

***Epichloë* endophytes mediate transgenerational effects in *Achnatherum inebrians* by enhancing photosynthetic capacity under drought stress**

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Transgenerational effects occur when plants exposed to biotic or abiotic stresses influence progeny phenotypes by transferring information and/or resources. As vertically transmitted symbionts, *Epichloë* endophytes may mediate transgenerational effects, but direct evidence remains limited. *Achnatherum inebrians* (commonly known as drunken horse grass) is a perennial bunchgrass widespread in arid and semi-arid grasslands of northwest China, where drought stress is common. Most *A. inebrians* plants in northwest China host the seed-transmitted endophytes *Epichloë gansuensis* or *E. inebrians*, making these symbioses ideal systems for studying endophyte-mediated transgenerational effects. This study examined plants of *A. inebrians* with (E+) and without (E-) *Epichloë gansuensis* endophyte, derived from the same seed line but originating from either a dry or wet site. Plants were grown under three soil moisture conditions: drought (15% relative soil water content, RSWC), control (45% RSWC), and abundant moisture (60% RSWC). Key photosynthetic parameters were measured to assess the role of *Epichloë* with respect to transgenerational effects. As expected, E+ performed better than E- under the same treatment. While, under drought, E+ plants from the dry site had

20% higher Mg^{2+} content than E+ plants from the wet site, whereas E- plants from the dry site showed only a 9.7% increase compared to E- plants from the wet site. Similarly, Ribulose-1,5-bisphosphate carboxylase/oxygenase (Rubisco) and Rubisco activase activities within E+ plants from the dry site were significantly higher by 21% and 17% ($p < 0.05$), respectively, than in E+ plants from the wet site, while E- plants showed only 3% and 11% increases in these enzyme activities between dry and wet site. In other words, the *Epichloë* endophyte amplified the transgenerational effects of host plants, further enhancing the drought resistance of their progeny. These increases in enzymes likely led to higher chlorophyll content and net photosynthetic rates in E+ plants from the dry site, with a greater difference compared to E- plants. Our findings confirm that transgenerational effects occur in *A. inebrians* and that *Epichloë* endophytes mediate these effects by enhancing photosynthetic capacity. This may explain why E+ plants have a selective advantage over E- plants in arid grasslands and highlights the potential of *Epichloë* endophytes in breeding drought-resistant forage germplasm for dry regions.