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The enrichment of Kelulut (*Trigona* spp.) feeding plants for its sustainability in mangrove ecotourism Beras Basah Village, Langkat Regency, North Sumatra, Indonesia

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ABSTRACT

The cultivation of Trigona honey bees by the "Kelompok Tani Peduli Pesisir" (Coastal Care Farmer Group) has strong potential for rapid development due to the abundant availability of food plants that support the life of kelulut bees (*Trigona* spp.), particularly from home gardens in mangrove areas. The diversity of plant species is crucial for ensuring a steady supply of nectar, pollen, and resin, which directly impacts honey production. However, limited community knowledge about suitable plant species and the lack of plant variety pose challenges to sustainable *Trigona* spp. beekeeping. This community service initiative aims to introduce potential food sources for kelulut bees and provide plants to enrich the variety of feed sources, ensuring availability year-round. Activities include 1) preparing plant materials and planting media, 2) planting fruit trees, and 3) conducting educational outreach. As a result, farmers' knowledge and the diversity of beneficial perennial plants such as mango (*Mangifera indica*), jackfruit (*Artocarpus heterophyllus*), and water apple (*Syzygium aqueum*) have increased, contributing to the sustainable development of Trigona spp. bee cultivation.

Keyword: Kelulut (*Trigona* spp), feed source, Mangrove Ecotourism Beras Basah Village

ABSTRAK

Budidaya lebah madu *Trigona* spp. oleh Kelompok Tani Peduli Pesisir berpotensi untuk berkembang pesat karena tersedianya bahan makanan atau tanaman yang dapat menopang kehidupan lebah kelulut yang banyak. Pakan *Trigona* spp. bersumber dari tanaman pekarangan di kawasan mangrove. Keterlibatan berbagai tanaman dalam menjamin ketersediaan sumber pakan lebah *Trigona* spp. sangat penting karena sangat berpengaruh terhadap hasil produksi madu. Selain kurangnya pengetahuan masyarakat tentang jenis tanaman yang berpotensi sebagai sumber pakan lebah trigona, minimnya varietas tanaman untuk mendukung sumber pakan lebah menjadi salah satu kendala dalam pengembangan budidaya lebah *Trigona* spp. Tujuan dari kegiatan pengabdian kepada masyarakat ini adalah untuk mengenalkan sumber pakan lebah kelulut dan menyediakan tanaman untuk melestarikan pakan *Trigona* spp. dengan cara memperkaya jenis tanaman sumber pakan, sehingga tersedia sepanjang musim. Metode kegiatan ini meliputi (1) persiapan pengadaan bahan tanaman dan media tanam, (2) penanaman pohon buah, (3) sosialisasi. Hasil pengabdian kepada masyarakat adalah peningkatan pengetahuan petani dan keanekaragaman jenis tanaman yang berfungsi sebagai sumber makanan bagi *Trigona* spp., penghasil nektar, serbuk sari, dan damar, meliputi tanaman tahunan (buah). Varietas tanaman tahunan

(buah) yang meningkatkan sumber makanan bagi *Trigona* spp., meliputi nektar, serbuk sari, dan damar meliputi mangga (*Mangifera indica*), nangka (*Artocarpus heterophyllus*), dan jambu air (*Syzygium aqueum*).
Keyword: Pengabdian Kepada Masyarakat, Saus Cabai, Serbajadi, Serdang Bedagai, Teknologi Pasca Panen,

1. Introduction

Stingless bees or kelulut (*Trigona* spp.) are a group of small bees that are included in a group called Meliponini and are still closely related to stinging honey bees (*Apis* spp.) in the Apidae family [1]. People in various places in Indonesia have known these mini bees produce honey that can be consumed. The "Peduli Pesisir" Farmers Group has commenced the cultivation of the kelulut honey bees in a mangrove-based agro-tourism region located in Beras Basah Village, Pangkalan Susu District, Langkat Regency, North Sumatra [2]. Bees are crucial to the ecosystem because they pollinate and cultivate diverse plants. It has been utilized as a commercial pollinator, particularly stingless bees, because of their non-stinging nature. Furthermore, they serve a vital function in preserving genetic variety and fruit quality [3]. Aside from honey, stingless bees generate other products, such as propolis, beebread, cerumen, and bee pollen, which have useful medical characteristics [4]. Propolis from Trigona provide antimicrobial, anti-inflammatory and immunostimulant activities [4]. Furthermore, the bioactive compounds in stingless bee honey promote antioxidant and anti-inflammatory effects, which is crucial to tackle various neurological disorder [5].

Stingless bee honey has several differences when compared to stinging bee honey (*Apis* spp.). These differences including water content, distinctive sour taste character, and antimicrobial activity [1]. According to [6] the honey production process in stingless bees involves a fermentation process assisted by microbes both in the honey pot and after the harvesting process. Stingless bees store honey in bags made of plant sap/resin, commonly called honey pots. The source of the sap varies and determines the properties of the honey, particularly in terms of aroma. Trigona bees take nectar as honey material from various types of flowering plants. Their small body size can reach various flower sizes. The ability to explore a variety of flowering plants makes trigona produce complex and unique flavors [1].

Bees favour an ideal environment that is rich in food sources and nesting materials [7]. Feed is a crucial necessity for stingless bee farming to be sustainable and a shortage of it will be a serious concern. Furthermore, insufficient nectar and pollen food supplies as a source of carbohydrates and protein can result in weak honey bee colonies, a limited number of worker bees, reduced production of honey, pollen, and royal jelly, and decreased productivity of queen bees [8]. Stingless bees actively forage on diverse floral resources throughout the year, but are proposed to have stronger interactions with some groups of native plants than others [9]. For beekeepers, having an excellent location with many plants that generate nectar and pollen is the most important factor in their success.

Plants that support cultivation include those that yield nectar, pollen, and resin 10]. According to [11], one of the challenges in the increase of kelulut production is the farmer's lack of knowledge about the types of potential kelulut feed sources. In addition, most kelulut honey bee farmers have difficulty in procuring bee feed source. Thus far, the farming community has relied solely on plants in the surrounding area such as fruit plants. The enrichment feed source such as planting activities and knowledge dissemination regarding kelulut's feed sources knowledge can solve solutions in providing sustainable sources of kelulut honey bee feeding plant in a mangrove-based agro-tourism region located in Beras Basah Village, Pangkalan Susu District, Langkat Regency, North Sumatra.

2. Methods

The community service activities include socialization and tree planting to support bees. Stages of action including;

2.1. Preparing plant materials

We planted the annual plant varieties (fruits) that enhance the food sources for Trigona spp. including mango (*Mangifera indica*), jackfruit (*Artocarpus heterophyllus*), and water apple (*Syzygium aqueum*). The plants were donated from the nursery belongs to Watershed Management Office (BPDAS), Wampu Sei Ular, North Sumatra, Indonesia (Figure 1). Then, we sent these fruits plants to "Peduli Pesisir" Farmers Group Mangrove

Ecotourism Beras Basah Village, Langkat Regency, North Sumatra, Indonesia where the community service was conducted as depicted in Figure 2.

Figure 1. Plant nursery belongs to BPDAS Wampu Ular, North Sumatra.

Figure 2. The plants were sent to “Peduli Pesisir” Farmers Group in Mangrove Ecotourism Beras Basah Vilage, Langkat Regency, North Sumatra.

2.2. Planting the feed source plant of kelulut bees in the honey bee farm

Pollination and floral resource optimization are the strategies underscores the importance of kelulut bees in pollination, particularly in enhancing nearby crops and plants, so benefiting both the bees and local agricultural output [12]. Perennial flora is maintained near the hives to ensure a consistent availability of pollen and nectar. Strategically planting nectar-rich flora, such as mangrove species and flowering plants, improves resource availability, hence boosting bee colony health and productivity [2]. The fruits plants will be planted nearby farms cultivating stingless bees in the Mangrove Ecotourism Beras Basah Village (Figure 3).

Figure 3. Planting the tree in the honey bee cultivation’s environment.

2.3. Sharing discussion regarding fruit trees as a food source for bees

Twenty-one farmers participated in training session focus on kelulut honey bee food source. Peer-to-peer learning sessions and demonstrations of scientific beekeeping practices increase local expertise and support the long-term sustainability of the initiative. Research supports that continuous training and community involvement are essential for the successful adoption of improved agricultural practices. The expert from international peer group from Tottori University, Japan were involved in this section which was gave a lot of knowledge and experience regarding honey bee practices for sustainable environment in mangrove ecosystem (Figure 4). Next, farmers knowledge regarding kelulut (Trigona spp.) feeding plants will be assessed by questionnaire.

Figure 4. Sharing discussion with the expert from Tottori University (Japan), Universitas Sumatera Utara and Universitas Tjut Nyak Dhien (Indonesia).

3. Results and Discussion

3.1. Enrichment of plant

Kelulut bee rely on natural, wild, and cultivated plant sources for their livelihood. The availability of food source plants has an impact on the growth and sustainability of bee colonies since kelulut bee depend on pollen and nectar as food and plant resin to construct their nests [13]. Lack of food sources as the one of the inhibiting factors, will have an impact on the decline in colony population, reduced honey and propolis production. Kelulut is a social bee that has an important role in the regeneration of forest plants and agricultural crops because of its role as a pollinator. The abundance of food sources will increase the production of kelulut bee honey and propolis. Flowering plants that produce nectar (bee food) and pollen (food source for honey bee larvae and provides protein, vitamins and minerals for bees), and resin (to build and protect hives from disturbances) in a balance quantity is food sources that favored by kelulut bee [9][13].

Fruit plants, commonly referred to as multi-Purpose Tree species (MPTs), are frequently cultivated to boost stingless bees' ability to acquire food. Therefore, these supporting factors can offer stingless bee for nectar, pollen, and resin including provide highly valuable fruit, wood and leaves [8]. Furthermore, MPTs plants are easier to attract worker bees gathering nectar and pollen because of their attractive aroma and variety of flower colours [8][14]. This community services enriched the kelulut bee farm with the annual plant varieties (fruits) that enhance the food sources for Trigona spp., including mango (*Mangifera indica*), jackfruit (*Artocarpus heterophyllus*), and water apple (*Syzygium aqueum*) (Figure 5 and 6).

Figure 5. Handover the plants to the leader of Farmers Group “Peduli Pesisir” and Honey Bee Farmer.

Figure 6. Planting the tree in the honey bee cultivation's environment.

Mango (*Mangifera indica* L.) is one of the most cultivated tropical fruits in the world including Indonesia. reported that *M. indica* might be a preferred botanical source of propolis from a tropical zone [15]. *M. indica* cultivated nearby honey bee cultivation could produce nectar, resin, and pollen which provide the feed for stingless bees. These plants are significant sources of propolis, as bees can gather two different substances from mango trees for propolis production: a reddish-brown resin from the bark and latex from the fruit [8]. In addition, the main metabolites of pollen and/or nectar together with other mango can be incorporated as food supplements to enhance the activity and survival of pollinators such as honey bee [16]. *Syzygium aqueum* also known as the brush cherry tree, can be a good food source for honey bees, particularly for its nectar and pollen. The tree's flowers are attractive to bees, and the fruit can also be a source of food. Honey bees prefer to visit plants depending on plant species and location altitudes. [17] reported that *S aqueum* is the types of potential plants that were available and visited by stingless honeybees in Jambi and South Sumatra. Meanwhile, *Artocarpus heterophyllus* (jackfruit) is a known source of resin and latex for stingless bees and utilize this plant material to produce cerumen and propolis [18]. These three species of fruits plants could enhance the productivity of the kelulut bee in the future and the farmers should get impact from this activity.

3.2. Knowledge of farmer regarding enrichment of plant

The improvement of farmers' understanding can be proven by giving several questions after the socialization is carried out [19]. Increasing farmers' knowledge can be seen from the initial test and final test during the socialization activity. A pre-test is given before the socialization to assess farmers' initial understanding of the types and use of the correct fertilizer dosage. After the socialization and demonstration session, a post-test is given to measure their increasing accomplishment. Comparison of the results of the pre-test and post-test provides an overview of the effectiveness of the socialization activity in increasing farmers' knowledge.

We gave questions (pre-test and post-test) to the respondent to measure their level of knowledge about regarding kelulut bee (Trigona spp.) feeding plants in Mangrove Ecotourism Beras Basah Village, Pangkalan Susu Sub-District, Langkat Regency, North Sumatra, Indonesia and the result demonstrated in Figure 7.

Through the pre-test, it was found that the average score of respondents from "Peduli Pesisir" group of farmers regarding feeding plant of honey bee about 47.6. With the socialization, it can be seen that the post-test results reached high score about 89.5 (Table 1).

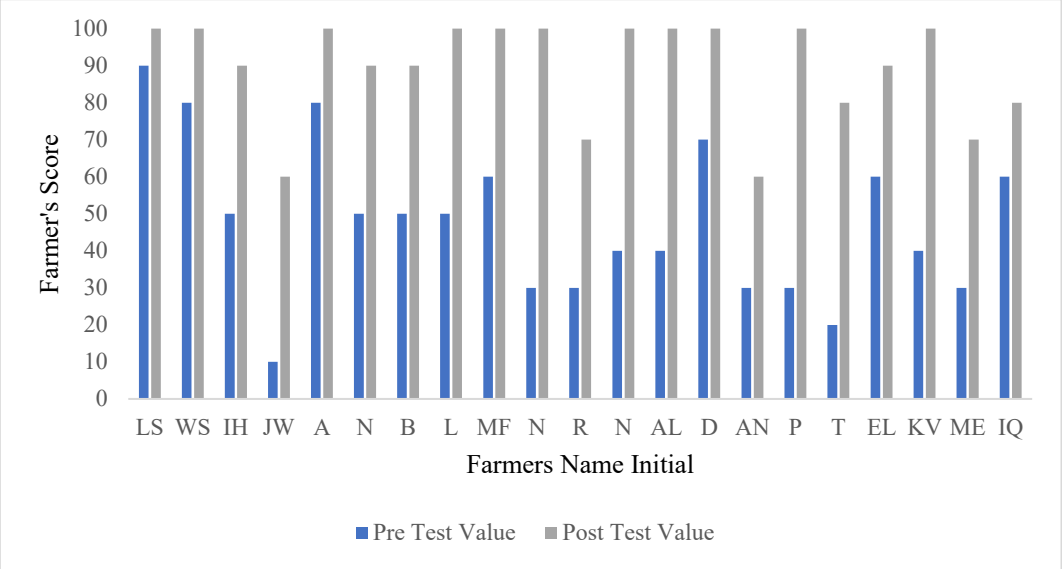

Figure 7. Pre-test and post-test the farmer knowledge regarding kelulut bee (Trigona spp.) feeding plants in Mangrove Ecotourism Beras Basah Village, Pangkalan Susu Sub-District, North Sumatra, Indonesia. (LS,WS,IH, JW, A, N, B, L, MF, N, R, N, AL, D, AN, P, T, EL, KV, ME, IQ are farmer's name initial).

Based on the data in Table 1, it can be seen that farmers' knowledge has increased very positively, reaching 41.5 points after the socialization material was presented. Hence, the socialization in this community activity could enhance the knowledge regarding kelulut (Trigona spp.) feeding plants of the farmers. Research consistently highlights the vital role of continuous agricultural training and robust community involvement in successfully adopting improved farming practices [20]. Hence, these factors are essential for enhancing productivity, promoting sustainability, and improving livelihoods among bee farmers.

Table 1. Pre-test and Post-test the farmer knowledge

Test	Responden (person)	Average Score
Pre test	21	47.6
Post test	21	89.5
Increase		41.5

4. Conclusions

This community service activity aims are the enhance of farmers knowledge and diversity of plant species that serve as food supplies for kelulut bee, yielding nectar, pollen, and resin, encompassing annual plants (fruits). The result of the socializations has the positive result which is could increase the farmer's knowledge regarding kelulut (Trigona spp.) feeding plants. Furthermore, the tree planting activity in this community services could enrich the kelulut bee farm with the annual plant varieties (fruits) that enhance the food sources. Follow up of this activity is the farmers should add more fruit plants for feeding the kelulut bee in order to increase the productivity including to provide other benefits.

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References

[1] S. Harjanto, M. Mujianto, Arbainsyah, A. Ramlan, *Budidaya Lebah Madu Kelulut Sebagai Alternatif Mata Pencaharian Masyarakat*, *[Kelulut Honey Bee Cultivation as an Alternative Livelihood for the*

Community], Goodhope Asia Holdings Ltd, Environmental Leadership & Training Initiative (ELTI), Tropenbos Indonesia dan Swaraowa, 2020.

[2] M. Basyuni, A. Mubaraq, A.A. Aznawi, I. Sivaipram, E.S. Siregar, N. Sulistiyono, "Kelulut (*Trigona* spp) cultivation to increase production and additional income of mangrove ecotourism Peduli Pesisir Farmer Groups, Beras Basah Village, Pangkalan Susu Sub-District, North Sumatra, Indonesia", *Journal of Community Services: Sustainability and Empowerment,* vol.04, no. 02, pp. 1–11. 2024.

[3] B.F. Bartelli, F.H. Nogueira-Ferreira, "Pollination services provided by Melipona quadrifasciata Lepeletier (Hymenoptera: Meliponini) in greenhouses with *Solanum lycopersicum* L. (Solanaceae)", *Sociobiology*, vol. 61, no. 4, pp. 510–516. 2014.

[4] M.A.I. Al-Hatamleh, J.C. Boer, K.L. Wilson, M. Plebanski, R. Mohamud, M.Z. Mustafa, "Antioxidant-based medicinal properties of stingless bee products recent progress and future directions", *Biomolecules*, vol. 10, no. 923, pp. 1–28. 2020.

[5] N.A. Zulkifli, Z. Hassan, M.Z. Mustafa, W.N.W. Azman, S.N.H. Hadie, N. Ghani, A.A. Mat Zin, "The potential neuroprotective effects of stingless bee honey", *Frontiers in Aging Neuroscience*, vol. 14, no. 2, pp. 1–18. 2023.

[6] P. Vit, D.W. Roubik, S.R.M. Pedro (Ed.), *Pot-Honey: A legacy of stingless bees. In Pot-Honey: A Legacy of Stingless Bees*, Springer Science & Business Media, 2013.

[7] P. Rosawanti, N. Hidayati, H. Hariyadi, N. Hanafi, B. Iskandar, "Pemberdayaan masyarakat dengan budidaya pakan lebah dan pemanenan madu kelulut", [Community empowerment with bee forage cultivation and kelulut honey harvesting], *SELAPARANG: Jurnal Pengabdian Masyarakat Berkemajuan*, vol. 6, no. 3, p. 1082, 2022.

[8] B. Rahmad, N. Damiri, Z. Hanafiah, D. Adriani, L. Hanum, "Food source diversity and honey production in stingless bee meliponiculture, Ogan Komering Ulu Timur, South Sumatra, Indonesia", *Biodiversitas,* vol. 25, no. 6, pp. 2747–2756, 2024.

[9] F.G.B. Bueno, L. Kendall, D.A. Alves, M.L.Tamara, T. Heard, T. Latty, R. Gloag, "Stingless bee floral visitation in the global tropics and subtropics", *Global Ecology and Conservation*, vol. 43, no. 3, p. e02454, 2023.

[10] H.F. Abou-Shaara, "Availability of nectar and pollen sources for honey bees in Oman", *Journal of Agricultural Sciences*, vol. 10, pp. 1–2, 2019.

[11] E. Wahyuningsih, M. Syaputra, P.K. Suparyana, I.P.A.T. Maya, A.T. Lestari, "Identifikasi diversitas sumber pakan lebah berbasis lahan pekarangan pada meliponikultur", [Identification of bee forage sources diversity based on home garden in meliponicultural], *Jurnal Penelitian Hutan Tanaman*, vol. 19, no. 1, pp. 29–44, 2022.

[12] M.S. Salleh, M. F. Yunus, A. Ahmad, "Integrated farming of stingless bee and pesticide-free chilli fertigation: sharing experience from Knowledge Transfer Project (KTP-RIGS) with Persatuan Anak Kuantan Utara and organic farm venture", *Revelation and Science*, vol. 1, no. 1, pp. 71–79. 2023.

[13] Ministry of Environment and Forestry of Republic Indonesia. *Success In Kelulut Honey Beekeeping (Trigona Sp.) "A Story from Forest Outskirts" (First).* Directorate of Peat land Degradation Control. 2022.

[14] N.A. Zariman, N.A. Omar, A.N. Huda, "Plant attractants and rewards for pollinators: their significant to successful crop pollination", *International Journal of Life Sciences and Biotechnology*, vol. 5, no. 2, pp. 270–293, 2022.

[15] A.M. Fikri, M. Popova, A. Sulaeman, V. Bankova, "Stingless bees and *mangifera indica*: A close relationship? Indian Journal of Natural Products and Resources", vol. 11, no. 2, pp. 130–134. 2020.

[16] M. Sánchez, A.C. Abreu, A.I. Tristán, Y. Velásquez, I. Fernández, J. Cuevas, "Floral attractants and rewards to pollinators in *Mangifera indica* L.," *Scientia Horticulturae*, vol. 332, no. 4, 2024.

[17] Y. Pujiastuti, W. Herlin, A. Meilin, "Variation of plant species as feed sources in honey beekeeping in Jambi and South Sumatera Indonesia", *IOP Conference Series: Earth and Environmental Science*, vol. 1346, no. 1, 2024.

[18] U. Layek, N. Das, S. Kumar De, P. Karmakar, "The botanical origin of cerumen and propolis of Indian stingless bees (*Tetragonula iridipennis* Smith): pollen spectrum does not accurately indicate latex and resin sources", *Apidologie*, vol. 54, no. 2, 2023.

[19] S.K.I. Rahmadani, R.A.S. Adriafirna, E.N.M. Rohmah, D. Atasa, "Improving farmer knowledge on the use of subsidized and nonsubsidized fertilizers in Sukoanyar Village, Turi Subdistrict, Lamongan Regency", *JATI EMAS (Jurnal Aplikasi Teknik dan Pengabdian Masyarakat)*, vol. 8, no. 3, pp. 27–32. 2024.

[20] E. Raji, T.I. Ijomah, O.G. Eyieyien, "Improving agricultural practices and productivity through extension services and innovative training programs", *International Journal of Applied Research in Social Sciences*, vol. 6, no. 7, pp. 1297–1309, 2024.