

The effect of invasive *Chrysanthemum coronarium* on a coastal sage scrub arthropod community in Southern California



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Abstract

Non-native plant invasions alter basal resources and abiotic factors leading to effects that ripple throughout an ecosystem¹. Arthropods often mediate these effects—responding quickly to changes and in turn influencing other species (e.g., vertebrate predators)². These invasions are of particular concern in the coastal sage scrub ecosystems of Southern California. Habitat loss, encroachment and degradation resulting from dense urban development increase propagule sources and decrease native community resistance. The introduced annual *Chrysanthemum coronarium* is a common invader (Fig. 1) with largely undocumented community-level effects. **Our study tested how the invasion of *C. coronarium* was affecting a coastal sage scrub arthropod community.** We performed a field study in the north end of the Tijuana River National Estuarine Research Reserve. **Preliminary data** from spring 2011 revealed that although total canopy abundance and diversity were not affected by the presence of *C. coronarium*, arthropod community composition changed dramatically. Plots with *C. coronarium* had higher abundances of opportunistic and/or detritivorous arthropods (e.g., dipterans) and lower abundances of herbivores (e.g., hemipterans) than native plant plots. Differences in arthropod communities were associated with the generally greater plant volume, a proxy for biomass, and less harsh physical conditions (shadier) afforded by the natives. Individuals of *C. coronarium* were ~1/3 of the plant volume of individuals of *Artemisia californica* and other native plants for the same amount of ground cover. This project reveals that even a proportionally small amount of *C. coronarium* may shift the arthropod community through alteration of abiotic properties and primary producer availability. We recommend that *C. coronarium* be removed at the first sign of invasion or that measures be taken to prevent spread since effects on arthropod community are dramatic and occur quickly.



Fig. 1. Invasive *C. coronarium* stand at the Tijuana River Estuary, Imperial Beach, California

Project Goal: To test the influence that a *C. coronarium* invasion is having on a coastal sage scrub arthropod community.

Specific objectives

We tested for differences in the 1) diversity, 2) abundance and 3) composition of arthropods in the canopies of native plant stands (mixed natives and native monocultures), *C. coronium* stands, and stands containing both.



Fig. 2. Study site located at the Tijuana River Estuary, Imperial Beach, California

Methods

- Study site: coastal sage scrub ecosystem of the Tijuana River National Estuarine Research Reserve (Fig. 2)
- Ten replicate plots for each of 4 plant assemblages (Fig. 3) were established in Spring 2011.
- Physical properties and plants were measured; and arthropods were collected from each individual plant spring 2011 using adapted leaf blowers.
- The effects of plant assemblages on arthropod and physical variables were tested with ANOVA and MDS
- The effects of all explanatory variables on arthropod variables were tested using forward stepwise multiple regressions (R^2 values shown, + or – indicates direction of relationship, all $p < 0.05$)

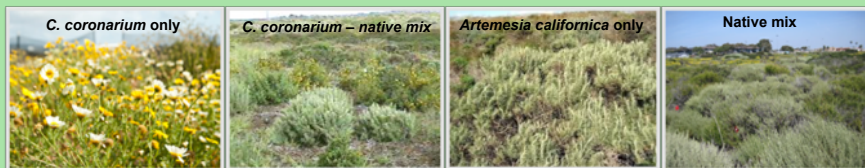


Fig. 3. Plant assemblages tested for their effects on a coastal sage scrub arthropod community.

Results & Discussion

Canopy arthropod diversity & abundance

- Neither diversity (measured as H' and no. species per plant) nor abundance differed between plots (Diversity: ANOVA, $F_{3,24}=0.37-1.20$, $p=0.28$; Abundance: ANOVA, $F_{3,24}=0.29$, $p=0.83$)
- Both diversity & abundance increased with larger plant size.
- Native species in this community tend to be perennial and larger than the annual *C. coronarium*. These traits generally make natives more conducive to higher diversity and abundance.

Presence of *C. coronarium* changes arthropod community composition (Fig. 4, Table 1)

- Dipterans & one beetle were found only in plots with (and mostly on) *C. coronarium*, although drivers are uncertain.
- Hemipterans, mites, wasps, thrips & spiders were more common in plots with native species & no *C. coronarium* due to more shading and lower temperatures, as well as greater volume offered by the native plants ($R^2=0.14-0.37$; $P \leq 0.04$)



Table 1. Community dissimilarity. Arthropod composition was most different between plots with and without *C. coronarium*.

	<i>C. coronarium</i> only	<i>C. coronarium</i> -native mix	<i>Artemisia californica</i> only	Native mix
<i>C. coronarium</i> only	52%			
<i>C. coronarium</i> -native mix	60%	65%		
<i>Artemisia californica</i> only	75%	72%	62%	
Native mix	63%	62%	57%	45%

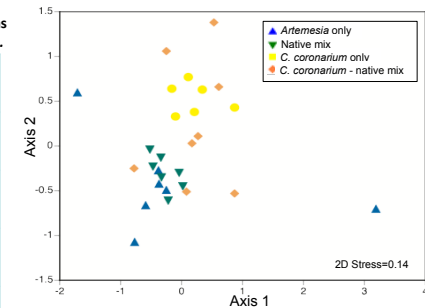


Fig. 4. Results of MDS of arthropod communities found in each plot type. ANOSIM $P=0.001$; pairwise between plots with *C. c.* and without *C. c.* $p \leq 0.018$

Research Significance & Conservation Implications

- Preliminary data reveal that even a small amount of chrysanthemum dramatically affects arthropod composition, despite no observed effects on abundance & diversity.
- The alteration of physical properties associated with *C. coronarium* influences arthropod community compositions; still needed are analysis of whole plot data vs. per plant to determine effects of invasion over between-plant scales. Also needed are investigations of food web and chemical effects of invasion.
- Restoration efforts should focus on early removal (or prevention of spread) of *C. coronarium*, and planting of native species after a disturbance to maintain arthropod community structure.

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