



Spinach leaf on right heavily infected with downy mildew, Race 2. Leaf on left from plant immune to both races of mildew.

of the parent line to Race 1 was derived from the Iranian spinach, and 99×95 was found free also of infection by Race 2.

The 99×95 thus provided an immediate source of immunity in a commercial, rather than wild, spinach. It also raised the questions: 1, how many other U.S.D.A. breeding lines were immune to Race 2? 2, why should the immunity of 99×95 and Califlay differ, if both obtained their immunity from the same original Iranian spinach? 3, was the 99×95 immune only to Race 2? 4, if so, had Race 2 been present but undetected in the eastern United States? and 5, how was this immunity inherited?

Testing was begun on other U.S.D.A. breeding stocks. Seventy-six lines were tested and all were immune to both Races 1 and 2. A single dominant gene was discovered to be responsible for immunity to both races. Furthermore, it was found that Race 1 occurs throughout the United States, but Race 2 is in California only although it is probably in western Europe.

Evidently the original Iranian spinach possessed two different types of immunity—one for Race 1 only, and another for both races. Purely by accident, one type went into the U.S.D.A. varieties, and the other type into the Califlay variety. Until Race 2 appeared there was no way to distinguish between the two types of immunity.

Because of the presence of both mildew races and the probable spread of Race 2 into other spinach-growing areas of the United States, only U.S.D.A. spinach lines should be used in developing new varieties. This is particularly important in view of the increasing use of hybrid varieties.

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DOWNY MILDEW on SPINACH

A second race of fungus has been found on Califlay variety in the coastal valley area of California

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For many years downy mildew—blue mold—on spinach has caused serious losses to growers and processors wherever spinach is grown. In a search for resistance, two primitive weedy spinach strains from Iran were found to be completely immune to the disease.

Those two strains became the sources for the immune variety Califlay, and for the immune F₁—first generation—hybrids Dixie Market, Early Hybrid #7, and others.

These varieties remained completely free of infection in the field, even when older susceptible varieties were severely

infected. However, in the spring of 1958, mildew was observed on the Califlay variety in the coastal valleys of California, and by 1959 this variety was infected in all spinach-growing areas of the state. When the first infection was observed on Califlay, tests were made on seed stocks from a number of commercial sources, as well as on the original Califlay. It was clear that a new—second—physiological race of the mildew fungus had appeared.

A search was immediately started for new sources of resistance—or immunity. The first test included the U.S.D.A. hybrid parent line, 99×95. The immunity