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Identification of honey bee plant sources to support the planning of apiculture locations in Sibolangit Natural Tourism Park

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ABSTRACT
Sibolangit Natural Tourism Park (SNTP) is a forest with an essential ecological function and is considered a conservation area. SNTP is currently trying to increase the benefits of the forest through non-timber forest products, namely, honey bee cultivation. This study aimed to identify the type of plant source of bee feed plants in SNTP. The methods utilized are literature studies and observational studies using two radius points, namely radius one and radius two, at a 500-meter separation. Based on the results of a literature study, it was found that 56 species of bee food sources in SNTP, including 36 plant species, of which the flowering period has been identified, namely 19 species of flowering plants throughout the year and 17 flowering seasonally. Based on the point one observation radius results, 25 species of bee feed plants were obtained, with the dominant plant being *Coffea arabica*. A radius of two through 10 types of bee feed plants was obtained at the observation point. The dominating plants are *Arenga pinnata*, *Arenga obtusifolia*, and *Coffea arabica*. Observation of radius one shows a more diverse variety of plants than radius two. The diversity of bee food plants in SNTP supports the honey bee cultivation.
Keyword: Apiculture, Honey Bee Feed, Sibolangit Natural Tourism Park

1. Introduction

The forest is a vital component of the natural world. A forest is, by definition, an ecosystem in its purest form, preserving its original land. Trees in harmony with nature and their surroundings, where each is interconnected, are dominated by the power of natural life (Law No. 41 of 1999). The rate of deforestation does not negate the width and richness of Indonesia's natural forests. Based on data from the Directorate General of PKTL KLHK, deforestation in Indonesian forests in 2018–2019 was 462.46 thousand hectares. Deforestation is when a previously vegetated area turns into an arid region or from a forested area to none [1].

Several approaches are available to support the effort to reduce the rate of deforestation, including sustainable forest management (SFM). Sustainable Forest Management is a dynamic process about growing, maintaining, and improving economic, social, and environmental forests for the current and future interest. At the local level, the Formation Unity Manager Forest (UMF) unit oversees entity management, planning, utilization management, participation with stakeholder interests, and new direct handling governance of the forest. By status and function characteristics, the types of FMUs are differentiated into Unity Management Forest Production (UMFP), Unity Management Forest Conservation (UMFC), and Unity Management Forest Protection (UMFP) [2].

SNTP Park is a forest with roles and functions that are important for the surrounding area. It is considered a conservation area. One of them is a functional ecology where an area of forest functions as a catchment and protective springs to prevent erosion. SNTP also works to lower the rate of deforestation. One approach SNTP takes to reduce deforestation is using Non-Timber Forest Products (NTFP) that can be obtained from the forest.

NTFPs are the results of forest biological goods, vegetables, and animals, along with their derivatives and cultivation, except wood.

Identifying plants in support of the availability of bee feeds and determining the type of bee is important to do in planning the cultivation of bee honey. The plan for cultivating bee honey is located in Sibolangit, which is directly administratively located in the Village of Sibolangit, District Sibolangit, North Sumatra. This area is perfect for the location development cultivation of bees because it is in the fringe forest area with vegetation, plant flowers, fruit, and wood, which are abundant as a source of feed for bees [3]. This study aimed to identify the type of plant source of bee feed plants and test suitable locations for planning the cultivation of bee honey at Sibolangit Natural Tourism Park.

2. Materials and Methods

2.1. Research Time and location

The research was conducted from February to June 2023. Sibolangit Natural Tourism Park, Village Sibolangit, District Sibolangit, Deli Serdang Regency, North Sumatra.

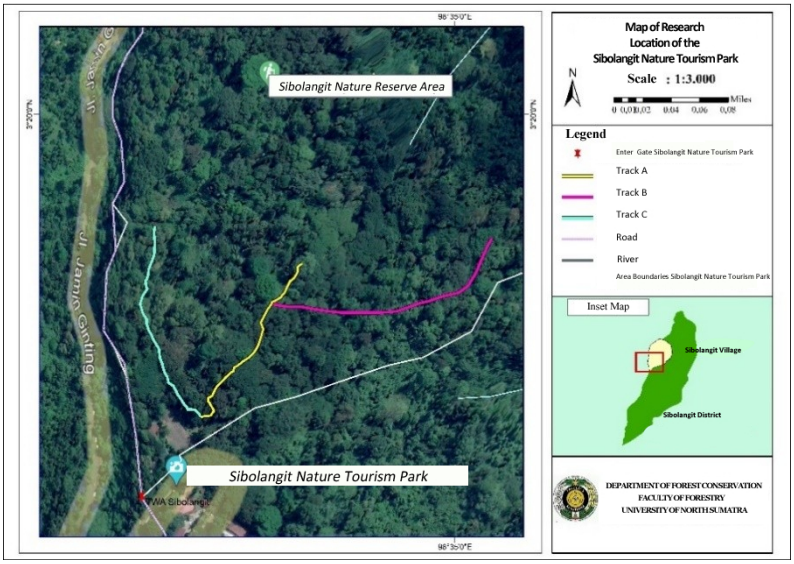

Figure 1. Trail map of SNTP

2.2. Materials

The tools in this research were binoculars, machetes, pickaxes, mobile phones equipped with Avenza maps, a calculator, a camera timestamp, a laptop device with Microsoft Word, Microsoft Excel, ArcMap 10.8, and Google Earth. Materials were a tally sheet, a label card, a data type list of plants in TWA Sibolangit obtained from Resort Sibolangit, a data type plant source feed for bees, and season data on flowering plant source feed obtained from journals and books related to research.

2.3. Methods

2.3.1. Collection of Plant Data Source Feed Bees at TWA Sibolangit

The type of data collection plan source feed bees in this research uses two methods: bibliography and observation [3].

2.3.2. Method bibliography (studies literature)

Data collected and reviewed in this study include a list of data type plants in SNTP obtained from Sibolangit Natural Resources Conservation Resort, data type plants, and seasons of flowering source feed bees, as well as several references from the journal and book related to bee feed. From the data type list, plants in SNTP will identify the plant source feed bee containing the plant's nectar, pollen, and resin. After identifying the source feed, the bee will identify and carry on the timetable or flowering period of the plant source feed.

2.3.3. Method observation (study observation)

Method observation is a technique of data collection carried out through studies, observations, and accompanied recording of circumstances or objects under study.

According to [4], the research on determination is based on the assumption that the ability to roam of bee workers is within a 500-meter radius. The site to be studied is 78.5 hectares, with a radius of ± 500 meters. The first observation area is 4 hectares since 5% sample intensity is used. When two observation sites are used, the area's total size is 8 hectares. This is related to the assertion made by Boon and Tideman (1950), which [5] cited. They stated that 5%–10% of the sample should be used if a large forest is not sufficiently vast, 1,000 ha or more. SNTP spans 24.85 hectares, of which 8 ha (or 32% of the total area) is the study area. According to Gay and Diehl (1992), referenced in [6], the form and character population will be more prevalent in the research descriptive sample, the larger the sample that is obtained.

The steps taken in the method observation are as follows: Observation was done with a 500-meter radius method. Based on [7], *Trigona*'s size is smaller, has a cruising radius between 350 - 500 meters, and A. *cerana* between 500–1000 meters. The observation radius sketch is presented in Figure. The number of radius points observed in the study there are 2, namely T1 (radius 1) and T2 (radius 2). Necessary things studied and observed in the observation radius, namely distance from the point center, found the plant source bee feed, name of plants, types of source feed, and conditions of the plants (flowering, fruiting, or no). The results of radius observations were recorded in a tally sheet. Every related plant object of research on the pathways observation radius transect was recorded with the application Avenza Maps and documented with a camera timestamp. Another necessary thing in radius observation is the observation of pests /predators, water sources, bees, or a beehive. This observation must be done to support the plan suggestions for the location cultivation of the honeybee.

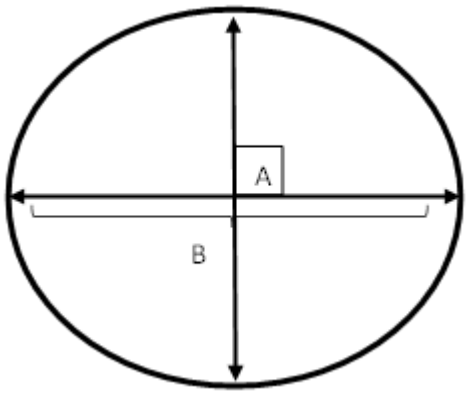

Figure 2. Observation Radius Sketch
Description : A = point observation , B = 500 meter observation radius

2.3.4. Testing Cultivation Sites for Bee Honey

The method used to define location suggestions for cultivating honeybees is the radius method. After observing the radius of T1 and T2 and obtaining the result, the next step is to compare the second results from that radius. Indicators to be compared in location suggestions. This is the type and amount of variation, abundance of plants, the most dominant plant, the flowering period, and there are bees/hives, bees, and pests /predators.

3. Results and Discussion

3.1. Studies Plant Library Feed Bees at TWA Sibolangit

Based on secondary data from the List of Plant Names in the SNTP Area, there are as many as 525 plant species, including 78 ornamental plants and 99 medicinal plants scattered throughout the SNTP. This shows the SNTP's diversity of tall plants. Statement [8] stated that the determination of the Sibolangit Natural Tourism Park is based on considering the diverse flora and fauna. Flora that grows in the area is a mix of original and exotic parts originating from outside (plant exotic). Plants from outside include Angsana (*Pterocarpus indica*), a plant local to mangosteen (*Grace* sp.), mahogany (*Swietenia mahagoni*), and ketapang (*Terminalia catappa*). Based on these data, the type of potential plants as source feed for bees are plants containing nectar, pollen, and resin. Results of identifying plant source feed bees at Sibolangit Natural Tourism Park using method studies and literature can be presented in Table 1.

Those results show that the characteristics of the source feed for the bees in Sibolangit Natural Tourism Park are very diverse. By statement [9], the availability of plant feed bees and the abundance of source feed are the main determinants of successful business cultivation of bee honey. This is because the development and productivity of the bee colony are very dependent on feed availability, which is nectar and pollen from the plant.

Table 1. Studies Literature Plant Source Feed Bees at Sibolangit Natural Tourism Park

No.	Local name	Scientific name	Family	Type	Source References
1.	Angrung	*Oriental trema*	*Ulmaceae*	P	[10]
2.	Aren	*Arenga Pinnata*	*Palmae*	N	[11]
3.	Bakung	*Crinum asiaticum*	*Amarylidaceae*	P	[12]
4.	Belimbing manis	*Averhoa calambolla*	*Oxalidaceae*	NP	[13]
5.	Belimbing wuluh	*Averhoa blimbi*	*Oxalidaceae*	NP	[13]
6.	Bunga bugenvil	*Bouganviella spectabilis*	*Nighaginaceae*	N	[9]
7.	Bunga soka hutan	*Ixora salicifolia*	*Rubiaceae*	N	[9]
8.	Bunga soka kampung	*Ixora coccinea*	*Rubiaceae*	N	[9]
9.	Bunga soka loreng	*Ixora javanica*	*Rubiaceae*	N	[9]
10.	Cempedak	*Artocarpus integra*	*Moraceae*	NPR	[14]
11.	Cengkeh	*Syzygium aromaticum L.*	*Myrtaceae*	NP	[9]
12.	Duku	*Elderly domesticum*	*Meliaceae*	N	[15]
13.	Durian lokal	*Durio zibethynus*	*Bombacaceae*	NPR	[15]
14.	Durian rimba	*Durio oxleyanus*	*Bombacaceae*	NPR	[15]
15.	Jambu air	*Syzygium aqueum*	*Myrtaceae*	NP	[13]
16.	Jambu biji	*Psidium guajava*	*Myrtaceae*	NP	[13]
17.	Jati	*Tectona grandis*	*Lamiaceae*	N	[11]
18.	Jeruk sukade	*Citrus medica*	*Rutaceae*	NP	[9]
19.	Kamboja	*Plumuiera acuminata*	*Apocynaceae*	P	[9]
20.	Kapuk randu	*Ceiba Petandra*	*Bombacaceae*	P	[10]
21.	Katsuba/rambungan besar	*Euphorbia pulcherima*	*Euphorbiaceae*	NPR	[16]
22.	Kedondong	*Spodias dulcis*	*Burseraceae*	NP	[17]
23.	Kembang sepatu	*Hibiscus rosa-sinensis*	*Malvaceae*	NP	[10]
24.	Kelapa	*Cocos nucifera*	*Palmae*	NP	[9]
25.	Kemiri	*Aleurity moluccanae*	*Euphorbiaceae*	NP	[16]
26.	Kerekep	*Santiria oblongifolia*	*Burseraceae*	NP	[17]
27.	Ketapang	*Terminalia catappa*	*Combretaceae*	N	[13]
28.	Kopi Arabika	*Coffea arabica*	*Rubiciae*	NP	[15]
29.	Langsat	*Elderly domesticum*	*Meliaceae*	N	[9]
30.	Lobi-lobi /tomi-tomi	*Flacourtia inermic*	*Flacourtiaceae*	NP	[9]
31.	Mahoni	*Swietenia mahagoni*	*meliaceae*	N	[13]
32.	Mahoni daun besar	*Swietenia macrophilla*	*Meliaceae*	N	[13]
33.	Mangga	*Mangifera indica*	*Anacardiaceae*	NPR	[14]
34.	Manggis	*Garcinia mangostana*	*Clusiaceae*	NP	[11]
35.	Matoa	*Pometia pinnata*	*Sapindaceae*	NP	[18]
36.	Mbakang	*Mangirefa foetida*	*Anacardiaceae*	N	[14]
37.	Medang	*litsea noronhoe*	*Lauraceae*	P	[17]
38.	Melinjo	*Gnetum gnemon*	*Gnetaceae*	NP	[12]
39.	Meranti	*Shorea* sp.	*Dipterocarps*	P	[17]
40.	Nangka	*Artocarpus heterophyllus*	*Moraceae*	N	[9]
41.	Pala	*Myristica fragans*	*Myristicaceae*	NP	[9]
42.	Pandan	*Pandanus* sp.	*Pandanaceae*	NP	[10]
43.	Petai	*Parkia speciosa*	*Fabaceae*	N	[13]
44.	Puring	*Codiaeum variegatum*	*Euphorbiaceae*	NP	[19]
45.	Puspa	*Schima wallici*	*Thaecae*	NP	[17]
46.	Rambutan	*Nephelium* sp.	*Sapindaceae*	NP	[18]
47.	Salam	*Syzygium polyyanthum*	*Myrtaceae*	P	[17]
48.	Saringkut	*Mallotus paniculata*	*Euphorbiaceae*	P	[10]
49.	Sawo	*Manilkara zapota*	*Sapotaceae*	N	[12]
50.	Sengon jawa	*Albizia chinensis*	*Mimosaceae*	N	[13]
51.	Sirih hutan	*Piper aduncum*	*Piperaceae*	N	[11]
52.	Sirsak	*Anona muricata*	*Annonaceae*	P	[16]

Source: Resort KSDA Sibolangit (2007); Description: N = Nectar, P = Pollen, R = Resin

Based on Table 1, the feed dominating bees contains plant nectar and pollen, that is, as many as 22 types, or equivalent to 39.28%, then containing plant nectar as many as 18 species, equivalent to 32.12 %, containing plant pollen 11 species (19.64%). The source that feeds the least is the type of plant feed bees prefer, which is those containing resin, which is only 5 species (8.9%). Plant resin producers are rare and protected plants, so availability is very limited. Feed bee resin producers at SNTP, among them cempedak (*Artocarpus integra*), durian (*Durio zibethynus*), katsuba (*Euphorbia pulcherima*), mangga (*Mangifera indica*), and tusam (*Pinus merkusii*).

After the identification results from Table 1, the next identified season and the scheduled flowering plant for the bee feed are as follows: The scheduled month for the flowering plant feed for the bee is presented in Table 2. From the results, 36 species of identified plants are seasonally disposed. Plant bee feed based on season and schedule flowering shared by 2, i.e, flowering seasonal plants only by season/month particular, flower throughout the year, flowering plants throughout the years, and unknown season. From the results, they obtained 19 types of flowering plants throughout the years and 17 seasonal plants. Plants with flowers that bloom for many years, compared to seasonal flowering plants.

Flowering plants throughout the year including: aren (*Arenga pinnata*), belimbing manis (*Averhoa carambola* Linn), belimbing wuluh (*Averhoa bilimbi*), cempedak (*Artocarpus integra*), cengkeh (*Syzygium aromaticum* L), jambu air (*Syzigium aqueum*), jambu biji (*Psidium guajava*), jeruk sukade (*Citrus medica*), coklat (Theobroma cacao), kapok randu (Ceiba petandra), katsuba/rambungan (Euphorbia pulcherima), kelapa (*Cocos nucifera*), kemiri (*Aleuritas moluccanae*), ketapang (*Terminalia catappa*), kopi arabika (*Coffea arabica*), nangka (*Artocarpus heterophyllus*), puli (*Arenga obtusifolia*) and tusam (*Pinus merkusii*). Flowering plants are seasonal like matoa (Pometia pinnata), which flowers and blooms from July to October, fruit duku (*Lancium domesticum*) with flowering and fruiting periods from June until August, durian (*Durio zibethynus*) with a flowering period twice a year, and plants of other types from different species' own time and intensity, with different flowers too [20].

The flowering period is something that a variety of factors influence, including internal factors like the type of plants and external factors like the environment. According to [21], factors influencing environmental flowering are bulk rain, humidity, temperature, sunlight, and nutrients from the ground. The availability of the sun will relate to the level of photosynthesis as an energy source.

Table 2. Calendar Flowering Type Feed Bees at TWA Sibolangit

No.	Local name	Scientific name	Flowering period	Flowering	References
1.	Aren	*Arenga Pinnata*	Y		[15]
2.	Bunga bakung	*Amaryllis* sp.	Y		Primary data
3.	Belimbing manis	*Averhoa calambolla*	Y		[12]
4.	Belimbing wuluh	*Averhoa blimbi*	Y		[12]
5.	Cempedak	*Artocarpus integra*	Y		[16]
6.	Cengkeh	*Syzygium aromaticum L.*	Y		[11]
7.	Duku	*Elderly domesticum*	S	Jun, Aug.	[15]
8.	Durian rimba	*Durio oxleyanus*	S	Sept., Oct.	[13]
9.	Durian	*Durio zibethynus*	S	Sept., Oct.	[13]
10.	Jambu air	*Syzygium aqueum*	Y		[13]
11.	Jambu biji	*Psidium guajava*	Y		[13]
12.	Jeruk sukade	*Citrus medica*	Y		[16]
13.	Kakao	*Theobroma cacao*	Y		[15]
14.	Kapuk randu	*Ceiba petandra*	Y		[21]
15.	Katsuba/rambungan besar	*Euphorbia pulcherima*	Y		[16]
16.	Kelapa	*Cocos nucifera*	Y		[12]
17.	Kemiri	*Aleurites moluccanae*	Y		[16]
18.	Ketapang	*Terminalia catappa*	Y		[12]
19.	Kopi arabika	*Coffea arabica*	Y		[15]
20.	Mahoni	*Swietenia mahagoni*	S	May, June	[13]
21.	Mahoni daun besar	*Swietenia macrophylla*	S	May, June	[13]

No.	Local name	Scientific name	Flowering period	Flowering	References
22.	Mangga	*Mangifera indica*	S	April, May, June	[12]
23.	Manggis	*Garcinia mangostana*	S	Oct - Dec	[22]
24.	Matoa	*Pometia pinnata*	S	July - Oct	[15]
25.	Bacang	*Mangirefa foetida*	S	April May	[12]
26.	Melinjo	*Gnetum gnemon*	S	May - July & Oct - Dec.	[15]
27.	Nangka	*Artocarpus heterophyllus*	Y		[15]
28.	Petai	*Parkia speciosa*	S	Aug - Dec	[23]
29.	Langkap	*Arenga obtusifolia*	Y		[15]
30.	Rambutan	*Nephelium lappaceum*	S	Sep - Oct.	[12]
31.	Sengon jawa	*Paraserienthes falcataria*	S	June - July & Aug - Sept	[13]
32.	Sirsak	*Anona muricata*	S	Jan - Mar	[24]
33.	Srikaya	*Anona squamosa*	S	Jan – Mar & Sept - Nov	[24]
34.	Sukun	*Artocarpus astilis*	S	Jan – Feb & July – Sept.	[15]
35.	Ara	*Ficus carica*	S	June - July	[16]
36.	Tusam	*Pinus merkusii*	Y		[13]

Source: Resort Sibolangit NRC-2007); Description: Y = flowering period throughout year; S = flowering period seasonal

The main factor in cultivating bee honey is the availability of feed. Diversity and flowering periods are factors to consider when starting plant cultivation of bee honey at TWA Sibolangit [21]. Plants need to flower throughout the year to support diversity and honey production. However, not all types of plants provide a food source throughout the year. So that matter, this can constrain the discontinuity of life for bee honey and complicate the cultivation plan for bee honey. Additionally, availability feeds. This is not yet visible from the facet continuity of the feed; it is only visible from the type plant. To solve this issue, the requirement for SNTP and development area plants to provide feed for bee honey from sustainable sources was met. Nonetheless, linked development areas continue to require further research. According to [25], planting flowers at a level and even distribution will facilitate the ability of bees to obtain pollen and nectar. At SNTP, a sufficient diversity overflow, bolstered by tall plants and dispersed vegetation, provides a sufficient food supply for continuity bees.

3.2. Studies Observation Plant Feed Bees at TWA Sibolangit

The Sibolangit Natural Tourism Park area is divided into 3 lanes transecting the main area, that is, lanes A, B, and C. The SNTP area is divided into 3 lanes transected by the main, that is, lanes A, B, and C. Observation studies use a 500-meter radius method with a 2-point observation radius. The observation point radius first (T1) is between lanes A and C, and the temporary observation point second (T2) is between lanes A and B. The observation radius points are presented in Figure 2.

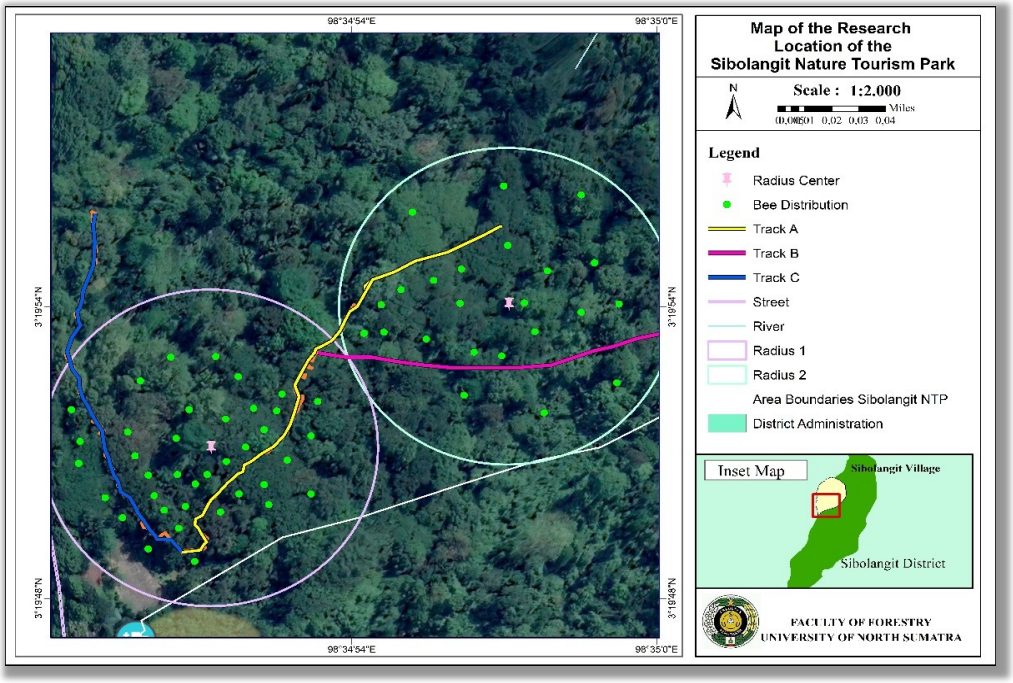

Figure 2. Point Map Feed Bees and Observation Radius Points

The first observation conducted at radius T1 involves recording the transect using the application Avenza Maps between lanes A and C. The indicators in these observations are that the plant feed bee contains plant nectar and pollen based on reference from results identification before, plant flowering, water sources, presence of bees or nest bees, presence of predators or predatory nests. These indicators need attention because they will influence the location plan for cultivating bee honey. The important indicators for developing and cultivating bee honey are the availability of feed and water sources, absence of pests or predators, and flat topography for placement of stop cultivation [26]. The results of T1 observations are presented in Table 3.

Table 3. Type Plant Source Feed Bees at a T1 Radius

No.	Local name	Scientific name	Type source feed	Flowering period
1.	Bunga bakung	*Amaryllis sp.*	Pollen	S
2.	Bunga ekor kucing	*Acalypha hypnosis*	Pollen	Y
3.	Bunga mawar	*Rosa hybrida*	Pollen	Y
4.	Bunga pagoda	*Clerodendrums paniculatum*	Nectar & Pollen	Y
5.	Bunga trompet	*Brugmansia arborea*	Nectar	Y
6.	Duku	*Elderly domesticum*	Nectar	S
7.	Durian	*durio zibethinus*	Nectar	S
8.	Jambu air	*Syzygium aqueum*	Nectar	Y
9.	Jeruk sukade	*Citrus medica*	Nectar	Y
10.	Kakao hutan	*Theobroma cacao*	Nectar	Y
11.	Kapuk randu	*Ceiba Petandra*	Pollen	Y
12.	Kemiri	*Aleurites moluccanus*	Nectar & Pollen	Y
13.	Ketapang	*Terminalia catappa*	Nectar	Y
14.	Kopi arabika	*Coffea arabica*	Nectar & Pollen	Y
15.	Kucai putih	*Allianum sp.*	Pollen	Y
16.	Mahoni	*Swietenia mahagoni*	Nectar	S
17.	Mangga	*Mangifera indica*	Nectar & Pollen	S
18.	Manggis	*Garcinia mangostana*	Nectar & Pollen	S
19.	Matoa	*Pometia pinnata*	Nekar	S
20.	Melinjo	*Gnetum gnemon*	Nectar & Pollen	Y
21.	Nanas	*Ananas comosus*	Nectar	Y
22.	Nangka	*Artocarpus heterophyllus*	Nectar	Y
23.	Pala	*Myristica fragans*	Nectar & Pollen	Y
24.	Pucuk merah	*Syzygium campanulatum*	Pollen	Y
25.	Tusam	*Pinus merkusii*	Pollen & Resin	Y

Description: Y = flowering period throughout the year; S = flowering period seasonal

Observations at point radius 1 obtained 25 species of plant feed sources for bees. Plant types found in this location are trees, plantation plants, and ornamental plants. The trees such as seperti kakao hutan (*Theobroma cacao*), kapuk randu (*Ceiba petandra*), ketapang (*Terminalia catappa*), mahoni (*Swietenia mahagoni*), pala (*Myristica fragans*), tusam (*Pinus merkusii*). Planted species such as jambu air (*Syzigium aqueum*), kopi arabika (*Coffea arabica*), mangga (*Mangifera indica*), and nanas (*Ananas comosus*). Ornamental plants such as flower mawar (*Rosa hybrida*), bunga pagoda (*Clerodendrum paniculatum*), kucai putih (*Allianum* sp.), pucuk merah (*Syzygium campanulatum*). The type of source feeds the dominating bees through point observation. This is nectar. There are 18 plants (72%) with flowering throughout the years and 7 species (28%) with seasonal flowering. Spread the plant feed bee with distance observation presented in Table 4.

Table 4. Distance and Patience Plant Source Feed Bees at a T1 Radius

Distance (meters)	Local name	Scientific name	Type plant	Amount spread
0-100	Bunga pagoda	*Clerodendrums paniculatim*	th	+
	Duku	*Elderly domesticum*	K	+
	Durian	*durio zibethinus*	K	+
	Kakao hutan	*Theobroma cacao*	K	+
	Kemiri	*Aleurites moluccanus*	K	+
	Ketapang	*Terminalia catappa*	K	++
	Mahoni	*Swietenia mahagoni*	K	++
101-200	Bunga bakung	*Amaryllis* sp.	th	++
	Bunga ekor kucing	*Acalypha hypnosis*	th	+++
	Bunga mawar	*Rosa hybrida*	th	+
	Bunga trompet	*Clerodendrums paniculatum*	Th	+++
	Durian	*Brugmansia arborea*	K	+
	Kakao Hutan	*Theobroma cacao*	K	+
	Kopi arabika	*Coffea arabica*	K	+++
	Kucai putih	*Allianum* sp.	Th	+++
	Pucuk merah	*Syzygiumcam panulatu*	Th	++
	Tusam	*Pinus merkusii*	K	+
201-300	Ketapang	*Terminalia catappa*	K	++
	Kopi arabika	*Coffea arabica*	K	+++
	Mahoni	*Swietenia mahagoni*	K	++
	Mangga	*Mangifera indica*	K	+
	Manggis	*Garcinia mangostana*	K	+
	Melinjo	*Gnetum gnemon*	K	++
	Nangka	*Artocarpus heterophyllus*	K	+
301-400	Kapuk randu	*Ceiba Petandra*	K	+
	Kopi arabika	*Coffea arabica*	K	+++
	Mahoni	*Swietenia mahagoni*	K	++
	Matoa	*Pometia pinnata*	K	+
	Melinjo	*Gnetum gnemon*	K	+
	Nangka	*Artocarpus heterophyllus*	K	+
401-500	Bunga bakung	*Amaryllis* sp.	Th	+
	Jambu air	*Syzygium aqueum*	K	+
	Jeruk sitrum	*Citrus medica*	K	+
	Kemiri	*Aleurity moluccanae*	K	+
	Kopi arabika	*Coffea arabica*	K	+++
	Mangga	*Mangifera indica*	K	+
	Nanas	*Ananas comosus*	Th	+
	Pala	*Myristica fragans*	K	+
	Pineapple	*Ananas comosus*	Th	+
	Nutmeg	*Myristica fragans*	K	+
	Tusam	*Pinus merkusii*	K	++

Description: Th = plant ornamental, K= plant forestry; + : a lot Plants found 1-5 stems; ++ : a lot plants found 5-15 stems; +++ : a lot Plants found > 15 stems

Based on the results in Table 4, type plants are categorized as being ornamental, herbs, trees, or forestry, with the categories being little, moderate, and abundant. At a radius of >100 meters, there are 7 plant feed bees, with 5 types of small distribution and 2 medium categories at a distance. This type of feed is dominated by plant types, including durian (*Durio zibethinus*), kemiri (*Aleuritas moluccanae*), ketapang (*Terminia catappa*), and mahogani (*Swietenia mahagoni*). At a > 200-meter radius of vegetation feed dominated by ornamental, with 4 of them in category abundant distribution like flower ekor kucing (*Acalypha hipsida*), bunga terompet (*Brugmansia aurea*), kopi arabika (*Coffea arabica*), and kucai putih (*Allianum* sp). Almost every track observation found a type of coffee plant, therefore, it's the coffee plants that dominate in the T1 radius. Coffee plants spread evenly in the SNTP Area because they are carried/spread by animals, primates, or birds in the SNTP. The number of plants at radius T1 36 species, distribution point feed bees at radius T1 can be presented in Figure 6. Several plant flowering/fruiting were found at the time of observation, as presented in Figure 3.

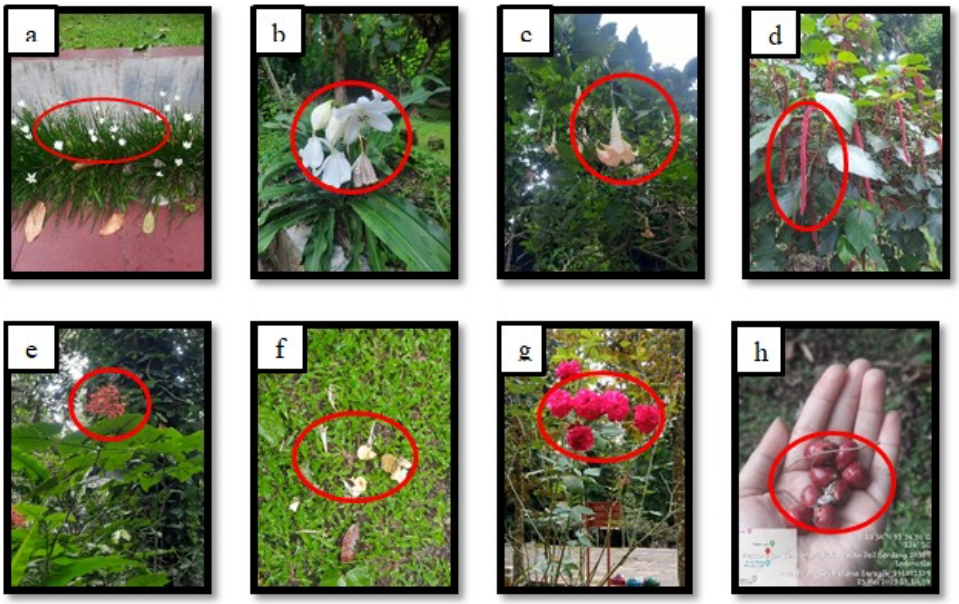

Figure 3. Plants Flowering / Fruiting at Radius T1; a. *Allianum* sp., b. *Amaryllis* sp., c. *Clerodendrums paniculatum*, d. *Acalypha hypnosis*, e. *Clerodendrums paniculatim*, f. *Durio zibethinus*, g. *Rosa hybrida*, h. *Coffea arabica*

Based on visual observation at the point radius T1, no pests/predators were found. Based on the discussion of the results with the SNTP, several kinds of predators, like bird eagles, bird srigunting, wasps, and some animals, often perch or cross the area. There are no bees at the moment experiencing the field at radius T1, however, based on an interview with the bee resort, kelulut (*Trigona* sp.) often nests around the resort office. Based on the discussion of the results with the SNTP, several kinds of predators like bird eagles, bird srigunting, wasps, and others often perch or cross the area. The nest nest bee is based on the results of the observation presented in Figure 4.

Figure 4. Finding a Beehive at Radius T1

The same methodology was used for the first radius observation for observation two. The kind of plant feed for bees is the first thing you should watch out for. Based on the findings, observations on the T2 radius yielded 10 plant source feed bees, 6 (60%) of which were annual flowering species and 4 (40%) seasonal. *Arenga pinnata*, *Ixora salicifolia*, *Ceiba petandra*, *Terminalia catappa*, *Coffea arabica*, and *Arenga obtusifolia* are some plant species that bloom yearly. Temporary plants with seasonal flowers, such as *Baccaurea motleyana*, *Pometia pinnata*, and *Parkia speciosa*, are shown in Table 5 and the observation findings of the type plant feed bees at radius T2. According to [16], the type of plant, the environment, the temperature, and the amount of solar exposure can all affect when a plant flowers.

Table 5. Type Plant Source Feed Bees on a T2 Radius

No	Local name	Scientific name	Type source feed	Flowering period
1.	Aren	*Arenga Pinnata*	Nectar	Y
2.	Soka flower forest	*Ixora salicifolia*	Nectar	Y
3.	Kapok randy	*Ceiba Petandra*	pollen	Y
4.	Ketapang	*Terminalia catappa*	Nectar	Y
5.	Arabica coffee	*Coffea arabica*	Nectar & Pollen	Y
6.	Matoa	*Pometia pinnata*	Nectar	S
7.	Melinjo	*Gnetum gnemon*	Nectar	S
8.	Petai	*Parkia speciosa*	Nectar	S
9.	pulley	*Arenga obtusifolia*	Nectar	Y
10	Rambai	*Baccaurea motleyana*	Nectar	S

Description: Y = flowering period throughout the year; S = flowering period seasonal

At the moment, several T2 radius observations have found plants currently in flower, like flower soka forest (*Ixora salicifolia*), sugar palm (*Arenga pinnata*), arabica coffea (*Coffea arabica*), puli (*Arenga obtusifolia*), and melinjo (*Gnetum gnemon*). At the moment, in the field, I have also found a plant named local waru tubung. Based on the results of the interview field, plant these flowers in August, and at the same time, birds like the hornbill often perch and eat fruit from the plant.

From the results, observation point spread feed bee with a distance of 500 meters obtained as many as 23 plant points. At a radius of 0-100 meters, there are plants *Terminalia catappa*, *Coffea arabica*, *Pometia pinnata*, and *Arenga obtusifolia* with category type plant tree. Type plants overflowing in the distance. These are *Coffea arabica* and *Arenga obtusifolia*. At a distance of 100-200 meters, a kind of plant was found 5 species of plants, with an abundance of 4 types. At a distance, this was found to be the plant Ceiba petandra. However, the amount is very small in distribution. Almost every distance observation found the plant *Coffea arabica*, *Arenga obtusifolia*, *Ixora salicifolia*, and *Arenga pinnata* with abundant distribution. Type plants at radius T2 are dominated by plant forestry/plant trees. The result of the observation distance and spread of plant feed bees at radius T2 is presented in Table 6.

Table 6. Distance and Patience Plant Source Feed Bees on a T2 Radius

Distance (meter)	Local Name	Scientific name	Type plant	Amount spread
0-100	Ketapang	*Terminalia catappa*	K	++
	Arabica coffee	*Coffea arabica*	K	+++
	Matoa	*Pometia pinnata*	K	+
	Pulley	*Arenga obtusifolia*	K	+++
101-200	Aren	*Arenga pinnata*	K	+++
	Soka flower forest	*Ixora salicifolia*	Th	+++
	Kapok randu	*Ceiba Petandra*	K	+
	Arabica coffee	*Coffea arabica*	K	+++
	Pulley	*Arenga obtusifolia*	K	+++
201-300	Aren	*Arenga pinnata*	K	+++
	Arabica coffee	*Coffea arabica*	K	+++
	Pulley	*Arenga obtusifolia*	K	+++
	Rambai	*Baccaurea motleyana*	K	++
301-400	Soka flower forest	*Ixora salicifolia*	Th	+++
	Kapok randu	*Ceiba Petandra*	K	+

Distance (meter)	Local Name	Scientific name	Type plant	Amount spread
	Arabica coffee	*Coffea arabica*	K	+++
	Petai	*Parkia speciosa*	K	++
	Rambai	*Baccaurea motleyana*	K	++
	Aren	*Arenga Pinnata*	K	+++
	Melinjo	*Gnetum Gnemon*	K	+
401-500	Arabica coffee	*Coffea arabica*	K	+++
	Petai	*Parkia speciosa*	K	++
	Pulley	*Arenga obtusifolia*	K	+++

Description: Th = plants ornamental, K = plant of Forestry; + : a lot Plants found 1-5 stems; ++ : a lot plants found 6-15 stems; +++ : a lot Plants found > 15 stems

According to [25], every plant flower (plant forest, plant agriculture, plant plantations, plant horticulture, and wild plants) containing elemental nectar as material, honey, pollen, and propolis can be used as feed for bees. The more overflow plants, particularly plant flowers, the more the bees are awake. Several medium-sized plants flowering/fruiting, were found in radius T2 at the time of observation, presented in Figure 5.

Figure 5. Plants Flowering and Fruiting at Radius T2; a. Fruit melinjo, b. Fruit pulley, c. Soka flower forest

4. Conclusion

The availability of bee feed in TWA Sibolangit is very diverse; based on plant list data, TWA Sibolangit obtained 56 species of potential plants as feed for bees. Based on the results of observation with two point T1 and T2 at a distance of 500 meters, T1 radius observations obtained 25 species of plant feed bees, and T2 radius observations obtained 10 species of plant feed bees. With that said, TWA Sibolangit has great potential in the planned cultivation of bee honey, given the availability of feed, topography, and accessibility.

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