Buchi Kombucha: Under the Microscope

Our culture is a traditional one that we received from a friend and home brewed with for years before we started the company. As the company has grown, we've put a lot of resources into our lab and testing, and we've been learning how to provide the microbes the conditions they want to make the kombucha we want more consistently. However, we don't add any probiotics and haven't changed anything about that original starter culture. We're not opposed to adding probiotics, but we're more interested in learning what's going on with the traditional culture.

What we've been learning is really interesting. The Biology Department at Western Carolina University has been doing DNA testing on Buchi, GTs, and several other brands, and Buchi appears to have a unique microbiota. We like to think it's because the open fermentation has incorporated some microbes unique to our bioregion into our fermenter ecosystem, but it's just a theory. We requesting more research be done to help us better understand what makes our microbiota unique.

Buchi has two microbes with research showing benefits in humans:

- **Lactobacillus coryniformis 1,700,000,000 cells per serving (studies) improves intestinal wall lining, decreasing leaky gut. One of the studies shows improved digestion for healthy adults. IBS, Crohn's, celiac, type 1 diabetes, and some varieties of autism are all diseases that seem to be caused, at least in part, by extra-permeable intestinal walls allowing things to enter the bloodstream and circulate to the cells that shouldn't.**
- **Sporidiobolus johnsonii 150,000,000 cells per serving (studies) produces coenzymeQ10.**

The other microbes present in Buchi that we haven't seen any research on potential benefits yet are:

- **Sporolactobacillus laevolacticus**
- **Corynebacterium durum**
- **Pichia membranaefaciens**
- **Rhodotorula aurantiaca B**
- **Issatchenkia scutulata var exiqua**
- **Gluconacetobacter**
- **Dermacoccus**
- **Gluconobacter oxydans**
- **Brettanomyces bruxellenis**
- **Dekkera anomala**

We reached out Western Carolina University to help us better understand what is our culture. Based on the merit of his abstract, the professor who commissioned the research was asked to presented his findings in May of 2014 at the American Society of Microbiology. Below is the abstract which was submitted for review and subsequent presentation.

Western Carolina University: Microbial Characterization of Commercially Available Kombucha
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Kombucha is an ancient beverage produced via the fermentation of sweetened black tea via a consortium of yeasts and bacteria. Complex successionary changes within the fermentor result in a host of organic acids (e.g., lactic and acetic acids) and other metabolites being produced. Many of these are reported to be of probiotic and nutritional value to

humans. Some research has previously been conducted on the microbial diversity within kombucha and on the benefits of the beverage for human health. The purpose of this study was to characterize the microbiology associated with raw kombucha from fermentors and bottled products available to the consumer. A further goal was to determine whether a predictable "mother culture" could be identified in order to produce a consistent flavor in batch-to-batch kombucha fermentations. Microscopic, phenotypic, most probable number (MPN), and rDNA sequencing tests were employed to characterize the diversity of microorganisms from three brands of kombucha (Buchi, Brand #2, and Brand #3). Isolated bacteria were all assigned to the genus *Gluconacetobacter* while yeasts were presumptively identified as *Saccharomyces* spp. and *Brettanomyces* spp. Initial results from MPN studies indicated that acetic acid bacteria outnumbered lactic acid bacteria by two orders of magnitude (10^5 versus 10^3 cells/mL). Biolog YT microplates were employed to characterize the cultures from the three brands and significant differences were detected. The culture from Brand #3 was only able to use three carbon sources in the YT plates (inulin, dextrin, and dextrin/D-xylose) while the cultures from the other two brands (Buchi and Brand # 2) produced a robust profile based on the 94 tests in the plates and they separated strongly based on principal components analysis. Significant differences in metabolism of D-galactose, α-D-glucose, D-arabitol, gentiobiose, and D-cellobiose, e.g., were observed between the consortia in these brands. The latter finding suggests that Biolog YT microplates could be employed as a sensitive assay for characterizing cultures during the production of kombucha in order to assure the desired culture mix is present. Ongoing work is being conducted to further elucidate the species present in kombucha and to describe the chemical diversity in these beverages.