Exploring *Epichloë* endophytes in Scottish wild barley for enhanced crop resilience

Lorena I. RANGEL[1*], Sarah E. LIGHT[2], Victoria BUSWELL[3], Beatrix KEILLOR[1], and Damian BIENKOWSKI[3]

[1]*Cell & Molecular Sciences, The James Hutton Institute, Dundee, UK*

[2]*University of California Cooperative Extension, Yuba City, California, USA*

[3]*Information & Computational Sciences, The James Hutton Institute, Dundee, Scotland, UK*

*Corresponding author: Lorena.Rangel@hutton.ac.uk

Barley (*Hordeum vulgare*) is the most economically important crop in Scotland, yet its yields are increasingly threatened by biotic and abiotic stresses. One promising approach to mitigating these challenges lies in the use of endophytic microorganisms—bacteria and fungi that live within plant tissues and often provide benefits such as pest protection and growth promotion. While the use of selected *Epichloë* endophytes as biological control agents has been successfully commercialised in countries like New Zealand and the United States, this potential remains largely unexplored in the United Kingdom (UK). Specifically, *Epichloë* endophytes are known to confer protection against pests and pathogens in grasses. Previous studies have shown that *Epichloë* strains from grass species within the *Triticeae*, including wild *Hordeum* species, cluster according to geographic location rather than host species, suggesting local adaptation is ecologically important to their survival and dissemination.

We hypothesised that locally adapted asexual *Epichloë* strains in Scottish wild barley may enhance the plants resilience to both abiotic and biotic stresses. To explore this, wild barley seeds were collected from across Scotland and assessed for their bacterial and fungal endophyte communities, with a focus on *Epichloë* species. Seeds from plants with no choke symptoms were collected to ensure that these endophytes were vertically transmitted within the plant, a key trait for their potential use in sustainable agriculture. Of the 27 sites across Scotland, only one contained *Epichloë*, identified as *E. baconii* by ITS sequencing. This isolate was whole genome sequenced to explore its potential secondary metabolite arsenal and other putatively secreted compounds that could be exploited to benefit domesticated barley. We also employed culture-independent methods to map bacterial and fungal endophyte community diversity and their potential associations with specific geographic regions or plant host.

This study fills a significant gap by providing the first inventory of seed-transmitted endophytes in UK wild barley. Future research will explore symbioses between local *Epichloë* strains and domesticated barley to boost resistance to pests, diseases, and environmental stress. The discovery of specific endophyte-associated compounds may also offer novel avenues for improving barley yield and quality. Ultimately, this research supports the development of more resilient and sustainable agricultural practices, contributing to the long-term health and productivity of barley farming in the UK.

ISSN 2463-2872 (Print) ISSN 2463-2880 (Online) https://doi.org/10.33584/rps.18.2025.3817