

**BBSRC South West Doctoral Training Partnership, UK Topic: *Analysis of interactions between slugs and weeds in arable crops***

*using next generation sequencing*

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Slugs are major crop pests throughout the temperate world, especially in the UK where the climate fosters high densities, threatening profits and food security. They are ecosystem engineers, having hierarchies of preference for the seedlings of different weed and crop species that alter subsequent plant community composition. Removal of weeds (with herbicides) results in greater slug damage to the crop while slug control (with molluscicides) is highly weather-dependent and slugs persist. Better understanding of the preferences of slugs for different weed species offers the opportunity to be more selective in the management of weeds and slugs in major crops such as wheat and oilseed rape. Selective herbicides can remove weed species less palatable to slugs, that are likely to be major competitors (e.g. monocots like Blackgrass) with the crop, while leaving seedlings that are palatable unharmed to potentially divert slugs from consuming the crop. Next Generation Sequencing will be used to analyse plant DNA in gut and faecal samples collected from slugs to determine their weed/crop preferences. We will target the ITS2 gene, exploiting the near comprehensive database of Welsh and UK sequences that now exists. Ratios of different plant species in the slugs will be compared with the abundances of weeds and crop plants in fields using Monte Carlo simulations and co-occurrence modelling to determine preferences. Plots trials will calibrate our field results and test the viability of selective weed control to protect crops. The multidisciplinary team of supervisors will ensure major training opportunities. WOCS will provide training in molecular analysis of herbivory, using NGS; POTW will provide bioinformatics training (NGS output); IPV will supervise Monte Carlo model development for herbivory and JRB will advise on co-occurrence networks (for slug-weed interactions).

Rotations: 1) NGS of gut contents requires comprehensive barcode databases for sequence identification. The student will be provided with a self-contained set of material to barcode from ongoing work into the diets of endangered species (supervisor WOCS). Expertise will be acquired in both practical molecular analyses and tree construction. 2) A major problem in diet analyses is differential DNA survival during digestion of sequences from different species, compounded by factors such as amplicon size and gene copy number. Feeding trials (using project-relevant slugs and weeds) will be conducted and decay curves will be incorporated into new Monte Carlo plant choice models (supervisor IPV). Training will be in conducting trials and model development, both directly relevant to the PhD.

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