SIGNIFICANCE OF RIPARIAN PLANTS AS RESERVOIRS OF *XYLELLA FASTIDIOSA* FOR INFECTION OF GRAPEVINES BY THE BLUE-GREEN SHARPSHOOTER

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ABSTRACT
On California's North Coast, plant species in natural habitats adjacent to vineyards, namely riparian areas, are non-crop hosts of *Xylella fastidiosa* (*Xf*). The importance of a riparian host as a pathogen reservoir is related to its ability to support pathogen populations and its attractiveness to the vector, *Graphocephala atropunctata* (blue-green sharpshooter [BGSS]). We quantified BGSSs on five species (California blackberry, California grapevine, elderberry, Himalayan blackberry, periwinkle) of naturally-established plants adjacent to vineyards. We assessed the ability of the same species to support *Xf*, using controlled inoculations of potted plants kept in screenhouses in the field. No species were characterized by both an abundance of BGSSs and a high frequency of *Xf* detection. A 71% frequency of *Xf* detection in periwinkle suggests that, regardless of having the fewest BGSS (0.4 nymphs and 0.9 adults per sample), infrequent visitations may result in a high acquisition rate. California grapevine supported eight times as many nymphs and three times as many adults as periwinkle, suggesting that frequent visitations may offset its significantly lower infection rate (19%). California blackberry, elderberry, and Himalayan blackberry are likely less important pathogen reservoir because *Xf* was infrequently detected in their tissues and they hosted few BGSSs.

INTRODUCTION
In the north-coastal grape-growing region of California, *Xylella fastidiosa (Xf),* the bacterium that causes Pierce's disease (PD) (Freitag 1951), is spread to grapevines by a native vector, *Graphocephala atropunctata* (Signoret) (Hemiptera: Cicadellidae) (blue-green sharpshooter [BGSS]; Hewitt et al. 1949; Purcell 1975). Purcell (1974, 1975) demonstrated a direct relationship between incidence of PD and proximity to riparian vegetation bordering vineyards. The distribution of diseased grapevines is associated with a high concentration of BGSS in spring in vinerows adjacent to riparian vegetation, which serves as feeding and reproductive habitat for the BGSS (Hewitt et al. 1949; Purcell 1975). Not only do some riparian plants provide habitat for BGSSs, but they also host *Xf* (Wells et al. 1987).

The spread of *Xf* from riparian hosts to grapevines is, in part, a function of the proportion of BGSSs that acquire the pathogen when feeding on infected riparian hosts. Acquisition of *Xf* is directly related to the concentration of the pathogen within the host. The minimum threshold for acquisition is 10^4 CFU of *Xf* per gram of plant tissue, increases above which result in proportionally higher transmission rates (Hill and Purcell 1997). Baumgartner and Warren (2005) found that *Rubus discolor* Weihe & Nees (Himalayan blackberry), *Vinca major* L. (periwinkle), and *Vitis californica* Benth. (California grapevine) supported populations $\geq 10^4$ CFU/g tissue, whereas *R. ursinus* Cham. & Schldl. (California blackberry) and *Sambucus mexicana* C. Presl (elderberry) did not. California grapevine, Himalayan blackberry, and periwinkle may be more important as pathogen reservoirs not only due to the high pathogen populations they support during part of the year (Baumgartner and Warren 2005), but also because they are systemic hosts of *Xf* (Purcell and Saunders 1999).

The importance of a riparian host as a pathogen reservoir is determined by the pathogen populations it supports and by the frequency of visitation by the vector. A common riparian host of *Xf* that is fed upon frequently by the BGSS likely will contribute more to the spread of PD because there will be more opportunities for acquisition of the pathogen from infected tissue. In this regard, it is noteworthy that some of the same riparian hosts that were previously recognized in field surveys as feeding hosts of the BGSS (Purcell 1976; Raju et al. 1983), namely California grapevine, Himalayan blackberry, and periwinkle, have since been identified as hosts in which *Xf* reaches high populations (Baumgartner and Warren 2005; Purcell and Saunders 1999).

OBJECTIVES
The goal of our research was to identify riparian hosts of greatest importance in the transmission of *Xf* to grapevines in the north-coastal grape-growing region of California. Our first objective was to determine if the BGSS is more abundant on some riparian hosts than others. We measured abundance of adults and nymphs in riparian areas adjacent to vineyards on five feeding and reproductive hosts: California blackberry, California grapevine, elderberry, Himalayan blackberry, and periwinkle. All five hosts are potentially important in the spread of PD because they are also systemic hosts of *Xf* (Purcell and Saunders 1999). Our second objective was to examine a possible relationship between the ability of riparian hosts to support both the BGSS and *Xf*. To address this second objective, we inoculated plants of the same riparian host species with *Xf*, transferred them to the field after confirming infection, and tested them afterwards for the presence of the pathogen. This approach was preferable to testing for *Xf* in the same naturally-established plants that we examined for BGSSs because (i) our