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Preliminary Report

A preliminary study of *Heteromeles arbutifolia* fruit morphology at Ballona Wetlands and Temescal Canyon, Los Angeles, California

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Abstract. Heteromeles arbutifolia, the California holly, is an evergreen shrub native to chaparral habitats of Southern California that fruits from November to January. Fruit species morphology has been shown to be a good indicator of habitat quality among other plants. The variation in fruit morphology was examined for the native plant at two diverse Southern California sites, a wetland and a canyon. California Holly fruits had a significantly greater volume in Ballona Wetlands than at Temescal Canyon ($Z=4.367$, $P<0.001$), as well as a significantly greater variance in Ballona Wetlands than at Temescal Canyon ($F=2.357$, $P=0.02$). The production of fruits with larger and more variable volumes in Ballona Wetlands may be a response to the presence of urban influences and environmental contaminants. As the reproductive structure, fruit morphology may be a good indicator of how habitat stress influences reproductive success.

Introduction

The California holly, *Heteromeles arbutifolia*, is an evergreen shrub that inhabits coastal chaparral habitats in California. The plant exhibits durability that allows it to grow in well-drained soils, and in both direct sunlight and partial shade. (Fischer, 1998). The peak season for fruit production of scarlet-colored berries is from November to January. Fruit morphology has been evaluated as an indicator of plant stress and habitat quality in other species (Martins and Johnson, 2009). In previous studies, habitats with high levels of disturbance or poor agricultural practices were correlated with reduced fruit set (Martins and Johnson, 2009). In this preliminary study, fruit production in the California Holly was examined to determine fruit morphology variation. Ballona Wetlands are located along the coast in Marina Del Rey, California and nestled between business and residential areas. The effects of urbanization in Ballona include the presence of contaminants and pollutants (Park and Stenstrom, 2006) and the presence of an irrigation system utilizing recycled water, from the Los Angeles, CA area, that provides consistent watering throughout the habitat. Temescal Canyon is a preserve in Pacific Palisades, California and most of the park is not directly exposed to outside urban influences. While it contains running trails, it is not managed regularly and lacks an irrigation system. The hypothesis was that California Holly fruit morphology in the Ballona Wetlands would have greater variability than fruit morphology in Temescal Canyon based on the effects of urbanization.

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Materials and Methods

This study was conducted at Ballona Wetlands and Temescal Canyon in Los Angeles, California on November 17, 2009. Samples were varied and included at least 20 berries from 60 California Holly shrubs each at Ballona Wetlands and 20 shrubs at Temescal Canyon. Mean fruit volume was calculated by the following equation:

$$MeanFruitVolume(cm^3) = \frac{V_{water}}{N_f} \qquad (1)$$

Where V_{water} was equal to the volume of water (ml) displaced by a given number of fruits and N_f was equal to the number of fruits measured. Fruit volume distribution was tested for normality using a Shapiro-Wilk test in Statistica (v.9.1). The mean difference of mean fruit volume was tested using a Mann-Whitney U Test in Statistica (v.9.1). The difference in fruit volume variance between sites was tested using F test in Microsoft Excel (2007).

Results and Discussion

Sixty plants from Ballona Wetlands and 20 from Temescal Canyon were sampled. Fruit volumes were not normally distributed across both sites (W=0.919, P<0.001). Average California Holly fruit volume from Ballona Wetlands (0.305 cm^3) was significantly greater than that at Temescal Canyon (0.200 cm^3) (Z = 4.367, P < 0.001) (Figure 1). There was significantly greater variance in fruit volume at Ballona Wetlands than at Temescal Canyon (F = 2.357, P = 0.02).

There was a skewed distribution toward lower volumes between the two sites indicating the abundance of smaller fruit volumes relative to the mean. Ballona Wetlands fruit morphology showed larger mean volumes and a greater variability (Figure 1). Previous studies show that habitat quality translates into variability in fruit morphology (Martins and Johnson, 2009), suggesting that the differences between Ballona Wetlands and Temescal Canyon present different environmental stresses.

The effects of urbanization have led to environmental contamination in Ballona Wetlands (Buffleben et al., 2002). Ballona Wetlands is polluted with high levels of hazardous metals such as cadmium, chromium, copper, lead, and nickel (Buffleben et al., 2002). It is possible that the use of treated sewage discharge in the irrigation system and the abundance of contaminants increased variability in fruit morphology

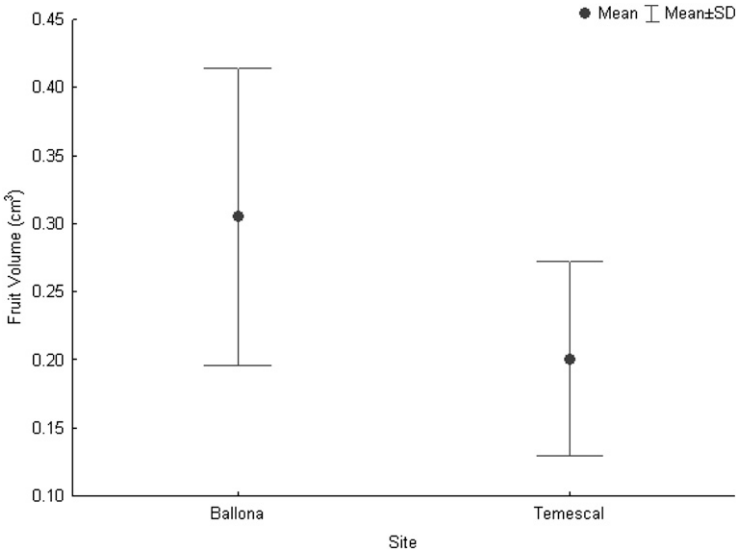

Figure 1. Average fruit volume (cm^3) at Ballona Wetlands and Temescal Canyon. See text for details.

that created more stressors for seed dispersers (Costanza et al., 1993).

Future studies might examine urbanized sites to determine the effect of stress on seed dispersal and ultimately seed viability. By assessing fruit morphology in relationship to environmental stress it will be possible to determine the specific functions that habitat quality has on plant dispersal.

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