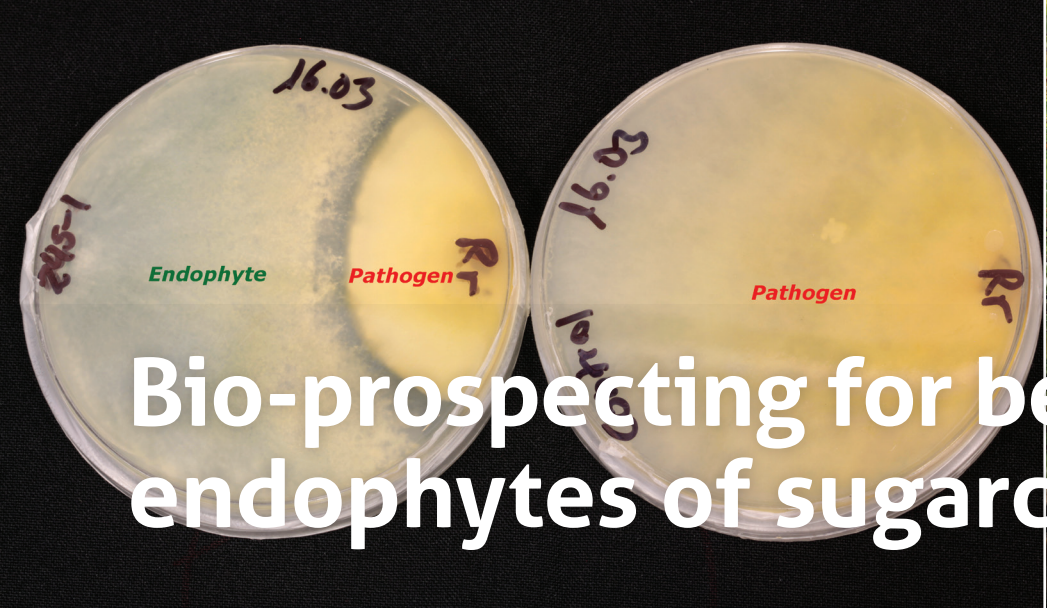


# Bio-prospecting for beneficial endophytes of sugarcane

**Ask someone what the most valuable thing is inside a sugarcane plant and the obvious answer is sugar.**

But if you ask what other valuable things are inside sugarcane, the answer is far less obvious.

However, new research is examining the vast array of microscopic organisms within sugarcane to discover if some of these microbes can be used to create improved productivity, profitability and sustainability outcomes for growers and millers.

This research is part of an SRA-funded project called *Bio-prospecting for beneficial endophytes of sugarcane*, where researchers from SRA and AgResearch are analysing the living communities of organisms within the sugarcane plant.

This living community – called a microbiome – consists of organisms such as fungi and bacteria.

Just like there are good and bad bacteria within the human body, there are also good and bad micro-organisms living within sugarcane.

"We have known for many years that plants can harbour pathogenic micro-organisms, but in the last few years it has become clear that plants contain large populations of both pathogenic and beneficial microbes," explained Dr Priya Joyce, SRA Leader for Molecular Genetics. "The beneficial microbes could help with productivity constraints by improving disease resistance, nutrient uptake, or promoting plant growth."

This research is investigating the microbiome of sugarcane (to go 'prospecting' to have a look what is inside), and then determine if these beneficial organisms can be exploited to help the industry.

With bio-prospecting, scientists are seeking out that valuable and elusive nugget of 'gold', but are doing so using advanced techniques such as DNA sequencing.

In the first part of the project, researchers isolated DNA from leaf, stalk and roots of commercial sugarcane varieties and wild relatives, and compared the microbiome between the two. By looking at more than 15 wild relative species, they found that the microbial communities varied between tissue type, geographical location and to a lesser extent by host species.

The research team has also discovered that the microbiome of modern sugarcane varieties is significantly different to the microbiome of wild sugarcane. Over time, through modern breeding and cultivation, our sugarcane varieties have lost parts of their microbiome. Some of these "lost microbes" are likely to confer beneficial traits to their host plants.

"Therefore, there is an opportunity to isolate beneficial microbes from wild relatives and introduce them into commercial varieties," Priya said.

The early results are promising. From the large pool of fungi and bacteria that they have isolated, they have already seen some that may have a positive impact.

A large collection of these bacteria and fungi from sugarcane plants has been screened against common fungal diseases such as red rot and pineapple sett rot. Of those screened, just over 12 percent inhibited the growth of at least one of the pathogens. Furthermore, some of these selected isolates also showed potent inhibitory activity against both root knot nematodes and root lesion nematodes.

In particular, some of these fungi were able to completely inhibit activity of both parasitic nematodes within 10 minutes of exposure. The next step would be to assess if these microbes have the same inhibitory effect when present within the plant, as they did in the petri dish.

"This testing of promising microbes has begun at the SRA Woodford research station, with the hope that we will see the same beneficial effect," Priya said. Encouragingly, preliminary data suggests that the first of these isolates can effectively control pineapple sett rot under glasshouse conditions, and further experiments are underway to confirm this result.

They are also assessing variations between regions and ecological factors such as soil type.

SRA Postdoctoral Researcher, Dr Stephen Mudge, said that the research could lead to a positive control mechanism without chemicals or genetic modification.

"We hope that this research will translate into ecologically sustainable solutions for challenges faced by the sugar industry," he said.

Once beneficial microbes are confirmed, future work will focus on optimal formulations for commercial delivery of this technology to growers. ■

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***(Above left)*** *An example of a fungal isolate that inhibits the growth of a sugarcane pathogen. In the Petri dish on the right the sugarcane pathogen Colletotrichum falcatum (which causes red rot) has grown enough to completely cover the plate. The dish on the left, however, contains an endophytic fungus from sugarcane which is inhibiting the growth of the pathogen. A zone of inhibition can be seen between the two fungi.*
***(Above right)*** *Harvesting wild relatives of sugarcane in PNG, from which endophytic microbes were isolated.*