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Relative Susceptibility of Selected Apple Cultivars to Fruit Rot Caused by *Botryosphaeria obtusa*

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Abstract. **Twenty-three apple (*Malus ×domestica*) cultivars were tested in the field and laboratory for their relative susceptibility to the black rot pathogen, *Botryosphaeria obtusa*. Wounded fruit were inoculated in the field at 2 to 3 weeks preharvest with mycelium from 14- to 21-day-old cultures. In the laboratory, detached fruit were inoculated similarly. Fruit were rated for relative susceptibility to the fungus by determining disease severity of attached fruit in the field based on lesion growth (mm/degree-day) and detached fruit in laboratory inoculations of wounded fruit (mean lesion diameter after 4 days). Based on the laboratory and field data from two growing seasons, cultivars were classified into three relative susceptibility groups—most susceptible: 'Orin', 'Pristine', and Sunrise'; moderately susceptible: 'Suncrisp', 'Ginger Gold', 'Senshu', 'Honeycrisp', 'PioneerMac', 'Fortune', NY 75414, 'Arlet', 'Golden Supreme', 'Shizuka', 'Cameo', 'Sansa', and 'Yataka'; and least susceptible: 'Creston', 'Golden Delicious', 'Enterprise', 'Gala Supreme', 'Braeburn', 'GoldRush', and 'Fuji'. Compared to previous cultivar rankings, the results of the present study indicate that no new apple cultivars from the first NE-183 planting show greater resistance to *Botryosphaeria obtusa* than current standard cultivars.**

Black rot, caused by the fungus *Botryosphaeria obtusa* (Schwein.) Shoemaker, is an important disease in the eastern United States (Jones and Aldwinckle, 1990). Losses from the disease occur through fruit rot, limb cankers, and less commonly, defoliation from leaf spot. Fruit losses of 25% to 50% have been reported in the southeastern United States (Jones and Aldwinckle, 1990). Black rot is managed by eliminating inoculum sources and applying fungicide sprays. Host resistance to the pathogen and the use of resistance for management of apple rot diseases has not been thoroughly explored, and the relative susceptibility of many cultivars is unknown. For purposes of determining the relative susceptibility of apple fruit to rot pathogens, field evaluations can be difficult because of the similarity of symptoms caused by various pathogens (e.g., *Colletotrichum acutatum*, *C. gloeosporioides*, *Botryosphaeria dothidea*, *B. obtusa*).

Determination of the causal organisms from natural infections by isolation is labor intensive and may yield multiple rot pathogens and contaminating organisms. Host reaction may be variable because of cultivar differences in developmental stage of the fruit when natural infection occurs. Laboratory and/or field inoculation studies under controlled conditions eliminate problems with uneven distribution of inoculum and the difficulty in the field of being certain that differences in resistance are real or due to inoculum escape. In addition, controlled studies provide the opportunity for positive identification of symptoms and characterization of the host/pathogen relationship. The susceptibility ranking of various apple cultivars to diseases often depends on the plant breeder and a few test sites or on observations by growers and/or nursery personnel in the field rather than the results of a systematic study. In 1994, a regional project was initiated to examine the performance of new apple cultivars in replicated trials under a wide range of climatic and edaphic conditions. The project (NE-183), entitled "Multidisciplinary Evaluation of New Apple Cultivars," has 26 cooperators in 18 states and two Canadian provinces. A primary objective of the NE-183 project is to evaluate horticultural qualities and pest susceptibility of new apple cultivars, strains, and advanced selections with commercial potential and to determine the limitations and positive attributes of these cultivars. To date, researchers have documented the relative susceptibilities of the NE-183 apple cultivars to apple scab (caused by *Venturia inaequalis*) (Jones et al., 1998; Rosenberger et al., 1996; Yoder et al., 1997), powdery mildew (caused by *Podosphaera leucotricha*) (Kiyomoto et al., 1998; Rosenberger et al., 1996; Yoder et al., 1997), cedar apple rust (caused by *Gymnosporangium juniperi-virginianae*) (Kiyomoto et al., 1998; Rosenberger et al., 1996; Yoder et al., 1997), white rot (caused by *B. dothidea*) (Biggs and Miller, 2003), and bitter rot (caused by *Colletotrichum acutatum*) (Biggs and Miller, 2001). The objective of this study was to evaluate the relative susceptibility of apple cultivars to the black rot pathogen, *B. obtusa*.

Materials and Methods

Test planting. The 23 apple cultivars selected for the NE-183 project were budded on M.9 337 rootstock. Trees were planted in north–south oriented rows in Apr. 1995 at a spacing of 2.5 m × 4.3 m using a mechanical tree planter. The design was a randomized complete block with five single-tree plots per cultivar. Drive middles were planted with Kentucky-31 fescue (*Festuca arundinacea*), and a weed-free strip (1 m wide in 1995; 2 m wide in the remaining years) was maintained in the tree row using paraquat plus oryzalin at recommended rates (Pfeifer et al., 1995). After planting, a conduit stake secured to a single trellis wire at 2.1 m high was placed beside each tree, and the tree's leader was tied to the stake. Minimal pruning was followed throughout this study, allowing trees to assume their natural form. Blossoms were removed in the first season (1995). Trees were allowed to fruit after the first growing season and crop load was adjusted by hand to space fruit ≈15 cm apart. Drip irrigation was installed in Summer 1997. The planting received no pesticide applications in 1995. Insecticides were applied from 1996 through 2002, as were fixed copper and streptomycin to suppress fire blight. Dodine, myclobutanil, fenarimol, and/or mancozeb were applied at recommended rates (Pfeifer, 1995) beginning 12 Apr., and continuing through 21 May 2002, for early season scab control. No fungicides were applied after 21 May in 2001 or 2002. Twenty-three cultivars (Table 1) were selected in the planting for field inoculation tests in 2001 and 2002. Temperature, relative humidity, and leaf wetness were monitored with a 7-d recorder (Belfort Instruments, Baltimore, Md.).

Fungal isolates. Based on preliminary experiments with a collection of isolates, two representative fungal isolates [designated BoVA-1 and BoVA-3, obtained from Dr. K.S. Yoder (Virginia Tech, Alson H. Smith Tree Fruit Research and Extension Center, Winchester, Va.)] were selected, and subcultured and maintained on potato dextrose agar in petri dishes. Fungal cultures were subcultured biweekly and maintained at 22 °C under continuous fluorescent light during the periods in which experiments were conducted. Only isolate BoVA-1 was used for tests in 2001, whereas both isolates were used in 2002.

Field experiments. Fruit were inoculated in the field at 2 to 3 weeks preharvest (Table 1), as determined by average ripening date and quality assessments, which included starch index rating, soluble solids concentration (SSC), and flesh firmness. Arbitrarily selected fruit were inoculated by making a 1-mm-deep wound through the fruit epidermis with a sterile 5-mm-diameter cork borer, removing the circum-

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Table 1. Cultivar, date of inoculation, soluble solids, fruit firmness, and mean temperature for the 5-day period following field inoculation for apple cultivars inoculated with *Botryosphaeria obtusa*.

	2001				2002			
Cultivar	Inoculation date	Soluble solids (%)[z]	Fruit firmness (Kg)[z]	Mean temp (°C)	Inoculation date	Soluble solids (%)[z]	Fruit firmness (Kg)[z]	Mean temp (°C)
Pristine	11 July	10.4	8.6	19.9	15 July	11.8	6.1	24.1
Sunrise	12 July	11.3	10.0	19.9	22 July	13.3	5.4	23.6
Sansa	25 July	12.1	7.8	20.8	29 July	12.4	8.4	26.9
Ginger Gold	2 Aug.	12.8	8.2	23.7	5 Aug.	12.5	9.3	20.7
PioneerMac	10 Aug.	12.6	9.9	23.4	19 Aug.	12.8	7.7	24.4
Arlet	9 Aug.	13.4	8.2	24.6	5 Aug.	13.1	10.0	20.7
Senshu	9 Aug.	12.0	9.8	24.6	12 Aug.	13.5	9.0	25.7
Golden Supreme	15 Aug.	12.5	8.2	22.4	---[y]	---	---	---
Honeycrisp	10 Aug.	12.7	9.6	23.4	12 Aug.	11.4	8.4	25.7
Creston	31 Aug.	14.0	7.3	20.4	26 Aug.	13.9	7.3	19.3
Fortune	5 Sept.	14.3	7.4	20.0	2 Sept.	12.8	7.5	20.9
NY75414	30 Aug.	12.4	8.5	20.6	26 Aug.	13.5	9.0	19.3
Golden Delicious	5 Sept.	13.4	8.4	20.0	2 Sept.	13.5	8.4	20.9
Gala Supreme	12 Sept.	14.1	8.9	15.4	16 Sept.	16.8	9.2	21.7
Shizuka	6 Sept.	14.5	7.1	20.7	9 Sept.	14.9	8.0	19.4
Orin	12 Sept.	13.8	8.5	15.4	---	---	---	---
Yataka	6 Sept.	---	---	20.7	---	---	---	---
Braeburn	20 Sept.	12.2	9.8	18.9	16 Sept.	14.6	11.8	21.7
Cameo	19 Sept.	13.2	8.0	19.0	23 Sept.	15.6	7.6	16.7
Fuji	19 Sept.	14.0	8.4	19.0	30 Sept.	17.3	8.3	21.2
Suncrisp	27 Sept.	14.9	8.3	11.3	---	---	---	---
Enterprise	21 Sept.	8.0	14.2	17.8	23 Sept.	15.5	8.7	16.7
GoldRush	3 Oct.	14.2	8.2	16.8	7 Oct.	19.2	11.3	14.1

[z]Measurements are the means from five fruit arbitrarily selected and measured on the inoculation date.
[y]Not inoculated; fruit unavailable.

scribed epidermis and placing a 5-mm-diameter agar plug supporting fungus mycelium over the wound. Wounds were wrapped in parafilm to maintain moisture. The parafilm was removed after 4 d. Thirty-two fruit were inoculated per cultivar per isolate in three replications of eight fruit, and eight fruit were inoculated with sterile agar as a control. None of the control fruit developed black rot during the course of the study. Re-isolations were conducted periodically to confirm the presence of *B. obtusa* in inoculated lesions. The study was conducted in 2001 and 2002.

Laboratory experiments. Fruit were picked at 2 to 3 weeks before their normal harvest date, brought to the laboratory, and washed with tap water. Fruit were inoculated as described above, placed in plastic trays with lids, and incubated at 21 to 23 °C in the laboratory. Thirty-two fruit, including three replications of eight fruit, and eight fruit inoculated with sterile agar were used per cultivar per isolate. Re-isolations were conducted periodically to confirm the presence of *B. obtusa* in inoculated lesions. Five additional fruit of each cultivar were sampled for determination of flesh firmness and SSC. Flesh firmness was measured with a hand-held penetrometer (Effigi Inc., Bologna, Italy) fitted with an 11-mm tip. Soluble solids were measured with a hand-held refractometer (Fisher Scientific, Pittsburgh). The study was conducted over two growing seasons, 2001 and 2002.

Data collection and analysis. Fruit were rated for relative susceptibility to the fungus using two criteria: disease severity of attached fruit in the field and disease severity of detached fruit in laboratory inoculations of wounded fruit. Severity was obtained from the mean of two measurements (length and width) from each lesion. Only symptomatic fruit were included in the calculation of mean disease severity. In both studies, severity was determined at 5 d postinoculation; however, severity data from the field were adjusted for temperature by calculating lesion diameter increase per degree-day accumulation (base temperature = 0 °C). Mean lesion diameter data were subjected to general linear models analysis and means were separated with the Waller-Duncan *k*-ratio *t*-test (SAS Institute, Cary, N.C.). Data from each year were analyzed separately because of the additional isolate and missing cultivars in 2002. Cultivar ranks from the tests over two growing seasons were used to calculate the mean relative susceptibility rating. Final cultivar ranks were determined by averaging the mean ranks for the four sets (field and laboratory severity from each of the 2 years' experiments) of observations. The nonparametric Spearman rank correlation analysis was used to determine the relationships among the various measures and with harvest date, fruit firmness, and SSC.

Results and Discussion

Field experiments. Black rot incidence following inoculations with mycelium in 2001 and 2002 was ≈94% and 87%, respectively. In 2001, severity ranged from 0.33-mm lesion increase/degree-day for 'Suncrisp' to 0.04-mm lesion increase/degree-day for 'Braeburn' (Table 2). When two *B. obtusa* isolates were tested in 2002, isolate BoVA-1 was more aggressive than isolate BoVA-3 ($P \leq 0.001$); however, the cultivar × isolate interaction was nonsignificant ($P = 0.36$), so data from the two isolates were combined to determine the cultivar relative susceptibilities. In 2002, severity ranged from 0.20-mm lesion increase/degree-day for 'Pristine' and 'Sunrise' to 0.03-mm lesion increase/degree-day for 'Goldrush' (Table 2). 'Fuji', 'GoldRush', and 'Braeburn' had the lowest mean ranks (least susceptible) for field severity, whereas 'Suncrisp', 'Yataka', and 'Pristine' had the highest mean ranks (most susceptible) (Table 3). The cultivar × year interaction for isolate BoVA-1 (used in both years) was significant ($P \leq 0.001$), with some cultivars showing differences in their relative susceptibility between years (i.e., most notable, 'Sunrise', 'NY75414-1', and 'Fortune').

Temperatures in the field might have contributed to the variability of the field experiments between years. Mean daily temperatures in 2001 ranged from 11.3 to 24.6 °C, compared to 2002, when temperatures ranged from 14.1 to 26.9 °C (Table 1). During the test period (July through September of each year), 2001 was ≈0.8 °C cooler than 2002, although some cultivars were exposed to differing postinoculation temperatures in each year (i.e., some cultivars were exposed to warmer temperatures in 2001 and others exposed to warmer temperatures in 2002). Most notably, July 2002 was ≈5.6 °C warmer than July 2001. 'Sansa' was the most extreme example with a 6.1 °C difference in mean temperature during the 5-d incubation period between years, followed by 'Gala Supreme' with a 5.3 °C difference between years (Table 1). Although lesion growth in the field was calculated as a function of temperature, it is possible that preinoculation temperature conditions or other environmental or host variables that weren't measured may have contributed to the observed cultivar × year variation in susceptibility to *B. obtusa*.

Laboratory experiments. None of the control fruit developed black rot during the observation period although a few (<5%) exhibited signs of infection by *Penicillium*

Table 2. Disease severity on selected apple cultivars inoculated in the field and laboratory with *Botryosphaeria obtusa* in 2001 and 2002.

Cultivar	Harvest date rank[z]		Field severity rating (mm lesion increase/degree-day)[y]		Laboratory severity rating [lesion diam (mm)after 5 d][y]	
	2001	2002	2001	2002	2001	2002
Pristine	1	1	0.24 b–d	0.20 a	31.3 a	21.4 b
Sunrise	2	2	0.18 d–h	0.20 a	25.5 ab	23.2 a
Orin	15	---	0.25 bc	---	---	---
Suncrisp	21	---	0.33 a[x]	--- [w]	17.9 b–f	---
Ginger Gold	4	4	0.24 b–d	0.15 cd	20.5 b–e	---
Senshu	6	6	0.19 c–f	---	24.7 a–c	17.9 c
Honeycrisp	8	8	0.24 b–d	---	16.8 c–g	20.2 b
PioneerMac	7	7	0.12 h-k	0.14 def	22.4 b–d	18.7 c
Fortune	10	12	0.10 i–l	0.15 bc	25.4 ab	15.5 de
NY75414-1	11	10	0.27 ab	0.11 g	21.8 b–e	13.1 f
Arlet	5	5	0.13 f–j	0.14 ef	19.3 b-f	16.6 d
Golden Supreme	9	---	0.25 bc	---	16.6 d–g	---
Shizuka	13	13	0.17 e–i	0.14 c–e	---	14.3 ef
Cameo	18	16	0.12 g–k	0.16 g	18.8 b–f	13.3 f
Sansa	3	3	0.19 c–g	0.16 b	12.4 f–h	14.2 ef
Yataka	17	---	0.26 ab	---	6.2 h	---
Creston	12	11	0.16 f–j	0.11 g	16.6 d–g	14.3 ef
Golden Delicious	10	12	---	0.14 d–f	13.9 e–h	11.3 g
Enterprise	22	18	0.12 h–k	0.11 g	14.2 e–g	15.5 de
Gala Supreme	14	14	0.23 b–e	0.12 g	9.0 gh	11.1 g
Braeburn	21	15	0.04 l	0.13 f	17.3 c-f	11.2 g
GoldRush	23	19	0.09 j–l	0.03 h	18.5 b–f	10.6 g
Fuji, B.C. No. 2	20	17	0.06 kl	---	---	13.3 f

[z] Harvest date rank is from earliest = 1 to latest =23. Cultivars are arranged from most susceptible to least susceptible based on the combined mean ranks from laboratory and field tests.
[y]Field and laboratory severity data are from 5 d postinoculation for both years.
[x]Data are the mean of 24 observations from three replicates of eight fruit per replicate. Different letters denote significant differences among means according to the Waller-Duncan test ($P \leq 0.05$).
[w] Fruit not available.

sp. Black rot incidence following inoculations with mycelium in 2001 and 2002 was 93% and 91%, respectively. In 2001, severity ranged from 31.3 mm for 'Pristine' to 6.2 mm for 'Yataka' (Table 2). When two *B. obtusa* isolates were tested in 2002, isolate BoVA-1 was more virulent than isolate BoVA-3 ($P \leq 0.001$); however, the cultivar × isolate interaction was nonsignificant ($P \leq 0.15$), so data from the two isolates were combined to determine cultivar relative susceptibility. In 2002, severity ranged from 23.2 mm for 'Sunrise' to 10.6 mm for the apple scab resistant cultivar 'GoldRush'. 'Pristine' and 'Sunrise' had the lowest mean ranks (most susceptible) for severity, followed by 'Senshu' and 'PioneerMac', whereas 'Yataka', 'Gala Supreme', and 'Golden Delicious' appeared most resistant based on the mean ranks of the laboratory tests (Table 3). There was a significant cultivar × year interaction for severity in the laboratory, with some cultivars showing significant differences between years. The cultivars that showed the most variation between years included those mentioned above as showing the most variation between years in the field tests, i.e., 'NY75414-1' and 'Fortune', as well as 'Honeycrisp'.

Fruit firmness and percent soluble solids were not correlated in this study, although we have observed both a negative correlation and no correlation in previous studies (Biggs and Miller, 2001, 2003). Softer apples generally possessed higher soluble solids (Biggs and Miller, 2003). Date of harvest was positively correlated with soluble solids ($r_s = 0.66$, $P = 0.001$), but not with firmness ($r_s = 0.21$, $P =$

Table 3. Mean ranks for field and laboratory disease severity of selected apple cultivars inoculated with *Botryosphaeria obtusa* in 2001 and 2002, listed from most to least susceptible based on combined mean ranks.

Cultivar	Mean harvest date rank[z]	Mean laboratory severity rank	Mean field severity rank[y]	Combined mean rank[x]
Pristine	1	1.5	4.0	2.8
Sunrise	2	1.5	6.5	3.8
Orin	16.5	--- [w]	4.5	4.5
Suncrisp	20.5	11.0	1.0	6.0
Ginger Gold	4	7.0	5.8	6.2
Senshu	7	4.5	10.5	6.5
Honeycrisp	8.5	8.0	7.0	7.7
PioneerMac	6	4.5	12.8	8.4
Fortune	13	5.2	11.8	8.5
NY75414-1	10.5	10.0	7.5	8.8
Arlet	5.5	7.0	11.2	9.1
Golden Supreme	8	14.5	4.5	9.5
Shizuka	14.5	9.5	10.2	10.0
Cameo	18	10.8	9.8	10.2
Sansa	3	14.5	6.5	10.5
Yataka	16	20.0	3.0	11.5
Creston	11.5	12.0	13.5	12.8
Golden Delicious	11	16.0	7.5	13.2
Enterprise	21.5	11.8	15.0	13.4
Gala Supreme	15	18.0	10.0	14.0
Braeburn	20.5	14.0	16.0	15.0
GoldRush	23	14.0	17.5	15.8
Fuji, B.C. No. 2	19.5	12.5	21.0	16.8

[z]Harvest date rank is from earliest = 1 to latest = 21.5. Cultivars are arranged from most susceptible to least susceptible based on the combined mean ranks of field and laboratory tests with wounded fruit.
[y]Data are the mean ranks from experiments conducted in 2001 and 2002. A lower rank indicates higher levels of disease severity.
[x]Data are the combined mean ranks from field and laboratory experiments conducted in 2001 and 2002. A lower rank indicates higher levels of disease severity.
[w]Fruit not available for testing.

0.34). Cultivars that matured later generally tended to possess increased soluble solids. Also, cultivars that matured later tended to have smaller lesions and appeared more resistant to *B. obtusa* in the laboratory tests (r_s = 0.56, P = 0.007) and when assessed with the combined mean rank criterion (r_s = 0.58, P = 0.004). Disease severity in the laboratory was correlated with soluble solids, but not with firmness (r_s = 0.39, P = 0.08; and r_s = 0.09, P = 0.70, respectively), with fruit possessing lower soluble solids tending to develop larger lesions. Similarly, disease severity in the field was correlated weakly with soluble solids, but not with firmness (r_s = 0.36, P = 0.10; and r_s = 0.35, P = 0.11, respectively), with fruit possessing lower soluble solids tending to develop larger lesions.

Internal maturity-related changes have been proposed as determining the onset of susceptibility to rot pathogens (Sitterly and Shay, 1960). Therefore, cultivar variation in maturity-related changes could be related to cultivar relative susceptibility to rot pathogens. Increased sugar content has been associated with increased susceptibility of apple to white rot caused by *B. dothidea* (Kohn and Hendrix, 1983), with "active rot lesions" seldom occurring until soluble solids reach 10.5%. However, in the present study with *B. obtusa*, it was observed that fruit with lower soluble solids tended to have larger lesions. Brown (1984) provided evidence that linear rot expansion of several apple fruit rotting pathogens was inversely related to levels of endopolygalacturonase inhibitor activity in fruit tissue. With *B. dothidea*, latent infections occur on apple in the early or middle part of the growing season, with infection occurring whenever environmental conditions are favorable (Biggs, 1995; Parker and Sutton, 1993). *Botryosphaeria dothidea* has a long incubation period in immature and mature fruit (Parker and Sutton, 1993), and symptom expression, rather than susceptibility, may be related to the physiological changes in the fruit, one component of which is the increase in soluble solids.

These aspects of the pathology of *B. dothidea* may be similar to *B. obtusa*, although more detailed studies are needed to demonstrate the occurrence of latent infection with the latter fungus. Infections caused by *B. obtusa* are visible as irregular-shaped dark lesions, 1 to 2 cm in diameter, and are often first observed in early to mid-summer. Alternatively, lesions in the field may be caused by ascospores or conidia infecting the sepals and then growing into the fruit as they mature. The present ranking of cultivars, based on wound inoculations of the fruit, may not reflect the actual perceived susceptibility of the fruit in the field if the infection was initiated in the sepal tissue. However, the data presented here would be reflective of what one might expect if sepal infections grew into the maturing fruit and resulted in a calyx end rot, which is often typical of black rot. Sepal infection is probably more closely related to the susceptibility of the leaves rather than the fruit.

Other factors may influence the relative susceptibility of apple cultivars to the black rot pathogen. For example, differences in amounts of inoculum from mummies, twig and branch cankers, or dead shoots could be an important element of perceived susceptibility in the orchard. Insect feeding preferences among cultivars also could influence perceived susceptibility by creating potential infection courts. Also, early-maturing cultivars could escape the larger amounts of inoculum that occur later in the growing season, although this explanation appears unlikely given the abundance of *B. obtusa* conidia observed in May and June in North Carolina (Sutton, 1981). Only two isolates of *B. obtusa* were used for the inoculation tests in the present study. Field populations of *B. dothidea* have been shown to vary in virulence (Brown-Rytlewski and McManus, 2000; Foster, 1937; Jones and Sutton, 1996; Parker and Sutton, 1993) on leaves, fruit, and woody tissues; however, cultivar specificity has not been reported on apple for either *B. dothidea* or *B. obtusa*.

Based on the combined laboratory and field data from 2 years of study, we classified the cultivars into three relative susceptibility groups—most susceptible: 'Orin', 'Pristine', and Sunrise'; moderately susceptible: 'Suncrisp', 'Ginger Gold', 'Senshu', 'Honeycrisp', 'PioneerMac', 'Fortune', 'NY 75414', 'Arlet', 'Golden Supreme', 'Shizuka', 'Cameo', 'Sansa', and 'Yataka'; and least susceptible: 'Creston', 'Golden Delicious', 'Enterprise', 'Gala Supreme', 'Braeburn', 'GoldRush', and 'Fuji'. The rankings may be tentative for some of the cultivars showing variation between years in the field and laboratory tests (i.e., 'Ginger Gold', 'Suncrisp', 'Golden Supreme', 'Sansa', and 'Orin'), and additional data may be needed to classify more accurately their relative susceptibility to *B. obtusa*. Previously published rankings have included 'Red Delicious', 'Empire', and 'Cortland' among the most susceptible cultivars to the black rot pathogen (McVay et al., 1993). Although these cultivars were not included in the present study, McVay lists them as more susceptible than 'Golden Delicious'. Of the 23 cultivars tested in this study, 17 of them were more susceptible to *B. obtusa* than 'Golden Delicious'. McVay et al. based their cultivar rankings on field observations, and their observations and the results of the present study indicate that only a few new apple cultivars (i.e., perhaps 'GoldRush', 'Enterprise', and 'Gala Supreme') from the first NE-183 planting possess greater resistance to *B. obtusa* than current standard apple cultivars.

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