

OCCURRENCE OF RESISTANCE TO VERTICILLIUM  
WILT IN WILD HELIANTHUS

By

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Seed of wild sunflower, mostly Helianthus annuus L., was collected<sup>1)</sup> at locations stretching from Saskatchewan and Manitoba in Canada to Texas in the southern United States. The collections were originally made because the plants showed resistance to rust. In the spring of 1967 the seeds were dehulled to promote germination and planted in rows in a field heavily infested with Verticillium dahliae Kleb. pathogenic to sunflower. On September 11, most sunflowers having finished flowering, the plants were scored for disease severity on a 0 - 10 scale (0 = healthy; 10 = dead). Table 1 records the results with the provinces or states of collection arranged according to latitude.

Table 1. Occurrence of resistance to Verticillium wilt in sunflower along with latitude and average summer temperature of province or state of collection.

Province or State	Parallel of Latitude	Mean Summer* Temperature (°F)	No. of Collections Tested	Total No. of Plants Tested	Mean Disease Score	%** Resistant Plants
Saskatchewan	49-51	60-70	4	102	5.73	20.6
Manitoba	49-51	60-70	2	54	5.62	20.4
North Dakota	46-49	60-70	2	49	4.55	34.7
Wyoming	41-45	60-70	1	19	4.79	31.6
South Dakota	43-46	70-80	2	56	2.66	55.4
Nebraska	40-43	70-80	1	19	3.37	52.6
Ohio	39-42	70-80	1	59	4.93	23.7
Colorado	37-41	70-80	3	97	2.69	59.8
Kansas	37-40	70-80	2	74	3.47	48.6
Oklahoma	35-27	70-80	3	64	3.00	57.8
Texas	26-35	80-90	1	7	3.71	42.9

\* Atlas of American Agriculture, 1916

\*\* Plants of 0-2 score with none or very mild symptoms.

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Resistance to *Verticillium* wilt occurred in all 22 collections, and % frequency of resistant plants varied from about 20% in Manitoba and Saskatchewan to about 60% in Colorado. All progenies seemed to segregate for resistance. Resistance is apparently widespread over the North American continent. Resistance was most frequent in an area comprising South Dakota, Nebraska, Colorado, Kansas, and Oklahoma, and varied in magnitude from 48.6 to 59.8%; this area might be called a "centre of resistance." Outside of this centre, resistance was less frequent and less pronounced. In Wyoming and North Dakota, states immediately bordering the centre, the frequency of resistance was, respectively, 31.6 and 34.7%; in more northerly Manitoba and Saskatchewan the frequency in each was about 20%. In distant Ohio east of the centre, the one collection of 59 plants showed a low frequency of 23.7%. In Texas, south of the centre, the one collection of seven plants had a frequency of resistance of 42.9%.

The results might be explained on the basis of selection pressure exerted by the pathogen under the influence of prevailing summer temperatures. It is assumed of course that wherever *Helianthus* occurs, pathogenic *V. dahliae* is prevalent also. No actual data supporting this assumption are available but circumstantial evidence makes it a likelihood. *V. dahliae* has a very wide host range invading numerous dicots including many weedy species. It occurs in virgin soil, is worldwide in distribution and is a serious pathogen wherever susceptible crops are grown. It is seedborne on sunflower and other hosts and inoculum is spread by windblown soil. It may be assumed to be ubiquitous.

Mean summer temperatures in the five states comprising the centre of resistance vary from 70-80°F, a range optimum for pathogenesis by *V. dahliae*. Selection pressure here would be most severe. Outside of the centre, the mean summer temperatures are 60-70°F and 80-90°F, ranges sub-optimum for pathogenesis and selection pressure here would be low. This hypothesis would explain the, respectively, high and low frequencies of resistance genes in the resistance centre and in the areas outside of it, except for Ohio. However, here only one collection was available for testing and it might not be representative of this state. The reason for the low frequency of resistant plants in Ohio might also be that selection pressure is logically lowered by the high rainfall. This is about twice as high here as in the other states with mean summer temperatures of 70-80°F. Adequate soil water would afford escape from disease by plants otherwise susceptible to *Verticillium*.

Appropriate crosses with cultivated sunflowers have been made in order to study the type and mode of inheritance of resistance.

This study indicates the ease with which resistance to *V. dahliae* can be found in wild sunflowers in North America.