

Research Article

Open Access

The Potential of Cell-free Cultures of *Rhizobium leguminosarum*, *Azotobacter chroococcum* and Compost Tea as Biocontrol Agents for Faba Bean Broomrape (*Orobanche crenata* Forsk.)

Yasser El-Halmouch^{1,4*}, Ahlam Mehesen² and Abd El-Raheem Ramadan El-Shanshoury^{3,4}

¹Botany Department, Faculty of Science, Damanhour University, Damanhour 22511, Egypt

²Soils, Water and Environment Research Institute, Agriculture Research Center, Giza 12619, Egypt

³Botany Department, Faculty of Science, Tanta University, Tanta 31527, Egypt

⁴Biotechnology Department, Faculty of Science, Taif University, Taif 21974, Kingdom of Saudi Arabia

Abstract

In the present study, cell-free cultures of four isolates of *Rhizobium leguminosarum*, an isolate of *Azotobacter chroococcum* and compost tea were investigated for their biocontrol potential against the root parasitic weed *Orobanche crenata*. Individual cell-free cultures of *Azotobacter chroococcum* or *Rhizobium* sp., dual and mixture of cell-free cultures of *Rhizobium* spp. or compost tea were applied to infested pots in greenhouse conditions. The treatments showed variable effects on many developmental parameters of both faba bean and broomrape. Significant decrease in the number of broomrape attachments, dry weight of the attached tubercles on faba bean roots and the reduction in percentage of broomrape seed germination were recorded. Compost tea, individual and mixture of *R. leguminosarum* isolates were more reducing on broomrape germination and growth than *A. chroococcum* alone did; being the former treatment is the best. The reduction in broomrape incidence by compost tea was due to certain phenotypic mechanisms, which acted alone or in combination. These mechanisms included negative effect of natural stimulant broomrape on seed germination, prevention of radical penetration inside the host roots, parasite yield reduction, and thus increasing the growth and vitality of faba bean. *In vitro* experiment indicated that seed germination percentage of broomrape was also negatively affected by the combination of root-exudates and compost tea. Radical apexes of the germinated seeds were distorted. These distortions may prevent the radicals to follow up the infestation. In conclusion, the study presents the potential of *R. leguminosarum* isolates and compost tea in biocontrol of broomrape. More investigations should be carried out with viable bacterial cells on the parasite plant before use in sustainable agricultural systems.

Keywords: Broomrape; Biocontrol; Faba bean; Root exudates; *R. leguminosarum*; *A. chroococcum*; Compost tea