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Black Solider Fly Compost Study Continuation

Introduction:

In Phase I, the Black Solider Fly Larvae (BSFL) demonstrated their ability to significantly reduce post-consumer waste at a 20:1 ratio (Leist, 2015). Phase II breeding research tested and demonstrated optimal conditions to breed Black Solider Flies (BSF), and develop eggs to enclosion. The optimal conditions were a minimum of 33.2% relative humidity, 70.63 degrees F, and direct sunlight (Leist & Dusenbury, 2016). The limitation of Phase II breeding was the inability to reproduce a viable population through multiple life cycles. Without a stable, self-renewing population, further research will be costly and unable to track changes through life cycles and generations. The goal of this phase was to develop a structure that will allow for BSF to self-renew over winter in a temperate climate.

Method:

Best practice research was used to evaluate how to best alter the existing structure. The structure was created to be used in the WMU Finch Green House, which is a temperature controlled building. This phase of the study chose to move the structure to the WMU Gibbs House. In moving to the Gibbs House the structure had two potential locations. The first location would be moving the structure to Hoop House I. While the Hoop House does provide some shelter from the cold temperatures of the Michigan winter it is not heated. The other option would be to move the structure to the Gibbs House basement, which would provide protection from the elements and has a higher humidity. In the end it was decided that the BSFL structure would be located in Hoop House I long-term. While the Gibbs house basement had some advantages, as a historic building meaning any changes would require oversight from a faculty member separate from the Office for Sustainability. The high cost of such an oversight made this option not viable. Thus the BSFL structure will be located in Hoop House I. However, due to the lack of heat, optimum breeding conditions for the Black Solider Flies would be virtually impossible without insulating the structure. Yet, the existing structure was 16x6x8 which would make insulation and heating costly.

To offset the high potential cost two possible alteration designs were evaluated. One design being segmenting the different life stages of the Black Solider Fly into different smaller structures, many of the large-sale BSFL operations rely on this technique. The other design option was to reduce the size of the existing structure by taking off the first two compartments, effectively reducing the size of the structure by half. In the end it was decided that cutting the structure in half, insulating it, and adding heat and water would be the best solution because it fit with the philosophy of permaculture. Permaculture

emphasizes that design and production of food should be centered on appreciating the whole system, rather than breaking it down into parts.

Results:

The result of the alterations to the previous 16x6x8 free standing structure will be an 8x6x8 structure. This smaller construction will be insulated on all sides, have one 3’9”x 2’7” window on the south facing wall, a space heater, and misting system. The space heater is 1,500 watts, enough to effectively heat the 84 square feet of space, and has over heat and tip safety’s .The misting system will be comprised of one four way fogger from Dripworks.org attached by black irrigation tubing to a 50 gal bucket of water with a pump. The bucket will be heated with a trough heater to insure it does not freeze. These modifications will create optimum breeding conditions for BFS over the winter months. By making these changes the structure will be ready so that next semester BSFL can be ordered to begin the next part of the study as soon as possible.

Limitations of analysis and proposed future work:

A possible limitation is that while this structure is insulated it may not be able to maintain the necessary conditions for the BSF. The next phase of research will work to have 3 self-renewing populations of the BSF. Temperature, humidity, and light will be measured using HOBO sensors to determine if optimum conditions are being met and to further analyze BSFL lifecycles. The energy input needed to maintain the structure will also be measured using a wemo real time energy monitor to determine if the energy input is worth it during the winter months. From there other experiments may be conducted into how to integrate BSFL into the OfS aquaponics system as a source of food, trying to determine if Black Soldier Flies require a critical mass for survival, the effect of pesticides on a colony.