**Plant genetic variation structures insect herbivore-parasitoid networks**

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**Abstract**

**Introduction**

Here, we provide empirical evidence that genetic variation within a dominant plant species can structure ecological networks by altering the strength of interactions among its associated species. Using a a large common garden experiment consisting of 26 genotypes of a dominant plant species, *Salix hookeriana*, and built quantitative interaction networks among its associated gall-inducing insects (herbivores) and their parasitoids for each genotype, we addressed the following questions: (i) test for compartmentalization in a plant genotype-herbivore-parasitoid network; (ii) partition the processes contributing to dissimilarity in network structure among different compartments; and (iii) analyze the plant and herbivore traits that are determining this compartmentalized structure.

**Materials & Methods**

### Natural History

Our focal plant species, *Salix hookeriana* (Coastal willow), is a dioecious and deciduous shrub (< 8 m), generally restricted to less than 100 m elevation, and commonly occurs in meadows, floodplains, and coastal dunes from northern California to Alaska (Argus 2013). As with other willows, *S. hookeriana* is an ideal system for studying the effects of host-plant genetics on herbivore-parasitoid interaction networks for two main reasons. First, willows display considerable genetic (Brunsfeld, Soltis, & Soltis, 1991) and phenotypic variation (Argus, 2013; Nichols-Orians, Fritz, & Clausen, 1993), which corresponds to variation in susceptibility to different species of herbivorous insects (Barbour et al. 2014, in review; Fritz & Price 1988; Roche & Fritz 1994). Second, previous work has shown that willow genotype may mediate the strength of pairwise trophic interactions between herbivores and their natural enemies (Price’s work, Craig’s work, Fritz’s work, your work too.).

The five species of herbivores we focused were four gall midges (Family Cecidomyiidae) and a leaf galling sawfly *Pontania californica* (Family: Tenthredinidae). Gall midges included the leaf galler *Iteomyia salicisverruca* (hereafter *Iteomyia*), bud galler *Rabdophaga salicisbrassicoides*, shoot galler *Rabdophaga salicisbattatus*, and an undescribed shoot gall (Cecidomyiid sp. A) that occurs at the apex of willow shoots (Plate 1, supplement)(for details in their biology see Caltagirone 1964 Gagné 1989, Russo 2006). In late April - early May, *Iteomyia* galls begin to appear, followed by galls from *R. salicisbrassicoides*, *R. salicisbattatus*, and Cecidomyiid sp. A. in late May – early June. By late August, all gall midge larva are fully developed and appear to overwinter inside the galls. In contrast to the gall midges, *Pontania* *californica* is bivoltine and are the first gall species to emerge in April, complete their development, emerge again in late June, and complete their development by late August where they exit the gall, drop to the ground, and overwinter in the soil.

The closed nature of these galls restricts the natural enemy community to about eight species of insects that can successfully locate and attack herbivore larva within these galls. These eight species consist of seven parasitoid wasps (Chalcidoidea = 6 sp.; Platygastroidea = 1 sp.; Ichneumonoidea = 1 sp.) and one predatory Cecidomyiid midge (*Lestodiplosis septemmaculata*)(Table S1 contains a list of species names and relevant biological details for this natural enemy community).