Original Article

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ISSN: 1656-4707
E-ISSN: 2467-5903
Homepage: www.palawanscientist.org

Insect-eating festivals as a tool for promoting entomophagy in Muslim Mindanao

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Received: 05 Feb. 2024 || Revised: 31 Aug. 2025 || Accepted: 11 Nov. 2025|| Available online: 14 Nov. 2025

How to cite:
Deocaris CC and Sabado EM. 2025 Insect-eating festivals as a tool for promoting entomophagy in Muslim Mindanao. The Palawan Scientist, 17(2): 91-102. https://doi.org/10.69721/TPS.J.2025.17.2.10

ABSTRACT

Entomophagy, or the consumption of edible insects, offers a sustainable approach to addressing food insecurity and malnutrition, particularly in marginalized and post-conflict communities. Despite its benefits, cultural resistance and entomophobia hinder broader acceptance. This study aimed to assess the effectiveness of insect-eating festivals (IEFs) in promoting awareness and acceptance of entomophagy in the Bangsamoro Autonomous Region in Muslim Mindanao (BARMM), Philippines, a predominantly Muslim region. From 2012 to 2022, as part of an extension program at Mindanao State University, Marawi City, IEFs were organized involving 3,426 participants through superworm *Zophobas morio* (Fabricius, 1776)-based food tastings, educational lectures, quizzes, and eating challenges. A descriptive research design employing pre- (n = 111; 2017) and post-event (n = 102; 2020) surveys measured changes in knowledge, acceptability, and willingness to consume insects. Survey results showed marked improvements in participants' willingness to consume insects, with the proportion expressing interest increasing from 35% before the IEF to over 50% after participation. Negative reactions, such as disgust, decreased from 33% to less than 20%, while positive descriptors (e.g., "curious," "happy") became more frequent. Sensory exposure—particularly tasting fried *Z. morio*—combined with educational lectures significantly enhanced acceptability and reduced entomophobia ($P < 0.05$). Beyond acceptance, insect-based foods offer practical nutritional and economic benefits, such as high-protein, resource-efficient alternatives that can help mitigate food insecurity in BARMM. Cultural contextualization—especially the integration of Islamic dietary norms—further enhanced acceptance, underscoring the potential for halal certification of insect-based products. These results demonstrate that culturally sensitive, community-driven interventions like IEFs can effectively normalize entomophagy and support alternative nutrition strategies in post-conflict settings.

Keywords: edible insects, food culture, sustainable food production, university extension programs

INTRODUCTION

The global rise in food insecurity alongside environmental degradation has driven interest in alternative food sources. Entomophagy, or the consumption of edible insects, offers a sustainable, efficient, and nutritionally rich option to complement conventional livestock, considering that insects constitute one of the Earth's most abundant biological resources, with approximately 1,900 edible species documented to date (Lisboa et al. 2024). Recognized by the United Nations Food and Agriculture Organization (FAO) for its role in food and feed security (van Huis et al. 2013), insects have been gaining global attention due to their high feed conversion efficiency, low environmental impact, minimal land and water use, and short production cycles (Yang et al. 2024). These characteristics make insect farming a viable option for addressing hunger, malnutrition, and rural livelihood challenges, especially in resource-constrained regions (Adundo and Mulungu 2024; Liceaga 2022).

Edible insects are also highly nutritious, often matching or even exceeding the nutritional value of traditional meat. This positions them as a strong solution to problems of protein deficiency and malnutrition. For example, species like *Locusta migratoria* (Linnaeus, 1758) and *Tenebrio molitor* (Linnaeus, 1758) are very protein-dense, with levels between 48% and 67% on a dry matter basis. Their amino acid profiles are also excellent, meeting or surpassing the daily requirements for essential amino acids such as lysine and threonine set the World Health Organization (WHO) (Nachtigall et al. 2025). Moreover, other insects, including *Zonocerus variegatus* (Linnaeus, 1758) and *Periplaneta americana* (Linnaeus, 1758), have been found to possess even higher protein content—up to 74%—while also providing crucial iron, zinc, and dietary fiber, nutrients that are often less abundant in conventional meat (Omotoso and Adesola 2023). A unique benefit of insects is that they contain chitin-derived fiber and bioactive compounds not present in livestock, offering additional health advantages. Altogether, this combination of nutritional density and functional properties makes them a strategic food source for regions facing food insecurity, such as the BARMM, which has the Philippines' highest rate of food insecurity at 84% according to the DOST-Food and Nutrition Research Institute (Gutierrez 2023). Thus, our work underscores the urgency of exploring culturally relevant, resource-efficient solutions such as entomophagy in this region.

Even with these benefits, people in many cultures are still hesitant to eat insects. This resistance often stems from deep-seated cultural norms, food neophobia, and a sense of disgust (Aguilar-Toalá et al. 2025). A significant barrier is entomophobia, which is a fear or aversion to insects that commonly manifests as disgust, avoidance, or anxiety. Research by Alhujaili et al. (2023) confirms that the main factors influencing willingness to eat insects include disgust, food neophobia, familiarity, visibility of insect in the dish, and taste. To mainstream insect-based foods, it is crucial to address these psychological and sociocultural hurdles. A growing body of research emphasizes that successfully changing perceptions requires communication and education strategies tailored to specific audiences (House 2016; Menozzi et al. 2017; Sogari et al. 2018; Verneau et al. 2016).

In the Philippines, the practice of eating insects, or entomophagy, is far from new. It has a long history within indigenous and rural communities, where insects have traditionally complemented staple diets as part of local food culture. For generations, Filipinos have incorporated locusts, beetles, bees, and crickets into various regional dishes—everything from simple fried snacks to the classic adobo—showcasing their dual role as seasonal treats and protein sources (Gibbs et al. 1912; Domoguen 1993). In fact, locusts (subfamily: Cyrtacanthacridinae) are the most well-documented edible insect in the country's history, with records of their consumption in places like the Batanes Islands (Starr 1991). However, despite this history, the broader Filipino public often perceives insect-eating as a primitive practice, which has prevented it from being integrated into the national food system.

This disconnect highlights the for educational efforts that are sensitive to local culture and can help demystify the idea of eating insects. One promising approach is the use of insect-eating festivals (IEFs). Research indicates that these festivals are highly effective at reducing fear and normalizing insects as food. They achieve this by offering hands-on experiential learning, opportunities to taste the insects, and a fun, public setting for engagement (Feng et al. 2018; Hvenegaard 2016; Shin et al. 2018; Woolf et al. 2019). By combining food samples with educational activities, these events make edible insects more approachable and socially acceptable. A particularly compelling place to study this kind of intervention is the Bangsamoro Autonomous Region in Muslim Mindanao (BARMM). As a predominantly Muslim and post-conflict region, its cultural and religious play a crucial role. Notably, Islamic dietary laws classify specific insects—including locusts, grasshoppers, and in some views, bees—as halal, or permissible to eat. This religious acceptance creates a natural pathway for cultural acceptability (El-Mallakh and El-Mallakh 1994).

This study focuses on the Mindanao State University-Main Campus in Marawi City (MSU-Marawi), Lanao del Sur, BARMM, which has conducted IEFs as part of its agricultural extension program since 2012. These festivals aim to promote entomophagy not only as a nutritious food source but

also as a sustainable pest control strategy and alternative income stream for the community. Over the years, the IEFs have showcased a wide variety of insect-based dishes, including coconut pest larvae *Rhynchophorus ferrugineus* (A.G.Olivier, 1791), *Oryctes rhinoceros* (Linnaeus, 1758), rice moth *Corcyra cephalonica* (Stainton, 1866), Malaysian black bugs *Scotinophara coarctata* (Fabricius), green leafhoppers (*Nephotettix* spp.), rice weevils *Sitophilus oryzae* (Linnaeus, 1763) and farmed edible insects such as black soldier fly larvae *Hermetia illucens* (Linnaeus, 1758) and superworms *Zophobas morio* (Fabricius, 1776). While a previous report documented the outcomes of a 2014–2015 IEF involving 90 participants (Aguanta 2017), this paper expands the scope by analyzing the responses of 3,426 participants from 2012 to 2022.

The study aims to (1) evaluate the effectiveness of IEFs in improving awareness and acceptance of entomophagy in a culturally specific, post-conflict setting; (2) assess participants' knowledge, acceptability, and willingness to consume edible insects; and (3) explore how integrating Islamic food norms can enhance the acceptability of insect-based foods. By documenting this large-scale, community-based intervention, the study seeks to inform future programs targeting food security, cultural nutrition, and behavioral change in similar contexts.

METHODS

Study Design, Study Areas, and Organization of IEFs

This study employed a descriptive research design. The MSU-Marawi extension program partnered with various institutions and groups to organize a series of IEFs (Table 1; Figure 1). These events were held on campus on different dates from 2012 to 2022 and had a total of 3,426 registered participants. Specifically, the IEFs were conducted on 06 March 2012 (Botanical Garden; n = 285), 31 August 2012 (Botanical Garden; n = 470), 22 February 2013 (Botanical Garden; n = 522), 07 March 2014 (Botanical Garden; n = 298), 14 March 2015 (Academic Complex; n = 350), 27 April 2016 (Aggie Quadrangle; n = 253), 29 April 2017 (Aggie Quadrangle; n = 402), 06 April 2018 (CHARM Pavilion; n = 299), and 01 May 2019 (CHARM Pavilion; n = 337). The researchers prepared for a 10th IEF for 2020, but due to the COVID-19 pandemic, the activities were rescheduled to 23 November 2022, at the Aggie Audiovisual Hall, which was attended by 210 participants.

The insect-based menus were developed by students enrolled in crop protection, entomology, and integrated pest management courses at the College of Agriculture, MSU-Marawi. The preparations utilized pest and non-pest insect species collected from the field and the university-based *Z. morio* mass rearing facility. Table 2 provides a representative snapshot of insect dishes exhibited and offered for free tasting; however, these were not formally subjected to sensory acceptability scoring. As MSU-Marawi has a predominantly Muslim population of students and faculty, the selection of insect species and menu design also considered participants' cultural and religious backgrounds. Insect species permissible under Islamic dietary norms (e.g. locusts, grasshoppers, and bees) were included in the menus to align with the predominantly Muslim context of BARMM. During the IEFs, the students attended entomophagy lectures, participated in quiz contests, and assisted in organizing competitions on live insect eating, insect menu preparation, and insect-themed face and body painting. The winners of various contests received special prizes, and there was a free tasting of the insect dishes and delicacies prepared by the students. The researchers noted the participants' reactions toward entomophagy during the events.

From 2017 to 2019, the Mr. and Ms. Entomophagist beauty pageant was held, with participation from entomology and agriculture students from MSU system external campuses, namely MSU-Naawan (Misamis Oriental) and MSU-Buug (Sibugay Province). The contestants paraded in insect-themed costumes and competed in the talent and question-and-answer rounds, with questions relevant to entomophagy and other insect-related issues. The pageant judges included top MSU administrators, professors, and agricultural officers from the Department of Agriculture.

Preparation of Insects for the Live and Speed-eating Challenge

The IEFs included two types of entomophagy challenges, namely live and fried *Z. morio* eating. The first three IEFs utilized two common coconut insect pests, the Asiatic palm weevil (*R. ferrugineus*) and the rhinoceros beetle (*O. rhinoceros*), as well as the rice moth (*C. cephalonica*). These pests were collected from sawdust piles produced by a sawmill in Aurora, Zamboanga del Sur, while the larvae of the rice moth were obtained from the Regional Crop Protection Center (RCPC), Region IX, Molave, Zamboanga del Sur. Prior to the event, the insects were fasted for one day. In the succeeding IEFs, however, laboratory mass-reared *Z. morio* were used due to the unavailability of rice moth larvae, which were being used by the RCPC for the mass rearing of *Trichogramma* spp., a parasitic wasp used to control rice stemborers. For the speed-eating challenge of the Mr. and Ms. Entomophagist pageant, contestants consumed chocolate-coated *Z. morio*.

Table 1. Partner institutions and their roles in the IEFs. Abbreviations: NGA – national government agency; NGO – non-government agency; M – military; A – academe; LC – local community.

Partner	Sector	Role
Commission on Higher Education	NGA	Funder
Department of Agriculture, Region IX, Mahayag, Zamboanga del Sur	NGA	Funder
Department of Agriculture, Isabela City, Zamboanga Peninsula Region	NGA	Funder
Philippine Coconut Authority, Butuan City	NGA	Funder
Department of Education, Ramon Magsaysay, Zamboanga del Sur	NGA	Participant
Omega Team Philippines, Inc.	NGO	Participant
Philippine Army	M	Participant
MSU Integrated Laboratory School, MSU, Marawi City	A	Participant
MSU Institute of Science Education, MSU, Marawi City	A	Participant
MSU-Iligan, Iligan City	A	Participant
MSU-Naawan, Naawan, Misamis Oriental	A	Participant
MSU-Buug, Buug, Sibugay Province	A	Participant
Barrio Sikap, MSU, Marawi City	LC	Participant
Cabingan, Marawi, Lanao del Sur	LC	Participant
Palao, Ranaranao, Marantao, Lanao del Sur	LC	Participant

Figure 1. Activities in the insect-eating festivals. (A) Mr. and Ms. Entomophagist, 2019; (B) live speed insect-eating challenge, 2014; (C) insect cooking contest, 2012; (D) insect face and body painting, 2017; (E) insect quiz contest, 2014; (F) sale of edible insect-based food products, 2013; (G) insect-eating acceptability survey, 2019; (H) judging of best insect menu, 2019; (I) free tasting of insect recipes, 2012; (J) *Zophobas morio* (Fabricius, 1776) ice cream eating contest, 2019; (K) lecture series on entomophagy, 2018; (L) Pest Management Council of the Philippines Scientific Convention 2014.

Pre-IEF and Post-IEF Online Survey

To evaluate the effectiveness of the IEFs in promoting entomophagy and the acceptability of edible insects, two surveys were conducted. Participants were informed of the study's purpose, provided with informed consent, and assured of their anonymity and confidentiality.

The first survey took place on 23 November 2017, during the foundation day of the MSU-Marawi, College of Agriculture. It involved 111 participants and served as a pre-IEF assessment. The instrument was a semi-structured questionnaire validated through pre-testing among fifteen students prior to administration. A five-point Likert scale (1 = strongly disagree; 5 = strongly agree) was used to measure willingness to taste insects, acceptability of entomophagy, and acceptability of insect dishes.

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Table 2. Edible insects and menu in the insect-eating festivals.

Common Name	Scientific Name	Host Plant	Category	Food Preparations
Malaysian black bugs	*Scotinophara coarctata* (Fabricius)	Rice	Pest	Crispy fried insect; scrambled eggs**;** cookies, mango float
Green leafhoppers	*Nephotettix* spp.	Rice	Pest	Scrambled eggs
Grasshoppers	*Oxya chinensis* spp.	Rice	Pest	Gelatin; Noodles
Rice bugs	*Leptocorisa oratorius* (Fabricius, 1794)	Rice	Pest	Fried insects; scrambled eggs
Rice weevil	*Sitophilus oryzae* (A. Hustache, 1930)	Rice	Pest	Polvoron
Rice moth	*Crocyra cephalonica* (Stainton, 1866)	Rice	Pest	Sticky rice
Red flour beetle	*Tribolium castaneum* (Herbst, 1797)	Rice	Pest	Polvoron
Ladybird beetle	*Micraspis crocea* (Mulsant)	Rice	Non-pest	Fried peanut mix
Corn weevil	*Sitophilus zeamais* (Motschulsky & V.de, 1855)	Corn	Pest	Polvoron
Earwig	*Euborellia annulata* (Fabricius, 1793)	Corn	Non-pest	Banana rolls
Migratory locust	*Locusta migratoria* subsp. *manilensis* (Meyen, 1835)	Corn	Pest	Orange cake
Cabbage worm	*Crocidolomia pavonana* (Fabricius, 1794)	Cabbage	Pest	Sticky rice cake
Curculionid beetle	*Metapocyrtus* spp.	Cabbage	Pest	Banana rolls
Banana pseudostem weevil	*Odoiporus longicollis* G.A.K.Marshall, 1930	Banana	Pest	Cookies
Coconut leaf beetle	*Brontispa longissima* (Gestro, 1885)	Coconut	Pest	Buttered cake
Asiatic palm weevil	*Rhynchophorus ferrugineus* (A.G.Olivier, 1791)	Coconut	Pest	Noodles; adobo
Rhinoceros beetle	*Oryctes rhinoceros* (Linnaeus, 1758)	Coconut	Pest	Vinegar-braised beetle
Cotton stainer	*Dysdercus cingulatus* (Fabricius, 1775)	Lady's fingers	Pest	Fried peanut mix
Leaf-footed bug	*Physomerus grossipes* (Fabricius, 1794)	Sweet potato	Pest	Fried peanuts mix
Lantana leaf-miner beetle	*Uroplata girardi* Pic, 1934	*Lantana camara* L.	Pest	Polvoron
Superworm	*Zophobas morio* (Fabricius, 1776)	Wheat bran	Non-pest	Spaghetti; stir-fried vegetables, pork rolls; deep fried insect; rice cake, macaroons, Polvoron, beef rendang, palapa, mango float, and superworm ice cream flavored with durian, mango and purple yam
Black soldier fly (larvae)	*Hermetia illucens* (Linnaeus, 1758)	Seaweed *Eucheuma cottonii* Weber Bosse, 1913	Non-pest	Fried maggots
Honeybee (larvae)	*Apis cerana* (Fabricius, 1793)	Coconut	Non-pest	Orange cake

The second survey was an online post-IEF assessment conducted from 26-30 May 2020. It aimed to evaluate the impact of the IEFs in promoting entomophagy and reducing entomophobia. The survey included 102 participants who responded to online requests for feedback. Purposive sampling was employed to capture individuals who had attended at least one IEF, thereby ensuring that the sample represented those with direct exposure to insect-based foods. However, we acknowledge the potential for

self-selection bias, as only those willing to give feedback responded.

Part I of the instrument focused on respondents' general knowledge of entomophagy, their acceptability of edible insects, and the perceived usefulness of the lectures. Part II gathered information about the participants' experiences during the IEFs and their suggestions for future activities. While changes in dietary patterns or protein intake post-IEF were not formally measured, open-ended responses included remarks about the potential inclusion of insect dishes in participants' diets.

Data Analysis

Survey data were analyzed using descriptive statistics (percentages, means) and chi-square tests to assess differences in reactions before and after the IEFs.

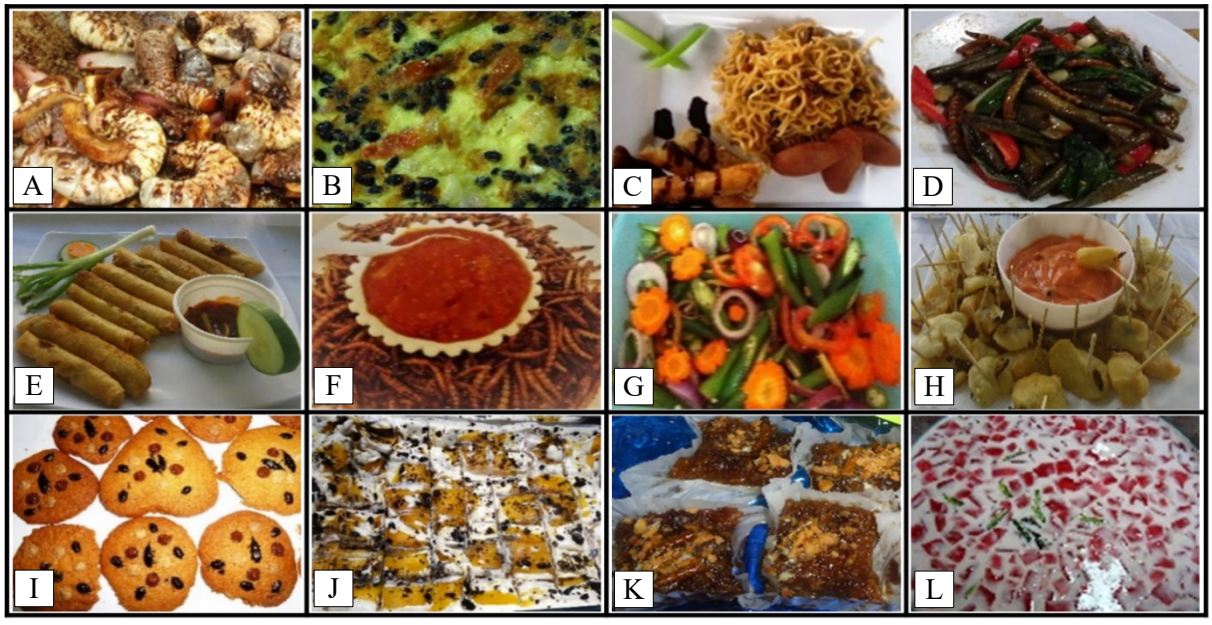
Ethics

At the time the IEFs were conducted, MSU-Marawi did not yet have a formally established Institutional Review Board. Nevertheless, the research adhered to the 2017 Philippine National Ethical Guidelines for Health and Health-Related Research developed by the Philippine Health Research Ethics Board (PHREB 2017). Participation was voluntary, informed consent was obtained, no minors (<18 years) were included, and anonymity and confidentiality were maintained. The study protocol, including survey design and participant recruitment, was reviewed by the College of Agriculture faculty panel to ensure compliance with ethical standards.

RESULTS

The MSU-Marawi organized 10 IEFs as part of its extension program, providing students, employees, and local communities with direct experiential learning in a fiesta-like atmosphere. Entomophagy was promoted through brief lectures, contests (e.g. quizzes, cooking, face/body painting) and opportunities to taste insect-based menus (Figure 2).

Figure 2. Selected Filipino insect-based dishes developed by the students and served during the insect-eating festivals. (A) Adobong "batod" (*Rhynchophorus ferrugineus* A.G.Olivier, 1791); (B) scrambled eggs with Malaysian black bugs (*Scotinophara coarctata* (Fabricius)); (C) pansit (Filipino-style noodles) with grasshoppers *Oxya chinensis* (Thunberg, 1815); (D) stir-fried vegetables topped with crispy fried superworms *Zophobas morio* (Fabricius, 1776); (E) superworm *Z. morio* lumpia (fried insect rolls in rice wrapper); (F) deep-fried superworms (*Z. morio*) with spicy chili sauce; (G) steamed vegetable salad with fried superworms (*Z. morio*); (H) fried palapa (traditional crochets) with *Z. morio*; (I) buttered insect cookies (*S. coarctata*; and *Odoiporus longicollis* G.A.K.Marshall, 1930); (J) Graham mango float dessert with Malaysian black bugs (*S. coarctata*); (K) superworm (*Z. morio*); biko (steamed rice cake with caramelized coconut); and (L) cathedral window gelatin with grasshoppers (*Oxya chinensis* Thunberg, 1815).



Attendee Demographics and Information Sources

Most survey participants were aged 20-24 years (67.3%; n = 68), female (57.4%; n = 58), and Meranao (63.7%; n = 64)—the second-largest cultural group among Muslim Filipinos, rooted in Lanao. A majority first learned about entomophagy through the university's crop protection courses (55.4%; n = 55). Others were introduced through previous IEFs (32.6%; n = 33), by friends out of curiosity (35.6%; n = 36), or through IEC materials (4.9%; n = 5) and posters (9.9%; n = 10). Fifty-three (52.8%; n = 54) were first-time attendees, while 23 (22.8%; n = 23) had joined once before IEF, and the rest had participated several times. Among those who attended, most of the participants (72.8%; n = 74) engaged in at least one IEF activity.

The most popular event was the free fried *Z. morio* tasting, which was the common dish served across all IEFs (56.4%; n = 57). This activity was followed by the insect cooking contest (19.8%; n = 20), insect-themed face and body painting (11.9%; n = 12), insect quiz contest (9.9%; n = 10), live insect-eating challenge (8.9%; n = 9), and the Mr. and Ms. Entomophagist pageant (3.9%; n = 4).

Knowledge and Awareness of Entomophagy

Most participants learned about entomophagy through their crop protection courses (55.4%; n = 56). Additionally, a sizable portion became aware of entomophagy through the IEFs (32.7%; n = 33) and through word-of-mouth from friends (35.6%; n = 36).

Among the participants who had low awareness of entomophagy, the initial responses to tasting fried *Z. morio* and larvae of soldier flies (*H. illucens*) were primarily entomophobia (40.6%; n = 41) and disgust (67.2%; n = 68). It is worth noting that the soldier fly maggots were reared on seaweed *Eucheuma cottonii* (Weber Bosse, 1913) organic fertilizer, while the *Z. morio* were reared on wheat bran under laboratory conditions.

Edible Insect Acceptability

Many participants found fried *Z. morio* and *H. illucens* maggots crispy (60.4%; n = 61), tasty (39.6; n = 40), and even delicious (14.9%; n = 15). These acceptability ratings imply a reduction of entomophobia (31.7%; n = 32) and disgust (49.5%; n = 50). Once they discovered the taste and flavor of insects, they repeatedly consumed them. Lectures on entomophagy were also useful (83.2%; n = 84) in promoting entomophagy and in overcoming entomophobia and disgust. Most participants recommended entomophagy as part of the modules (72.3%; n = 73) in future Crop Protection classes. Only one out of those surveyed did not find the lectures useful (1.0%; n = 1), while the rest remained undecided (15.8%; n = 16) about the impact the lectures had on them in persuading them to attempt eating the insects. As individuals attend these events more frequently, their exposure to and familiarity with insect-based foods increase, contributing to a measurable reduction in entomophobia (Table 3).

While participants primarily engaged with the IEFs as an introduction to entomophagy, the surveys did not explicitly capture perceptions of edible insects as a sustainable protein source in the context of food scarcity or rising prices. Nonetheless, anecdotal observations during open discussions suggested that some participants informally associated entomophagy with alternative or future food options, indicating an interesting area for further investigation.

Table 3. Participants' reactions before and after participating in the insect-eating festivals. *The *P*-value is less than the significance level (α = 0.05), indicating a statistically significant difference in participants' reactions, ** the participants were offered ten live superworms in the speed-eating challenge (see Methodology).

Question	Answer	Pre-IEF (n=111)	Post-IEF (n=102)	X^2 (*P*-value)
Are you interested in eating insects?	No	40.6	15.8	15.60* (p = 0.020)
	Yes	34.6	52.5	
	Undecided	26.7	34.6	
How do you feel about being challenged to taste an edible insect?**	Disgust	32.7	11.9	20.52* (p = 0.041)
	Positive	20.9	11.9	
	Surprised	16.8	20.8	
	Happy	5.9	1.9	
	Curious	34.7	58.4	

DISCUSSION

Overcoming Entomophobia: Promoting Acceptance of Insect-based Foods

The fear of eating insects prevails based on individual experiences and Filipino superstitious beliefs (DeFoliart 1999). Insects are seen as pests that damage crops, invade kitchens, and feed on rotten foods, dung, dead bodies of animals, and even human corpses, and they are seen as vectors for malaria and dengue hemorrhagic fever. In addition, there is a traditional belief that "mambabarangs*"* (or sorcerers) use insects in their rituals to inflict injuries or torture their victims. Many Filipinos, especially in the

provinces, believe that hearing cricket songs and seeing a black butterfly fluttering augurs the spirit of a loved one relaying a message, which instills entomophobia and disgust (van Huis 2013).

Educational activities play a vital role in promoting entomophagy, as evidenced by our experiences organizing IEFs. By informing consumers about the numerous benefits of consuming insects, such as their potential as an alternative source of protein and their effectiveness in pest control, we take a significant step towards overcoming entomophobia and disgust among individuals (Looy and Wood 2006). Rather than simply providing knowledge, the combination of lectures, public demonstrations, and direct tasting helped participants replace negative associations with positive sensory experiences. The model used in these IEFs operates similarly to exposure therapy, wherein a person's fear is mitigated through gradual and repeated encounters with the source of anxiety (Pachana et al. 2007).

According to Sogari et al. (2018), curiosity is the main driver that leads people to sample insect-based dishes for the first time during such events. In their study, curiosity functioned as a psychological gateway. Once participants overcame their initial hesitation and actually tasted the insects, a positive experience with the flavor made them much more willing to eat them again. We can see a similar pattern in the work of Han et al. (2017) in South Korea. However, the situation in the BARMM was distinctive because curiosity was supported by a powerful framework of cultural and religious acceptance.

It is also critical to understand that the fear of insects is not solely psychological as it can also elicit observable physiological responses. These include facial distortion, eye closure, trembling, sweating, raised neck hairs, goosebumps, and even vomiting (Sikora and Rzymski 2025). These findings indicate that role modeling by teachers and respected community members amplified the desensitization process, but unlike in European contexts where disgust dominates (Kröger et al. 2022), in BARMM, the embedding of insects in halal and culturally familiar dishes provided an additional layer of reassurance.

To further enhance consumer acceptance of insect-based foods, incorporating entomophagy-related topics in various courses such as entomology, integrated pest management, and crop protection could be an effective strategy. From 2012 to 2022, the annual IEFs helped dispel preconceived notions and fallacies about insects, leading to increased acceptance of entomophagy among participants.

It may be useful to consider the effects of exposure therapy, a common treatment for phobias (Pachana et al. 2007). Gradual desensitization through repeated exposure to insects in the form of food consumption can help individuals confront their fear of insects. However, it is important to note that not all visitors to IEFs are willing to try insects, despite their curiosity. These non-insect eaters may benefit from alternative approaches such as processing insects into various food products, which may be more appealing and enticing to them. To further contextualize these findings, conventional and advanced processing methods (e.g. drying, milling, protein extraction) can transform insects into powders and analogs, making them less visually off-putting for hesitant consumers (Kozlu et al. 2024). Similarly, disgust and food neophobia have been documented as major psychological barriers to entomophagy within multiple cultural contexts (Kröger et al. 2022).

Factors Contributing to the Acceptance of Insect-based Foods

One of the most persistent barriers to entomophagy is the widespread perception of insects as inherently disgusting and inedible, often triggering what is commonly referred to as the yuck factor (Volden 2024). This visceral reaction is deeply ingrained in many cultural contexts and contributes significantly to food neophobia—the reluctance to try unfamiliar foods. Taste functioned as the key counterpoint to this reaction: participants who moved past initial hesitation often expressed surprise that insect dishes were pleasant, demonstrating how flavor can reframe expectations and reduce disgust.

For many attendees, this sensory experience marked a turning point, with several expressing willingness to try insect-based foods again in future events. The observations from the IEFs are consistent with findings from previous studies, which highlight taste as a key determinant of consumer acceptance of edible insects (Hartmann et al. 2015; Schouteten et al. 2016). In BARMM, however, taste was seen to be reinforced by religious legitimacy and cultural resonance, showing that sensory appeal alone is not enough without alignment to values in a Muslim-majority, post-conflict setting.

Notably, a distinct pattern among younger participants was noticed, particularly children, who displayed a higher willingness to eat insects compared to their older counterparts. Although children were not part of the formal survey, informal observations suggested that taste mattered more than appearance to them, an insight worth looking into in future research. This suggests that positioning whole insect pieces—as also recommended by Castro and Chambers IV (2019)—may resonate with younger consumers in BARMM, where adventurousness and cultural curiosity intersect with communal eating practices. The more adventurous individuals, often described as brave participants, were usually the first to volunteer in tasting challenges. Once they discovered that the flavor of insects could be pleasant, they tended to consume them repeatedly, illustrating how curiosity

and initial sensory approval can create a reinforcing cycle of acceptance.

Curiosity emerged as a significant factor influencing participants' willingness to try insects for the first time during the IEFs. Unlike in Italy, where media promotion played the dominant role (Sogari et al. 2018), in BARMM peer encouragement, playful tasting challenges, and religious reassurance were equally critical in lowering barriers. For instance, food-tasting challenges and speed-eating of live insects created an atmosphere of laughter and exhilaration while simultaneously reducing disgust and entomophobia among the participants. Witnessing others accept the challenge of eating live insects, such as the Asiatic palm weevil (*R. ferrugineus*), rhinoceros beetles (*O. rhinoceros*), and mealworms (*Z. morio)*, encouraged curious visitors to taste the insect-based menu themselves.

Popularizing insect-based foods through the media may have also played a significant role in promoting the consumption of insects in the region, particularly through the coverage of the IEFs held at MSU Main Campus. The IEFs gained visibility and reached a wider audience through their features on the prominent and multi-awarded television programs "Kapuso Mo, Jessica Soho" and "I-Witness" by Howie Severino both on GMA 7 (GMA Network, Inc., Quezon City), as well as national radio programs, such as "Pinoy Scientist" on DZEC 1062-Radyo Agila (Eagle Broadcasting Corporation, Quezon City) and "Sa Kabukiran" on DZMM (ABS-CBN Broadcasting Center, Quezon City, Metro Manila). These are examples of media appearances are effective in increasing consumers' attention and awareness of entomophagy in Italy (Sogari et al. 2018). The coverage provided an opportunity to highlight the IEFs, educate the public about the benefits of consuming insects, and challenge prevalent misconceptions.

University-led Research and Agricultural Extension

Through its agricultural extension program, MSU-Marawi campus is actively contributing to the development and promotion of entomophagy as a sustainable and innovative food solution. The university provides valuable educational opportunities and immersive experiences through the IEFs, which serve as a platform for promoting entomophagy. Since 2012, the university has been actively integrating entomophagy-related topics into class lectures, ensuring that students have access to comprehensive knowledge on this subject.

Beyond education, these efforts illustrate how MSU-Marawi has helped bridge the gap between scientific nutrition and cultural acceptability in a Muslim-majority region. By contextualizing entomophagy within halal principles and presenting it through culturally familiar dishes, the IEFs moved insect consumption beyond a laboratory experiment and into a socially and religiously meaningful practice. Such convergence of scientific education and cultural legitimacy not only reduced entomophobia but also fostered trust, highlighting the capacity of universities to mediate between modern nutritional science and deeply rooted community values.

Recognizing the importance of research and development, the university has secured both in-house funding and external research grants from the Commission on Higher Education. These resources supported the mass-rearing of edible insects, contributing to the growth and sustainability of this emerging industry. Furthermore, the university has fostered collaborative partnerships to further advance the field of entomophagy in allied fields. By collaborating with the DOST-Philippine Nuclear Research Institute and receiving assistance from the International Atomic Energy Agency (IAEA), the university is conducting research on the functionality of insect-based foods, given the recent discoveries that insect-based peptides have antioxidant, anti-angiotensin-converting enzyme, anti-dipeptidyl peptidase-IV, anti-glucosidase, anti-lipase, anti-lipoxygenase, anti-cyclooxygenase, anti-obesity, and hepatoprotective activities (Quah et al. 2023). This collaboration aims to explore the potential of these innovative food sources and promote their sustainable utilization. This commitment to research and innovation has positioned the university as a leader in exploring possibilities for insect-based food production in the country.

Cultural Nuances and Post-conflict Recovery

Insects deemed edible in early Christian, Jewish, and Islamic sacred texts align with Islamic tradition, permitting the consumption of specific insects like locusts, bees, ants, and termites (El-Mallakh and El-Mallakh 1994). During the IEFs, Muslim students adhered to Islamic principles, preparing regional cuisines, such as palapa and beef rendang infused with locusts, exemplifying a harmonious blend of tradition and innovation. This culinary pathway—where halal framing and cultural familiarity intersect—differs from European interventions, where entomophagy often enters as an exotic novelty rather than a recovery and resilience tool.

The university's initiatives to promote entomophagy received reinforcement from influential Muslim women academic leaders who recounted their childhood experiences of consuming locusts during the IEFs. Such leaders function as "embodied advocates," whose credibility is rooted in both scholarly expertise and cultural authenticity. Their endorsement of insect-based dishes—especially when prepared in culturally resonant formats like palapa or rendang—helped reduce entomophobia and fostered

openness among Meranao participants. In post-conflict settings like BARMM, where identity and trust are fragile, the presence of respected female figures helped bridge the gap between scientific nutrition and cultural acceptability.

This interpretation aligns with the FAO's Gender Transformative Approaches framework, which emphasizes the need to challenge structural barriers and power imbalances by empowering women as agents of change in food systems. The FAO highlights that mentorship, peer networks, and leadership grounded in lived experience are essential for catalyzing sustainable and equitable food innovations. By fostering collective agency and promoting courageous leadership practices, women not only influence dietary norms but also reshape governance structures to be more inclusive and resilient (FAO 2023).

Finally, the advocacy of entomophagy in the region has also played a role in Marawi's post-conflict recovery. The Marawi Siege, a five-month-long armed conflict, left a lasting impact on the community. Insect-based food has emerged as a sustainable and innovative solution, not only addressing nutritional challenges but also providing economic opportunities. The university's engagement in entomophagy, especially in the aftermath of the conflict, has contributed to rebuilding livelihoods and fostering resilience in Marawi.

This study demonstrates that IEFs in post-conflict BARMM can effectively promoted entomophagy by improving awareness, reducing entomophobia, and fostering cultural acceptance through community-based engagement. Beyond enhancing knowledge and attitudes, the integration of Islamic dietary principles reinforced legitimacy, supporting the potential development of halal-certified insect products.

From a policy and development perspective, the IEF model provides a scalable approach for local governments, educators, and extension programs to integrate insect-based foods into nutrition, food security, and livelihood initiatives. Such culturally grounded interventions are particularly relevant in disaster-prone and resource-limited areas, where resilience and affordable protein alternatives are urgently needed.

While the IEFs demonstrated clear potential in improving awareness and acceptability of entomophagy, the study is limited by its descriptive, cross-sectional design and the use of different participant groups and insect recipes across years. These constraints preclude direct longitudinal comparisons, but the findings nonetheless highlight the potential for culturally grounded interventions in normalizing edible insects in post-conflict and food-insecure settings. Future research should examine sustained adoption, economic and health outcomes, and the role of entomophagy in broader resilience strategies in both local and regional food systems.

FUNDING

This work was supported by a grant from the Commission on Higher Education Grants-in-Aid and by the International Atomic Energy Agency (IAEA-RCA, Contract No. 24363). Additional support for the technology transfer component of superworm production in BARMM was provided by the Southeast Asian Regional Center for Graduate Study and Research in Agriculture (SEARCA).

DECLARATION OF COMPETING INTEREST

The authors declare that they have no competing interests.

GENERATIVE AI STATEMENT

During the preparation of this work the authors utilized ChatGPT-5 to enhance grammar and improve the clarity of the text. After using this tool/service, the authors reviewed and edited the content as needed and take full responsibility for the content of the published article.

ETHICAL CONSIDERATIONS

We adhered to the Philippine National Ethical Guidelines for Health and Health-Related Research developed by the Philippine Health Research Ethics Board (PHREB 2017).

ACKNOWLEDGMENTS

The authors are grateful for the support from the Philippine Army (Campo Ranao, Marawi City) for their assistance with the survey and information dissemination; Candida Adalla (University of the Philippines-Los Banos); Michael Colon (Philippine Coconut Authority-Butuan); Olivia Ablao, Estrella Franco and Saturnino Parcasio (Department of Agriculture); Leo M. Aguanta, Jocelyn Aman, Pangandag Magolama, Celeste Querijero, Rasid Paca and Teresita Sanchez (MSU) for technical and administrative support; and the logistical support and endorsements from the Philippine Coconut Authority, Department of Agriculture, and the LGUs of Barrio Sikap, Cabingan, and Palao, Lanao del Sur. The authors also express their gratitude to the reviewers for

their valuable feedback and patience in reviewing the manuscript.

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ROLE OF AUTHORS: *CCD –analysis of data, collection, drafting and revising the manuscript; EMS – concept, design, collection, analysis of data, drafting and revising the manuscript.*

Responsible Editor: Roger G. Dolorosa, PhD