

Effect of exogenous application of alkali compounds on the aggressiveness of *Sclerotinia sclerotiorum*

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Background:

Oilseed crops are the second largest agricultural commodity in India, after food grains. Rapeseed mustard holds an important position in the world and in India. The stem rot caused by *Sclerotinia sclerotiorum* (Lib.) de Bary is one of the major diseases of rapeseed-mustard crops. An acidic host-pathogen environment is ideal for *Sclerotinia sclerotiorum* degradation enzyme activities, as is a compatible host-pathogen interaction.

Objective:

S. sclerotiorum exhibits some mechanisms to modify ambient conditions to make extracellular pH more suited for pathogenicity and suppress the host defence. Thus, we have attempted to evaluate some alkali salts for their effect on *S. sclerotiorum* pathogenicity. A set of *S. sclerotiorum* isolates for their pathogenic ability, associated pathogenicity factors, and related genes were also studied.

Methods:

The study was carried out at Punjab Agricultural University, India, both under in vitro and in vivo conditions. Different concentrations of alkali salts, viz. sodium carbonate (SC), potassium silicate (PS), sodium propionate (SP), and calcium propionate (CP), were evaluated, under in vitro conditions, using the poisoned food technique. On the other hand, under in vivo conditions, spray treatments were given. In addition, the activity of oxalic acid and different enzymes (cellulase and cutinase) was assessed to correlate with the pathogenicity of *S. sclerotiorum*. Genes responsible to produce cutinase and oxalic acid (Sscut and Ssoah1) were also studied.

Results:

Various alkali salts exhibited their inhibitory effect on *S. sclerotiorum*. Complete mycelial growth inhibition was observed in PDA media amended with sodium carbonate (0.6–1.0%), potassium silicate (0.8–1.2%), calcium propionate (1.6–1.8%), and sodium propionate (0.8–1.2%). Under field conditions, calcium propionate resulted in significant inhibition of *S. sclerotiorum* (61.19%) compared to an untreated control. A positive correlation was observed between AUDPC and the production of oxalic acid (0.89), and hydrolytic enzymes, viz., cellulase (0.62) and cutinase (0.89). Seven SNPs were detected for the gene Ssoah1 when comparing sequences for low and high (3 isolates of each) oxalic acid-producing *S. sclerotiorum* isolates.

Conclusion:

Given the negative effects of chemical fungicides, the application of alkali salts has the potential to manage *S. sclerotiorum* in rapeseed-mustard. Among the different alkali salts tested, the application of calcium propionate was the most effective in preventing disease spread. A Ca²⁺ elevation in the cytoplasm is known to be an important early event in plant cell perception of pathogen invasion (Wang *et al.* 2019). Exogenous application of Ca²⁺, besides neutralizing the acidic environment around the infection site, may also induce defence pathways, thus making it more effective in preventing the spread of disease.

Reference:

Wang Z, Ma LY, Cao J, Li YL, Ding LN, Zhu KM, Yang YH and Tan XL (2019). Recent advances in mechanisms of plant defense to *Sclerotinia sclerotiorum*. *Frontiers in Plant Science* 10: 1314. doi:10.3389/fpls.2019.01314