Allicin a "natural" antifungal from garlic and its potential in controlling wheat diseases.

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Pyrenophora tritici-repentis (Ptr) (anamorph, *Drechslera tritici-repentis*), causal agent of tan spot (TS) of wheat, Mycosphaerella *graminicola* (Mg) (anamorph *Septoria tritici*), and *Bipolaris sorokiniana* are economically important pathogens in many wheat growing regions of the world. Since conservation tillage is accounting for a great portion of the wheat producing region in Argentina, these disease makes one of the consistent limiting factors to overcame. Currently, TS is one of the most important foliar diseases of wheat, with symptoms more intense in wheat monocultured under zero tillage.

Breeding, fungicide treatments, and appropiate cultural practices currently are used for diseases control. However, level of resistance in wheat cultivars to these diseases is known to be relatively low. Fungicidal treatments are a widely recommended practice to protect wheat against these pathogens, but some fungicides have become less effective because of the development of resistance in this fungus. Furthermore, effectiveness of seed chemical treatments is variable and too short-lived to protect the wheat plants throughout the growing season. Moreover, infections from secondary inoculums on plant debris are difficult to control by chemical treatments. In addition, pesticides may adversely affect the health of people, are harmful to the environment, and make disrupt the natural equilibrium among leaving microbial communities. The goal remains to integrate all natural substances available methods for disease control in a way to optimize their benefits and minimize their risks for producers, consumers and the environment in a sustainable crop production system. Thus, evaluation of alternative methods such as the use of allicin and others natural fungicides and inductors of systemic adcquied resistance (SAR) , as proposed in this project, could allow to minimize the use of chemical fungicides in Argentina.

Antagonistic natural products are present in substantial quantity in nearly all agricultural environments, and their use is now being recognized worldwide as an alternative in both disease control and plant growth promotion (PGR´s).

The approach developed for this proposal was based on the concept of natural fungicides resulting in the suppression of wheat pathogens either directly, or possibly via an up-regulation of host responses.

A step-wise screening system to select the appropiate natural fungicides and concentrations with potential activity to control leaf-spotting is conducting nowadays in the RWTH Institut für Pflanzenphysiologie, Lab of Biologie III, Aachen, Germany, under the supervision of Prof. Dr Slusarenko.

The suite of mechanisms to regulate development of disease and suppression of necrotrophic fungal wheat pathogens include control of infection, reduction of fungal spread in foliar tissue, and development on senescent tissue (pseudotecia) on infested stubble. So, the effect of natural fungicides on the anamorph and teleomoph of the pathogens, are considered in this project.

Potentially useful products such as allicin or lipoxygenase pathway volatiles-trans-2-hexenal- will be tested under in vitro and greenhouse conditions.

The volatile antimicrobial substance allicin (diallyl-thiosulphinate) is produced in garlic when tissues are damaged and the substrate alliin (S-allyl-L-cysteine sulphoxide) mixes with alliin-lyase.

Allicin is readily membrane-permeable and a pro-oxidant which undergoes thiol-disulphide exchange reactions with free thiol groups. It was suggested that inactivation of thiol-containing enzymes was the basis of allicin´s antimicrobial action.

Allicin thus shows multi-site activity. Allicin is inhibitory in vitro against a selection of plant pathogenic bacteria, fungi and Oomycetes.

We hypothesized than fungal pathogens spore germination and development is inhibited and that wheat plants infection is supressed.

In support of our hyphotesis about how allicin and trans-2-hexanal can affect in vivo ascospore and conidia germination of wheat pathosystems, different experiments are performed on leaves of differents argentinian wheat cultivars.

Furtherore uniformly infected wheat stubble are treated with allicin/t-2-h and control untreated beds which are sown with wheat seeds and look at infection rates with/without subsequent antagonist treatments.

The investigation of some molecular marks in the pathogen and the host in response to allicin/t-2-h treatment is in progress.

If the tretments are effective on laboratory scale the problems of scale-up to the field situation must be adressed later as allicin to be developed for use as a fumigant for wheat seeds in organic farming.

Therefore, the results of this research will fully contribute to use in future programmes of integrated plant protection to enlarge the posibility to suppression pathogens with an ecological approach like the ecofriendly management, useful to researchers, progressive farmers and all those involved in the adoption of biopesticides or botanical pesticides to maintain good quality of crops.