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Are invasive plants more toxic than native plants? An example of rapid evolution after invasion

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Biological invasions are excellent systems to study rapid evolution of plant chemical defenses. Current hypotheses predict a divergence of plant chemical defenses in response to a decrease in herbivory after invasion (e.g. EICA hypothesis) or in response to novel climatic conditions. Post-invasive changes in plant chemistry can modify the interactions with herbivores and facilitate invasion success. However, whether plant toxicity is changed after invasion remains to be evaluated.

Senecio pterophorus is a shrub native from Eastern South Africa and a recent invader in Western South Africa (~100 years ago), Australia (>70-100 years ago) and Europe (>30 years ago). These distributional regions of *S. pterophorus* differ in their summer drought stress and in their interactions with herbivores. As other Asteraceae, *S. pterophorus* contains pyrrolizidine alkaloids (PAs) toxic to vertebrate and invertebrate herbivores. Plants from 54 populations sampled throughout the entire known worldwide distributional area, including the native and three non-native ranges, were grown under controlled conditions. First, we analyzed the levels of chemical defenses and leaf morphological traits to determine whether plant genetically-based traits diverged between native and non-native populations. Second, we performed non-choice bioassays with generalist herbivores (e.g. *Spodoptera* sp) to evaluate changes in plant toxicity after invasion.

Plants from different origins diverged in their chemical and morphological traits. Levels of chemical defenses were higher in the introduced populations, including the highly toxic 1,2-unsaturated PAs and the less toxic 1,2-saturated PAs. These results, indicative of higher toxicity in the invasive range, were consistent with the lower larval growth when insects consumed non-native plants. We discuss what factors, either chemical or morphological, determine the increase in plant toxicity after invasion. By comparing the genetic similarity across the native and non-native areas obtained by neutral markers we evaluate whether changes in toxicity are result of a rapid evolution.