OPTIMIZING BLACK SOLDIER FLY (HERMETIA ILLUCENS) MAGGOT PRODUCTION USING FRUIT AND VEGETABLE WASTE AS FEED

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ABSTRAK

Ketergantungan yang tinggi pada bahan pakan kaya protein impor seperti bungkil kedelai dan tepung ikan telah mendorong eksplorasi sumber pakan alternatif yang berkelanjutan. Larva lalat tentara hitam (Black Soldier Fly/BSF) atau maggot (Hermetia illucens) menawarkan solusi yang layak karena kemampuannya yang cepat dalam biokonversi dan kandungan nutrisinya yang tinggi. Penelitian ini mengkaji pengaruh berbagai jenis pakan organic limbah buah, limbah sayur, dan kombinasi keduanya terhadap produksi maggot. Desain acak lengkap (RAL) dengan tiga perlakuan dan tiga ulangan digunakan. Parameter yang diamati meliputi daya tarik BSF (perilaku oviposisi), biomassa larva (berat segar dan kering), serta populasi larva. Analisis statistik menggunakan ANOVA dan Uji Jarak Berganda Duncan (DMRT) menunjukkan bahwa perlakuan kombinasi pakan (limbah buah + sayur) secara signifikan meningkatkan hasil maggot dan tingkat oviposisi BSF. Hasil penelitian ini menunjukkan bahwa substrat organik campuran mengoptimalkan produktivitas maggot dan menawarkan jalur berkelanjutan untuk konversi limbah menjadi protein dalam konteks pertanian tropis.
Kata Kunci: Dagusibu, Edukasi Kesehatan, Edukasi Obat, Remaja, Telefarmasi.

ABSTRACT

The high cost of protein-rich feed components such as soybean meal and fishmeal—mostly imported—poses economic challenges for livestock production. This study evaluates the use of organic waste (fruit, vegetables, and a combination of both) as an alternative feed for Black Soldier Fly (BSF) maggot (Hermetia illucens) production. A Completely Randomized Design (CRD) with three treatments and three replications was used. Treatments included: fruit waste (P1), vegetable waste (P2), and a combination (P3). Variables observed included BSF attractiveness (oviposition rate), maggot population, fresh and dry biomass. Results show that P3 yielded the highest maggot population and biomass (1.113.67 maggots; 216 g fresh weight), followed by P1, while P2 produced significantly less. The combination of fruit and vegetable waste proved to be the most efficient medium for maggot production. This study highlights the potential of BSF bioconversion using agro-waste for sustainable feed solutions.
Keywords: *Black Soldier Fly (Hermetia Illucens), Fruit Waste, Vegetable Waste, Maggot Biomass, Organic Waste.*

INTRODUCTION

The livestock industry faces significant challenges due to rising feed costs, especially protein-rich ingredients such as soybean meal and fishmeal, which are largely imported in Indonesia. Insects like Hermetia illucens, known as Black Soldier Fly (BSF), present a promising alternative protein source due to their high reproduction rates, bioconversion efficiency, and sustainability. BSF larvae (maggots) can convert organic waste into high-quality protein and fat, suitable for animal feed.

Previous studies have emphasized the importance of feed substrate on maggot growth performance. Fruit and vegetable waste, abundant and easily biodegradable, are potential substrates for BSF larval rearing. However, comparative data on their effects on maggot yield are limited. This study investigates the production performance of BSF larvae fed on different types of organic waste: fruit waste, vegetable waste, and a combination of both.

RESEARCH METHODS

Study Design

The experiment was conducted over 6 weeks in Amban, Manokwari (March–April 2025), using a Completely Randomized Design (CRD) with three treatments:

P1: Fruit waste (100 g/day)

P2: Vegetable waste (100 g/day)

P3: 50 g fruit + 50 g vegetable waste/day

Each treatment had three replicates (9 experimental units).

BSF Rearing and Waste Substrate Preparation

BSF prepupae (10 g) were introduced into rearing cages. Substrates included:

Fruit waste: rambutan, langsat, jackfruit, pineapple peels

Vegetable waste: cucumber, eggplant, carrot, potato peels, leafy greens

Feed was administered daily for 21 days. Environmental conditions were monitored (temperature: 25–34°C; humidity: 60–90%).

Data Collection

Maggot biomass (fresh and dry weights)

Maggot population (counted manually)

Attractiveness: Number of adult BSF laying eggs on substrates, observed with CCTV

Statistical Analysis

Data were analyzed using one-way ANOVA followed by Duncan's Multiple Range Test (DMRT) using SPSS 21.0. Significance was accepted at $p < 0.05$.

RESULT AND DISCUSSION

Results

Maggot Population

Maggot count was significantly affected by feed type ($p < 0.05$). P3 had the highest population (1113.67), followed by P1 (982.33), while P2 yielded the lowest (3.00).

Maggot Biomass

Fresh and dry weights also varied significantly among treatments:

P3: 216 g (fresh), 48.5 g (dry)

P1: 214 g (fresh), 44 g (dry)

P2: 3 g (fresh), 0.5 g (dry)

BSF Attractiveness

Substrate attractiveness (measured by egg-laying adult visits) was highest in P3 (3.33 individuals/week) and P1 (3.00), indicating that fruit-based substrates release more volatile compounds preferred by BSF.

Discussion

The results confirm that substrate type significantly influences BSF maggot production. Fruit waste, rich in fermentable sugars and acids, stimulates oviposition and supports larval growth. However, the combination of fruit and vegetables (P3) offers a balanced nutritional profile, enhancing both larval biomass and survival rate. These findings align with Gumanti et al. (2024) and Wulandari et al. (2022), suggesting that optimal nutrient and moisture levels promote BSF productivity.

The low performance of P2 may be attributed to lower sugar content and less attractive odors, reducing BSF oviposition. Moreover, vegetable fibers are harder to decompose, slowing maggot digestion and development.

CONCLUSION

Combining fruit and vegetable waste significantly improves BSF maggot production

in terms of biomass and population compared to single-type waste. The combination (P3) offers a promising strategy for organic waste valorization and sustainable animal feed development

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