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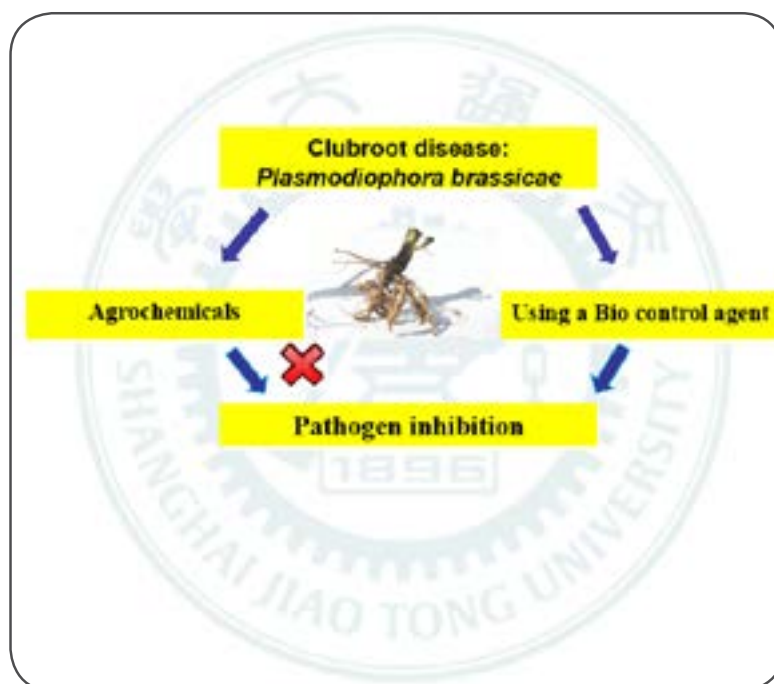
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Suppression of clubroot (*Plasmodiophora brassicae*) development in *Brassica campestris* ssp. *chinensis* L. via exogenous inoculation of *Piriformospora indica*

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The goal of the current study is to contribute to basic understanding of *Piriformospora indica*-*B. campestris* ssp. *chinensis* interactions and to assess its impact on clubroot infection as well as the expression level of known *Plasmodiophora brassicae* (causal agent) genes in root of infected *B. campestris* ssp. *chinensis*. Study revealed that *P. indica*, plant-root-colonizing fungus of Basidiomycetes, is capable to reduce formation of clubroot in *B. campestris* ssp. *chinensis* which is extremely susceptible to the root pathogen *P. brassicae*. Roots of the *P. brassicae*-infected plant were colonized with *P. indica*, as demonstrated by staining technique and microscopy. Like that, enhanced biomass was observed in *P. indica* co-inoculated pakchoi plants by comparing with plants infected with the pathogen only. Co-inoculation of Pakchoi plant with *P. indica* and *P. brassicae* reduced gall formation up to 61.60 % by comparing plants infected with only *P. brassicae* as shown by the Disease Index (DI). In addition, higher level of flavonoids were observed in *P. indica* inoculated plants which has been excessively reported to contribute in enhancing the plant immune system. Thus, a hypothesis was proposed that *P. brassicae* development in *B. campestris* ssp. *chinensis* plants could be delayed with the inoculation of *P. indica*. Expression of *P. brassicae* genes which were expressed differentially during disease development were monitored using quantitative RT-PCR and was corroborated with delayed pathogen development. These results suggest that *P. indica* and perhaps other beneficial endosymbiont could be an effective tool for the management of clubroot infection.



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Recent Publications:

1. Khalid M et al. (2017) Elevation of secondary metabolites synthesis in *Brassica campestris* ssp. *chinensis* L. via exogenous inoculation of *Piriformospora indica* with appropriate fertilizer. PloS one. 12(5):e0177185.
2. Khalid M et al. (2017) Identification of oral cavity biofilm forming bacteria and determination of their growth inhibition by *Acacia arabica*, *Tamarix aphylla* L. and *Melia azedarach* L. medicinal plants. Archives of Oral Biology. 81:175-185.
3. Khalid M et al. (2017) Influence of bio-fertilizer containing beneficial fungi and rhizospheric bacteria on health promoting compounds and antioxidant activity of *Spinacia oleracea* L. Botanical studies. 58(1):35.
4. Khalid, Muhammad et al. (2017) Characterization of ethno-medicinal plant resources of karamar valley Swabi, Pakistan. Journal of Radiation Research and Applied Sciences. 10(2):152-163.

Biography

Muhammad Khalid has his Doctoral study in progress at the Shanghai Jiao Tong University, Shanghai, P R China. His research interests are physiology and molecular biology, flavonoid and secondary metabolites analysis, bio synthetic pathways molecular analysis, transcription analysis, abiotic and biotic stress in plants.

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