

Cryptic Vectors, Lurking Pathogens, and Novel Chemistry: Culturable Microbes Associated with a Native and Invasive Wasp Species



Anne A. Madden and Philip T. Starks
Department of Biology, Tufts University Graduate School of Arts, Sciences & Engineering



Summary: *Polistes dominulus* is a species of paper wasp which has recently invaded North America, where it is increasing its range with climate change and development. While many insects are known to transfer microbes from their nests to plants they visit, acting as microbial vectors, there have been no molecular assessments evaluating the microbes which inhabit the nest of *P. dominulus* and which may have been transferred along with their invasion. By culturing the microbes from *P. dominulus* nests throughout Massachusetts and using the natives species of *P. fuscatus* for comparison, this study provides the first assessment of microbes associated with nests of two sympatric paper wasps. This study also investigated paper wasp nests as novel locations for antibiotic producing bacteria and provided data (using a novel assay set-up) to determine if *P. dominulus* can vector plant pathogens from its nest while foraging. Results from this study are currently being written up for publications which will be available at the Tufts Institute of the Environment.

Introduction: Due to the increasing frequency of multiply-resistant strains of bacteria, there is a dire need for novel antibiotics. Unfortunately, pharmaceutical companies have historically reduced their efforts to investigate antimicrobials. This has led to a recent resurgence in investigating natural products for novel therapeutics.^{1,2} It is therefore critical to investigate previously unexplored microbial habitats and continue to isolate environmental microbes so that their potential antimicrobial production can be assessed and utilized.



Polistes dominulus

While actinobacteria and microfungi are ubiquitous soil microbes, researchers have recently cultured these organisms from previously unexplored environments.^{3,4} Many insects have established close associations with actinobacteria where these bacteria produce antimicrobials that protect nests from pathogenic bacteria and fungi.⁵⁻⁷



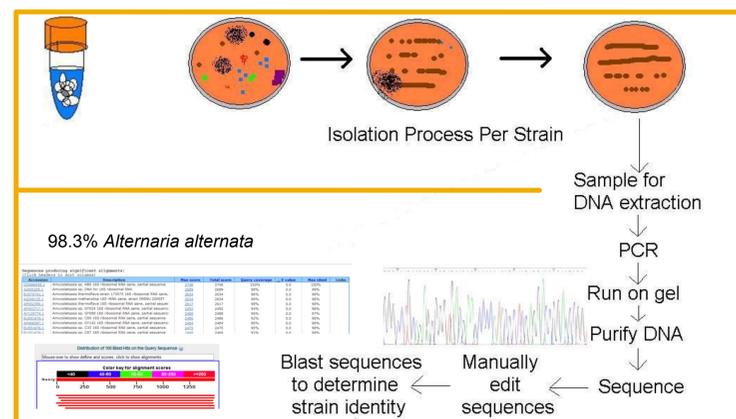
Polistes fuscatus

Rather than acting as symbiotic microbes, other pathogenic fungi use foraging insects to disperse among plants where they begin infections.^{8,9} Acknowledging that insects can potentially act as vectors for agricultural and human

invasive diseases, or vectors of vital antimicrobials, it is critical to characterize the microbial communities associated with insects which have not previously been holistically assessed, such as that of the generalist invasive paper wasp, *Polistes dominulus*.

Methods:

Microbe Isolation and Identification: *P. dominulus* and *P. fuscatus* nests were collected from 3 locations in Massachusetts. Microbes were cultured on 4 different media and isolated based on colony morphology. DNA was extracted, amplified using universal eubacterial and fungal primers, and the 16S rDNA gene or the ITS1-5.8rDNA-ITS2 fragments were sequenced and compared to sequences in the GenBank repository for putative identification.



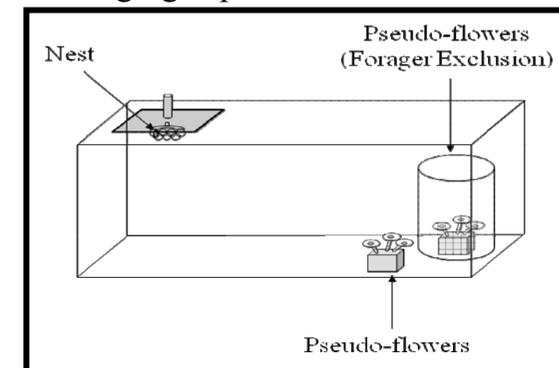
Schematic of the methods used for microbial isolation and identification.

Likelihood of Pathogenicity Assessment:

A literature search was conducted using the putative fungal strain identities generated to determine the likelihood of these strains being pathogens.

Microbial Antibiotic Production: Using a modified cross streak assay,¹⁰ antibiotic production of isolated bacterial strains with high homology to actinobacteria was quantified against clinically relevant bacteria.

Wasp Vectoring Capability: Vectoring capability of *P. dominulus* was determined using a novel assay allowing for the quantification of microbial propagules distributed via foraging trips.



Schematic of the novel assay arena used to determine microbial vectoring capacity.

Results: My results are currently being prepared for publications in peer-reviewed journals. Copies of these publications will be made available at the office of Tufts Institute of the Environment.



A microbial strain isolated from a *P. dominulus* nest

References: 1: Pelaez 2006, 2: Harvey 2008, 3: Bull and Stach 2007, 4: Gonzalez et al. 2005, 5: Kaltenpoth et al. 2005, 6: Currie et al. 1999, 7: Scott et al. 2005, 8: Torres-Barragan et al. 2003, 9: Beatson 1972, 10: Romano and Kolter 2005

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