Development of Sclerotinia-Resistant Sunflower Germplasm

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Automated mist irrngation system in Sclerotinia head rot nursery in Carrington, ND.

Location of three mist irrigated Sclerotinia nurseries at Fargo and Carrington, ND, and Brookings SD.

Wild sunflower evaluation portion of head rot nursery showing (left to rigth) cultivated sunflower check row, *Helianthus praecox*, row of dead *H. exilis*, and *H. petiolaris*.

Gerald Seiler, research botanist, & Tom Gulya, pathologist, inoculating wild sunflowers with *Sclerotinia* ascospores.

ABSTRACT

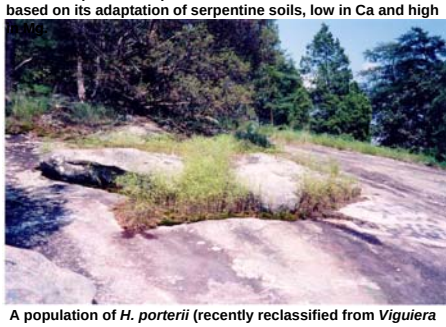
Several lines of study to develop sunflower germplasm tolerant to Sclerotinia head rot or stalk rot were continued or initiated during 2003. Following successful field tests in 2002, three sunflower inbred lines (RHA 439, RHA 440, HA 441) with high levels of head rot resistance were released in the spring of 2003. USDA breeding material was again evaluated for head rot tolerance at the mist field plots in Carrington, ND. Sclerotinia infection was low with susceptible checks averaging only 36% infected heads and a DSI of 2.7 on a 5-point scale. High winds and hot weather following ascospore inoculation were suspected to be the main factors causing the low disease severity. Modifications for 2004 to improve infection include switching from mist nozzles to micro–sprinkler heads, and installing leaf wetness and relative humidity sensors to determine when the mist duration is insufficient. Future modifications may include use of a data logger coupled with the sensors, programmed to activate the mist system instead of a simple time controller. In studies to evaluate wild sunflower germplasm, eight annual *Helianthus* species were tested for the second year at Carrington, ND. As observed in the first year, the primary response of wild *Helianthus* species to ascospore inoculation was peduncle necrosis rather than head rot. Only in *H. annuus,* with the largest heads, (approaching 3 cm in diameter) were typical head rot symptoms observed, and then only after cut heads were incubated in moist chambers in the laboratory. Additionally, only 35% of the 500+ transplanted wild sunflowers produced flowers in time for inoculation. The consensus after two years of experience is that evaluation of wild *Helianthus* species for *Sclerotinia* resistance would be most efficient after crossing with cultivated sunflower, and testing the F_1 interspecific hybrid, which should have agronomic characteristics approaching that of cultivated sunflower. A second mist irrigation nursery at Fargo was initiated to supplement the Carrington site. Sunflower, canola, and dry bean pathologists from North Dakota State University will use the four-acre site cooperatively. A two–year stalk rot inoculation method study at two locations was completed. Sclerotinia grown on either oats or millet and placed in a row-side furrow one month after planting gave consistent and high levels of stalk rot. Sclerotia, in contrast, produced low levels of disease. Twenty commercial hybrids were evaluated at four locations using the oat/Sclerotinia inoculum. Disease incidence across hybrids ranged from 22 to 56% at the four locations, with the resistant check hybrid averaging 17% infection compared to 55% for the susceptible check hybrid. Mechanizing this inoculation procedure by dispensing the inoculum with a granular chemical applicator mounted on a tractor–drawn cultivator should enable us to efficiently test a large number of entries. With artificial inoculation procedures for both head rot and stalk rot, our program should be able to screen for both diseases in our attempt to incorporate resistance to both Sclerotinia diseases in the same germplasm.

Oilseed sunflower hybrid with *Sclerotinia* stalk rot and resultant wilt, illustrating complete loss of infected plants.

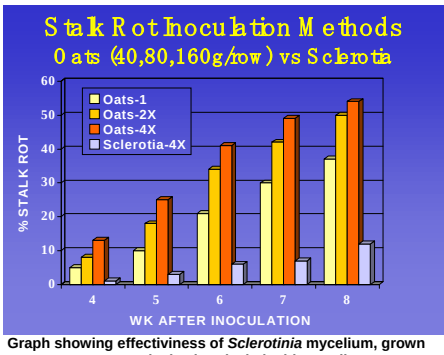
Helianthus verticilliatus in western TN, a rare perennial sunflower presumed to be extinct for 100 years – another candidate for *Sclerotinia* evaluation.

The authors wish to achkoweldge the valuable technical assistance of Scott Radi, Nikolay Balbyshev, Marjorie Olson, and Dale Rehder, and the help of Brenda Fradet in composing this poster.

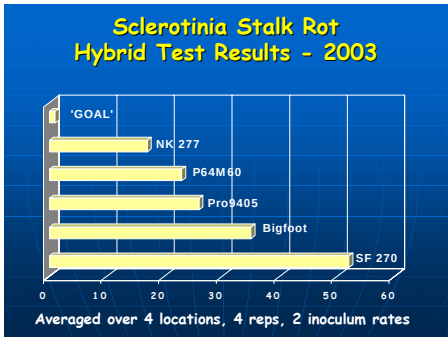
Gerald Seiler collecting seeds of *Helianthus exilis* in northern CA. This species has potential for Sclerotinia resistance based on its adaptation of serpentine soils, low in Ca and high



A population of *H. porterii* (recently reclassified from *Viguiera porterii*) in North Carolia. This is one of the many wild *Helianthus* species which has not been tested for Sclerotinia resistance because of the unavailability of seeds in the USDA germplasm collection.



Graph showing effectiviness of *Sclerotinia* mycelium, grown on oats, versus cracked sclerotia, in inciting stalk rot on cultivated sunflower (mean of 4 locations, over two years).



Current status of *Sclerotinia* stalk rot resistance in commercial sunflower hybrids, based on artificial inoculations using mycelia grown on oats.