BULLETIN 565
FEBRUARY 1953

# Boxwood Pests

# and their Control

By JOHN C. SCHREAD

THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION
NEW HAVEN, CONNECTICUT

# Boxwood Pests and Their Control

**John C. Schread**[1]

Connecticut is apparently close to the northern limit of the range for successful growth of boxwoods. However, boxwoods are highly prized here as ornamental shrubs in many cemeteries and around private homes. The most serious pests in this area are the boxwood leaf miner, the psyllid, and at least two species of mites. These disfigure the foliage, and occasionally may kill entire branches. This bulletin has been prepared to present the results of observations on the biology of these pests, and to summarize experiments designed to control them.

The materials formerly suggested for control of pests of boxwood left much to be desired. During the last nine years many new and effective insecticides and acaracides have been introduced. Consequently, in our experiments several of these new materials were compared with those suggested for use on boxwoods in the past.

A portable Potts-Spencer mist blower (2) was used to apply the sprays. This apparatus was very effective in covering the surface of boxwood foliage.

The tests were made on boxwood growing in cemeteries, and as ornamental shrubs around homes. The size of the plants varied from 18 inches to almost six feet in height. Some were in hedges and others were large specimen plants. The quantity of spray was adjusted to the size of the plants. Large specimen plants required about two gallons of spray for good coverage. All sprays were applied on clear days in an effort to avoid loss of spray residue by rain.

Not all plantings of boxwood were infested by all the pests under study. However, most had at least two of the three pests.

## BOXWOOD LEAF MINER (*Monarthropolpus buxi* Lab.)

### Biology and Habits

The boxwood leaf miner has only one generation a year. It may attack all varieties of boxwood growing in Connecticut, but the tree boxwood, *B. sempervirens* var. *arborescens,* has been most seriously damaged.

[1] Entomologist, The Connecticut Agricultural Experiment Station.

Injury by the miner is noticeable in early summer, when small irregular pin-point blotches, light gray in color, appear on the leaves. These blotches indicate the presence of eggs, and are usually more conspicuous on the under surface of the leaves.

After the eggs hatch, the feeding of the miners increases the size of the blotches. By late summer the blotches look more like blisters on the under surface of the foliage. However, they can be seen through the upper epidermis of the leaves. The small yellowish maggots are found in the blisters, and remain there over the winter. The length of blisters varies from 1.5 to 2.5 mm.

In the spring the maggots resume feeding and the blisters are enlarged. On badly infested leaves, the blisters open into one another and the larvae intermingle. Some cannibalism may develop, for all of the original inhabitants of a heavily infested leaf do not mature. However, as many as 17 living pupae have been found in a single infested leaf (Figure 1).

Transformation to the orange colored pupal stage occurs in late April or early May. In preparation for emergence of the adults, the pupae work their way half through the under surface of the leaf. The adult midges are delicate orange-yellow flies, about 1/10 of an inch long. In 1951, the first adults emerged May 13 in New Haven and on May 31 there were living pupae in infested leaves.

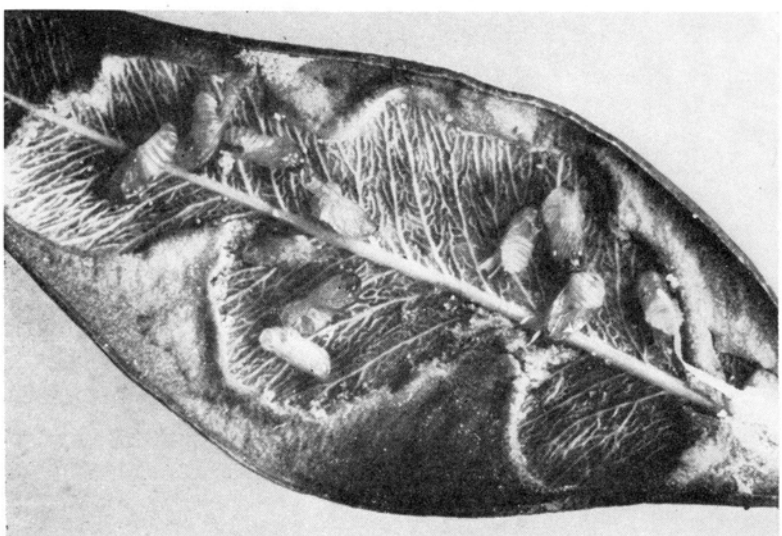

**Figure 1. Pupae of boxwood leaf miner on boxwood leaf. Surface of leaf removed to expose them.**

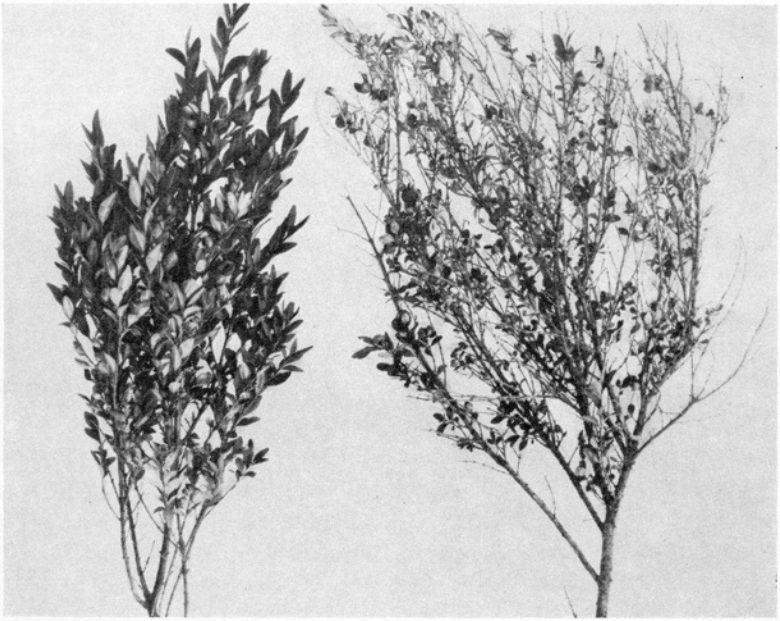

**Figure 2. Left, uninfested boxwood foliage. Right, foliage badly infested with boxwood leaf miner.**

Badly infested leaves are stunted and turn gray or yellowish brown (Figure 2). They frequently drop from the plant prematurely.

Eggs are deposited almost exclusively on new foliage. Even mildly infested leaves of the previous year are seldom attacked.

## Control

Hamilton (1) developed a method of controlling the boxwood leaf miner by applications of nicotine sulfate and molasses in sprays. The first treatment was made as soon as the adult midges started to emerge, and additional sprays were applied once a week (or after every rain) as long as adults were emerging. This treatment was effective but did require several applications.

If the larvae or pupae could be killed in the mines, as demonstrated for the birch leaf miner (4), one application should be sufficient to control this pest. The first material tested for this purpose was DDT, which was applied to cut branches in the laboratory and to whole plants in the field. In neither case did the highest dosage used, 1-800, kill the larvae or pupae. Adults emerged from all the treated branches. However, great numbers of paralyzed adults accumulated under the branches sprayed with

DDT at 1-800 and 1-1600. Those emerging from the branches treated with DDT were affected and paralyzed, but not until they had flown several feet. Adults from unsprayed twigs appeared to be normal in survival.

The DDT treatment to plants in the field was not effective in killing larvae or pupae. Consequently, additional tests were made using lindane, chlordane and aldrin. Tests were made on the overwintering larvae, and on the summer generation as well. The tests can be discussed best according to the materials used.

*Lindane* was applied to overwintering larvae in emulsion form on May 14. Examination of leaves on May 24 showed that no larvae or pupae had survived the 1-800 dilution. One pupa had survived the 1-1600 treatment.

Plants in another location treated on May 23 were examined in the fall. At a dilution of 1-1600, only two living larvae were found in two leaves out of the 77 examined. At a dilution of 1-3200, 13 leaves had 15 living larvae in the 88 leaves examined. Untreated plants had 120 living larvae in 20 leaves.

The summer generation of larvae was treated June 15 and July 3, with the results in Tables 1 and 2. The first treatment reduced the infestation, especially at the 1-800 concentration. The second treatment resulted in much more complete control at 1-800 and 1-1600 concentrations. The two treatments were necessary because lindane did not kill the eggs.

It is obvious that lindane was highly effective in killing boxwood leaf miner larvae and pupae. One treatment of overwintering larvae was sufficient to protect isolated plants throughout the season.

**TABLE 1. RESULTS OF LINDANE SPRAY APPLIED JUNE 15. COUNTS MADE ON JULY 1.**

| Concentration | No. leaves not infested | No. leaves infested | Total no. larvae |
|---|---|---|---|
| 1-800 | 41 | 9 | 122 |
| 1-1600 | 18 | 13 | 420 |
| 1-3200 | 5 | 22 | 546 |
| None | 0 | 25 | 584 |

**TABLE 2. RESULTS OF LINDANE SPRAYS APPLIED JUNE 15 AND JULY 3. COUNTS MADE ON JULY 24.**

| Concentration | Number larvae in six leaves | |
|---|---|---|
| | Alive | Dead |
| 1-800 | 0 | 36 |
| 1-1600 | 0 | 40 |
| 1-3200 | 3 | 31 |
| None | 19 | 0 |

*Aldrin, chlordane and dieldrin* were applied to the first generation on May 15, and to the same plants on June 15 and July 5. The results have been summarized in Tables 3, 4 and 5. In addition to these counts, examination of plants while adults were emerging showed that large numbers were dead on twigs of treated plants. However, many survived to reinfest the plants. In all cases, sprayed plants had a much smaller number of the summer generation larvae than unsprayed checks.

At the end of the test, there were no living larvae following three treatments with aldrin at 1-1000, or dieldrin at 1-1350.

*DDT* did not kill larvae or pupae, but did kill the emerging adults. Plants, sprayed on May 23 at 1-1600 and 1-3200 were reinfested very lightly in the fall. There were only seven living leaf miners in 163 leaves from sprayed plants. Twenty unsprayed leaves had 120 living larvae.

**TABLE 3. RESULTS OF SPRAYS APPLIED MAY 15.**
**COUNTS MADE ON MAY 25 AND JUNE 4 FROM SIX LEAVES.**

| Material | Concentration | No. exit holes | No. larvae and pupae | | No. eggs and larvae |
|---|---|---|---|---|---|
| | | | Alive | Dead | |
| Aldrin | 1-1000 | 39 | 13 | 5 | 18 |
| | 1-2000 | 6 | 6 | 1 | 10 |
| | 1-4000 | 25 | 14 | 0 | 18 |
| Chlordane | 1-400 | 28 | 28 | 3 | 24 |
| | 1-800 | 34 | 16 | 4 | 24 |
| | 1-1600 | 27 | 9 | 0 | 18 |
| Dieldrin | 1-1350 | 19 | 31 | 0 | 0 |
| | 1-2700 | 24 | 2 | 16 | 10 |
| None | None | 7 | 11 | 0 | 170 |

**TABLE 4. RESULTS OF SPRAYS APPLIED MAY 15 AND JUNE 15.**
**COUNTS MADE ON JULY 1.**

| Material | Concentration | No. of leaves | | No. larvae |
|---|---|---|---|---|
| | | Uninfested | Infested | |
| Aldrin | 1-1000 | 36 | 24 | 45 |
| | 1-2000 | 34 | 24 | 44 |
| | 1-4000 | 12 | 32 | 83 |
| Chlordane | 1-400 | 55 | 8 | 15 |
| | 1-800 | 44 | 8 | 15 |
| | 1-1600 | 0 | 35 | 170 |
| Dieldrin | 1-1350 | 56 | 5 | 7 |
| | 1-2700 | 60 | 2 | 3 |
| None | None | 0 | 25 | 584 |

TABLE 5. RESULTS OF SPRAYS APPLIED MAY 15, JUNE 15 AND JULY 3. COUNTS MADE ON JULY 24 FROM SIX LEAVES.

| Material | Concentration | No. of larvae | |
|---|---|---|---|
| | | Alive | Dead |
| Aldrin | 1-1000 | 0 | 14 |
| | 1-2000 | 11 | 11 |
| | 1-4000 | 15 | 10 |
| Chlordane | 1-400 | 4 | 4 |
| | 1-800 | 6 | 10 |
| | 1-1600 | 21 | 6 |
| Dieldrin | 1-1350 | 0 | 24 |
| | 1-2700 | 4 | 5 |
| None | None | 19 | 0 |

## THE BOXWOOD PSYLLID (*Psylla buxi* L.)

### Biology

The boxwood psyllid is a sucking insect related to aphids, scale insects and mealy bugs. The adult psyllid is grayish-green in color and about 1/8 of an inch long. The nymphs are wingless and covered with a white waxy secretion.

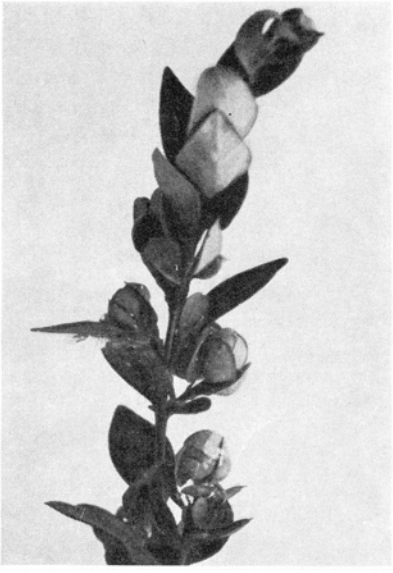

**Figure 3. Damage by boxwood psyllid; cupping of the leaves is a characteristic symptom. Adult psyllids can be seen on the plant.**

This insect has only one generation a year. It overwinters as a first-instar nymph protected by the outer scales at the base of boxwood buds. Examination showed that the terminal buds were much more commonly infested than lateral buds. Adults begin to appear in May, and become more abundant as the season advances. The eggs are laid in the base of the buds.

As the buds develop in the spring, the nymphs infest the terminal leaves. The feeding punctures cause the leaves to curl and form a sort of cup in which the nymphs are concealed. Cupping is especially noticeable when the plants are growing rapidly (Figure 3).

## Control

Hamilton (4) found that the nicotine sulfate-molasses spray applied to control the leaf miner also controlled psyllids. He suggested thorough spraying with nicotine sulfate and soap if the pest was abundant.

The experimental sprays included the materials tested for control of the leaf miner, with nicotine sulfate as a standard of comparison.

*Evaluation of Results.* When psyllid nymphs were killed, they lost their grip on the foliage and fell from the plant. Early in the season this was no particular disadvantage, because the population remaining on sprayed and unsprayed plants could be compared. The adults, however, are too active and too difficult to find on foliage to be counted in this same way. Consequently, a system of counting adults was developed. It was found that these adults could be shaken from the plants and collected on a piece of bristol board for counting. If this was done on cool, cloudy days, or in the early morning or late evening hours, the adults moved slowly enough to permit counting.

## Results of Tests

*DDT* applied May 10 to nymphs failed to kill nymphs that were present at the time. A second test made in a different location gave similar results.

Counts of adults present on July 18 on plants sprayed with DDT on May 10 showed that there was an average of 32 on treated and 682 on untreated plants. The DDT was used at 1-800, 1-1600 and 1-3200. When two applications were made (May 10 and July 21), there were no psyllids on the plants sprayed with DDT at 1-800 and 1-1600 when results were checked on September 10. There were only two psyllids on those sprayed with DDT at 1-3200, while the untreated plants had 300 adults.

Plants sprayed with DDT on May 14 and July 21 were almost free of psyllids in the fall. Those sprayed only once on May 14 were, however, heavily infested.

*Lindane* was applied to two different lots of plants on May 19 and May 24. Lindane at 1-800 and 1-1600 killed all of the nymphs. When it was diluted to 1-3200, some nymphs survived.

When lindane was applied twice, on May 14 and June 1, there was no infestation on June 18. By July 18, infestation was very light on plants sprayed at 1-800 and 1-1600, and 53 adults were found following 1-3200 treatment. Untreated plants had 682 adults.

When there were three sprays with lindane, May 14, June 1 and July 21, there was no infestation on September 10.

*Nicotine sulfate* at 1-600 killed about two-thirds of the nymphs when a single treatment was made on May 19. A second application on June 1 killed all the nymphs that were present, but a few adults came in during July. A third treatment July 24 controlled these.

*Aldrin, chlordane and dieldrin* were applied to infested plants on May 15. By May 24 aldrin at 1-1000, 1-2000 and 1-4000 had killed practically all of the nymphs. Chlordane at 1-400 was equally effective, but some living nymphs were found following 1-800 and 1-1600 dilutions. Dieldrin was effective at 1-1350, and 1-5400, but a few nymphs survived at 1-2700.

These plants were sprayed again on June 15 and July 12. When they were examined on July 31, all but one plot showed no infestation. The plant sprayed with dieldrin at 1-2700 had 6 adults, the untreated plant 750 adults.

It seemed obvious that aldrin was an effective spray for nymphs, but that all three materials worked if applied frequently.

## MITES

### (*Tetranychus bimaculatus* Harvey
### Simplinychus (*Neotetranychus*) buxi Garman)

### Biology

Ornamental boxwoods are susceptible to injury by these mites, especially in dry seasons. The mites are very small and difficult to see with the naked eye. The adult red spider mites vary in color from pale yellow with conspicuous darker spots to purplish red. The eggs are white or

translucent. Boxwood mites vary from green to yellowish brown, and the eggs are lemon yellow.

Mites feed by sucking the sap from the leaves. They may inject a toxic substance in the course of feeding. When mites are abundant, the feeding causes a silver-like appearance of the foliage, and some webbing is noticeable. Later the foliage turns yellow and may drop from the plant prematurely.

## Control

A number of materials have been used to control mites on boxwoods. Sulfur dusts or sprays have given good results. Ries (3) used nicotine, rotenone, selenium, lauryl thiocyanate and pyrethrum with good to excellent results.

The new materials introduced for control of mites were of special interest because they showed promise of better control than the sprays usually used. The one chosen for tests on boxwood was chlorophenyl-chlorobenzene sulfonate. This material was applied to plants previously treated with DDT and lindane for control of leaf miners. Before spraying, about 92 per cent of the leaves were infested by mites or eggs. The average number of eggs was three to the leaf. Adult mites occurred on one out of three leaves. The spray was applied at a dilution of 1-1600 on July 21. On August 3, treated leaves had no mites, and an average of only one egg on eight leaves. Untreated leaves averaged about 70 eggs, and about 14 mites per leaf. On September 10, there were no mites and only one egg on 600 leaves taken from treated plants. Untreated leaves had about seven eggs and three mites per leaf.

Obviously chlorophenyl-chlorobenzene sulfonate controlled the mites very effectively. It not only killed the mites but the eggs as well, thus stopping the infestation.

## SUMMARY

Lindane killed over-wintering larvae and pupae of the boxwood leaf miner. DDT did not kill the larvae, but its residues killed young adults, and prevented further infestation.

Aldrin, chlordane and dieldrin were not very effective in killing leaf miner larvae. Repeated treatments did kill the adults.

Lindane applied twice gave excellent control of boxwood psyllids. Nicotine sulfate was also very effective, but three applications were required.

Aldrin, chlordane and dieldrin were not consistently effective in killing psyllid nymphs.

All materials used killed psyllid adults.

Chlorophenyl-chlorobenzene sulfonate gave excellent control of boxwood mites.

## SUGGESTIONS FOR CONTROL

DDT (25% emulsion) at the rate of one pint in 100 gallons of water, applied late in May, should kill adult leaf miners and prevent reinfestation of the plants.

Lindane (25% emulsion) applied not later than May 15, at the rate of one pint in 100 gallons of water, should kill leaf miner larvae of the over-wintering type and prevent reinfestation.

Psyllids may be controlled by the lindane treatment suggested for leaf miners.

Mites may be controlled by an application of chlorophenyl-chlorobenzene sulfonate (50% wettable powder) at the rate of one pound in 100 gallons of water.

## LITERATURE CITED


1. Hamilton, C. C. Insect pests of boxwood. N. J. Agr. Exp. Sta. Circ. 179. 1926.

2. Potts, S. F., and R. A. Spencer. A small portable blower for applying concentrated sprays. U.S.D.A., B.E.P.Q., ET-234. 1947.

3. Ries, D. T. A new mite (*Neotetranychus buxi*, n.s. Garman) on boxwood. Jour. Econ. Ent. 28:55-62. 1935.

4. Schread, J. C. Birch leaf miner control. Conn. Agr. Exp. Sta. Circ. 182. 1952.