Endophytes As Biological Control Agents of Dandelions (*Taraxacum officinale*) in Turfgrass Systems

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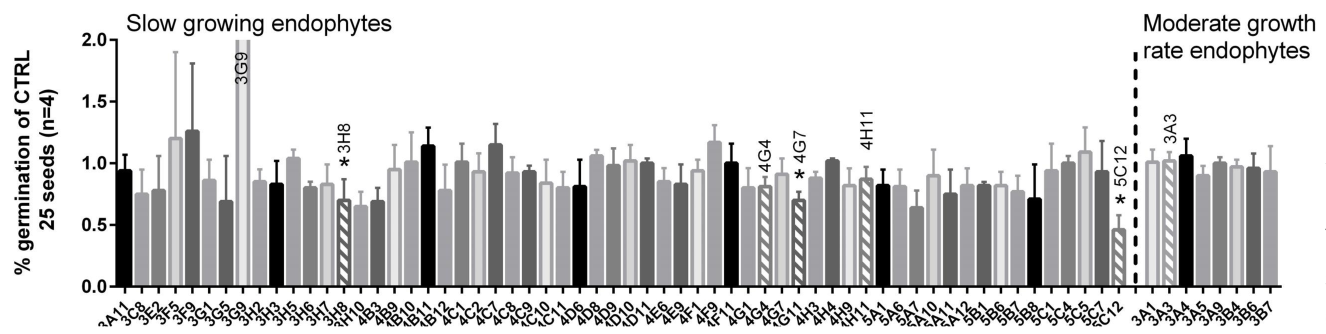
Introduction

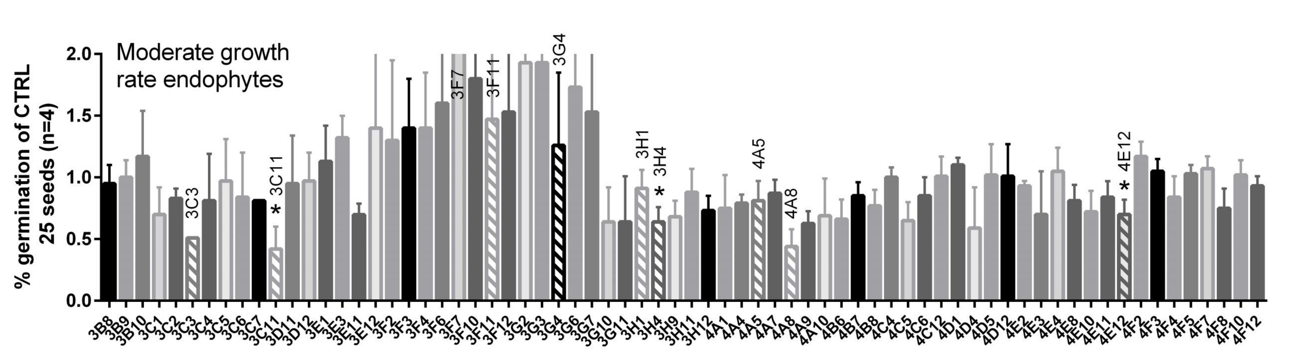
The increasing prevalence of bans and restrictions on cosmetic pesticide use has significantly reduced the number of weed control options available for turf systems. Thus, new weed-management strategies are required. The application of microorganisms to control weeds is a potential alternative to traditional herbicide use. Previous research has demonstrated that the introduction of beneficial endophytes (microbes that inhabit plants without causing disease) during establishment of grass-based pastures can reduce the encroachment of weeds (Saikkonen et al., 2013; Vazquez de Aldana et al., 2013). This project has investigated the possibility of translating this phenomenon to controlling dandelions (*Taraxacum officinale*) in turfgrass systems using *Zea*- genus endophytes that have previously demonstrated antagonistic effects when introduced to potato (*Solanum tuberosum*) (Johnston-Monje and Raizada, 2011).

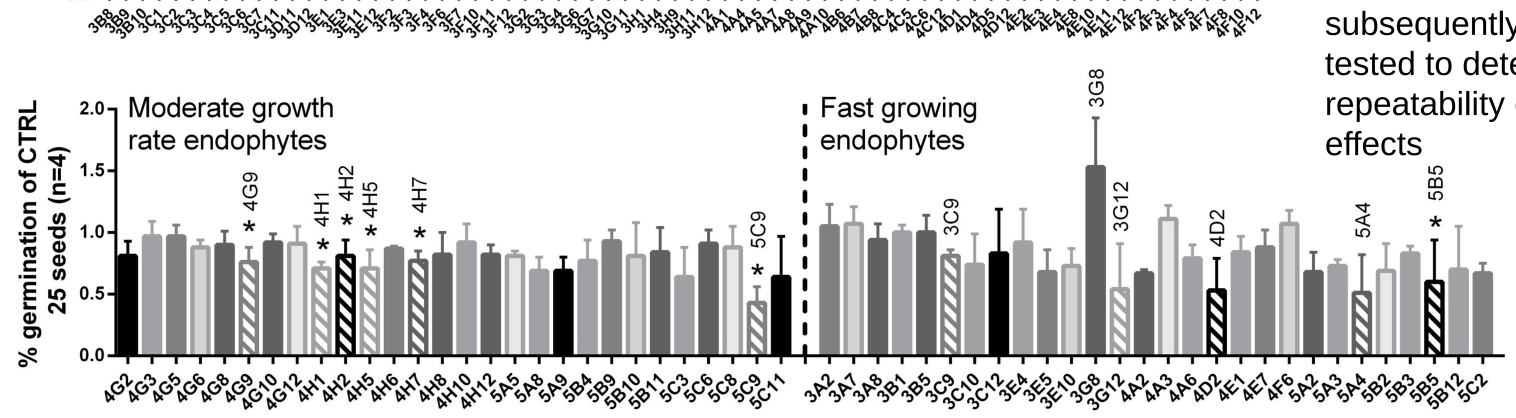
Hypothesis: Bacterial endophytes isolated from *Zea*- genus grasses (monocots) will suppress the germination and growth of a dicot species, specifically dandelion.
Objective 1: Test a library of *Zea*-derived bacterial endophytes for suppression of dandelion seed germination
Objective 2: Test a variety of turf species for compatibility with dandelion-inhibiting endophytes
Objective 3: Test strategies for improving establishment of dandelion-inhibiting endophytes in field conditions

Obj 1: Screening for anti-dandelion activity

Screening 1: Dandelion collected in Guelph, ON (43.5333° N, 80.2236° W)





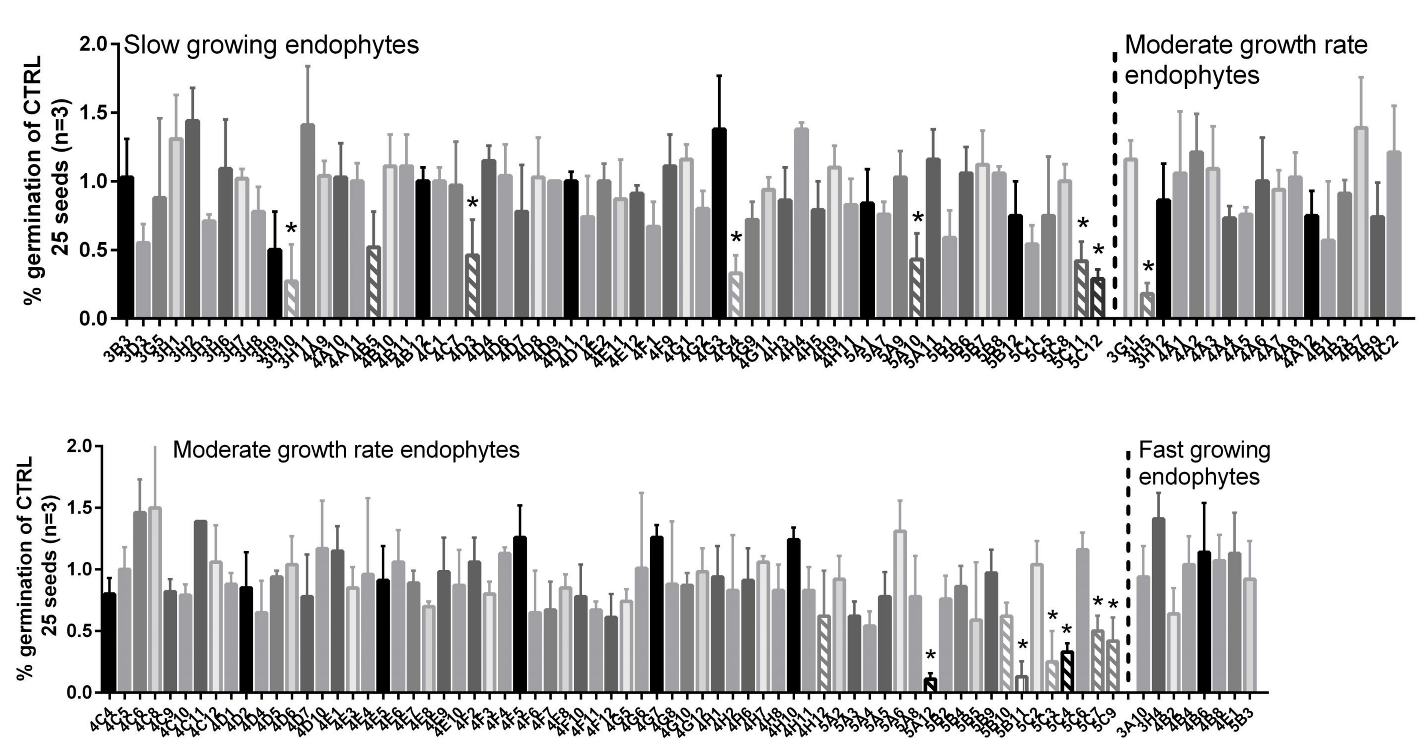


Error bars indicate standard deviation

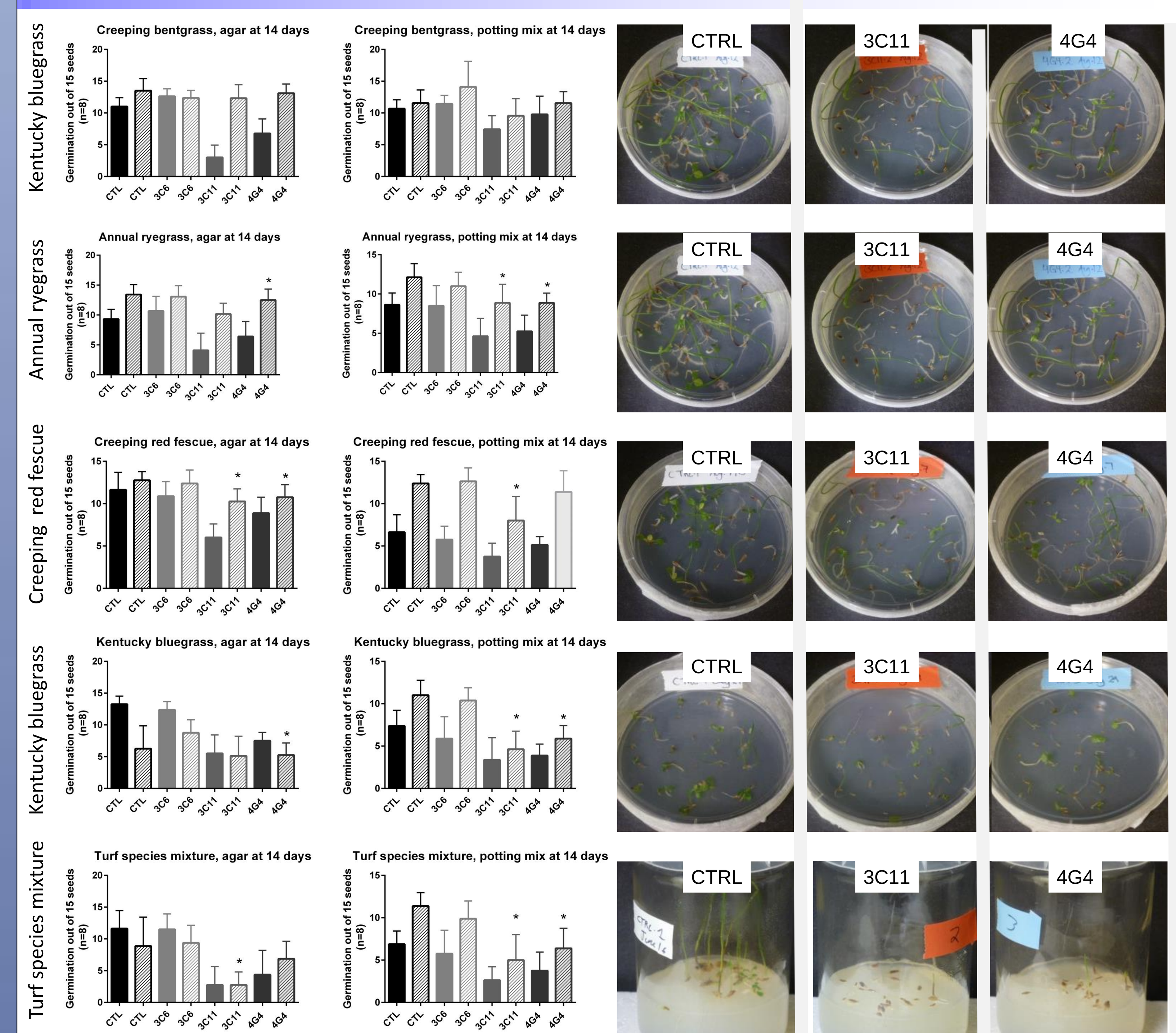
*Indicates significant difference from the associated negative control according to a one-way ANOVA, p=0.05

Striped bars indicate cultures that were subsequently tested to determine repeatability of effects

Screening 2: Cultivated dandelion variety



Obj 2: Testing turf species for compatibility

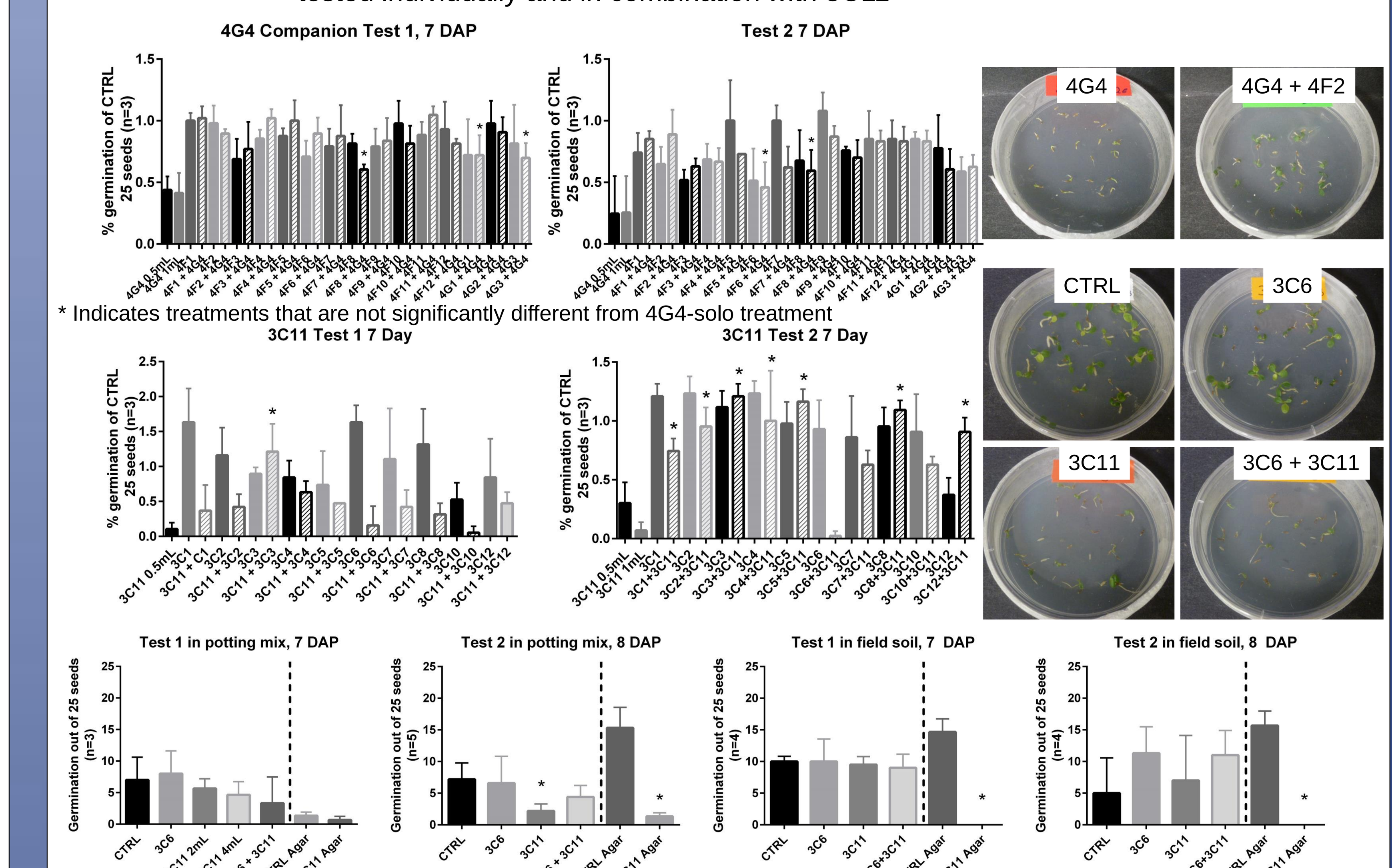


Striped bars denote grass germination, solid bars denote dandelion germination

Error bars denote standard deviation, * indicates significant different from the associated control according to a one way ANOVA

Obj 3: Improving field persistence with co-inoculation

- Germination-inhibiting effects associated with these endophytes have not been achieved in field soil
- Establishment of N-fixing bacteria species has in some cases been improved by coinoculating with other bacteria from the original microbial community (Tilak et al., 2006; Rajendran et al., 2008; Zhao et al., 2013)
- The co-inoculation strategy was tested with the germination-inhibiting endophytes
  - 15 endophytes isolated from the same source as 4G4 (*Zea mays* spp. *parviglumis* root) were tested individually and in combination with 4G4
  - 10 endophytes isolated from the same source as 3C11 (*Zea diploperennis* seed) were tested individually and in combination with 3C11



* Indicates treatments that are not significantly different from 4G4-solo treatment

Error bars denote standard deviation, * indicates significant different from the associated control according to a one way ANOVA

Results: Testing turf species for compatibility

- Germination-inhibiting effects associated with some endophytes of the *Zea* genus can affect both monocot and dicot species
- Sensitivity to germination-inhibiting endophytes varies among grass species
- Creeping bentgrass may be sufficiently resistant to these endophytes to enable selective biological weed control on golf greens and other bentgrass systems

Results: Improving field persistence with co-inoculation

- 15/ 15 companion endophytes interfered with germination inhibiting effects associated with 4G4
- 1/ 10 companion endophytes did not interfere with germination inhibiting effects associated with 3C11
- The non-interfering companion endophyte did not enhance the effect of the biocontrol agent in unsterile media
- This strategy for improving establishment of biocontrol agents should be tested on a case-by-case basis

References

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