An appalling picture, to lovers of boxwood. This is one of several 10 x 10 plots in a Northern Virginia nursery with boxwood in various stages of decline. They are being studied and recorded as part of the A.B.S. — V.P.I. & S.U. Research on Causes of Boxwood Decline.
Edited Under The Direction Of
THE AMERICAN BOXWOOD SOCIETY
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RESEARCH PROGRAM ON BOXWOOD DECLINE BEGINS

Above: George Montgomery, V.P.I. graduate student, collecting root samples from diseased English boxwood for laboratory analysis.

Our A.B.S. President says:

Please send contributions for this vital research program, which may eventually be the means of saving a great deal of our cherished boxwood, not only in Virginia but all over the country. Disease in plants as in humans is not stopped by state lines.

The American Boxwood Society has pledged its support for two years of the Program; and our share of the first year's cost has about wiped out the balance in the A.B.S. savings account, which has been built up over more than ten years. We now need another $5,000 for the second year's cost.

Please make your checks out to The American Boxwood Society (Research fund) and mail to our Secretary-Treasurer, Mrs. Andrew Kirby, Box 85, Boyce, Va., 22620.

Neill Phillips

Contributors to the Boxwood Research Program to date:

Mrs. Ruth Donovan
Mr. Robert Plott
Mr. & Mrs. D. Goodrich Gamble
Boxwood Study Group, Missouri Botanical Garden
James J. O. Anderson
“Anonymous”
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If any donor wishes to make a gift in memory of anyone, or in honor of a living person, the name of that person will also appear.

As previously announced, the amount of the gift will not be published, but a receipt will be sent for income tax return purposes, since gifts to or for the use of A.B.S. are tax-deductible.
The Status of Boxwood Decline
In Virginia

Wirt H. Wills & R. C. Lambe*

The American Boxwood Society is supporting a research project at Virginia Polytechnic Institute and State University aimed at determining the cause of boxwood decline, a condition which has assumed heretofore unequalled importance in plantings of English boxwood in northern Virginia and perhaps in other places. Boxwood decline has been recognized in the Washington, D. C. area since at least 1933, but the etiology or cause of the disease has remained obscure despite sporadic efforts to define the problem. In light of recent observations by the authors, the brief report by Andrus in 1933 appears to contain the most significant early observations pertinent to the present situation. Andrus reported that the fungus Verticillium buxi (Link) Sacc., which he regarded as a growth form of Volutella buxi (Corda) Berk., was "deeply systemic" in numerous older plants of both English and American box, and was "the immediate cause of wilting and death of numerous individual branches, sectors of plants and occasionally whole plants." He isolated Verticillium from roots as well as stems. Furthermore, he suggested that certain environmental conditions rendered the plants susceptible, a view which has prevailed to the present. Andrus also isolated the fungus, Phytophthora parasitica Dastur, the cause of Phytophthora root rot, from a dead English box plant and considered it to be an important primary pathogen in the decline and death of box.

No significant research was reported in the ensuing years until in the late 1950s, Haasis (6) found P. parasitica on boxwood in North Carolina consistently associated with diseased plants of both the English and American types. Bell and Haasis (2) then published an extensive research study of the fungus P. parasitica and established its role as a destructive root pathogen. This fungus has been isolated from diseased box plants sent in to VPI & SU from several locations in Virginia, primarily from the southern and eastern parts of the state but also from Lexington.

Meanwhile, the status of Verticillium and/or Volutella had been under investigation from a taxonomic position. Dodge and Swift (5) in 1934 believed that Vert. buxi and Vol. buzi were stages of the same fungus since spores from each, developed into colonies of both organisms, but Dodge (4) in 1944 questioned his own earlier conclusions and decided that Vol. buzi, the more pathogenic fungus, produced several spore types in its development and could be misidentified, depending on when it was observed. He concluded that Vert. buxi was only weakly pathogenic. When Verticillium spores were sprayed on leaves only Verticillium developed. Vol. buzi has been described as the imperfect (asexual) stage of an ascomycete variously assigned to the genera Nectria, Nectriella, Hyponectria and Pseudonectria. The entire confused taxonomic situation has apparently been resolved by Bezerra (3) who determined that Vol. buzi is the imperfect stage of Pseudonectria rouselliana (Mont.) Seaver. Vert. buxi was shown to have no connection to Volutella or to Pseudonectria and indeed belongs to the form genus Paecilomyces and was renamed Paecilomyces buzi (Link ex Fr.) Bezerra, a new species in synonymy with the old name Vert. buxi. Therefore Verticillium is not a valid name for this fungus. Thus, there seem to be two imperfect fungi associated with boxwood leaves, stems and roots, one of which, Vol. buzi is the imperfect stage of the ascomycete, Pseudonectria rouselliana, the other P. buzi.

The symptoms of natural infection by P. parasitica as described by Bell and Haasis (2) have been observed in Virginia. Both English and American box are affected similarly, the major difference being the extent of the symptoms as influenced by the size of the plants. They described these as loss of natural foliage luster, followed by a gradual fading of chlorophyll. The leaves inclined upward and the edges became undulate. Ultimately, the leaves were bleached to a bright straw color and remained attached to the plant. Symptoms developed on one or more branches or throughout the entire plant simultaneously. The inner tissues of the phloem-cambial region of infected stems was dark brownish-black at the ground line and for several inches above the ground line. Roots of diseased plants were dull and dark brown as compared with roots of healthy plants which were white. The outer tissue or cortex of diseased roots was decayed and sloughed-off easily, but the inner tissue or stele remained relatively intact. Large portions of the root system were often destroyed before any symptoms were visible above ground.

*Professor, Plant Pathology & Associate Professor Plant Pathology, respectively, Department of Plant Pathology & Physiology, Virginia Polytechnic Institute and State University, Blacksburg, Virginia 24061.
English box decline observed during the last 3 years in Northern Virginia is similar in many respects to the box decline attributed to *Phytophthora*. Both foliage and roots are similarly affected. The principal differences are found when diseased stems are examined by slicing away the bark. Whereas, plants affected with the *Phytophthora*-incited disease have discoloration in the wood extending for a few inches above the ground, diseased plants in Northern Virginia may have discoloration extending from the stem tips to the ground line, or from the base to the top, or in a few instances discontinuous discoloration in stems in the center portion of the plant.

*V. buxi* forms pink cushions of spores on leaves and stems of boxwood of both types. We have found it wherever boxwood grows, and have isolated it from roots of declining plants also. We have isolated *Paecilomyces buxi* from roots, stems and leaves of declining plants, particularly in Northern Virginia. In southern Virginia we have isolated *Phytophthora parasitica* from both English and American box. We have uniformly failed to isolate *Phytophthora* from declining plants in Northern Virginia, where the decline appears confined to English box. At Lexington we have isolated *Phytophthora* as well as a *Volutella* and *Paecilomyces*.

Specimens of diseased boxwood plants have been received at VPI & SU for the past 5 years from numerous locations throughout the state of Virginia. In many instances it has not been possible to ascribe a cause to the condition of the diseased plant since no known pathogen could be isolated. Undoubtedly some of these problems were of environmental nature, but in many instances symptoms may have been overlooked because of failure to look at the right tissue at the right time, while looking for the reasonably suspected *Phytophthora* or for nematodes. We now think that the field of suspects may have been too narrowly delimited.

It would appear that there may be two distinct decline diseases in boxwood having similar symptoms, one associated primarily with *Phytophthora* and the other not associated with *Phytophthora*. The latter appears to be more northern in distribution and the former more southern. Certain nematodes cause or contribute to the symptom expression of boxwood decline also. The unravelling of the inter-relationships described here is the main objective of the research project. The roles of *Vol. buxi* and *Vert. buzi* will be examined critically in this study. The role of nematodes will also be studied. The disease in the south, incited by *Phytophthora* and reasonably well defined, will be compared with the situation in the north, of presently-uncertain etiology. The state of Virginia will be surveyed to determine the extent and cause of boxwood decline in various sections of the state. Meanwhile control studies will be instituted in the greenhouse and field, but until the actual causes are determined, the control approaches will be, of necessity, empirical in nature. After determination of causal agents in the various areas of the state, then a systematic search for control measures can be undertaken with some predictability of success possible. Our project proposal (7) has outlined the general scope of the research and subsequent reports will bring the report up-to-date with a more specific description of procedures, progress and results.

Bibliography


Overleaf:

George Montgomery, V. P. I. graduate student, examining inoculated boxwood in the Greenhouse at V.P.I. & S.U. Mr. Montgomery is the recipient of the A.B.S. grant for research on boxwood decline.

A portion of 171 English Boxwood inoculated in the Greenhouse at V.P.I. & S.U., to study and determine pathogenicity of organisms that have been isolated from diseased boxwood.
Progress Report on Causes of Boxwood Decline

George Montgomery

This is a report on the progress that has been made these past 3 months into the cause of boxwood decline, an investigation funded in part by the American Boxwood Society.

Before a comprehensive research program can be initiated, it is first necessary to review the existing literature. At the present time, we have reviewed approximately 60 articles pertaining directly to boxwood and boxwood problems. These range from antibacterial substances found in boxwood seeds to various disease organisms that have been isolated from boxwood in Europe and the United States. Boxwood decline is not a new phenomenon as decline has been reported in articles published in the years 1930, 1938, 1946, 1959, and 1971.

Certain investigators have minimized boxwood diseases. For example, it was stated in the American Nurseryman in the August 15, 1972 edition as follows: “The ailments of boxwoods over the years, like hypochondria in humans, have run in fads.” Boxwood diseases like other plant diseases fluctuate in their seriousness. As a result of a survey of boxwood plantings conducted last summer, it is definitely known that boxwood decline in Northern Virginia is widespread and extremely serious. A similar decline is now known to extend as far south as Lexington, Va.

Two hundred-thirty English boxwood have been planted in the field at the Plant Pathology and Physiology Research Station, Chatham, Va. for field experimentation. One hundred-eighty English boxwood have been rooted and potted in the greenhouse at VPI & SU and an additional three hundred English boxwood cuttings have recently been rooted at VPI & SU for future studies. We will attempt to determine the pathogenicity of 6 selected fungus isolates of Volutella buxi and Paecilomyces buxi isolated from declining English boxwood from various geographical locations in Virginia.

A selective artificial medium for the isolation of Phytophthora parasitica, the cause of Phytophthora root rot, has been prepared and both healthy and diseased plants are being analyzed to determine if this fungus is present in the Waterford nursery.

A 21 acre boxwood plantation has been selected in Halifax County, Va. with four acres of apparently healthy English boxwood. We have received permission from the owner to conduct research in this plantation.

Through short progress reports in the Boxwood Bulletin, I will attempt to keep the members of the American Boxwood Society informed of new developments and future research plans.

230 English Boxwood have been planted at the Plant Pathology and Physiology Research Station, Chatham, Virginia, for field studies.

All photographs from V.P.I & S.U.
Boxwood is flourishing in a garden started just 19 years ago on a limestone bluff overlooking the Missouri River some 130 winding miles west of its confluence with the Mississippi. The garden is at "Harrison's Hill," 19th century farmhouse home of Mr. and Mrs. William F. Harrison. The house, built in 1869, was decrepit, its two-story, white-pillared front porch propped up by mail order catalogs, when the Harrisons purchased it, and there was not a boxwood on the place. Today the restored house, which faces the wooded Ozark foothills, has boxwood plantings and gardens on all sides, with more than 400 plants of interesting varieties of two species.

"Harrison's Hill" is just two miles from Hermann, one of Missouri's historic German settlements. Its original families came to Philadelphia from Germany during the late 18th and 19th centuries when so many Germans were fleeing the political and economic unrest in their homeland. But they were not satisfied with the Quaker city, finding it "too English" in customs and language. In August 1836 a group banded together to establish a colony that would be "characteristically German in every particular." Their choice of a land site was in the newly formed state of Missouri, near the meeting of the Missouri and Gasconade rivers. It was hilly, wooded land that, by Missouri farm standards, was poor, but that proved fruitful for the grapes the emigrants

Above: The formal garden at "Harrison's Hill" occupies a site that was once a livestock feed lot, adorning a chicken house. The bed's surface is brick and "pea" gravel, the latter covering a moisture-conserving plastic sheet. The outer border plants (some 25 years old) are from a clone of dainty, small-leaved, dark green B. semp. that has grown for years at Waterloo, Ill. These, and a handsome, vigorous Buxus at Ste. Genevieve, south of Waterloo and on the Missouri side of the river, have long been the boxwoods chosen by many St. Louis area boxwood enthusiasts.
brought with them. They named their future town Hermann for the Germanic hero (called Arminius by the Romans but Hermann in modern German) who crushed three Roman legions in the 9th century.

Like most pioneer U.S. settlements, Hermann had its ups and downs; but the vineyards flourished. The first grape, the Isabella, was introduced in 1843; other early varieties were the Virginia Seedling, the Catawba, Concord and Delaware. By 1904 Missouri shipped one-twelfth of the wine marketed in the U.S., most of it from Hermann. This came to an end with the enactment of the 18th amendment in January 1920 and the coming of Prohibition. Most of the vineyards were destroyed and the winery at what came to be called "Harrison's Hill" ceased legal operations. The road was downhill until the Harrisons began their rehabilitation program, including the planting of boxwood.

Offhand, one would say that boxwood could not succeed there. While woods cover the nearby hills, the garden sites are the high point so that the prevailing winter winds sweep in unimpeded from the south-west. The untreated water supply comes from a deep-bore well and, while adequate, could not, according to Mr. Harrison, be described as ample. Much of the soil is shallow, with a limestone base, but the formal garden covers what was once a pigsty. The gardens benefit from every natural aid, and from Mr. Harrison's ingenuity. For example, he has solved the water problem by the use of black plastic, pierced by holes at regular intervals, laid over all bed areas and along both sides of borders; this in turn is covered by a muted rust colored "pea" gravel from the river. He soaks all planting areas when a slight yellowing of the boxwood leaves indicates need. The unseen plastic slows evaporation and also eliminates weeds. And, as a good boxwood gard-
A member of the Boxwood Study Group of the St. Louis Herb Society examines the leaf shape of an arborescent Buxus sempervirens propagated from a plant brought to Hermann, Mo., a century ago by the town's early settlers. Local legend is that the parent of this clone came from Germany in the early 19th century.

Above photograph by Arthur Penhole, all others by author.

ener should, Mr. Harrison soaks the boxwood in the fall. He does not feed it.

Mr. Harrison prefers to plant box in full sun and considers at least a half-day's sun necessary to healthful growth. He maintains a boxwood nursery where he roots cuttings in soil, reporting about 90% success. "Harrison's Hill" supports many deer. These do great damage to the native Missouri seedling trees that are another of the Harrison interests, but they have not damaged the box. His main problem with boxwood is mites. They appear in early April and, if unchecked, can ruin a plant in a week's time. He finds they build an immunity to sprays in three generations; in 1972 he found Kelthane effective, but questions its future.

Historically, the most interesting Buxus at "Harrison's Hill" is an arborescent type brought by the early settlers. This box has been growing in Hermann for a century and legend has it that it came from Germany with the original settlers; but this has not been authenticated. It is a handsome, stalwart plant; its leaves are a dark green, rather large and broadly elliptical. Mr. Harrison set two at one side of his house (one is pictured) when they were 5 ft. tall; now, at an estimated 50 years, they measure 15 by 15 feet. Many cuttings have been made from these plants, including a number intended for the Edgar Anderson Memorial Boxwood Garden now being installed at the Missouri Botanical Garden in St. Louis.

Some of the most beautiful plants were collected some years ago in Williamsburg, Virginia, and at The Hermitage, home of Pres. Andrew Jackson at Nashville, Tennessee. These grace the formal garden where their rounded forms require a minimum of pruning. The plants which edge this bed are a variety of B. semp. that has grown for many years at Waterloo, Illinois, a town south of St. Louis and not far from the Mississippi.

Other interesting boxwoods at "Harrison's Hill" are B. microphylla koreana (B. koreana) which are from the clone developed at Shaw's Garden from the test plant sent to the Garden in 1926 by Dr. Ernest Wilson who discovered the parent plant near Seoul, Korea, and brought it back to the Arnold Arboretum. Still another is B. m. compacta, used both as specimen and border. For some of these plants, Mr. Harrison has had a local nurseryman root cuttings under mist; the potted plants are then placed in a cold frame for one year before being set into a bed. Mr. Harrison continues his search for varieties of boxwood that will thrive in the gardens of "Harrison's Hill," just as members of the St. Louis Herb Society look for varieties that will be hardy in the broader area of the Midwest. Those of us who have had the privilege of visiting "Harrison's Hill" and meeting its "gardener" are heartened to hear him say he likes boxwood because it is "tough." It is enthusiasm such as his, tempered by practical experience and fired by imagination and ingenuity, that will win and keep new friends for "man's oldest garden ornamental."

P.S. And as a happy addendum, Hermann's vineyards have been replanted and are flourishing as is "Harrison's Hill" boxwood; once again good Missouri wines are being produced in this old river town.
The plants in the foreground, and some in the central group, are B. semp. from Williamsburg, Va. and from The Hermitage, Nashville, Tenn. The garden's owner, William Harris, says only the merest snips are needed to maintain the rounded shapes and neat appearance.

The American Boxwood Society

Annual Meeting, May 9th, 1973

Newcomb Hall, University of Virginia, Charlottesville

More Information in April Issue

Please Put It on Your Calendar
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Early plans for The Boxwood Bulletin included an Index every five years; but — "twixt want and get, the road runs rocky." Many requests have lately come in for an up-to-date Intex; and now, after a series of delays it makes a belated appearance, covering six years instead of five.

For obvious reasons, this issue of January 1973 is not included in this Index but will be in the next one (when and if) which we hope will be easier to compile than this one has been.

Pictures are not separately listed as they are in each issue, but are included with the relevant articles in the page numbers. This keeps the Index to a more manageable size.

This Index has been checked and re-checked, but experience has taught us that errors may still creep in. The Editor will be grateful for notice, of any needed corrections. We hope you will find this a valuable and useful addition to your file of Boxwood Bulletins.

Correction to the July 1972 issue (Vol. 12 No. 1, p. 16):

The illustrations to Mr. William C. Trimble's article, "Frames To Protect Boxwood In Winter," were erroneously credited to Mr. William Gray. Mr. Trimble was the photographer as well as the author, and the Editor apologizes for the slip.
The American Boxwood Society
January 1973

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The Boxwood Society year runs from one Annual Meeting to the next; from May of one year to May of the next year. Those joining the Society at other times are sent all the *Boxwood Bulletin* issues for the current Society year, beginning with the July number. Their dues are then again due and payable in the following May. This was voted by the Society in order to lighten as far as possible the heavy work load of our busy Secretary-Treasurer; who, like all other officers of the Society, is an unpaid volunteer.

Price per single copy $1.25 plus 5¢ postage to members: $1.50 plus 5¢ postage to non-members. Orders of five or more copies are sent postpaid. At the present time any or all Bulletins are available, back to Vol. 1, No. 1 (Vol. 1 consists of three issues only, there was no Vol. 1, No. 4.)

Besides regular membership dues at $5.00 per year, there are other classes of membership available: Contributing, $10.00; Sustaining, $25.00; Life, $100.00; and Patron, $500.00.

Gift memberships are announced to the recipients by boxwood-decorated cards which carry the information that *The Boxwood Bulletin* will come as your gift four times a year.

Members of The American Boxwood Society are reminded of the 1968 IRS decision that contributions to and for the use of the Society, are deductible by donors as provided in Section 170 of the Code.
BOXWOOD—
A heritage from Yesterday
A privilege for Today
A bequest for Tomorrow