Innovative Black Soldier Fly Life-Cycle Box for Organic Waste Management

Piyachet Saengchan[1*], Kamolchanok Thamat[1], and Pornpawee Sriwongniam[1] , Nawamin Wongchai[1], Jirawat Varophas[1] and Nopphasul Sirijant[1]

[1]*Princess Chulabhorn Science High School Chiang Rai, Rob Wiang, Mueang Chiang Rai, Chiang Rai 57000, Thailand*

**E-mail: Piyachet.barnaby@gmail.com*

Abstract

Thailand generated approximately 26.95 million metric tons of municipal solid waste in 2023, with food and garden waste forming a major fraction. This project developed an enclosed black soldier fly (BSF; *Hermetia illucens*) life-cycle box for household organic-waste treatment. During a 21-day pilot trial, mixed food waste was supplied in portions of up to 1 kg day−1. Waste input and residue, processing time, larval biomass, frass, temperature, and relative humidity were recorded. Mean waste reduction was 68.1%, with a maximum weekly value of 82.8%. Three processing runs required 18–22 days (20 ± 2 days). Internal temperature and relative humidity averaged 29.5°C and 65.2%, respectively. Mean weekly yields were 0.26 kg of fresh larvae and 0.58 kg of frass. The prototype therefore showed technical feasibility for small-scale waste treatment and resource recovery. Replicated seasonal trials and nutritional and safety analyses are required before wider household or community deployment.

Keywords: black soldier fly, closed system, food waste, organic waste, waste bioconversion