Plant Health Care Report

Scouting Report of The Morton Arboretum

August 27, 2010 Issue 2010.17

Our report includes up-to-date disease and insect pest reports, as well as color images, for northeastern Illinois. You'll also find a table of accumulated growing degree days throughout Illinois, precipitation, and plant phenology indicators to help predict pest emergence.

Quick View

Weekly reminder
What to look for in the next week

This week's sightings:

Insects
Fall webworm
Sycamore lace bug

Diseases
Volutella stem and leaf blight
Oak wilt

Woody of the week: Hardy kiwi (*Actinidia kolomikta)*

Article: An Ounce of Prevention in the Autumn by Stephanie Adams

2010 Plant Health Care Report Index

I have run out of Orton's indicator plants, so for this week I'm sharing an interesting plant that's flowering right now.
Hidcote St. John's Wort (*Hypericum* 'Hidcote') (Figure 1)

Accumulated Growing Degree Days (Base 50): 2455
Accumulated Growing Degree Days (Base 30): 5577

Figure 1 Hidcote St. John's Wort (*Hypericum* 'Hidcote')

Degree Days and Weather Information

Table 1 Growing Degree days and precipitation for the past two weeks.

Location	Growing Degree Days through August 25	Precipitation (in) Between August 13 – August 25
Aurora, IL**	2607.2	
Cahokia, IL**	3453.0	
Carbondale, IL **	3589.6	
Champaign, IL**	3020.3	
Chicago Botanic Garden (Glencoe, IL)*	2622.5	0.42
Chicago Midway	2846.7	
Chicago O'Hare*	2709.5	0.48
Decatur, IL**	3158.7	
DuPage County Airport (West Chicago, IL)**	2652.3	
Lawrenceville, IL**	3541.6	
Mattoon, IL**	3141.2	
Moline, IL**	2907.8	
The Morton Arboretum (Lisle, IL)	2455.0	2.36
Peoria, IL**	3042.8	
Quincy, IL**	3108.1	
Rockford, IL**	2615.1	
Springfield, IL**	3258.4	
Sterling, IL**	2738.6	
Waukegan, IL**	2321.3	
Wheeling, IL**	2633.7	

*Thank you to Mike Brouillard, Northbrook Park District, and Chris Henning, Chicago Botanic Garden, for supplying us with this information.

** We obtain most of our degree day information from the GDD Tracker from Michigan State University web site. For additional locations and daily degree days, go to http://www.gddtracker.net/?zip=60185&model=2&state=IL

Table 2 Maximum, minimum and average temperature and cumulative precipitation for 2009 and 2010 and average cumulative precipitation for the historical average

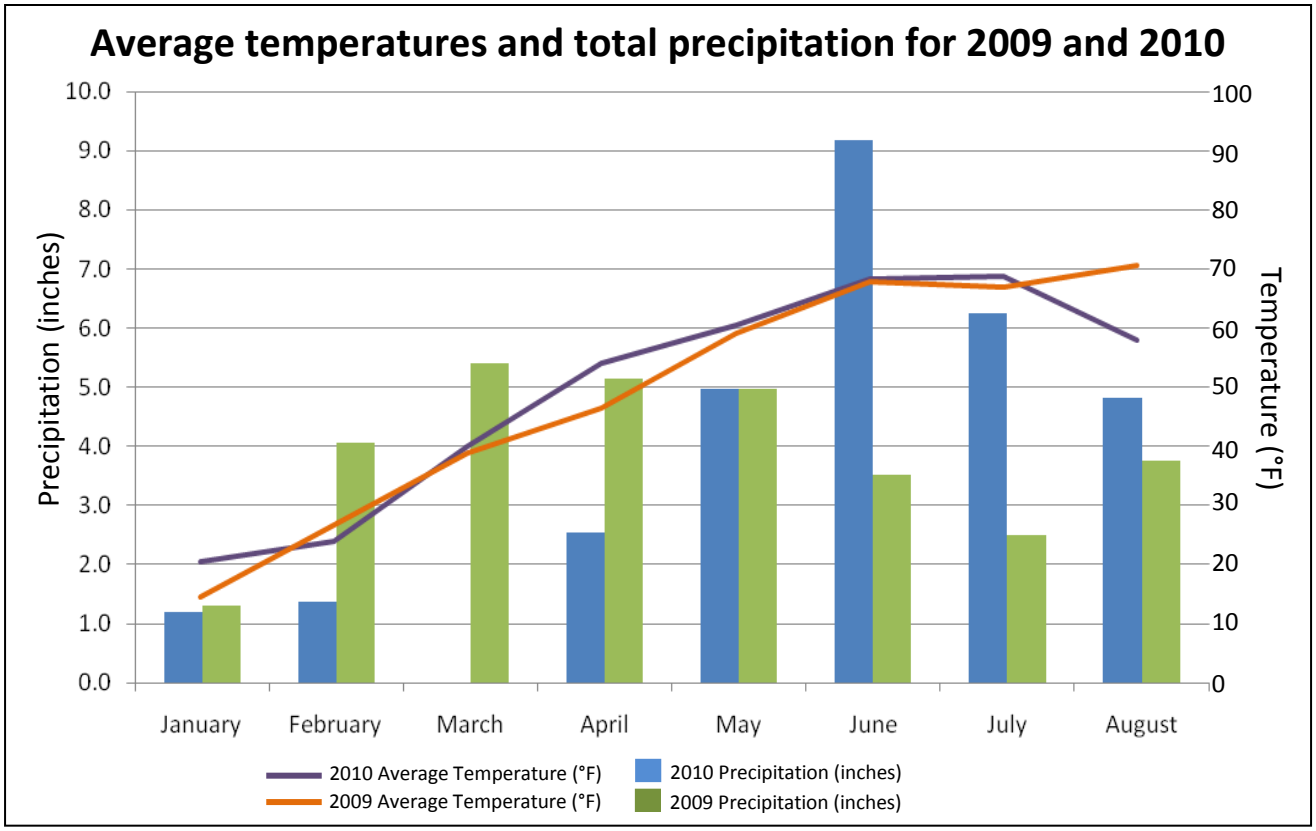
	2010				2009				Historical Weather 1937-2009			
Month	Max Temperature (F)	Min Temperature (F)	Avg. Temperature (F)	Precipitation Inches	Max Temperature (F)	Min Temperature (F)	Avg. Temperature (F)	Precipitation Inches	Max Temperature (F)	Min Temperature (F)	Avg. Temperature (F)	Precipitation Ave. Inches
January	27.7	12.6	20.2	1.2	23.0	5.2	14.1	1.3	47.8	-6.4	23.2	1.9
February	32.7	16.8	23.7	1.4	37.8	16.1	26.4	4.1	50.3	0.7	27.2	1.7
March	51.2	28.7	40.0	1.8	50.0	27.2	38.6	5.4	63.7	13.7	37.4	2.6
April	66.9	41.2	54.1	2.6	57.4	35.5	46.4	5.1	72.7	31.7	49.8	3.7
May	72.2	49.0	60.6	5.0	69.3	48.8	59.0	5.0	78.2	42.4	60.3	3.8
June	81.0	60.2	68.5	9.2	79.1	56.9	67.9	3.5	83.7	53.6	69.9	4.0
July	87.1	65.0	76.0	6.3	77.9	56.2	67.0	2.5	87.4	60.5	74.0	3.8
August (thru 25th)	85.5	64.6	60.5	4.8	82.0	59.5	70.7	5.8	87.0	59.5	72.6	3.7

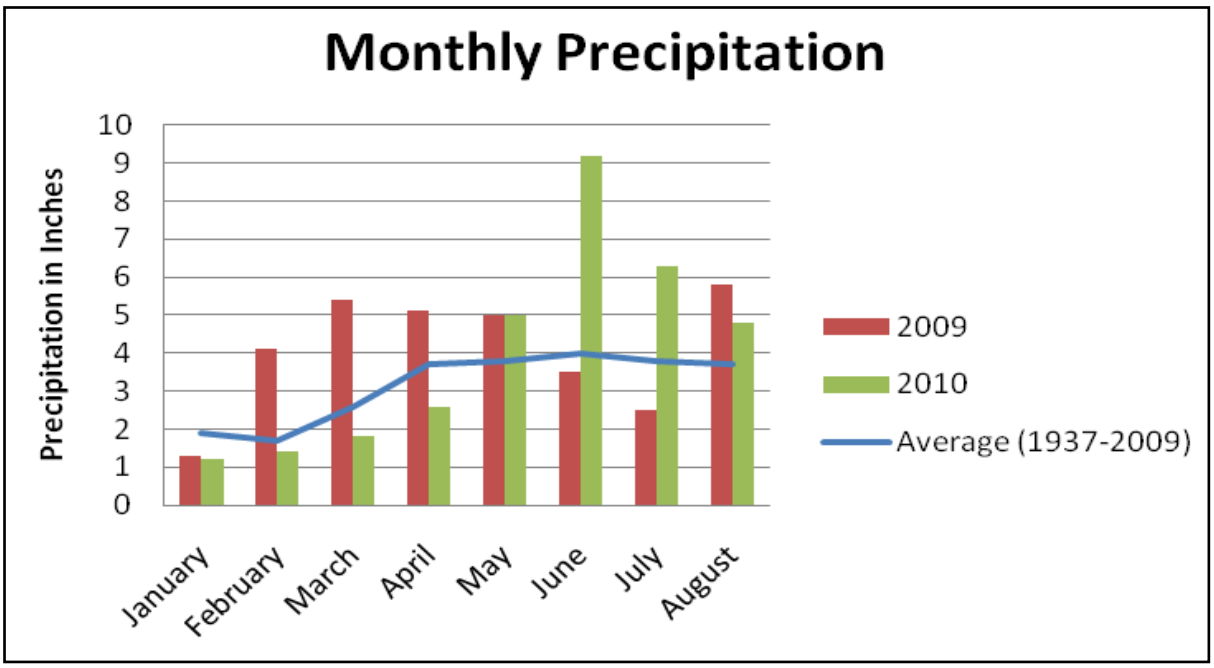
As seen in Table 1 as of August 25, 2010, we are at 2455 base-50 growing degree days (GDD), which is approximately 24 calendar days (488 GDD) ahead of 2009 at this time, and ahead of the historical average (1937-2009) by 69 GDD, 3 calendar days. In the past two weeks, it has rained 2.36 inches, 4.82 inches this month, and 30.34 inches for the year.

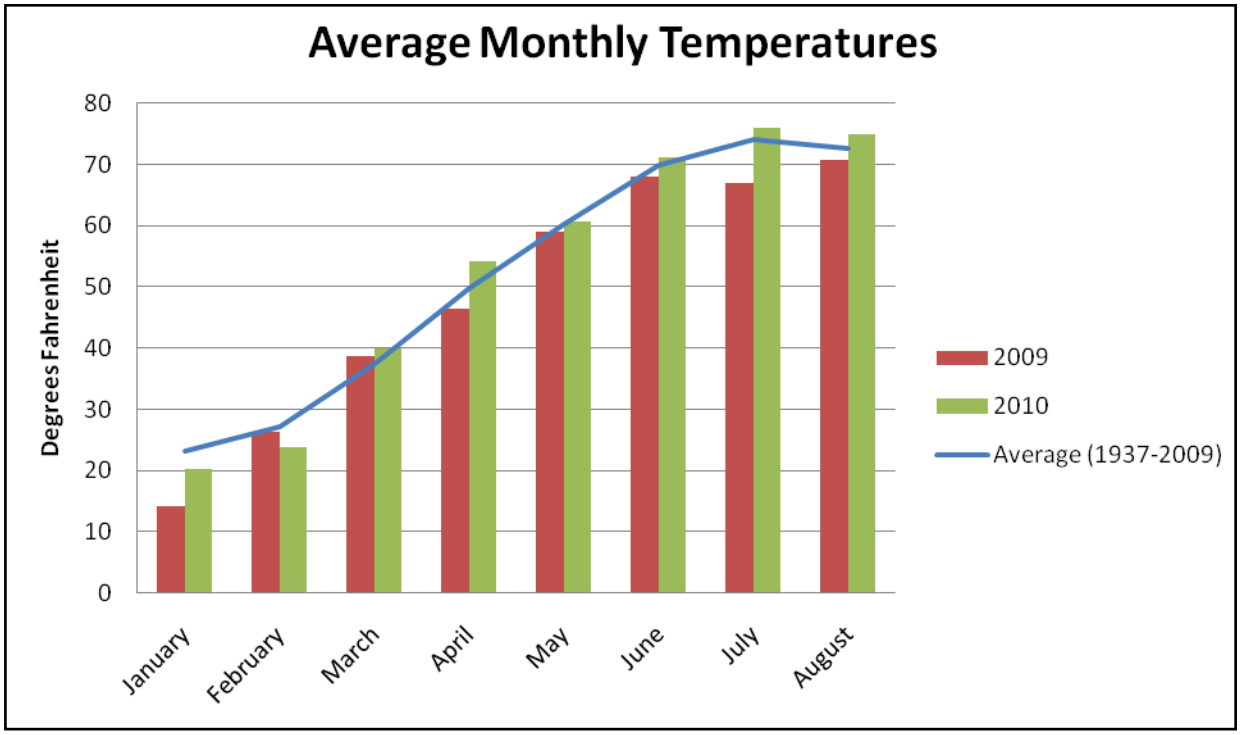
Precipitation in 2010 was lower than average through April, while 2009 was much wetter than average through May. Then 2010 began to receive a lot more rainfall beginning in May and continuing through the summer. In 2009, May and August were wet months, but June and July were drier than average. Overall, the summer of 2010 was much wetter than summer 2009.

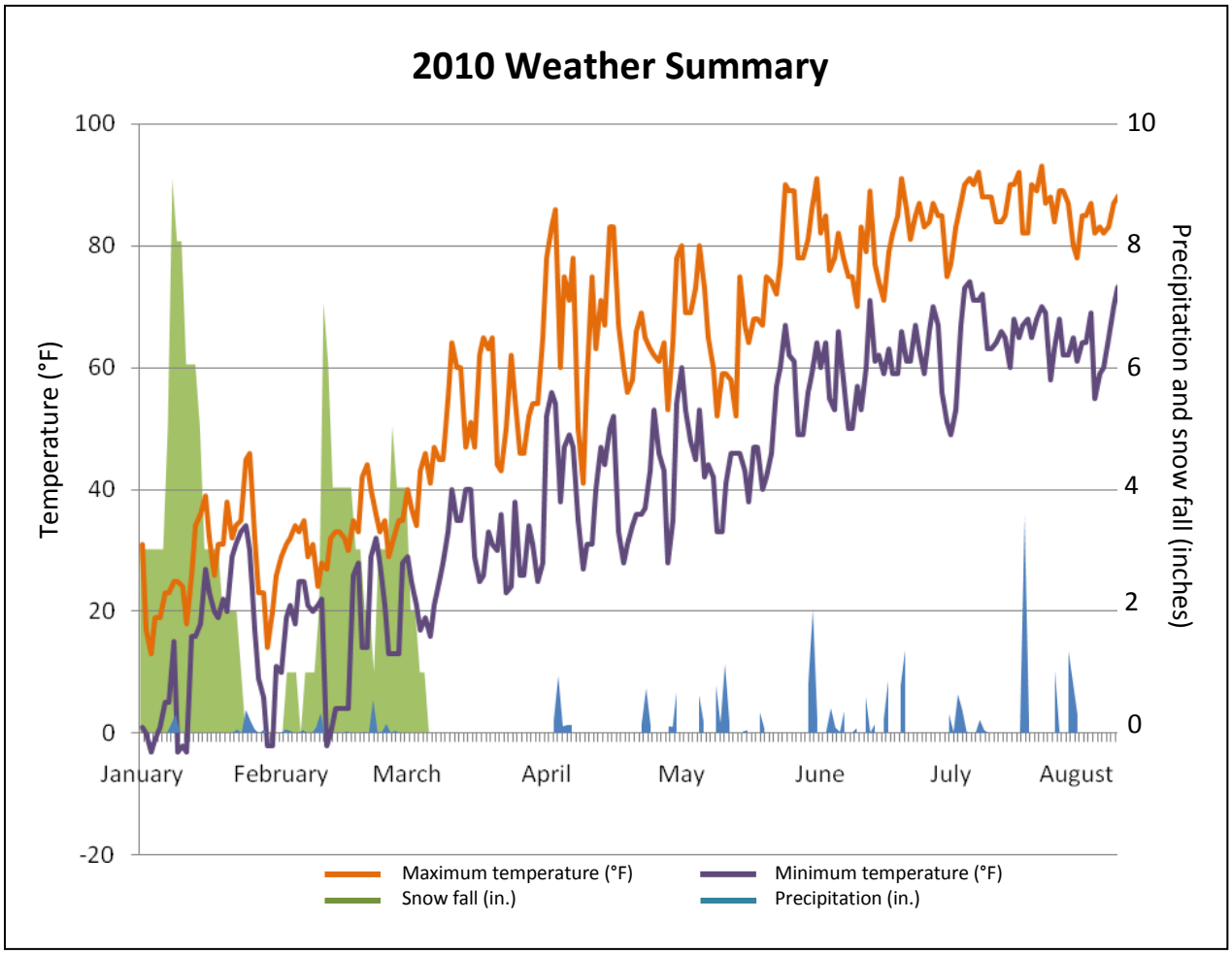
The two years also differed in temperature. This past January and February was colder than normal, but not nearly as frigid as 2009. Except for February, 2010 has been warmer than 2009 for every month, sometimes significantly warmer. This past July was nine degrees warmer than July 2009!

The winter weather for 2010 will be reported next spring 2011 in the first Plant Health Care Report.




Monthly Precipitation
Precipitation in Inches
10
9
8
7
6
5
4
3
2
1
0
January
February
March
April
May
June
July
August
2009
2010
Average (1937-2009)


Average Monthly Temperatures
Degrees Fahrenheit
80
70
60
50
40
30
20
10
0
January
February
March
April
May
June
July
August
2009
2010
Average (1937-2009)



This Week's Sightings…

Fall webworm

Fall webworm *(Hyphantria cunea*) caterpillars (Figure 2) are feeding on black walnut (*Juglans nigra*). This caterpillar is known to feed on more than 100 species of deciduous trees. Preferred hosts include hickory, ash, birch, black walnut, crabapple, elm, maple, oak, and pecan. The caterpillars are pale green to yellow, sometimes with black spots, and covered with long, silky white hairs. There are two races, black-headed and red-headed. The black-headed webworms are supposed to appear about a month earlier than the red-headed race. Full-grown caterpillars reach about one inch in length.

Fall webworms overwinter in the pupal stage in the ground, under loose bark, and in leaf litter. Adult moths appear from late May through August, and females deposit eggs in hair-covered masses on the underside of host leaves. Eggs hatch into caterpillars in about one week and begin to spin a silken web over the foliage

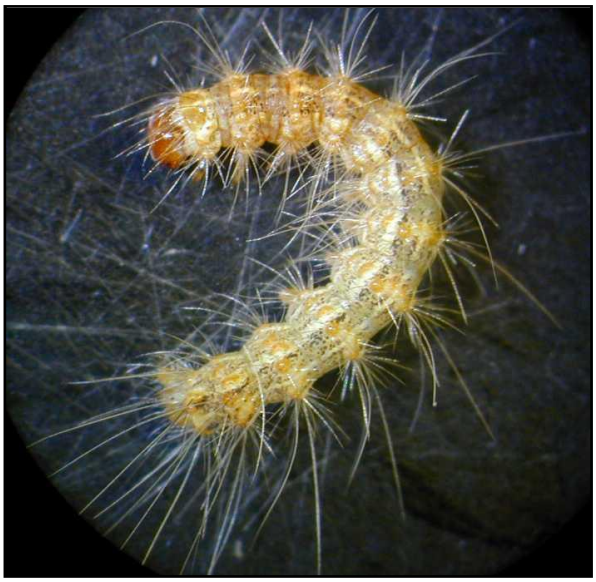


Figure 2 Fall webworm *(Hyphantria cunea*)


Figure 3 Fall webworm web

on which they feed (Figure 3). The webs increase in size as caterpillars continue to feed, and heavily infested trees can be completely covered with nests. In about six weeks, caterpillars will drop to the ground and pupate. Damage is generally aesthetic since this pest usually eats leaves late in the season and webs are typically concentrated to limited areas.

Some people confuse fall webworm and eastern tent caterpillar. How can you tell the difference? It's easy, just remember that the Eastern tent caterpillars are spring caterpillars, and only eat plants in the rose family such as crabapples. Fall webworm caterpillars are active much later in the season and have a much larger number of host trees.

Control: Chemical control is generally not warranted. The unsightly webs can be pruned out of small trees. Since these caterpillars stay in the web while feeding, pruning the webs at any time of day will eliminate the caterpillars, unlike Eastern tent caterpillars which leave the web during the day to feed. Webworms also have many natural enemies including birds, predaceous bugs, and parasitic wasps. Don't burn the nests in the trees because you will only do additional harm to your tree like the caller who burned the toilet paper out of his tree. *Bacillus thuringiensis* var. *kurstaki* (Btk) can control the larvae, but you must penetrate the webs in order to be effective. Btk is also not as effective against mature larvae. For information about chemicals to use for serious infestations, refer to the *2010 Commercial Landscape Turfgrass Pest and Management Handbook* (CPM) if you are a commercial applicator or the *Home, Yard and Garden Pest Guide* (HYG) if you are a homeowner.

Suggested reading: http://ohioline.ag.ohio-state.edu/hyg-fact/2000/2026.html
http://www.bugwood.org/factsheets/webworm.html

Sycamore lace bug

Sycamore lace bug (*Corythucha ciliata*) adults (Figure 4) have been found feeding on American sycamore (*Platanus occidentalis*). Lace bugs are a common pest of ornamental trees and shrubs and most lace bug species are host specific. An exception is the hawthorn lace bug (*C. cydoniae*) that attacks several species within the *Rosaceae* family including cotoneaster, flowering quince, crabapple, mountain ash, pyracantha, and hawthorn. Most lace bug species have two or more generations per year. The hawthorn lace bugs have only one generation per year.

The sycamore lace bug overwinters as an adult under loose bark of its host and becomes active in early spring as leaves begin to develop. Soon afterwards, the female lays eggs on the undersides of leaves. Eggs hatch within a few days, and spiny, wingless, black nymphs begin feeding. Within 4 to 6 weeks the nymphs pupate and the next generation of adults emerge (Figure 5). Adults are 1/8 to 1/4 inches long with lacy wings.

Sycamore lace bug adults and nymphs live on the lower surfaces of leaves and feed on leaf sap, causing yellow and white stippling on the upper leaf surface. As the insects feed, they deposit brown varnish-like excrement, referred to as tar spots, on the underside of leaves. Heavy infestations may lead to complete stippling of the leaf and premature leaf drop.


Figure 4 Sycamore lace bug (*Corythucha ciliata*) adult

Control: There are several naturally occurring predators including green lacewings, mites, and assassin bugs. A forceful spray of water will dislodge newly hatched nymphs, and they will often die before they find their way back to suitable leaves. Plant site selection is also

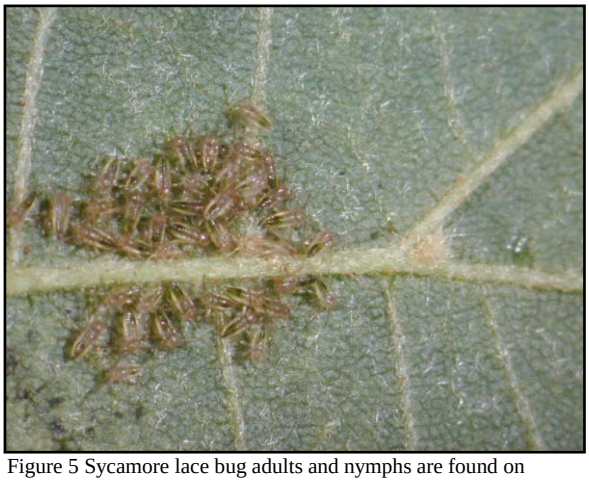


Figure 5 Sycamore lace bug adults and nymphs are found on the lower surfaces leaves

important as lace bugs prefer bright, sunny locations. Insecticides generally are not necessary except for severe infestations. Avoid using insecticides if natural predators are present. For further information about chemical control and timing, refer to the CPM and HYG.

Suggested reading:
http://entnemdept.ufl.edu/creatures/trees/sycamore_lace_bug.htm

Volutella stem and leaf blight

Volutella blight was diagnosed on ornamental ground cover Japanese pachysandra (*Pachysandra terminalis*) on our grounds (Figure 6). This is a serious, destructive stem and leaf blight. Volutella blight, caused by the fungus *Volutella pachysandricola*, will cause leaf blight and stem cankers on most pachysandra species. Symptoms first noticed in early spring as brown to tan leaf spots can be confused with winter desiccation. The spots will enlarge and may eventually cover the entire leaf. Concentric circles form within the spots and are diagnostic for this disease. Leaves eventually turn yellow and fall off the plant. Stems turn dark and die. During extended wet periods, orangish-pink fungal spore masses may be visible. Eventually, large patches of the ground cover may become infected and die.

Volutella is an opportunistic pathogen. It can infect a plant any time during the growing season but is more common during periods of rainy weather. Infections tend to diminish as the weather becomes drier in the summer, but the high humidity created by densely planted and heavily mulched beds can promote the blight. Stress from overcrowding, too much sun, winter injury, and shearing may increase susceptibility to stem blight. Older and injured plant parts of Japanese pachysandra are more susceptible to the disease than young succulent tissue. Bottom line: consider whether the site is one in which pachysandra can thrive.

Control:

- Purchase healthy plants that are free of disease. The native Allegheny pachysandra (*Pachysandra procumbens*) is reported to be more tolerant.
- Pachysandra prefers filtered sun or full shade more than full sun conditions, and will be stressed by the latter and more susceptible to blight.
- Plants should be watered during dry periods by using drip irrigation and/or by watering early in the day to allow foliage to dry out.
- Avoid working with plants when they are wet to prevent the spread of disease.
- Remove and discard diseased leaves and plants as soon as symptoms are visible to limit spread to healthy plants.

Figure 6 Volutella blight on Japanese pachysandra

- Clean up fallen leaves and other debris that may have accumulated on top of ground covers.
- Thin, prune, and divide overcrowded plants in early spring, when weather is dry, to improve air circulation.
- Avoid over-fertilization, which causes dense foliage that encourages infection.

For chemical recommendations, refer to the CPM or HYG from the University of Illinois if you are a homeowner.

Suggested reading:
http://www.umassgreeninfo.org/fact_sheets/diseases/vollutella_blight.pdf


Figure 7 Oak wilt symptoms on a red oak

Oak wilt

The University of Illinois has found oak wilt (*Ceratocystis fagacearum*), a very serious fungal disease, on oaks in the red oak group. Symptoms on red oaks include leaf wilting and bronzing, and premature leaf drop. Both the red and white oak groups are susceptible to oak wilt; however, the former is most susceptible. Symptoms between the two groups are different. In red oaks, death is rapid with wilt symptoms starting at the top of the tree and progressing inward and downward on the lateral branches within a few weeks (Figure 7). Leaves wilt from the leaf tip and margins to the bases and typically turn an off-green before showing bronze coloration. Near complete leaf drop usually occurs by the middle of summer, making infected trees stand out. Fallen leaves are often green at the base. There can be profuse suckering at the base of the tree. When an infected branch is cut in cross section, or bark peeled back, very light brown streaking or speckling can sometimes be seen in the outer ring of sapwood (Figure 8). Symptoms of the disease on white oaks are similar, but infected white oaks die slowly, a branch at a time, over a period of one too many years. Leaf discoloration of affected white oaks usually resembles autumn colors (but appears much earlier than autumn), and brown streaking in the outer growth ring of sapwood is often apparent.

The fungus invades the xylem and induces the tree to clog its own water-conducting vessels. Water flow is stopped and cells begin dying. Oak wilt can spread from infected trees to healthy trees through root grafts and by sap-feeding beetles that carry spores of the fungus from one tree to another as they feed and visit wounds.

Control: Monitoring and rapid removal (sanitation) is key to controlling oak wilt. Remove infected oaks as soon as you confirm the disease. Vector insects feed on fresh pruning wounds; therefore, oaks should not be pruned during the growing season when the nitidulid beetles are active. This disease can spread to other healthy oaks about 25 to 50 feet away (depending on tree size) via root grafts. To help halt the spread, dig a trench to a depth of approximately three feet between infected and healthy trees to break root grafting. Some systemic fungicides are labeled for preventing this disease. Refer to the CPM from the University of Illinois for chemical recommendations. The fungicides must be injected into the tree by someone trained in tree injections.

Suggested reading:
http://na.fs.fed.us/spfo/pubs/howtos/ht_oaklab/toc.htm

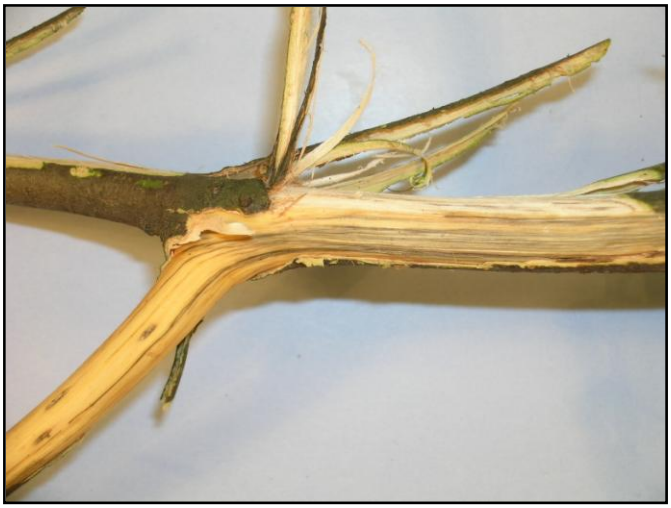


Figure 8 Dark brown streaking in the sapwood of a tree with oak wilt

Woody of the Week

by Jaime Horn

The Woody of the Week is written to aid in basic botanical identification of the featured plant, while adding to the reader's knowledge bank of woody plants. Many of the terms used are standard for describing plant morphology and may require definitions for complete understanding. There are several publications on botanical terminology. Two of

these publications are *Plant Identification Terminology: An Illustrated Glossary* by J.G. Harris and M. Woolf Harris and the Plant Morphology section in Michael Dirr's *Manual of Woody Landscape Plants* (page xiv) for pictures and descriptions.

Hardy kiwi (*Actinidia kolomikta*)

Family: Actinidiaceae
Native: Northeast Asia to Japan, central/western China. Introduced 1855.
Mature Size: Vine up to 20' or more
Hardiness: Zone 4-8
Foliage: Deciduous, emerges purple, alternate, broadly ovate, up to 6" long and 4" wide, sharply serrate, acuminate apex, 6 to 8 pairs of veins, develops a characteristic white or pink blotch at the apex
Flower: Dioecious, white, stamens yellow, fragrant, up to ½" diameter, borne in 1-3's from the leaf axils, May to June.
Fruit: Berry, up to 1" long, sweet, edible, yellow-green, September to October, occur only on fe males.
Stem: Brown, white lenticels, swollen nodes, brown pith.
Culture/Usage: A unique addition to any garden, *A. kolomikta* prefers well drained soil. Its unusual variegation is most pronounced when placed in full sun to light shade and alkaline soil. Less vigorous than *A. arguta*, it may be easier to keep down to size in the residential landscape. Supposedly, the male plants have better l eaf variegation than females. Provide a sturdy support for *Actinidia* to climb on in your garden.
Get An Up-Close View! Head up to Thornhill's Four Seasons Garden and take a peek at the Actinidia growing on the lamppost behind the stone wall on the East side. Grid location: JJ-28/68-77.
Interesting fact of the week: *Actinidia* is a genus containing the beloved Kiwi fruit (*A. deliciosa*—and how delicious they are!*).* Sometimes, Kolomikta Actinidia is referred to in the trade as Variegated Kiwi Vine. If you would like to eat their delicious fruits, make sure you plant a female plant (with a male plant nearby to ensure fruit production)! *Actinidia* is derived from the Greek word for ray (*aktis),* and *kolomikta* is the native name for the plant in the Amur Region of Asia.

Figure 9 Hardy kiwi (*Actinidia kolomikta*) foliage and form. Photo Courtesy of the Missouri Botanical Garden

Figure 10 Hardy kiwi (*Actinidia kolomikta*) flower. Photo courtesy of the Missouri Botanical Garden

Literature used to write the Woody of the Week:

Michael Dirr. 1998. *Manual of Woody Landscape Plants*. ISBN-10: 0-87563-800-7.
Harris, J.G. and M. Woolf Harris. 2001. *Plant Identification Terminology: An Illustrated Glossary*. ISBN-13: 978-0964022164.

An Ounce of Prevention in the Autumn
By Stephanie Adams
(first published August 2009)

Autumn clean-up is probably one of the easiest ways to make the next season in your garden a lot easier. People spend a lot of money on chemicals to inhibit or manage disease during the growing season, while merely removing the infested tissue the year before can prevent chemical applications. Because many plant pathogens overwinter in dead infected branches, fruit and leaves, removing infected tissue also removes the inoculum for the next growing season.

One important thing to note when discarding the infected tissue is that putting it into a compost pile will not kill the pathogens, because most compost piles do not get hot enough to kill them. The best way to dispose of the debris is to remove it from the property by bagging it, taking it to a landfill or burning it, if possible. Composting the infected plant debris will only perpetuate the disease cycle and potentially make it worse.

In gardens, diseases such as powdery mildew (caused by various fungal species), bacterial rots and early leaf blight of tomato (*Alternaria solani*) can be reduced by removing the old dead leaves and stems during the growing season. Also, remove any tissue that looks like it was bored into by insects. Removing it may reduce your insect infestations. After vegetable gardens are killed by frost, do a complete clean up of the vegetable garden. Remember to remove weeds too, because they may also harbor insects and pathogens.

Tree diseases such as apple scab (*Venturia inequalis*), rust (*Melampsora medusa*) on poplars (*Populus* spp.), anthracnose (fungal pathogens are host specific) on several tree species (oak, maple, ash, sycamore and others), and tar spot (*Rhytisma* spp.) on maple (*Acer* spp.) are also managed by removing the infected leaves. For some tree diseases like fire blight (*Erwinia amylovora*) and black knot (*Apiosporina morbosa*, sym. *Dibotryon morbosum*) on cherry (*Prunus*), removing the infected branches and galls is the best management practice. When removing infested rose leaves for black spot (*Diplocarpon rosae*), be sure to remove infested canes as well.

When pruning out infected branches in woody plants, the cuts should be made 8-12 inches below the symptomatic tissue during dry and calm weather, and be sure to sanitize the pruning tools between cuts to ensure that the tools aren't spreading the pathogen. To sanitize tools, either dip them in a 5% bleach solution, spray them with isopropyl alcohol or spray them with Lysol disinfectant spray (70% alcohol). When pruning out the infected tissue, be sure to make proper pruning cuts, do this by not leaving a stump and by keeping the branch collar intact. For more information on pruning and other tree care information visit the www.TreesAreGood.com website (http://www.treesaregood.com/treecare/treecareinfo.aspx).

To make the winter landscape a little more aesthetically pleasing, don't cut back grasses, hollies or other berry-bearing plants that may be food for birds, unless they have disease problems. Autumn is also a good time to mulch planting beds and trees. Applying 6-8 inches of hardwood mulch will reduce your need to water next year. Most evergreen species continue to transpire during the winter, which is the process where water is evaporated from aerial plant parts. Giving your trees a long slow watering before the ground freezes helps prevent unsightly scald symptoms in the spring. This kind of watering is easily achieved by using a soaker hose and allowing it to run for several hours until the soil is moist 12-16 inches below the surface.

Once the vegetable garden has been cleaned up go ahead and till it and then plant a cover crop, such as clover, legumes, and grains such as rye, oats or alfalfa. The cover crops benefit your garden by adding organic matter to the soil and they shade out weeds in the spring. Using legumes ensures that nitrogen will be added to the soils, due to their relationships with nitrogen-fixing bacteria. This will reduce the need to use high nitrogen fertilizers in the following year. Doing a soil test before selecting the cover crop is a good idea to ensure that the right mix of plants is used. Having the correct mix will benefit your soil the most.

Another important reminder is that the best time to prune oak (*Quercus* spp.) and elm (*Ulmus* spp.) trees is in the winter, between November and February. Open wounds on oaks and elms attract their respective beetles, which vector Oak Wilt (*Ceratocystis fagacearum*) and Dutch elm disease (*Ophiostoma ulmi*). Pruning these trees when the beetles are not active reduces the chances of your trees being infected.

When pruning trees be sure to keep safety in mind at all times. A hard hat and safety glasses should be worn when pruning over your head. If a chainsaw is being used be sure to wear chainsaw pants or chainsaw chaps during

operation too. Also, be aware of any people or animals that enter the area where pruning is taking place, and don't take on a job that's too big. If you are unsure of what needs to be done with your landscape trees contact an ISA Certified Arborist for a consultation.

Most people have done at least some of these relatively simple maintenance tasks already, so adding a few more tasks to your autumn 'to do' list can make your time spent in your yard more relaxing and enjoyable in the summer. When you think of your yard and gardens try to think more hammock and lemonade rather than weeding gloves and perspiration.

Report Contributors:

Plant Health Care Report is a team effort. It could not have been written without a whole slew of people. Donna Danielson, Plant Clinic Assistant (and lifesaver); Doris Taylor, Plant Information Specialist; and Dr. Fredric Miller, research entomologist at The Morton Arboretum and professor at Joliet Junior College, edited the report for content. Carol Belshaw, Plant Clinic volunteer, was the main editor for punctuation and grammar. Michael Brouillard, Northbrook Park District, and Chris Henning, Chicago Botanic Garden, reported degree days, precipitation, and sightings in their locations weekly. David Marin, senior grower, dependably supplied us with weather data on our grounds.

Faithful scouts included people from Horticulture, Greenhouse, and Collections: Brian Malatia, Ron Picco, Sara Koert, Mark Hoover, Merrill McNicholas, Jaime Horn, Tiffani Howell, Matthias Scheidler, John Sosnowski, Kunso Kim, Patrick Kelsch, Phil Riske, Katrina Lewin, Emily Sommerville, Emma Sprau, and David Marin.

The following plant clinic volunteers scouted for insects and diseases: Ann Klingele, Bill Coates, Fritz Porter, LeeAnn Cosper, Jack Leider, Laurie Blackmon, Mary Carter Beary, Davida Kalina, Pat Miller, Betsy Morton, Janice Sommer, Fritz Porter, Loraine Miranda, and Stu Vogel. John Hagstrom, Plant Clinic Volunteer, was kind enough to let us use his beautiful photos.

We are grateful that The Arboretum continues to fund the Plant Health Care program. We continue to be very thankful to Joy Morton, founder of The Morton Arboretum, for without his foresight, this wonderful institution would not exist. We're beginning to sound as though we were accepting an academy award, so thanks to all you readers and we'll end this now.

Index

Following is an index of the various subjects in this year's report. The number after each subject is the report number. For example, using the chart below, Anthracnose, oak 6 means that it was discussed in the PHC report 2010.06 or the newsletter dated May 15 - 21, 2010.

Report Number	Dates	Report Number	Dates
2010.01	May 28 – April 3	2010.10	June 12 – June18
2010.02	April 4 – April 16	2010.11	June 19 – June 25
2010.03	April 17 – April 30	2010.12	June 26 – July 2
2010.04	May 1 – May 7	2010.13	July 3 – July 9
2010.05	May 8 – May 14	2010.14	July 10 – July 16
2010.06	May 15 – May 21	2010.15	July 17 – July 30
2010.07	May 22 – May 28	2010.16	July 31 – August 13
2010.08	May 29 – June 4	2010.17	August 14 – August 27
2010.09	June 5 – June 11		

The Plant Health Care Report is prepared by Stephanie Adams, M.S., Plant Health Care Technician, and edited by Donna Danielson, M.S., Plant Clinic Assistant; Fredric Miller, Ph.D., research entomologist at The Morton Arboretum and professor at Joliet Junior College; and Doris Taylor, Plant Information Specialist, and Carol Belshaw, an Arboretum Volunteer. The information presented is believed to be accurate, but the authors provide no guarantee and will not be held liable for consequences of actions taken based on the information.

I would like to thank the volunteers that scouted this year and found most of the insects and diseases that are in this report. Your hard work is appreciated.

Literature recommendations:

David Arora. 1986. *Mushrooms Demystified 2nd ed*. Ten Speed Press. Berkeley, CA. ISBN-13: 0-89815-169-4.

Michael Dirr. 1998. *Manual of Woody Landscape Plants*. ISBN-10: 0-87563-800-7.

Mark L. Gleason, Margery L. Daughtrey, Ann R. Chase, Gary W. Moorman, and Daren S. Mueller. 2009. *Diseases of Herbaceous Perennials*. ISBN: 978-0-89054-374-0

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This report is available on-line at The Morton Arboretum website at http://www.mortonarb.org/tree-plant-advice.html

For pest and disease questions, please contact the Plant Clinic at (630) 719-2424 between 10:00 and 4:00 Mondays through Saturdays or email plantclinic@mortonarb.org. Inquiries or comments about the PHC reports should be directed to Stephanie Adams at sadams@mortonarb.org.