

Ethnobotany of Mountain Regions

Series Editors:

R. W. Bussmann · N. Y. Paniagua-Zambrana

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F. Merlin Franco *Editor*

Ethnobotany of the Mountain Regions of Southeast Asia

 Springer

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Series Editors

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Saving Knowledge
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Ethnobotanical research in recent years has increasingly shifted into applied aspects of the discipline, including climate change research, conservation, and sustainable development. It has by now widely been recognized that “traditional” knowledge is always in flux and adapting to a quickly changing environment. Trends of globalization, especially the globalization of plant markets, have greatly influenced how plant resources are managed nowadays. While ethnobotanical studies are now available from many regions of the world, no comprehensive encyclopedic series focusing on the worlds mountain regions is available in the market. Scholars in plant sciences worldwide will be interested in this website and its dynamic content.

The field (and thus the market) of ethnobotany and ethnopharmacology has grown considerably in recent years. Student interest is on the rise, attendance at professional conferences has grown steadily, and the number of professionals calling themselves ethnobotanists has increased significantly (the various societies—Society for Economic Botany, International Society of Ethnopharmacology, Society of Ethnobiology, International Society for Ethnobiology, and many regional and national societies in the field currently have thousands of members). Growth has been most robust in BRIC countries.

The objective of this new series on Ethnobotany of Mountain Regions is to take advantage of the increasing international interest and scholarship in the field of mountain research. We anticipate including the best and latest research on a full range of descriptive, methodological, theoretical, and applied research on the most important plants for each region. Each contribution will be scientifically rigorous and contribute to the overall field of study.

More information about this series at <http://www.springer.com/series/15885>

F. Merlin Franco
Editor

Ethnobotany of the Mountain Regions of Southeast Asia

With 418 Figures and 1 Table

 Springer

Editor

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Dedicated to the folk healers of Southeast Asia

Preface

Plants assume ethnobotanical importance only when they are associated with human societies. Use of plants as medicine, food, fodder, and cultural purposes all happen in specific cultural and landscape contexts. This is a major factor often ignored by biologists studying human-plant relationship. Touting a plant as an ethnobotanically important one without providing adequate information on the societies that use them, or the context of use, distorts the picture. Chapters included in this volume provide comprehensive information on the medicinal, food, cultural, and phytochemical values of selected plant species, along with the cultural context. Gleaning out these information from published literature was not an easy task as a good percentage of published articles merely mention the plant use without specifying the community and context of its use. Also, most literature do not provide an understanding on how plant use has changed over times. Our authors have taken extra care to ensure that these information are presented, wherever possible. Another highlight of this volume is that majority of our contributing authors are budding ethnobiologists. These youngsters are poised to emerge as torch bearers of ethnobiology in Southeast Asia, and the larger Asian continent. We hope that this volume would serve as an important reference material for academics, plant lovers, and members of local communities of Southeast Asia.

Acknowledgments

This volume took birth with an invitation from Rainer W. Bussmann and Narel Y. Paniagua-Zambrana, series editors of *Ethnobotany of Mountain Regions*. I thank both of them for providing me the opportunity to edit the volume and also the freedom to include sections on biocultural importance of the selected species.

I express my sincere gratitude to all individual authors who have contributed to this volume. However, I should specifically place on record the important role played by Anisatu Z. Wakhidah, a young ethnobiologist from Indonesia. Her entry into the project came at a time when we had suffered a major setback with a few authors dropping out. She had helped me network with other ethnobiologists from Indonesia. Without her, this project would have taken longer to complete.

For this volume, I had the privilege to work with an extremely efficient team at Springer Nature including Eric Stannard, Johanna Klute, and Sylvia Blago. The experience and patience of Johanna and Sylvia helped a lot in troubleshooting various unforeseen glitches that arose especially during the initial stages of the project.

Special thanks to D. Narasimhan, former professor of botany at Madras Christian College, Chennai, and Santhana Ganesan of Singapore Botanical Gardens for their moral support and encouragement.

I thank the Institute of Asian Studies at Universiti Brunei Darussalam for supporting me throughout this project. Though ethnobiology is an interdisciplinary subject, in Asia it is often considered as a part of the natural sciences due to the domination of a bioprospecting narrative. I am indebted to my home institute for appreciating the interdisciplinary value of this project and permitting me to work on this.

F. Merlin Franco

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Photographs and Findings 1137



Pandanus amaryllifolius Roxb. ex Lindl.

PANDANACEAE

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Synonyms

Pandanus hasskarlii Merr.; *Pandanus latifolius* Hassk.; *Pandanus odoratus* Ridl.

Local Names

English: Aromatic pandan, pandan; **Indonesia:** *keker moni* (Ambonese, Moluccas), *pandan wangi* (Balinese, Javanese), *pandan rampe* (Balinese, Javanese, Sundanese), *pandan musang* (Sundanese), *pandan seungit* (Sundanese), *pondak* (Moluccas, Ternate), *seuke bangu* (Acehnese), *seuke musang* (Achenese); **Malay:** *pandan wangi*; **Philippines:** *pandan mabongo* (Luzon).

Botany and Ecology

Description: *Pandanus amaryllifolius* is clustered, slender, shrubby and 0.5–1 m tall (Fig. 1). Prop roots short, slender, 4.5–9 cm long, 1–2 mm in diameter. Stem 3–4 mm in diameter, greenish brown, glabrous. Leaf ensiform or sword shape, 19–34 cm long, 1.2–1.5 cm wide, chartaceous to fairly thin coriaceous, 2 pleated, in section low M shaped; adaxial surface green, glossy, apical ventral pleats absent, longitudinal veins present, tertiary cross vein absent; abaxial surface yellowish green, longitudinal veins present, obvious, 0.6–0.8 mm apart, tertiary cross vein form a network of meshes, oblong or rhombic, longer than broad, recurved spines absent; middle to

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Fig. 1 *Pandanus amaryllifolius*.
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basal parts of leaf with 12–15 secondary parallel veins, glabrous, apical part terminating at once in a point, acute to acuminate, not abruptly, without tapering in any degree at 1.5–2 mm long, apically with subulate serrate prickles, 0.5–0.75 mm long, 0.5–1 mm apart, approximately 5° ascending; leaf-sheath widened and amplexicauli, glabrous. Staminate inflorescence evidently exceedingly rare, once collected (see Stone 1978), probably pendent, to 60 cm long, peduncular bracts/spathes 90 cm long, white or lower ones with green foliaceous tips, bearing several oblong spikes to 35 cm long or more, several cm wide; upper ones much shorter, about 9–10 cm long, 2 cm wide, composed of many crowded staminal phalanges. Staminate flower minute; staminal phalange with column 4–9 mm long, or perhaps longer, compressed to flat, 1.5–2.5 mm wide, broadening slightly to the base; filaments very short, 0.5–1.5 mm long, 0.4–0.6 mm wide; anther oblong, ca. 2.5 mm long, 0.5 mm wide, apex bluntly convex, without or with a barely discernible apiculus, connective beset with scattered shining raphidophorous cells which are absent from the filament and thecae; stamens mostly 3–6 per phalange (described from a collection from Laguna, Ternate in the Moluccas under collection number *Beguin 1690*) Pistillate inflorescence unknown. Pistillate flower unknown. Infructescence unknown. Cephalium unknown.

Phenology: *Pandanus amaryllifolius* has never been found in flowering or fruiting. The only information on the sexual organ of the species is from one herbarium specimen of a staminate inflorescence collected from Ternate Island in the Moluccas (Stone 1978). Thus, *P. amaryllifolius* is always in vegetative form and as the consequence the propagation of this species is by cutting.

Distribution and Habitat: Bangladesh, Cambodia, China South-Central, Lesser Sunda Island, Malaya, New Guinea, Philippines, Sri Lanka, Thailand, and Vietnam (POWO 2020). *Pandanus amaryllifolius* is always found as clustered shrubs.

Rumphius (1743) reported that the species could grow as tall as *pinang* or bettle nut palm trees (*Areca catechu*), ranging from 8 to 9 feet (approximately 2.4–2.7 m) tall. Other than Rumphius' account, the tree habit of *P. amaryllifolius* has never been reported. Stone (1978) reported the small tree habit of the species planted in Singapore Botanic Garden. The species has never been found in the wild. Rumphius (1743) wrote that the species has always been found in cultivation and even in Moluccas, at the locality from where *P. amaryllifolius* was first described, it has never been found in the wild. Nevertheless, *P. amaryllifolius* is sometimes found as escapees or grow in abandoned human settlements such as observed in Simeulue Island after the tsunami (Keim et al. 2019). Based on the only herbarium specimen found with sexual organ, collected by *Beguïn 1690* from Ternate Island (believed to be kept in Herbarium Bogoriense and Rijksherbarium of the Netherlands), the place of origin for *P. amaryllifolius* has long believed to be somewhere in the Moluccas (Rumphius 1743; Stone 1978). Rheedé tot Drakenstein (1686) did not mention *P. amaryllifolius* in Hortus Malabaricus of India. *Pandanus amaryllifolius* is commonly found widely cultivated in lowland up to submontane areas. In Java, the species is cultivated from 150 up to 700 m altitude. In many places in Sumatera, the species is planted in the gardens in altitudes reaching up to 1000 m.a.s.l. The species is observed planted in the vicinity of Wamena, Jayawijaya Range, Papua (Indonesian New Guinea), at around 1600–1800 m.a.s.l. (Keim et al. 2018).

Local Medicinal Uses

Pandanus amaryllifolius is well known in folk medicine for its healing properties. The Balinese, Filipinos, Javanese, Malays, Moluccans, Sundanese, and Thai believe that the water extract of fresh leaves has a cooling effect and is excellent for the treatment of internal inflammations, colds, coughs, leprosy, measles, rheumatic pain, and sore throat and as a sedative, purgative, and diuretic (Heyne 1927; Burkill 1935; Beers 2001; Lemmens and Bunyaphatsara 2003; Roosita et al. 2008; Balangcod and Balangcod 2011; Sujarwo et al. 2015). A drink made by boiling finely chopped fresh stem or root in water is used to cure urinary infections (Heyne 1927; Burkill 1935; Bown 2002). The juice extracted from fresh leaves is administered in combination with that of *Aloe vera* to cure some skin diseases (Bown 2002; Wongpornchai 2006). The aromatic herbal tea from well-processed leaves has a cardiotoxic function. **Brunei Darussalam:** The healers in Kiudang mix pandan leaves with *Cordyline fruticosa* (Asparagaceae), *Blumea balsamifera* (Asteraceae), *Leucosyke capitellata* (Urticaceae), *Dillenia suffruticosa* (Dilleniaceae), *Blechnum orientale* (Aspleniaceae), and *Lygodium microphyllum* (Schizaeaceae) in a herbal bath to treat bloating and in postpartum healthcare (Kamsani et al. 2020). **Thailand:** *Pandanus amaryllifolius* is a traditional medicine for treating diabetes (Ravindran and Balachandran 2005). **Malaysia:** Traditionally, leaves are used as medicinal bath for women after childbirth, and also as hair wash (Samy et al. 2005).

Phytochemistry

Leaves: Anticancer (Ghasemzadeh and Jaafar 2013), Antidiabetic (Saenthaweesuk et al. 2016), Antihyperglycemic (Chiabchalard and Nooron 2015), Antimicrobial (Laluces et al. 2015), Antioxidant (Ghasemzadeh and Jaafar 2013; Shukor et al. 2018), Antiviral (Ooi et al. 2004).

Local Food Uses

The most important plant part harvested for food purposes is the leaf. The main food use of the leaf is to enhance flavor of food, ranging from main course such as cooked rice to desserts and sweet drinks throughout Southeast Asia. The plant is widely sold in Southeast Asia. Bottled pandan extract is available in shops, and often contains green food coloring. Thai people use the leaves to wrap chicken parts before frying. Besides food flavoring, the leaves are also used as natural food coloring that gives the food a pleasant green color (Setyowati and Siemonsma 1999; Franco et al. 2020). The leaf of *P. amaryllifolius* is also considered as a spice (Seidemann 2005).

Biocultural Importance

Pandanus amaryllifolius has been an integral part of the cultures of the people in Southeast Asia for centuries, particularly in Indonesia, where *P. amaryllifolius* is believed to be first cultivated. **Indonesia:** The species has always been included in most of their cultural activities from the daily rice cooking to religious offerings as can be seen in Javanese and Balinese cultures. In Balinese culture, leaves are always present in the daily offering known as *canangsari* (see Sujarwo et al. 2020), sometimes as a substitute of *P. tectorius*, explains why the species is considered sacred by the Balinese (Sujarwo et al. 2020). *Pandanus amaryllifolius* and *P. tectorius* are seen planted in the Hindu temples. The first ethnobotanical record of the use of *P. amaryllifolius* leaf as food flavoring was by Rumphius (1743) in Ambon Island of the Moluccas, where he used it to enhance the aroma of the rice (Fig. 2). The practice then spread to the other tribes visited Ambon, such as the Balinese, Bugis, Javanese, and Malays. The fragrance of *P. amaryllifolius* reminds the Javanese, Sundanese, and Balinese of the aromatic feathered rice from Cianjur in West Java. Hence, the fragrant cultivar was later named *pandan wangi* rice.

Economic Importance

The leaves of *P. amaryllifolius* has immense economic value for the people of Southeast Asia. The plant, specifically the leaves, has been regarded as a spice in relation with food flavoring and coloring (Seidemann 2005); it has been traded within the Indonesian Archipelago, as well as exported to China and India centuries

Fig. 2 *Pandanus amaryllifolius* is sold in a traditional market in the Moluccas, which is believed to be the homeland of the species. (© Ary P. Keim)



ago along with other spices from the Moluccas such as cloves (*Syzygium aromaticum*; Myrtaceae), candlenuts (*Aleurites moluccana*; Euphorbiaceae), and nutmegs (*Myristica fragrans*; Myristicaceae). West Java Province of Indonesia has been the center of production up to the present day (Hofstede 1925; Heyne 1927; Burkill 1935). Currently, Indonesia and Thailand are two major producers of aromatic pandans, followed by Vietnam and Cambodia. Countries in Western Europe, Japan, and China are the major importers of the leaves. In Thailand, cab drivers use pandan for natural air fresheners. The aromatic chemical constituents in *P. amaryllifolius* are harvested for perfume industries (Keller 2001). The pandan fragrance perfume was first crafted by the peranakan Chinese somewhere in Indonesia and Malaysia in the nineteenth Century. Since then, it has become a part of the Peranakan Chinese identity together with other scents such as Jasmine (*Jasminum sambac*; Oleaceae) and champak (*Magnolia champaca*; Magnoliaceae) (Gondomoro 2013; Wong 2019). Aromatic pandan-based perfumery has now gained popularity throughout the world; many major names in perfumery now produce ethnic Asian fragrances including pandan perfumes (Brechbill 2009, 2012). Similar to tropical aromatic herbs such as the lemon grass (*Cymbopogon citratus*; Poaceae), fresh leaves of *P. amaryllifolius* possess repellent activity toward certain household insects (Heyne 1927).

References

- Balangcod TD, Balangcod AKD. Ethnomedical knowledge of plants and healthcare practices among the Kalangunya tribe in Tinoc, Ifugao, Luzon, Philippines. *Indian J Tradit Knowl*. 2011;10(2):227–38.
- Beers SJ. *Jamu: the ancient Indonesian art of herbal healing*. Hong Kong: Periplus; 2001.
- Bown D. *The Royal Horticultural Society new encyclopedia of herbs and their uses*. London: Dorling Kindersley; 2002.

- Brechbill GO. Asia's fragrance industry. New Jersey: Fragrance Book Inc; 2009.
- Brechbill GO. The spice notes on fragrance. New Jersey: Fragrance Book Inc; 2012.
- Burkill IH. A dictionary of the economic products of the Malay peninsula. London: Governments of the Straits Settlements and Federated Malay States; 1935.
- Chiabchalard A, Nooron N. Antihyperglycemic effects of *Pandanus amaryllifolius* Roxb. leaf extract. *Pharmacogn Mag.* 2015;11(41):117–22. <https://doi.org/10.4103/0973-1296.149724>.
- Franco FM, Chaw LL, Bakar N, Abas SNH. Socialising over fruits and vegetables: the biocultural importance of an open-air market in Bandar Seri Begawan, Brunei Darussalam. *J Ethnobiol Ethnomed.* 2020;16:6. <https://doi.org/10.1186/s13002-020-0356-6>.
- Ghasemzadeh A, Jaafar HZE. Profiling of phenolic compounds and their antioxidant and anticancer activities in pandan (*Pandanus amaryllifolius* Roxb.) extracts from different locations of Malaysia. *BMC Complement Altern Med.* 2013;13:341.
- Gondomoro. Manusia dan kebudayaan Han. Jakarta: Penerbit Buku Kompas; 2013.
- Heyne K. De Nuttige Planten van Nederlandsch Indië, vol. 1. 2nd ed. Batavia: Department van Landbouw, Nijverheid en Handel in Nederlandsch Indië; 1927.
- Hofstede HW. Het Pandanblad: Als grondstof voor de pandanhoeden-industrie op Java. Eibergen: H. Heinen; 1925.
- Kamsani K, Franco FM, Slik F. A comparative account of the traditional healing practices of healers and non-healers in the Kiudang area of Brunei Darussalam. *J Ethnopharmacol.* 2020;256:112788. <https://doi.org/10.1016/j.jep.2020.112788>.
- Keim AP, Kartawinata K, Effendy O. Biodiversitas terkini Danau Habbema Papua, Indonesia. Ciputat: Universitas Muhammadiyah Jakarta Press; 2018.
- Keim AP, Agusta A, Royyani MF, Efendy O, Qarim BA. Botani Pulau Simeulue (Spermatofita). Muara Batu Aceh: Universitas Malikussaleh Press; 2019.
- Keller J. Pandanaceae. In: Hanelt P, editor. Institute of Plant Genetics and Crop Plant Research: Mansfield's encyclopedia of agricultural and horticultural crops, vol. 5. Berlin: Springer; 2001. p. 2816–24.
- Laluces HM, Nakayama A, Nonato M, Cruz TED. Antimicrobial alkaloids from the leaves of *Pandanus amaryllifolius*. *J Appl Pharm Sci.* 2015;5(10):151–3.
- Lemmens RHMJ, Bunyapraphatsara N. Plant resources of South East Asia (PROSEA) 12 (3): medicinal and poisonous plants 3. Bogor: PROSEA Publications; 2003.
- Ooi LSM, Sun SSM, Ooi VEC. Purification and characterization of a new antiviral protein from the leaves of *Pandanus amaryllifolius* (Pandanaceae). *Int J Biochem Cell Biol.* 2004;36(8):1440–6.
- POWO. Plants of the world online. Facilitated by the Royal Botanic Gardens, Kew. 2020. <http://www.plantsoftheworldonline.org/>. Retrieved 5 May 2020.
- Ravindran PN, Balachandran I. Underutilized medicinal species – III. *Spice India.* 2005;18(2):16–24.
- Rheede tot Drakenstein HA. Hortus Malabaricus. Amsterdam: Johannes van Someren, Johannes van Dyck, Hendrijk and Theodore Boom Publication; 1686.
- Roosita K, Kusharto CM, Sekiyama M, Fachrurrozi Y, Ohtsuka R. Medicinal plants used by the villagers of a Sundanese community in West Java, Indonesia. *J Ethnopharmacol.* 2008;115(1):72–81.
- Rumphius GE. Herbarium Amboinense, vol. 4. Amsterdam: Franciscus Changuion; 1743.
- Saenthaweesuk S, Naowaboot J, Somporn N. *Pandanus amaryllifolius* leaf extract increases insulin sensitivity in high-fat diet-induced obese mice. *Asian Pac J Trop Biomed.* 2016;6(10):866–71.
- Samy J, Sugumaran M, Kate LWL. Herbs of Malaysia: an introduction to the medicinal, culinary, aromatic and cosmetic use of herbs. Kuala Lumpur: Federal Publications, Times Editions–Marshall Cavendish; 2005. p. 180–1.
- Seidemann J. World spice plants: economic usage, botany, taxonomy. Heidelberg: Springer; 2005.
- Setyowati FM, Siemonsma JS. *Pandanus amaryllifolius* Roxb. In: de Guzman CC, Siemonsma JS, editors. Plant Resources of South-East Asia No 13: Spices. Bogor: PROSEA Foundation; 1999. p. 164–166.

- Shukor NAA, Ablat A, Airina MN, Jamaludin M. In vitro antioxidant and in vivo xanthine oxidase inhibitory activities of *Pandanus amaryllifolius* in potassium oxonate induced hyperuricemic rats. *Int J Food Sci Technol*. 2018;53:1476–85.
- Stone BC. Studies in Malesian Pandanaceae XVII on the taxonomy of “Pandan Wangi” A *Pandanus* cultivar with scented leaves. *Econ Bot*. 1978;32:285–93.
- Sujarwo W, Keim AP, Savo V, Guarrera PM, Caneva G. Ethnobotanical study of Loloh: traditional herbal drinks from Bali (Indonesia). *J Ethnopharmacol*. 2015;169:34–48.
- Sujarwo W, Caneva G, Zuccarello V. Pattern of plant use in religious offerings in Bali (Indonesia). *Acta Bot Bras*. 2020;34(1):40–53.
- Wong A. *The Baba Nyonya Peranakan: a journey into her past, traditions and cuisine*. Penang: Baba Wong Publications; 2019.
- Wongpomchai S. Pandan wangi. In: Peter KV, editor. *Handbook of herbs and spices*, vol. 3. New York: CRC Press; 2006. p. 453–9.