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Vegetational Changes in Ungrazed Grassland at the Iowa Lakeside Laboratory.

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Sprays for Control of Sycamore Anthracnose[1]

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Sycamore anthracnose, *Gnomonia veneta,* (Sacc. & Speg.) Klebahn (4), prevalent in Iowa (1), belongs to a group of plant diseases with life cycle patterns which suggest the use of fungicidal sprays for their control. In early spring this disease appears as a blight on the young leaves soon after they emerge from the bud (Fig. 1). The blighted leaves become brown to black and frequently appear as if they had been injured by frost. Mature leaf infection characteristically produces elongate brown streaks along the midveins and laterals (Fig. 2), and many such infected leaves fall within two or three weeks. In addition to defoliation, sycamores undergo extensive twig blight. The death of terminal buds stimulates the development of numerous lateral branches which later may also be destroyed. This results in dead clusters of branches, "witches' broom", around a swollen terminal area (Fig. 3).

For years the standard recommendation for control of sycamore anthracnose has been three applications of Bordeaux mixture of sulfur. Recently some of the newer organic fungicides have been used. Carter (3) tested 22 organic fungicides from 1943 to 1947. He found phenylmercuri-triethanol ammonium lactate was most effective in preventing the disease, with three per cent of the leaves on sprayed trees and 60 per cent of those on unsprayed trees being infected. In 1948 Dimond and Potts (4) applied yellow cuprous oxide, ferric dimethyldithiocarbamate, copper naphthenate and phenylmercuri-triethanol ammonium lactate with a mist blower. Phenylmercuri-triethanol ammonium lactate gave the best control. Phytotoxicity was rated in decreasing order as follows: copper naphthenate, yellow cuprous oxide, phenylmercuri-triethanol ammonium lactate and ferric dimethyldithiocarbamate.

During the spring and summer of 1948, fifty counties in the state of Iowa were visited to determine the prevalence and severity of anthracnose diseases on common shade and forest trees. Sycamore anthracnose occurred on 97 per cent of the trees examined and the extent of defoliation ranged from slight to 95 per cent depending on local conditions of temperature and humidity. In the spring of 1949 and 1950, due to higher temperatures and lower humidities in

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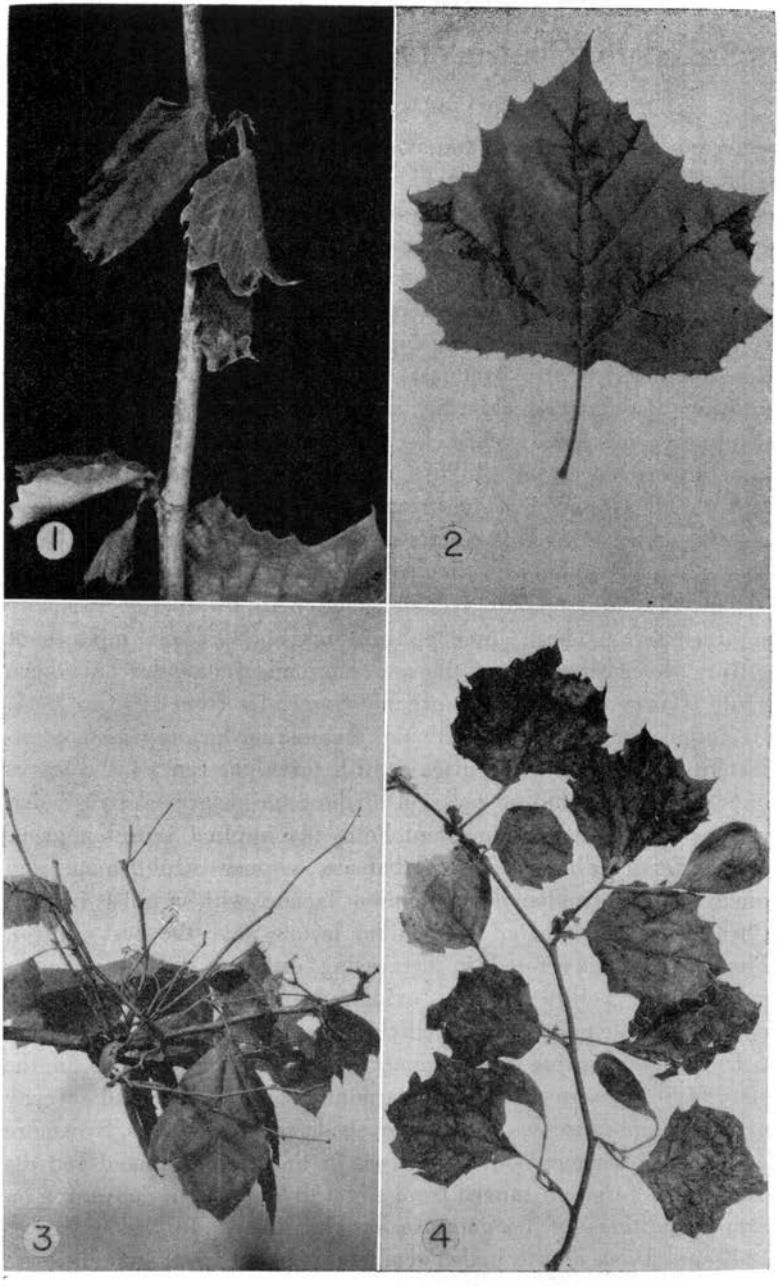

Figure 1. Sycamore blight on young leaves soon after they emerge from the bud.
Figure 2. Sycamore leaf with typical brown lesions extending along the veins.
Figure 3. "Witches'-broom" effect characteristic of sycamore anthracnose after the terminal branch had been killed.
Figure 4. Spray injury on sycamore caused by phenylmercuri-triethanol ammonium lactate.

April and May, the incidence and severity of the disease were much reduced.

In 1949 and 1950, sprays were applied to 187 trees 25 to 50 feet high on Polk Boulevard and to 155 trees 50 to 80 feet high on Thompson Avenue in Des Moines, Iowa. The chemicals were applied with hydraulic equipment, mounted on a truck, with a 400 gallon capacity and 600 pounds pressure at the spray gun. The amount of infection was determined by counting the number of infected leaves that could be seen from the ground. Infected leaves that were still green but had fallen were added to the total number of infected leaves per tree. The central three trees of the five in each treatment were counted on Polk Boulevard and the central two of four on Thompson Avenue. This was done to eliminate as much as possible the effect of spray drift between treatments.

On Polk Boulevard blocks of five trees per treatment in six replications were sprayed with the following materials at the rates indicated: tribasic copper sulfate (Tennessee Tribasic Copper Sulphate) 4 pounds per 100 gallons, Bordeaux mixture 4-4-50, ferric dimethyldithiocarbamate (Fermate) 1½ pounds per 100 gallons, 2,3-dichloro-1,4-naphthoquinone (Phygon) ¾ pound per 100 gallons and phenylmercuri-triethanol ammonium lactate (Puratized Agricultural Spray) 1 pint per 100 gallons. In 1949 spray applications were made on May 12 and 28 and records were taken on June 20 and 21. In 1950 spray applications were made on April 7, May 13, May 29 and June 16; records were taken one June 3, 8 and 20.

On Thompson Avenue a test of nine treatments of four trees per treatment in 4 replications was designed to determine what combinations of sprays corresponding to progressive stages of development of the new leaves are necessary to control sycamore anthracnose with phenylmercuri-triethanol ammonium lactate. Combinations of the following 4 sprays were used: (1) April 7, dormant spray; (2) May 13, broken bud spray; (3) May 27, young leaf spray; and (4) June 16, Mature leaf spray. Of the possible spray date combinations the following seven were chosen: spray No. 1; spray No. 2; sprays No. 1 and 2; sprays No. 2 and 4; sprays No. 2 and 3; sprays No. 1, 2 and 3; and sprays No. 1, 3 and 4. This experiment was carried out in 1949 and one treatment which had been sprayed three times in 1949 was set aside to measure carry-over value and designated as the carry-over check in 1950. The check was unsprayed in 1949 and 1950. Records were taken on June 3 and 20.

Phenylmercuri-triethanol ammonium lactate showed one undesirable characteristic in causing recognizable injury in 1949 and dis-

tinct damage in 1950 (Fig. 4). Injury was most severe on the smaller trees on Polk Boulevard but of little consequence on the larger trees on Thompson Avenue. This may be explained by the fact that the smaller trees received proportionately greater amounts of spray and with greater force since the foliage was nearer the nozzle. Due to this injury on Polk Boulevard, it was comparatively difficult to make accurate disease readings on trees sprayed with this chemical; hence they are not included in the 1950 analysis.

All of the materials used on Polk Boulevard in 1949 and 1950 decreased the prevalence of infection. The difference between the unsprayed checks and the various treatments was significant at the

Table 1.

Effectiveness of five fungicides in controlling sycamore anthracnose in 1949 and 1950.

Fungicides applied to trees	Mean number of infected leaves per tree	
	1949 (two applications)	1950 (four applications)
Bordeaux mixture	12.8	18.0
2, 3-dichloro-1, 4-naphthoquinone	15.2	35.0
Ferric dimethyldithiocarbamate	20.5	40.0
Phenylmercuri-triethanol ammonium lactate	22.4	43.9†
Tribasic copper sulfate	17.9	25.0
Check	51.2	118.0

Analysis of Variance — 1949

Sources of variation	Degrees of freedom	Mean square	F
Treatments	5	3,566.2	
Check vs. treatments	1	16,700	11.71*
Among treatments	4	283	
Error (check vs. treatments)	5	1,426.6	
Error among treatments			

Analysis of Variance —1950

Sources of variation	Degrees of freedom	Mean square	F
Treatments	5	88,987	
Check vs. treatment	1	340,587	8.12*
Among treatments	3	15,400	
Error (check vs. treatments)	4	41,954	
Error among treatments	15	13,108	

† On the basis of one reading.
* Indicates significance at the 5 percent level.

5 per cent level but differences between treatments were not significant (Table 1). In 1949 treatments in decreasing order of apparent effectiveness were: Bordeaux mixture, 2,3-dichloro-1,4-naphthoquinone, tribasic copper sulphate, ferric dimethyldithiocarbamate, and phenylmercuri-triethanol ammonium lactate. In 1950 the results were comparable except for a reversal between 2,3-dichloro-1,4-naphthoquinone and tribasic copper sulfate as shown in figure 5. These small differences may well have been due to experimental error, however, under the conditons of moderate natural infection which existed and on the basis of two years' results Bordeaux mixture seems a very satisfactory material for controlling sycamore anthracnose.

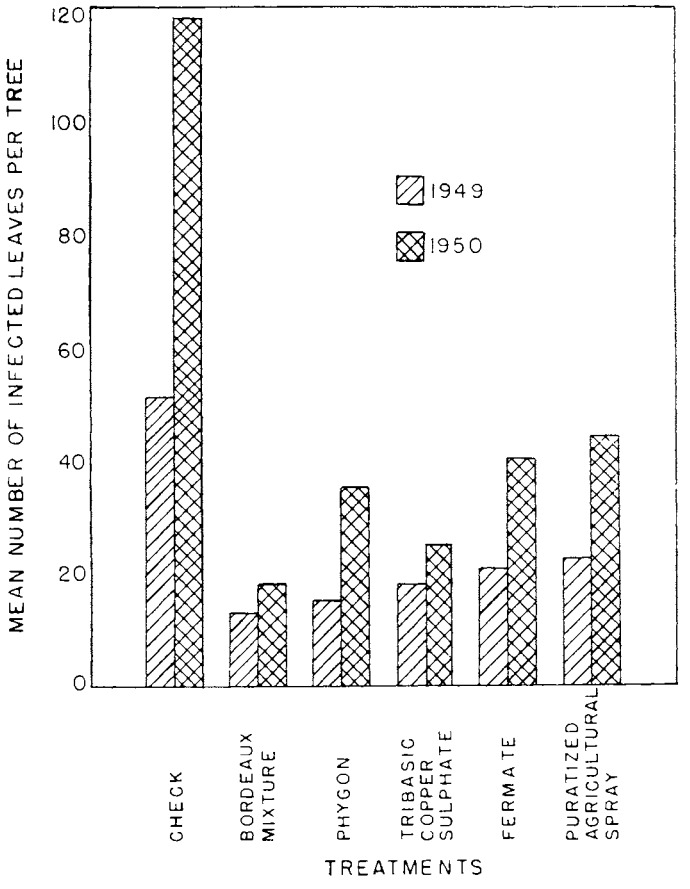

Figure 5. Effectiveness of five fungicides in controlling sycamore anthracnose in 1949 and 1950.

On Thompson Avenue the treatments do not appear significantly different by a standard analysis of variance test (Table 2). However, using a "t" test to compare the means of groups of treatments, the combination of sprays 1 and 2, and 1, 2 and 3 were significantly better than all other treatments at the 1 per cent level. This comparison is justified since a dormant spray with eradicant action to destroy the fungus spores on the dead twigs, followed with a protective spray on the young leaves as they emerge, would be expected to control the disease. Phenylmercuri-triethanol ammonium lactate has both of these properties and a combination of spray 1 and 2 had the geratest effect of all treatment combinations used (Fig. 6).

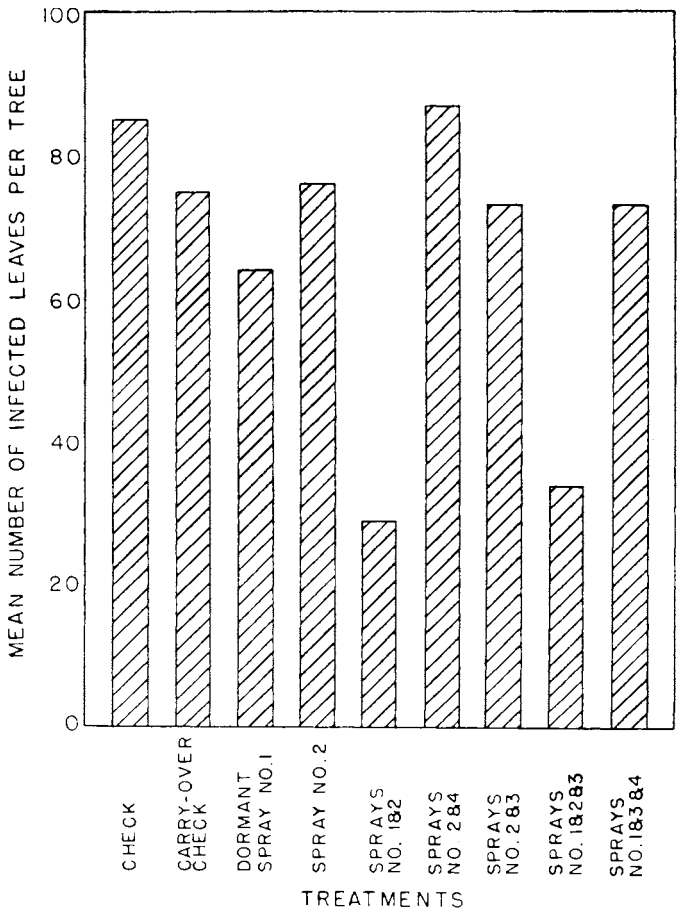

Figure 6. Effectiveness of various spray date combinations in controlling sycamore anthracnose in 1950 with phenylmercuri-triethanol ammonium lactate.

Table 2.

Effectiveness of various spray date combinations in controlling sycamore anthracnose in 1950 with phenylmercuri-triethanol ammonium lactate.

Spray date combinations*	Mean number of infected leaves per tree
Check	85
Carry-over check	75
Spray No. 1	64
Spray No. 2	76
Sprays No. 1 & 2	29
Sprays No. 2 & 4	87
Sprays No. 2 & 3	73
Sprays No. 1, 2 & 3	34
Sprays No. 1, 3 & 4	73

* Spray No. 1—dormant spray, applied April 7.
Spray No. 2—broken bud spray, applied May 13.
Spray No. 3—young leaf spray, applied May 27.
Spray No. 4—mature leaf spray, applied June 16.

Analysis of Variance

Sources of variation	Degrees of freedom	Mean square	F
Treatments	8	6,873	1.86[1]
Replication	3	11,079	
Error	24	3,693	

[1]Not significant.

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