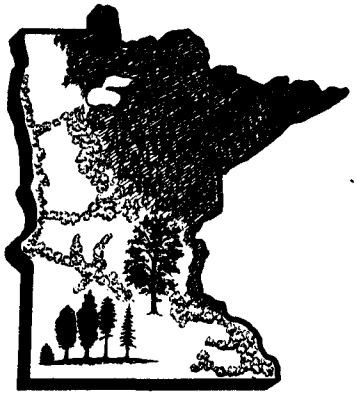

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TOXIN IN RELATION TO RESISTANCE TO DUTCH ELM DISEASE

Frank S. Santamour[1] and David W. French[2]

Several plant pathogens have been thought to produce a soluble toxin as the prime disease-causing factor. Luke and Wheeler (1955) and Wheeler and Luke (1955) have developed methods of assaying the toxin of Helminthosporium victoriae Meehan and Murphy and have used the toxin as a screening agent for the selection of oats resistant to the blight. It has been found by Zentmyer (1942) and others that Ceratocystis ulmi (Buism.) C. Moreau, the causal organism of Dutch elm disease, also produces a toxin in culture that is capable of inducing disease symptoms in susceptible elms. Therefore it seemed desirable to investigate some of the relationships of this toxin with susceptible and resistant elm species as a possible technique in mass-screening for resistance.

Isolates of the fungus from New Jersey and Wisconsin were grown for seven days in either still or shake cultures using liquid media described by Feldman, et al. (1950). The culture fluid was filtered through filter paper and used as such or after passing through fine (F) or ultra-fine (UF) fritted glass filters. Some lots were autoclaved as shown in the Table.

Toxin (100 percent) produced by both isolates completely wilted cuttings from 3-week-old seedlings of tomato (Sparks Earliana), the resistant Siberian elm (Ulmus pumila), and the susceptible American elm (Ulmus americana) when these cuttings were placed in the toxin solution for 24 hours.

Five freshly germinated seeds each of U. americana and U. pumila were placed in Petri dishes containing 5 ml. of each toxin preparation. Only seedlings with roots 5 mm. long were used. The effect of this treatment is shown in the Table.

1/ Graduate student, School of Forestry, University of Minnesota when work reported was done; now Geneticist, Northeastern Forest Experiment Station, Forest Service, Morris Arboretum, Philadelphia 18, Pennsylvania.
2/ Associate Professor, Department of Plant Pathology and Botany, University of Minnesota.

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Table

Mean growth[1] in length of roots grown in toxin 48 hours

Toxin		U. americana	U. pumila
Lot	Percent	mm	mm
UF-1	100	4.8	26.0
F-1	100	4.5	22.0
F-2	100	8.4	17.6
F-3	100	0.0	8.0*
F-3	50	2.0	8.0
F-3	10	4.6	7.6
F-3	1	5.8	10.2
F-3 autoclaved	100	0.0	3.4**
Raw autoclaved	100	7.6	16.5
Stationary culture	100	0.0	0.0
Water		5.8	4.8

[1] all figures are averages of 5 seedlings
* 3 were killed after some growth
** all killed after some growth

These results indicate that in general the various toxin filtrates produced in shake culture have a stimulating effect on root growth of the resistant U. pumila. The effect on the non-resistant U. americana is erratic. Toxin produced in stationary culture completely killed all seedlings of both species in 12 hours.

No toxin or concentration of toxin was found which would selectively kill susceptible species of elm. However, resistance to disease in plants is sometimes caused by a hypersensitive reaction of the host to the pathogen, which may either result in rapid death or increased growth and division of the cells in the area adjacent to the infection. In either case the advance of the pathogen may be effectively retarded. The auxin-like effect of the toxin on root growth in U. pumila suggests that the nature of resistance in this species may be a suppression of the pathogen. The possibility of using the factor of relative increase in root growth to distinguish between susceptible and resistant American elms is suggested as a course for further investigation. It should be pointed out though that the toxin present in the cultures may not be directly related to the toxin produced by the fungus in the host tree.

Note: The work here reported was done during the period December, 1956, to March, 1957. All experimental materials were autoclaved at the completion of each test.

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