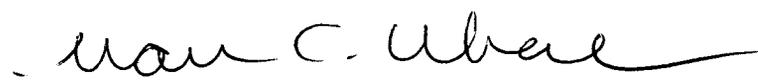
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Dean, College of Agricultural and Environmental Sciences
University of Davis



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Deputy Administrator, Crop Production and Protection
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