

Harnessing rhizosphere *Bacillus* and *Epichloë* symbionts to promote the performance of *Achnatherum inebrians* within arid ecosystems

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Plants in natural ecosystems form intimate associations with diverse microorganisms, including bacteria and fungi, collectively termed the plant-associated microbiota. Notably, the entire rhizosphere microbial community is widely recognised as the plant's second genome, crucial for host growth and health. *Achnatherum inebrians*, a perennial grass increasingly dominant in the arid/semiarid grasslands of northwest China, is almost universally colonised by *Epichloë* fungal endophytes. We isolated bacteria from the rhizosphere soil of *Epichloë* endophyte-infected (E+) and endophyte-free (E-) plants of *A. inebrians*. A total of 393 bacterial isolates were identified, primarily belonging to Proteobacteria (195), Actinobacteria (100), and Firmicutes (98) at the phylum level, with dominant genera including *Acinetobacter* (45 isolates), *Pseudomonas* (90 isolates), *Rhizobium* (60 isolates), *Bacillus* (98 isolates), and *Arthrobacter* (100 isolates). E+ plants exhibited significantly higher relative abundances of *Bacillus* and *Pseudomonas* compared

to E- plants. E+ plants showed significantly enhanced germination potential, germination index, seedling length, and fresh weight ($P < 0.05$) compared to E- plants. Inoculation of selected *Bacillus* isolates onto *A. inebrians* seedlings demonstrated their growth-promoting ability. All isolates of *Bacillus* improved germination rate, germination potential, germination index, root length, seedling length, fresh weight, and dry weight ($P < 0.05$). Based on membership function analysis, 80 out of 90 *Bacillus* isolates positively influenced seed germination of *A. inebrians*. Both *Epichloë* endophytes and *Bacillus* significantly increased tiller number, fresh weight, and dry weight ($P < 0.05$), while their interaction notably affected plant height and reproductive branch number ($P < 0.05$). These findings highlight the synergistic role of *Epichloë* spp. and rhizosphere bacteria in enhancing host plant performance. Future research will focus on constructing synthetic microbial communities to leverage these beneficial plant-microbial interactions for sustainable agricultural practices.