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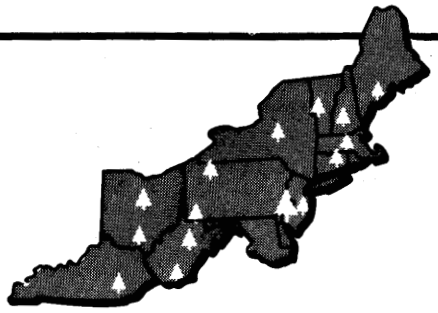


FOREST SERVICE, U.S. DEPT. OF AGRICULTURE, 6816 MARKET STREET, UPPER DARBY, PA. 19082

LABORATORY ASSAY OF CACODYLIC ACID AND ®META-SYSTOX-R[1, 2] ON SCOLYTUS MULTISTRIATUS AND PSEUDOPITYOPHTHORUS SP.[3]

Abstract. Cacodylic acid and Meta-Systox-R were applied to oak and elm bark beetle diets. Diets containing 900 to 1,000 ppm of cacodylic acid and diets containing 100 to 200 ppm of Meta-Systox-R killed both oak and elm bark beetles.

One problem still confronting investigators of oak wilt and Dutch elm disease is to control overland spread of the causal fungi. Control depends mostly on suppressing populations of the European elm bark beetle, *Scolytus multistriatus* (Marsham), and oak bark beetles, *Pseudopityophthorus* sp., vectors of the pathogens.

A herbicide, cacodylic acid (Silvisar 510®),[4] has shown promise as a systematic pesticide for the suppression of several species of bark beetles in the western United States. A systemic insecticide, Meta-Systox-R®,[5] is effective against many insect pests of ornamentals, but had not been tested against bark beetles.[6]

We needed to know whether these two pesticides are toxic to oak and elm bark beetles. The objective of our study was to determine whether cacodylic acid and Meta-Systox-R will kill elm and oak bark beetles when the pesticides are present in the insects' diets.

Methods and Materials

Test media.—The basic ingredient of the test media was ground phloem. Bole and limb sections (< 3 inches diameter) of black and scarlet oak (*Quercus velutina* and *Q. coccinea*) and American elm (*Ulmus americana*), 10 to 20 years old, were debarked with a drawknife. The fresh phloem strips were placed immediately in a drying oven at 122° F for 18 hours, then ground in a No. 3 Wiley mill using

[1]Mention of a particular product does not constitute an endorsement by the Forest Service or the United States Department of Agriculture.

[2]This paper reports research involving pesticides. It does not contain recommendations for their use nor does it imply that the uses discussed here have been registered. All uses of pesticides must be registered by appropriate state and/or federal agencies before they can be recommended.

[3]Coleoptera: Scolytidae.

[4]Trade name for a product of Ansul Company.

[5]Trade name for a product of Chemagro.

[6]Personal correspondence with Dr. Robert A. Fisher, field research representative, Chemagro.

a ½-mm mesh sieve. The ground phloem was stored at room temperature until used. The entire bark was macerated; no attempt was made to separate inner and outer bark.

The components of the oak bark beetle test medium were: 10 g of ground oak phloem, 2 g agar-agar dissolved in 50 ml of distilled water, 35 g alphacel to add non-nutritive bulk, and a sufficient quantity of the chemical being tested to provide the specified concentration. The mixture was thoroughly blended, then pressed to reduce the moisture content to approximately 45 percent. The elm diet was prepared in the same way, but because elm bark is bulkier, only 25 g of alphacel were used.

Beetles.—The adult beetles were obtained from naturally infested elm and oak bole and limb sections (3 to 5 inches in diameter) near Delaware, Ohio. One-foot bolts were cut and placed in cylindrical cages *(Rexrode 1969)* until natural emergence occurred. Only newly emerged beetles were used for the tests. Both sexes were used indiscriminately. Two species of oak bark beetles, *P. pruinosus* and *P. minutissimus*, were used for the tests, and no distinction was made between them.

Feeding cage.—The caging apparatus (fig. 1) was a glass tube, 10 mm in outside diameter by 75 mm in length. The medium was packed loosely into the glass tube. Then a glass rod, 5 mm in diameter and 58 mm in length, was pushed into the center of the glass tube, compressing the medium against the tube walls. This restricted the beetles to the outer edge of the tube for easy and accurate observations. Five adult beetles were placed in each end of each tube. The cage was capped at the ends by size 0 corks covered with aluminum foil to prevent the beetles from feeding on the corks. The tubes containing the diet and beetles were stored in a horizontal position in a darkened constant-temperature cabinet at 26° C and approximately 50 percent relative humidity.

Six concentrations of cacodylic acid, ranging from 900 to 21,000 ppm, and 12 concentrations of Meta-Systox-R, ranging from 100 to 21,000 ppm, were tested on oak bark beetles. Similarly, six concentrations of cacodylic acid, ranging from 1,000 to 28,000 ppm, and 12 concentrations of Meta-Systox-R, ranging from 200 to 28,000 ppm, were tested on elm bark beetles.

Each test was replicated three times, with 10 adult beetles per replicate. There were two sets (10 beetles each) of checks for each series of tests. Observations and mortality counts were recorded daily and continued until all the beetles had succumbed.

Results and Discussion

Cacodylic acid and Meta-Systox-R are toxic to oak and elm bark beetles when the pesticides are present in the beetles' diets (figs. 2 to 5). The data indicated that both chemicals are more toxic to oak bark beetles than to

Figure 1.—Bark beetle feeding apparatus: (a) cork with aluminum foil; (b) glass tube; (c) glass rod; (d) medium.

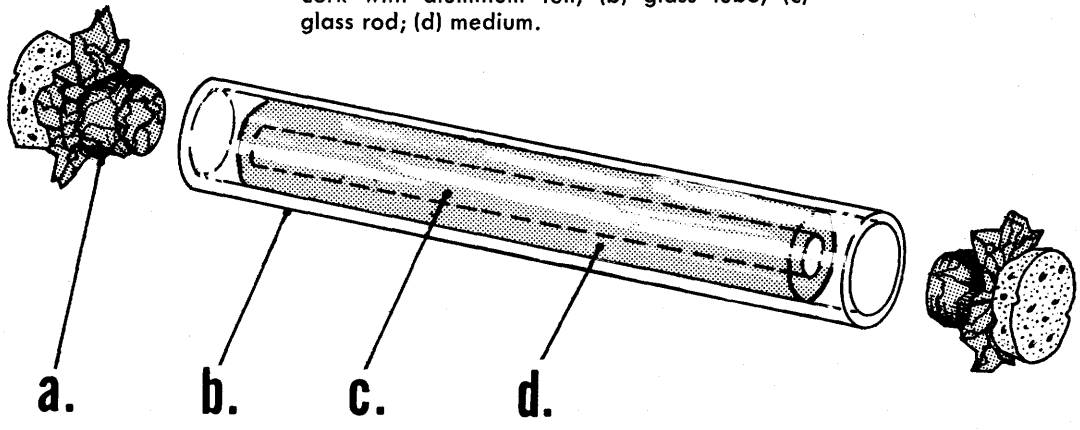


Figure 2.—The effect of cacodylic acid on oak bark beetles, *Pseudopityophthorus* sp.

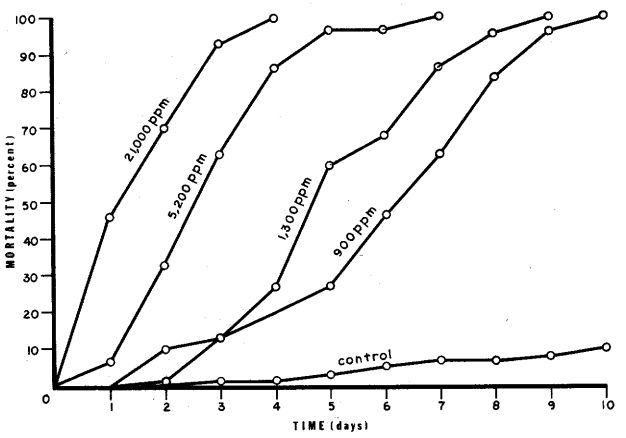


Figure 3.—The effect of cacodylic acid on elm bark beetles, *Scolytus multistriatus*.

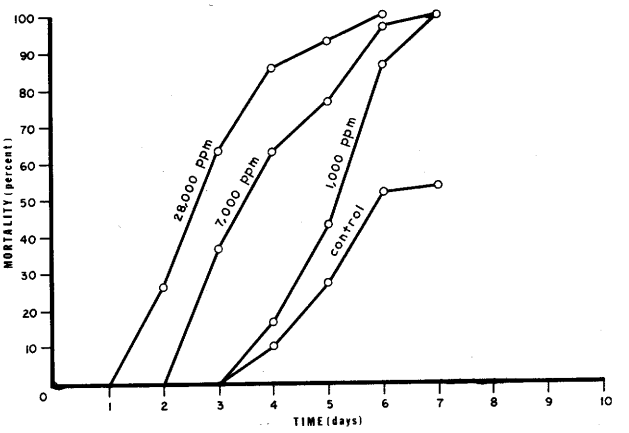


Figure 4.—The effect of Meta-Systox-R on oak bark beetles, *Pseudopityophthorus* sp.

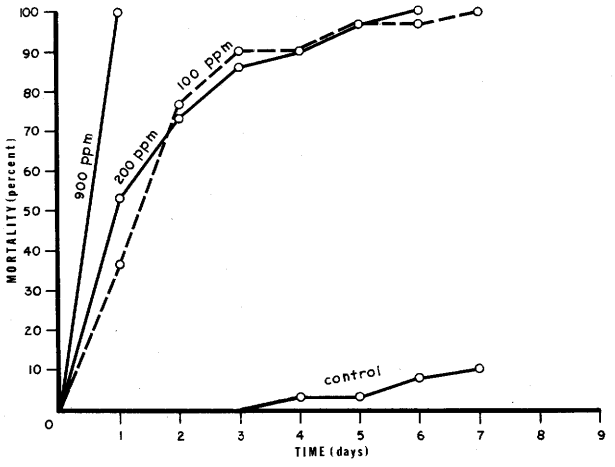
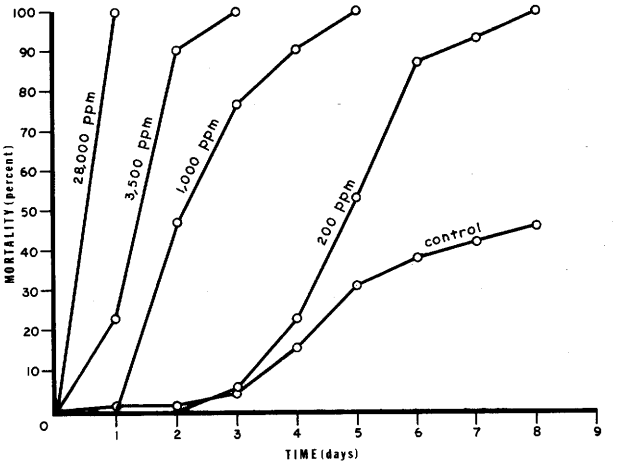


Figure 5.—The effect of Meta-Systox-R on elm bark beetles, *Scolytus multistriatus*.



elm bark beetles. However, oak bark beetles constructed egg galleries at a faster rate than elm bark beetles, so their rate of ingestion was greater.

Diets containing 900 to 1,000 ppm of cacodylic acid were effective in killing both oak and elm bark beetles (figs. 2 and 3). Diets containing 100 to 200 ppm of Meta-Systox-R were also effective in killing both kinds of beetles (figs. 4 and 5).

Egg gallery construction by both types of beetles was slower on the media containing the chemicals than on the control diets.

References

Buffam, P. E.
1971. SPRUCE BEETLE SUPPRESSION IN TRAP TREES TREATED WITH CACODYLIC ACID. J. Econ. Entomol. 64: 958-60.

Buffam, P. E., and H. W. Flake.
1971. ROUNDHEADED PINE BEETLE MORTALITY IN CACODYLIC ACID-TREATED TREES. J. Econ. Entomol. 64: 969-70.

Chansler, J. F., and D. A. Pierce.
1966. BARK BEETLE MORTALITY IN TREES INJECTED WITH CACODYLIC ACID (HERBICIDE). J. Econ. Entomol. 59: 1357-9.

Chansler, J. F., D. B. Cahill, and R. E. Stevens.
1970. CACODYLIC ACID FIELD TESTED FOR CONTROL OF MOUNTAIN PINE BEETLES IN PONDEROSA PINE. USDA Forest Serv. Res. Note RM-161. 3 p.

Chemagro.
1972. PRODUCTS GUIDE. Kalamazoo, Michigan. 219 p.

Copony, J. A., and C. L. Morris.
1972. SOUTHERN PINE BEETLE SUPPRESSION WITH FRONTALURE AND CACODYLIC ACID TREATMENTS. J. Econ. Entomol. 65: 754-7.

Frye, R. H., and N. D. Wygant.
1971. SPRUCE BEETLE MORTALITY IN CACODYLIC ACID-TREATED ENGELMANN SPRUCE TRAP TREES. J. Econ. Entomol. 64: 911-6.

McGhehey, J. H., and W. P. Nagel.
1967. BARK BEETLE MORTALITY IN PRECOMMERCIAL HERBICIDE THINNINGS OF WESTERN HEMLOCK. J. Econ. Entomol. 60: 1572-4.

Newton, N., and H. A. Holt.
1971. SCOLYTID AND BUPRESTID MORTALITY IN PONDEROSA PINES INJECTED WITH ORGANIC ARSENICALS. J. Econ. Entomol. 64: 952-8.

Rexrode, C. O.
1969. POPULATION INCREASE OF TWO SPECIES OF PSEUDOPITYOPHTHORUS IN OAK BRANCHES. Ann. Entomol. Soc. Amer. 62: 448-9.

Stelzer, M. J.
1970. MORTALITY OF *Ips lecontei* ATTRACTED TO PONDEROSA PINE TREES KILLED WITH CACODYLIC ACID. J. Econ. Entomol. 63: 956-9.

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