Use of the Brown Marmorated Stinkbug's primary symbiont for population genetic analyses

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Title: Use of the Brown Marmorated Stinkbug's primary symbiont for population genetic analyses

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Highlights
Invasive stinkbug and its bacterial symbiont show low nucleotide diversity.
Vertically inherited bacterial symbiont shows lower diversity than its host.
Host haplotypes are structured within symbiont haplotypes.

Abstract
Halyomorpha halys, commonly known as the Brown Marmorated Stinkbug, is a highly polyphagous invasive pest introduced from East Asia into North America and Europe. It harbors '*Candidatus* Pantoea carbekii', an obligately-associated, vertically-inherited gamma-proteobacterial mutualist. We evaluated the use of this symbiont as a proxy for measuring host diversity, distribution, and phylogeography. Despite the symbiont's accelerated molecular evolution, the symbiont genome shows relatively lower genetic diversity and structuring compared to the host mitochondrial genome in both native and invaded ranges. Therefore, we conclude that *P. carbekii* is not as effective as the host mitochondria for determining recent host population history and migration.

Keywords
Brown Marmorated Stinkbug, '*Candidatus* Pantoea carbekii', vertically transmitted endosymbiont, invasive species, genetic diversity.

1. Introduction

The Brown Marmorated Stinkbug, *Halyomorpha halys* (Pentatomidae), (henceforth called BMSB) is an invasive pest native to eastern Asia that has been recently introduced into North America and Europe. BMSB is highly polyphagous, attacking a wide range of plants from up to 45 different families (Lee et al., 2013), including many economically important crops such as apple, soybean, and corn (Leskey et al., 2012). Initially detected in North America in Allentown, PA in 1996 (Hoebeke and Carter, 2003), and in Europe in Zurich-Seefeld, Switzerland in 2004, it has since rapidly expanded, reaching 43 US states and two Canadian provinces (StopBMSB, June 2016) in North America and 8 countries in Europe, being widespread in Switzerland (CABI, 2016).

BMSB harbors a primary, obligately-associated, vertically-transmitted endosymbiont, '*Candidatus* Pantoea carbekii' (henceforth called *P. carbekii*), that is the sole inhabitant of host midgut gastric invaginations called caeca (Bansal et al. 2014). *P. carbekii* is vertically transmitted from mother to offspring through symbiont-enriched gastric secretions posteriorly deposited on the eggs. As only a subset of the total maternally-