Oil Application Reduces Powdery Mildew Severity in Black and Red Currants

Kim E. Hummer¹ and
Deric D. Picton²

ADDITIONAL INDEX WORDS. *Ribes nigrum*, *Ribes rubrum*, efficacy

SUMMARY. Powdery mildew (*Sphaerotheca mors-uvae*) severely infects young shoots and leaves of black currants (*Ribes nigrum*) and red currants (*R. rubrum*) in the Pacific northwestern U.S. Environmentally sound control measures are being sought as alternatives to sulfur or demethylation-inhibiting fungicides. This study examined the effect of mineral oil spray on powdery mildew infection in susceptible black and red currants. Mineral oil at 8 mL·L⁻¹ (8000 ppm) was applied to plants until runoff at 0-, 2-, and 4-week intervals from April through June in 1999 and 2000 on eight currant cultivars growing in Corvallis, Ore. Shoot and leaf surfaces were rated for powdery mildew incidence in early July both years. Oil applications significantly reduced mildew severity in vegetative growth as compared with that of the unsprayed control. The disease control from 2-week interval and 4-week interval oil applications was not significantly different.

Powdery mildew is a spring and early summer disease of black and red currants in Asia, Europe, North America, Australia, and New Zealand (Diekmann et al., 1994). This disease can be severe in the rainy, mild climate of the Pacific north-

western U.S. The fungus appears as a white powdery growth on the young shoots and leaf surfaces and can cause stunting and a reduction in marketable fruit (Pscheidt, 2000).

Control recommendations for powdery mildew include inorganic sulfur in dust or wettable formulations, and demethylation-inhibitor fungicides (Dell et al., 1998; Pscheidt, 2000). A biological control containing the fungal hyperparasite *Ampelomyces quisqua*, in a mineral-oil-based surfactant is also recommended as a mildew preventative (Pscheidt, 2000). Mineral oil has proven effective in controlling mildew on grapes (*Vitis vinifera*) (Dell et al., 1998), roses (*Rosasp.*) (McWhorter, 1927), and hops (*Humulus lupulus*) (Pscheidt, 2000). Oil is effective in low concentrations, has little or no toxicity to animals, and is relatively inexpensive (Dell et al., 1998). Calpouzos (1966) mentions two disadvantages: that oil may not be effective against some plant diseases and that it may cause phytotoxicity. The object of this study was to determine the effect of mineral oil on mildew infection of shoots and leaves of susceptible black and red currant cultivars in Corvallis, Ore.

Materials and methods

Seven susceptible black currant cultivars and one susceptible red currant cultivar were chosen based on prelimi-

nary observations. 'Consort' and 'Crusader' were highly susceptible; 'Baldwin,' 'Boskoop Giant,' and 'Minaj Smyriov' had medium susceptibility, and 'Rovada' (red currant), 'Jet' and 'Polar' were least susceptible (Hummer, data not shown). In November 1998, rooted cuttings of the eight cultivars were field planted in Corvallis, Ore., in a completely randomized block design with three blocks, three replicates, and three treatments. In Spring and Summer 1999, replacement plants for two 'Minaj Smyriov,' two 'Polar,' and four 'Rovada' were planted where initial establishment was unsuccessful.

The treatments were applied from April through June, 1999 and were repeated in 2000. They included an unsprayed control, and applications at 2- and 4-week intervals with JMS Stylet-Oil (JMS Flowers Farms, Inc., Vero Beach, Fla.). This oil is a highly refined paraffinic mineral oil with an unsulfonated residue of 99.1%. It was sprayed on treated leaves until runoff using a Solo backpack sprayer (Solo Inc., Newport News, Va.) with fan nozzle #8002 at a rate of 8 mL·L⁻¹. Weather conditions occasionally required spray on the day following the predetermined interval.

In early July 1999 and again in 2000, terminal growth, and leaves were visually estimated as 0% (no infection),

Fig. 1. Powdery mildew severity (estimated % of infected leaf surface area) plotted by mineral oil treatment for seven black currant cultivars (Baldwin, Boskoop Giant, Consort, Crusader, Jet, Minaj Smyriov, and Polar) and one red currant cultivar (Rovada). Oil was applied at 8 mL·L⁻¹ (8000 ppm) for 0-, 4-, and 2-week intervals from Apr. through June, 2000. Disease severity estimates were taken on 10 July 2000. Each bar represents the mean of three samples.

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¹Research leader, to whom correspondence should be addressed; USDA ARS NCGR, 33447 Peoria Road, Corvallis, Oregon 97333-2521, email hummerk@bcc.orst.edu.

²Graduate research assistant, Department of Horticulture, Oregon State University, Corvallis, Oregon, 97330.

20% leaf surface infected, 30% of the leaf surface infected, 40% of the leaf surface infected, and 50% infection or greater. Friedman's nonparametric test for significance was applied to determine significant difference. Tukey's least square difference (LSD) test was applied to separate means.

Results and discussion

Oil application significantly reduced mildew severity in vegetative growth as compared with that of the unsprayed control ($P = 0.05$) (Fig. 1). Under Corvallis conditions, the extent of mildew following 4- or 2-week oil applications was not significantly different (Fig. 1). The mildew severity between the untreated control and the 4- or 2-week treatments for Boskoop Giant, Consort, and Crusader, the highly- and medium-susceptible cultivars, was reduced by about 20%; that for Polar and Rovada, the least-susceptible cultivars, was reduced by about 6% (Fig. 1).

In conclusion, the application of mineral oil at either a 4- or 2-week interval reduced mildew severity on black or red currant shoots and leaves. An equivalent level of control was achieved with either 4- or 2-week spray under study conditions. In other areas of high inoculum, a 2-week application (label recommendation) may be needed. Reduction of the mildew was greatest on the most susceptible types. This study was conducted on 2-year old plants which had not reached full fruiting capacity. Further study is needed to determine if oil application affects yield in currants.

Literature cited

Calpouzos, L. 1966. Action of oil in the control of plant disease. 1966. Annu. Rev. Phytopathol. 4:369-390.

Dickmann, M., E.A. Frison, and T. Putter (eds.). 1994. FAO/IPGRI Technical guidelines for the safe movement of small fruit germplasm. Food Agr. Org. U.N., Intl. Plant Genet. Resources Inst., Rome.

Dell, K.J., W.D. Gubler, R. Krueger, M. Sanger, and L.J. Bettiga. 1998. The efficacy of JMS stylet-oil on grape powdery mildew and *Botrytis* bunch rot and effects on fermentation. Amer. J. Enol. Viticult. 49(1):11-16.

McWhorter. 1927. Fungicidal value of oil sprays. Phytopathology 17:201-202.

Pscheit, J.W. 2000. Gooseberry and currant - powdery mildew. <http://plant-disease.orst.edu/disease.cfm?recordid=512.00000> on 20 Sept. 2000.

Vesicular-Arbuscular Mycorrhiza and Plant Growth Response to Soil Amendment with Composted Grape Pomace or Its Water Extract

R.G. Linderman¹ and
E.A. Davis²

ADDITIONAL INDEX WORDS. *Allium cepa*, endomycorrhizae, humic substances, onion, phosphorus, soil pasteurization

SUMMARY. Composted materials with high humic and microbial content, and their water extracts, are increasingly used in the nursery industry as potting mix components or as liquid amendments for the purposes of enhancing plant growth. Common speculation is that such materials either contain beneficial microbes or stimulate those in or added to the medium, such as vesicular-arbuscular mycorrhizal (VAM) fungi, known to have growth-stimulating effects on plants. Experiments were conducted to determine if one such compost enhanced plant growth by stimulating VAM fungi or other growth-enhancing microbes, by simply providing limiting nutrients [phosphorus (P)], or a combination of the two. Highly mycorrhiza-responsive onion (*Allium cepa*) 'White Lisbon' was used to evaluate the interactions of composted grape pomace (CGP), the VAM

fungus *Glomus intraradices*, and preplant soil heat treatment on onion growth under P-limiting conditions. CGP and its water extract stimulated onion growth under P-limiting conditions in the absence of VAM; the extract was more effective than the granular CGP. Growth was enhanced further by addition of *G. intraradices*, and the extract enhanced its colonization of roots. Heat pretreatment of the soil inconsistently affected growth-enhancement by CGP or its extract. Thus, inoculating plant roots with mycorrhizal fungi in combination with this composted organic amendment or its extract was beneficial. The effect could have been due to the CGP providing a source of P to overcome the P-limiting conditions, and to the mycorrhizal fungus enhancing P uptake by its extraradical hyphae and thereby increasing nutrient-use efficiency.

The application of organic amendments with high humic content in horticultural and agricultural practices has numerous benefits, some of which include improved soil structure and increased fertility (Vaughan and Malcolm, 1985), which consequently stimulate plant growth through diverse complex mechanisms. Guttay (1982, 1983) reported mixed growth responses to humic substances depending upon the bioassay host, compost substrate, and presence or absence of mycorrhizal fungal propagules. Organic materials with high humic content resulting from composting, or humic extracts from soil have been shown to influence microflora populations and activity. Visser reported that humic acid increased populations of diverse soil bacteria (1985a), possibly through changes in their metabolic processes (1985b). Root disease caused by *Fusarium* or *Pythium* on douglas fir (*Pseudotsuga menziesii*) was suppressed by soil amendment with organic substances high in humic content (Schisler and Linderman, 1989). A hypothesis explaining these effects on plant growth is that the humic substances stimulate beneficial soil microbes that in turn stimulate plant growth or suppress disease.

Organic matter and humic substances influence endomycorrhizal fungi (Giovannetti and Avio, 1985; Hepper and Warner, 1983; Sreenivasa, 1994; Soedarjo and Habte, 1993;

USDA, Agricultural Research Service, Horticultural Crops Research Laboratory, 3420 NW Orchard Avenue, Corvallis, OR 97330.

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¹Research plant pathologist, corresponding author; e-mail: lindermr@bcc.orst.edu.

²Faculty research assistant.