Sclerotinia berry drop: a newly-recognized blueberry disease

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Blueberry growers are frequently confronted with mummyberry, phomopsis canker, botrytis grey mould and several other common blueberry diseases that can substantially reduce yield, quality and economic returns of the crop. What may come as a surprise to growers, crop specialists, and indeed plant pathologists is that another destructive but hitherto unrecognized disease has been found lurking in blueberry crops in central and eastern Canada and in Scotland. The disease easily passes unnoticed even to experienced eyes, and has probably been overlooked for years. No mention of the disease can be found in grower information articles or in authoritative disease compendia. As well, no reports of the disease were found in a search of the scientific literature. Yet the disease is caused by one of the most widespread and destructive plant pathogens on the planet, *Sclerotinia sclerotiorum,* which produces "white mould" diseases in numerous kinds of crops.

So how can *Sclerotinia* cause considerable losses in blueberry crops without anyone noticing it? The basic reason is that flowers, berries and leaves that become infected by *Sclerotinia* usually fall to the ground without having first shown any obvious symptoms or signs of disease while attached to the blueberry plants. The fallen tissues become obscured and lost among the crop residues accumulating on the soil. At the same time, sufficient normal-looking flowers, berries and leaves remain on the plants that no suspicion of anything being amiss may be raised during field inspections.

Sclerotinia first turned up unexpectedly in lowbush blueberries during disease diagnostic work on samples from Prince Edward Island during 2010 and again in subsequent years. It was also frequent in lowbush blueberry samples from Quebec and northern Ontario in 2014 and in highbush blueberries in Scotland in 2013 and in southern Ontario in 2014. The diagnostic work involved laboratory assessments of field samples taken at intervals throughout each grow season. In the course of the lab work, flower parts, berries and leaves were incubated in Petri dishes on an agar medium containing traces of the herbicide paraquat, which accelerates senescence and death in plant tissues. The relatively rapid senescence of the plant materials on this medium evokes almost immediate growth and sporulation of many kinds of fungi which can then be identified and tracked with the aid of microscopes. Cases in point include the pathogens *Botrytis* and *Phomopsis*, and the beneficial fungus *Clonostachys rosea*. The procedure also led to the first detection and identification of *Sclerotinia* in the blueberry samples.

We have to confess that *Sclerotinia* deluded us during the first two seasons of the R&D work. Pinhead-sized black bodies developed on corolla tubes and calyces of the flowers, and on berries and leaves (Figure 1a-d). These were easily seen on a stereoscopic microscope and were often visible to the naked eye. The small black bodies did not fit descriptions of any pathogens in disease compendia, websites and other publications. They certainly were not reminiscent of *Sclerotinia sclerotiorum* which normally produces much larger black bodies (sclerotia) on canola, sunflowers, soybeans, carrots and

hundreds of other plants. After small black bodies appeared yet again in the third year of R&D, they were cultured in the lab and, eureka, coarse mycelium (fungal growth) and large sclerotia typical of *Sclerotinia sclerotiorum* developed. These sclerotia were able to cause typical symptoms of white mould disease on sunflowers and carrot roots. The unusually small size of the sclerotia that formed on blueberry flowers berries and leaves was presumably related to limited availability of food to support growth of the fungus compared to that in the relatively massive organs of other plants such as sunflower heads, soybean stems and carrot roots.

Repeated sampling during the growing season in the blueberry R&D paid off with a better understanding of *Sclerotinia* in this crop. It turned out that the proportion of berries infected by *Sclerotinia* declined from peak values during early to mid July to zero sometime during August. For example, in samples from PEI in the 2014 growing season, 20 to 40% of berries taken from the plants in mid July were infected by *Sclerotinia.* However, very few infected berries were encountered in August, and no infected berries were found in samples of the harvested crop. What happened to the 20-40% of infected berries found in July? Our observations for samples from PEI, Quebec, and Northern Ontario in 2014 and also for samples from PEI in 2013 leave little doubt that most or all berries infected by *Sclerotinia* dropped off in the field. Hence we have come to call the disease "Sclerotinia berry drop".

The recognition that *Sclerotinia* berry drop may cause substantial berry losses in blueberry crops draws attention to how infection occurs and to possible options for managing the disease. Given what is known of the pathogen in other crops, it is likely that the flowers are a main portal of entry of the fungus into blueberries. *Sclerotinia* probably infects the flowers by means of spores (ascospores) dispersed from tiny fungal structures (apothecia) formed on sclerotia of previous seasons or from other kinds of crops. *Sclerotinia sclerotiorum* is extremely indiscriminate and any given isolate of the pathogen is able to attack hundreds of kinds of temperate and tropical crops. Once established on the flowers the fungus may spread into the developing berries. Our work suggested that *Sclerotinia* berry drop develops in patchy areas in the crop. At this time it is known that applications of the biological agent *Clonostachys rosea,* especially when the crop is flowering can greatly reduce flower and berry loss associated with *Sclerotinia*. The same agent can also work well against the other "big three" mummyberry, Phomopsis and Botrytis when appropriate grower-friendly protocols are followed. The same protocols are expected to be good against all four diseases.

Taken together, our findings in blueberries and the widespread distribution of *Sclerotinia sclerotiorum* around the world suggest that Sclerotinia berry drop may be a significant crop loss factor in lowbush and highbush blueberries in many countries. The disease warrants further attention in terms of its distribution, impact on berry yield, epidemiology and management.

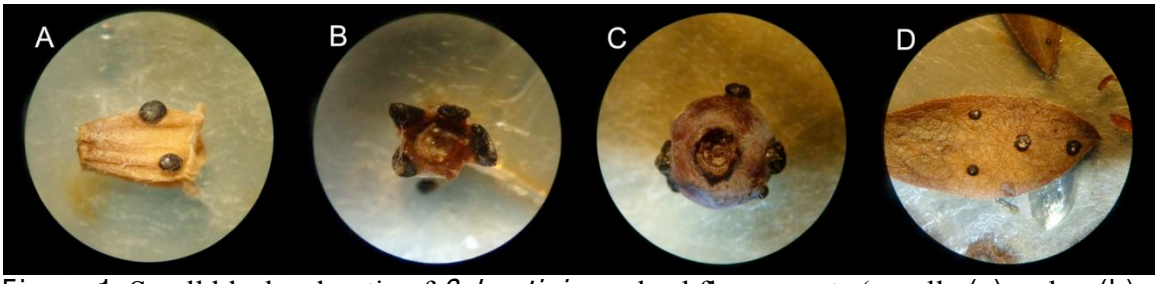

Figure 1. Small black sclerotia of *Sclerotinia* on dead flower parts (corolla (a), calyx (b), berry (c), and leaf (d)) of blueberry following incubation on paraquat-chloramphenicol agar medium.

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