

Plant diversity of ceremonial foods used by Minangkabau ethnic group in West Sumatra, Indonesia

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Abstract. Kanara N, Arifin HS, Zuhud EAM, Noorochmat BP. 2025. Plant diversity of ceremonial foods used by Minangkabau ethnic group in West Sumatra, Indonesia. *Biodiversitas* 26: 6352-6366. Ethnic communities generally possess Traditional Ecological Knowledge (TEK) in managing natural resources and the environment as well as traditional ceremonies and foods. This study is the first that comprehensively document plant diversity for ceremonial foods by Minangkabau communities in West Sumatra, Indonesia. The objectives are to: (i) identify the ceremonial food plants, (ii) analyze the cultural food significance of ceremonial food plant species, and (iii) analyze the important local agroforestry system to conserve the ceremonial food plants used by the Minangkabau ethnic group. Data collection was performed using purposive sampling and ethnobotanical approaches. The information was obtained through semi-structured interviews with 104 informants in Lima Puluh Kota District and Payakumbuh Municipality, West Sumatra, Indonesia. Valuation of the key plant species was obtained using the Cultural Food Significance Index (CFSI) method. The data show that Minangkabau ethnic group use 86 taxa from 38 families as ceremonial foods with the dominance family is Solanaceae. Total 30 taxa from 13 family were considered to have a very high-CFSI with the dominance families are Fabaceae and Zingiberaceae. Plants often used in ceremonies by the Minangkabau ethnic group are mostly gathered in the mixed garden and homegarden, showing that local agroforestry systems are the most potential landscape in conserving ceremonial food plants. Maintain local agroforestry systems and preserve socio-cultural practices in Minangkabau ethnic group have implication for the conservation of local food plants and enhance local food security.

Keywords: Agroforestry system, biodiversity conservation, Cultural Food Significance Index, ethnobotany, traditional ecological knowledge

INTRODUCTION

Globalisation has changed the world's food system through global food culture. Culinary innovation also enable food fusion and simplification of cooking processes, altering authentic traditional foods and ethical eating experiences (Galanakis 2024). Urbanisation have increased the rural consumers preference for global foods, leading to the neglect of local and healthy food sources (de Bruin et al. 2021; Casari et al. 2022). This has implication to changes in local biodiversity and shifts in cultural foods. Traditional foods generally use local food ingredients and are processed with local resources. In the other hands, a scientific study noted that biodiversity loss and other ecological problems have generated societal consequences, including changes in diets and cuisines, the food environment, food security, and Traditional Ecological Knowledge (TEK) (Ebel et al. 2021). A recent IPBES assessment shows that there are strong interlinkages (so called nexus interaction) among biodiversity, food and health (Harmáčková et al. 2024). Also, social and ecological systems hold by a society affect the relationship between

biodiversity and food elements in a complex way (Das et al. 2022; García-del-Amo et al. 2022).

The Minangkabau are an ethnic group originating from West Sumatra, Indonesia. This matrilineal ethnic community possesses rich traditional culinary knowledge that has been passed down from generation to generation (Fatimah et al. 2021). Based on recipe archives collected by previous research, the number of traditional Minangkabau dishes accessible to researchers was 158 (Gardjito et al. 2017). Minangkabau traditional foods are known worldwide for their spicy and savory taste (Waryono 2021). Much of popular traditional Minangkabau foods are composed of complex ingredients and used in traditional ceremonies (Des et al. 2019).

Minangkabau ceremonial foods (*makanan adat*) are prepared with special meaning, symbolism, and purpose. These foods are served or delivered as gifts, and consumed together during traditional and religious events. Minangkabau ceremonial foods are not used as offerings because the majority of the Minangkabau people are Muslim, which emphasizes worship of God without the intermediary of ritual offerings. Minangkabau philosophy states "*adat basandi*

sara', sara' basandi kitabullah" (custom is based on religion, and religion is based on the Quran). This differs from India, Vietnam, Java and Batak Toba ethnic group, where certain ceremonial foods can serve as offerings (Hüwelmeier 2021; Sitanggang et al. 2022; Candraningtyas et al. 2025; Yadav et al. 2025).

Traditional ceremonial practices and ceremonial foods have implication to social and ecological aspect. Recent studies shows the role of ceremonial food as cultural identity and community strengthening in India, Sundanese, and Minangkabau (Dewantara et al. 2023; Manik et al. 2024; Tiara et al. 2025). Ceremonial foods are reported to have significant role in land protection, plant diversity, and TEK conservation in China and Thailand (Nan et al. 2021, Saensouk et al. 2025a). One thesis stated, "ceremony and ritual are not important for conservation; they are conservation" (Knight 2021).

Minangkabau ethnic group has TEK practices to conserve natural-cultural landscape. It is reflected in this traditional adages, "*nan gurun jadikan parak, nan bancah jadikan sawah, nan padek ka parumahan, ka rimbo babungo kayu, ka sawah babungo ampiang*" (the dry lands are modified into mixed gardens, the wet lands are modified into paddy fields, the solid flat lands are for housing area, the forest produces wood, the paddy field produces rice grain) (Amir 1997; Asmin 2021; Oktavianus et al. 2023). Two of the natural-cultural landscapes mentioned in such adages can be categorized as agroforestry systems, namely *halaman* (homegardens) and *parak* (mixed gardens), which are frequently advocated as sustainable land use system. Previous studies reported that local agroforestry systems in West Sumatra are the sources of local food and edible wild plant diversity (Pawera et al. 2020; Suwardi et al. 2023).

Research on ceremonial foods in Indonesia has been conducted in several regions, mostly focusing on cultural sciences and food sciences (Oktavianus and Anwar 2022; Muniroh et al. 2025; Surya et al. 2025). Ethnobotanical studies of ceremonial plants has been conducted primarily in Java, Indonesia, but is still limited in the Minangkabau

ethnic group (Des et al. 2019; Sumarwati 2022; Sulistiyowati et al. 2022). Previous ethnobotanical studies in the Minangkabau ethnic group still focused on food plants in general (Agesti et al. 2023; Aziz et al. 2024) and medicinal plants (Khairiah et al. 2022; Stark and Kurniawan 2022). It leave a gap on the investigation to what extent the traditional ceremonies and local agroforestry can conserve ceremonial food plants used by Minangkabau ethnic group. This study aims to: (i) identify the ceremonial food plants, (ii) analyze the plant cultural food significance of ceremonial food plant species, and (iii) analyze the important local agroforestry system to conserve the ceremonial plants used by Minangkabau ethnic group. The results of this study are expected to contribute to further research and policy making regarding local food diversification, local plant conservation and Minangkabau culture.

MATERIALS AND METHODS

Study area

Data collection was carried out in thirteen *nagari* (village-level customary area), representing thirteen *keselarasan* (a union of several *nagari* with similar customs) in *luhak* (traditional confederation area of Minangkabau, Indonesia) of *Limo Pulu Koto*: Batu Balang, Batuhampar, Guguak VIII Koto, Halaban, Lubuak Batingkok, Mungka, Situjuah Banda Dalam, Solok Bio-Bio, Sungai Kamuyang, Taeh Bukik, Koto Nan Godang, Koto Nan Ompek, and Payobasuang. The *luhak* was used as the context of research area (instead of government administrative area) because its status as representation of Minangkabau cultural area that has certain distinctive customs, including similar ritual foods. *Luhak Limo Pulu Koto* is part of the administrative regions of Lima Pulu Kota District and Payakumbuh Municipality, West Sumatra Province, Indonesia (Figure 1).

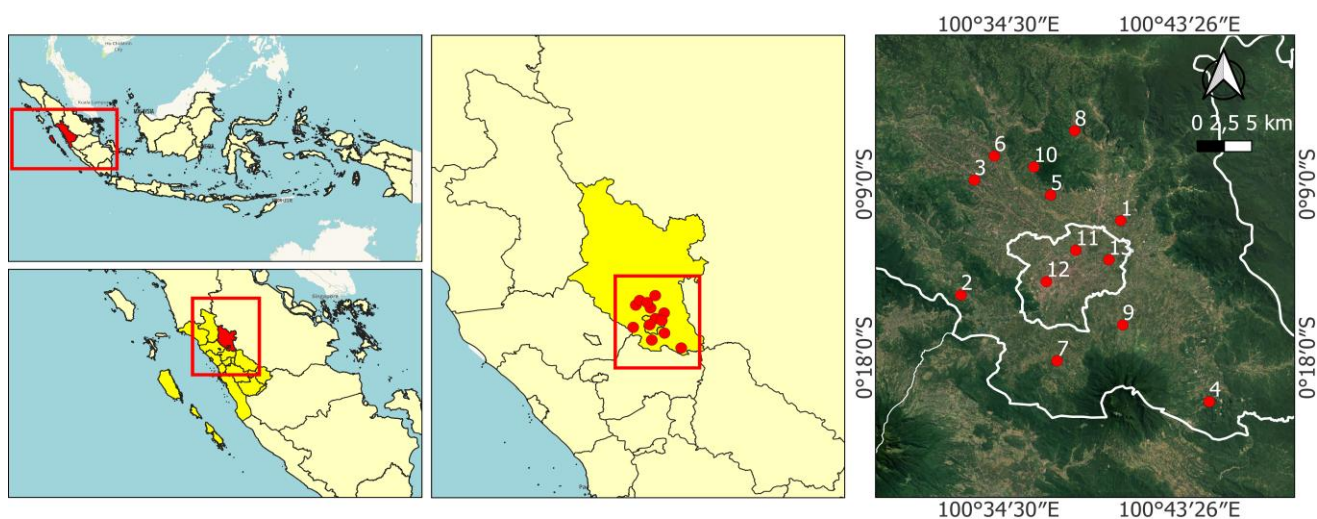


Figure 1. Research site in Lima Pulu Kota District and Payakumbuh Municipality, West Sumatra Province, Indonesia, consisted of thirteen *nagari*: 1. Batu Balang, 2. Batuhampar, 3. Guguak VIII Koto, 4. Halaban, 5. Lubuak Batingkok, 6. Mungka, 7. Situjuah Banda Dalam, 8. Solok Bio-Bio, 9. Sungai Kamuyang, 10. Taeh Bukik, 11. Koto Nan Godang, 12. Koto Nan Ompek, 13. Payobasuang

Procedures

Data collection was performed using purposive sampling method. The informants were selected based on four criteria: indigenous people, utilizing food plants in daily life, having extensive local knowledge about local culture and traditional foods, *bundo kanduang* (the respected and oldest married Minangkabau women in her clan) over 30 years old. Based on these criteria, 104 informants were obtained from 13 *nagari* (8 informants from each *nagari*). The average age of informants is 63 years old. Informants were determined using the snowball sampling method, with the first informant is the most respected *bundo kanduang* in the *nagari*.

Ethnobotanical information was obtained through semi-structured interviews. Informants were asked about plants used as ceremonial foods (i.e. consumed during traditional ceremonies and Islamic holiday celebrations) in the past and present time, along with the plant parts used, processing techniques, perception of availability, frequency of use, taste appreciation, and medical and health benefits. Informants were also asked about the use categories of the plant species in traditional foods and where they gathered it.

The authors declare no conflict of interest. Permission was obtained from the local government and local elders before collecting data at the research site. Informants were provided with complete information about this study, and the participation was voluntary by signed the informed consent sheet. The founding sponsors had no role in the design of the study; in data collection, analyses, or interpretation of data; in the writing of the manuscript; and in the decision to publish the results.

Data analysis

Quoted plant species were identified by matching plant taxa lists from previous inventory studies on food plant biodiversity (Devy et al. 2015; Hapsari et al. 2017; Pawera et al. 2020; Silalahi et al. 2020; Sofiyanti et al. 2022; Agesti et al. 2023). All scientific names were verified referring to the Global Biodiversity Information Facility (<https://www.gbif.org/>). Plant taxonomic diversity was analyzed using a combination of descriptive and quantitative approach and displayed in tabular form. It was also equipped by the local name (using the Payakumbuh-Minangkabau dialect), main function, part used and the status as the ritual foods of traditional ceremonies in the Minangkabau ethnic group. Due to the multiple uses, a plant taxa was possible to have more than one main function and part used.

Valuation of the important plant species was obtained using the Cultural Food Significance Index (CFSI) (Pieroni 2001):

$$CFSI = QI \times AI \times FUI \times PUI \times MFUI \times TSAI \times FMUI \times 10^{-2}$$

The formula consists of seven indexes which are multiplied in order to amplify eventual variations. Certain categories have been modified to suit local usage for traditional Minangkabau food. Those are: (i) Quotation Index (QI). The index was indicated the number of responses that given by the interviewees about a plant

species. Taxa with less than three responses were not considered. (ii) Availability Index (AI). The index was represented the plant availability and corrected by localization of use, whether it ubiquitous or localized in study area (Table 1). (iii) Frequency of Utilization Index (FUI). The index indicates the frequency of each plant species utilization in the study area (Table 2). The index value per plant species was the average index value of the responses given by interviewees. (iv) Plant Parts Used Index (PUI). The index resembles the various plant parts used as food (Table 3). The more plant parts used for various food uses, the higher the value, and the use of mature plant tissue will have the higher value than the younger tissue. PUI value of a plant taxa was the sum of the indexes of the plant parts used. (v) Multifunctional Food Used Index (MFUI). This index indicates all the possible food uses of each plant species (Table 4). The index categories were modified to suit the traditional foods processed by Minangkabau ethnic group. The value of one species was obtained from the sum of its processing methods. The more ways to process food from a plant taxa, the greater the value obtained. (vi) Taste Score Appreciation Index (TSAI). The index represents the appreciation of food taste (Table 5). The value was based on the appreciation of the taste when the food is consumed by the interviewees. (vii) Food-Medical Used Index (FMUI). This index reflects the uses of the plant species for medicinal and health benefits beside its role as food source (Table 6). The benefits of plants for healing rituals and cure of non-medical diseases that local people believe were also included in this category.

Table 1. Availability Index (AI) categories

Availability	Index value
- Very common	4
- Common	3
- Middle	2
- Rare	1
Localisation of the use	
- Obiquitary	-0.0
- Localised (limited used in West Sumatra Province, Indonesia, or only used by Minangkabau ethnic)	-0.5
- Very localized (limited used in some location site)	-1.0

Table 2. Frequency of Utilization Index (FUI) categories

Frequency of utilization	Index value
More than once a week	5
Once a week	4
Once a month	3
More than once a year, but less than once a month	2
Once a year	1
No longer used in the pass 30 year	0.5

Table 3. Plant Parts Used Index (PUI) categories

Parts used	Index value
Bark	1
Roots	1.5
Roots, only the younger parts	1
Bulbs, tubbers, rhizomes	1.5
Stems	1
Stems, only the pith	0.75
Leaves	1.5
Sap or fluid from the plant	0.75
Young leaves/whorls	1
Leaves with few stems	2
Shoots	1.25
Shoots, only the younger parts	0.75
Buds	1
Flowers	1.5
Young fruits	1
Mature fruits	2
Seeds	1.5
Whole aerial parts of plant	3
Whole aerial parts of young plant	2
Stalks or midrib	0.75

Table 4. Multifunctional Food Used Index (MFUI) categories

Usage	Index value
Raw, pickle, salad	0.75
Beverages, syrup, jam	1
Fried with or without coating	1
Fried, to be used in another process	1.5
Boiled or steam	1
Boiled or steam, to be used in another process	1.5
Soup or stew without coconut cream (<i>asam padeh</i>)	1
Stew with coconut cream (<i>gulai, pangek, kalio, rendang</i>)	1.5
Roasted or grilled (<i>singgang, panggang</i>)	1
Roasted or grilled or steam with wrap	1
Condiment	0.75
Organic wrapper that contributes flavor and aroma	0.5
Chili sauce (<i>sambalado</i>)	1
Ingredients that are not compulsory or can be replaced	-0.5

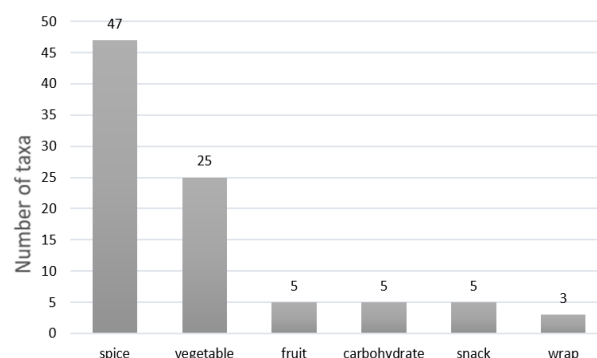
Table 5. Taste Score Appreciation Index (TSAI)

Taste appreciation	Index value
Best	10
Very good	9
Good	7.5
Fair	6.5
Poor	5.5
Terrible	4

CFSI values ranged from 0.1 to 662. Species were classified into six significance levels: very high (CFSI $\geq$ 300), high ($100 \leq$ CFSI $<$ 300), moderate ($20 \leq$ CFSI $<$ 100), low ($5 \leq$ CFSI $<$ 20), very low ($1 \leq$ CFSI $<$ 5), and negligible (CFSI $<$ 1).

Table 6. Food-Medical Used Index (FMUI) categories

Role as food-medicine	Index value
Very high (“the food is very important as medicine”)	5
High (“the food is quite important as medicine”, the interviewee can state the efficacy of the treatment)	4
Middle-high (“the food is very healthy”)	3
Middle-low (“the food is healthy”, the interviewee cannot state the particular therapeutic action)	2
Not recognize	1

**Figure 2.** Numbers of botanical taxa in main function categories of food plants

RESULTS AND DISCUSSION

Plant diversity of ceremonial foods

The informants mentioned 86 taxa of food plants belonging to 38 families. The most common families utilized as the Minangkabau ceremonial foods were Solanaceae (7 taxa), followed by Apiaceae, Fabaceae and Poaceae (6 taxa each) (Table 7). Previous research reported that 154 species from 51 families of food plants used by Minangkabau ethnic group in Lima Puluh Kota District (Agesti et al. 2023). Therefore, it can be assumed that 55 percent of the food plants in the same region are used as ceremonial food plants.

The most food plant category mentioned by local people was spices (47 taxa), including herbs, sweeteners, seasoning and flavorings. It was followed by vegetables (25 taxa), fruits (5 taxa), carbohydrates (5 taxa), snacks (5 taxa) and wraps (3 taxa) (Figure 2). In contrast to daily food plants, the most widely used are vegetables, followed by fruits, while spices are in third place (Agesti et al. 2023). Although the use of vegetables in ceremonies is not as much as in daily diets, certain mandatory dish have vegetables as main ingredients. In nagari Koto Nan Godang, *jaruak toruang*, a side dish made from eggplant (*Solanum melongena*), and *samba marungai* (light curry of *Moringa oleifera*) are obligatory foods for *Batagak Panghulu* (clan leader inauguration). Wild vegetable plants are also substantial in traditional ceremonies of Minangkabau. The curry of *Bambusa vulgaris* shoot (*gulai robuang*) is a mandatory food in wedding ceremony, which can only be substituted by the curry of *Artocarpus heterophyllus* (*gulai cubadak*).

Table 7. List of foods plants uses in Minangkabau traditional ceremonies, mentioned by the local people in Lima Puluh Kota District and Payakumbuh City, West Sumatra, Indonesia

Family	Scientific name	Local name	Synonym	Main categories	Main part used	QI	AI	FUI	PUI	MFUI	TSAI	FMRI	CSFI	CSFI categories	Source
Solanaceae	<i>Capsicum annuum</i> L.	<i>Lado</i>	Cabai merah, red chilli pepper	Spices	Fruit	88	5	5	3	6	7	3	8316	I	H, M
	<i>Capsicum frutescens</i> L.	<i>Lado Kutu</i>	Cabai rawit, bird's eye chilli	Spices	Fruit	3	5	3.5	3	5.25	5	2	82.69	III	H, M
	<i>Nicotiana tabacum</i> L.	<i>Tembakau</i>	Tobacco	Snacks	Leaf	1								-	*
	<i>Solanum lycopersicum</i> L.	<i>Tomat</i>	Tomatto	Vegetables	Fruit	61	5	5	2	5.75	8	5	7015	I	H,M
	<i>Solanum melongena</i> L.	<i>Toruang</i>	Terung, eggplant	Vegetables	Fruit	11	5	4	2	3.5	7.5	2	231	II	H,M
	<i>Solanum rude-pannum</i> Dunal	<i>Rimbang</i>	Takokak, turkey berry	Vegetables	Fruit	17	4	3	2	2.25	6	3	165.24	II	H,M
	<i>Solanum tuberosum</i> L.	<i>Kontang</i>	Kentang, potato	Vegetables	Fruit	23	5	4	1.5	7.25	9.5	2	950.48	I	*
Apiaceae	<i>Apium graveolens</i> L.	<i>Daun Sop</i>	Seledri, wild celery	Spices	Leaf	12	5	4.5	2	1.75	7.5	5	354.38	I	H
	<i>Coriandrum sativum</i> L.	<i>Katumba</i>	Ketumbar, coriander	Spices	Seed	12	5	4	1.5	3.5	7.5	2	189	II	*
	<i>Daucus carota</i> L.	<i>Wortel</i>	Carrot	Vegetables	Tuber	9	5	5	2	7.5	7.5	2	506.25	I	M
	<i>Eryngium foetidum</i> L.	<i>Pinjolang Lauik</i>	Ketumbar jawa, culantro	Spices	Leaf	8	3	3.5	1.5	1.5	8	1	15.12	IV	H
	<i>Pimpinella anisum</i> L.	<i>Adas Manih</i>	Adas manis, anise	Spices	Seed	13	4	2	1.5	2.5	9	4	140.4	II	*
	<i>Trachyspermum roxburghianum</i> (DC.) Craib	<i>Jintan</i>	Jinten	Spices	Seed	11	4	2	1.5	2.5	7.5	2	49.5	III	M
Fabaceae	<i>Arachis hypogaea</i> L.	<i>Kacang Tanah</i>	Peanut	Vegetables	Seed	1								-	M
	<i>Archidendron jiringa</i> (Jack) I.C.Nielsen	<i>Joriang</i>	Jengkol	Vegetables	Seed	25	4	4.5	1.5	5.25	9	2	637.88	I	F,H,M
	<i>Parkia speciosa</i> Hassk.	<i>Potai</i>	Pete, stinky bean	Vegetables	Seed	40	4	4.5	1.5	5.25	8	1	453.6	I	F,H,M
	<i>Phaseolus vulgaris</i> L.	<i>Buncih</i>	Buncis, green bean	Vegetables	Fruit	6	4	4	2	6	7.5	2	172.8	II	H,M
	<i>Tamarindus indica</i> L.	<i>Asam Jawa</i>	Tamarind	Spices	Fruit	12	5	3.5	2	3	8	4	403.2	I	F
	<i>Vigna unguiculata</i> subsp. <i>sesquipedalis</i> (L.) Verdc.	<i>Kacang Panjang</i>	Yard long bean	Vegetables	Fruit	11	5	4.5	3	7.25	7.5	3	1211.2	I	H,M
Poaceae	<i>Bambusa vulgaris</i> Schrad. ex J.C.Wendl.	<i>Robuang</i>	Buluh, bamboo	Vegetables	Shoot	72	3	4	0.8	3	7.5	2	291.6	II	F
	<i>Cymbopogon citratus</i> (DC.) Stapf	<i>Sorai</i>	Sereh, lemongrass	Spices	Leaf	78	5	4	0.8	4.5	7.5	4	1579.5	I	H
	<i>Oryza sativa</i> L.	<i>Padi</i>	Rice	Carbohydrates	Seed	45	5	5	1.5	3.5	7.5	2	885.94	I	P
	<i>Oryza sativa</i> var. <i>glutinosa</i> Blanco	<i>Sipuluik/ Kotan</i>	Ketan, sticky rice	Carbohydrates	Seed	65	5	3.5	1.5	3.5	7.5	1	447.89	I	P
	<i>Saccharum officinarum</i> L.	<i>Tobu</i>	Tebu, sugarcane	Beverages	Stem	6	2	2	1	0.75	8.5	3	4.59	V	H,M
	<i>Triticum</i> sp.	<i>Terigu</i>	Wheat	Carbohydrates	Seed	1								-	*
Arecaceae	<i>Areca catechu</i> L.	<i>Pinang</i>	Betel nut palm	Snacks	Fruit	1								-	H,M
	<i>Arenga pinnata</i> (Wurmb) Merr.	<i>Onau</i>	Sugar palm	Spices	Sap	56	3	4	0.8	4.25	9.5	4	813.96	I	F,M

Myrtaceae	<i>Cocos nucifera</i> L.	<i>Karambia</i>	Kelapa/ coconut	Spices, wraps	Fruit, leaf	69	5	5	4	7	8	5	19320	I	H,M,P
	<i>Metroxylon sagu</i> Rottb.	<i>Sagu</i>	Sago palm	Carbohydrates	Stem	11	4	2	0.8	1	7	1	4.62	V	* *
	<i>Salacca zalacca</i> (Gaertn.) Voss	<i>Salak</i>	Snake fruit	Fruits	Fruit	2								-	*
	<i>Syzygium aqueum</i> (Burm.fil.) Alston	<i>Jambu Aia</i>	Jambu air, water apple	Fruits	Fruit	6	3	2	2	0.75	8	1	4.32	V	H,M
	<i>Syzygium aromaticum</i> (L.) Merr. & L.M.Perry	<i>Congkeh</i>	Cengkeh, clove	Spices	Flower	17	4	2	1	3.5	6.5	3	92.82	III	F,H,M
Zingiberaceae	<i>Syzygium malaccense</i> (L.) Merr. & L.M.Perry	<i>Jambak</i>	Jambu bol, Malay apple	Spices	Leaf	1								-	H,M
	<i>Syzygium polyanthum</i> (Wight) Walp.	<i>Salam</i>	Bayleaf	Spices	Leaf	72	5	4	1.5	3.5	6.5	5	2457	I	F,H,M
	<i>Alpinia galanga</i> (L.) Willd.	<i>Langkueh</i>	Lengkuas, laos, galangal	Spices	Rhizome	74	5	5	1.5	6.25	8	2	2775	I	H,M
	<i>Curcuma longa</i> L.	<i>Kunyik/ Kunik</i>	Kunyit, tumeric	Spices	Rhizome, leaf	99	5	5	3	6.5	7.5	5	18098.4	I	H
	<i>Etlingera elatior</i> (Jack) R.M.Sm.	<i>Kincuang</i>	Kecombrang, honje, torch ginger	Vegetables	Flower	70	2	3	2.5	2.5	7.5	2	393.75	I	H,M
Rutaceae	<i>Wurfbainia compacta</i> (Sol. ex Maton) Škorničk. & A.D.Poulsen	<i>Gardamunggu/ Darmamunggu</i>	Kapulaga, java cardamom	Spices	Fruit	14	3	3	2	2.5	7.5	2	94.5	III	M
	<i>Zingiber officinale</i> Roscoe	<i>Sipodeh</i>	Jahe, ginger	Spices	Rhizome	93	5	5	1.5	4.5	8	5	6277.5	I	H
	<i>Citrus × aurantium</i> L.	<i>Limau Manih</i>	Jeruk manis, bitter orange	Fruits	Fruit	17	5	4	2	1.75	9	5	535.5	I	H,M
	<i>Citrus × aurantifolia</i> (Christm.) Swingle	<i>Limau Kapeh</i>	Jeruk nipis, key lime	Spices	Fruit	59	5	4.5	2	4	5	5	2655	I	H,M
	<i>Citrus hystrix</i> DC.	<i>Limau Puruik</i>	Jeruk purut, kaffir lime	Spices	Leaf	74	4	4	2	5.5	7	4	3646.72	I	H,M
Amarillydaceae	<i>Citrus hystrix</i> DC. “Sundai”	<i>Limau Sundai</i>	Jeruk sundai	Spices	Fruit	16	2	3	2	1	7	4	53.76	III	H
	<i>Allium cepa</i> L.	<i>Bawang Merah</i>	Shallot	Spices	Tuber	106	5	5	1.5	10.3	9	5	18334.7	I	M
	<i>Allium fistulosum</i> L.	<i>Bawang Perai</i>	Bawang daun, welsh onion	Spices	Leaf	14	5	5	3	2.25	7.5	3	531.56	I	H,M
	<i>Allium sativum</i> L.	<i>Bawang Putiah</i>	Garlic	Spices	Tuber	105	5	5	1.5	5.5	9	5	9745.31	I	*
	<i>Mangifera foetida</i> Lour.	<i>Ambacang</i>	Bacang	Vegetables	Fruit	15	2	1	3	0.75	7.5	1	5.06	IV	H,M
Malvaceae	<i>Mangifera indica</i> L.	<i>Mangga</i>	Manggo	Vegetables	Fruit, leaf	5	4	2.5	3	0.75	9	3	30.38	III	H
	<i>Spondias dulcis</i> Parkinson	<i>Kedondong</i>	Ambarella	Vegetables	Leaf	1								-	H
	<i>Hibiscus surattensis</i> L.	<i>Asam Batang Baru</i>	Sibaru, waru	Spices	Leaf	2	2								-
	<i>Hibiscus tiliaceus</i> L.			Spices, wraps	Leaf	5	2	1	1.5	1	8	1	1.2	V	M
	<i>Garcinia xanthochymus</i> Hook.fil. ex J.Anderson	<i>Asam Kandih</i>		Spices	Fruit	88	88	5	3.5	2	3	8	4	2956.8	I
Euphorbiaceae	<i>Aleurites moluccanus</i> (L.) Willd.	<i>Dama</i>	Kemiri, candlenut	Spices	Seed	20	4	4	1.5	4.5	7.5	3	486	I	F,M

[illegible]

Pandanaceae	<i>Pandanus amaryllifolius</i> Roxb. <i>Pandan</i> ex Lindl.			Spices	Leaf	5	5	4	1.5	2	7	2	42	III	H
Pentaphylacaceae	<i>Eurya acuminata</i> DC.	<i>Jirak</i>		Spices	Leaf	1								-	F
Sapindaceae	<i>Schleichera oleosa</i> (Lour.) Oken.	<i>Kasambi</i>	Kosambi	Spices	Leaf	1								-	F,H
Schisandraceae	<i>Illicium verum</i> Hook.fil.	<i>Bungo Lawang/</i> <i>Pekak</i>	Bunga lawingl star anise	Spices	Fruit	14	14	4	2	2	1.5	7.5	2	50.4	III
Vitaceae	<i>Leea indica</i> (Burm.fil.) Merr.	<i>Mali-Mali</i>	Girang merah	Spices	Leaf	4	4	1	1	1	2	7	2	0.84	VI
Myristicaceae	<i>Myristica fragrans</i> Houtt.	<i>Palo</i>	Pala, nutmeg	Spices	Seed	16	4	3	1.5	2.5	7.5	4	189	II	*

Note: The spices category includes herbs, sweeteners, seasoning and flavorings; CSFI categories: I: Very high significance, II: High significance, III: Moderate significance, IV: Low significance, V: Very low significance, VI: Negligible significance, -: Not considered ($QI \leq 2$); Source: F: Forest, H: Homegarden, M: Mixed-garden, P: Paddy field, *: only from market

The part used of food plants that local people mentioned was mostly leaf/midrib (35 taxa). One of this category is the *kemumu* (*Leucocasia gigantea*), which is used only in the midrib part. *Kemumu* is commonly used as a mixed ingredient of gulai (typical Minangkabau curry) in ceremonial events. The next part which is mostly used is fruit (30 taxa), followed by seed (12 taxa), tuber/rhizome (7 taxa), stem/bark (3 taxa), flower (3 taxa), sap (2 taxa) and shoot (1 taxon) (Figure 3). In contrast, the Sundanese in Cianjur, West Java, mainly use fruits, followed by seeds and flowers, for ceremonies because some are used as ritual offerings (Erawan et al. 2018).

Cultural significance of ceremonial food plants

Food plants play an important role in Minangkabau culture. Of 86 taxa used for ceremonial foods, 30 taxa (13 families) showed very high cultural significance, while 13 were high, 9 moderate, 8 low, 6 very low, and 20 negligible. The most frequent families in the very high category were Fabaceae and Zingiberaceae (four taxa each), followed by Solanaceae, Poaceae, Rutaceae, and Amarillydaceae (three taxa each) (Table 7, Figure 4).

Coconut (*Cocos nucifera*) was in the highest rank of cultural food significant index in Minangkabau ethnic group with CSFI of 19320. It is because coconut milk is substantial in Minangkabau foods. Previous studies reported that 37.98% Minangkabau traditional foods is side dishes with coconut milk souce (Gardjito et al. 2017). Coconut milk is main ingredients in the typical Minangkabau curries: *gulai* (liquid sauce, fast cooking), *kalio* (thick sauce, moderate cooking) and *rendang* (dry sauce, long cooking). Consume coconut milk is healthy, as previous reseach of *rendang* nutrition found that higher coconut milk concentrations (50-125%) combined with moderate cooking times (2 to 4 hours) enhanced antioxidant activity at once reduced lipid and protein oxidation (Karim et al. 2025).

Food plants often used for basic spice mixture of typical Minangkabau foods were in the group of very high-CSFI.

Local people always supply shallots (*Allium cepa*) (CFSI 18334.7), garlic (*Allium sativum*) (CFSI 9745.31), chilli (*Capsicum annum*) (CFSI 8316), *asam kandis* (*Garcinia xanthochymus*) (CFSI 2956.8), lime (*Citrus × aurantifolia*) (CFSI 2655) and *langkok-langkok* (a complete bunch of spices) along with coconut. This package contains turmeric and turmeric leaves (*Curcuma longa*) (CFSI 18098.4), ginger (*Zingiber officinale*) (CFSI 6277.5), kaffir lime leaves (*Citrus hystrix*) (CFSI 3646.72), galangal (*Alpinia galanga*) (CFSI 2775), *salam* leaves (*Syzygium polyanthum*) (CFSI 2457), and lemongrass (*Cymbopogon citratus*) (CFSI 1579.5) (Table 7). The diversity of spices in complementing the presentation of a dish symbolizes the diversity of characters in Minangkabau culture (Waryono 2021). Local people also known these plants for their medical efficacy which shown by the high number of Food Medical Used Index (FMUI). As examples, local people smear sliced shallots and coconut oil on children's bloated stomachs and drink a brew of grated turmeric to treat stomach ulcers. The existence of these spice plants also provides additional benefits as a gastronomic tourism attraction in West Sumatra. (Mardiyah et al. 2023).

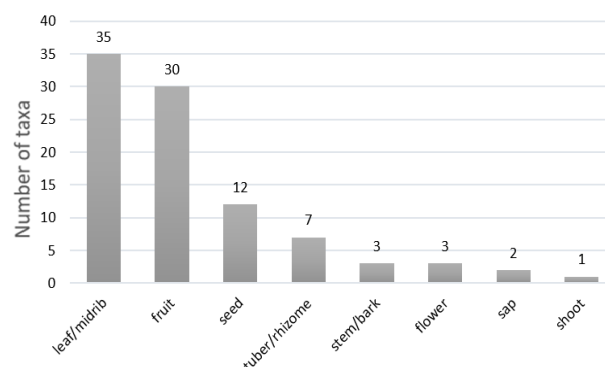


Figure 3. umbers of botanical taxa in the part plant used (right)

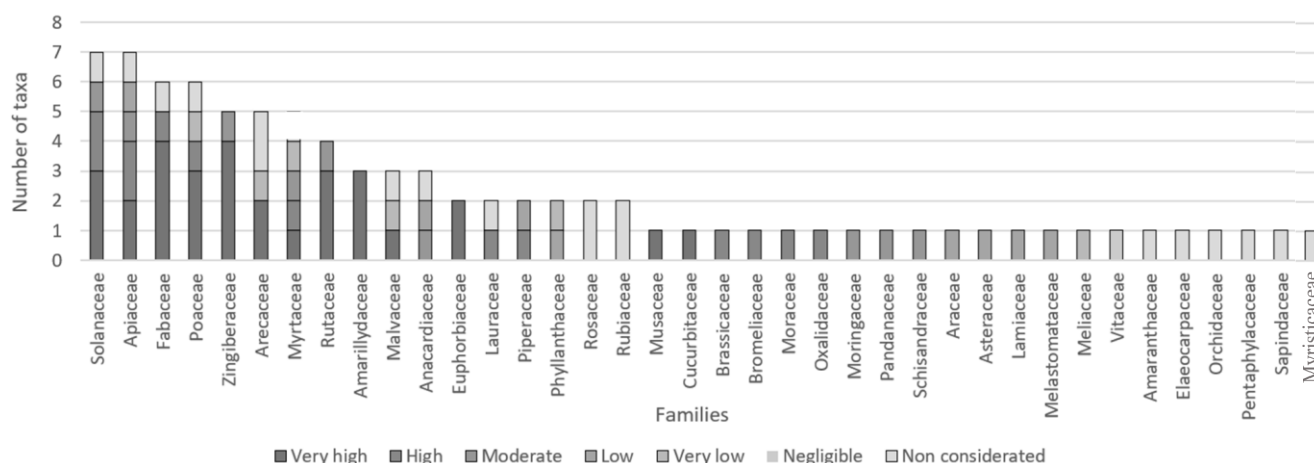


Figure 4. Numbers of plant taxa in the CSFI categories

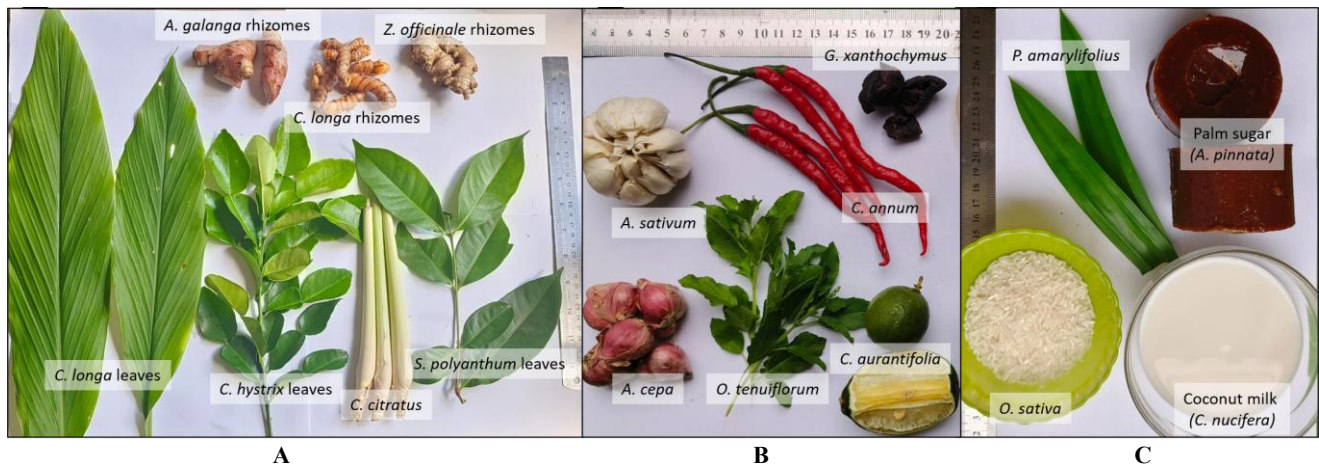


Figure 5. A. *Langkok-langkok*, B. Basic spices of Minangkabau foods, C. Ingredients of a lot of Minangkabau sweet cakes

The most important fruit in Minangkabau ethnic group is the banana (*Musa* spp.) (CFSI 17187.2). Banana bunch are served fresh in every Minangkabau ceremonies as symbol of welcoming guest. The main banana varieties that served in ceremonies are local varieties such as *pisang cik minyak* (AA, Inarnibal), *pisang rajo* (AAB, Raja), *pisang kolang* (AAB, Silk), and *pisang buai* (AAA, Cavendish subgroup: Robusta). Banana leaves are also used as organic wrap in Minangkabau ceremonial foods, such as *lopek* (glutinous rice flour mixed with palm sugar wrapped in banana leaves and steamed) and *lomang* (glutinous rice wrapped in banana leaves steamed in bamboo). Local people use the stiff and thick banana leaves of *pisang kepok* (ABB, Saba). The leaves must be prepared by softening them with the air from the stove fire and wiping them dry without water. For the reason of practicality, local people are starting to substitute these organic wraps with plastic wraps. Banana fruits and leaves were reported used as ceremonial food in various countries and other regions of Indonesia. In Uganda, banana fruits were brewed for wedding ceremonies, funeral rites, god worship and communal gatherings in Uganda and Papua (Mulugo et al. 2024; Zebua et al. 2025). In Sumba, West Nusa Tenggara, banana fruits were used as ingredients of ceremonial food as a symbol of respect and hospitality (Royyani et al. 2025). In Thailand and Bali, banana leaves used as packaging and decoration of ceremonial foods (Ponnill et al. 2021, Sari et al. 2023).

The primary source of carbohydrates in Minangkabau is rice (*Oryza sativa*) (CFSI 885.94). Local people mentioned that eating food without rice considered not taking a meal, indicating that rice cannot be substituted for other carbohydrate sources. Local people in West Sumatra prefer *pera* rice (non-sticky rice) (Sumilah et al. 2024). Therefore, rice cultivars often found in the study area are local cultivars that have high amylose levels, such as *Anak Daro*, *Junjuang*, and *Kuriak kusuik*. The presence of rice is obligatory in ceremonies. Rice is placed in a special container called *katidiang tunggak* (a tall container made of woven bamboo) which is carried by holding it on the head (Putri et al. 2025). It is expressed the high value and prosperity symbol of rice in Minangkabau culture. In the

study area, relatives and neighbors bring rice to the host as a symbol of joy, sympathy or condolences, depending on the form of the ceremony being held. Rice is also important in special days of festival and ceremonies to many culture. Rice is symbolic food of *Wahshoku* culture in Japan (Ohtsubo and Nakamura 2022) and Tumpeng in Java (Septia et al. 2024).

Along with ordinary rice, glutinous rice (*O. sativa* var. *glutinosa*) (CFSI 447.89), palm sugar from *Arenga pinnata* (CFSI 813.96) were important in Minangkabau ceremonies. Ceremonial cakes and snacks are mostly made from rice or glutinous rice, palm sugar, coconut and pandan (Figure 5.C). The example are *galamai* (long cooked caramelized glutinous rice flour mixed with palm sugar), *nasi lomak* (steamed glutinous rice), *ajik* (caramelized glutinous rice mixed with palm sugar) and *bungo inai* (caramelized rice powder mixed with palm sugar and grated coconut). These sweets are placed in special trays during traditional ceremonies called *talam* or *dulang*, arranged in odd number. The sweets variations depend on the customs of the respective villages. If certain sweets are missing, the ritual ceremony is considered invalidated. In many ethnic in Indonesia, *A. pinnata* is considered as important plants. Sasak ethnic group in West Nusa Tenggara Province called *A. pinnata* as gift tree or blessing tree and (Haryoso et al. 2020) and Baduy ethnic group in Banten Province used *A. pinnata* for various socio-cultural aspects, including traditional medicine, rituals, and botanical pesticides (Iskandar and Iskandar 2021).

A total of 34 taxa had low, very low, and negligible of cultural significant to local people. Even so, plants with lower and negligible status still has potential importance for the ecological conservation and socio-cultural heritage (Mandal et al. 2023; Luo et al. 2024). Taxa in these categories need special attention because if its not utilize, it will slowly faded from public memory. The sustainability of certain types of plants and authentic ceremonial foods can be threatened. An example is holy basil (*Ocimum tenuiflorum*) (CFSI 18.9) and betel (*Piper betle*) (CFSI 18.9). Holy basil is a typical plant of Minangkabau food and rarely used in other places in Indonesia (Gardjito et al. 2017). Differ with Minangkabau, other research reported

that holy basil has a high value of cultural significance index in Thailand (Saensouk et al. 2025b).

Betel leaves is obligatory in Minangkabau ceremonies. It serves as a complete package of betel quid called *siriah langkok* with areca nut (*Areca catechu*), gambier sap (*Uncaria gambir*), tobacco (*Nicotiana tabacum*) betel lime (Ca(OH)_2). It is used to invite relatives and as a sign of greetings in traditional ceremonies. Even though it is served as a package, betel leaves is better memorized to the local people than its complementary plants. Betel is a key plant in traditional ceremonies and practiced across Asian culture (Singh et al. 2020; Padilla and Paglinawan 2025). Betel leaves are also popular as a medicinal plant because of its antibacterial dan antiungal properties (Nayaka et al. 2021). Recently, the use of betel quid in traditional ceremonies has been declining. Several factors contribute to this are the decline in betel quid consumption in society, the replacement of betel quid with cigarettes in ceremonies, the use of technology to invite relatives and neighbors, and the increase scarcity of *siriah langkok* plants, which is also occurred in Malaysia (Jamil et al. 2025). This demonstrates the influence of globalization and urbanization on local people preferences and socio-cultural activities.

Ceremonial food plants in local agroforestry systems

The majority of ceremonial food plants products are usually found in the city wet market and *pokan* (weekly market). However, food plants are still cultivated or gathered by local people from their landscapes (Figures 6). Informants mentioned *porak* (traditional mixed gardens), *halaman* (homegardens), *rimbo* (forests), and *sawah* (paddy fields) as locations where they gathered the ceremonial food plants. Local people mentioned that 51 taxa can gathered from mixed gardens, 51 taxa from homegardens, 22 taxa from forests and 4 taxa from paddy fields (Figure 7). Although the diversity of food plants in paddy fields is low, paddy fields is the most important landscape for the Minangkabau ethnic group, as rice is the most important food for this community (Agesti et al. 2023).

Through TEK, biodiversity conservation intersects with cultural conservation (Susilowati et al. 2022; Levis et al. 2024; Rahayu et al. 2024). The results revealed that mixed gardens and homegardens play the important role as sources of ceremonial food ingredients. Of the 22 taxa that can be obtained from the forest, 51 taxa also occur in mixed gardens and homegardens (Figure 7.A). There are 13 taxa that only can gathered from homegardens and 10 taxa that can be gathered from mixed garden (Figure 7.B). The informants explain that several ceremonial food plants are easier to find in homegardens and mixed gardens than daily vegetable stall, such as *kemumu* (*L. gigantea*) and *kincuang* (*Etlingera elatior*). These local agroforestry systems also provide wild food plants which serve as key ingredients in ceremonial foods of specific village. The examples are *kromak* (*Alternanthera sessilis*) and *rumpul lambau* (*Spermacoce alata*) in *gulai bahuik* (eel curry) for big scale

ceremonial events in Nagari Payobasuang, *madang paraweh* (*Litsea elliptica*) leaves in *nasi putu* for seven month pregnant ceremony in Nagari Sungai Kamuyang, *pinjolang lauik* (*Eryngium foetidum*) in *pongek situjuah* for traditional ceremonies of Nagari Situjuah Banda Dalam. It is indicates that homegarden and mixed gardens plays an important role in the ex-situ conservation of food plants and the manifestation of social-ecological system (Garcia-del-Amo et al. 2022; Al Manar et al. 2025; Septian et al. 2025).

Majority of plants used as basic ingredients in Minangkabau ceremonial foods are present in the traditional homegarden, especially near the kitchen. Householders intentionally cultivate plants with known uses, growth patterns, and cultural significance whether they are domesticated or wild plants (Kusuma et al. 2025). Householders also maintain food plants in their homegardens for convenience reasons and economic motivation. Householders are easy to go to homegarden to harvest products for daily cooking and traditional healthcare. Number of informans explained that they can save money when gathering food plants from homegardens. Utilizing ritual food plants products from local agroforestry can reduce expenses for traditional ceremonies which are known to be expensive (Suzuki 2025). Moreover, surplus products from homegarden plants can provide extra income. It indicates that homegarden supports food security and food resiliency at the household level (Duffy et al. 2021, Ali et al. 2022).

Ceremonial food plants are components of multi-strata canopies vegetation in mixed garden and homegarden (Nair et al. 2022; Kardiman and Putri 2023). Traditional mixed garden is usually planted more densely with ground cover plants, shrubs, trees, coconuts trees (Hikmat et al 2025). The homegarden is dominated by cultivated plants with low growth and fruit trees. Food plant diversity in this agroforestry systems with multistorey condition provide various environmental services from carbon storage to agrotourism (Arifin et al. 2014; Trisnanto et al. 2023).



Figure 6. Important landscapes to cultivate and gather ceremonial food plants in the research site: paddy field, mixed garden, forest, and a local village with homegardens

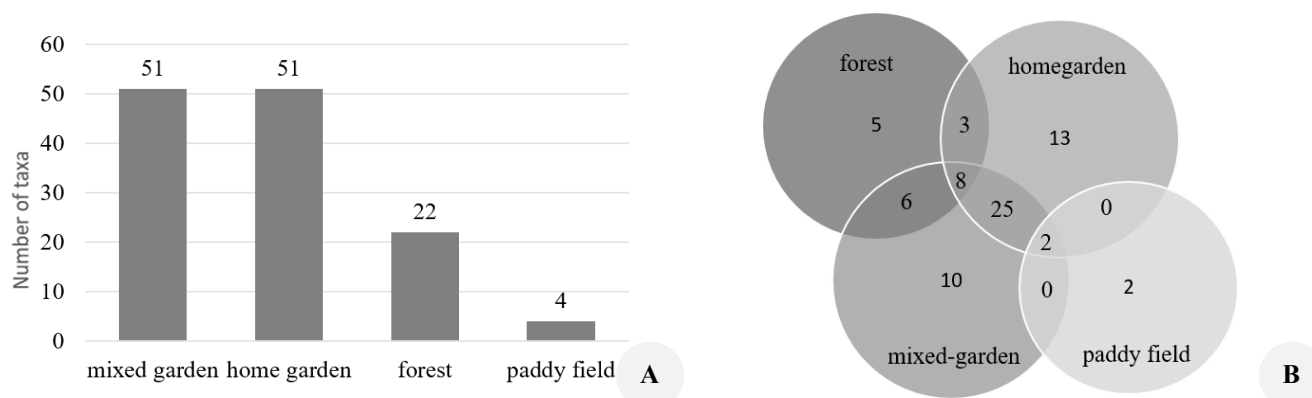


Figure 7. A. Number of ceremonial food plant in various landscapes of Minangkabau, Indonesia; B. A Venn diagram reflecting interconnected landscapes (forest, mixed-garden, homegarden, paddy field) as the sources of ceremonial food plants of Minangkabau ethnic group

Older informants are usually more knowledgeable in identifying food plants, medicinal efficacy of plants and know certain food plants for the substitute ingredients in some foods, than younger informants. This indicates a weakening of TEK and a decrease in the variety of food crops used by local people over generations. This TEK erosion also occur in many ethnic group as reported in Java, Kalimantan and Madura (Santoso et al. 2023; Kusuma et al. 2025; Suwardi et al. 2025). Older informants has mentioned the adage “*tanam nan bapucuak, paliharo nan baongok*” (plant who have a bud, raise who are breathe) and “*tanam sagalo ciek*” (planting one plant per species) including to useful wild plants in homegarden. This indicate Minangkabau ethnic group have knowledge of ex-situ conservation management in homegarden. Youth engagement is needed to preserve the local philosophy by inviting *pemuda nagari* (village youth) to participate in *bundo kanduang* or farmer group activities, promote ceremonial foods, and biodiversity conservation trough formal education and social media (Huambachano et al. 2022; Fischer et al. 2023).

Other issues is the area of homegarden and mixed gardens is decreasing, especially in urban areas (Ali et al. 2021). Low-layer plants can still be cultivated, but trees are increasingly difficult to find space to grow. This has implications for increasing market reliance (Mukarromah et al. 2024). To overcome this problem, householders need to plant fruits in containers or pots at their homegarden. In addition, community gardens can be recommended for local plant conservation in urban area to replace extensive mixed garden. This action has been successfully done in Berlin, Germany and Singapore (Seitz et al. 2022; Song et al. 2022).

In conclusion, local people in Lima Puluh Kota District and Payakumbuh City used 86 taxa from 38 families as Minangkabau ceremonial foods. The dominant families are Solanaceae, followed by Apiaceae, Fabaceae and Poaceae. Key plant species have a very high significance for the culinary culture of local communities over generations, with the most highest-CSFI plant is *C. nucifera*. The

ceremonial food plants used by Minangkabau ethnic group are mostly gathered in the mixed garden and the homegarden (51 taxa each). Key plants in Minangkabau ceremonies such as *C. nucifera*, *Musa* spp., and *P. bettle* are gathered from these two agroforestry systems, suggesting that that local agroforestry systems are important in ex-situ food plants conservation. Maintain the local agroforestry systems and preserve the socio-cultural practice in Minangkabau ethnic group have implication for conservation of local food plants and enhance local food security.

This study provides an interesting starting point for further development (e.g., the direct research in the field to identify existing food plant diversity, a comparative study with other regions in Indonesia, pharmacological studies of high-CFSI plants, or geo-mapping of agroforestry systems in Lima Puluh Kota). Academics are expected to play a role in conserving and increasing added value of local agroforestry towards food resilience, food security and ethnic food conservation of Minangkabau communities. The local government is expected to strengthen programs related to the biodiversity and food security with local plants diversity (i.e., key species must be present in the P2L, Dasa Wisma PKK, TOGA and school garden programs in West Sumatra). Furthermore, stakeholders in the education sector are recommended to include TEK into teaching materials to reduce TEK erosion and promote plants conservation.

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