

Crisphead Lettuce Resistant to Corky Rot: Cultivars Glacier and Misty Day and 16 Resistant Breeding Lines

Edward J. Ryder and William Waycott

U.S. Agricultural Research Station, U.S. Department of Agriculture, Agricultural Research Service, 1636 East Alisal Street, Salinas, CA 93905

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Corky root (CR), caused by the bacterium *Rhizomonas suberifaciens* (gen. nov., sp. nov.) (van Bruggen et al., 1990), is an economically important lettuce (*Lactuca sativa* L.) disease in California coastal lettuce districts and in the muck-soil districts in eastern and Midwestern states and Florida. Susceptible cultivars develop yellow-green lesions on the taproot, which may cover the entire surface and become corky in texture. The taproot and infected secondary roots may become constricted below the crown and detach.

CR resistance was identified in a cos (romaine) lettuce from Turkey (PI 171669) (Dickson, 1963; Sequeira, 1970). Resistance is conferred by a single recessive (*cor cor*) (Brown and Michelmore, 1988) and is manifested in a range of phenotypes, from essentially white roots with no lesions to presence of some lesions (covering 20% to 40% of the root surface).

Two resistant cultivars, 'Green Lake' and 'Montello', were developed by L. Sequeira, Univ. of Wisconsin, Madison, and released in 1978. Additional cultivars, which incorporated the resistance from 'Green Lake' and 'Montello', were later developed for use in Florida. The eastern cultivars are too small for western lettuce production, so a program to incorporate CR resistance in a western type was started at this U.S. Dept. of Agriculture location in 1982. Two cultivars, 'Misty Day' and 'Glacier', and 16 breeding lines were developed.

Origin

Cultivars. 'Misty Day' and 'Glacier' were released in 1991, jointly with the California Agricultural Experiment Station. They were developed from across between 'Green Lake' and 'Salinas' (Fig. 1) to combine the CR resistance from 'Green Lake' with the size, color, and texture of 'Salinas'. 'Salinas' and 'Salinas'-derived cultivars occupy the bulk of California coastal district acreage. An F₁ population (83-6 17) was screened in the green-

house in 1983, and 351 selections; free or nearly free of CR symptoms, were made. A sample of 28 F₃ (84-680) families was grown in the field in 1984. Forty-two single-plant, CR-free selections were made from seven of these families. F₄ families from 10 of these were grown in a commercial lettuce field in 1986, and 26 single-plant selections were made in three of the families. All were grown as F₅ families in 1987. Sixty-three selections that were most similar to the 'Salinas' phenotype were made in eight of the families. All were considered homozygous CR resistant, based on extent of root lesions. Fifty-eight F₆ families were planted in Spring 1988; 42 selections were made in five of the families. Twenty-seven F₇ families were planted in Spring 1989; 56 selections were made in five of the families.

Commercial trials using eight F₇ mass lots bulked from the 1987 selections were grown

in 1988. Commercial trials using these lots and five F₆ mass lots bulked from the 1988 selections were then grown in 1989. The same 13 lines and five F₆ mass lots bulked from the 1989 selections were grown in 1990. A total of 21 trials was evaluated in the Salinas Valley and two in the Santa Maria Valley, Calif., during these 3 years. These materials have not been tested in other lettuce production areas. Two lines, 89-103M and 89-107M, were selected for release as 'Misty Day' and 'Glacier', respectively.

Breeding lines. Sixteen breeding populations related to 'Misty Day' and 'Glacier' were released in 1992. They are all descended from the same F₃ family (84-680) as the two cultivars. They consist of eight F₅ populations (87-87M, 87-89M, 87-93M, 87-94M, 87-95M, 87-102M, 87-105M, and 87-111M), five F₆ populations (88-52M, 88-67M, 88-68M, 88-97M, and 88-99M), and three F₇ populations (89-81M, 89-101M, and 89-106M). Their relationships to each other and to 'Misty Day' and 'Glacier' are shown in Fig. 1.

Description

'Misty Day' and 'Glacier' have dull, dark-green outer leaves that are slightly paler than those of 'Salinas'. Green color extends close to the core. Interior color is creamy-yellow, as in 'Salinas'. Seeds (achenes) are black. Heads are firm to hard at maturity, larger than 'Salinas' under moderate to severe CR stress, and the same size at lower stress. The top of the head is well covered to spiraled, more like 'Green Lake' than 'Salinas'. The butt and ribs

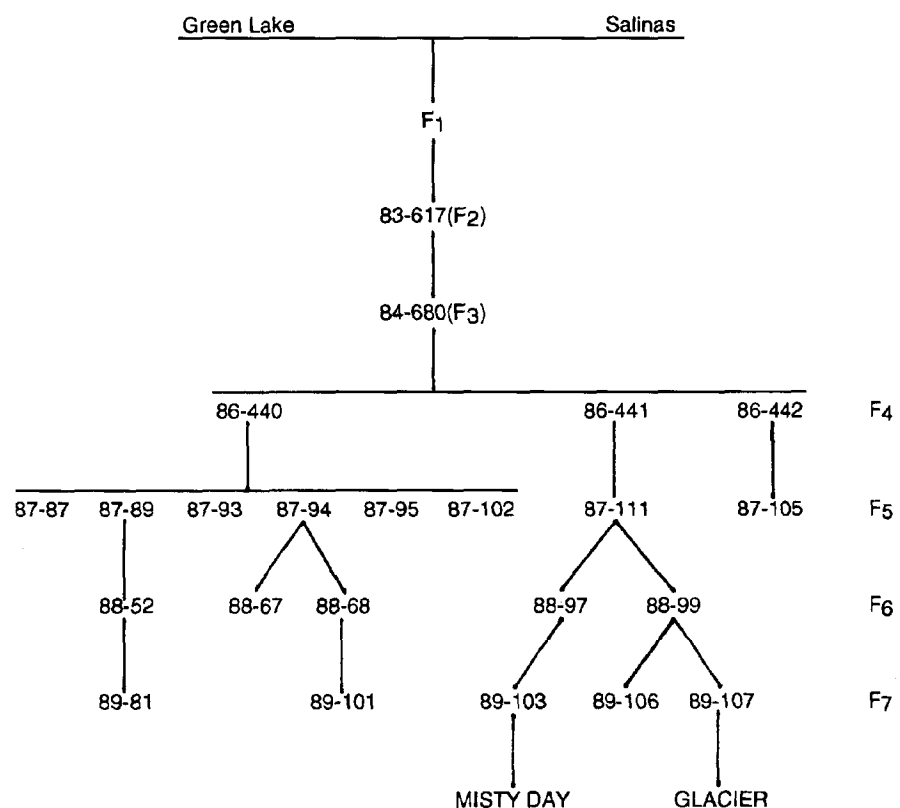


Fig. 1. Pedigree of 'Misty Day', 'Glacier', and lettuce breeding lines resistant to corky root.

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are usually flat, the core is usually ≈ 4 cm in diameter, and the bases of the leaves overlap well. Leaf margins are mildly undulate, moderately dentate, and strongly ruffled, resembling 'Green Lake'. Leaf texture is relatively soft; leaf surface is moderately crinkled or blistered; and outer leaves are broader than long. Both cultivars have a taller stem than 'Salinas' and maybe more susceptible to bolting induced by high temperature.

The breeding populations are morphologically similar to the cultivars. They vary primarily in leaf margin appearance, color, and texture and in extent of head cover.

Disease reactions

When 'Misty Day' and 'Glacier' are grown in CR-infested soil, root damage is slightly to considerably less severe than that observed on 'Salinas' and similar to or slightly more severe than that on 'Green Lake' (Fig. 2). When root damage is severe enough to restrict 'Salinas' head size and weight, these traits on the resistant cultivars are essentially unaffected.

'Misty Day' and 'Glacier' are susceptible to lettuce mosaic (LMV) and big vein (BV) viruses. They are resistant to Pathotype I of downy mildew (*Bremia lactucae* Regel), but susceptible to other current pathotypes in California. Reaction of 'Glacier' and 'Salinas' to mildew is similar, but that of 'Misty Day' is more severe. Neither cultivar is as resistant to tipburn as 'Salinas'. Reaction to other diseases, such as sclerotinia drop (*Sclerotinia*

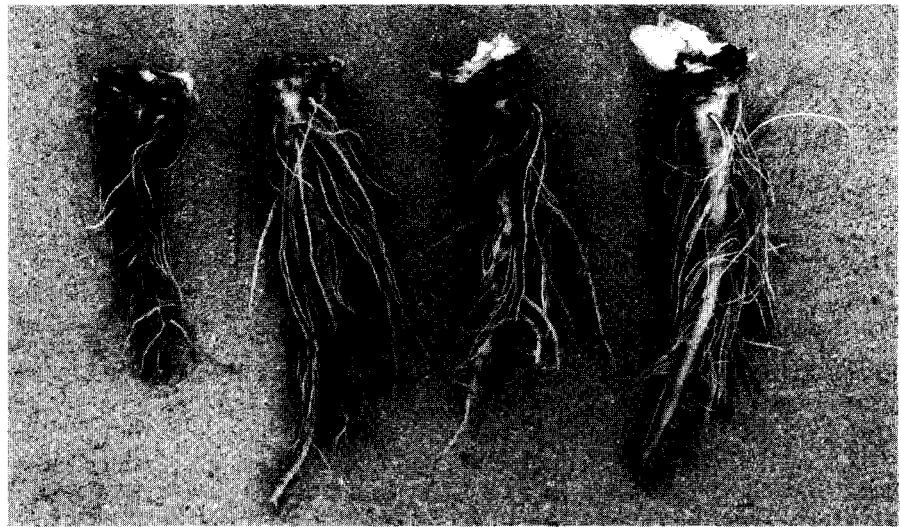


Fig. 2. Corky root reaction on roots of (left to right) 'Salinas', 84-680-2, 84-680-4, and 'Green Lake'. Reaction of 'Misty Day', 'Glacier', and released breeding lines are similar to 84-680-2 and 84-680-4.

minor Jagger), beet western yellows virus, and turnip mosaic virus, is not known.

All of the breeding populations are also CR resistant and LMV and BV susceptible.

Availability

Commercial quantities of 'Misty Day' and 'Glacier' seed are available from seed companies. Seed samples of the cultivars and of the breeding lines are also available from E.J.R.

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