



THE UTILIZATION OF COSMETIC PLANTS: AN ETHNOBOTANICAL STUDY IN INDONESIA

PEMANFAATAN TANAMAN BERGUNA KOSMETIKA: STUDI ETNOBOTANI DI INDONESIA

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Abstract

Indonesia has a long history and development of plant utilization for cosmetics; until now, various cosmetic products have been mass-produced and can slowly eliminate the traditional knowledge of local communities on plants that have potential as cosmetics. This study aims to provide information about the types of potential cosmetic plants used by people from several regions in Indonesia. The methods used were open-ended, non-structured interviews and direct observation in the field. The research was conducted in five locations from four provinces (Banten, West Java, West Nusa Tenggara, and Southeast Sulawesi), and 34 plant species from 24 families were recorded. The *Zingiberaceae* family is the group with the highest number of species, at four. Fruit was the most utilized plant part at 35.2%, followed by flowers and leaves. Most recorded plants were used in skin care (40.38%). *Santalum album* is one of the plant species that is utilized and is now included as one of the threatened plant species, and there is a need for conservation efforts for this species.

Keywords: Conservation; *Santalum album*; Traditional knowledge; *Zingiberaceae*

Abstrak

Indonesia memiliki sejarah dan perkembangan pemanfaatan tumbuhan untuk kosmetika yang panjang. Hingga saat ini, berbagai produk kosmetik diproduksi secara massal dan perlahan dapat menghilangkan pengetahuan tradisional masyarakat lokal terhadap tumbuhan yang berpotensi sebagai kosmetik. Penelitian ini bertujuan untuk memberikan informasi tentang jenis tumbuhan berpotensi kosmetik yang digunakan oleh masyarakat dari beberapa daerah di Indonesia. Metode yang digunakan adalah wawancara non-terstruktur open ended dan observasi langsung di lapangan. Penelitian dilakukan di lima lokasi dari empat provinsi (Banten, Jawa Barat, Nusa Tenggara Barat, dan Sulawesi Tenggara) dan tercatat sebanyak 34 spesies tumbuhan dari 24 famili. Famili *Zingiberaceae* adalah kelompok dengan jumlah spesies tertinggi, yaitu empat jenis. Buah adalah bagian tumbuhan yang paling banyak dimanfaatkan sebesar 35,2%, diikuti oleh bunga, dan daun. Sebagian besar tumbuhan yang tercatat digunakan dalam perawatan kulit (40,38%). *Santalum album* merupakan salah satu jenis tumbuhan yang dimanfaatkan dan kini termasuk sebagai salah satu jenis tumbuhan terancam dan perlu adanya upaya konservasi terhadap jenis ini.

Kata Kunci : Konservasi; Pengetahuan tradisional; *Santalum album*; *Zingiberaceae*

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INTRODUCTION

Ever since ancient times up to this day, cosmetics have been developed by humans to fulfill the need for self-beautification, and have even become one of the necessities in everyday life, especially for women. Cosmetics originated from the Greek word of “*kosmetikos*,” which means the skill of decorating. Cosmetics have always evolved over time, and today cosmetics are used to enhance attractiveness, increase self-confidence, protect the skin from ultraviolet rays, and are used to prevent aging of the skin (Mitsui, 1993). The use of various fragrant scents and oils to cleanse and smooth the skin was recorded in Egypt for more than 1,000 BC, as cosmetics were an integral part to the hygiene and health of the Egyptian society (Chaudhri & Jain, 2009). The initial activities of this study were started with an extensive research for relevant and reliable literature on cosmetics, including the history of cosmetics use from various countries, particularly in the Southeast Asian region (Narayanaswamy & Ismail, 2015; Mohd-Nasir & Mohd-Setapar, 2018; Batubara & Prastya, 2020; Spyropoulou et al., 2020). Historical records in Indonesia related to the use of cosmetics and female beauty date back to the Hindu-Buddhist Kingdoms (Mahrunnisa et al., 2020). Until now, some local communities in Indonesia continue to use plant-based cosmetics.

Indonesia has a long history and development of plant utilization for cosmetics. Now, the development of technology and innovation in concocting cosmetics in Indonesia continues to grow. In fact, various cosmetic products have been mass-produced and can slowly eliminate the traditional knowledge of local communities on plants that have potential as cosmetics. In modern cosmetics, it is not uncommon for various chemical compounds to be added as one of the ingredients, which has resulted in a high number of skin diseases experienced by people in Indonesia. Although several tribes and cultures in Indonesia have recognised and used various types of plants as cosmetics, it is the rapid development of today’s beauty products that has made traditional cosmetic ingredients considered less practical. The risk of losing both biodiversity and local knowledge about plants that could be used in cosmetics is increasing, in addition to the loss of habitat and changes in modern society’s lifestyle (Camilla & Hakim, 2023). The purpose of this study is to provide information on the species of potential cosmetic plants that have been used by people from several regions in Indonesia. In the longer term, to preserve the knowledge of the potential cosmetic plants.

MATERIALS AND METHODS

This research began with various literature studies followed by field exploration of useful plants in several locations in Indonesia, including Sembalun, East Lombok Regency (in 2003), and Batudulang, Sumbawa Regency (in 2009) of West Nusa Tenggara Province; Sukabumi Regency-West Java Province, in 2010; Lampeapi, Konawe Islands Regency-Southeast Sulawesi Province, in 2014; and Taman Jaya, Pandeglang Regency-Banten Province, in 2015; and Bodogol. The study locations are shown in Figure 1. This study refers to the methods of van Hoang et al. (2008), Nolan and Turner (2011) by means of non-structured and “open-ended” interviews and direct observation in the field. Interviews were conducted using a purposive method with traditional leaders, traditional healers, and local people who are familiar with and use plants for cosmetics or beauty treatments. The criteria for selecting informants included indigenous people who had lived in the research village for at least 20 years, were over 25 years old, and knew or used valuable species of plants. A total of 98 people were interviewed across the study sites.

Data recorded includes the local name of the plants, the parts used, and their functions. Plant species with unknown scientific names were sampled for identification at the Herbarium Bogoriense (HBO). Data on the diversity of plant species used as traditional cosmetics were then tabulated, and the scientific names and distribution were validated using the Plants of the World Online (POWO) website (2023), and the conservation status of the species, referring to the International Union for Conservation of Nature (IUCN) Redlist Database. The utilization of plant parts and the purpose of utilization of each plant by the community are analyzed using the following formulation.

$$\text{Relative of plant parts utilized (\%)} = \frac{\text{number of plant parts utilized}}{\text{total plant species utilized}} \times 100\%.$$



Figure 1. Locations of the study

RESULTS

Socio-Demographic Characteristics of Respondents

This study involved 98 respondents from five locations in Indonesia. Respondents consisted of 61 females (62.25%) and 37 males (37.76%), with the youngest being 25 years old and the oldest being 65 years old (Figure 2a). The jobs of the respondents were diverse, although generally dominated by housewives (53%) and farmers (23%), with some midwives and broken bone shamans who were familiar with utilizing various species of plants as ingredients in the treatment process (Figure 2b).

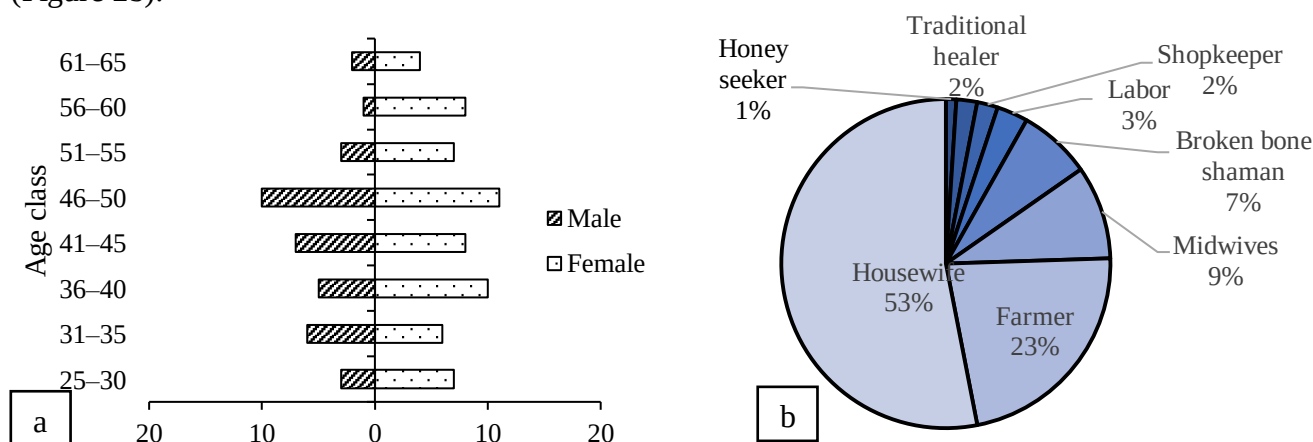


Figure 2. Socio-demographic characteristics of respondents; age class of respondents (a) and job types (b)

Biodiversity of Cosmetic Plants

Results from observation in five different villages in Indonesia recorded 34 plant species from 24 families (Table 1) used by the community as cosmetics and body care ingredients. A total of 21 plant species were utilized in the five study locations, while several other species were only utilized in one to three locations. The utilization of these plant species is closely related to the customs and culture of the local community. *Arenga pinnata* (kawung) grows widely in West Java, and the local community uses its old ash stalk for facial care. Then, *Entada phaseoloides* (welalo) seeds are used by the people in Lampeapi as a hair insecticide.

Table 1. List of potential cosmetic plant species

Family	Scientific names	Vernacular name	Parts used	Usage	Distribution category	Location
Annonaceae	<i>Cananga odorata</i> (Lam.) Hook.f. & Thomson	Cananga	Flower	Fragrance oil	Native	A, B, D
Apiaceae	<i>Apium graveolens</i> L.	Celery	Leaves	Hair care	Introduced	A, B, C
Arecaceae	<i>Arenga pinnata</i> (Wurmb) Merr.	Kawung	Old stalk	Facial care	Native	B
Arecaceae	<i>Cocos nucifera</i> L.	Coconut	Oil from fruit	Facial & hair care	Introduced	A, B, C, D, E
Asparagaceae	<i>Agave amica</i> (Medik.) Thiede & Govaerts	<i>Sedap malam</i>	Flower	Aromatherapy, spa, fragrance oil	Introduced	A, B
Asphodelaceae	<i>Aloe vera</i> (L.) Burm.f.	Aloe vera	Leaf strand	Skin & hair care	Introduced	A, B, C, D, E
Caricaceae	<i>Carica papaya</i> L.	Papaya	Fruit	Skin care	Introduced	A, B, C, D, E
Cucurbitaceae	<i>Cucumis sativus</i> L.	Cucumber	Fruit	Skin care	Introduced	A, B, C, D, E
Ericaceae	<i>Arctostaphylos uva-ursi</i> (L.) Spreng.	Bearberry	Fruit	Skin care	Introduced	C
Fabaceae	<i>Entada phaseoloides</i> (L.) Merr.	<i>Welalo</i>	Seed	Hair insecticides	Native	E
Fabaceae	<i>Pachyrhizus erosus</i> (L.) Urb.	<i>Bengkung</i>	Tuber	Skin care	Introduced	A, B, C, D, E
Lamiaceae	<i>Lavandula angustifolia</i> Mill.	Lavender	Flower	Aromatherapy, fragrance oil	Introduced	B, C
Lauraceae	<i>Cinnamomum burmanni</i> (Nees & T.Nees) Blume	Cinammon	Bark skin, leaves	Spa, fragrance oil	Native	A, B, C, D, E
Lauraceae	<i>Persea americana</i> Mill.	Avocado	Fruit	Skin care	Introduced	A, B, C, D, E
Lythraceae	<i>Lawsonia inermis</i> L.	Henna	Leaves	Skin & hair care	Introduced	C, D
Lythraceae	<i>Punica granatum</i> L.	Pomegranate	Fruit	Skin care	Introduced	A, B, C, D, E
Myrtaceae	<i>Syzygium aromaticum</i> (L.) Merr. & L.M.Perry	Clove	Fruit	Spa, fragrance oil	Native	A, B, C, D, E
Oleaceae	<i>Jasminum sambac</i> (L.) Aiton	Jasmine	Flower	Aromatherapy, spa, fragrance oil	Introduced	A, B, C, D, E
Piperaceae	<i>Piper betle</i> L.	Betel	Leaves	Skin care, female hygiene	Native	A, B, C, D, E
Poaceae	<i>Chrysopogon zizanioides</i> (L.) Roberty	<i>Akar wangi</i>	Root	Spa, fragrance oil	Introduced	A, B
Poaceae	<i>Cymbopogon citratus</i> (DC.) Stapf	Lemon grass	Stalk	Aromatherapy	Introduced	A, B, C, D, E
Rosaceae	<i>Malus domestica</i> (Suckow) Borkh.	Apple	Fruit	Skin care	Introduced	C
Rosaceae	<i>Rosa canina</i> L.	Rose	Flower	Spa, fragrance oil	Introduced	A, B, C, D, E
Rubiaceae	<i>Coffea arabica</i> L.	Coffee	Seed	Skin care, spa	Introduced	B, C, D
Rutaceae	<i>Citrus x aurantiifolia</i> (Christm.) Swingle	Lime	Fruit	Skin & hair care	Introduced	A, B, C, D, E
Rutaceae	<i>Murraya paniculata</i> (L.) Jack	Orange jasmine	Flower	Skin care	Native	A, B, D, E
Santalaceae	<i>Santalum album</i> L.	<i>Cendana</i>	Oil from wood	Fragrance oil	Native	A, B, C, D, E
Solanaceae	<i>Solanum lycopersicum</i> L.	Tomato	Fruit	Skin care	Introduced	A, B, C, D, E
Theaceae	<i>Camellia sinensis</i> (L.) Kuntze	Tea	Leaves	Skin care	Introduced	A, B, C, D, E
Vitaceae	<i>Vitis vinifera</i> L.	Grape	Seed	Skin care	Introduced	C
Zingiberaceae	<i>Curcuma longa</i> L.	Turmeric	Rhizome	Skin care, spa	Introduced	A, B, C, D, E
Zingiberaceae	<i>Elettaria cardamomum</i> (L.) Maton	<i>Kapulaga</i>	Fruit	Skin care, spa	Introduced	A, B, C, D, E
Zingiberaceae	<i>Kaempferia galanga</i> L.	Aromatic ginger	Rhizome	Skin care	Introduced	A, B, C, D, E
Zingiberaceae	<i>Zingiber officinale</i> Roscoe	Ginger	Rhizome	Skin care, spa, fragrance oil	Introduced	A, B, C, D, E

Note: A= Taman Jaya, Banten; B= Bodogol, West Java; C= Sembalun, West Nusa Tenggara; D= Batudulang, West Nusa Tenggara; E= Lampeapi, Southeast Sulawesi

The most common part of the plants used by the community was the fruit, comprising 35.29%, followed by flowers and leaves at 17.65%. A more detailed utilization of plant parts by the community is presented in Figure 3a. Generally, the community used fruit for skin care, which was in accordance with the results of analysis on the usage of plants presented in Figure 3b, in which skin care dominated the usage by 40.38%. Two other categories, usage for spa and fragrant oils, had the same value of 19.23%.

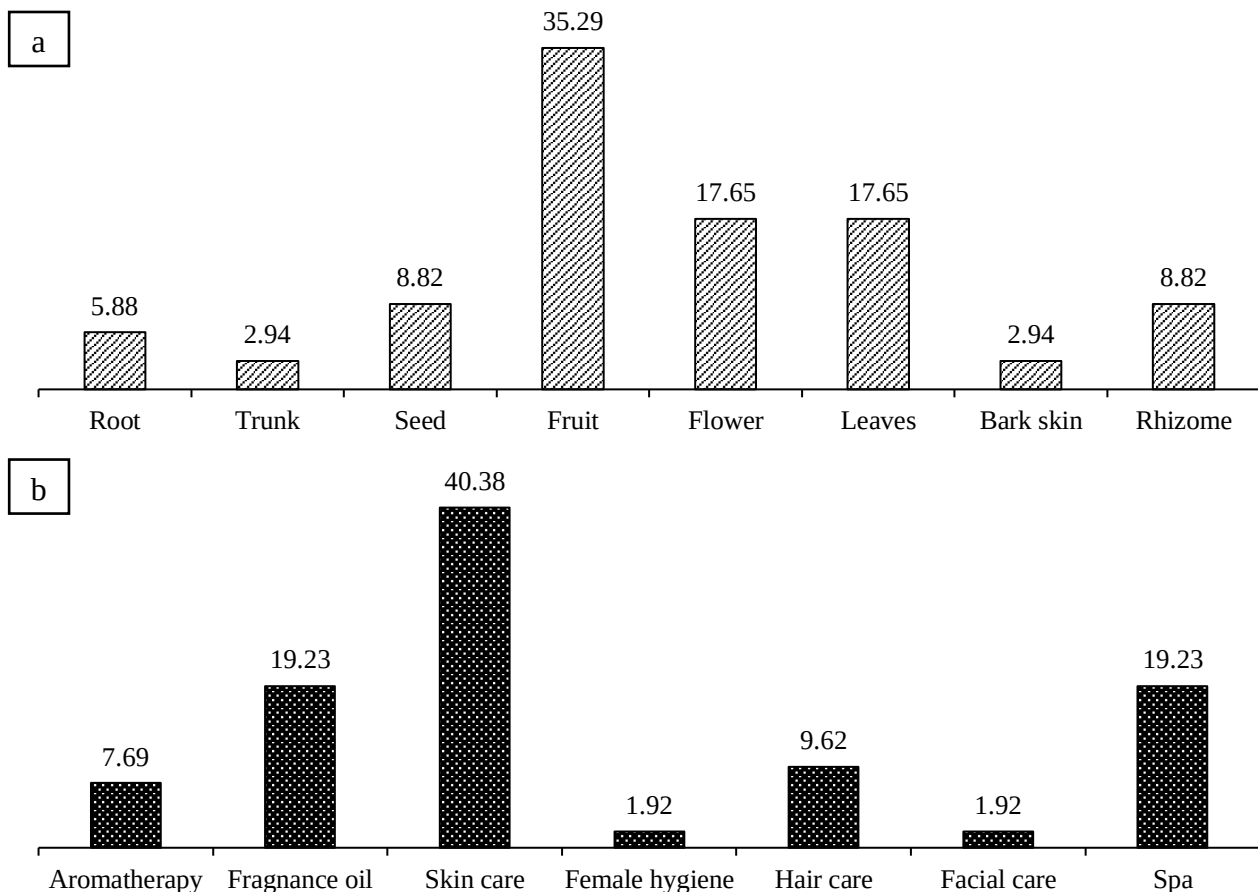


Figure 3. Utilisation of useful plants; percentage of utilization of plant's part (a) and percentage of usage of plants by community (b)

DISCUSSION

The community from five villages in Indonesia used several plants as cosmetics and body care ingredients. The family with the highest number of species used is the *Zingiberaceae* family with, four species, whereas other families have only one or two species. *Zingiberaceae* is one of the families widely used as medicinal ingredients, cosmetics, and other health products because it has high bioactive and antioxidant compounds (Zhang et al., 2020). *Curcuma longa* (turmeric) is one species quite popularly used as a cosmetic. Several regions in tropical Southeast Asia, India, and China recognise and grow *C. longa* because of its many benefits, one of which is as a cosmetic (Goel et al., 2008; Gonçalves et al., 2014; Saensouk & Saensouk, 2021). The results of this study showed that rhizomes of *C. longa* were utilized as an ingredient in skin care and spa; which were similar to its use by many women in India who used it as a scrub because it has antibacterial benefits that maintain healthy skin from infection and sunburn, it can also be used as an effective skin cleanser (Velayudhan et al., 2012; Kumar & Sakhya, 2013).

Apart from *C. longa* rhizomes, *Kaemferia galanga* and *Zingiber officinale* were also used as skin care ingredients. *K. galanga* rhizome can whiten the skin due to its hypopigmentary activity (Khairullah et al., 2021), and its high content of bioactives such as phenols and flavonoids which absorb ultraviolet rays. In this regard, *K. galanga* can be used as a sunscreen (sunscreen cream) ingredient that is not harmful and does not irritate the skin (Pratama et al., 2021). *Z. officinale* also has potential as a skin whitening due to its high antioxidant content and distinctive scent (Chen et al.,

2022). In addition, in Indonesia, mashed rhizomes of *Z. officinale* are commonly used as a scrub for postpartum skin care because of their warm sensation (Wahyuni et al., 2023).

Further analysis showed that 23.53% of the species recorded were native and 76.47% were introduced plants that had been naturalized for a long time. *Cocos nucifera* (coconut) has a natural distribution in the Philippines, the Bismarck archipelago to various islands in the Southeast Pacific (Plants of the World Online (POWO), 2023). However, Metusala et al. (2020) explained that *Cocos nucifera* was found on the Lalitavistara relief in Borobudur temple, this showed that some introduced species had long been known, planted, and utilized in Indonesia. A total of 1,177 species of vascular plants were recorded as naturalized foreign plant species in Malesia, with at least 31 species naturalized on each island (Holmes et al., 2023). The presence of introduced plant species was caused by various factors, including as a trade commodity or a contaminant in a commodity which was then cultivated and released in the wild (Pyšek et al., 2011). This could be observed from the high number of introduced species (76.47%) used by the community in general or as cosmetics, such as *Carica papaya* (papaya/pawpaw), *Camellia sinensis* (tea), *Coffea arabica* (coffee), *Persea americana* (avocado), and others.

The use of fruit parts (35.29%) is the most used part by the community (Figure 3a) due to various important factors, including the content of bioactive compounds that are good for the body, found in many parts of the fruit (Michalak & Kiełtyka-dadasiewicz, 2018; Hsouna et al., 2023). This is supported by the species of plants whose fruits are used (Table 1), which can bear year-round, without waiting for a specific fruiting season. Thus, locals can use it to complete their daily care needs without worry. Generally, the community used fruit for skin care, which was in accordance with the results of analysis on the usage of plants presented in Figure 3b, in which skin care dominated the usage by 40.38%. Two other categories, usage for spa and fragrant oils, had the same value of 19.23%. From previous discussion, it was established that fruit had a benefit for skin care; however, only the fruits of *Syzygium aromaticum* (cloves) were used in spa ingredients. *Syzygium aromaticum* is a well-known spice that has phenolic compounds such as eugenol. Eugenol acetate and gallic acid, which are used in pharmaceutical, food, and cosmetic industries, were extracted from the fruit to become essential oils that has a calming and relaxing effect (Cortés-Rojas et al., 2014; Selles et al., 2020).

Application of plants for skin care was not limited only to fruit but could also use the strand part as in *Aloe vera* (aloe vera) and *Camellia sinensis* (tea); seed as in *Coffea arabica* (coffee); and rhizome as in *C. longa* (turmeric), *Elettaria cardamomum* (cardamom), *Kaemferia galanga* (aromatic ginger), and *Z. officinale* (ginger). Caring for female hygiene used only one species, namely *Piper betle* (betel). The utilization of *Piper betle* has long been known and developed by various tribes in Indonesia (Widowati et al., 2020). Similarly, facial treatment also uses two species, namely *Cocos nucifera* (Coconut) and *Arenga pinnata* (kawung). Cream made from ashes of *kawung* old stalks was widely tested and proved to be an effective sunscreen and applied to maintain soft facial skin, relieved acne, smallpox, and excessive sunburn (Oktavia & Wungkana, 2018; Sadiyah et al., 2019).

In terms of distribution, plants used by the community listed in Table 1 were generally in abundance and in high distribution; one species was categorized as Vulnerable (VU), namely *Santalum album* (Arunkumar et al., 2019), and one species was considered Endangered (EN), namely *Coffea arabica* (Moat et al., 2020). *Santalum album* is one native species in which its wood is extracted to produce aromatic oil, due to its over-exploitation and difficulty to produce new plant, it is now included in the VU category based on the IUCN conservation status. Efforts to cultivate this species have been made using various methods, one of which is the tissue culture method to mass produced young seedlings from the best parent tree or 50 to 60 years old parent tree (Sanjaya et al., 2006). Climate change is also a threat to the population of *Santalum album*, as this plant is very sensitive to climatic condition, the best quality seeds were produced during a long dry season (Ratnaningrum & Indrioko, 2015).

CONCLUSION

This study recorded 34 plant species from 24 families used as cosmetic ingredients in five different regions in Indonesia. The *Zingiberaeae* is the family with the highest species, comprised of

four species. The most utilized plant part is the fruit, at 33.35%, followed by flowers and leaves at 17.65% respectively. The main usage of plants was for skin care (48.38%). *Santalum album* is one of the native species in which its wood is extracted to produce aromatic oil; however, its use needs careful consideration because this species is now under the Vulnerable category based on the IUCN conservation status. Therefore, future efforts should focus on integrating traditional knowledge into modern cosmetic development, encouraging sustainable harvesting practices, and promoting conservation strategies to ensure the continued availability of these valuable plant resources for both local communities and future generations.

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