



# Urban ethnobotany of Surakarta, Indonesia: a case study of non-edible plants in Gede Hardjonagoro and Kembang Markets

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## Research

### Abstract

**Background:** Urban ethnobotany studies the interactions of urban societies and the environment, specifically the uses of plants and plant products. The traditional markets in Indonesia are rich sources of data, as is the case in Surakarta, Central Java, which is considered a unique urban society due to the city being the historical capital of the Javanese kingdom of Surakarta Hadiningrat; with significant Chinese, Indian and Arab communities adding to the unique Javanese culture of Surakarta. This study demonstrates the diversity of non-edible plants and their vernacular usage. This study classified non-edible plants into three distinct categories: plants used for traditional ceremonies, decorative plants, and plants utilized for handicrafts.

**Methods:** Data was collected from January to July 2023 collected in two large traditional markets in Surakarta, *Gede Hardjonagoro* and *Kembang* through direct observations and interviews and analyzed using an ethnobotanical approach.

**Results:** The results demonstrate 48 species from 29 families of non-edible plants traded in the *Gede Hardjonagoro* and *Kembang* markets with a traditional supply chain linking rural hinterlands to urban markets. There is 70.27% similarity of non-edible plants sold in both markets. The similarity stems from the diverse non-edible plants and plant products used as offering in traditional ceremonies. Non-edible plants sold in *Gede Hardjonagoro* and *Kembang* Market are sourced from complex supply chains based on traditional supply chains through generations.

**Conclusion:** The various traditional ceremonies and contemporary arts created from the plants showcase Surakarta's vibrant and unique culture.

**Keywords:** Ethnobotany, Non-edible Plants, Surakarta, Urban

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## Background

The Javanese, who make up 40.5% of the entire Indonesian population (Ananta *et al.* 2015), have had a considerable cultural impact on Southeast Asia throughout history. The Javanese people, who reside in the central and eastern regions of Java, have a distinct and highly centralized culture that revolves around the remaining but no longer ruling kings of Yogyakarta and Surakarta. The current cultural activities observed within the *keraton*, or palace, are evident in all levels of Javanese society, showcasing millennia of ethical knowledge and local environmental traditions. The connection between tradition and the body of knowledge in Javanese society include the utilization of plants in ceremonial traditions and traditional rites. This aspect is a focal point of investigation in this ethnobotanical study.

Surakarta, colloquially known as Solo, Indonesia, was founded on February 17<sup>th</sup>, 1745, as a purpose-built capital city of the Mataram Kingdom, which at the time still ruled over the majority of Java and subsequently the much-diminished kingdom of Surakarta Hadiningrat following the Java war of 1755. As per royal Javanese philosophy, the royal palace retains a sacred place of power and administration, although the city's beating heart would be its markets (Cowherd 2012, Widayat & Prameswari 2022). Within the various markets of Surakarta, people from various social classes could meet and exchange goods, services, and ideas (Julianto *et al.* 2023). During the period of Dutch colonialism and its associated era of forced racial segregation, markets provided a means of interaction and integration between the Javanese population and the various Arab and Chinese communities that developed over the centuries (Breman 2020).

The royal Javanese heritage of Surakarta Hadiningrat continues to permeate every facet of daily life in Surakarta, as the still extant royal palace, currently led by HM Pakubuwono XIII, along with the former aristocracy still performs major roles in Surakarta society and commands considerable respect and reverence from the city population (Fawaid *et al.* 2022, Kristiyanto *et al.* 2019, Qodariah *et al.* 2022). The long-standing traditions and ceremonies of the Javanese, stemming from times immemorial, are still often observed in Surakarta (Al-Fajriyati 2019, Pradanta *et al.* 2015, Saddhono & Pramestuti 2018;), especially those rites concerning marriage, birth, and death are considered particularly sacred (de Grave 2018, Panuntun *et al.* 2023, Pradanta *et al.* 2015, Sahar 2019, Widyanita & Sudrajat 2023). These rites often require offerings of various plants of various species considered sacred creating a unique biocultural system and market demand (Albuquerque *et al.* 2023, Iskandar 2017, Lestari 2019, Rosidah 2019). It is within these traditional markets that continue to serve the urban population, providing essential goods, occasional luxuries, and sacred plants and plant products both sacred and mundane (Panuntun *et al.* 2023, Rosidah 2019, Sutyono 2013), linking the urban center of Surakarta with the rural hinterlands via a complex traditional supply chain that survives to this day often within the same families. Traditional markets today fall under the authority of the local government, which administers the stores, kiosks, and tents selling a wide range of products, including various plants and plant products.

Ethnobotanical observations were conducted at two traditional Surakartan markets, *Gede Harjonagoro* and *Kembang* market, explicitly concerning non-edible plants and plant products. In this study, non-edible plants were classified into three distinct categories: plants used for traditional ceremonies, decorative (ornamental) plants, and plants utilized for handicrafts. *Gede Harjonagoro* market, also known as "*Gede*" Market, translated from Javanese as the grand market, is the oldest market in Surakarta, established concurrently with the royal palace. The grand market has a large handicraft section of wood and bamboo for everyday items, as well as an extensive ornamental flower section providing fresh flowers and plants, including rose (*Rosa* sp.), white lily (*Lilium longiflorum* Thunb.), chrysanthemum (*Chrysanthemum indicum* L.), and aster (*Aster bracteatus* Turcz. ex Herder). *Kembang* market is a much newer market, constructed in 1963 to accommodate the various flower peddlers who would assemble in front of a historical park on Honggowongso Street, Kemlayan district. As with the flower peddlers of the past, *Kembang* market is dominated by sellers who provide the various flowers and items used in traditional rituals and ceremonies. Both markets also provide a range of products and services, with hundreds of shops and peddlers offering everything from shovels to stools, from snacks to fresh fruits and vegetables.

Previous research had been conducted exploring the diversity of edible and medicinal plants and plant products in various cities in Indonesia (Iskandar *et al.* 2023, Robi *et al.* 2019, Silalahi & Nisyawati 2018, Sujarwo *et al.* 2018, Suwardi *et al.* 2019) and in Surakarta specifically (Sagitarian *et al.* 2023; Santhyami *et al.* 2024); however, there has to be a single study concerning non-edible plants and plant products in Surakarta. This study aims to study the urban ethnobotanical diversity specifically concerning the non-edible plant species currently traded in the above-stated markets and register the various current uses as well as the intrinsic cultural meaning of each plant species to the Javanese. The use of these non-edible plant species and plant parts within the rites and rituals of the Surakarta palace and its common folk are part of the cultural knowledge and psyche of the Javanese and their interactions with their local environment. The registration of species and their uses in

Surakarta is significant because the Surakarta Palace represents a monolith of classical Javanese cultural knowledge, thereby bestowing upon Surakarta culture a distinctive position as a benchmark of Javanese culture, which is replicated by Javanese individuals beyond Surakarta and its dependencies. This investigation also endeavors to investigate the dynamics of the plant market chain, which encompasses the origin of the plants. The objective is to determine the extent to which the community has made an effort to cultivate plants and to identify the varieties that are still being extracted from the environment or forests in the Surakarta region. This research can allow us to determine the significance of specific plant species in Javanese culture, thereby facilitating the implementation of additional conservation measures for rare plant species.

## Materials and Methods

### Study area

The study was conducted within the city of Surakarta. Spread out over an area of 46.72km<sup>2</sup> and a total population of 523,008 (BPS 2022), Surakarta is one of the largest metropolitan areas in the island of Java. The Great Solo Area (GSA) roughly corresponds with the former colonial administrative region of residency Surakarta. GSA includes the traditional *Negaragung*, the traditional core of the kingdom of Surakarta Hadiningrat, including the royal capital city and the surrounding regencies that support the royal court with manpower and resources. The complex interconnectivity of relations within the *Negaragung* has created a unique culture developed over the centuries with the various ecosystems found within the *Negaragung*, namely the lowland riverine ecosystem of the Bengawan Solo River of Surakarta proper, the flat, rich agricultural lands of the Prambanan plains to the south of Surakarta, the mountainous ecosystem of the Merbabu - Merapi Complex to the west and the thickly wooded rolling limestone hills of Grobogan. Various products from all ecosystems within the *Negaragung* come together in Surakarta to be sold in various markets, specifically the Grand Markets.

The research is limited to the city of Surakarta proper, specifically in two markets marked out as “cultural heritage” markets by the city administration due to the cultural and historical role the markets have played in the city over the years. The two markets selected were Gede Hardjonagoro and Kembang Market (Figure 1). Data was collected from January 2023 to July 2023.

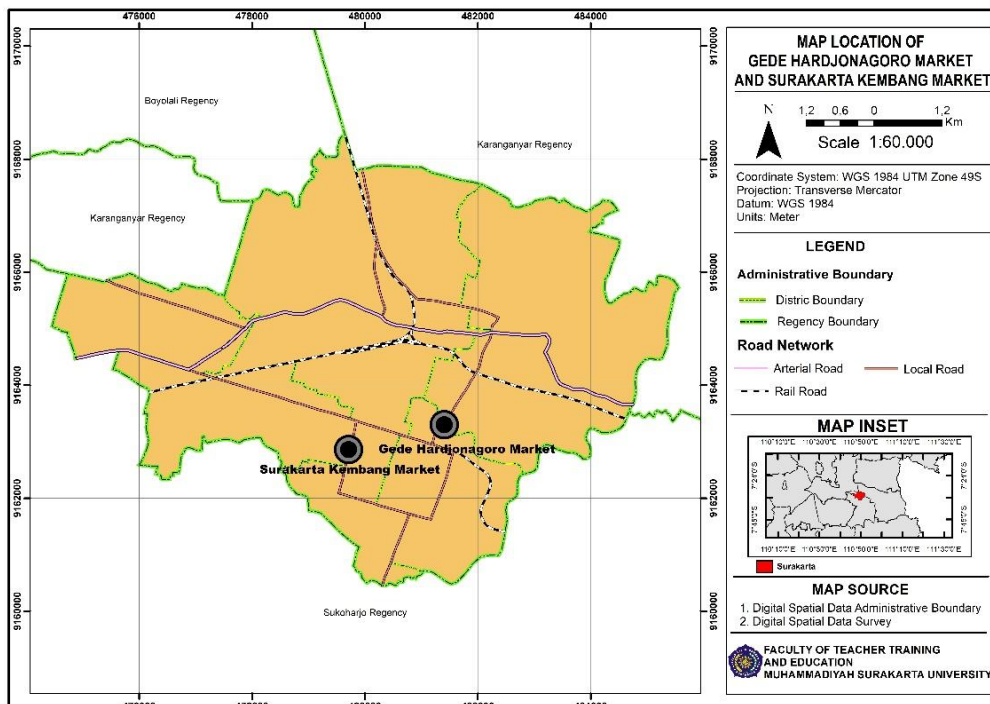


Figure 1. Location of *Gede Hardjonagoro* and *Kembang* Market in Surakarta City, Indonesia

*Gede Hardjonagoro* Market or *Pasar Gede* (Grand Market in Javanese) was considered the central market of Surakarta. Originally built right on the Bengawan River with ships and barges stopping by the river harbour loading and unloading goods directly by the market, it is now located in Jendral Urip Sumoharjo Street, Sudioprajan subdistrict, Jebres district, Surakarta City, Central Java. According to the Mayoral Decree No. 646 of 1997 on the protection of cultural reserves in Surakarta, the market was officially recognized as a cultural reserve of the city of Solo. The market is spread out over an area of 8,560 m<sup>2</sup>

consisting of 127 shophouses, 133 kiosks, 633 market stalls and about 250 merchants; the market is well known to visitors and tourists of Surakarta.

In addition to the *Gede Hardjonagoro* Market, this study was carried out in the Surakarta *Kembang* Market. This market is historically much newer, established in 1967 and now comprises 34 kiosks and 52 stalls. It is located on Honggowongso Street, Kemlayan subdistrict, Serengan district, Surakarta. *Kembang* market has two floors, although most merchants prefer selling on the 1<sup>st</sup> floor or street side stalls. *Kembang* market is open 24 hours every day, as the need for flowers, specifically those used in traditional ceremonies, are used at all times of the day or night.

#### Data Collection

The acquisition of field data involved direct observations corroborated with semi structured interviews (Cunningham 2001, Hurrell & Pochettino 2014, Martin 1995). Data was collected after permission was obtained from the appropriate authorities, namely the municipal trade department of Surakarta and the traders association "Rukun Makmur Sejahtera" in *Gede Harjonagoro* market and "Sekar Madu Manunggal" in *Kembang* Market. All respondents were asked permissions and signed documents of consent preceding the interview. Observations were carefully and systematically recorded, concerning the volume and name of various species traded as well as the set-up and distribution of shops and kiosks selling plants. Specimens from each species were collected for further identification at the Educational Herbarium of the Biology Laboratory of Universitas Muhammadiyah Surakarta. The scientific names of the sample species were cross-checked for accuracy by consulting authoritative sources (Backer & Bakhuizen van den Brink 1968, POWO 2023, WFO 2023), which were accessible in both book and online formats.

In addition to technical observations, semi-structured interviews were conducted with the head of the trader association (2 respondents), the traders (12 respondents at *Gede Harjonagoro* and 32 respondents in *Kembang* market), mongers (8 respondents), customers (25 respondents at *Gede Hardjonagoro* and 26 respondents at *Kembang* market), as well as with various court officials at Surakarta Hadiningrat palace, namely the abdi dalems (lit. courtiers) (3 respondents) and sentono dalem (lit. senior nobility) (1 respondent) with responsibility of preparing rites and ceremonies. The interviews followed clearly predetermined interview guidelines which involved: the taxonomic name, the vernacular name, the volume, the source, as well as the cultural meaning behind each species used. Although the discussions were free flowing, the primary questions as per interview guidelines remained unchanged with all respondents. The court officials of the Surakarta Palace were also asked to perform in depth interviews. As the keepers of the sacred knowledge of the rites and rituals of the palace, the court officials were expected to provide deeper knowledge concerning the historical and current use of various plant species.

#### Data Analysis

This paper is a descriptive qualitative and quantitative study of the biodiversity and cultural usage of non-edible plants using an ethnobotanical approach. Observations performed was cross-checked and cross-referenced with analytical data obtained from the semi structured interviews and descriptive data of the in-depth interviews and subsequently summarized and synthesized. All data acquired from interviews were categorized and registered according to the interview guidelines, namely: taxonomic data, the vernacular name, the volume, the source, as well as the cultural meaning behind each species used. Data from interviews concerning the source, volume and value of species traded was cross referenced and cross checked against data from the municipal trade department as well the traders' association. In depth interviews were analyzed using an ethnographic approach due the vast knowledge of the courtiers and the authoritative nature of the *pakem* (provision) of Surakarta upon the Javanese identity as a whole. As such, all data obtained through observation and interviews are subject to further quantitative analysis through the Sorensen Similarity Index (SSI), which is widely used in ethnobotany (Rahman *et al.* 2019, Tahraoui *et al.* 2023) to quantify the similar number of non-edible plant species by comparing two markets, *Gede Hardjonagoro* and Surakarta *Kembang* Market. The comparison is made using the Sorensen Similarity Index  $(SSI) = [2C / (A+B)] \times 100$ , where A is the total number of non-edible plant species in the *Gede Hardjonegoro* Surakarta Market, B is the total number of non-edible plant species in the *Kembang* Market, and C is the number of non-edible plant species in both markets. SSI ranges from 0-100% in value, with a higher value signifying more species available at the two traditional markets. Due to the semi-structured nature of interviews, the interviews were summarized and categorized to ease further analysis. The compressed interview data were then crosschecked with observational and any secondary data available. The final analysis synthesizes all data into a comprehensive descriptive analysis of the complex socio-economic dynamics of the two markets.

## Results and Discussion

Both markets have a wide range of products for sale, including edible and non-edible plants and plant products. The non-edible plants and plant products can be broken down into three general categories: plants as offerings in rites and ceremonies, ornamental flowers and handcrafts (Figure 2). Based on interviews with the traders and species identification, 48 species from 29 families of plant types were identified at *Gede Hardjonagoro* Market and Surakarta *Kembang* Market.

### Plants used in traditional ceremonial

There are 26 types of plants used in traditional ceremonies in of Surakarta, seen in table 1. The use of various *ubarampe* (lit. tools) composed of various plants species in Javanese tradition as the offerings in rites and ceremonies (called *caosan* in Javanese) has been well-established (Sahar 2019, Setiawan 2021, Wright 1987). The ceremonies and their offerings are well attested to by various texts from the pre-classical era known as *kakawin*, speaking towards the prehistoric origins of such practices. *Caosan*, continues to be an intrinsic part of the Javanese cultural consciousness (Aryanti & Az Zafi 2020, Faris 2014, Kholil 2007, Sahar 2019), to the point that the public and communal performance of *caosan* known as *slametan* is considered to be a part of social responsibility. This social responsibility is essential to maintaining of a harmonious social state known as *rukun* (lit peaceful coexistence). *Rukun* is a uniquely Javanese concept of acceptance and tolerance based on the innate sociopragmatic principle of non-interference (Prayitno 2017) that creates peace and harmony with their fellow man and nature in general.



Figure 2. Types of plants and plant products marketed in the Surakarta Market; (a) used as offerings in rites and ceremonies, (b) ornamental flowers, (c) handcrafts

Table 1. Plant species used in traditional ceremonies in Surakarta

Local name	Scientific Name	Family	Used Parts
mawar	<i>Rosa</i> sp.	Rosaceae	flower
melati	<i>Jasminum officinale</i> L.	Oleaceae	flower
kanthil petak	<i>Magnolia xalba</i> (DC.) Figlar	Magnoliaceae	flower
kanthil jene	<i>Magnolia champaca</i> Baill. ex Pierre	Magnoliaceae	flower
kenanga	<i>Cananga odorata</i> (Lam.) Hook.f. & Thomson	Annonaceae	flower
pinang	<i>Areca catechu</i>	Arecaceae	flower
selasih	<i>Ocimum basilicum</i> L.	Lamiaceae	seed
cendana	<i>Santalum album</i> Linn.	Santalaceae	stem
secang	<i>Biancaea sappan</i> L. Tod.	Fabaceae	stem
kayu manis	<i>Cinnamomum burmanii</i> Blume.	Lauraceae	stem

Local name	Scientific Name	Family	Used Parts
lempuyang	<i>Zingiber zerumbet</i> (L.) J.E. Smith	Zingiberaceae	rhizome
dlingo	<i>Acorus calamus</i> L.	Acoraceae	rhizome
temu ireng	<i>Curcuma aeruginosa</i> Roxb.	Zingiberaceae	rhizome
temulawak	<i>Curcuma zanthorrhiza</i> Roxb.	Zingiberaceae	rhizome
kunir	<i>Curcuma longa</i> L.	Zingiberaceae	rhizome
kayu angin	<i>Usnea thallus</i>	Parmeliaceae	all part
gedhang watu	<i>Musa balbisiana</i> Colla	Musaceae	leaf
serai	<i>Cymbopogon nardus</i> (L.) Rendle	Poaceae	leaf
suruh ayu	<i>Peperomia pellucida</i> Kunth	Piperaceae	leaf
sirih	<i>Piper betle</i> L.	Piperaceae	leaf
pandan wangi	<i>Pandanus amaryllifolius</i> Roxb.	Pandanaceae	leaf
janur	<i>Cocos nucifera</i> L.	Arecaceae	leaf
tembakau	<i>Nicotiana tabacum</i> L.	Solanaceae	leaf
salam	<i>Syzygium polyanthum</i> (Wight) Walp.	Myrtaceae	leaf
gambir	<i>Uncaria gambir</i> (W.Hunter) Roxb.	Rubiaceae	fruit
kemenyan	<i>Styrax</i> sp.	Styracaceae	exudate

çAlthough there has been considerable controversy surrounding the practice of *caosan*, specifically with the Muslim community (Nurrohim & Fikri 2021, Saddhono & Pramestuti 2018, Supriyanto *et al.* 2022), there has been a substantial renaissance of the Javanese cultural consciousness particularly in the royal cities of Surakarta and Yogyakarta, particularly regarding the practice of *caosan*. The consciousness is due to the spreading availability of royal manuscripts that give a nuanced argument concerning the practice of *caosan* that differentiates *caosan* as a cultural expression through the use of objects from the natural environment to be symbols and instruments to aid in the visualization of prayer to the All-mighty Creator God (Fawaid *et al.* 2022, Ismawati *et al.* 2022, Saddhono & Pramestuti 2018) and the forbidden practice of witchcraft and shamanism (Faris 2014).

The modern practice of *caosan* is based upon the traditions of the karaton (lit. Royal Palace) of Surakarta Hadiningrat and the *Pura* (lit. Ducal Palace) of Mangkunegaran. These institutions represent the epitome of Javanese civilization and safeguard its cultural consciousness and knowledge. The guidelines and principles of proper living, known in Javanese as *pakem*, are codified within the *Serat Wulangreh*. *Serat Wulangreh*, personally written by *Sampeyan dalam Ingkang Sinuhun Kanjeng Susuhunan* (lit. King) (SISKS) Pakubuwono IV (1768 - 1820), is considered a masterpiece of High Javanese literature written as a Javanese *macapat* poem, divided into 13 songs. It discusses each step in a person's life journey from birth until death, known as *laku*, emphasising personal religious scholarship and the shunning of superstitions.

*“Ironing Qur’an nggoning rasa yekti, nanging ta pilih ingkang uninga, kajaba lawan tuduhe, nora kena den awur, ing satemah nora pinanggih, mundhak katalanjukan, tedah sasar susur, yen sira ayun waskitha, sampurnane ing badanira, puniku sira anggugurua.”*

Within the Qur'an is a place of true guidance, choose what is familiar to you, except for the instructions. Do not mix what is familiar and what is instructed. If you do then you shall not find the right guidance. You will be misguided with wrong instructions. If you wish to be wise and know perfection, study it (*Wulang Reh*, SISKS Pakubuwono IV)

The Duke Mangkunegara IV of Surakarta also expounds upon the principle of an intimate personal relationship with God and the principles of knightly virtue and honour to be upheld with a person's life journey within his *macapat* poem, *Serat Wedhatama*.

*Mangkono janma utama, tuman tumanem ing sepi, ing saben rikala mangsa, mangsah amemasuh budi, laire anetepi, ing reh kasatriyanipun, susilo anor raga, wignya met tyasing sesame, yeku aran wong barek berag agama*  
Such is the true human being, fond of tranquillity, in certain moments, sharpening and purifying his character, intending to fulfil his duty as a knight, doing good manners, being humble, good at cooling the hearts of others, that is what truly appreciates religion (*Wedhatama*, Duke Mangkunegara IV)

Thus, the performance of *caosan*, is considered an intrinsic part of that person's *laku* as a constant reminder of his birth and eventual death (Fawaid *et al.* 2022, Hilmy 2018). The performance of *caosan* at regular intervals and to mark significant milestones of his life is based upon the Javanese calendar cycle that is roughly based upon the Islamic hijra lunar calendar but is uniquely divided into 7-day weeks and concurrently a 5-day *pasar*an (lit. market) days (Table 2). Hence, the person would have his "birth day", locally known as *weton*, in a 35-day cycle known as a *selapan* commemorated with a small communal meal called a *slametan*.

Table 2. Name of days in the Javanese Calendar

In a week (English - Javanese)	In a <i>pasar</i> an cycle
Sunday - <i>Minggu</i>	<i>Legi</i>
Monday - <i>Senen</i>	<i>Pahing</i>
Tuesday - <i>Slasa</i>	<i>Pon</i>
Wednesday - <i>Rebo</i>	<i>Wage</i>
Thursday - <i>Kemis</i>	<i>Kliwon</i>
Friday - <i>Jemuah</i>	
Saturday - <i>Setu</i>	

Based on the *pakem* (provision) of Surakarta Hadiningrat, there are nine main types of offerings based on the various arrangements and compositions of *caosan* (Table 3).

Table 3. Types of *caosan* and their compositions

No	Name of offerings ( <i>caosan</i> )*	Composition	
		Plant	Non plant
1	<i>Sekar Telon/ Sekar among</i>	– <i>Rosa</i> sp. (only red) – <i>Cananga odorata</i> – <i>Magnolia × alba</i>	Incense stick
2	<i>Sekar Telon suci</i>	– <i>Rosa</i> sp. (only white) – <i>Jasminum officinale</i> – <i>Magnolia × alba</i>	Incense stick
3	<i>Sekar Setaman / Sekar liman</i>	– <i>Rosa</i> sp. (red and white) – <i>Cananga odorata</i> – <i>Jasminum officinale</i> – <i>Magnolia × alba</i> – <i>Areca catechu</i> – <i>Cocos nucifera</i>	Incense stick metal coin
4	<i>Sekar sri setaman</i>	– <i>Rosa</i> sp. (red and white) – <i>Jasminum officinale</i> – <i>Magnolia × alba</i> – <i>Magnolia champaca</i> – <i>Cananga odorata</i> – <i>Santalum album</i>	– Incense stick – metal coin
5	<i>Sekar agung</i>	– <i>Rosa</i> sp. (red and white) – <i>Jasminum officinale</i> – <i>Magnolia × alba</i> – <i>Magnolia champaca</i> – <i>Cananga odorata</i> – <i>Santalum album</i> – <i>Pandanus amaryllifolius</i>	Incense stick
6	<i>Sekar bayen</i>	– <i>Rosa</i> sp. (red and white) – <i>Magnolia × alba</i> – <i>Pandanus amaryllifolius</i>	Incense stick
7	<i>Sekar caosan</i>	– <i>Rosa</i> sp. (red and white) – <i>Jasminum officinale</i>	– Incense stick – Cigarette

No	Name of offerings ( <i>caosan</i> )*	Composition	
		Plant	Non plant
8	<i>Empon-empon</i>	– <i>Magnolia xalba</i>	
		– <i>Cananga odorata</i>	
9	<i>Kinangan</i>	– <i>Acorus calamus</i>	– Incense stick
		– <i>Curcuma longa</i>	
		– <i>Zingiber zerumbet</i>	
		– <i>Curcuma aeruginosa</i>	
		– <i>Curcuma zanthorrhiza</i>	
		– <i>Cymbopogon nardus</i>	
		– <i>Cinnamomum burmannii</i>	
		– <i>Syzygium polyanthum</i>	
		– <i>Piper betle</i>	
		– <i>Peperomia pellucida</i>	
		– <i>Ocimum basilicum</i>	
9	<i>Kinangan</i>	– <i>Uncaria gambir</i>	– Incense stick
		– <i>Peperomia pellucida</i>	– Whiting
		– <i>Piper betle</i>	
		– <i>Nicotiana tabacum</i>	

\*All forms of *caosan* are offered upon *Musa balbisiana* leaves

#### a. Birth

After birth, the amniotic sack and the placenta locally known as the *ari-ari* will be brought home where the father or elder of the family will perform an *ujub*, a ceremony involving the burning of *Styrax* sp., over the *ari-ari* by symbolically placing it with *empon-empon* in an unglazed clay pot that is buried in the front yard of the family home. The *ari-ari* composed of the amniotic sac, considered his older brother, and the placenta, considered his little brother (*kakang kawah adi ari-ari*), will continue to play a significant role in the life of the Javanese child, as these are considered an intrinsic part of his existence even though they are no longer with him physically. The unglazed clay pot signifies the microcosm of the child's existence (*jagad cilik*) and contained within it is placed the *empon-empon* (Table 3) signifying all the spices of life, the happiness and sadness of life and every other emotion as well as sensation to be had. Thus, as the *ari-ari* is placed with the *empon-empon*, the father would pray, asking for divine guidance so that the child will know what to choose and be consistent in his choices in life. The burying of the clay pot in the front yard of the family homes is the physical representation of the prayer for the child to remember his home permanently while living a whole and prosperous life. A prayer for the safety and speedy recovery of the mother, symbolized by an offering of *sekar bayen* would be made by her bedside (Pradanta et al. 2015). The *sekar bayen* is composed of four elements with red and white roses (*Rosa* sp.) signifying a prayer for a healthy body and soul, **pandan wangi** (*Pandanus amaryllifolius*) signifying a prayer for a healthy mind, **kanthil** (*Magnolia xalba*) signifying the hope that the prayers would stick, *kumanthil*, or be perpetually true for the person being prayed. Most offerings, including *sekar bayen* are typically accompanied by incense burning and are traditionally wrapped within banana leaves.

The following ritual is a communal feast called the *aqiqah* which is based on the Islamic naming ceremony although *aqiqah* is now thoroughly syncretized with Javanese culture. This ceremony is the public presentation of the child to the community and a communal giving of thanks and prayer for the continued safety and prosperity of the child and the community. *Sekar* or flower among is used for the *ujub* of the ceremony.

At every *selapan* following birth, the child's parents would perform the *among-among* ritual on the night of the child's *weton*. The *among-among* ritual is a prayer for the continued safety and health of the child and a moment when the child's parents periodically benchmark the child's development. This prayer is symbolized by the ritual offering of *sekar among*. The *sekar among* is composed of three elements with red roses (*Rosa* sp.) signifying a healthy body, **kenanga** (*Cananga odorata*) signifying the wisdom and strength of the ancestors, and **kanthil** (*Magnolia xalba*) signifying the hope that the prayers would be perpetually true for the child. Thus the *sekar among* is a physical manifestation of a prayer that the child be healthy and have the strength and wisdom of the ancestors in his life (Widyanita & Sudrajat 2023).



During the time from birth till the 13<sup>th</sup> *selapan*, the child is considered a holy blessing of God and untouched by the world and its evils and thus is generally not allowed to touch the ground or more specifically the bare earth. On the 13<sup>th</sup> *selapan*, the family would hold the ceremony of *tedak siten*, a specific ceremony in which the child takes his 1st step on the bare earth. This is a communal event, as the neighbours and family are invited to witness the first steps as the child will choose between 3 items that will symbolize the child's future occupation. The ritual starts with a specific prayer symbolized by the *sekar setaman*. The *sekar setaman* represents all the blessings of the world and is composed of five elements with red and white roses (*Rosa* sp.) signifying a prayer for a healthy body and soul, jasmine (*Jasminum officinale*) signifying the purity of the soul, **kenanga** (*Cananga odorata*) signifying the wisdom and strength of the ancestors, the **kanthil** (*Magnolia xalba*) signifying the hope that the prayers would be true for the person being prayed.

### b. Marriage

The complex rituals of a traditional Javanese marriage begin with raising the *bleketepe*. The *bleketepe*, a woven mat of young coconut leaves, hangs above the door as a public sign to the community that the house will have a significant event, and traditionally the neighbors will offer their help. The following public event is the *siraman* ritual. The *siraman* ceremony is a ritualistic bath using *sekar setaman* that is put into a brass pot filled with water from 7 wells or springs. During this ceremony, the entire community is asked to witness that the soon-to-be bride/groom is now pure and ready for marriage. The final preparatory ritual is known as *midodareni*. During this ritual, the bride is asked to spend the final night in prayer and meditation during which a *widodari*, a Javanese angel, gives her blessing to the bride and the marriage.

The wedding procession begins with offering *sekar setaman* in prayer for the smooth running of the day's events. The wedding process of the groom entering the location with the dowry is preceded by the bringing of *kembar mayang*, which are twin offerings composed of young coconut leaves and *sekar setaman* as well as various fruits that symbolize both the philosophical tree of life as well as the flower of the *Areca catechu*. The *kembar mayang* is presented to the community, symbolizing the marriage and the end the bride and groom's single life and the beginning of married life.

The final phase of the traditional Javanese wedding is the ritual meeting of the bride and groom. Upon the meeting, the groom and bride throw *gantol* which are **suruh** (*Peperomia pellucida*) leaves tied with an unwound cotton string. The **suruh** symbolizes the unconditional love of the household, as something is given, not expecting anything in return, but when done mutually, all are loved equally and unconditionally. The final ceremony performed is *kucar kucur*, whereby the groom pours various grains (rice and corn), flowers, and coins into a cloth bag held by the bride, symbolizing the responsibilities of the man of the house to provide for the household and the woman of the house to manage and protect that which is provided (Natsir et al. 2022).

### c. Death

Javanese funerary traditions begin on the same day of the death, *geblak*, with the ritualistic washing of the body with a unique mixture of rice water (*leri*) mixed with *Acorus calamus* L. and *Zingiber cassumunar* Roxb. This mixture is believed to ease the separation of body and soul. The final washing will be with camphor water as per Islamic tradition. *Sekar telon suci* is often offered on the bedside of the recently deceased. *Sekar telon suci* is composed of three components: white roses (*Rosa* sp.) symbolizing the purity of the body, jasmine (*Jasminum officinale*) signifying the purity of the soul, and **kanthil** (*Magnolia xalba*) signifying the hope that the prayers would be true for the person being prayed. Several types of *caosan* used in Javanese death ceremonies can be seen in Table 4.

Table 4. Type of *caosan* (offerings) of Javanese funerary traditions

Name of phase (after death)	Types of offerings	Philosophy purpose
<i>nigang dinten</i> (third day)	– <i>Sekar setaman</i>	– To ask for forgiveness for the sins of the recently deceased
	– <i>Sekar konyoh</i> ( <i>Sekar telon suci</i> and <i>Cendana</i> inside a bronze or glass vessel with water)	– To soothe and comfort the soul as it becomes accustomed to the separation from the body
<i>pitung ndinteni</i> (seventh day)	– <i>Sekar setaman</i>	– To ask for forgiveness for the sins of the recently deceased
	– <i>Sekar konyoh</i>	– To ask that the ancestors accept the newly deceased and guide him as he begins his journey the to the realm of the dead

Name of phase (after death)	Types of offerings	Philosophy purpose
<i>ngawandasa ndinteni</i> (fortieth day)	<ul style="list-style-type: none"> <li>– <i>Sekar telon suci</i></li> <li>– <i>Sekar setaman</i></li> <li>– <i>Sekar konyoh</i></li> </ul>	<ul style="list-style-type: none"> <li>– To ask for forgiveness for the sins of the recently deceased</li> <li>– To commemorate the complete separation of the spirit and body</li> <li>– To mark the time when the spirit of the deceased passed the hereafter. By this time, the memories begin to fade and the dreams stop and the spirit arrived in the land of the dead (<i>Kasuwargan jati</i>)</li> </ul>
<i>nyatus ndinteni</i> (hundredth day)	<ul style="list-style-type: none"> <li>– <i>Sekar telon suci</i></li> <li>– <i>Sekar setaman</i></li> <li>– <i>Sekar konyoh</i></li> </ul>	<ul style="list-style-type: none"> <li>– To remember the deceased, and celebrate the corpse's complete decomposition, the flesh and organs melting away leaving only the bones (<i>Lebur daging</i>)</li> </ul>
<i>mendak pisan</i> (one-year anniversary)	<ul style="list-style-type: none"> <li>– <i>Sekar telon suci</i></li> <li>– <i>Sekar setaman</i></li> <li>– <i>Kinangan</i></li> <li>– <i>Sekar konyoh</i></li> </ul>	<ul style="list-style-type: none"> <li>– To commemorate the death anniversary. The whole community partakes in a remembrance of those who have passed and those left behind. By this time the soft bone and cartilage have faded away (<i>Lebur balung</i>)</li> </ul>
<i>mendak kaping kalih</i> (two-year anniversary of death)	<ul style="list-style-type: none"> <li>– <i>Sekar telon suci</i></li> <li>– <i>Sekar setaman</i></li> <li>– <i>Kinangan</i></li> <li>– <i>Sekar konyoh</i></li> </ul>	<ul style="list-style-type: none"> <li>– As with <i>mendak pisan</i>, this ceremony is to commemorate the death anniversary. The whole community partakes in a remembrance of those who have passed and those left behind. By this time the keratinous tissue such as hair and nails fade away (<i>Lebur rambut</i>)</li> </ul>
<i>nyewu</i> (thousandth day after death)	<ul style="list-style-type: none"> <li>– <i>Sekar telon suci</i></li> <li>– <i>Sekar setaman</i></li> <li>– <i>Kinangan</i></li> <li>– <i>Sekar konyoh*</i></li> </ul>	<ul style="list-style-type: none"> <li>– This ceremony is traditionally only a private affair, with only family invited. This is considered the final meal where the spirit of the deceased is present. Thus, it can be considered a final farewell and the end to the traditional mourning period. By this time the spirit of the deceased is believed to have entered eternal peace (<i>Kasuwargan langgeng</i>)</li> </ul>

\* specifically, for *nyewu* the *sekar konyoh* is placed in coconut water to symbolize eternal life

During the various rites and ceremonies conducted during the showing of the body, *sekar setaman* will always be on hand to serve as a prayer that the recently deceased will be as fragrant as flowers to the angels and ancestral spirits who will guide the soul to the afterlife. The journey from the home to the final resting place will be prepared by an older woman who will ritualistically sweep the path, symbolically praying for a clear path for the soul's journey to the grave (Setyawan et al. 2022). As the body is brought to the grave by the mourners who take turns being pallbearers, the others throw *sekar sawur-sawur* upon the path, blessing the path to the final resting place. The *sekar sawur-sawur* is composed of *sekar telon* with coins mixed in. It is subsequently spread out, symbolizing alms being given in the name of the recently deceased (Almu'tasim & Hendrajaya 2020).

Based on Javanese traditions, the journey of the soul from the temporal world to the afterlife lasts roughly 1000 days. Thus, after each step, those who have been left behind will hold a remembrance of the recently departed. Each remembrance is a communal meal with traditional prayer, *ujub*, by which the entire community asks for the forgiveness of the deceased sins and safe passage on the journey to eternal peace. Through every phase of the funerary rites, *sekar setaman* symbolizes a prayer for blessings of strength for those left behind, and *sekar konyoh*, a unique offering specifically for a soul on its journey to the afterlife, is presented. *Sekar konyoh* is composed of *sekar telon suci*, representing the fragrant and purified body, mind, and soul of the recently deceased, mixed with **cendana** (*Santalum album* Linn.) wood shavings, representing the good

deeds of the recently deceased; within a bronze or glass container symbolizing the eternal aspect of the hereafter. *Kinangan* is served as a symbol of birth in the afterlife, as the soul is accepted into everlasting peace. *Kinangan* composed of **gambir** (*U. gambir*), **suruh** (*P. pellucida*), tobacco (*N. tabacum*) and whiting, represents the devotion of the children to the father represented by the tobacco and the mother represented by **gambir**, which becomes red when chewed with **suruh**.

#### e. Special occasion

##### *Nyadran*

*Nyadran* is a vital tradition during the last two weeks of the Islamic month of Sha'ban, which precedes the holy month of Ramadhan. Javanese who can make the journey, make pilgrimages to their hometowns and pay homage to their ancestors in their respective family cemeteries. During these pilgrimages, they would clean the tombs of their respective ancestors, read *tahlil* and various other Islamic prayers, and leave offerings of *sekar caosan* and *kinangan*. *sekar caosan* is similar to *sekar setaman*, but due to a different *ujub*, it also represents a remembrance of the deeds and achievements of the ancestors personified by the sweet smell of the flowers in addition to reminding the descendants that all the blessings of the world can be attained by emulating the good deed of the ancestors. Those who are able will also take the opportunity to make pilgrimages to notable, honored, historical, or "blessed" figures (i.e. kings and saints) (Briliyandio 2021). Although this tradition has been historically done since early Mataram history (c. the 1500s), the number of people performing the pilgrimages has expanded exponentially, straining the traditional supply chain and leading to peaks in prices due to shortages of flowers and other plant materials necessary for *caosan* (Santosa & Sujaelanto 2020). The mass pilgrimages from various urban centers to their hometowns and villages are an essential avenue to the maintenance of the tradition itself and the transfer of cultural consciousness and knowledge from one generation to another. Various changes happen within the local supply chain as farmers prepare extra crops, specifically rose and jasmine, in anticipation of *Nyadran* and *Ramadhan*. In various areas, this has led to the establishment of monoculture farms under the local farmers' unions to the detriment of biodiversity.

##### *Selikuran*

During the holy time of Ramadan, particularly on the 21<sup>st</sup> day of the month, those who possess the opportunity to undertake a journey to their hometowns, where they engage in the act of presenting offerings to their forebears as a means of commemorating Ramadan, akin to the customary practices observed during the *nyadran* rituals. During this period, it is normal for individuals to prepare for *led-ul-fitr* festivities, which typically involve the collection of charitable donations for the less fortunate. Therefore, *selikuran* serves as a method of providing charitable donations in the form of prayers, represented by the offering of flowers, to individuals who have passed.

##### *Guyuban*

*Guyuban* can be classified as a harvest celebration that occurs on the initial Friday *Legi* (as indicated in Table 1) during a significant harvest period. The entire community will assemble following the prayers to partake in a communal feast. The festivities commence with a prayer of gratitude, symbolized by the ceremonial offerings of *sekar telon suci*, *sekar setaman*, and *sekar agung*, which have similarities. *sekar agung* resembles *sekar setaman*, as both symbolize the prosperity and blessings bestowed upon the community. However, *sekar agung* distinguishes itself by incorporating **cendana** (*S. album*) wood shavings, representing the virtuous acts performed by the ancestors of the community's inhabitants. Additionally, the presence of **kanthil jene** (*M. champaca*) in *sekar agung* signifies the well-being and commendable actions of the community's leaders (Palevi 2013).

Due to the continuous demand from the population since prehistoric times, the vast majority (92%) of non-edible plant species used for traditional rites have been domesticated. In most of the Indonesian region, the domestication process involves the creation of sacred groves and forests with a high natural concentration of ceremonial plants (Santhyami et al. 2021) followed by the eventual transplantation of the said plants to artificial gardens with specific environments in which the gradual process of divergence from "wild" specimen to create "domesticated" variant with optimal characteristics (Purugganan 2019). This domestication process, conducted over the centuries, according to the traditional norms and methods of the Javanese, is part of the cultural consciousness, specifically the traditional ecological knowledge of the Javanese. This history of domestication is in line with trends in various cultures, as the domestication of ceremonial plants has been observed in India (Pandey & Pandey 2016), Aceh (northern part of Sumatera island) (Sutrisno et al. 2020), and Bali (Ratnani et al. 2021). In line with the concept of hybridization in ethnobiology by Ladio & Albuquerque (2014), traditional concepts undergo a transformation into traditional-modern when they are commercialized, giving rise to new hybrid processes. This occurs due to the concurrent interaction of different symbolic components, ensuring the persistence of conventional concepts within contemporary monetary and cultural contexts.

The plants considered sacred or intrinsic to traditional rites have been domesticated in all three cases. They are cultivated in small home gardens, creating unique ecosystems with up to 70 species growing within a small district in Bali. The ecological effect of the gradual modernization of cultivation techniques favoring large monoculture plantations has yet to be studied.

### Plants as decorative (ornamental)

In addition to flowers and other plants and plant products used in traditional rites and ceremonies, both markets' ornamental florists also provide flowers to cater to contemporary preferences and requirements. A substantial portion of the market is devoted to selling floral arrangements, which fall into two categories: large and personal bouquets. Large floral arrangements have become the norm in modern Indonesian culture as a means of making public declarations. In order to convey their condolences at funerals and extend their congratulations on momentous occasions like marriages or grand openings, institutions and individuals frequently employ sizable floral arrangements. Given these expansive floral arrangements' substantial dimensions and public visibility, several supplementary materials are employed, including bamboo, styrofoam, velvet, paint, wire, foam, pencils, and needles. Large and vibrant flower varieties, including chrysanthemums (*Chrysanthemum indicum* L.), sunflowers (*Helianthus annuus* L.), daisy (*Aster bracteatus* Turcz. ex Herder) and flamingos (*Anthurium andraeanum* Linden ex André), were selected in an effort to attract the attention of the public.

Personal bouquets are frequently exchanged as gifts and can be utilized as decorative elements in interior spaces. Personal bouquets are typically characterized by their smaller size, designed to be carried or placed in vases. Consequently, they are often more affordable and frequently accompanied by personalized cards. Crafting individualized floral arrangements adheres to Western European conventions of florigraphy, wherein the compositions are tailored to convey specific messages through carefully selecting flowers, colors, and their respective symbolic meanings (Warisman et al. 2023). Two flower species often used in personal bouquets are of particular interest due to their sourcing directly from the wild, specifically edelweiss (*Anaphalis javanica* (DC.) Sch.Bip) and eucalyptus (*Eucalyptus deglupta* Blume.). The edelweiss flower, a protected species under Indonesian law PERMENLHK No. 106/2018 (KLHK 2018), grows only in alpine ecosystems. The sale of this protected flower has also been reported by Iskandar et al. (2022) in Yogyakarta, attesting to the widespread violation of the law. It is hoped that with increased law enforcement and education to the population, the Javanese edelweiss can be protected for future generations in its original pristine environment.

Table 5. Plant species used as decorative in Surakarta

Local name	Scientific name	Family	Used parts
krisan	<i>Chrysanthemum indicum</i> L.	Asteraceae	flower
lili putih	<i>Lilium longiflorum</i> Thunb.	Liliaceae	flower
mawar	<i>Rosa</i> sp.	Rosaceae	flower
aster	<i>Aster bracteatus</i> Turcz. ex Herder	Asteraceae	flower
bunga matahari	<i>Helianthus annuus</i> L.	Asteraceae	flower
bokor	<i>Hydrangea macrophylla</i> (Thunb.) Ser.	Hydrangeaceae	flower
sadap malam	<i>Polianthes tuberosa</i> L.	Agavaceae	flower
edelweiss	<i>Anaphalis javanica</i> (DC.) Sch.Bip	Asteraceae	flower
flamingo	<i>Anthurium andraeanum</i> Linden ex André	Arecaceae	flower
cemara pensil	<i>Cupressus sempervirens</i> L.	Cupressaceae	leaf
ekaliptus	<i>Eucalyptus deglupta</i> Blume.	Myrtaceae	leaf
bambu air	<i>Equisetum hyemale</i> L.	Equisetaceae	stem

### Plants as handicrafts

Handicraft traders at *Gede Hardjonagoro* Market are located in the eastern part of the market. Handicraft traders open from 7 AM to 3 PM. The size of the product arranges the products sold. Large-size products will generally be placed on the walls of the kiosks, while smaller-sized products are placed on the table displayed both inside and outside of the kiosk. Handicraft products include tools for household needs, such as rotan plates, fire mittens, woven hot trays, wooden tablespoons, cutting boards, and wood mortars (Table 6). It is noted that most items sold in *Gede Harjonagoro* are utilitarian, as opposed to the more decorative and souvenir items sold at Brinjarjo, Jogjakarta (Iskandar et al. 2022). Although both were initially built as royal markets, this discrepancy is due to the nature of the regional economy, where Surakarta is more geared to regional and local trade. In contrast, Yogyakarta is geared primarily towards tourism.

Table 6. Plant species used as handicraft in Surakarta

Local name	Scientific name	Family	Used parts	Uses
pring	<i>Gigantochloa atroviolacea</i>	Poaceae	stem	craft materials, trays, trivet pads
wulung	Widjaja.			
pring	<i>Dendrocalamus asper</i>	Poaceae	stem	craft materials, baskets, pads, rice plate, steamers, trays, trivet pads
petung	(Schult.f.) Backer ex Heyne			
pring	<i>Bambusa vulgaris</i> Schrad.	Poaceae	stem	craft materials, baskets, pads, rice plate, steamers, trays
ampel	ex J.C.Wendl.			
rotan	<i>Calamus manan</i> Miq.	Sparidae	stem	rotan plates, baskets, trays, trivet pads
pinus	<i>Pinus merkusii</i> Jungh. & de Vriese	Pinaceae	stem	wooden spoon, wood mortar
sawo	<i>Manikara zapota</i> L.	Sapotaceae	stem	trays, wood mortar
kelapa	<i>Cocos nucifera</i> L.	Arecaceae	stem, leaf	<i>lidi</i> brooms, brushes
jati	<i>Tectona grandis</i> L.f.	Lamiaceae	stem	craft materials, cutting boards
aren	<i>Arenga pinnata</i> (Wurmb) Merr.	Arecaceae	stem	wooden spoon, mortar wood.
nangka	<i>Artocarpus heterophyllus</i> Lam.	Moraceae	stem	craft materials

#### Market chain of non-edible plants in Surakarta

Table 7 demonstrates the number of non-edible plants sold in the *Gede Hardjonagoro* Market and Surakarta *Kembang* Market. Upon comparison, it can be demonstrated that the non-edible plant types are similar. 70.27% of non-edible plant species are available in Gede Hardjonagoro Market and Kembang Market. The primary factor influencing the similarity is the market demand for *caosan* and items relating to *caosan* that are the same due to the homogenous culture of the immediate local community served by both markets. Both markets have all the offerings necessary for *caosan* (26 species) on sale. The factor leading to a 29.73% difference is the specialization of each market. Although both markets are designated cultural tourism markets by the municipal government, *Gede Harjonagoro* serves as a general market with utilitarian items and household amenities; meanwhile, Surakarta Kembang market is a highly specialized market, focusing on the supply and sale of flowers, for both traditional rites and modern necessities.

Table 7. Similarity Index of non-edible plants marketed in the *Gede Hardjonagoro* Market and Surakarta *Kembang* Market

Parameter Analysis of Value	Value
Number of non-edible plants sold in the <i>Gede Hardjonagoro</i> Market (A)	36
Number of non-edible plants sold in the <i>Kembang</i> Market (B)	38
Number of non-edible plants sold in <i>Gede Hardjonagoro</i> Market and <i>Kembang</i> Market (C)	26
Non-edible plant equivalence index sold in <i>Gede Hardjonagoro</i> Market and <i>Kembang</i> Market (Sorensen Similarity Index (SSI))	70.27 %

As is demonstrated in Figure 3, the vast majority of non-edible plants currently traded in the two target locations are flowers and stems. The high number of stems available at the *Gede Harjonagoro* market is due to the number of wooden objects sold as handicrafts and furniture utilizing ten wood species, including three bamboo species (Table 3). Surakarta *Kembang* market only utilizes one species in which the stem part is used, *Equisetum hyemale* L., a local type of bamboo commonly used as disposable framing for large floral displays.

The wide range of floral species present at the Surakarta *Kembang* Market is unsurprising, given that the market primarily focuses on the trade of flowers and flower-related products. Additionally, it is worth mentioning that both marketplaces utilize the same species for traditional rituals. This signifies the substantial demand and uniformity of cultural practices. The number of flower species available for ritual purposes is comparatively fewer in rite (6 species) (Table 1) than in Bali (10 species) (Darmadi *et al.* 2023, Ratnani *et al.* 2021). The disparity in flower quantities can be attributed to the cultural and religious split between the Javanese and the Balinese following the decline of the Majapahit Empire, which brought the two islands together. The palace employed a significantly higher number of species (97) for the royal rites, as observed by Sari *et al.* (2019).

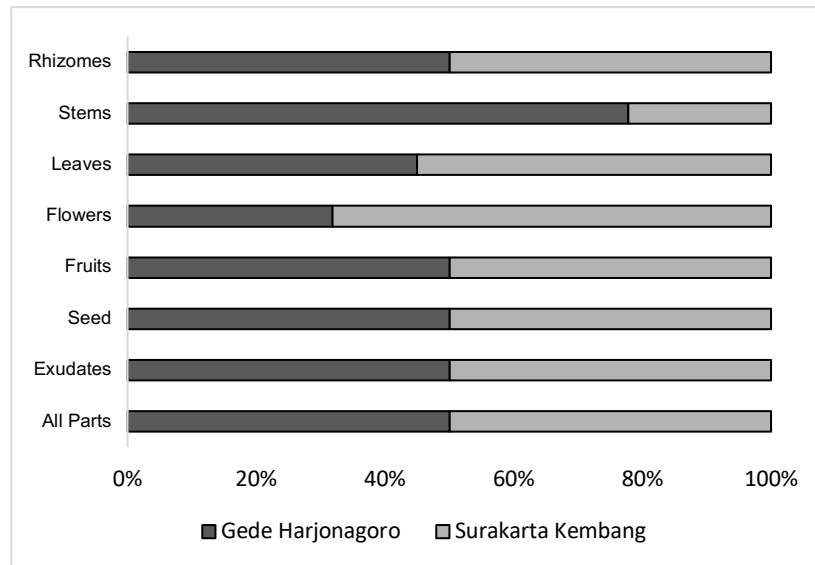


Figure 3. Plants part used comparison between *Gede Harjonagoro* and *Kembang* Market, Surakarta

Every item sold in *Gede Harjonagoro* Traditional Market and *Kembang* Market is sourced from complex supply chains (Figure 4), often based on traditional supply chains through generations. The supply chain of small wooden items begins in the forests of the mountains of Merapi and Merbabu, Karanganyar and Ungaran and the bamboo plantations found in the lower elevations of Merapi Mountain and the lowlands of Sragen and Ngawi, where foresters living in small villages supply the lumber necessary to the carpenters and artisans located primarily in semi urban and urban regions such as Sragen, Jogjakarta, Boyolali and Klaten. In turn, these are bought by mongers based in or near the artisans who wholesale these products and distribute them to the traders at *Gede Harjonagoro*. These mongers usually have multigenerational relationships with both the artisans and the traders. The raw materials used are selected for their unique utilitarian and artisanal value, such as *Dendrocalamus asper* for its strength and resilience and *Gigantochloa atroviolacea* for its aesthetic value. The supply of handicrafts is based on constantly fluctuating market forces, with mongers making deliveries on demand from the traders.

The supply chain for flowers is as complex as the handicraft, as flowers have a relatively short shelf life. Flowers are generally grown in the mountainous ecosystems of Merapi, Merbabu, Karanganyar and Ungaran. Jasmine and Chrysanthemum are traditionally grown in small garden plots, with various species grown in diverse ecosystems spread throughout Java. *Magnolia xalba*, *Magnolia champaca* and *Cananga odorata* flowers are generally grown in small monoculture plantations on the submontane zone of of Mount Merapi and Merbabu, which form the borders of Sleman and Boyolali regencies. Roses production is mainly centered on submontane zone of Mount Ungaran in Semarang regency, with some notable production found on Mount Merbabu. The large number of traditional farmers, grow and harvest the flowers for resale by the various *tengkulak* (wholesaler). Once harvested, the flowers are bought wholesale and stored in ice boxes by *tengkulak* in preparation for their regular trips to the large markets including *Gede Harjonagoro* and *Kembang* Market. The *tengkulak* usually bring their supplies to the markets three times a week to drop off outstanding orders made by the traders and auction off the rest of their supplies to other traders.

These results corroborate the findings by Iskandar *et al.* (2022) who report similar supply chains for the *Bringharjo* market. This similarity is due to the geographical proximity of Yogyakarta and Surakarta and the availability of supply, specifically flowers, which require the mountainous environment to thrive. It is noted, though, that the supply chain of Yogyakarta, another still extant royal city, is much more integrated to the *negaragun* of the Yogyakarta sultanate, and therefore draws more flower supplies from the Bantul, Magelang, and Sleman regencies. Bringharjo market also derives souvenirs from local Yogyakarta artisan from wood harvested in the forests and plantations of Sleman and Kulon Progo Regencies. The critical role of mongers as middlemen connecting the rural farmers with the urban traders and, subsequently, end users has also been reported by Rozci (2021) in Nganjuk Regency; Putri *et al.* (2014) in Bali; Sutrisno *et al.* (2020) in East Aceh; and Ridhawardani *et al.* (2017) in west Bandung.

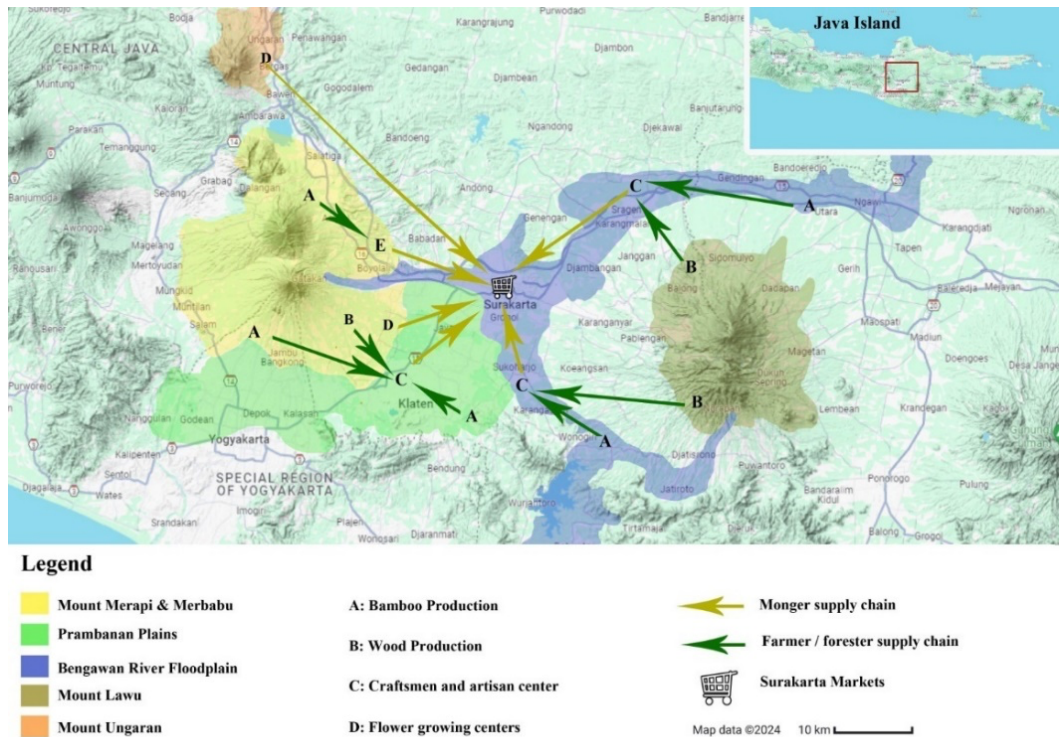


Figure 4. Market chain of non-edible plant in Surakarta

## Conclusion

Based on the data collected, it can be concluded that there are 48 species belonging to 29 families of non-edible plants traded at *Gede Market* and *Kembang Market*. There is 70.27% similarity of non-edible plants sold in *Gede Hardjonagoro Market* and *Kembang Market*. The similarity stems from the diverse non-edible plants and plant products used in *caosan* rituals. The availability of plants and plant products necessary for *caosan* in two different markets slated as tourist markets indicates the importance of *caosan* to the urban population of Surakarta who still require *caosan* literally from the cradle to the grave. It can thus be concluded that *caosan* is an intrinsic part of the Javanese social consciousness. With Surakarta's unique position as a center for Javanese culture, *caosan* has become a unique ethnobotanical phenomenon, having influenced the natural landscape through the planting and maintenance of various species in various ecosystems spread out from the mountains to the river valleys. Even with the development of modern tastes and fashions, *caosan* continues to unite the farmers, mongers, traders and the urban population. *Caosan* is a reminder of the initial relationship between man and nature established since immemorial and shall continue as long as the Javanese identity remains.

## Declarations

**List of abbreviations:** GSA. -Great Solo Area; SSI. -Sorensen Similarity Index

**Ethics approval and consent to participate:** The data were gathered with confidentiality, anonymity, and permission ensured. All participants were apprised of the study's aim and granted prior informed consent.

**Consent for publication:** Participants shown nin images agreed to have their images published.

**Ethical statements:** This study was conducted in accordance with ethical standards, and all participants provided informed consent prior to their inclusion in the study. This article does not include any experiments using animals conducted by any of the authors.

**Conflict of interest:** The authors have no conflicts of interest to declare.

**Availability of data and materials:** The data used to support the findings of this study are available from the corresponding author upon reasonable request.

**Competing interests:** Not applicable

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**Author contributions:** S conceptualized the idea, authored the initial text, and performed the data analysis; FRI gathered the data and assisted in overseeing the data analysis; LA and PA generated graphics and refined the final manuscript.

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