

Spotted Lanternfly (SLF) Honeydew Honey: A New Frontier in Medicinal Honey Research from the US

Ferhat Ozturk¹, Zeynep Dulkadir¹, Natalia Castillo¹, Alia Elkhaili¹, Robyn Underwood²

¹The University of Texas at San Antonio, San Antonio TX, 78249
²The Penn State Extension & Department of Entomology, The Pennsylvania State University, PA



Abstract

The spotted lanternfly (*Lycorma delicatula*) has contributed to the emergence of a distinctive, dark honey produced by managed honeybees (*Apis mellifera*) using honeydew as a nectar source. Beekeepers in Pennsylvania and New Jersey have reported the production of this unique honey, characterized by remarkable aromas, flavors, and potentially valuable bioactive properties. To explore the medicinal potential of this honey, samples were collected and analyzed for physicochemical characteristics, antibacterial activity, antioxidant capacity, phenolic content, sugar, and metabolomic profiles. Results were compared to manuka honey, widely recognized as the gold standard for medicinal-grade honey. The findings revealed that this honey exhibits high antimicrobial, antioxidant, and anti-inflammatory properties, suggesting its strong potential for applications in wound healing and other medicinal uses.

This study highlights a promising new variety of honey with exceptional bioactivity, underscoring its value for both the apicultural industry and medical research. The emergence of this honey offers an exciting avenue for innovative honey products that contribute to health and wellness.

Introduction

The spotted lanternfly (SLF), *Lycorma delicatula*, is an invasive insect species first reported in 2014 in China. It is a pest of agricultural and ornamental plants, particularly in the United States, where it has caused significant damage to crops and trees. SLFs feed by inserting their mouthparts into the phloem of plants, extracting phloem sap, particularly from the tree of heaven (*Ailanthus altissima*) and grapevines, leading to plant stress, reduced productivity, and even death. As they feed, SLFs excrete large volumes of honeydew, which promotes the growth of sooty mold and disrupts photosynthesis, posing a major threat to both agriculture and natural ecosystems.

During periods of nectar scarcity, honeybees may forage on honeydew excreted by SLFs. Beekeepers in SLF-infested regions have observed unusually dark honey in their hives—suspected to result from bees collecting SLF honeydew. Given the SLF's preference for chemically rich host plants like *Ailanthus altissima*, their honeydew may carry secondary metabolites that influence the resulting honey's flavor, composition, and potential therapeutic properties.

Our study presents the first scientific evaluation of SLF honey, investigating its antimicrobial and antioxidant properties. We hypothesize that SLF honey, due to its unique origin and dark color, may exhibit enhanced bioactivity, particularly compared to light-colored honey. This well-known medicinal honey from Manuka. This study aims to explore SLF honey as a novel U.S.-based candidate for medicinal applications.



Figure 1. Spotted lanternfly (*Lycorma delicatula*) insect

Materials and Methods

Color Detection

Honey color was measured using the Pfund scale based on absorbance at 560 nm. A 50% (w/v) honey solution was prepared, vortexed, centrifuged, and transferred into 96-well plates. Pfund values were calculated by multiplying Abs₅₆₀ by 3.15 and USDA color grades were assigned accordingly.

pH and Moisture Content

pH was measured using a calibrated pH meter in a 40% honey solution prepared with deionized water. Moisture content was determined using a handheld honey refractometer.

Antibacterial Activity – Zone of Inhibition

Antibacterial activity was assessed using the agar well diffusion method against *Staphylococcus aureus* (ATCC-25923). Honey samples (~100 µl) were added to 8 mm wells in Mueller Hinton Agar plates seeded with bacteria. Plates were incubated at 37°C for 18 hours, and zones of inhibition were measured in millimeters.

DPH Radical Scavenging Assay

Antioxidant activity was evaluated by DPPH assay. A 10% honey solution was mixed with DPPH (17 mM in methanol) in a 96-well plate and incubated for 30 minutes in the dark. Absorbance was measured at 517 nm, and radical scavenging activity (%RSA) was calculated relative to the control.

Total Phenolic Content (TPC)

TPC was determined using the Folin-Ciocalteu method. A 10% honey solution and gallic acid standards were reacted with FC reagent and sodium carbonate. After 2 hours incubation in the dark, absorbance was measured at 765 nm. Results were expressed as mg gallic acid equivalents (GAE) per kg of honey.

Results

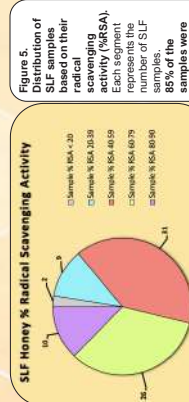
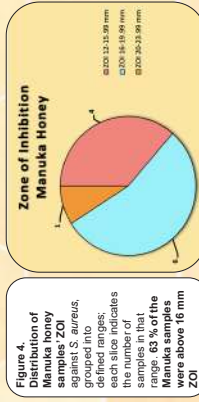
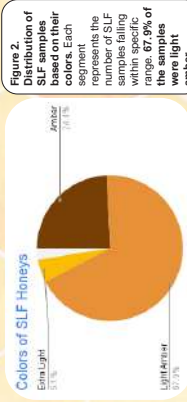
Antibacterial Activity – Zone of Inhibition SLF and Manuka honey samples were tested against *Staphylococcus aureus* using the agar well diffusion method (Figures 3 & 4). Most samples demonstrated notable antibacterial effects. Sample NU-15 showed the strongest activity with a 26.0 mm zone of inhibition. In contrast, minimal inhibition (9.0 mm) was seen in AB-32, AR-37, AR-42, C1, and C2. Among the Manuka samples, 7 of 11 samples had high antimicrobial activity (ZOI > 16mm)

Antioxidant Activity – DPPH Radical Scavenging Assay

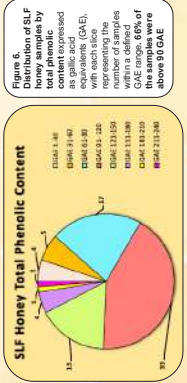
The antioxidant potential of SLF and Manuka honeys was evaluated using the DPPH radical scavenging assay. Percent radical scavenging activity (%RSA) was calculated based on absorbance at 517 nm. SLF honey samples demonstrated a wide range of antioxidant activity (Figure 5), with sample PA3 showing the highest %RSA at 92.6%, while Wiles24 exhibited the lowest at 11.7%.

Total Phenolic Content (TPC) A key indicator of antioxidant capacity, TPC, varied across SLF honey samples (Figure 6). The highest TPC was observed in NJ-14 with 211.1 mg GAE/100 g honey, indicating high phenolic concentration. The lowest was

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Conclusions

- This is the first study to scientifically evaluate the medicinal potential of Spotted Lanternfly (SLF) honeydew honey, a newly identified honey in the U.S.
- 67.9% of SLF honey samples were classified as light amber, aligning with common medicinal honey color profiles.
- 56.6% of SLF samples (43/76) exhibited zones of inhibition >16 mm against *S. aureus*, indicating strong antibacterial activity comparable to or exceeding that of Manuka honey.
- 85% of SLF samples (67/78) showed %RSA > 40%, and 66.7% (52/78) had TPC > 91 mg GAE/100 g, demonstrating robust antioxidant potential.
- These findings highlight SLF honey as a high-bioactivity, U.S.-based honey with strong therapeutic potential.
- Its antibacterial and antioxidant properties make it a promising candidate for future research on honey-based products, particularly for the prevention and treatment of *Staphylococcus aureus* infections and oxidative stress-related diseases.

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Ferhat Ozturk¹, Robyn Underwood²

¹Biology, Health and Environment, The University of Texas San Antonio, San Antonio, Texas, USA

²Department of Entomology, Penn State University, University Park, Pennsylvania, USA

The invasive spotted lanternfly *Lycorma delicatula*, first reported in the Northeastern United States in 2014, has become both a challenge and an unexpected opportunity. As its range expands, beekeepers in regions like Pennsylvania and New Jersey are reporting a distinctive, dark fall honey produced by managed honey bees *Apis mellifera* using the honeydew of these phloem-feeding insects. This novel honey, characterized by unique aromas and flavors, prompted an investigation into its properties and potential medicinal uses.

Samples of suspected spotted lanternfly (SLF) honey were collected from regional beekeepers and analyzed for a comprehensive suite of biochemical and microbiological properties. These included pH, color, antibacterial activity, antioxidant capacity, phenolic and flavonoid contents, and detailed metabolomic profiling. Comparisons were made to manuka honey, the gold standard for medical-grade honey, to contextualize the findings. Remarkably, SLF honey demonstrated exceptional antimicrobial, antioxidant, and anti-inflammatory properties, suggesting significant potential for applications such as wound healing and other medicinal uses. This study highlights a promising new variety of honey with exceptional bioactivity, underscoring its value for both the apicultural industry and medical research. The emergence of this honey offers an exciting avenue for innovative honey products that contribute to health and wellness.