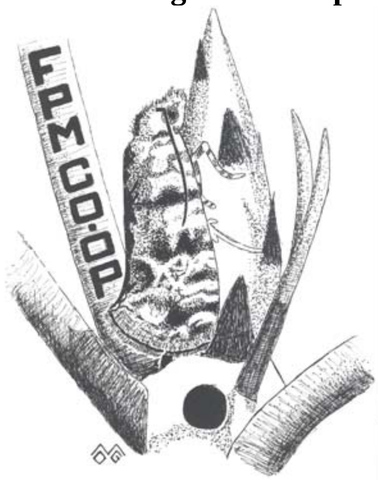
Progress **E**ducation **S**cience **T**echnology

Vol. 15 No. 2 June 2010

Quarterly Newsletter on Forest Pest Management Issues

Forest Pest Management Cooperative



Nantucket Pine Tip Moth, *Rhyacionia frustrana* (Comstock)

Texas Forest Service, Forest Pest Management,
P.O. Box 310, Lufkin, Texas 75902-0310

PEST is a quarterly newsletter that provides up-to-date information on existing forest pest problems, exotic pests, new pest management technology, and current pesticide registrations related to seed orchards and plantations. The newsletter focuses on, but is not limited to, issues occurring in the South (Texas to Florida to Virginia,).

****

Announcement:

PTM™ Strategy Meeting - All interested parties are invited to attend a strategy meeting to address EPA concerns about use of PTM™ Insecticide on containerized pine seedlings. The meeting will be held on Tuesday, July 20, 2010 at International Forestry Company's facility in Moultrie, GA. The meeting will begin at 9:00 AM. For additional information and/or an agenda, contact Don Grosman at 936-639-8170 (ph), 936-546-3175 (cell) or dgrosman@tfs.tamu.edu.

****

Summary of 2009 FPMC Research Projects

In 2009, three research project areas – tip moth, leaf-cutting ant, and systemic injection - were continued from 2008. Results from leaf-cutting ant, fire ant and weevil studies were presented in the last *PEST* newsletter (March 2010). Summaries of the results from systemic injection studies are presented below. Results from tip moth impact, hazard-rating and control studies will be presented in the next *PEST* newsletter (Sept. 2009).

Systemic Injection

The Forest Pest Management Cooperative (FPMC) has continued work to evaluate the potential of using systemic insecticide injections to protect pine seed orchard crops from coneworms and seed bugs. Emamectin benzoate (EB) (Syngenta/Arborjet) has been shown in several injection trials to be highly effective in reducing coneworm damage for extended periods and effective in preventing the colonization and mortality of injected trees by *Ips* engraver beetles and aggressive *Dendroctonus* species. Trials were continued in 2009 to test EB and other potential insecticides for seed bug protection in pine seed orchards, to ascertain efficacy of different chemicals against bark beetles, and to evaluate different injection systems.

Seed Orchard Trial

A trial was installed in fall 2008 to evaluate the efficacy of imidacloprid (Imid) and abamectin (Aba) alone or combined with each other or EB for protection against seed bugs (primarily) and coneworms. In a loblolly pine seed orchard (Yulee, FL), each chemical or combination was injected into 7 trees. All trees were also treated with a foliar spray five times through the growing season. Survival was evaluated by counting cones and conelets first in April and again in August. All cones from each study tree were collected in the fall and evaluated for coneworm damage. Seeds were extracted from 10-cone samples and x-rayed to evaluate for seed bug

Continued on Page 2

Systemic Injections – Continued from Page 1

damage. Surprisingly, none of the treatments improved cone or conelet survival in 2009, nor did they significantly reduced seed bug damage compared to checks. Mean reductions in 2000 ranged from 0 - 15% (Fig. 6).

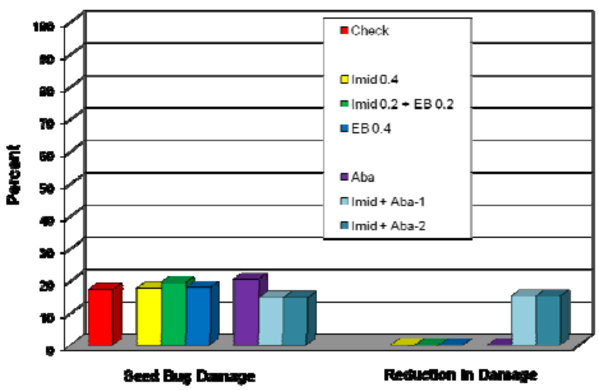


Figure 6. Percent seed bug (*Leptoglossus* and *Tetyra* spp.) damage and reduction in damage on FL loblolly pine seed collected from trees injected with imidacloprid (Imid), abamectin (Aba), or emamectin benzoate (EB) treatments, 2009.

All treatments containing an EB component significantly reduced coneworm damage in 2009; reductions ranged from 90 - 100% (Fig. 7).

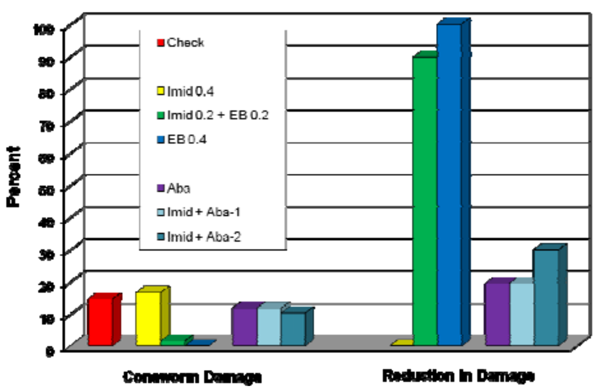


Figure 7. Percent coneworm (*Dioryctria* spp.) damage and reduction in damage on second-year FL loblolly pine cones treated with injections of imidacloprid (Imid), abamectin (Aba) or emamectin benzoate (EB) treatments, 2009.

Bark Beetle Trials

Three separate trials were established in 2005 - 2009 to evaluate EB, fipronil (FIP) or abamectin against:

1 & 2) *Ips* engraver beetles on loblolly pine in TX, and
3) Southern pine beetle (SPB) on loblolly pine in AL

The *Ips* trial evaluated the duration of three rates of EB applied at different times of the year (fall 2005 and spring 2006); and two rates of abamectin and FIP in 2008. In addition, concentrations of EB were analyzed from phloem, xylem, foliage, and cones.

The timing and rate trial indicates that all emamectin benzoate injection treatments, particularly those at higher rates, were highly effective in preventing the successful colonization by *Ips* of logs from treated trees 28 and 34 months after injection (Fig. 1). Tissue analysis showed EB concentrations (Fig. 2) were highly correlated to treatment efficacy

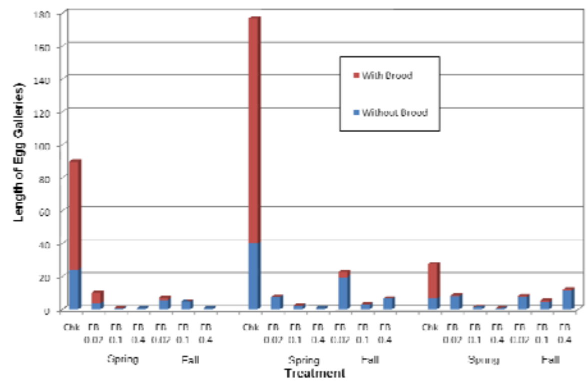


Figure 1. Effect of injection treatment on *Ips* engraver beetle attack success expressed as length of egg galleries with and without brood. EB = emamectin benzoate.

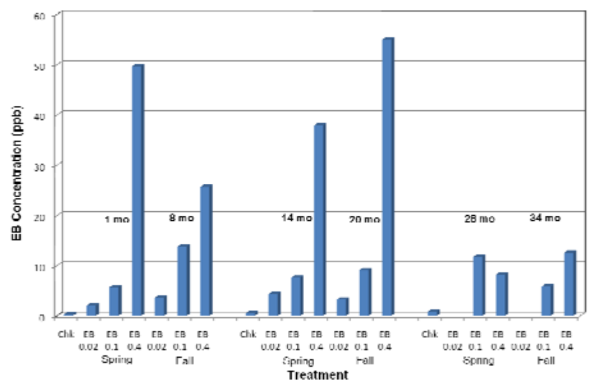


Figure 2. Concentration (ppb) of emamectin benzoate in loblolly pine phloem tissue at different times after injection.

Both rates of abamectin were highly and equally effective against *Ips* engraver beetles 5, 10 and 16 months after injection (Fig. 3).

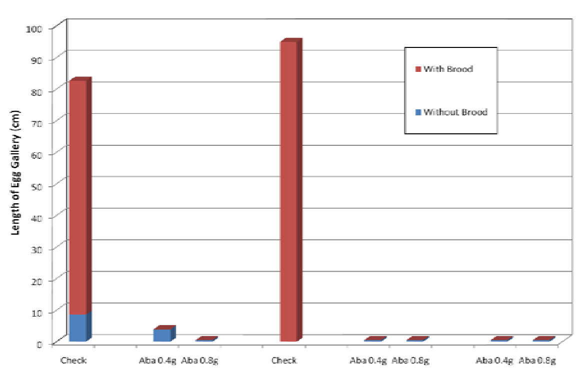


Figure 3. Effect of two abamectin injection treatments on *Ips* engraver beetle attack success expressed as length of egg galleries with and without brood.

Systemic Injections – Continued from Page 2

In the SPB trial, trees (30) were injected with EB, a fungicide mix or combination treatment using Arborjet's Tree IV. Four weeks later, all trees (treated and untreated) were baited with species-specific pheromones to induce beetle attack. SPB populations were not sufficient to kill >60% of check trees in AL during the first year. However, the beetle attack levels on injected trees were markedly lower than those on untreated checks (Fig. 4).

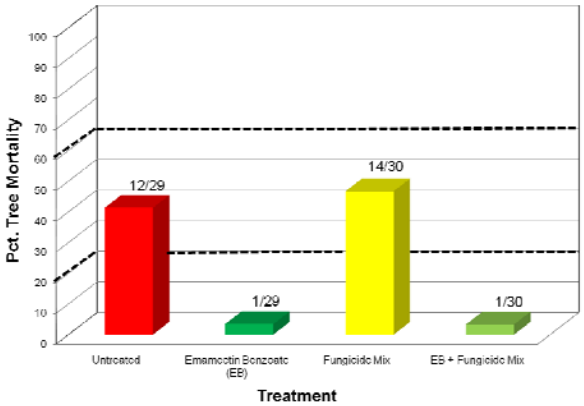


Figure 4. Effects of injection treatments on mortality of loblolly pine attacked by southern pine beetle in 2009, Oakmulgee, R.D., Talladega N.F., AL.

Injection System Evaluation

Seven injection systems (Mauget's capsule, Rainbow Treecare's M3™, Arborsystem's Portal™, Arborjet's Quik-jet™ and Tree IV™ and Sidewinder's backpack and Bug Buster™) were evaluated for their ability to inject EB into pine based on 15 criteria related to loading, installing, injecting, and safety. Four (Tree IV™, Quik-jet™, Portal™ and Sidewinder™ – backpack) of the seven systems were found capable of injecting the desired amount of EB into study trees and had the highest scores. The EB treatments applied by all four of these systems were very effective in preventing *Ips* engraver beetle colonization 25 months after injection (Fig. 5).

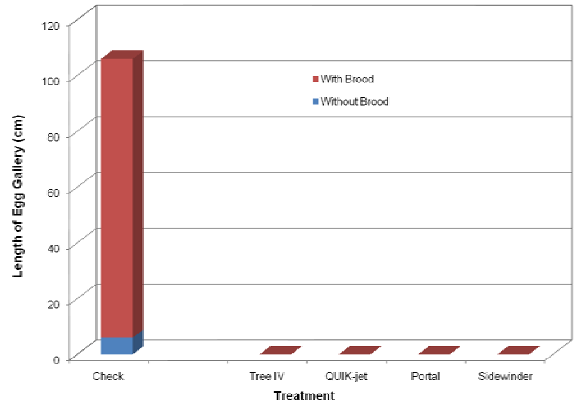


Figure 5. Effectiveness of emamectin benzoate 25 months after application with four different tree injection systems, Lufkin, TX 2009.

The FPMC and other researchers are continuing to look at other potential markets including evaluating the potential of emamectin benzoate for protection of oaks (cherrybark, bur and willow) against various forest pests including defoliators, wood borers, ambrosia beetles, and gall insects. Because the new formulations of EB appear to be effective against cone and seed insects, as well as bark beetles, the FPMC has asked Syngenta/Arborjet to also include conifer seed orchard use on any registration package submitted to EPA.

Syngenta submitted its registration package for TREE-äge™ (EB) to EPA in December 2007. EPA approved the full (Section 3) registration of this product for use on ash against the emerald ash borer in July 2009. Approval for uses on other hardwoods and conifers for various pests has been delayed until October 2010. With regard to eventual EPA registration of EB, cross your fingers, but don't hold your breath.

BASF has lost interest in registering fipronil for bark beetles based on the relatively poor results compared to EB. However, J.J. Mauget has taken up the fight for this chemical. Stay tuned.

Acknowledgements - We greatly appreciate the effort and support provided by:

Rayonier (Early McCall and Josh Sherrill)
Texas Forest Service (Tom Byram, I.N. Brown, Jason Ellis)
U.S. Forest Service (Steve Clarke)
Weyerhaeuser Co. (Steve Smith)
Arborjet (Joe Doccola)

****

Southern Pine Beetle South-wide Trend Predictions for 2010

by Ronald F. Billings, Texas Forest Service

In the southeastern U.S., 2009 was a year of record low levels for southern pine beetle (SPB) activity. Only 445 SPB infestations were reported in 16 states, with most infestations occurring in South Carolina. Based on pheromone traps deployed during the spring of 2010, continued low levels are expected this year, with some increased activity expected in portions of Georgia, Virginia, South Carolina, and New Jersey.

The southern pine beetle, *Dendroctonus frontalis*, has a well-deserved reputation as the most destructive forest pest of pine forests in the South. In 2000, nearly 60,000 multiple-tree infestations were detected on federal, state and private forest lands throughout the South, resulting in the loss of millions of dollars of resources. By 2008, the number of SPB infestations had declined to 1,433 spots detected in 16 states, with most spots occurring in Alabama, North Carolina, and South Carolina. SPB activity continued to decline in 2009 to levels seldom enjoyed throughout the South. Only South Carolina reported more than 35 infestations and no SPB spots were detected in Oklahoma, Arkansas, Texas, Mississippi, Tennessee, Delaware, or New Jersey last year.

The Texas Forest Service (TFS) has developed a reliable system for predicting SPB infestation trends (increasing, static, declining) and levels (low, moderate, high, outbreak) that has been implemented across the South since 1986. This information provides forest managers with valuable insight for better anticipating SPB outbreaks and more lead time for scheduling detection flights and preparing suppression programs.

Each spring, traps baited with the SPB attractant (frontalin) and host compounds (alpha-pinene and beta-pinene) are set out in pine forests when dogwoods begin to bloom. Dogwood blooms mark the primary dispersal season for populations of the destructive SPB as well as certain beneficial insects. The traps are monitored weekly for a 4-6 week period by federal and state cooperators. Of particular value for forecasting purposes are catches of clerids (also called checkered beetles), known predators of SPB. Using data on the average number of SPB captured per trap per day and the relative proportion of SPB to checkered beetles, infestation trends for the current year can be forecasted.

The results from the 2010 prediction survey, based on 501 traps distributed among 206 trapping locations within 16 states, indicate continued low SPB activity in all southern states, with the exception of a few counties or Ranger Districts in Georgia, South Carolina, Virginia, and New Jersey where some SPB activity may occur. Of those locations surveyed, only the Fort Stewart Army Base and the Conasauga and Chattooga Ranger Districts in Georgia, the Long Cane Ranger District and Oconee County in South Carolina, Chesterfield County in Virginia, and Atlantic, Cumberland and Wharton counties in New Jersey are predicted to have SPB activity that may increase to a moderate level, but no severe outbreaks are expected. Overall, beetle activity is predicted to remain low in all other areas surveyed. Very few or no SPB infestations are expected again this year in Oklahoma, Arkansas, Texas, Louisiana, Mississippi, Kentucky, Tennessee, Alabama, Florida, North Carolina, Maryland, or Delaware. A state-by-state summary of trap catches for SPB and clerids for 2009 and 2010, together with SPB predictions for 2010, is listed in Table 1.

Annual predictions of infestation trends have proven to be 75-85% accurate. Collectively, trend predictions from numerous specific locations provide insight into SPB population shifts within a given state as well as across the South. Also, comparison of trapping results for the current year with those from the previous year for the same localities provides additional insight into SPB population changes.

In general, average trap catches that exceed 30 SPB per day, especially those in which SPB make up more than 35% of the total catch (of SPB and clerids), are indicative of increasing or continued high SPB infestation levels in the current year. Conversely, when catches of predators far outnumber those of SPB and fewer than 10 SPB adults are caught per

Continued on Page 5

SPB Prediction – Continued from Page 4

day, infestation trends are likely to decline or remain at low levels. It is uncertain whether the predator population is directly responsible for declines in SPB outbreaks. Most likely, predators are just one of many contributing factors. It is interesting to note, however, that average trap catch of clerid beetles has declined somewhat (17%) from last year across the South (Average = 4.3 clerids/trap/day in 2010 versus 5.2 in 2009). This is down from a high of 16.8 clerids/trap/day in 2004 (a decline of 74%). Interestingly, the highest numbers of clerids were captured in Texas (11.6 clerids/trap/day) and Virginia (10.7 clerids/trap/day) and the lowest in Florida (0.6 clerids/trap/day) in 2010. It remains unclear what this annual and geographical variation in clerid abundance means with regard to SPB population dynamics. Presumably, a high number of predator beetles should yield improved biological control, helping to maintain pest populations at low levels.

Landowners with pine stands throughout the range of SPB are encouraged to take advantage of these low SPB population levels to thin overly-dense pine stands as a preventive measure before the next SPB outbreak occurs. Federal cost shares for precommercial thinning of natural or planted pine stands and first thinning of pulpwood stands are available in many states as part of the SPB Prevention Program. Contact your state forest pest specialist for details.

Appreciation is expressed to the many state and federal cooperators who provide the data for this annual survey. If you have questions, contact Dr. Ronald Billings, Texas Forest Service, at (979) 458-6650 or by e-mail at rbillings@tfs.tamu.edu.

Table 1: Summary of Southwide Southern Pine Beetle Trend Predictions For 2010

Compiled by Ron Billings, Texas Forest Service, based on data received from Southwide cooperators

State	No. of infestations 2008	2009 No. of locations trapped	2009 %SPB	2009 SPB/ trap/day	2009 Clerids/ trap/day	2010 No. of infestations 2009	2010 No. of locations trapped	2010 %SPB	2010 SPB/ trap/day	2010 Clerids/ trap/day	Prediction Trend / Level	Most Likely Locations of SPB Activity
Oklahoma	0	2	0%	0.0	1.6	0	2	0%	0.0	1.1	Static/Low	
Arkansas	0	9	0%	0.0	5.1	0	10	0%	0.0	4.5	Static/Low	
Texas	0	16	0%	0.0	2.6	0	16	0%	0.0	11.6	Static/Low	
Louisiana	7	25	1%	0.0	2.4	0	27	0%	0.0	1.9	Static/Low	
Mississippi	28	20	4%	0.2	4.1	0	20	10%	0.4	3.4	Static/Low	
Alabama	222	7	22%	1.8	7.1	31	8	18%	1.2	5.6	Declining/Low	
Georgia	54	24	21%	2.4	11.2	24	21	38%	3.4	5.5	Increasing/Low	Fort Stewart Army Base, Conasauga R.D., Chattooga R.D.
Kentucky	0	2	5%	0.1	1.0	1	2	0%	0.0	1.7	Static/Low	
Tennessee	1	6	15%	0.2	8.8	0	6	8%	0.2	2.2	Static/Low	
Virginia	33	6	33%	6.8	11.0	25	6	33%	5.2	10.7	Static/Low	Appomattox/Buckingham Co., Chesterfield Co.
Florida	17	26	22%	0.7	3.2	15	26	33%	0.3	0.6	Static/Low	
South Carolina	940	35	10%	1.3	8.3	344	31	24%	2.7	8.5	Increasing/Low	Longcane R.D., Oconee Co.
North Carolina	131	21	13%	0.4	6.6	5	20	10%	0.5	4.5	Static/Low	
Maryland	0	4	24%	0.8	3.0	1	4	64%	2.1	1.1	Static/Low	
Delaware	0	1	0%	0.1	1.4	0	1	5%	0.1	1.3	Static/Low	
New Jersey	0	6	24%	1.7	5.8	0	6	62%	7.4	4.6	Increasing/Low-Mod.	Atlantic Co., Cumberland Co., Wharton Co.
16 States	1433	210	12%	1.0	5.2	445	206	26%	1.5	4.3	Increasing/Low	Static, low levels in most southern states, particularly west of the Mississippi River. Increasing trends in certain countie sand Ranger Districts in GA, VA, SC, and NJ.

Thought You Might Be Interested to Know . . .

Fertilizer and Consequences for Trees

(By Joseph Heckman, Ph.D., Specialist in Soil Fertility, in Rutgers Cooperative Extension, Plant and Pest Advisory, Landscape, Nursery & Turf Edition, May 6, 2010)

Conventional thinking assumes that fertilization of trees increases their ability to ward off insects, disease, and stress, but research by Dr. Daniel Herms at The Ohio State University, suggests otherwise. http://www.ohio4h.org/~news/story.php?id=2442

The nutritional quality (protein content) of host plants is usually a limiting factor in the growth and survival of insects. Fertilization increases the nutritional value of the tree as food for insects. For example, on fertilized trees, gypsy moth larvae have been observed to grow 49% faster and eastern tent caterpillar 530% faster.

There is a trade-off between tree growth rate and defense against pest attack. While fertilization does increase the growth and may enhance aesthetic quality of trees, scientific evidence shows that fertilization almost always decreases tree resistance.

In addition to enhancing the nutritional quality of the plant to the feeding insects, fertilization decreases the concentrations of plant defensive compounds. Alkaloids (nicotine), terpenes, phenols (flavonoids, lignin, tannins), and cyanide are examples of defensive chemicals that become less concentrated in plant tissue when trees are given fertilizer.

Tree fertilization also increases the shoot/root ratio. Increasing shoot growth while decreasing the proportion of root growth, adds to the trees water requirement while reducing tree capacity to acquire water. Consequently, fertilized trees may be more susceptible to drought.

Nevertheless, fertilization may have a role in a plant health care program, especially in high maintenance landscapes. Caretakers, however, should be aware of potential consequences of fertilizer on pest resistance and stress tolerance in trees.

Urban landscapes are often plagued with soil compaction. Besides fertilization, efforts to improve tree health should focus on preventing soil compaction or remediating soils that are already compacted.

Plant Health Care Concerns & Curiosities

(By Steven K. Rettke, Ornamental IPM Program Associate, in Rutgers Cooperative Extension, Plant and Pest Advisory, Landscape, Nursery & Turf Edition, May 20, 2010)

✔ **BURL/KNOT GROWTHS ON TREES:** Some people may be curious about the abnormal growth of knots or burls that occasionally are found on some trees. These mysterious aberrant growths often produce an ugly, distorted appearance and are usually found on certain deciduous trees. The actual cause of these burls is not fully understood, but they seem to be a genetic wound response. The tree may receive only a relatively mild injury that initiates compartmentalization and callus tissues to form. However, this defensive mechanism within the tree does not seem to be able to shut itself off, resulting in a massive overgrowth of cells on stems or branches. Apparently, there are no pathogens or toxins involved, as is the case with the formation of witches' brooms. Often times the affected trees do not experience any decline and continue to grow.

✔ **LICHENS HARMFUL TO TREES & SHRUBS? :** The blue-green colored lichens growing

on the bark of trunks and stems are the well-known mutualistic association between fungi and algae. Lichens have prolific growth when exposed to full sunlight. Sometimes people may become concerned with lichen growth on their trees or shrubs, especially after crown thinning has opened up the canopy and the increased sunlight promotes further growth. Nearly all of the literature states that lichens are purely superficial and cause no harm to the health of trees/ shrubs. Interestingly, a few non-scientific studies have indicated that lichens may possibly have some detrimental health effects. For example, it has been postulated that lichens may disrupt gas exchange. Furthermore, these organisms have the ability to break down rocks and hence, it is

Continued on Page 7

Plant Health Care – Continued from Page 6

suggested some damage to plants do occur. However, until replicated and controlled scientific studies prove otherwise, we should continue to reassure our clients that these curious growths on their trees/shrubs are of no concern.

✔ **URBAN PLANTS:** New York City horticulturalists have prepared a list of "City Tough Plants." These are plants that survive both shaded and dry conditions, in the shadow of tall buildings. Examples include: Bugleweed (*Ajuga*); Aucuba; Boxwood; Creeping Euonymus; English Ivy; Inkberry; Leucothoe; spicebush (*Lindera*); Mahonia: Andromeda (*Pieris*); Yew; Vinca; Cherry Laurel; Lady's mantle (*Alchemilla*); Japanese painted fern (*Athyrium*); Bergenia; Leadwort (*Ceratostigma*); Lily-of-the-Valley; Barenwort (*Epimedium*); Coral bells (*Heuchera*); Hosta; and Crested iris.

✔ **DROUGHT VS. FROST CRACKS:** Many arborists and landscapers often suggest to their inquiring clients that frost-cracks are the reason for the bark separation within the trunks of trees. Often times, however, the actual cause may be from drought stress. Drought cracks most commonly occur when trees are first planted or a year or so after transplant. The trunks will crack if trees are allowed to become too dry. Some common trees more susceptible to this condition include maple, honey locust, crabapple, mountain ash, and London-plane. One of the easiest ways to distinguish between drought vs. frost cracks is by the way the wounds close. Drought cracks typically represent a one-time event and will generally close or seal almost completely and never re-open again. On the other hand, frost cracks are more likely to continue to open and close over subsequent years. Usually less freezing and thawing stress is required to re-open the crack in the future and a conspicuous callus ridge often develops over time. Sunscald wounds occurring on the south or southwest sides of tree trunks can also create cracks (i.e., frost or drought cracks can occur on trunk sides facing any direction). Sunscald wounds generally never close or seal over and may often increase in size as the tree grows. Although there is rarely any need for immediate concern when managing trees with these types of trunk cracks, the open wounds can increase the potential exposure to wood decay fungi.

✔ **GIRDLING ROOTS:** Many tree species can develop potentially life threatening girdling roots, but maple species are notorious for developing them in the landscape. As offending girdling roots expand in diameter and press against the also expanding central stem, an inevitable slow decline of the tree begins. When two roots grow together or when two branches grow together they have the ability to graft and share conducting tissues. However, root and stem tissues cannot graft together and detrimental effects occur when they expand into one another. Typically the growth of the crown declines, leaves display early fall colors, and twig/branch dieback becomes progressively pronounced. A common symptom that can be observed easily from a distance is when the tree trunk goes straight into the ground with no visible root flare. With valuable trees, the excavation and removal of offending roots may be considered. This management strategy is only suggested if the tree decline is not too advanced and no more than a couple major girdling roots are involved. One of the primary causes of girdling is when new transplants are planted too deep. The casual observation in wooded and forested areas indicates that girdling roots are very rare at these sites.

✔ **OVERPLANTING OF BRADFORD PEARS:** The Callery Pear cultivar 'Bradford' has been widely used because of its spring flowers and tolerance of poor urban sites. However, it has severe branch splitting due to poor branch attachment and narrow branch angles. This typically results in susceptibility to storm damage and branches breaking off of large trees. A recent parking lot study from Rutgers evaluated 5 cultivars of Callery pear as potential substitutes for 'Bradford.' Results after 4 years showed that the cultivar 'Aristocrat' was the only tree to display branch angle attachments at maturity that could resist storm damage. "Aristocrat' occasionally suffered frost damage to flowers, had a lower, broader crown and a deep purple-red fall color. "Chanticleer' grew the fastest, but had narrow branch angles. 'Redspire' also had fairly narrow branch angles with intermediate, open growth. 'Capital' and 'Whitehouse' were both dense, upright and heavy blooming. Some new cultivars of the Callery Pear have been developed in recent years that were not included in the Rutgers studies. These newer additions may also contain the desirable characteristics displayed by 'Aristocrat' cultivar.

✔ **WITCHES' BROOMS:** The development of witches' brooms on woody plants and the resulting formation of abnormal growth can cause curiosity and concern to your clients. Typically, the new

Continued on Page 8

Plant Health Care – Continued from Page 7

growth is distorted and a proliferation of leaves or fruit/cones closely clumped together appears when apical dominance is lost. Witches' Brooms are created on plants when the transfer of growth hormones is disrupted (perhaps caused from the introduction of a foreign substance). Insects (e.g. aphids), fungi, bacteria, phytoplasmas, and herbicides have all been implicated in causing the formation of

witches' brooms in a large number of plant species. It is interesting to note that sub-lethal doses of glyphosate (Round-Up®) when applied late in the season can cause witches' brooms on new plant growth the following spring.

****

Pest Spotlight: Pitch Canker

Importance - Pitch canker, caused by *Fusarium moniliforme var. subglutinans*, can damage many pine species, including all of the commercially important southern pines. In forest stands, only plantations of slash, and occasionally loblolly pine, are seriously affected. While mortality can result from abundant cankering, losses from growth suppression are more common.

Identifying the Fungus - Pinkish fruiting bodies (sporodochia) containing fungus spores are produced on cankered shoots in the needle scars and on the outer surface of bark. Microscopic features of the sporebearing structures aid in identification.

Identifying the Injury - Infected trees exhibit shoot dieback of the current year's growth (A), and abundant resin flow from the affected area. The wood beneath cankers is resin-soaked (B). The main terminal and upper laterals are most often affected.


A


B

A) Terminal dieback
Photo by Robert L. Anderson, USDA Forest Service
B) Internal resin impregnation of infected xylem tissue
Photo by Edward L. Barnard, Florida

Biology - Fungus spores are airborne and spread in the summer during windy, wet periods. The spores infect wounds. Insect vectors, such as the deodar weevil (C), *Pissodes nemorensis*, and cerambycid (longhorned beetle) adults (D), that breed in dying trees and feed on the phloem of young branches, can transmit the disease. Spores are abundant in the litter beneath diseased stands, and fruiting bodies persist for months on diseased shoots. The incidence of pitch canker has been spatially correlated to nitrogen levels near poultry operations


C


D

C) Deodar weevil D) Cerambycid feeding

Control - No specific control procedures are available for pitch canker. Forest practices which maintain stand vigor - for example, thinning - may minimize disease hazard. Avoid over-fertilization, especially with nitrogen. Salvage harvesting of heavily-diseased stands is recommended. Genetic resistance to the disease exists and should be included in future pest management strategies.

Reference:

Insects and Diseases of Trees in the South. 1989. USDA Forest Service - Forest Health Protection. R8-PR16. 98 pp. Taken from http://fhpr8.srs.fs.fed.us/forstpst.html

****