Do mycotoxigenic fungi cause equine grass sickness (EGS)?

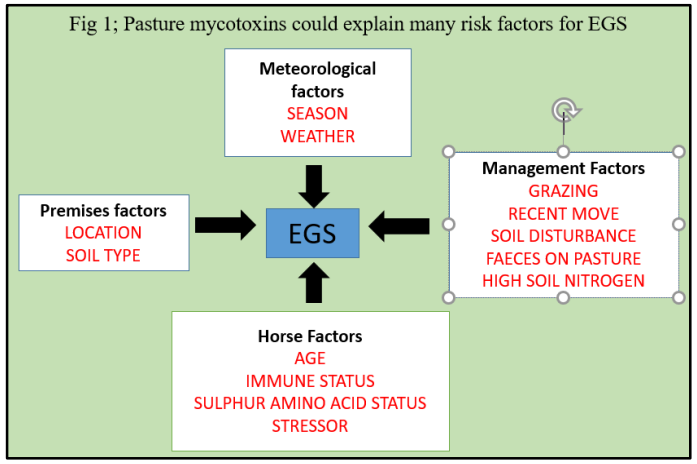
[1]Bruce McGorum, [2]Zihao Chen2, [1]Laura Glendinning, [3]Hyus S Gweon, [1]Luanne Hunt, [2]Alasdair Ivens, [1]John Keen, [1]Scott Pirie, [4]Joanne Taylor, [1]Toby Wilkinson, [1]Gerry McLachlan
[1]Royal (Dick) School of Veterinary Studies and The Roslin Institute; [2]Ashworth Laboratories, University of Edinburgh; [3]School of Biological Sciences, University of Reading; [4]Royal Botanic Garden Edinburgh

McGorum BC et al (2021) EGS (a multiple systems neuropathy) is associated with alterations in the gastrointestinal mycobiome. Animal Microbiome. 9;3(1):70. doi: 10.1186/s42523-021-00131-2

Background; EGS is a multisystem neuropathy that kills 1-2% equids in affected regions. The cause is unknown. Many of the risk factors for EGS (Fig 1) are consistent with it being caused by ingestion of neurotoxic mycotoxins produced by microscopic fungi growing on pastures (Fig 2).

Aim & methods; To identify possible causal fungi, we used a genomic approach to compare the entire population of fungi (termed mycobiota) within 5 regions of the equine gastrointestinal (GI) tract of EGS horses (150 samples), healthy horses co-grazing EGS pastures (48 samples), and healthy horses grazing pastures where EGS had not occurred (67 samples).

Fig 1; Pasture mycotoxins could explain many risk factors for EGS



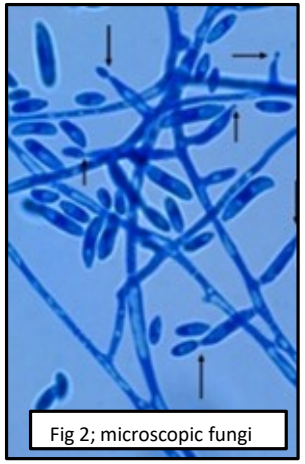
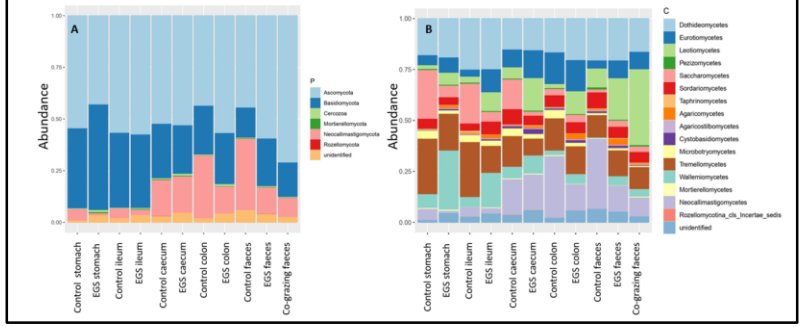


Fig 2; microscopic fungi

Fig. 3: Taxonomy plots showing relative abundance of taxa at (A) phylum and (B) class levels. Data are filtered at 0.05% abundance threshold.



Results & conclusions;

- This is the first genomic characterisation of the equine GI mycobiota at 5 GI sites
- All horses had a rich and diverse mycobiota (2,816 different fungi identified)
- Most fungi were ingested environmental fungi, including those living in/on soil, dung, litter, and plants. Only 1% were fibre digesting fungi that live permanently in the GI tract
- Fungal diversity and richness were greater in the colon, caecum and faeces than in stomach and ileum, and were greater in EGS horses (Fig 3)
- Consistent with the hypothesis that ingested fungi cause EGS, mycobiota of EGS horses differed from those of healthy grazing horses and co-grazing horses
- Key fungi (n=56) which were significantly associated with EGS, and which could potentially cause EGS, were identified
- Many key fungi produce neurotoxins
- Many key fungi are extremophiles, which may allow them to survive the adverse cold and dry weather conditions that often precede EGS outbreaks
- Many key fungi are dung fungi, potentially explaining the reduced EGS risk with 'poo picking'

Further work; Follow-up analysis of archived samples collected from EGS horses for neurotoxic mycotoxins is underway to determine whether the key fungi cause EGS