ALABAMA COOPERATIVE Extension SYSTEM
Your Experts for Life

HORTICULTURE SERIES

TIMELY INFORMATION
Agriculture & Natural Resources

Viruses Affecting Blackberry Plantings in Alabama

Dr. Elina Coneva, Extension Specialist, Department of Horticulture, Auburn University, **Dr. John F. Murphy**, Professor, Department of Entomology and Plant Pathology, Auburn University, **Robert Boozer**, Extension - Research Horticulturist, Alabama Cooperative Extension System, **Gary Gray, James Miles, William East, and Lloyd Chapman**, Regional Extension Agents, Alabama Cooperative Extension System

Blackberries have been a favorite native fruit in the southern United States. Although the vast majority of cultivated blackberry production in the U.S. is concentrated in the Pacific Northwest, blackberry production in the eastern U.S. has increased during the last five years. This growth is attributable to breakthroughs in nutraceutical science that demonstrated berries were among the richest sources of natural vitamins and antioxidants, which contributed to higher market demand of the consumers for fresh market southern berries. Current production of blackberries in Alabama is limited, but there is a growing interest in this high-value specialty crop as consumer demand for a quality local supply increases. Blackberry production offers farmers an excellent potential for profit, having a great market potential in addition to the high crop value. A market exists at grocery chains, gourmet restaurants, and farmers' markets. In addition to the above outlets, berries can be sold to processors, at pick-your-own locations, or pre-picked at farm stands.

Although the outlook for blackberry production is very encouraging, certain pests like viruses and virus-like diseases can cause serious yield losses and longevity of blackberry plantings. Not all viruses cause serious damage to plants, but some are widespread and destructive.

Knowledge of viruses that infect blackberry and their control are important when considering establishing blackberries. Since 2000, a number of viruses that affect blackberry growth and production were found in commercial settings throughout the Southeastern United States, but their presence in Alabama-grown blackberries was unknown. The first signs of viral infection in Alabama blackberries were noticed in 2006 on 4-year-old Kiowa and Apache blackberry cultivars grown at the Chilton Research and Extension Center (CREC), Clanton. Blackberry plants exhibited stunted vegetative growth and crumbly berry development. Commonly, growth decline and fruit malformations are some of the symptoms associated with a viral infection of blackberry plants. Therefore, samples of the affected plants were tested for virus infection. The results showed that three of four samples tested positive for the nematode-transmitted plant virus, *Tobacco ringspot virus.*

This initial finding was followed up by a state-wide commercial blackberry plant survey in the summer of 2007 in an effort to determine the presence and distribution of the most widely spread viruses affecting blackberry production in the southeastern U.S. Thirteen blackberry farms and two research stations were selected throughout the state with 239 blackberry tissue samples collected representing 14 cultivars. The blackberry leaf samples were individually tested for the presence of each of four plant viruses: *Tomato ringspot virus* (ToRSV), *Tobacco ringspot virus* (TRSV), *Impatiens necrotic spot virus* (INSV), and *Raspberry bushy dwarf virus* (RBDV).

Tomato ringspot virus is the most important and widespread of the viruses affecting cultivated blackberries and raspberries in North America. ToRSV has a large natural host range that includes more than 35 plant families. Hosts include such fruit crops as apple, blueberry, peach and strawberry. ToRSV infected many vegetable crops as well as common weeds such as dandelion and chickweed which also serve as reservoirs for the virus.

The host range of ***Tobacco ringspot virus*** is also rather extensive and includes blackberry, blueberry, ornamental plants, raspberry and tobacco.

ToRSV and TRSV are transmitted to cultivated plants by the dagger nematode, which is common throughout the U.S. These viruses induce various symptoms in blackberry plants including chlorotic or necrotic ringspots, mosaic, mottling, yellowing, plant tissue necrosis, spots, plant or branch dwarfing, and overall plant stunting.

Impatiens necrotic spot virus poses a serious threat to more than 300 plant species from 50 plant families including many greenhouse-grown ornamental crops. Moreover, INSV-induced symptoms vary in severity due to environmental conditions, e.g., high light and temperatures have been shown to suppress symptoms in some hosts. Western flower thrips are known to transmit INSV. Generally, INSV symptoms include overall plant stunting, necrotic or chlorotic spotting, areas of black or brown stem necrosis, ringspots, mosaic, line patterns and vein necrosis. Extensive foliar necrosis can also be observed, which can be misattributed to chemical injury or bacterial or fungal pathogens. A single infected plant may express two or more types of symptoms and symptoms may vary with plant cultivar and even among plants of the same cultivar. INSV can also cause symptomless infections in some hosts.

Raspberry bushy dwarf virus naturally infects many red and black raspberry, blackberry-raspberry hybrids and blackberry varieties. RBDV is a seed- and pollen-borne virus that only spreads during bloom. The virus is found inside pollen grains and, it is likely that insects spread the virus-infested pollen. RBDV infection is symptomless in many red raspberry cultivars. Blackberry-raspberry hybrids, such as Bryson, appear to be symptomless when naturally infected with RBDV in the U.S. Some primocane leaves can show chlorosis and vein-clearing later in the growing season and fruit can be malformed and small on infected plants (Strick et al., 2003). The severity of fruit symptoms may vary each year. Therefore, a reliable detection method, such as detection of virus by ELISA, should be used to identify the disease.

The results of the 2007 state-wide survey revealed the presence of all four viruses in Alabama-grown blackberries. ToRSV was detected in 45% of the blackberry samples, INSV occurred in 35%, with TRSV and RBDV found in 31% and 26% of the blackberry samples,

respectively (Table 1). We also found that the four viruses were widely distributed in commercial blackberry plantings throughout the state with TRSV detected in 13 of the 15 sites tested, ToRSV in 14 sites, with RBDV and INSV each detected in all 15 sites.

A comparison of viral incidence in various blackberry cultivars revealed that all four viruses were detected in 8 of the 14 cultivars tested (Table 2). Only two of the viruses were detected in Bryson (RBDV and TRSV) and Choctaw (INSV and ToRSV) blackberries. ToRSV was not detected in Lochness and Shwanee, while TRSV was not found in Chester. Cultivars showing over 50% incidence of ToRSV include Apache, Arapaho, Chester, Doyle, Ouachita, and Rosenborough. TRSV incidence was greater than 50% in Apache, Bryson, and Rosenborough, and Shawnee. INSV incidence was high in Apache Choctaw, Lochness, Navaho, Shawnee and, and RBDV incidence was high in Apache and Shawnee.

It is important to emphasize the fact that out of the 180 asymptomatic blackberry tissue samples collected, 138 tested positive for at least one virus. Furthermore, despite the attempts to correlate virus incidence and symptom expression in an infected plant, no clear pattern was found. Apparently, symptom expression is not a reliable method for diagnosis of virus-infected blackberry plants. For that reason, it is highly recommended that one or more methods other than visual assessment for virus symptoms be used to confirm virus infection.

Management: The early and accurate diagnosis of plant diseases is a crucial component of any crop management system. Upon determination that a virus is the causal agent for a disease, a series of tests is necessary to determine its identity. Symptom assessments play an important role in the diagnostic process despite the fact that a positive identification of a virus or virus complex requires one or more other diagnostic procedures.

A few options are available to minimize the impact of virus diseases (Ellis et al., 1997), although no anti-viral chemicals have been identified that inhibit or interfere with the virus infection.

1. Use of certified, micropropagated, virus-tested, and disease-free stock to establish nursery blocks and commercial plantings is strongly recommended.
2. To control ToRSV and TRSV, preplant soil testing for the presence of dagger nematodes and preplant fumigation with an approved nematicide if dagger namatodes are found is recommended.
3. Rogue infected plants and additional symptomless plants in each direction beyond the symptomatic plants to eliminate new, latent infections. Studies in Oregon red raspberry fields showed that five symptomless plants in each direction needed to be removed.
4. Chemicals applied to manage the vector, e.g., those that target the nematode or insect, may help to reduce losses caused by virus infection..
5. Removal of weeds to eliminate potential in-season and overwintering reservoirs for viruses.
6. Select resistant cultivars when available.

Literature cited:

Ellis, M., R.H. Converse, R.N. Williams, and B. Williamson. 1997. Diseases caused by viruses and virus like agents. In: Ellis M. et al, ed. Compendium of raspberry and blackberry diseases and insects. St. Paul, Minnesota, USA: APS Press, The American Phytopathological Society: 42-62.

Strik B. and Martin R.R. 2003. Impact of *Raspberry bushy dwarf virus* on 'Marion' blackberry. Plant Disease 87, 294–6.

Table 1. Incidence and distribution of four blackberry viruses in Alabama, 2007

Site	Incidence, (%)			
	ToRSV	INSV	TRSV	RBDV
Summerdale	67	100	0	100
Fairhope	71	57	43	7
Silverhill	70	60	0	20
Fairhope St.	21	54	13	33
Safford	33	67	8	67
Montevallo	23	41	5	10
Jemison	7	10	7	17
Wilsonville	0	9	73	9
Randolph	20	60	30	60
Clanton	25	20	20	80
Alex.City	36	7	79	21
Deatsville	47	7	20	13
Milbrook	39	6	56	6
Meridianville	75	42	83	33
Toney	71	42	58	25
Average:	45	35	31	26

Table 2. Incidence of four viruses in 14 Alabama-grown blackberry cultivars, 2007

Cultivar	Virus incidence, (%)			
	TRSV	ToRSV	RBDV	INSV
Arapaho	38	62	15	24
Apache	55	62	55	55
Kiowa	38	19	21	9
Navaho	20	50	35	55
Ouachita	14	86	5	48
Chickasaw	10	20	10	29
Rosenborough	50	67	17	17
Triple Crown	40	20	40	40
Lochness	40	0	40	80
Shawnee	100	0	100	100
Bryson	67	0	33	0
Chester	0	67	33	33
Choctaw	0	33	0	67
Doyle	0	67	0	0