

Waste to wealth: Technology on black soldier fly mediated bioconversion of farm and kitchen wastes



Hermetia illucens

Technology Description

The black soldier fly (BSF), *Hermetia illucens* (L.) (Stratiomyidae: Diptera) is mainly a tropical insect that is useful in converting solid organic waste into manure thereby reducing the quantity of the waste. The BSF pre-pupae are also used as valuable nutrient additive in poultry feed and fish meal. In this current technology rearing method and structure for rearing BSF larvae were standardised and developed.

Background

India produces around 3000 million tons of organic waste annually. Utilization of this waste material for productivity process is important for both economic and environmental reasons (Mehta and Chorawala, 2014). Farm and kitchen waste is a source of foul odour, due to slow degradation leading to environmental pollution. Farm waste has enormous nutrient wealth to be recycled for its effective utilisation. Composting is a process that safeguards and conditions diversity of decomposing ecosystem with the help of micro and macroorganisms. Bioconversion of organic solid waste into compost by earthworms or microbes normally takes several weeks to months. The present technology employing the larvae of Black Soldier Fly (BSF) for the above purpose is a simple bioconversion process that effects a 70-85% reduction in the weight and volume of food waste within a matter of few days. This process does not require energy, electricity and chemicals. It is totally self-contained and does not produce methane or any other greenhouse gases. The process does not require introduction of any foreign or exotic material. The BSF larvae feed voraciously on the organic solid waste and



Pupae of *H. illucens*

convert it into manure in a matter of days, achieving a dry mass volume waste reduction. The larvae are the primary output of the solid waste conversion and the weight of the prepupae for meal could be around 20kg / 100 kg solid waste conversion.

Benefits /Utility

- **Biomass conversion:** Biomass reduction of 50-95% are been reported with this technology involving various types of organic wastes.
- **Odour reduction:** Black soldier fly larvae are voracious feeders, and process waste very quickly, restraining bacterial growth and significantly reducing the bad odours. Also, larvae aerate and dry the manure, reducing odours.
- **Housefly and other fly control and reduction of pathogenic bacteria:** Being competitors for housefly larvae they significantly control housefly and other fly populations. Larvae suppress the population of pathogenic bacteria.
- **BSF is neither pest nor vector:** Both larvae and adults are neither pests nor vectors of pathogens. Adult flies do not have functional mouth parts and do not feed, whereas larvae feed on decaying matter only.
- **Rearing structure:**
 - Structure designed is compact, economical, easier to fabricate and maintain and can be utilized for rearing of black soldier fly throughout the year irrespective of seasons and geographical locations.
 - Easier harvesting of pupae, collection of egg masses, leachate separation from biomass
 - Structure conserves moisture for degradation of substrates compared to other reported open structures, and avoids entry of rodents and other pests.



Larvae of *H.illucens*



BSF compost

Scalability

The structure for rearing BSF is scalable to the commercial level for processing large volumes of organic wastes with minor alterations/ modifications in rearing structure as per convenience according to need. The process and methodology of rearing BSFL remains the same.

Business and Commercial Potential

The current technology has business potential as the technology has advantages of up to 90% reduction of bulky organic wastes generated in urban and rural areas yielding matured compost which can be utilized for diverse crops nutrition and establishment of nurseries. Also, the technology yields larvae as primary output of the solid waste conversion and the weight of the prepupae for meal could be around 20kg / 100 kg solid waste conversion, which can be used as valuable nutrient additive in poultry feed and fish meal

Financial Requirement

Establishment of polyhouses for BSF breeding and to house fabricated rearing structures involves financial requirement depending on need and the volume of output desired by the entrepreneur or stakeholder. Approximately Rs. 50,000/- for two size net-houses (10 x10 ft²)

Economic Analysis

The technology is viable and adopted in foreign countries and is very effective in reducing the organic wastes biomass, generating useful by products and will generate employment. Technology evaluated with designed structure has net overall benefit: cost ratio of 1.173 and net composting benefit: cost ratio of 0.94.

Target Market/Customer

- Poultry sector/ Fish Farming Sectors/ Farmers
- Contract farming companies/ Farmer's federations/Groups
- Municipalities / Panchayats
- This technology already commercialized to nine firms.

Social Impact of the Technology

- Black Soldier Flies are safe biological means for bioconversion of organic waste and help in reduction of organic waste biomass, associated filthy and foul smells and yielding a good degraded organic matter suitable as compost.
- Also, larvae can be used as valuable nutrient additive in poultry feed and fish meal. Thus, organic wastes are recycled effectively reducing organic wastes and converted to useful compost and larvae.