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Utilization of Local Agricultural Waste Products for Production of Viable Biopesticides in Mosquito Infested Regions via Rudimentary Fermentation

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Background:
Mosquito-borne illnesses have plagued humanity for centuries. Outbreaks of malaria, yellow-fever, dengue, chikungunya, and Zika continue to rise around the world, resulting in the annual deaths of an estimated 1 million people. Recent studies have demonstrated how climate change and increased human travel/migration have exacerbated the occurrences of these mosquito-borne illnesses.

Current methods of mosquito control can be costly, potentially dangerous, and inaccessible to regions most in need. Biopesticides, such as Bacillus thuringiensis subsp. Israelensis (Bt/Bti), have been used to effectively control mosquito populations. However, commercial Bt/Bti production is considered expensive. Overall, cost-effective use of biopesticides would lessen the nuisance factor imposed by mosquito populations.

Objectives:
The primary goals of this study were to examine cassava, yam, sweet potato waste as potential culture media bases for Bt/Bti, develop rudimentary fermentation devices and parameters for use in field applications, and examine both functional and economic feasibility of using local agricultural waste products to produce viable Bt/Bti biopesticide.

Methods:
Locally sourced (Beninese) Bt/Bti was cultured in varying mixtures of cassava, yam, and sweet potatoes in both liquid and agar media. Growth efficacy and efficiency was measured utilizing standard plate counts and UV/Vis Spectrophotometry. Successful medias were scaled up and applied to 208-liter drums and Bt/Bti was added. These rudimentary fermentation vessels were monitored for biopesticide production under ambient conditions. pH, temperature, and Bt/Bti growth were recorded. Additional microscopy analyses and PCR confirmation were performed.

Results:
Preliminary results indicate that varied concentrations of cassava, yam, and sweet potato as growth media are utilized by Bt/Bti. All experimental medias yielded Bt/Bti growth similar to, or surpassing, that of standard nutrient controls. Large scale field experiments demonstrated Bt/Bti growth efficacy, with the expressed need to maintain consistent temperatures during the growth phase in order to achieve more efficient concentration of Bt/Bti.

Conclusions:
Agricultural waste products originating from cassava, yam, or sweet potato function sufficiently to culture Bt/Bti biopesticides at both laboratory- and field-scale. Additional work should be performed to further demonstrate the feasibility of such biopesticide production in the rural regions most in need of mosquito control.