

Abstract

Worldwide, alien plant invasions are altering ecosystem dynamics, and affecting natural resources and economic activities. One potential way of boosting the fight against plant invasions is to predict which plants will invade where. An understanding of the relationships between alien and indigenous plants from a phylogenetic perspective can be useful here. Phylogenetics describes the way in which plants are related to each other, and it has been shown that the way in which plant communities are assembled is critically dependent on the phylogenetic relationships between plants. Not all ecological relationships between alien and related indigenous plants will be competitive; neutral co-occurrence and even facilitation can also result. The aim of this study was to determine whether the co-occurrence of alien and indigenous plants depends on their phylogenetic relatedness, taking into account Darwin's Naturalization Hypothesis and the Invasional Meltdown theory. The Palmiet Nature Reserve, a protected area, and the University of KwaZulu-Natal (UKZN) Westville Campus, an urban conservancy, formed the study area. Six 5x5m plots were sampled; identifying each plant and its exact position on a grid, and using Hawth's Analysis Tool to calculate the physical distance relationships within plant species pairs. This was plotted against family-level phylogenetic distance to produce alien-to-indigenous, alien-to-alien and indigenous-to-indigenous plant species regression relationships.

The relationship between phylogenetic-physical distances varied depending on the plants involved but also within each group. Alien-to-alien regression trendlines indicated highly significant relationships with significantly steeper slopes than the other regression relationships. This suggests that competition and facilitation between alien plants are both phylogenetically mediated. Alien species occupancy also influenced co-occurrence with related plant species. Higher occupancy species seldom co-occurred with other closely related aliens, whereas low occupancy generally indicated co-occurrence, possibly suggesting a facilitation relationship. These findings fail to support Darwin's Naturalization Hypothesis, provide a set of phylogenetic rules for the Invasional Meltdown theory, but may also have implications for the management of alien plant species both locally and elsewhere.