Seed bio-priming of *Brassica napus* (ssp. *oleifera*) with the bacterial antagonists *Serratia plymuthica* and *Pseudomonas chlororaphis* for control of *Phoma lingam* and *Verticillium longisporum*

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With the increased production of oil seed rape (OSR) *Brassica napus*, reports on pathogen causing diseases have increased simultaneously. *Phoma lingam* (blackleg disease) and *Verticillium longisporum* (*Verticillium* wilt) are among the most important diseases of OSR that contribute to severe loses in yields. In this work, *Serratia plymuthica* HRO-C48 and *Pseudomonas chlororaphis* MA 342 were used as biological control agents (BCAs) to control *P.lingam* and *Verticillium* wilt in different OSR cultivars. On plant, which had been seed treated with *S. plymuthica* and *P. chlororaphis* applied alone or in combination, the disease incidences caused by *P.lingam* or *V. longisporum* were significantly reduced. *S. plymuthica* reduced the infection with *P. lingam* by 71.6 %, *P. chlororaphis* by 54.0 % and the combined treatment by 66.1 %. The seed treatment also reduced the infection with *V. longisporum* in all cultivars by 57.2 % when treated with *S. plymuthica*, by 51.3 % with *P. chlororaphis* and 55.7% with the combined treatment. The bacteria colonized successfully the rhizosphere of OSR plants. Colonization was not significantly different between the different cultivars, restricted to the roots and hypocotyls and significantly higher in OSR plants infested with the pathogens. In addition, BCAs enhanced the growth of the OSR plants. The optimum culture temperature was 28°C for *S. plymuthica* and 22°C for *P. chlororaphis*. Both antagonists grow at increased salinity. The optimal pH for growth of *P. chlororaphis* is within a small pH range around 7, whereas *S. plymuthica* grows at a much extended range of pH. Seed bio-priming of oilseed rape with the antagonistic rhizobacteria was improved. Addition of $MgSO_4$ to the priming solution was significantly superior to other priming solutions including the trypcase soy broth culture supernatant. A considerable reduction in the bio-priming process duration was achieved and the shelf-life of the BCAs prolonged in bio-primed seeds by storage at low temperature or under anaerobic conditions. Germination of OSR seeds was increased by treatment with the BCAs.