Photographic Guide of

Boxwood Pests & Diseases on Long Island

Cornell University
Cooperative Extension
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Foreword

This guide is a diagnostic tool for nursery growers and landscape professionals who grow or maintain boxwood. It serves as a starting point to become familiar with common problems that affect boxwood on Long Island and is not a substitute for diagnosis. When uncertain, obtain a diagnosis from your local Horticulture Diagnostic Lab (see page 22) or consult with a specialist to learn the most up-to-date management recommendations.

The images in this guide provide a visual library of various symptoms associated with the many abiotic and biotic disorders that affect boxwood. Within the categories (Abiotic and Cultural Problems, Diseases, and Insect & Mite Pests), cultural problems are listed alphabetically, and diseases and insect pests are listed in order of importance. Listings include descriptions of the symptoms and signs, biology of the pests, best management practices to avoid and correct the issue, and susceptibility of different boxwood species or cultivars to infection.

Pesticide management recommendations are not provided in this guide since this information needs to be routinely updated. Regularly updated pest management information for commercial growers and landscape professionals in New York State is offered in the annual *Cornell Pest Management Guide for Commercial Production and Maintenance of Trees and Shrubs.* To purchase a copy of this guide, contact your local Cornell Cooperative Extension Office. Contact information is listed on page 23.

Abiotic Disorders & Cultural Problems

Abiotic disorders comprise a collection of problems caused by unfavorable environmental conditions such as frost injury or poor drainage, and improper cultural practices such as deep planting and poor nutrition. Recognizing and correcting abiotic disorders is important to maintain plant vigor and avoid secondary infections.

The abiotic disorders pictured in this guide are commonly encountered in both landscape and production settings on Long Island. This is not a comprehensive list of all the potential disorders that may affect boxwood. Most of the images are landscape examples. The most common abiotic issues that affect boxwood in production are inadequate nutrition and soil/media moisture problems.

Environmental Problems: Winter Injury, Sunscald, & Siting Issues

Many problems can arise from poor environmental conditions. Adverse effects from environmental problems are usually widespread and uniform instead of scattered or randomly patterned. Symptoms usually appear as off-colored leaves, leaf drop, stunted growth, tip and stem dieback, and bark injury. Siting boxwood in areas exposed to prevailing winter winds, salt spray or deicing salts, or in unfavorable soil conditions can blemish appearance and stunt growth. Winter injury is often more prevalent in exposed sites, but can also occur in protected sites. Boxwood that have thrived under shady conditions will be very sensitive to full sun if suddenly exposed after loss or removal of the overstory. Other siting issues such as compacted soil and heavy clay will also stunt growth.

Plant boxwood in a protected location away from drying winds and salt spray. Boxwood responds well to relocation to a site with favorable conditions.

Snow load injury.

If conditions have been dry, ensure both recently transplanted and mature boxwood are hydrated before the ground freezes. If planted near a path that regularly receives deicing salts in winter, choose a plant-friendly ice melt. Prune out any adversely affected growth and dead stems. For plants affected by winter burn (reddish-orange leaves), hydration and adequate soil nutrition may alleviate the symptom.

Cold injury along a boxwood hedge in early spring.

Reddish-orange leaves can be a symptom of winter burn.

Boxwood in containers require greater cultural care to survive through the winter; the straw-colored leaves are symptomatic of desiccation.

Excessive Edging & Mulch Problems

Where boxwood serves as a shrub border or specimen planting near the front of the border, excessive soil or mulch placed over the root system during edging hinders water infiltration, reduces soil oxygen, and kills roots (primarily by suffocation). Stem dieback and thinning results from this practice in the short-term, with overall decline in vigor and eventual death if the practice is not corrected.

Mulch at a depth of no more than 3 inches (less if voles are in the landscape); coarse mulch is preferred. Keep mulch away from the base of the shrub. Eliminate or minimize bed edging to no more than twice a season and be very conservative with the amount of edge sliced; remove any soil obtained from edging instead of spreading it into the planted shrub border or over the roots, otherwise soil will build up over time.

Poor growth due to excessive soil on roots from displaced soil from edging.

When edging a bed, avoid placing soil into the shrub border.

Nutrient Deficiencies

Various leaf symptoms are attributed to nutrient deficiencies or toxicities. Common nutrient deficiency symptoms include yellow to orange leaf tips and margins. If leaves are tinged reddish-orange after winter, this may be a symptom of low leaf nitrogen levels, drought stress, and/or winter burn. To determine what nutrient is lacking, it's best to conduct both a soil and foliar test at the same time to evaluate the problem fully; this test can be done whenever a deficiency is suspected. To monitor nutrient management, collect tissue and soil samples in late July or early August.

Before applying fertilizers to any landscape, have a soil nutrient analysis done, especially if it's been more than three years from the last test. The preferred soil pH range for boxwood is commonly suggested as 6.0 to 7.2. A range of 4.5 to 6.2 is more frequently encountered for Long Island soils, and boxwood generally appear to do well. To avoid nutritional problems, do not allow soil pH to drop below 5.5.

Yellow leaf tips on boxwood planted in the landscape. This symptom has been associated with magnesium deficiency[1].

Over- & Under-watering

Containerized and newly transplanted boxwood are most vulnerable to under- and overwatering practices. Once established, boxwood can resist the occasional drought spell. Overwatering should be avoided in production and landscape use as this may promote disease and weak growth.

Reddish-orange leaves on field-grown boxwood in late winter. Low leaf nitrogen, drought stress, and/or winter burn have all been associated with this symptom[1].

After transplanting, monitor soil moisture and supplement with drip irrigation. Overhead irrigation should be avoided since it may support conditions for disease development.

Desiccated stem tips from drought stress developed shortly after transplant in spring.

Aerial roots produced on interior stems are a sign of overwatering and poor air circulation.

[1] As referenced in *The American Boxwood Society Boxwood Handbook: A Practical Guide to Knowing and Growing Boxwood, 3rd Edition*

Poor Pruning Practices

Excessive shearing of boxwood to maintain form produces a dense branching habit that decreases air circulation within the shrub and reduces vigor by constant removal of new growth. Shearing too late in the season may encourage tender new growth susceptible to winter burn.

To maintain form and acceptable size, prune or shear hard in late winter before new growth occurs. After foliage hardens off, lightly shear or prune to maintain shape. To counter the negative effects of shearing, thin shrubs to improve air circulation and avoid bare spots. To avoid producing tender growth susceptible to winter burn, do not prune later than mid-August.

Boxwood are often sheared to promote dense branching, which decreases air circulation and encourages infections.

Excessive shearing produces dead tips and decreases plant vigor.

Poor pruning practices can cause bare areas, diminishing the ornamental value of the shrub.

At any time of year, entirely remove stems exhibiting leaf discoloration or stem cankers, cutting low on the stem below the area of discolortion.

Poor Transplanting Practices

At transplanting is the perfect time to investigate the root system and correct any potential issues such as root-bound stock, unhealthy roots and incompatible soil types. Boxwood are sold as either field-grown, balled-and-burlapped (with or without wire), or container-grown stock. A common practice with balled-and-burlapped stock is to plant without removing or even partly removing the burlap or wire. Even if the burlap is biodegradable, this practice can hinder establishment and possibly lead to deep planting. Applying too much mulch (greater than 3 inches) after planting may interfere with water infiltration and nutrient uptake.

Always remove the upper (if not all) burlap and wire from the root ball. This allows removal of excess soil from around the lower stems that sometimes accumulates during field removal. Where the soil texture of the root ball is dramatically different from the landscape soil (e.g., clay root ball being planted into a sandy loam) remove as much of the soil from the root ball as possible without damaging roots by gently washing with water, to allow for healthy root establishment into the new soil. For root-bound stock, gently loosen and spread packed roots before setting. Transplant in spring, late summer or early fall, but no later than early October. Be sure root balls and surrounding soil are well-watered after planting.

Leaf drop and desiccated leaves in early spring after poor establishment from late fall transplant. Water well at planting and during dry periods (through winter as well) to ensure adequate hydration. Place drip irrigation at the dripline of the shrub instead of near the base.

Rodent Injury

As the growing season progresses, leaves on entire stems become off-color and eventually appear chlorotic. Leaves on affected stems may be smaller than usual as well. Close examination of the stem at or near ground level reveals uneven stem girdling, and what may appear as teeth marks, especially if examined with a hand lens. Rodents, such as rabbits and voles, will eat the bark and vascular tissue of boxwood and other shrubs. Injury tends to be more severe in harsher winters.

Presence of voles is evident by their tunnels at or below the soil surface, which are noticeably soft when stepped on. Sites with heavy mulch are favored by voles because of the protective cover. If tunnels are evident on the property, maintain mulch at no more than 1-inch depth or so and keep mulch away from the base of stems. Use fencing where needed to exclude rabbits, and be aware that rabbits prefer to nest in areas with dense cover.

Off-color leaves on a stem fed on by voles during the winter season. Photo was taken in early fall.

Vole feeding injury.

Boxwood Diseases

Boxwood Blight

(Calonectria pseudonaviculata,
syn. *Cylindrocladium buxicola)*

This aggressive disease is more of a threat to boxwood performance in the landscape than any other disease of boxwood since it may destroy all the shoots and leaves of an infected plant. It can easily be confused with the more-familiar Volutella blight of boxwood (caused by *Volutella buxi*), but this disease strikes much more quickly and affects healthy rather than stressed or injured boxwood. Initial symptoms appear on leaves as black, cloudy spots that lack a distinct edge; spots often enlarge to encompass the entire leaf, and then the leaf usually drops from the plant. Catastrophic leaf drop is often seen. Leaf spots vary from dark brown to black. There may also be tiny black cankers on young shoots, but these are usually black streaks rather than girdling cankers. In containers and field production, leaf blight is often seen at the base of the plant. Whitish masses of spores appear on the underside of blighted leaves or on infected stems, and these are easily mistaken for Volutella infections. To further confuse the viewer, *Volutella* may sporulate on leaves killed by boxwood blight. Boxwood blight affects large areas of leaves quickly, whereas *Volutella* most often kills foliage on a single stem, slowly, following a wounding event such as snowload breakage.

Black and brown leaf spots typical of boxwood blight caused by Calonectria pseudonaviculata.

Black lesions with tan centers caused by Calonectria pseudonaviculata.

Brown leaf spots with some associated blackening of the stems caused by Calonectria pseudonaviculata.

Epidemiology

This fungal pathogen produces spores on infected boxwood leaves and twigs during wet, rainy conditions in fall, spring or summer. It also produces survival spores called microsclerotia, which are formed inside dead leaves and allow the fungus to persist for years in the absence of a living host plant. Boxwood are most likely to become infected at 60° to 80°F, and the extent of the symptoms will be correlated with the length of time that the foliage is continuously wet. In addition to boxwood, the same fungus also affects both native and Japanese pachysandra, as well as sarcococca.

Best Management Practices

To avoid introduction of the fungus to a landscape or nursery carefully examine new plants for symptoms. If the disease appears in a landscape, the diseased plants should be severely pruned or discarded entirely, carefully collecting all the fallen leaves because they contain microsclerotia. If boxwood are removed after a disease outbreak, take care to remove pachysandra and sarcococca from the immediate area as well, as these can also harbor the fungus. Locate boxwood in full sun rather than shade and irrigate with trickle irrigation at the base of the plants rather than using overhead irrigation.

Boxwood blight may be concentrated at the base of a plant.

Sporulation of Volutella buxi *on leaves (note pinkish undersides of leaves) of shoots cankered by boxwood blight caused by* Calonectria pseudonaviculata.

Defoliation on a planting of boxwood in the landscape caused by boxwood blight.

White sporulation of Calonectria pseudonaviculata *on a boxwood stem.*

If doing landscape maintenance, keep pruners/shears on each property, to reduce the potential for introducing the disease from another property. Scout boxwood carefully after each rain during the growing season. Maintain historic boxwood gardens in isolation, to protect them from accidental introduction of diseased plants that could serve as inoculum for others. Use fungicides to protect other boxwood after the disease has been detected and infected plants have been removed. Rotate contact with systemic materials to reduce the opportunity for fungicide resistance to develop. Consider locating replacment boxwood in a different area of the nursery or landscape, or switching to a non-susceptible plant, such as an *Ilex* species.

Boxwood blight may be particularly dramatic in a shady site.

Diffuse black leaf spots and defoliation from boxwood blight in a planter.

Susceptibility

Many different species and cultivars of boxwood are susceptible. American and English boxwood (*B. sempervirens* and *B. sempervirens* 'Suffruticosa', respectively) are the most highly susceptible. Other species and hybrids of boxwood are also susceptible, but usually to a lesser degree. Ideally nurseries should choose to grow cultivars with low susceptibility to both Volutella and Calonectria boxwood blights, as well as to the boxwood leafminer. A recent Connecticut study indicated that disease severity (measured as leaf drop) of 2-yr rooted cuttings in containers was greater in common boxwood and English boxwood than in 'Green Mountain' or 'Green Velvet', while Korean and 'Winter Gem' boxwood showed the least disease impact—although all of the cultivars showed leaf spotting.

Large areas of foliage may be affected at one time by boxwood blight.

Volutella Blight
(*Pseudonectria buxi*, syn. *Volutella buxi*)

Leaves on branches that have been infected by Volutella Blight lose their green color and turn light tan or brown. Leaves that are killed by this fungus generally are held on the plant for months, whereas leaf drop is typical for the Calonectria boxwood blight. Inspection with a hand lens will show the fungus growing in white or orange cushions called sporodochia on the undersurface of leaves or on stems. The cushions turn peach- or salmon-colored (light orange) over time. *V. buxi* grows into larger wood once it gains entry to a plant.

Epidemiology

The pathogen can grow at temperatures from 50-95°F, but is most favored by 68-77°F, and grows only slowly at cold or very hot temperatures. The fungus does not invade through stomata on the leaf undersurface: a wound is necessary for infection. The spore structures are stalked when they emerge from stomata, and are often surrounded by a fringe of white hairs. When these spore structures are young they very closely resemble those of *Calonectria pseudonaviculata*, the causal agent of boxwood blight. Seek help from a laboratory if you are not sure of the diagnosis.

Clumps of foliage attached to an infected branch turn brown when the branch is cankered by Volutella buxi.

Winter injury has led to Volutella blight on this variegated boxwood.

Best Management Practices

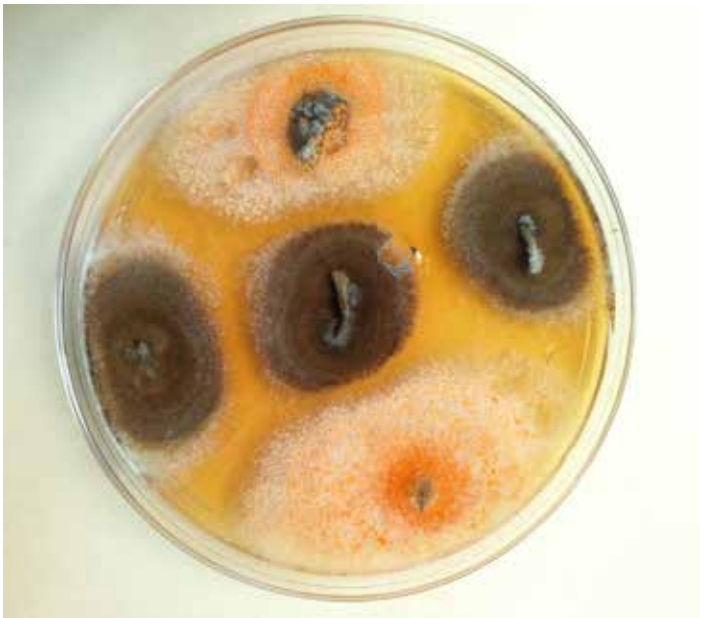
If infection with *Volutella* is encountered, prune out affected stems below the affected area, disinfecting pruners with 70% ethanol between cuts. Consider improvements in winter protection and irrigation management to reduce environmental stress. Drought stress is frequently cited as a precursor of Volutella attack. Leafminer control may have a side benefit of reducing Volutella canker by reducing wounding of foliage. Prune or shear only in dry weather, on plants that are not drought stressed. Thinning is recommended over shearing, in order to let light and air penetrate down into the boxwood.

Conspicuous orange sporulation of Volutella buxi.

Susceptibility

Correcting stress conditions is important to avoid Volutella blight for all boxwood species. There is, however, some evidence of variation among cultivars: recent studies at the University of Guelph compared 5 cultivars for susceptibility. 'Green Gem' was the most susceptible and 'Pincushion' the least susceptible, with 'Green Velvet', 'Green Mound' and 'Green Mountain' intermediate. Losses in Canadian nurseries were extensive in 2008-9 in hybrids between English boxwood and Korean boxwood: 'Green Gem', 'Green Velvet', 'Green Mound' and 'Green Mountain'. Nursery losses were also reported on *Buxus* 'Chicagoland Green' in British Columbia in 2009. Further research identifying cultivars less prone to Volutella blight is needed.

Closeup of leaf underside showing sporulation of both V. buxi *and* C. pseudonaviculata.



The difference between the Volutella blight and boxwood blight pathogens can be seen in the laboratory after culturing or microscopic examination. Here the white and orange colonies are V. buxi, *while the chestnut brown colonies are* Calonectria pseudonaviculata, *which causes boxwood blight.*

Macrophoma Leaf Blight
(*Dothiorella candollei*)

One of the most conspicuous of the fungi that attack boxwood foliage is *Dothiorella candollei*, which causes Macrophoma leaf blight. *D. candollei* forms small round black fruiting structures (pycnidia) in dead areas on leaves. Infected foliage is thus covered with black "dots" that contain the fungal spores. This disease is, in itself, not a threat to boxwood: the fungus invades stressed boxwood tissue.

Epidemiology

D. candollei is not a primary pathogen, but acts as an opportunist, invading leaves and branches that have been killed by other pathogens or environmental stresses.

Best Management Practices

If Macrophoma leaf spot is seen, prune out the affected portion of the plant. Protect boxwood against environmental stress and insect invasion.

Boxwood branches covered with dead foliage may show sporulation indicating Macrophoma leaf blight.

Susceptibility

Stress-tolerant cultivars will be less prone to show Macrophoma leaf blight. Choose cultivars that are not prone to winter or drought injury. Keep root systems healthy by not overwatering or subjecting roots to compacted soils.

Black spore cases of D. candollei *on leaves.*

Sporulation of D. candollei *on two leaves with Macrophoma leaf blight.*

Phytophthora Root Rot
(*Phytophthora* spp.)

Loss of lustre in the canopy may be the first symptom of Phytophthora root rot, caused by one of many species of oomycete (water mold) in the genus *Phytophthora*. Leaves become lighter green and eventually turn purplish brown or a pale straw color. The roots become softened and browned, and the outer cortex of the root will slough off easily when handled. Sometimes loose bark and cankering at the soil line are also noted. This disease will kill infected boxwood.

Epidemiology

Many species of *Phytophthora* have been found associated with root rot and stem base cankers in boxwood. In North America, there are records of *Phytophthora cactorum*, *P. cinnamomi*, *P. citricola*, *P. citrophthora*, *P. elongata*, *P. gonapodyides*, *P. multivora*, *P. nicotianae*, and *P. pini* causing disease on boxwood. Because they are oomycetes, all of these organisms thrive in wet soil conditions. Phytophthora root rot is seen more often in container production in nurseries than it is in landscapes with light soil.

Best Management Practices

If Phytophthora root rot is discovered on boxwood in the landscape, remove ailing individuals and replant with an alternative shrub that is relatively resistant to Phytophthora root rot. Utilize fungicides during nursery production if needed to halt disease spread. Avoid planting in heavy soils that drain poorly. If soil drainage is poor, boxwood can be grown in raised beds or containers. Avoid deep planting and overwatering.

Phytophthora root infection caused wilt and discoloration of boxwood in these nursery containers.

Susceptibility

There is no information on the relative susceptibility of different boxwood cultivars to Phytophthora diseases. All cutivars will be less prone to infection in well-drained soils or container media.

Other Miscellaneous Diseases

Fusarium Diseases

Diseases of boxwood caused by *Fusarium* species have not received research attention. When looking at foliage for sporulation of *Calonectria pseudonaviculata*, the fungus causing the new boxwood blight, the white sporulation of a *Fusarium* sp. is often observed. *Fusarium buxicola, F. lateritium, F. moniliforme* and *F. solani* have all been reported from boxwood leaves, stems or roots in the United States. *Fusarium oxysporum* and *F. tricinctum* were found associated with *Volutella buxi* on boxwood in Canada. *F. solani* has been associated with a root rot of boxwood, while *F. moniliforme* has been reported causing twig dieback in Florida. *Fusarium buxicola* has been found in several states on limbs of *Buxus sempervirens* cv. 'Arborescens', but the majority of reports of this species are from Europe. The ability of *Fusarium* species to cause leaf spots on boxwood has not been demonstrated, but the fungus is often found fruiting on moribund foliage.

Nematodes

Nematode injury to boxwood has been well documented, and would be expected to be especially problematic in the sandy soils of Long Island. Symptoms of nematode feeding on roots include branch dieback, stunted growth, decline, and wilt during drought periods. Foliage may take on an orange to bronze discoloration, which is an indication of root stress. Root knot nematodes (*Meloidogyne* spp.) may cause tiny galls on boxwood roots. Lesion nematodes (*Pratylenchus vulnus*) feed on roots and produce tiny black lesions, or lead to more extensive root rot by encouraging the attack of soil fungi on the wounded roots. Soil samples collected in spring or fall may be sent to a diagnostic laboratory and analyzed for the population levels of potentially damaging nematode species. Nematicides are not available for nursery or landscape use. In nurseries, avoid placing boxwood in extremely light soil. In the landscape, reduce the impact of nematodes by providing adequate moisture on a regular basis and fertilizing appropriately to encourage root growth annually. Experimentally, entomopathogenic nematodes have been used to suppress plant-parasitic nematodes on English boxwood.

Boxwood Rust

Boxwood rust is not yet reported in North America, but growers and gardeners should stay alert for its appearance. Orange spots on the upper leaf surface mark the location of bumps on the undersurface, which become filled with the dark brown spores of the fungus. Infected leaves may fall from the plant. *Puccinia buxi* is the rust fungus affecting boxwood: it is found in both Asia and Europe. This disease has not been especially troublesome in UK landscapes—the infection is more apparent in wild populations of boxwood. It might be a more serious problem in overhead irrigated production areas, so it will be a pity if this disease is introduced to the United States nursery industry.

Boxwood Insect and Mite Pests

Boxwood Leafminer
(*Monarthropalpus flavus*)

This gall midge (fly), is the most troublesome pest for boxwood. The larvae feed within the leaves causing blistering, yellowing and leaf drop. Plant vigor is reduced by repeat attack.

Life Cycle

Adult flies emerge mid-May through early June and lay eggs in new spring growth. Shortly before emergence they create a small 'window' in the underside of leaves, through which the pupae partially extend. The bright orange adult flies (1/8") appear often in large numbers, leaving the empty pupal cases protruding from the leaves. Larvae (up to 17) feed within the leaf, overwinter and then transform to pupae in spring. There is one generation per year.

Susceptibility & Management

Control leafminers by planting resistant varieties; for susceptible varieties time foliar applications for adults in spring or for young miners in early to mid-summer. Systemic insecticides can also be applied to soil in fall or early spring. Include a penetrating surfactant with foliar applications and direct sprays towards leaf undersides.

Boxwoods noted 'highly resistant' to leafminer among the *Buxus sempervirens* group include 'Handsworthiensis' and 'Vardar Valley.' Cultivars rated 'resistant/least susceptible' include 'Memorial,' 'Pendula,' 'Pyramidalis,' Suffruticosa,' and 'Argenteo-variegata.' At one location we observed 'Newport Blue' remaining uninfested while growing near heavily infested 'Green Mountain.' Some sources report *B. microphylla* 'japonica,' *Buxus sinica* var. *insularis* 'Nana,' and most dwarf *Buxus microphylla* cultivars to have resistance. Saunders Bros. Nursery (VA), specializing in boxwoods, found "moderate to good resistance" in 'Insularis Nana,' 'Vardar Valley,' 'Suffruticosa,' 'Grace Hendricks Phillips,' 'Morris Dwarf,' 'Green Pillow,' 'Golden Dream,' 'Jim Stauffer,' 'Wintergreen,' 'Jensen,' 'Winter Gem,' 'Morris Midget,' 'Rotundifolia,' 'Elegantissima,' 'Fastigiata,' and 'Dee Runk'.

Exposed pupae in early spring as seen from the underside of a boxwood leaf. The 'windows' (small white spots near center vein) created by the pupae shortly before emergence as adults are visible as well.

Adult leafminers and empty pupal cases protruding from the undersides of the leaves in spring.

Slight blistering on the undersides of leaves is an early sign of a boxwood leafminer infestation.

Boxwood Mite (*Eurytetranychus buxi*)

Boxwood mite (a type of spider mite) feeding results in small white 'scratches' or speckles on the upper surface of foliage. Severe damage can result in leaf drop and pale foliage. Small amounts of damage don't always significantly affect appearance of landscape plants, but can be objectionable in nurseries on plants grown for sale.

Life Cycle

Boxwood mite overwinters as eggs under leaves, hatching around late April in southeastern NY. Some sources note most activity from spring to early summer but mites have been observed throughout summer into fall on Long Island. Up to eight generations annually are reported in Michigan with possibly more in southeastern NY.

Susceptibility & Management

European, English and common boxwood are more susceptible than Japanese. Higher populations of boxwood mite and injury are sometimes associated with systemic (soil) application of imidacloprid often used for leafminer or psyllid—monitor treated plants for mites. Boxwood mites can be controlled with periodic blasts of water, dislodging them from foliage, or with miticides and/or horticultural oil in early May.

Speckled or scratched leaves caused from boxwood mite feeding.

Small scratches on the surface of boxwood leaves caused by boxwood mites. (The yellow-brown spots or blisters are caused by boxwood leafminer feeding injury.)

Boxwood Psyllid (*Psylla buxi*)

Boxwood psyllid is a leafhopper-like insect that feeds on new foliage causing it to become cupped, twisted and stunted. Leaves become galled as they grow, partially enclosing and protecting the psyllids within. Nymphs may also feed on older expanded leaves and produce noticeable white wax and honeydew that falls onto foliage beneath, on which sooty molds grow. On some cultivars damage is relatively minor and often ignored (e.g. *B. sempervirens* 'Suffruticosa') particularly in landscape settings, although in nurseries even small amounts of damage are unacceptable.

Life Cycle

Boxwood psyllid overwinters as eggs stuck into buds; nymphs emerge in mid-spring. The green adults appear after about 6 weeks in late spring; there is one generation per year.

Susceptibility & Management

Plant resistant varieties, or for susceptible boxwood a dormant-stage oil spray that targets the egg stage. Cultivars noted as partially resistant include: *B.* x 'Glencoe' ('Chicagoland Green'), *B. microphylla* 'Fiorii,' *B. sempervirens* 'Arborescens,' and the hybrids 'Green Mountain' and 'Green Velvet'.

Cupped new growth caused by boxwood psyllids.

Close-up of distorted leaf caused by boxwood psyllids. Slight blistering caused by boxwood leafminer is also visble.

Adult psyllids are light green and only about 1/10 inch in length.

Least preferred cultivars include: *B. microphylla* 'Sunnyside,' *B. sempervirens* 'Suffruticosa,' *B. sinica* var. *insularis* 'Winter Beauty,' and hybrids 'Green Gem' and 'Green Mound'. When nymphs are present foliar insecticide applications can be used. Coverage may be difficult on distorted foliage, so products with translaminar activity may be helpful. Include a surfactant to enhance wetting and coverage.

Other Boxwood Pests

Boxwood Webworm (*Galasa nigrinodis*)

Also known as boxwood leaftier, this moth pest webs or ties leaves together on boxwood. Damage to boxwood foliage appears to be very minor and is

Boxwood webworm caterpillars are brown-grey in color and about 1/4 to 1/2 inch in length.

Boxwood webworm webbing and frass.

usually confined to the canopy interior. Caterpillars may be found among webbing and fallen dead leaves collected in the twigs.

The rust-brown moth resembles a leaf-footed bug in appearance and is active from June to September. Possibly a native insect, pachysandra may be its original host. One reference reports *Osmanthus* is also a host.

Boxwood webworm infestation has not yet been associated with dieback or other noticeable damage.

Boxwood Erineum or Bud Mite (*Eriophyes canestrinii*)

Boxwood erineum causes distortion of new growth and felt-like erineum galls on foliage, as well as flower 'blasting.' Caused by a type of eriophyid mite, it has been seen on Long Island on indoor-grown boxwood only.

Erineum mite injury on boxwood stem tips.

Green peach aphid (*Myzus persicae*) has been reported to feed on boxwood.

Armored scales reported on boxwood include Florida red (*Chrysomphalus aonidum*), bifasciculate (*C. bifasciculatus*), dictyospermum (*C. dictyospermi*), San Jose (*Diaspidiotus perniciosus*), holly (*D. brittanicus*), palm fiorinia (*Fiorinia fioriniae*), latania (*Hemiberlesia lataniae*), greedy (*H. rapax*), oystershell (*Lepidosaphes ulmi*), black araucaria (*Lindingaspis rossi*), camphor (*Pseudaonidia duplex*), peony (*P. paeoniae*), trilobe (*P. trilobitiformis*), white prunicola (*Pseudaulacaspis prunicola*) and euonymus (*Unaspis euonymi*) scales. Some of these are established on Long Island and are an occasional pest of other plants.

Soft scales noted from boxwood include cottony camellia (= cottony taxus) (*Chloropulvinaria floccifera*), Indian wax (*Ceroplastes ceriferus*), and European fruit lecanium (*Parthenolecanium corni*) scales. All have been pests of other shrubs or trees; wax scale has only appeared on Long Island in recent years.

Comstock and ground mealybugs (*Rhizoecus falcifer* & *Pseudococcus comstocki*, respectively) have been recorded from boxwood as well.

Box tree caterpillar (*Cydalima perspectalis*) is an Asian native recently (UK in 2008) discovered in Europe. It can defoliate plants and damage bark. It has not yet been seen in the US but is one to watch for (see factsheet in references).

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Long Island Horticulture Diagnostic Labs

If there is any uncertainty concerning causes of abnormal symptoms on the plant, submit a sample to one of the several horticulture diagnostic labs in Nassau or Suffolk County. Samples can either be dropped off, or mailed. Refer to the instructions below on how to properly take a sample and mail it, if needed.

How to Take a Sample for Lab Diagnosis

1. Provide pictures of the affected plant and growing area. Photos can assist in understanding growing conditions. Include close-ups of the symptoms or pest and a landscape image showing the area surrounding the plant—these are very helpful. Photos can be emailed or mailed.
2. For your sample, choose the section of the plant showing the symptom(s), including a healthy portion beyond with the 'transition zone' between. Do not include dried-up or dead stems or leaves. Place this sample in a re-sealable plastic bag. Include dry paper towels to help absorb any free moisture. Label the sample with a date, location, species/cultivar, and information on any recent chemical or other applications.
    a. If the suspected cause is soil-borne, include a small sample (about a cup) of roots by sampling within the root zone. Including a little bit of soil to maintain moisture is fine.
    b. If the suspected cause is a pest, either trap the insect in a small container, or place a stem that has an active population (such as for scale or mites) in a re-sealable plastic bag.
3. Disinfest your pruners to avoid contaminating other plantings.
4. Keep the sample in a cool place out of direct sun and get it to the diagnostic lab as soon as possible, to minimize deterioration. If necessary, store the sample in a refrigerator or cooler (no more than 24 hours) until ready to ship or deliver.
5. Complete the submission form, if one is needed from the diagnostic lab.
6. For mailed samples, choose either overnight or 2-day delivery. Best to send early in the week; avoid allowing samples to linger in the mail over a weekend.

Lab Locations

Long Island Horticultural Research and Extension Center
(Commercial samples only)

3059 Sound Ave., Riverhead, NY 11901
631-727-3595
Lab Hours: 8AM to 5PM, Monday through Friday.

Cornell Cooperative Extension of Suffolk County Horticulture Diagnostic Labs
(Home Garden and Commercial Samples)

Eastern location:

Extension Education Center
423 Griffing Ave, Riverhead, NY 11901
631-727-4126 (9AM to 12PM)
Lab Hours: 9AM to 4:30PM, Monday through Friday

Western location *(Open April through October):*
(Sample drop-off only. No mailed samples)

Bayard Cutting Arboretum
Montauk Highway, Great River, NY 11739
631-581-4223 (8:45AM to 11:45AM; 1PM to 4PM)
Drop-off Hours: 10AM to 4:30PM, Thursday and Friday

Cornell Cooperative Extension of Nassau County Horticulture Center
(Home Garden and Commercial Samples)

Demonstration & Community Gardens at East Meadow Farm
832 Merrick Ave., East Meadow, NY 11554
516-565-5265
Diagnostic Lab Walk-in service: March-October; T, W, Th, & Sa, 10AM to 1PM; and Thursday evenings 4-7PM.

Helpful Resources

Cornell Pest Management Guide for Commercial Production and Maintenance of Trees and Shrubs

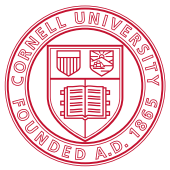
This guide is an invaluable resource for arborists, landscapers, pesticide applicators, nurserymen and the like. This manual is updated annually by Cornell University researchers and Extension Specialists and is designed as a practical guide for those working in the field. You'll receive the most up-to-date disease, insect and mite pest, and weed recommendations for the many woody ornamental plants on Long Island.

This inexpensive book can be picked up at the Cornell Cooperative Extension Suffolk County Education Center at 423 Griffing Avenue in Riverhead, NY, or it may be mailed directly to you (additional shipping costs apply). An on-line version is available for purchase as well. Please call 631-727-4126 Monday through Friday 9AM to 12 Noon for pricing information.

Pest-Resistant Key Trees and Shrubs by Deborah Smith-Fiola, Landscape IPM Enterprises, 5124 Hollow Tree Lane, Keedysville, MD 21756. This self-published book—originally published in 2004—is only available by contacting the author. Visit the Landscape IPM Enterprises website to purchase: http://landscapeipm.weebly.com/pest-resistant-ornamental-key-plants.html

Insects That Feed on Trees and Shrubs, 2nd edition by Warren T. Johnson and Howard H. Lyon. First published in 1976 by Cornell University Press in Ithaca, NY, this reference offers many color images of insect pests with detailed life cycle information.

The American Boxwood Society has several publications on boxwood for sale on their website, along with historical and cultural information about boxwood. Visit their website for more information: http://www.boxwoodsociety.org/index.html



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