

# Missouri Forest Health Highlights - 2010

## Invasive Species

**Emerald Ash Borer** – The emerald ash borer (EAB), *Agrilus planipennis*, is an exotic forest pest that is capable of eliminating ash trees from North American forests. It has been detected in 15 states and 2 Canadian provinces as of November 2010. The only population detected thus far in Missouri is in Wayne County, in the southeastern part of the state. That infestation is centered on the Greenville Recreation Area campground at Wappapello Lake. EAB is assumed to have been introduced by movement of infested firewood by campground visitors. The infestation was detected in 2008, but evidence from trees at the site indicates introduction occurred at least 5 to 6 years prior to being discovered.

Delimiting surveys of the Wayne County infestation using EAB sticky traps were conducted by U.S. Department of Agriculture (APHIS-PPQ) crews in 2009 and 2010. A total of 923 traps were monitored within a 16 mile x 16 mile area in 2010. EAB adults were captured as far as five miles north and five miles south of the infestation center at the Greenville Recreation Area. The surveys focus on lowland and riparian areas where ash is more abundant. Oak-hickory forests dominate upland areas surrounding the infestation.

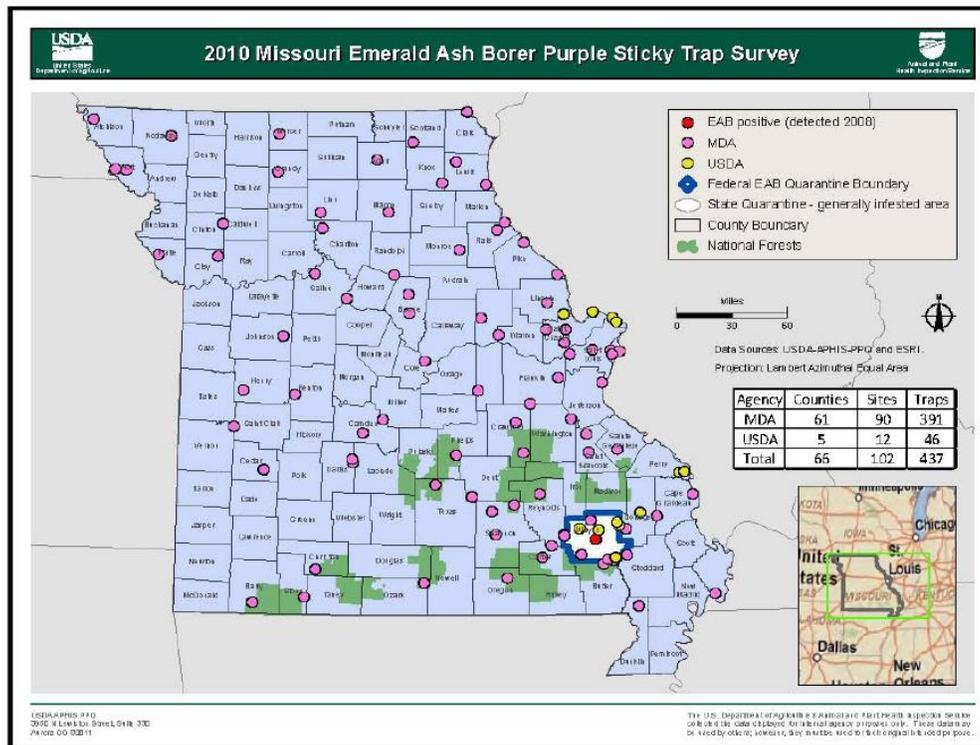


Emerald ash borer adult

*Forestry Images – David Cappaert*

The Missouri Department of Agriculture (MDA) led a statewide survey to detect other EAB populations. A total of 437 traps were monitored at 102 high-risk sites in 66 counties. No new EAB populations were discovered in Missouri in 2010.

The center of the Wayne County infestation is located on land owned and managed by the US Army Corps of Engineers (USACE). The USACE removed and destroyed ash trees (greater than 4 inches DBH) from about 200 acres per year in 2008-2009 and 2009-2010 in an attempt to slow the spread of the infestation. Destruction of larger ash trees removes a large portion of the EAB population and reduces the ash phloem resource available for EAB reproduction. Additional tree removals are planned for fall and winter 2010-2011.



In a complementary effort to detect and slow the spread of the EAB infestation, the Missouri Department of Agriculture, in cooperation with the USDA Forest Service and USACE, began initial steps of a SLAM (Slow Ash Mortality) project in May 2009. In spring 2010, 54 detection trees (stem-girdled trees) were established along nine miles of river corridor through the EAB-infested area. Within that total were eight clusters of girdled trees (3 or 4 trees per cluster) established to operate as EAB sinks. Detection trees will be felled, debarked and examined during late fall and winter to determine if they are infested with EAB.

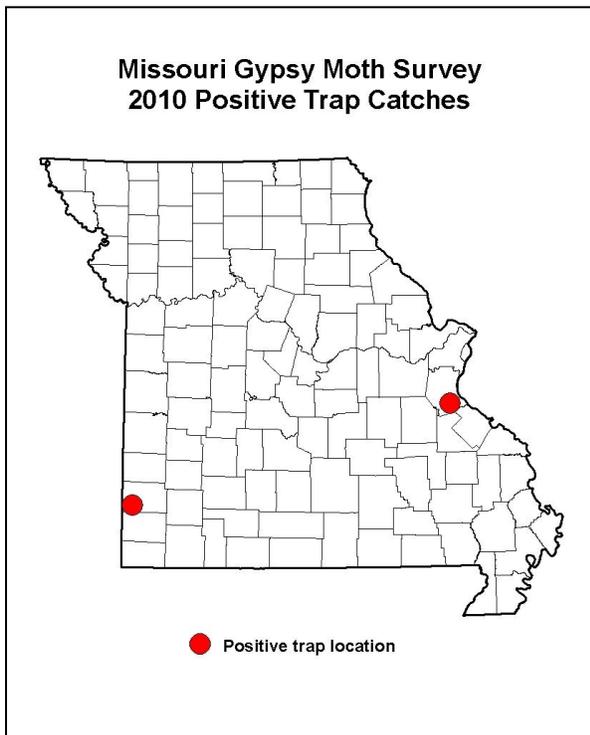
Another component of the SLAM project is assessment of the ash resource available for spread of the EAB population. An ash resource inventory was conducted in June 2010 on 8,865 acres surrounding the infestation center.

Outreach efforts continue to accelerate in Missouri. An EAB Outreach Coordinator was hired in March 2010 as a cooperative position with Missouri Department of Conservation (MDC), MDA, and USDA APHIS PPQ. The primary outreach goal is to further raise public awareness about EAB and the threats posed by movement of firewood. The Missouri cooperative EAB web site was redesigned and significantly updated (<http://eab.missouri.edu>). Missouri Governor Jay Nixon signed a proclamation recognizing EAB Awareness Week (May 23-29). Billboards were placed throughout the state along highways leading to major



recreational areas. A radio campaign was operated from Memorial Day through Labor Day. Advertisements were placed in numerous newspapers and magazines with potential to reach more than 500,000 Missourians. A newsletter, “Borer Bite”, was created to inform about the latest news and program efforts regarding EAB. Messages informing about the risks associated with moving firewood were sent to out-of-state residents holding Missouri hunting permits. A new logo was created to provide branding for the Missouri EAB Program. Staff from cooperating agencies gave numerous presentations and displays at trade shows, stakeholder meetings, and other events. MDC staff continued to respond to questions and reports of suspected EAB infestations submitted by the public via toll-free phone number and web-based reporting form.

**Gypsy Moth** - The multi-agency Missouri Cooperative Gypsy Moth Program continued its annual survey to detect the presence of gypsy moths by placing and monitoring 9,276 traps in 71 of 114 counties in 2010. Sites where gypsy moths were captured in 2009 were surveyed more intensively at a higher trap density (delimit areas) in 2010.



Only 2 moths were captured statewide in 2010, one in Jasper County in southwestern Missouri and the other in Jefferson County on the east side of the state. This is a significant decrease from the results of the 2009 survey when 22 moths were captured statewide, including 15 in the St. Louis metropolitan area. Neither of the moths captured in 2010 were in delimit areas.

The absence of gypsy moth captures in St. Louis County is quite unusual for the annual survey. That absence and the low numbers captured statewide may be related to the recent decline in gypsy moth populations in the northeastern U.S. due in large part to increases in activity of the *Entomophaga* fungus. Population declines in the generally infested area of the Northeast reduce the risk of gypsy moths being transported to Missouri. Gypsy moth monitoring efforts will continue annually in Missouri.

**Thousand Cankers Disease (TCD)** occurs when the walnut twig beetle, *Pityophthorus juglandis*, attacks walnut trees, spreading a *Geosmithia* sp. fungus that causes small cankers in the phloem tissue under the tree bark. As the number of beetle attacks increases, an increasing number of cankers weaken the tree causing dieback and eventual tree death. Black walnut is ecologically and economically important to Missouri, and TCD represents a serious threat to this resource. Thousand cankers disease has not been detected in Missouri; however there is concern that TCD could spread from western states and Tennessee where it has been detected. In April 2010, MDA enacted the first state exterior quarantine in the nation to protect the black walnut

resource from the TCD threat. Importation of walnut material capable of spreading TCD and all hardwood firewood was prohibited from states known to have TCD.

A preliminary visual survey was conducted in 2010 by several agencies, including MDC, MDA, and USDA Forest Service. Trees were examined near high-risk sites including state park campgrounds with high rates of visitation from states where TCD has been detected, urban areas, and reports of declining walnut from the public. Trees with possible symptoms of TCD (dieback in the upper canopy, branches with attached wilted brown leaves, and extensive epicormic sprouting) were examined more closely.

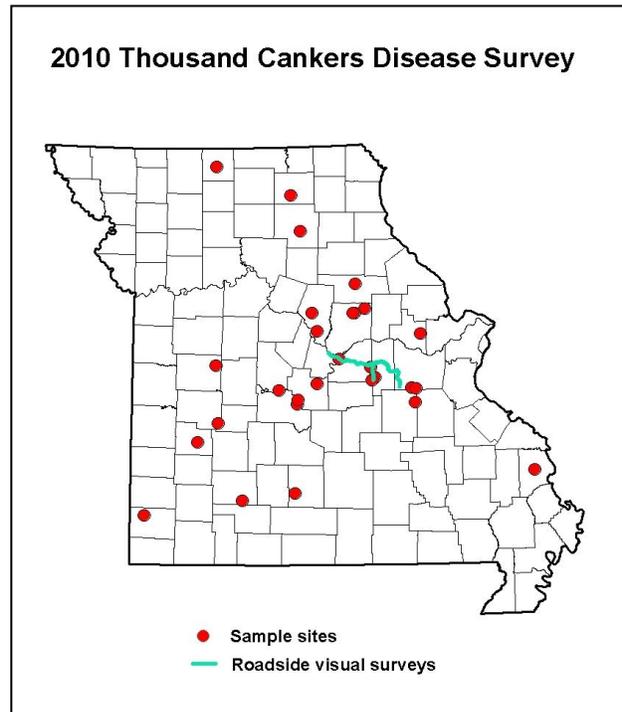
Symptomatic branches 1-2 inches in diameter were collected and bark scraped away to look for any evidence of walnut twig beetle and discoloration in the phloem. When discoloration was noted, sample branch sections were triple-bagged and placed in a cooler with icepacks for transport to a freezer. Samples were frozen for 48 hours prior to lab analysis and culturing.

Several insect and disease agents, other than TCD, were observed on walnut samples.

*Fusarium* species were frequently cultured from discolored phloem tissue. Other problems noted included exposed, elongate *Fusarium* cankers on black walnut trunks, defoliation from anthracnose beginning in mid-July, site-related decline issues, and infestation by several other wood-boring insects {roundheaded and flatheaded borer larvae, granulate ambrosia beetle (*Xylosandrus crassiusculus*) and black vine borer (*Xylosandrus germanus*)}.

Outreach efforts were expanded this year to raise public awareness about TCD. Messages included the potential impact of this new disease, the threat posed by movement of potentially infected walnut materials, and identification and handling suspect trees. Several state agencies including MDC, MDA, University of Missouri Extension, as well as stakeholder groups were involved in outreach. Efforts have included a brochure, poster, websites, news releases, presentations, trainings, and displays at a variety of public and green industry meetings. An email address has been publicized as a place to email photos of suspect trees as a first step in determining what trees should be visited by trained personnel.

**Butternut Canker**, *Sirococcus clavigignenti-juglandacearum*, is killing butternut throughout its range. Elongated annual cankers girdle the branches and trunk, killing the tree. Butternut canker is known to be present in Missouri where butternut occurs. No survey work occurred to examine this issue in Missouri in 2010.



**Dogwood Anthracnose**, *Discula destructiva*, can be lethal to flowering dogwood, *Cornus florida*, in the eastern states. Lesions develop on the leaves and girdling cankers develop on the twigs, branches and trunk. Dogwood anthracnose is not common in Missouri and has not been reported in native forested areas. It has been detected in nurseries and landscaped trees, and when traceable, has been traced to out-of-state sources. In 2010, the University of Illinois Plant Clinic confirmed the presence of conidiomata and conidia of *Discula destructiva* associated with a single landscape specimen from Kirkwood in St Louis County.

**Laurel Wilt Disease** occurs when the redbay ambrosia beetle, *Xyleborus glabratus*, attacks susceptible trees, spreading the fungus *Raffaelea lauricola*. In the southeast, this disease is causing mortality to redbay, where diseased trees exhibit drooping foliage with reddish discoloration and gradual wilting of the entire crown. Redbay is not found in Missouri, and the redbay ambrosia beetle and laurel wilt have not been detected in Missouri. However, there are some Missouri plant species believed to be susceptible. Sassafras (*Sassafras albidum*) and spicebush (*Lindera benzoin*) are common Missouri species, and pondberry (*Lindera melissifolia*) is known to occur in a single southeastern Missouri county.

**Sudden Oak Death**, *Phytophthora ramorum*, affects a wide range of hosts. *P. ramorum* was first identified on the West Coast and has since been confirmed in nursery stock in western nurseries which ship plant material to eastern states. Missouri has several plant species that are proven hosts; however *P. ramorum* has not been detected in Missouri. USDA APHIS and MDA have primary responsibility in tracking down plants from western nurseries when *P. ramorum* detections occur in the nursery. In 2010, trace-forward samples from western nurseries were collected and tested by MDA using ELISA and found to be negative for *P. ramorum*.

### **Weather-Related Issues**

Highly variable and extreme weather conditions of the past few years have been major stressors on forest health in Missouri. Multiple ice storms have caused severe tree damage (branch and stem breakage) in many parts of the state. An unusually severe and widespread windstorm in May 2009 broke and uprooted trees in much of southeastern Missouri.

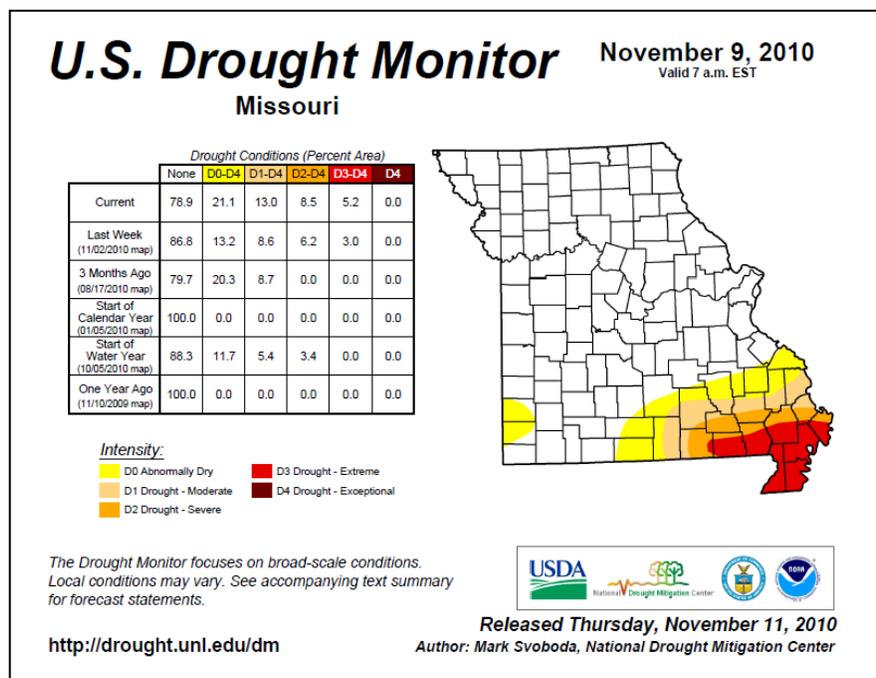
Other weather patterns have affected even larger portions of the state. A week-long freeze event in April 2007 following an early warm-up and advanced shoot development resulted in tree damage nearly statewide. Foliar destruction and twig death were the most obvious effects. But various types of decline and tree health problems in subsequent years are suspected of being related to more subtle types of damage occurring during that freeze event.

Precipitation was much above normal across the state for 2008 and 2009, making that the wettest two-year period on record. Increased activity of fungal diseases was common. Temperatures during the growing season (April-October) in those years were mild, averaging 1.1 and 2.1 degrees cooler than normal, respectively.

This past winter of 2009-2010 was the 13<sup>th</sup> coldest winter of the past 116 years. Cold temperatures were persistent, with no mid-winter warm-ups. Precipitation was above normal, particularly in northern and central Missouri, with snowfall near 50 inches in northwestern parts of the state.

Spring 2010 was generally mild and wet. That pattern continued into a hot and humid summer across the entire state, resulting in the hottest summer of the last 30 years and the 9<sup>th</sup> hottest in 116 years.

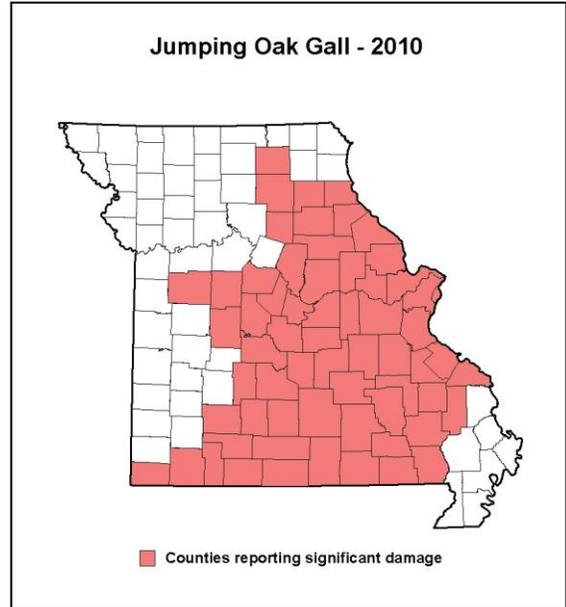
Summer precipitation, however, varied greatly within the state. Rainfall amounts for June to August were above average in northeastern Missouri totaling more than 25 inches in many places. Hannibal reported the 2<sup>nd</sup> wettest July on record. Meanwhile, drought conditions developed by late June in southeastern Missouri and continued throughout the summer and fall. By November 2010, the Bootheel region and several adjacent counties were in severe to extreme drought conditions. Although most of the state, with the exception of the Bootheel, received above normal precipitation in September, October was the 4<sup>th</sup> driest on record statewide since 1964. By November, topsoil moisture was low across much of south central and southeastern Missouri. Significant portions of the state's forests were heading into winter with below normal moisture supplies.



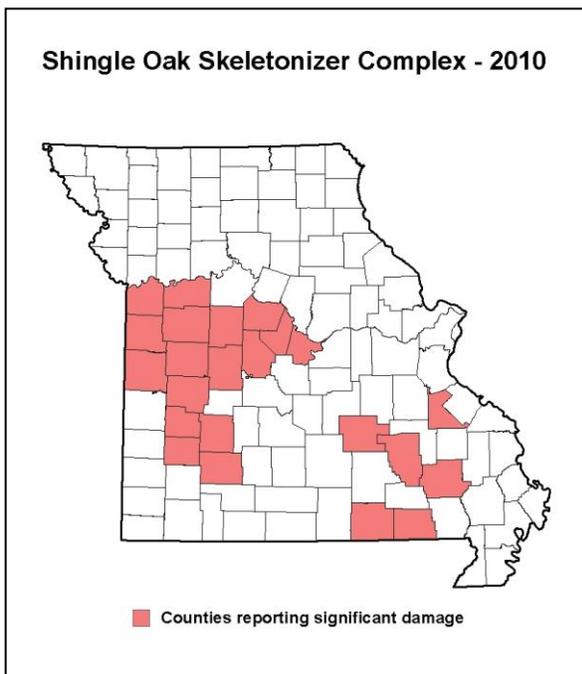
## Other Forest Health Issues

**Jumping Oak Galls** – Unusually high populations of jumping oak gall wasps (*Neuroterus* sp.) caused significant leaf damage on white oaks across much of Missouri in 2010. The map below illustrates the extent of the outbreak based on observations of MDC and USDA staff. The

number of galls per leaf was often so high that entire tree crowns turned brown and many leaves dropped prematurely from branches. Jumping oak gall outbreaks have typically occurred every few years and more often in eastern Missouri. Damage in 2010 was much higher than past years, particularly in south central and southwestern Missouri.

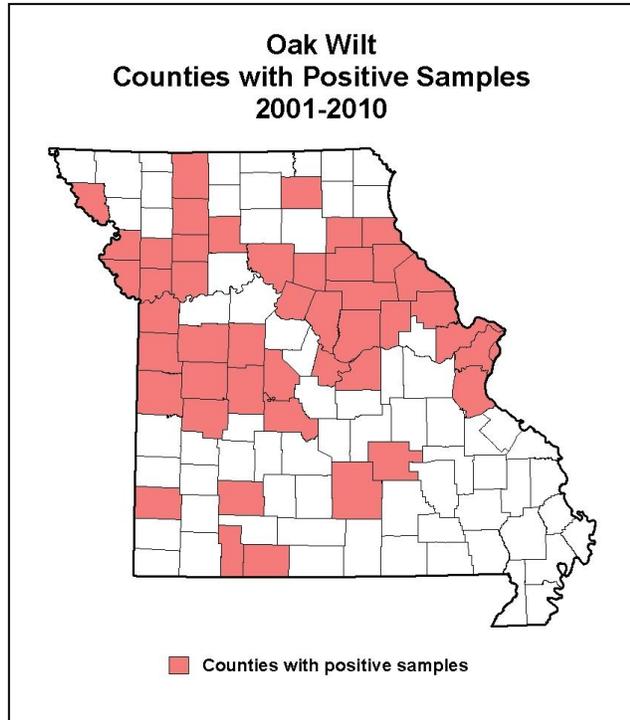


**Shingle Oak Skeletonizers** – Large populations of leaf skeletonizers returned in 2010 on shingle oaks in many parts of western and southern Missouri. Outbreak populations appear every few years. Damage is caused by a complex of unidentified species of moth larvae (Lepidoptera) that feed on lower surfaces of leaves leaving a lacy skeletonized upper leaf layer. They specialize almost exclusively on shingle oaks, although other oaks may be occasionally used as hosts. During outbreaks, leaf damage is severe enough to cause entire tree crowns to turn brown.



Skeletonizer outbreaks over the last 20 years have been most extensive in western Missouri. Smaller outbreaks have occurred in southeastern Missouri. Outbreaks occurred in 1983, 1991, 1996-1997, and 2004. The 1996-1997 event caused especially heavy damage in west central Missouri. The current outbreak began in 2009 in that same general area. Many more counties were involved in 2010, with the largest area of defoliation occurring between Kansas City, Jefferson City and Springfield (based on observations of MDC and USDA staff). Additional counties in southeastern Missouri reported significant defoliation.

**Oak wilt** is an aggressive fungal disease affecting many oak species and causing oak mortality every year in Missouri. Symptoms vary by species; however red oak species are more severely affected than white oak species, with rapid leaf discoloration, wilting, and leaf drop. Since 2001, the MDC forest health lab has diagnosed oak wilt from 45 counties across the state. In 2010, positive samples were submitted from seven counties (Boone, Caldwell, Calloway, Clay, Greene, Henry, and Ray). Oak species that were positive include black, blackjack, pin, shingle and red. Some negative samples were received late in the summer after several weeks of high temperatures which may have impacted the results. However, the last positive sample this year was received October 15.



**Sugar maple leaf scorch and mortality –**

In July and early August we received many reports of previously healthy sugar maples that were observed rapidly developing a leaf scorch or dying. This was reported in areas with heavy, poorly drained soil in northeast and central Missouri where unusually high soil moisture was followed by high temperatures this summer. The phenomenon was reported specifically in Adair, Boone, Clark, Macon, and Ralls counties as well as surrounding areas.

**Conifer needle diseases –** The effects of wet weather the past few years was apparent on conifers, especially Austrian pine where reports of severe *Dothistroma* needle blight and *Diplodia* tip blight were widespread. High levels of infection appeared to be causing mortality in some areas. *Diplodia* tip blight was also reported in several Scots pine Christmas tree plantations. *Rhizosphaera* and *Stigmina* needle casts were frequently reported on blue spruce.



*Dothistroma* needle blight on Austrian pine

**Branch flagging and tip dieback in oaks –** Flagging (leaf browning on individual branches) and twig dieback was reported in southwest Missouri. White oak damage was most frequently reported. Samples examined in the MDC Forest Health Lab were small branches or twigs averaging 6 inches long. Healthy growth was sometimes present, and sometimes samples and information suggested trees were declining for other reasons. Similar appearing samples examined in the lab last year were damaged by *Kermes* scale and *Botryosphaeria* canker, however this year *Coryneum* twig blight was present on examined samples. *Coryneum* is considered

a secondary pathogen attacking trees that have been stressed by various factors. Damage may be related to weather events such as excessive moisture and freeze damage.

**Eastern Redcedar Issues** – In 2009, many eastern redcedars were observed to die rapidly. This year, this phenomenon was not frequently reported, although the MDC lab received widespread reports of random dieback this spring and summer. In early spring, samples examined in the lab had Kabatina tip blight. Later in the growing season, similar samples had Phomopsis tip blight. The presence of healthy needles and growth associated with these samples suggested recovery was possible.