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Food Safety for Fruit and Vegetable Farms

BARDOT — A New, Fast Method for Identifying Microbes

Bruce Applegate
Trevor Lim
Purdue Food Science
ag.purdue.edu/FoodSci

Elizabeth Maynard
Purdue Horticulture & Landscape Architecture
ag.purdue.edu/HLA

Ellen Phillips

ag.purdue.edu/hla/foodsafety

Microbes can live everywhere and in almost any environment — hot or cold, dry or moist. Most of these adaptable organisms are harmless — some may be beneficial. But a few microbes can be pathogens that harm humans, plants, or animals.

In food safety and other areas, it is important to quickly identify microbes that are present.

Purdue University researchers Arun Bhunia and E. Daniel Hirleman developed a technique that can identify many types of microorganisms three times faster than normal lab analysis. The system, **BA**cterial **R**apid **D**etection using **O**ptical scattering **T**echnology (BARDOT), can perform in a short amount of time what previously took days to do. Identifying a microbe can take less than 24 hours. This savings in time can save lives when trying to identify pathogens that cause foodborne illness during an outbreak.

This publication will explain how BARDOT works and its potential in food safety.

BARDOT uses a red diode (635 nm) laser beam that is similar to what a laser pointer produces. The user collects bacteria from surfaces, food, or other places, and grows that bacteria into colonies on an agar plate using traditional methods. Then, the user places the agar plate with bacterial colonies in the BARDOT machine.

When bacterial colonies grow, they form complex multi-organism structures. Each microbe grows in its own particular structure. When the BARDOT laser illuminates the colonies, it shows these structural differences. The laser light scatters as it passes through the colony. It creates a black and white image which becomes the unique "fingerprint" for that microbe. A user can then compare the microbe's "fingerprint" from the machine to a library of known "fingerprints" to identify the organism (Figure 1).

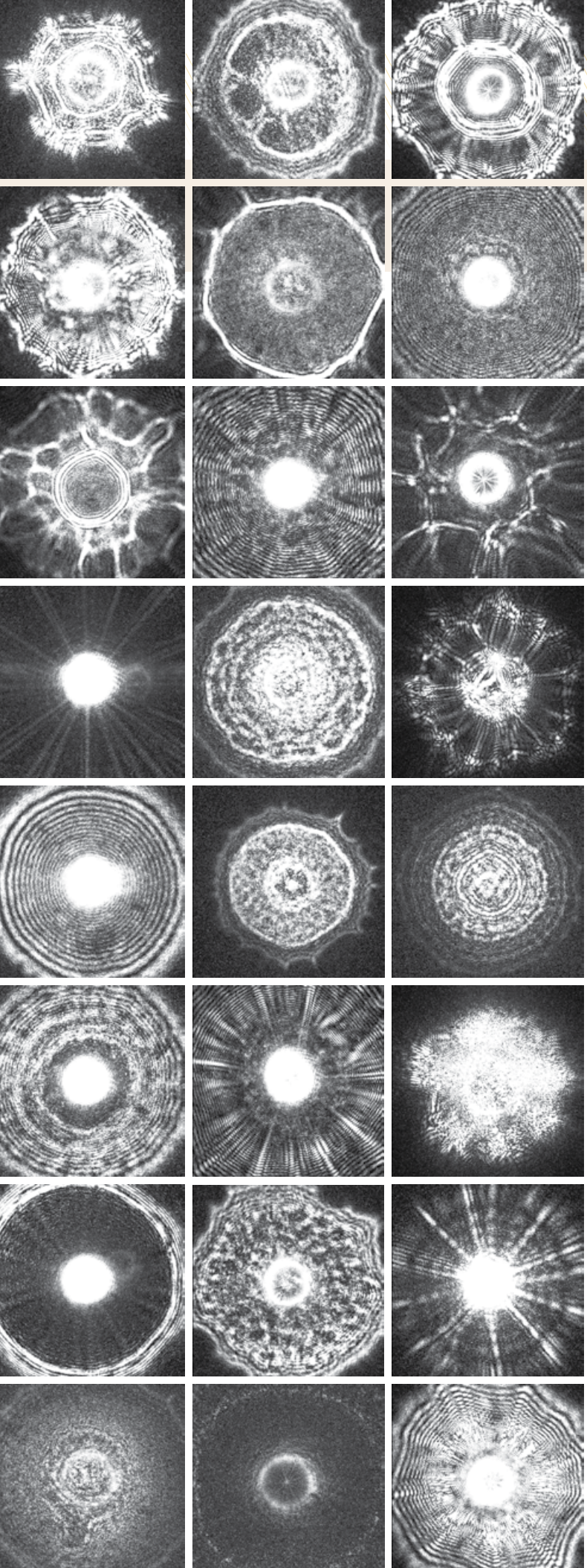


Figure 1. These images show the scatter patterns created by BARDOT technology that reveal the "fingerprints" for various microbes.

Because the system is automated, BARDOT creates a map of the colonies as the laser scans the agar plate. Since BARDOT does not harm the microbes, researchers could follow up the BARDOT scan with further lab analysis if they require other confirmation or research. What's more, a single BARDOT scan can detect multiple harmful bacteria from the same sample — instead of several different tests to detect each type.

Microbial Profiling

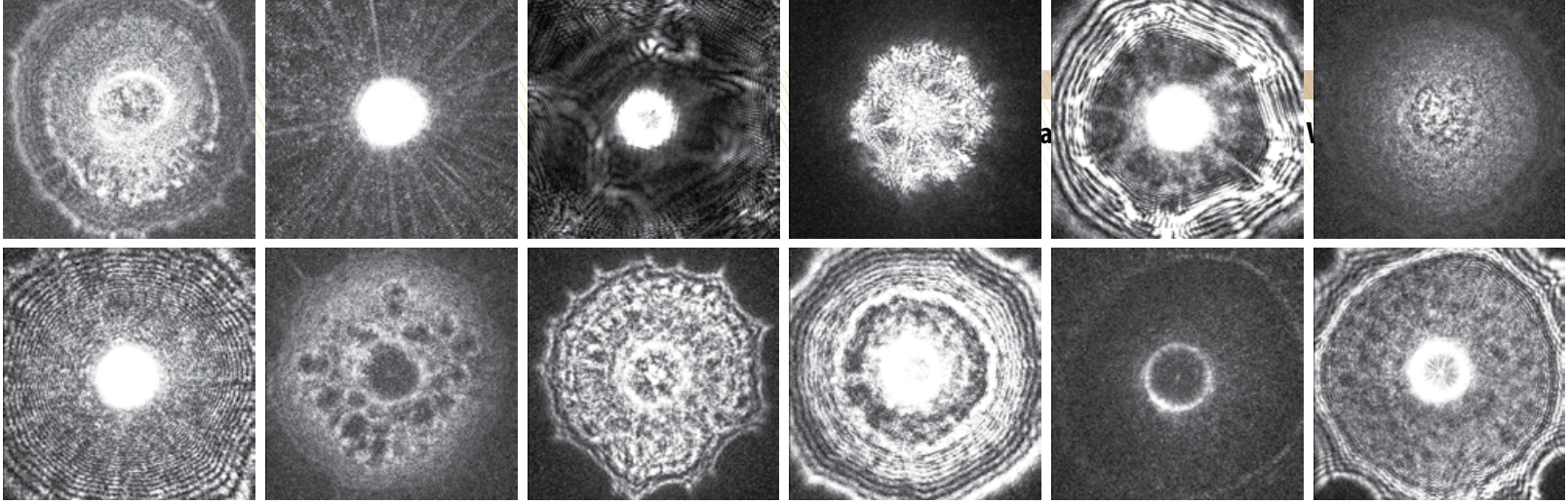
Microbial profiling with the BARDOT system is an efficient way to gather information about the presence, number of kinds, and diversity of organisms naturally present on a surface (such as fresh produce). So far, the BARDOT system has been used to identify *Listeria*, *Salmonell*a, *Bacillus*, *Vibrio* and *E. coli* among multiple other species within 24 hours.

In recent studies, BARDOT correctly identified *Salmonella* 95.9 percent of the time. More importantly, this system detected 20 of the most prevalent *Salmonella* serovars, which are unique variations within a bacteria species. BARDOT's ability to accurately identify serovars means it will become a valuable tool to help identify an organism responsible for a foodborne illness outbreak and to trace it back to its source.

Microbial Profiling Cantaloupe

In addition to its potential uses in monitoring and tracking microbes in the food supply, BARDOT has already helped us study microbes in experiments. For instance, researchers used BARDOT to evaluate the effectiveness of the High Voltage Cold Atmospheric Plasma (HVCAP) technique for controlling surface bacteria on cantaloupe (see Resources).

Researchers collected cantaloupe from Indiana farms and other markets. They used BARDOT to identify the number of unique isolates and their frequency on the melons before and after HVCAP treatment. Researchers also compared the surface population on washed and unwashed cantaloupe.



Researchers then determined the overall reduction of surface microbes and the specific reduction in both population size and diversity (different microbial populations).

The results (obtained from BARDOT) indicated that cantaloupe had a wide variation in type and number of microbes, but only a few were a potential concern as pathogens causing plant diseases. One of these was *Erwinia tracheiphila*, the bacterium that causes bacterial wilt of cucurbits.

The Future of BARDOT

BARDOT has proven to be a revolutionary approach to microbial identification. It screens for the presence and diversity of microbes quickly and inexpensively, and it can identify several important human pathogens. However, researchers need to test this technology further to determine if it can accurately identify other microbes.

Although some research is needed to confirm the results, researchers believe that BARDOT's low-energy laser beam does not damage or alter microbial cultures in any way. This would make it valuable in concert with other testing procedures such as DNA analysis.

The BARDOT equipment requires minimal training to operate, does not require a very large space, and can be operated in locations with limited resources (as long as a microbe scatter pattern library is available).

The BARDOT system's ability to quickly and accurately identify microorganisms will be an important tool in monitoring and providing safer food to consumers.

Acknowledgements

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Find Out More

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BARDOT Demonstration on YouTube
youtube.com/watch?v=dLjHXBV7eko

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