Screening of Fruit Rot Diseases in Muscadine Grape  
(*Vitis rotundifolia* Michx.)

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Muscadine grape (*Vitis rotundifolia* Michx.) is one of the major fruit crops in Florida. Although far more resistant to most diseases than bunch grapes (*Vitis vinifera*, *Vitis labrusca*, or their derivatives), muscadine grape suffers extensive economic losses every year due to fruit berry rotting diseases that significantly reduce fruit yield and marketability for both wine and fresh consumption. Three berry rot diseases, including black rot (*Guignardia bidwellii* f. *muscadinii*), bitter rot (*Greeneria uvicola*), and macrophoma rot (*Botryosphaeria dothidea*) were evaluated in 45 commercially available muscadine cultivars at the research vineyard of Florida A&M University in order to develop a disease-resistant breeding program. The cultivars were randomly arranged in three blocks and data were collected in five randomly picked clusters on each tree according to Kummuang et al. (1996) in the 2009 harvesting season. The results indicated that bitter rot was the most prevalent fruit rot disease that occurred on 29 muscadine grape cultivars, followed closely by black rot. The incidence of macrophoma rot was low. The most susceptible cultivar to bitter rot and black rot diseases was ‘Early Fry’ with 33.33% and 17.65% berry infection rate, respectively. Twelve cultivars showed no symptoms of bitter rot, black rot, and macrophoma rot diseases. They are ‘Alachua’, ‘Albermarle’, ‘Black Beauty’, ‘Digby’, ‘Fry’, ‘Granny Val’, ‘Golden Isle’, ‘Higgins’, ‘Noble’, ‘Pride’, ‘Sterling’, and ‘Supreme’. Co-occurrence of ripe rot on the same berry often makes identification of bitter rot more difficult, especially during the later harvest season.

Muscadine grape (*Vitis rotundifolia* Michx.) is a native species of the southeastern United States and one of the most valuable fruit crops in Florida (Lu et al., 2000). Muscadine grape is priced for its unique qualities and health benefits of high level phenolic phytochemicals such as resveratrol and ellagic acid (Musingo et al., 2001; Talcott and Lee, 2002; Yi et al., 2005). Although far more resistant to most fungi and bacterial diseases than any other bunch grapes (*V. vinifera*, *V. labrusca*, or their derivatives), muscadine grape suffers extensive economic losses every year due to fruit berry rotting diseases, particularly black rot (*Guignardia bidwellii*), bitter rot (*Greeneria uvicola*), and macrophoma rot (*Botryosphaeria dothidea*) (Fig. 1), which significantly reduce fruit yield and marketability for both wine and fresh consumption (Kummuang et al., 1996a).

Black rot is caused by *Guignardia bidwellii*, which infects all young green parts of the vine, including leaves, shoots, tendrils, and fruits. Symptoms of black rot on fruits are light brown color at the beginning of infection; soon the entire berry turns dark brown, and then black spherical fruiting bodies (pycnidia) develop on its surface. Infected berries eventually turn into shriveled, hard, black mummies. These mummies serve as a source of secondary inoculums later in the growing season and are the

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Fig. 1. Different kinds of fruit rot in ‘Summit’.
primary means by which the fungus overwinters (Kummuang et al., 1996b). Berries from bloom to shortly after bloom are susceptible to the infection. Symptoms of black rot on leaves are brown circular lesions and pycnidia within the lesions. Each one of these pycnidia can produce a second type of spore (conidia), which causes secondary infections throughout the growing season. Early infections in the growing season destroy blossom clusters or cause developing berries to “shell off” the cluster and fall to the ground. Later infection can destroy a high percentage of the berries. When warm, muggy weather in the spring and summer is prolonged, unsprayed fruit on very susceptible varieties may become almost completely rotted by harvest time (Kummuang et al., 1996a).

Bitter rot was named for its bitter taste that developed in infected berries. It is caused by Greeneria uvicola, which infects muscadine grape young shoots, stems of fruit clusters, pedicels, and fruits. Bitter rot is easily confused with black rot. Unlike black rot, bitter rot fungus does not infect green berries. The typical symptoms of bitter rot are on mature berries, exhibiting olive-brownish water-soaked lesions covered with black spore masses (Kummuang et al., 1996b). These lesions increase in size rapidly and cause soft rot. Severe bitter rot infection can cause a blight of young berries and pedicels, causing berries to shrivel and drop. Ten percent of infected berries in wine grape may make the wine undrinkable. If cluster stems are infected and killed early in the season, berries do not develop and remain attached to the stem. When cluster stems are infected late in the season, berries may fall off the bunch. This “shelling” of berries may be an important sign that bitter rot is occurring.

Macrophoma rot is caused by Botryosphaeria dothidea, which is a fungus with an extremely broad host range. It is difficult to control because of its broad host range. Generally, macrophoma rot occurs on full-size berries and is most prevalent on ripe berries (Kummuang et al., 1996a). Spots on berries are circular, flat, or slightly sunken, and on susceptible cultivars they can result in a soft rot that covers the entire berry, and abundant pycnidia are produced in the lesions. Early season infections remain latent and there are no visible symptoms until the fruit begin to mature. Lesions are black, circular, or slightly sunken. The centers of the lesions are a tan color and embedded with scattered pycnidia.

Florida now has 600 to 1000 acres of muscadine grapes and has been cultivated in the state for many years (Cline and Fisk, 2006; Lu et al., 2000). A large market for muscadine grape products exists in Florida. As production expands, berry rot diseases are likely to become a greater problem. An understanding of berry rot diseases among muscadine is essential for growers in the region to make cultivar selection decisions. The objectives of this research are to screen fruit rot disease resistance in commercially available muscadine cultivars and to identify promising muscadine grape germplasm for use as parents in the breeding and genetics research program.

**Material and Methods**

**PLANT MATERIAL.** Forty-five commercially available muscadine grapes, consisting of 20 dark fruit color and 25 light fruit color cultivars, were used in this survey. They were randomly arranged in three blocks with two trees per block at the Center for Viticulture and Small Fruit Research, Florida A&M University, Tallahassee, FL.

**DISEASE SCORE.** Fruit rot diseases were screened on mature
berries of 45 cultivars in the last week of Aug. 2009. Five clusters were randomly picked from each tree, and the numbers of berries infected with the three rot diseases were individually recorded. Identification of the berry rot disease was visually observed and consulted with plant pathologist Dr. B. Smith (USDA, Poplarville, MS). Percentages of berries infected with berry rot diseases were calculated based on the total berries collected.

**Results and Discussion**

Differences in susceptibility of bitter rot, black rot, and macrophoma rot diseases among cultivars were noted in this study. Bitter rot was the most prevalent berry rot disease that occurred in 29 out of 45 muscadine cultivars (Fig. 2), followed closely by black rot (Fig. 3), which could also be observed on vine leaves (Fig. 4). The incidence of macrophoma rot was low (Fig. 5). Twelve out of 45 cultivars showed no symptoms of black rot, bitter rot, and macrophoma rot diseases. They were ‘Alachua’, ‘Albermarle’, ‘Black Beauty’, ‘Digby’, ‘Fry’, ‘Granny Val’, ‘Golden Isle’, ‘Higgins’, ‘Noble’, ‘Pride’, ‘Sterling’, and ‘Supreme’.

‘Early Fry’ was the most susceptible muscadine cultivar to bitter rot and black rot with 33.33% and 17.65% of berries infected, respectively. Although cultivars Late Fry and Tara showed no symptoms, it was difficult to assess their resistance because the berries were still not mature by the time of evaluation.

Identification of individual berry rot disease is a complex process; co-occurrence of several rot diseases on the same berry often makes identification more difficult, particularly at the late stage of disease development. Very often, once the first berry rot attacks, the other berry rot disease easily follows (Kummuang et al., 1996b). A more sophisticated identification method is needed for further study.
Literature Cited


