ANU Seminar

EVOLUTION, ECOLOGY, & GENETICS
RESEARCH SCHOOL OF BIOLOGY

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Plastic and adaptive response to changing climates

Current models of the impact of climate change on plant species do not adequately account for resilience, dispersal and adaptation, and are therefore misleading for biologists and managers.

Investigations on common species across environmental gradients can provide insights into historical patterns and capacity to respond to future environmental change.

The distribution of NSW Waratah (*Telopea speciosissima*) across a strong climatic gradient, and the availability of relevant background research, makes it an excellent system to explore the relative importance of phenotypic plasticity and adaptive evolution to changing climate.

Nuclear microsatellite, morphological variation and climate modelling indicate coastal and upland populations have differentiated over evolutionary time scales with fluctuating levels of connectivity during Quaternary climatic cycles.

We investigated how the seed germination, seedling establishment, and time of flowering of coastal and upland populations respond to climatic variables in field, common garden, and laboratory experiments linked to RNA-sequencing.

Germination shows a plastic response with most events taking place across a range of temperatures (>80% 10-30C). However, a significant differential population response to temperature cues is suggestive of weak adaptive evolution. A pattern supported by a reciprocal transplant experiment (RTE) of seed.

Seedling growth and survivorship was explored in the field RTE and in glasshouses manipulating carbon dioxide concentration, temperature and water availability. Coupled with characterisation of morphological traits and cell structure the findings of this experiment provide insights into adaptive plasticity.

Flowering in natural populations is separated by up to 8 weeks between the coast and uplands. In a common garden, the pattern flattens but the sequence of first flowering is retained with flowering of coastal followed by upland plants. Flowering is strongly genetically controlled requiring 10 days above 20C (limited plasticity), however weak differential adaptation is suggested among populations at either end of the environmental gradient.

Utilising NGS Illumina platform, a comparative transcriptomic analysis of populations (coastal, uplands), organs (floral bud, germinated seed), and conditions (10C, 30C) was performed. Variation in gene expression levels and signatures of selection in coding sequences was revealed. Functional annotation of transcripts was facilitated by the strong link with experiments (genotype-response-transcript).

The final analysis will provide detailed information on the capacity for germination and flowering to change through phenotypic plasticity and adaptive evolution. The applied (robust predictions of population resilience to future climate scenarios) and theoretical (relative importance of plastic and adaptive response) will be discussed.

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Seminars are held in the Gould Wing Seminar Room, Building 116 Daley Rd, ANU

ALL STAFF AND STUDENTS ARE WELCOME TO ATTEND