Pollen Fertilizers, Carbon Dots, Bee Lactobacillus

Posted by Karn Piana
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Karn Piana
Pollen Fertilizers, Carbon Dots, Bee Lactobacillus
August 02, 2018 05:30AM
Registered: 5 years ago
Posts: 77

A few days ago, I made a batch of fermented plant juice (FPJ) from Koschia scoparia, a noxious weed here in New Mexico. It is abundant in an adjoining arroyo and serves as one of the only sources of plentiful green material in the immediate vicinity. The Koschia had begun to flower, (it produces a profusion of tiny yellow flowers) and it was exclusively these which I harvested for my concoction. As I was filling my gallon jar with flowers, my hands became yellow with pollen and I began consider the super nutritious qualities of pollen as a food source and I wanted to look into whether pollen has been used as a fertilizer and also whether there was information on fermenting pollen.

Fermented pollen, also known as Bee Bread is pollen fermented by honey bees with lactobacillus. This provides the bee with a potent source of protein along with a huge regional array of constituents compiled on a grower forum which is one of the only references to pollen being looked at as a fertilizer I could find.

The only other reference to pollen being used as a fertilizer was a very recent study conducted last year by a group of Chinese researchers from the College of Horticulture, South China Agricultural University, Guangzhou. They made a nanoparticulate solution of "carbon dots" (which are extremely easy and inexpensive to produce) of rapeseed pollen and then fed this in solution to hydroponic lettuce. The scientists observed miraculous growth increases of 50% in biomass. It looks like brix levels are unchanged (same sugar content, ascorbic acid, and soluble protein). Carbon dots are made by combining water, an acid, and the carbon source (pollen) in an air tight sealed pressure container and heating at a low temperature in the oven for a number of hours.

This is interesting for several reasons, one of which is in that carbon dots can be easily made from a number of different carbon sources and this seems like it might become a powerful agricultural tool in the future. The potential of carbon dot foliar sprays come to mind.

Here is a link to the full research paper, "Bioimaging Application and Growth-Promoting Behavior of Carbon Dots from Pollen on Hydroponically Cultivated Rome Lettuce"

Here is a link to a more general summarizing article.

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Karn Piana
Re: Pollen Fertilizers, Carbon Dots, Bee Lactobacillus
August 10, 2018 11:18PM
Registered: 5 years ago
Posts: 77

I was interested to know more about the lactobacillus found in beehives and what other beneficial microbes might be located therein. This is a new line of inquiry for me, and yet again, the exciting potentials of biologic agricultural frontiers come to the fore.

The mycologist Paul Stamets made an observation of large numbers of bees interacting with decaying wood and hypothesized that there was a vital immunologic relationship between bees and fungi. He is currently working with entomologists at the University of Washington in a study which is indicating great promise against Varoa destructor and generalized colony collapse. He had posted a video on his YouTube channel showing him adding extracts from several familiar medicinal fungi to the hive's feeder, but this has subsequently been removed.

Lactobacillus bacteria also plays a vital role in the bee immune system, and this immunological role can be speculated to extend to the flowers they visit from the efficacy of competitive colonization and the role of lactobacilli in forming a kind of chainmail of protection around leaf stoma.

Recently this year (2018), scientists from the University of California Riverside collected wild flowers and bee species from Texas and California and were able to isolate three new lactobacillus strains which they hypothesize protects the bee eggs, larvae, and food from pathogen outbreak. Dr. Quinn McFrederick, one of the researchers and authors of the study, is quoted in the article linked above as saying, “It is interesting that the bacteria were able to live on both wild flowers and bees.” As well as, “The species we isolated have fairly small genomes and not as many genes as you would expect considering they survive in two different environments.”

This evidence of naturally occurring lactobacillus colonization leads one to speculate that compost teas being primarily directed into hyper competitive rhizospheres, while Lactobacillus & photosynthesizing Purple bacteria derived EM solutions, as well as FPJs (Fermented Plant Juices) being directed to leaves and flowers could more closely reflect natural patterns. Without a microscope it is impossible to truly ascertain what is happening with microbial inputs.

I am curious, once a microscope is incorporated, if it is possible to culture this wild flower lactobacillus by perhaps placing a pile of them atop the paper cover of the culture jar or into the starch solution itself in hopes of strengthening bee and plant health even more.

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Karn Piana
Re: Pollen Fertilizers, Carbon Dots, New Lactobacillus
August 11, 2018 12:35AM
Registered: 5 years ago
Posts: 77

Perhaps rather than using a rice water solution to capture the Apis Lactobacillus, a soluble pollen solution, or a combination with rice water would be an interesting avenue to explore. Also, could the bee specific lactobacillus be more singularly cultured from bee bread itself rather than the flowers...

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Karn Piana
Re: Pollen Fertilizers, Carbon Dots, Bee Lactobacillus
August 11, 2018 08:20AM
Registered: 5 years ago
Posts: 77

Here is an excellent article, *The Bacterial Communities Associated with Honey Bee (Apis mellifera) Foragers*, from a USDA scientific team at the Carl Hayden Bee Research Center in Tucson, Arizona which consistently identified 13 bacteria in the foregut of the bee which "inoculate collected pollen and act in synergy to preserve pollen stores". These were 9 strains of Lactobacillus and 4 of genus Bifidobacterium. This has been known prior to this study and evidently this is consistent worldwide in bee populations. The dominate bacterium is Lactobacillus kunkeei. This bacteria is evidently a big problem for wine makers as it propagates rapidly in grape juice and produces heightened levels of acetic acid that inhibit wine fermentation. Lactobacillus kunkeei is a crucial and powerful factor in forming an immunologic umbrella against pathogenic attack through myriad vectors throughout the hive. The link from L. kunkeei is to another article which goes into further depth and history of this bacteria, a deeper rabbit hole for anyone curious.

These bacteria are continuously exchanged in the hive and between bees and flowers. When larval bees emerge from eggs, they do not contain the 13 bacteria. Lactobacillus is a huge genus and is found in mutualistic coevolved relationship throughout nature as key constituents of anatomical function and immunologic systems. If the type of lactobacillus utilized in foliar sprays were calibrated to the bee / flower affiliation, might we see an increase in both plant & bee vitality? These 13 bacteria are responsible for the production of bee bread which makes this material seem like a viable candidate to culture from into a solution for foliar spray.

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Karn Piana
Re: Pollen Fertilizers, Carbon Dots, Bee Lactobacillus
August 11, 2018 09:04AM
Registered: 5 years ago
Posts: 77

Experimental Method of Culturing Bee & Flower Associated Lactobacillus Using the KNF Process for Producing LAB

Lactobacillus is what is known as a facultative aerobe, meaning that it produces a chemical compound providing cellular energy by aerobic respiration if it is in an oxygenated environment, but will switch to fermentation or anaerobic respiration in the absence of air. Therefore, to isolate the bee bread from airborne Lactobacillus we are less interested in, employ the KNF LAB recipe by obtaining a starchy rice water solution (potentially with an addition of pollen), but rather than leave sitting with a breathable cover, add a small quantity of bee bread to the solution and cover with a non breathable lid.

Once the solution has cultured after 3 -5 days and has a sweet fermented smell, add 1 part of this solution to 10 parts organic, whole or raw milk. Cover this with a breathable (paper) lid and let sit until solution separates into curds and whey. Separate and keep the whey (which is your LAB solution), and discard the curds however you want.

For long term storage, add an equal weight of brown sugar to create osmotic pressure to force microbial stasis. I am curious how the bacteria respond to this step as some of these strains possess "osmotic resistance" as they play a role in the production of honey.

The idea here is not so much to produce a laboratory grade culture of specific isolates, but rather to attempt to easily capture and propagate the beneficial microorganisms associated with bees and wild flowers with allowance for other strains of lactobacillus diversity.

Any criticism or ideas for refinement of this process are welcome and encouraged. Perhaps a person reading this has a microscope and the ability to identify if the organisms on the bee bread have taken up residence in the solution.

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Karn Piana
Re: Pollen Fertilizers, Carbon Dots, Bee Lactobacillus
September 10, 2018 05:55AM

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Something to consider with regard to calibrating a LAB culture to bees is a 2014 study, "Honey Bees Avoid Nectar Colonized by Three Bacterial Species, But Not by a Yeast Species, Isolated from the Bee Gut" by scientists at Stanford. The researchers inoculated artificial flowers containing synthetic nectar with 3 bacteria present in the bee gut: the aforementioned Lactobacillus Kunkeei, Asaia astilbes (a fast search didn't yield a definition, but it has been isolated from wild flowers in Japan in one reference), and Erwinia tasmaniensis (a non phytopathogenic bacterium in the Erwinia genus isolated in Tasmania). The study showed that the synthetic nectar inoculated with the bacterial strains was 3 -30% less removed by honeybees than the non inoculated control and one with a yeast inoculum. Over a few days, this trend became more pronounced and the researchers hypothesized that this was due to the bacteria interacting with the synth-nectar and altering it's properties.

To quote from the paper: "We expected honey bees to prefer nectar inoculated with bacteria because the literature suggested that the bacterial taxa we used could be beneficial as symbionts in the honey bee gut. Although evidence for the potential of E. tasmaniensis to be an important insect symbiont is not definitive, L. kunkeei has been indicated to be a mutualistic symbiont of A. mellifera, and several species of Asaia have been indicated as dominant symbionts of some species of insects..."

So, on one hand, this experiment might indicate that Lactobacillus Kunkeei colonized blooms are potentially 30% less alluring to bees.

On the other, I think that this experiment is too divorced from nature. I don't mean to sound arrogant or pretentious, but there are important differences between complex interlinked living systems and a dead scarecrow made by man. Obviously the artificial flowers are not able to replicate the incredible sophistication of what is occurring in even a single cell dividing. The researchers themselves acknowledge the issue of the modeling; "Although we used a realistic mixture of sugars and amino acids in the synthetic nectar, future studies could use real flowers to confirm the relevance of our findings to pollination by bees..."

There are numerous studies before and after this experiment which discuss L. Kunkeei being isolated from wild flowers and it being a crucial component in a continuous exchange in bee and flower interaction. In fact, all three of these bacterial strains have been isolated from flowers, and naturally occur there. Most likely even the mother inoculums used in the experiment came from flowers. Despite this, I think it is important to share this study for consideration.

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