

# Rapid Diagnosis and Mapping of Emergent Honey Bee Health Issues via an AI-Powered Smartphone App

Jerry Bromenshenk, Robert Seccomb, Colin Henderson, David Firth, Geoffrey Pepos;

Presented by Dr. Malcolm T. Sanford; Bee Alert Technology, Inc.; Missoula, MT 59803

## Introduction

A newly developed smartphone app has yielded a way to improve honey bee colony health by letting the bees communicate their health status directly to the beekeeper. In essence, the bees themselves become the guru, indicating the status of colony health via the sounds they produce.

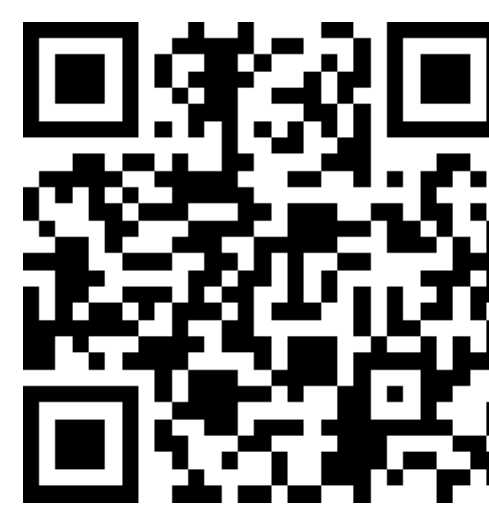
## Approach

The Bee Health Guru Smartphone app requires two steps: (1) Beekeepers collect recordings of colonies using their smartphone microphone; and (2) Artificial intelligence (AI) software algorithms perform a diagnosis of a colony's condition, without beekeeper interpretation. The AI compares new beekeeper recordings with specific, archived, beehive audio recordings. These AI algorithms are not static but learn with training (tuning), not only to diagnose specific situations in a beehive, but also to optimize relevance over geographical regions and extended periods.



How healthy are your bees? Check your phone!  
Is your honey bee colony queen right? Check your phone!  
How does your bee hive compare to those around the world?

Join our Citizen Science project to find out!

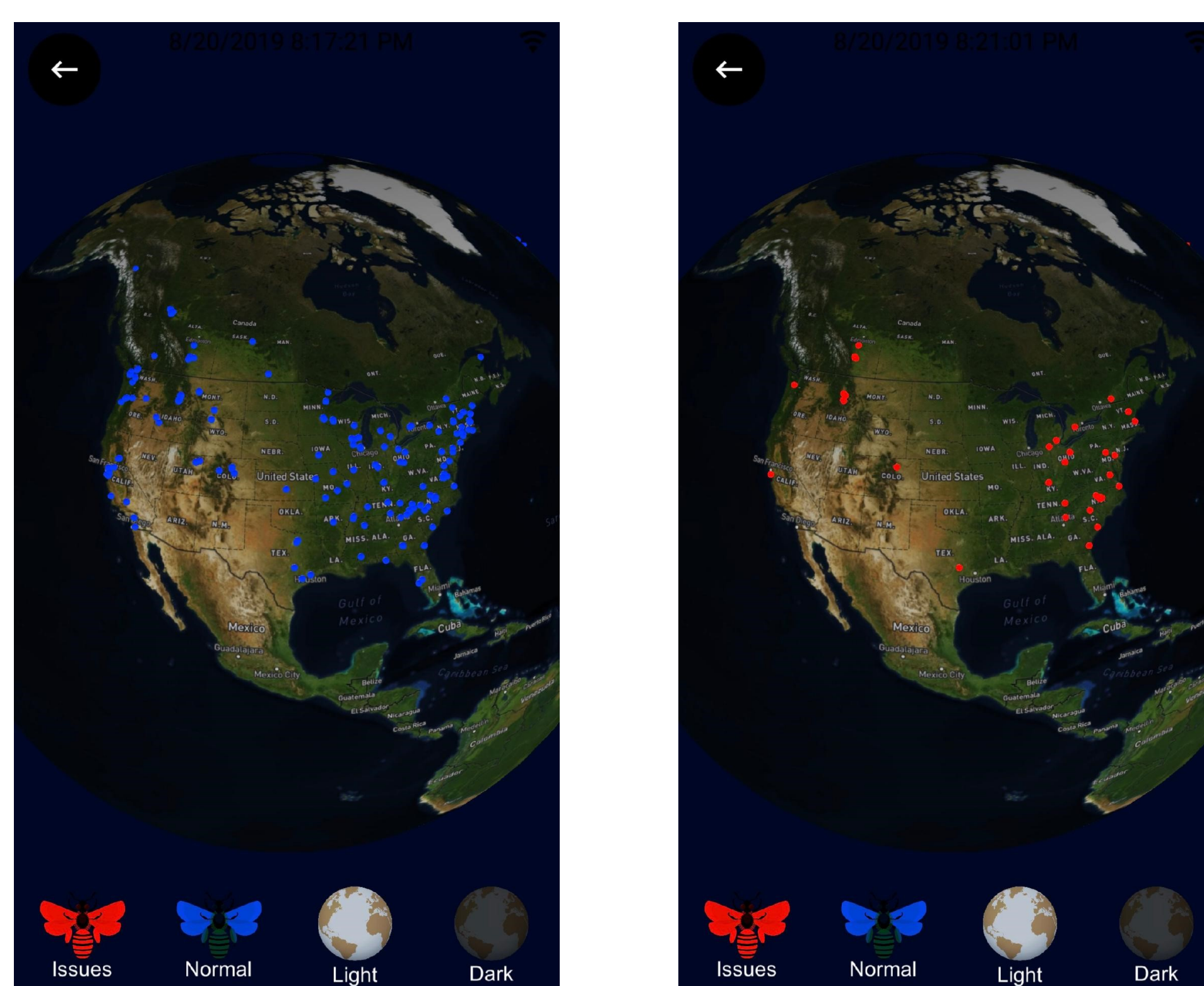


[www.beehealth.guru](http://www.beehealth.guru)

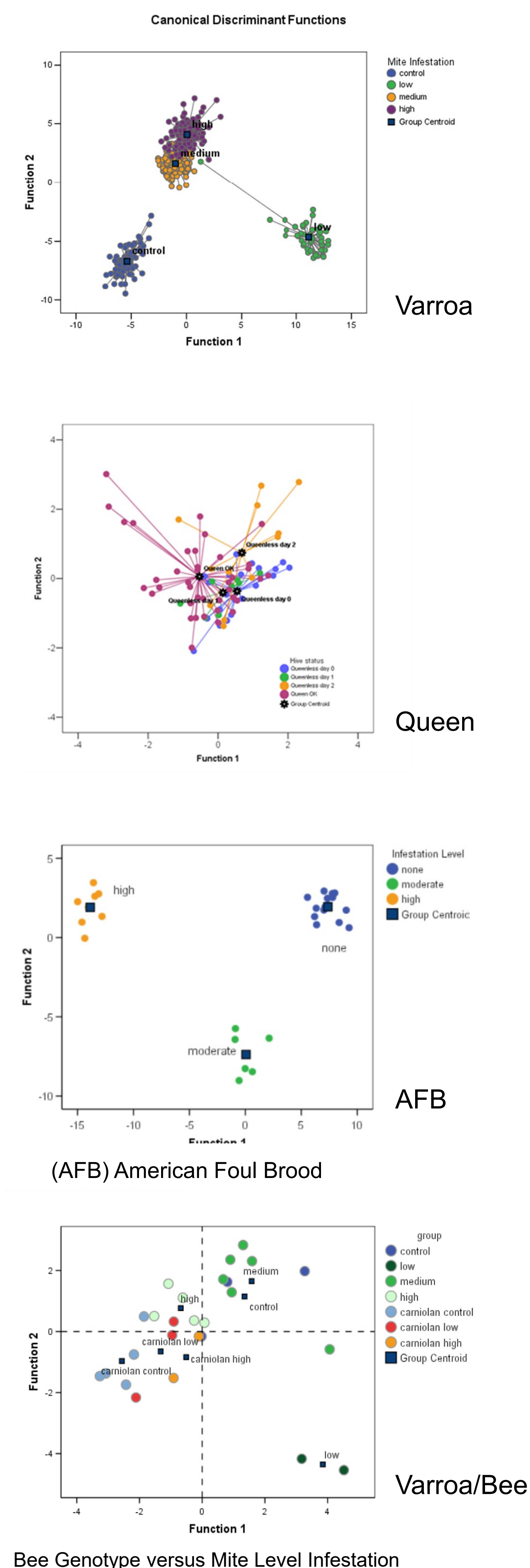
## Methods

The first step builds on referenced samples collected by research scientists and experienced beekeepers. We have asked beekeepers worldwide to download the application, inspect colonies, and provide the app diagnosis along with their recordings. The Bee Health Guru Smartphone app allows beekeepers to submit their own observations to our research scientists to supplement the diagnostics provided by the app.

A May 2019 Kickstarter yielded 653 backers, with over 400 data uploads received within three days of the project launch; the first geo-referenced data maps within five days. For every location, the app uploads recordings, analyses, and inspection reports for app tuning and bee health mapping.



## Results



## Conclusions

The smartphone application automatically creates a copy of the recordings along with beekeeper observations, combining them into a comprehensive, transformative AI colony health diagnosis featuring real time monitoring and mapping. All electronic records are stored in a common, cloud-based destination and have safeguards to protect data privacy, confidentiality, and security of beekeeper-reporters.

## Literature cited

Bees as Biosensors: Chemosensory Ability, Honey Bee Monitoring Systems, and Emergent Sensor Technologies Derived from the Pollinator Syndrome.

Bromenshenk et al. Biosensors 5(4):678-711.



## Acknowledgments

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3-D digital bee models by Eric Keller, artist and animator.  
Portfolio: [www.bloopatone.com](http://www.bloopatone.com)  
Animations: [www.facebook.com/entomologyanimated/](http://www.facebook.com/entomologyanimated/)

## USA Federal Sonic R&D

DOD - W81XWH-04-C-0013 SBIR I  
DOD - W81XWH-04-C-0013 SBIR II  
USDA - 007-33610-17968 SBIR I  
USDA - 2009-33610-20137 SBIR II  
MBRCT - #08-52 MT Dept Commerce  
USDA - 2014-33610-21930 SBIR I

**Bee Alert Tech/Kickstarter App**

