



บันทึกข้อความ

ส่วนราชการ งานเลขานุการ วิทยาลัยแพทยศาสตร์และการสาธารณสุข โทร. ๕๘๗๑

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เรื่อง ขออนุญาตเข้าร่วมการประชุมวิชาการระดับนานาชาติ International Conference on Innovations in Biotechnology for Sustainability (IBS-๒๐๒๔)

เรียน คณบดีวิทยาลัยแพทยศาสตร์และการสาธารณสุข (ผ่านหัวหน้ากลุ่มวิชาสาธารณสุขศาสตร์)

ด้วยข้าพเจ้านางสาวปวีณา ลิ้มปิทีปการ ตำแหน่ง อาจารย์ สังกัดกลุ่มวิชาสาธารณสุขศาสตร์ มีความประสงค์เข้าร่วมการนำเสนอผลงานวิจัยแบบโปสเตอร์ (Poster Presentation) ในหัวข้อ “Efficiency of Organic Waste Disposal with Black Soldier Fly Larvae” ในการประชุมวิชาการระดับนานาชาติ International Conference on Innovations in Biotechnology for Sustainability (IBS-๒๐๒๔) ณ Jawaharlal Nehru University เมืองนิวเดลี ประเทศอินเดีย ระหว่างวันที่ ๒๓ - ๒๕ พฤศจิกายน ๒๕๖๗ ซึ่งจัดโดย School of Biotechnology, Jawaharlal Nehru University, New Delhi, India ซึ่งข้าพเจ้าได้รับการตอบรับให้นำเสนอบทความ ดังรายละเอียดที่แนบมาพร้อมนี้

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Efficiency of organic waste disposal with black soldier fly larvae

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Abstract

This experimental study investigated the effectiveness of Black Soldier Fly Larvae (BSFL) in decomposing organic waste from three types of fruit peels: durian, mangosteen, and pomelo. Each type of peel (500 grams) was placed in four containers, with four replicates. Containers 1–3 had 3 grams of BSFL added, while container 4 served as a control without larvae to measure natural mass loss. The experiment was conducted over 18 days in a greenhouse, with observations every 3 days. These included monitoring the larvae and measuring the temperature inside and outside the greenhouse. The weight of the fruit peels was recorded before and after the experiment, and decomposition efficiency was calculated as a percentage. Results showed that BSFL was most effective at decomposing pomelo peels, with a 93.2% reduction in mass, followed by durian peels at 84.06% and mangosteen peels at 56.28%. The average weight loss was highest for pomelo peels (381.60 grams), followed by durian

(280.96 grams), and mangosteen (33.22 grams). The higher efficiency in decomposing pomelo peels is likely due to their soft, spongy texture, which made them easier for the larvae to break down.

Keywords: Striped fly larvae, Organic waste decomposition, Fruit peels, Biodegradation

Introduction

In 2022, Thailand produced 25.70 million tons of solid waste, according to a report from the Pollution Control Department. Of this, 17.01 million tons consisted of improperly managed or residual waste. The increasing waste problem stems from various factors, including population growth, urban expansion, and inefficient waste management practices. Notably, 64% of this waste is biodegradable, primarily from households, food vendors, and food-related activities [1]. Several methods have been developed to manage organic waste, such as composting and feeding organic waste to livestock. One promising method involves the use of Black Soldier Fly larvae (BSFL) larvae [2], which can consume organic waste, such as fruit peels, within 14–18 days during their larval stage. These larvae are also valuable as animal feed, further reducing waste disposal costs. Additionally, other studies highlight the efficiency of BSFL in processing organic waste, confirming their rapid consumption rates and the potential for significant waste reduction within a similar timeframe [3].

Fruit peels play a crucial role in organic waste management due to their abundance and potential for reuse. As a significant portion of household and agricultural waste, fruit peels offer a rich source of organic material that can be efficiently decomposed and transformed into valuable byproducts. These peels, which include thick, fibrous, and nutrient-rich materials like durian, mangosteen, and pomelo peels, are often discarded despite their high potential for recycling. Utilizing fruit peels as a substrate in waste decomposition processes not only reduces the volume of waste that ends up in landfills but also helps convert this organic matter into useful products, such as compost or animal feed. Moreover, using fruit peels in processes like BSFL composting is sustainable, as these materials decompose quickly, are non-toxic, and can enhance the larvae's growth, improving the efficiency of waste reduction [4]. By focusing on fruit peels, the research contributes to a circular economy, where waste is minimized and organic matter is reused, leading to more environmentally friendly waste management solutions.

Research on using BSFL to decompose organic waste, including fruit peels, has made significant progress in recent years [5-7], but several gaps remain. One critical gap is the limited understanding of how different types of fruit peels, with varying chemical compositions and physical structures, impact the larvae's growth and efficiency in waste decomposition. For example, thick and fibrous peels like durian and pomelo differ significantly from softer peels like mangosteen, and the larvae's ability to break down these materials efficiently can vary. This variation suggests a need for more specific research on how different fruit peel types affect the larvae's decomposition rate, nutrient uptake, and overall growth performance.

This study aims to examine the efficacy of BSFL in decomposing three types of fruit peels—durian, pomelo, and mangosteen—while also assessing their growth and development. By comparing the decomposition rates, the research seeks to provide insights into the potential of BSFL as a sustainable waste management solution, particularly in reducing organic waste and promoting circular economy practices.

Materials and Methods

This experimental research aimed to investigate the efficiency of BSFL (*Hermetia illucens* L.) in decomposing organic waste, specifically fruit peels from pomelo, mangosteen, and durian. The containers used for housing BSFL in the experiment are four-layer plastic containers. Each layer measures 35 cm in width, 44 cm in length, and 18 cm in height (Figure 1). The experiment was conducted in a greenhouse area located beside the waste bank near the student club building of the College of Medicine and Public Health, Ubon Ratchathani University. The structure was made from PVC pipes and bamboo, covered with green shade netting. The entrance was made from black shade

netting, with an additional mesh covering and a striped tarp placed on top. The floor of the greenhouse was concrete, and the greenhouse itself measured 2.30 meters in width, 3.58 meters in length, and 2.30 meters in height (Figure 1).

The food used in the experiment to determine the efficiency of the larvae consisted of three types of organic waste from fruit peels: thick peels (pomelo), soft peels (mangosteen), and hard peels (durian), all obtained from fruit vendors in the Ubon Ratchathani University area. Each fruit peel was replicated 4 times: 3 sets of experiments included black soldier fly larvae with the fruit peels, while 1 set served as the control, containing only fruit peels without larvae. In each experiment, 500 grams of fruit peels was provided for 3 grams of BSFL aged 4-7 days. Feeding began on day 1 of the experiment, and changes were observed throughout. The larvae's growth and waste decomposition were observed over 18 days, with environmental factors such as temperature monitored every three days using a thermometer. A precision scale (two decimal points) was used to measure the initial and final weight of both the fruit peels and the larvae.

The fruit peels were cut into smaller pieces (Figure 2), weighed, and then provided as food for the BSFL. Feeding began on the first day of the experiment, or whenever the food was depleted, with the amount of food used being recorded throughout the study period. Each experimental set also received 15 ml of EM (Effective Microorganisms) solution, mixed with 500 grams of coconut husk per set to create more air gaps within the experimental containers. The larvae were observed until their color changed from opaque white to brown or black, indicating the prepupal stage (Figure 3), which occurred after 18 days from September 25 to October 13, 2023. This was designated as the final day of the larval stage, marking the end of the experiment. The total amount of food consumed by the BSFL was then determined.



Figure 1 Four-layer plastic containers and the greenhouse

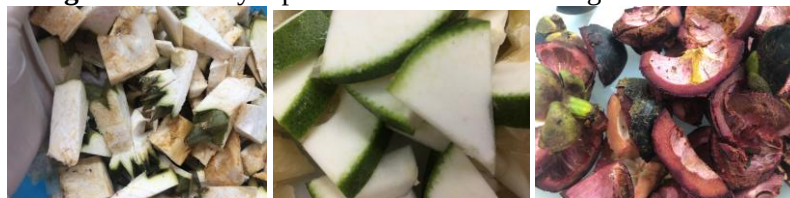


Figure 2 Three types of fruit peels after being cut



Figure 3 Place the BSFL into the container and the the final stage in the form of a pupa

The efficiency of organic waste disposal by black soldier fly larvae can be calculated using the following formula:

$$(A - B)/A \times 100$$

where:

A = Initial weight of the organic waste used in the experiment (grams)

B = Remaining weight of the organic waste after the experiment (grams)

Results and Discussion

The experiment to assess the efficiency of organic waste disposal by black soldier fly larvae on three types of fruit peels revealed that the weight of all three types of fruit peels decreased over time as they were processed by the larvae and decomposed by EM (Effective Microorganisms) water. A control set was prepared to compare the dryness and decomposition of the fruit peels with and without EM water. The findings showed that the black soldier fly larvae were most effective at disposing of pomelo peels, with an average reduction of 381.60 grams. This was followed by durian peels and mangosteen peels, with reductions of 280.96 grams and 33.22 grams, respectively. The pomelo peels, being less hard and with a spongy texture due to the inner tissue, were easier for the larvae to process compared to the other fruit peels.

The study found that during the 18-day experiment of raising BSFL, the temperature was relatively high throughout the period, with some days of rain. The fruit peels used in the experiment were dry and hard. The larvae needed time to burrow and feed, and it was necessary to use EM (Effective Microorganisms) water to moisten the peels. This was because EM water helps decompose the fruit peels and attracts the BSFL. The study on the weight of black soldier fly larvae after disposing of fruit peels revealed that the average total weight of larvae raised on pomelo peels was $4.12 \text{ grams} \pm 1.04$, which was the highest among the three types of fruit peels (Figure 4). This was followed by larvae raised on durian peels and mangosteen peels, with average weights of $2.33 \pm 0.32 \text{ grams}$ and $0.92 \pm 0.30 \text{ grams}$, respectively. In summary, larvae raised on pomelo peels were heavier, had higher survival rates, and were larger compared to those raised on the other two types of fruit peels. This is likely due to the softer texture of pomelo peels, with only the outer layer being hard, whereas mangosteen peels are very hard, making it difficult for the larvae to penetrate and feed, resulting in smaller weights and sizes.

The study on the efficiency of black soldier fly larvae in disposing of three types of fruit peels—durian, mangosteen, and pomelo—using 3 grams of larvae per 500 grams of peels found that pomelo peels were disposed of most effectively, with an efficiency of 93.12%. Durian peels followed with an efficiency of 84.06%, while mangosteen peels had the lowest disposal efficiency at 56.28%. In summary, black soldier fly larvae demonstrate effective organic waste disposal capabilities, though their efficiency varies depending on factors such as the decomposition process facilitated by EM water, the larvae's consumption behavior, and the dryness of the fruit peels over time.



Figure 4 Fruit peels after 18 days

The study evaluating the effectiveness of BSFL in disposing of three types of fruit peels—pomelo, durian, and mangosteen—over 18 days found that the larvae were most efficient with pomelo peels. This is because the pomelo's thick, smooth outer layer and soft, spongy inner peel make it easier for the larvae to penetrate and feed. In contrast, the harder, thicker peels of durian and mangosteen posed more of a challenge, particularly for the smaller larvae.

In the experiment, the fruit peels were chopped, placed in containers with coconut coir, and treated with 15 milliliters of EM (Effective Microorganisms) water. The larvae processed all three types of peels, but after 18 days, those fed on pomelo peels averaged 4.12 grams in weight and disposed of 381.60

grams of pomelo peels, achieving a 93.12% efficiency. The control setup with only EM water achieved 83.19% efficiency, indicating a 9.93% improvement with the larvae.

Challenges included using an outdoor shelter covered with canvas, which did not effectively regulate temperature or protect against environmental factors. This impacted the experiment's conditions, as environmental factors, weather, and sunlight affected the larvae's activity and the drying rate of the peels. Future experiments should use a more controlled environment with proper temperature and light regulation to improve results.

BSFL are well-suited for managing soft organic waste like fruit peels, offering an effective solution for household waste disposal. Future studies should explore their effectiveness with different types of fruit waste to enhance agricultural applications and potentially increase farmers' income. Additionally, investigating the impact of reducing the size of organic waste by chopping or grinding it could further improve decomposition efficiency.

Conclusions

In conclusion, the study found that black soldier fly larvae (BSFL) were most effective in disposing of pomelo peels, achieving a 93.12% efficiency. This is attributed to the soft, spongy texture of the pomelo peels, which facilitates easier feeding by the larvae. In comparison, durian and mangosteen peels, which are harder and thicker, resulted in lower efficiency. The use of EM water in the experiment further supported the decomposition process, but environmental factors impacted overall performance.

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IBS-2024 Abstract Review

1 ข้อความ

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11 กันยายน 2567 เวลา 14:15

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Efficiency of organic waste disposal with black soldier fly larvae

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Presenting author Email: pawena.l@ubu.ac.th

Dear Dr Pawena Limpiteeprakarn,

I am glad to inform you that your paper as above has been accepted for an oral presentation in IBS-2024 (ibs2024.in) to be held at JNU, New Delhi, India on Nov 23-25, 2024. We cordially invite you to present your work in the conference.

Sincerely,
Kashyap Kumar Dubey
Convener, IBS-2024



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International Conference on Innovations in Biotechnology for Sustainability



November 23-25, 2024, Jawaharlal Nehru University (JNU), New Delhi, India



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Abstracts Submission

Abstracts Submission

Conference participation and submission of abstracts

Participation is open to the persons involved in the cross-fields R&D, teaching, consultancy, planning, business, etc in the fields of biotechnology, energy and environment for developing bioprocesses. Plenary and invited presentations will be made by the experts (by invitation only). Contributory participants are invited to submit the abstracts of their research work (NO REVIEWS) to be presented as (i) oral (only by faculties/scientists/PDF) and (ii) rapid oral & poster presentation (by students/others).

Abstracts Book and Proceedings

Abstracts of the plenary and invited lectures and of contributory presentations will be published.

Full paper publications in special issues of Journals

Works presented in the conference will be eligible to submit to the special issues of the selected journals, which will be reviewed following the standard peer review process of the journal. Mere acceptance of the abstract in the conference will not qualify the manuscript for publication in these journals. Each registered delegate will be eligible to submit one manuscript to the journal of his/her choice. The selection of the journal should be made on the abstract submission form.

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1.

เรียน คณบดี (ผ่านหัวหน้ากลุ่มวิชาสาธารณสุขศาสตร์)

ด้วย นางสาวปวีณา ลิ้มปิติปรการ

มีความประสงค์เข้าร่วมประสงค์เข้าร่วมการนำเสนอผลงานวิจัยแบบโปสเตอร์ (Poster Presentation) ในหัวข้อ "Efficiency of Organic Waste Disposal with Black Soldier Fly Larvae"

ในการประชุมวิชาการระดับนานาชาติ International Conference on Innovations in Biotechnology for Sustainability (IBS-๒๐๒๔) ณ Jawaharlal Nehru University เมืองนิวเดลี ประเทศอินเดีย ระหว่างวันที่ ๒๓-๒๕ พฤศจิกายน ๒๕๖๗ ซึ่งจัดโดย School of Biotechnology, Jawaharlal Nehru University, New Delhi, India ซึ่งข้าพเจ้าได้รับการตอบรับให้นำเสนอบทความดังรายละเอียดที่แนบมาพร้อมนี้โดยค่าใช้จ่ายในการเดินทางไปราชการในครั้งนี้อ้างอิงพัฒนาดตนเอง ประจำปีงบประมาณ 2568 นั้น

งานบริหารบุคคล

ได้ตรวจสอบคุณสมบัติของบุคคลดังกล่าวแล้วเป็นไปตามที่ประกาศกำหนด และมีเงินงบประมาณในการเข้าร่วมประชุมวิชาการ จำนวน 15,000 บาท และนำเสนอผลงาน จำนวน 10,000 บาท

จึงเรียนมาเพื่อโปรดทราบ

และพิจารณาการอนุมัติเข้าร่วมประชุมวิชาการของบุคคลดังกล่าว
(นายประวิทย์ อ่ำพันธุ์)

คณบดีวิทยาลัยแพทยศาสตร์และการสาธารณสุข
11 ต.ค. 2567 12:10:38

(นางสาวจิราภรณ์ ศรีสุวรรณ)

ผู้ปฏิบัติงานบริหารปฏิบัติงาน
10 ต.ค. 2567 10:42:46

2.

เรียน คณบดี

-ผศ.ปวีณา ลิ้มปิติปรการ

มีความประสงค์เข้าร่วมประสงค์เข้าร่วมการนำเสนอผลงานวิจัยแบบโปสเตอร์ (Poster Presentation) ในหัวข้อ "Efficiency of Organic Waste Disposal with Black Soldier Fly Larvae"

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ซึ่งได้รับการตอบรับให้นำเสนอบทความโดยค่าใช้จ่ายในการเดินทางไปราชการในครั้งนี้อ้างอิงพัฒนาดตนเอง ประจำปีงบประมาณ 2568 และ

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ได้ตรวจสอบคุณสมบัติของบุคคลดังกล่าวแล้วเป็นไปตามที่ประกาศกำหนด และมีเงินงบประมาณในการเข้าร่วมประชุมวิชาการ จำนวน 15,000 บาท และนำเสนอผลงาน จำนวน 10,000 บาท

-เห็นควรอนุมัติ



(ผศ.กิตติ เหลาสุภาพ)

หัวหน้ากลุ่มวิชาสาธารณสุขศาสตร์
10 ต.ค. 2567 11:27:25