Diversity, ecology and applications of *Epichloë* endophytes from South America

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The presence of *Epichloë*-infected grasses in South America was inadvertently reported in 1908 when two veterinaries attributed the cause of the poisoning in cattle and livestock to the consumption of *Festuca* plants infected with a fungus that they wrongly identified and named *Endoconidium tembladerae* (today *Epichloë tembladerae*). It was only at the end of the 20th century that systematic studies of endophytes in Argentinian native grasses began, and the host list of new and already known *Epichloë* endophytes is continually expanding. The team at UBA-FCEyN and CONICET-UBA have, and continue, to work on three central projects:

1. Toxic and mammalian safe genotypes of *Epichloë* associated with native fescues.
   Festuca fiebrigii and *F. argentina* associate with *Epichloë tembladerae* and in populations of *F. argentina* endophyte incidence is higher than 90%. These endophyte-grass associations are infamous for their toxicity to livestock with preliminary analyses suggesting that mammalian toxicity is due to the production of the alkaloids terpendole C and I. However, extensive surveys in *F. fiebrigii* populations have now revealed that this grass species also associates with several non-toxic genotypes of *E. tembladerae,* and these endophytes may contribute to the development of novel forages for Argentina. Recently, we have also detected a new toxic endophyte genetically related to *E. aotearoae* but more difficult to culture. *E. aotearoae* is a symbiont of *Echinopogon ovatus*, a grass endemic to New Zealand.
2. Endophytes in wild forage grasses.
   Bromus auleticus, an important forage grass, is associated with at least three peramine producing *Epichloë* species, *E. pampeana*, *E. tembladerae* and *E. platensis*. Only the N-formylloline producing *E. pampeana* is harmful to aphids (*Rhopalosiphum padi*) while none of these endophytes have effects on the feeding preference of crickets (*Gryllus assimilis*). However, *B. auleticus* plants infected with *E. platensis* are more tolerant to root feeding scarab beetle larvae (*Philochloenia bonariensis*). Current research aims to further understand the complexity of insect resistance within these grass-endophyte associations. *Epichloë* endophytes also modulate host physiology in *B. auleticus*. Germination of endophyte-infected (E+) seeds was prevented under low water activity and salinity and E+ plants, exposed to water deficit, suffered less cellular damage, maintained higher values of stomatal conductance and net photosynthesis than endophyte-free (E-) plants. The *Epichloë* endophytes also modulate the community of non-systemic foliar endophytes and the community structure of cultivable dark septate endophytes in roots of *B. auleticus* differed between E+ and E- plants with higher proportions of pathogenic fungi in the E- plants.
3. Inoculation of Argentinean endophytes in commercial forage grasses.
   The wide host range, genetic and chemical diversity, and the advantageous traits conferred upon their original host grasses led to research developing novel grass-endophyte associations. Attempts were made to infect commercial forage grasses and barley (*Hordeum vulgare*) with *E. tembladerae*, *E. cabralii* and *E. pampeana*. Only *Lolium multiflorum* inoculated with *E. tembladerae* formed a stable association. This association remained stable for five generations and these plants did not behave differently from those associated with their original endophyte, *E. occultans*.

Summarising, more research is needed to understand the complexity and the potential of endophyte-grass associations in South America.

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