



Traditional uses and cultural significance of *Piper retrofractum* (Piperaceae) among Javanese and Sundanese communities, Indonesia

Themas Felayati, Fatin Oktavianti

Correspondence

Themas Felayati^{1*}, Fatin Oktavianti²

¹Department of Biology, Faculty of Science and Technology, Universitas Airlangga Surabaya, East Java, 60115, Indonesia

²Department of Chemistry, Faculty of Mathematics and Natural Sciences, State University of Malang, Malang, East Java, 65145, Indonesia

*Corresponding Author: themas.felayati-2016@fst.unair.ac.id

Ethnobotany Research and Applications 36:03 (2026) - <http://dx.doi:10.32859/era.36.03.1-14>

Manuscript received: 22/08/2026 - Revised manuscript received: 02/10/2026 - Published: 03/10/2026

Research

Abstract

Background: *Piper retrofractum* Vahl is an important medicinal and culinary plant that has long been integrated into the cultural traditions of the Javanese and Sundanese communities of Indonesia. This study examines the ethnobotanical relationship between *P. retrofractum* and these two ethnic groups by synthesizing information on its botanical description, geographical distribution, vernacular nomenclature, traditional uses, and cultural significance.

Methods: A qualitative approach was employed by integrating primary ethnobotanical observations with secondary data from the scientific literature and historical sources. Particular attention is given to traditional products derived from the fruits of *P. retrofractum*, including **cabe puyang** herbal tonic, **sambal gepleng**, and **bandrek**, which illustrate the species' enduring importance in local food and healthcare traditions. The review also summarizes the phytochemical constituents reported for *P. retrofractum* and discusses their relevance to its traditional medicinal applications.

Results: The findings demonstrate that Javanese long pepper occupies a significant role in Javanese and Sundanese culture, serving not only as a medicinal plant and culinary spice but also as an integral component of traditional rituals and cultural practices. This study highlights the close association between biological resources and local knowledge and emphasizes the importance of preserving the ethnobotanical heritage of *P. retrofractum* as part of Indonesia's biocultural diversity.

Conclusions: The common use of *P. retrofractum* among Javanese and Sundanese communities reflects its long-standing cultural significance, with diverse local names and traditional uses in foods and beverages. It serves medicinal and culinary roles in **cabe puyang**, **bandrek**, and **sambal gepleng** highlighting its multifaceted role in Javanese and Sundanese ethnobotanical traditions.

Keywords: *Piper retrofractum*; Javanese long-pepper; ethnobotany; Javanese; Sundanese

Background

Ethnobotany is the scientific study of plants' uses and cultural perceptions, employing qualitative and quantitative methods drawn from anthropology and botany (Ryan, 2011). It explores how plants integrate into cultural identity, healthcare, nutrition, rituals, and practical applications, emphasizing traditional knowledge of indigenous and local communities worldwide (Lamy, 2024). Ethnobotany also informs bioprospection by providing knowledge for applications in food, beverages, agriculture, and medicine (Afrianto *et al.*, 2020). Indeed, many modern medicines have originated from ethnobotanical surveys (Fongod *et al.*, 2014), while the field further supports nutritional prospecting, biodiversity conservation, and cultural heritage preservation (Kindscher *et al.*, 2018; Sutraningsih *et al.*, 2019; Lee & Kim, 2024; Ariyanto *et al.*, 2025).

The genus *Piper*, type genus of the Piperaceae family, comprises 2,432 species distributed across tropical and subtropical regions (POWO, 2025). *Piper* species are readily identifiable by morphological traits such as swollen nodes, entire distichous leaves, and terminal spikes that become leaf-opposed (Asmarayani, 2018). This genus holds commercial value in flavoring, pharmaceuticals, insecticides, and traditional practices (Torres-Pelayo *et al.*, 2016). Research on societal uses of *Piper* is extensive, reflecting its longstanding association with human cultures. For instance, *Piper nigrum* L. (black pepper) serves as a spice, while species such as *P. angustifolium* Lam., *P. betle* L., *P. glabratum* Kunth., *P. ossanum* Trel., and *P. submultinerve* C. DC. function as natural antiseptics in traditional communities (Salehi *et al.*, 2019).

Piper retrofractum Vahl, known locally as **cabe jawa** or Javanese long pepper, is native from western-central Malesia and Bangladesh to China (POWO, 2025). All parts of the plant are used in traditional medicine (Salleh & Farediah, 2020; Faramayuda *et al.*, 2021), though this study focuses solely on its fruit. Among the Javanese, the fruit features in **jamu** (Indonesian herbal tonics) and harvest-opening ceremonies (**wiwitan**), beside Sundanese the fruit features in beverages. These uses form the basis of the present investigation. In Javanese and Sundanese society, plants play vital roles in daily life, ceremonies, and spiritual practices. Although numerous Indonesian ethnobotanical studies address medicinal plants broadly, the specific medicinal and ritual roles of *P. retrofractum* in both cultures remain underexplored. Accordingly, this study documents its medicinal and ceremonial applications among Javanese and Sundanese communities and analyzes its significance within local ethnobotanical traditions.

Materials and Methods

Dataset sources

Data were collected using a qualitative approach that combined primary and secondary data sources. Primary data were obtained through semi-structured interviews with local community members, including knowledgeable elders, traditional healers, and other key informants, to document traditional knowledge regarding plant uses, cultural significance, and preparation methods. This study was conducted through interviews with **sambal gepleng** makers and participants in the **wiwitan** ceremony in several areas of Yogyakarta Province, including Gunung Kidul and Bantul. Some data regarding the distribution of **cabe puyang** which particularly from Central Java were also obtained through interviews with locals. The same applies to data on the **bandrek** beverage. Interviews were conducted in the local language whenever necessary, and responses were recorded with the participants' informed consent.

Secondary data were gathered through an extensive literature review of published and unpublished sources, including scientific articles, books, textbooks, electronic newspapers (e.g., kompas.com, tempo.co), websites (e.g., murtigading.bantulkab.go.id, <https://berita.upi.edu/bandrek-versus-ronde-jahe/>) and credible internet resources. The literature review was utilizing electronic scientific databases such as PubMed, Thieme, Scopus, ScienceDirect, and Google Scholar. Search keywords included "*Piper retrofractum*," "**cabe jawa**," "**cabai jawa**," "**wiwitan**," "**cabe puyang**," "**lempuyang**," "*Zingiber zerumbet*" and "**bandrek**". To complement these data, relevant information shared on social media platforms was systematically examined to identify contemporary ethnobotanical practices, local perceptions, and public documentation of plant utilization. This curation followed established protocols (Ohme *et al.*, 2024; Chani *et al.*, 2023; Pretious, 2023). Information obtained from different sources was cross-checked and triangulated to ensure consistency, reliability, and accuracy of the recorded ethnobotanical knowledge before qualitative analysis. Data on the distribution of **wiwitan**, **sambal gepleng**, **cabe puyang**, and **bandrek** are presented on the map in Figure 1.

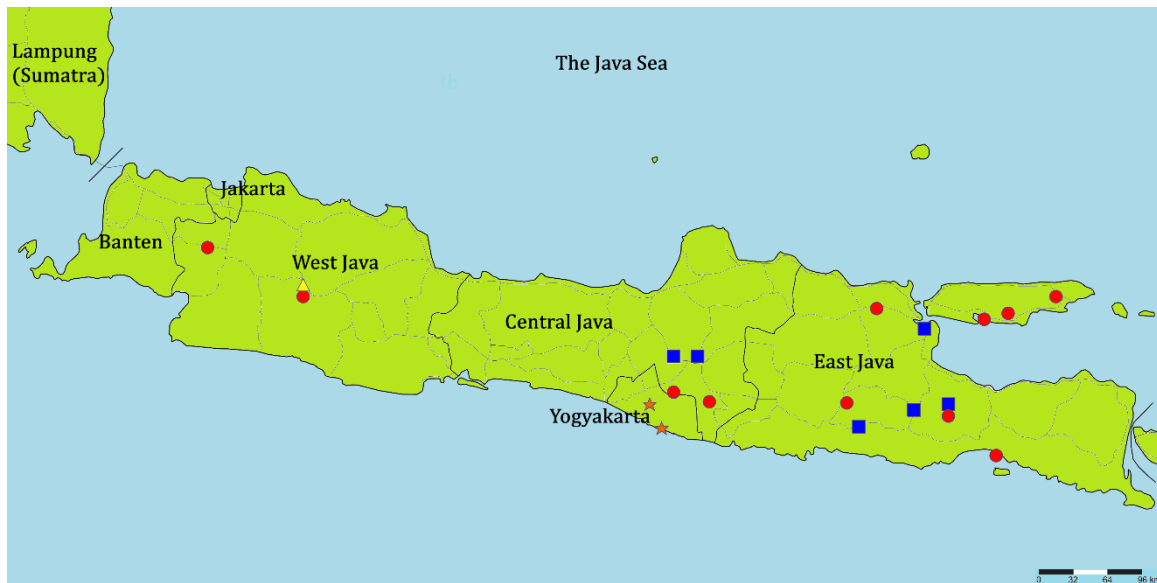


Figure 1. Occurrence of *Piper retrofractum* based on primer and secondary studies in Java. The red dotted area indicates the distribution of *P. retrofractum*; The orange stars indicate locations where **wiwitan** held and **sambal gepleng** are produced; The blue squares indicate locations associated with the production of **cabe puyang**, a Javanese traditional herbal tonic; and the yellow triangles indicate locations where **bandrek**, a Sundanese traditional beverage is produced.

Results and Discussion

Taxonomy of *Piper retrofractum*

P. retrofractum was described by Vahl at 1804. In another, this plant named *Chavica retrofracta* by Miquel 1843 and placed in section *Euchivaca* because have cylindrical spikes (Asmarayani, 2018; POWO, 2025). This species has heterotypic synonymies i.e., *Amalago antillana* Raf., *Amalago malamiri* Raf., *Chavica arnottiana* Miq., *Chavica chaba* Miq., *Chavica labillardierei* Miq., *Chavica maritima* Miq., *Chavica officinarum* Miq., *Chavica parvifolia* (Blanco) Hassk., *Cubeba chaba* (W.Hunter) Miq., *Piper arnottianum* (Miq.) C.DC., *Piper callosum* Opiz, *Piper chaba* W.Hunter, *Piper chuvya* W.Hunter ex C.DC., *Piper hapnium* Buch.-Ham. ex Hook.f., *Piper longum* Blume, *Piper maritimum* (Miq.) Blume ex C.DC., *Piper officinarum* (Miq.) C.DC., *Piper palawanum* C.DC., *Piper parvifolium* Blanco and *Piper siriboa* B.Heyne.



Figure 2. Appearance of *Piper retrofractum* Vahl. A. Fruits; B. Leaves and unmatured fruits (Photo by Themas Felayati)

According to Chaveerach *et al* (2008), *P. retrofractum* has drupe fruit in a globose shape, embedded on the rachis, red when ripe, the spike stout with conico-cylindric shape, and blooms almost every month in year. This spice is distributed in Southeast Asian countries such as Thailand, Philippines, Malaysia, Vietnam, and Indonesia (Sholehah & Ulya, 2023). This plant was cultivated and commercialized throughout Indonesia including Java, Madura, Bali, Sumatra, Kalimantan, Sulawesi, Maluku, and Nusa Tenggara (Silalahi *et al.*, 2015). *Piper retrofractum* (Figure 2) was commonly mentioned for its long-spiked and red-colored fruit, nutritious, rarely attacked by pests, and produces fruit throughout the year. In Indonesia, this plant grows in coastal areas up to 600 m above sea level, dry areas to high humidity, and survives in high and low rainfall (Sholehah & Ulya, 2023).

Cabya

In ancient Javanese society, *Piper retrofractum* was known as cabya. According to Zoetmulder (1997), the term **cabya** derives from Sanskrit (**cawi** or **cawya**), refers to a type of pepper and specifically to *Piper caba*—correctly identified as *Piper chaba* W. Hunter, a synonym of *P. retrofractum* Vahl (POWO, 2025). This linguistic evidence indicates that Javanese ancestors utilized the spice, as it held a distinct name in Old Javanese. Contemporary literature continues to employ **cabya** for *P. retrofractum* (Hawa *et al.*, 2021; Wang *et al.*, 2022).

Food history expert Fadly Rahman from Padjadjaran University notes that **cabya** appears in 10th-century Javanese inscriptions and ancient manuscripts (kompas.com, 2019; tempo.co, 2021). He cites Zoetmulder and Robson's Old Javanese-Indonesian Dictionary (1997) and Timbul Haryono's archaeological study, the Inventory of Food and Beverages in Written Archaeological Sources (1997). Rahman further describes how Javanese ancestors prepared sambal (spicy sauce) using *P. retrofractum*, black pepper (*P. nigrum*), and ginger (*Zingiber officinale*). These ingredients provided a spicy sensation long before the Portuguese introduced *Capsicum* spices to Indonesia in the 16th century (kompas.com, 2019; tempo.co, 2021).

Among current Javanese communities, *P. retrofractum* is traditionally known as **cabe**, whereas chili peppers (*Capsicum* spp.), which are widely used as everyday culinary spices, are called **lombok**. In contrast, the Indonesian national language (Bahasa Indonesia) uses the term **cabai** for *Capsicum* spp. This difference in vernacular terminology often leads to confusion because the final vowel sequence -ai in **cabai** is frequently pronounced as -e in everyday speech, making its pronunciation nearly identical to **cabe**. To distinguish these taxonomically and culturally distinct plants, *P. retrofractum* is therefore commonly referred to as **cabe jawa** (Javanese pepper) in Indonesian, emphasizing its identity and avoiding ambiguity with *Capsicum* species.

Cabe Puyang

The term **cabe puyang** is often mistakenly equated with *P. retrofractum* itself, though it actually refers to an Indonesian herbal tonic commonly consumed by Javanese people. This tonic combines *P. retrofractum* fruit and *Zingiber zerumbet* rhizome, with optional additions such as ginger, pepper, and lemongrass. Variations in ingredients and consumption locations are detailed in Table 1. **Cabe puyang** effectively relieves fatigue, prevents colds, and stimulates appetite (Wulandari & Azrianingsih, 2014). **Cabe puyang** report that traditional tonic vendors in Surabaya, East Java, also market it as a **pegal linu** remedy or muscle soreness, alleviating tingling sensations, fever, and alternating hot-cold feelings, while proven suitable for third-trimester pregnant women (Suharmiati & Handayani, 1998). This herbal medicine is widely consumed not only in East Java but also in Central Java. At the Surakarta Palace, this traditional herbal preparation is uniquely presented in the form of pills. The herbal ingredients are processed using traditional methods and subsequently shaped into small pills, distinguishing them from the liquid form in which most Indonesian herbal medicines (jamu) are commonly prepared and consumed.

The fruit of *P. retrofractum* exhibits a spicy, heating flavor (Hariana, 2008) and belongs to plants with aphrodisiac properties (Sampurno, 2003). Indonesians employ it to treat digestive issues, coughs, bronchitis, epilepsy, lung and heart disorders, hypotension, rhinitis, flatulence, intestinal ailments, and postpartum conditions (Hariana, 2008; Lim, 2012). Madurese communities prepare it as a warming infusion with coffee, tea, or milk (Haryudin & Rostiana, 2009), valuing its stimulant effects (Lim, 2012).

Zingiber zerumbet (**lempuyang**), a rhizome widely used in Southeast Asian traditional medicine, addresses inflammation, fever, toothache, indigestion, typhoid, stomach disorders, allergies, poisoning, haemorrhoids, asthma, skin conditions, postnatal care, constipation, diarrhea, sprains, and pain. It also serves as an antispasmodic, antirheumatic, and diuretic agent (Burkill, 1966; Wutthithamavet, 1997; Bhuiyan *et al.*, 2009; Zakaria *et al.*, 2010; Sulaiman *et al.*, 2010; Zakaria *et al.*, 2011; Sharifi-Rad *et al.*, 2017). Javanese use its rhizomes specifically to enhance appetite and refreshment (Hakim, 2015).

In summary, **cabe puyang** offers multifaceted benefits from the synergistic effects of *P. retrofractum* and *Z. zerumbet*, enhanced by additional ingredients (Table 1). *P. retrofractum* grows wild but is also cultivated in Central Java (Wonogiri) and East Java (Madura, Lamongan, Jember) (Haryudin & Rostiana, 2009, 2011), evidencing its longstanding integration into Javanese culture. Known alternatively as Javanese long pepper, it maintains close ties to Javanese society (Haryudin & Rostiana, 2009, 2011; Hasan *et al.*, 2016; Ohno *et al.*, 2016; Octarya *et al.*, 2020; Silalahi, 2020; Sholehah & Ulya, 2023).

Table 1. Cabe puyang's recipe

Place	Original recipe	Additional Ingredients	Reference
Blitar, East Java	Fruit of <i>Piper retrofractum</i> Vahl. and rhizome of <i>Zingiber zerumbet</i> (L.) Roscoe ex Sm.	<i>Zingiber officinale</i> Roscoe, <i>Kaempferia galanga</i> L., <i>Curcuma domestica</i> Valetton (or <i>Curcuma longa</i> L.) <i>Cymbopogon citratus</i> (DC.) Stapf, <i>Imperata cylindrica</i> (L.) Raeusch.	(Rozci et al., 2022)
Malang, East Java		No additional ingredients	(Wulandari & Azrianingsih, 2014)
Surabaya, East Java		<i>Curcuma aeruginosa</i> Roxb., <i>Curcuma zanthorrhiza</i> Roxb., <i>Zingiber officinale</i> Roscoe, <i>Morinda citrifolia</i> L., <i>Foeniculum vulgare</i> Mill., <i>Alyxia reinwardtii</i> Blume, <i>Curcuma domestica</i> Valetton (or <i>Curcuma longa</i> L.), <i>Piper nigrum</i> L., <i>Parkia timoriana</i> (DC.) Merr., <i>Boesenbergia pandurata</i> (Roxb.) Schltr (or <i>Boesenbergia rotunda</i> (L.) Mansf.), <i>Cinnamomum burmanni</i> (Nees & T.Nees) Blume, <i>Tamarindus indica</i> L.	(Suharmiati & Handayani, 1998)

Sambal Gepleng

Sambal gepleng, a traditional Indonesian spicy sauce made from *P. retrofractum*, features prominently in the Javanese harvest ceremony known as **wiwitan**. According to Sathotho (2023), the term **wiwitan** derives from **awit**, meaning "to begin," and denotes a ritual marking the start of agricultural activities, such as plowing or harvesting rice and other crops. Heringa (1997) defines **wiwitan** as the ritual initiating the agricultural season, performed just before plowing, while Tamara (2021) describes it as a pre-harvest tradition when grains turn yellow and are ready for collection. This ceremony expresses respect for the earth and Dewi Sri, the goddess of rice and fertility in Old Javanese society (Listiyani, 2020; Sathotho, 2023; Salim et al., 2024). In contemporary practice, such reverence is often directed toward the Almighty God (Tamara, 2021; Salim et al., 2024).

The **wiwitan** ritual typically begins with selecting an auspicious day, followed by presenting offerings (**uborampe**) in the fields, conducting prayers, and concluding with a communal meal (Tamara, 2021; Sathotho, 2023). These activities involve collaboration between farmers and the local community that spans at least two days. Although variations exist across Javanese communities—such as differences in implementation—core elements like chicken and snacks remain consistent. Ceremonial items and foods carry symbolic meanings; for instance, brown sugar, chili, coconut, and **terasi** (fermented shrimp paste) represent life's diverse emotions, including sadness, happiness, anxiety, and peace (Tamara, 2021).

Based on the data, both informants— natives of Gunung Kidul and Bantul, Yogyakarta—has experience participating in **wiwitan** ceremonies. In this region, **sambal gepleng** (also known as **sambal gepeng**) serves as a complementary dish in **wiwitan** ceremonies. According to the Bantul district website, this authentic Yogyakarta chili sauce, made from spices and fried soybeans, holds cultural uniqueness and is commonly used by Javanese communities during **wiwitan** rituals. The informant prepares **sambal gepleng** using fried *P. retrofractum* fruit as the key spice (Figure 3). The preparation technique is illustrated in a flowchart (Figure 3). This sauce is typically served with fried **gereh pethek** (*Leiognathus equula*) and warm rice.

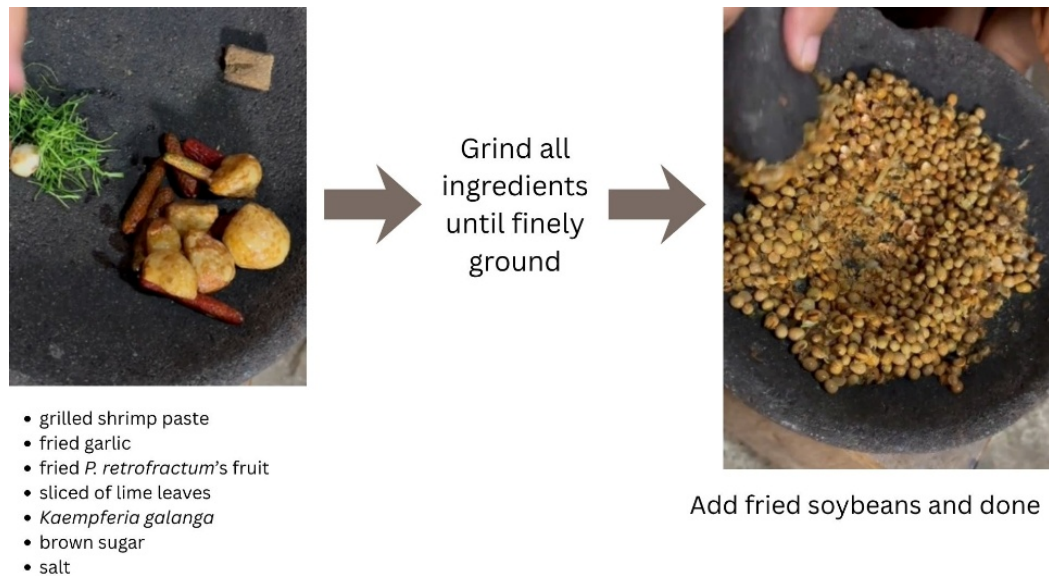


Figure 3. Concept map for preparing **sambal gepleng** (photo by Mbok Wiryo, 2025).

Cabe Areuy

The Sundanese people refer to *Piper retrofractum* as **cabe areuy**. According to Sumantri et al. in the Sundanese-Indonesian Dictionary (1985), **areuy** is defined as a climbing plant or liana, reflecting the characteristic growth habit of *P. retrofractum*, which climbs by twining in the manner similar to betel vine. Because the Sundanese are the predominant ethnic group of western Java, this vernacular name also indicates the long-standing occurrence and familiarity of the species in the region. The continued use of the name **cabe areuy** further suggests that *P. retrofractum* has been recognized and utilized by Sundanese communities as part of their traditional plant knowledge and everyday life.

Bandrek

Bandrek is a traditional herbal beverage widely consumed in West Java, Indonesia, and is valued for its warming properties, particularly in the cool highland regions of the province. Historically, it has been an integral component of Sundanese culinary culture. Historical accounts indicate that bandrek was included among the ancestral recipes of the Galuh Kingdom, established in 612 CE by King Sang Wretikandayun, as documented in the Nagara Kreta Bhumi manuscript (Darwis, 2020; Turgarini, 2024). This historical record highlights the longstanding cultural significance of **bandrek** within Sundanese society. Traditionally, **bandrek** (Fig 4A) is prepared by boiling a mixture of spices and sweeteners in water, after which the decoction is strained to obtain a clear, aromatic beverage. With the advancement of food-processing technology, commercially available **bandrek** is now commonly produced as an instant powdered formulation, allowing convenient preparation by simply dissolving the powder in hot water. The principal ingredients are ginger (*Zingiber officinale*) and palm sugar (brown sugar), which provide the characteristic pungent flavor and sweetness of the beverage. According to Sundanese native, additional spices are frequently incorporated to enhance its aroma, flavor, and perceived health benefits, including *Cymbopogon citratus*, *Cinnamomum verum*, *Myristica fragrans*, *Piper retrofractum*, *Pandanus amaryllifolius*, *Amomum compactum*, *Syzygium aromaticum*, and *Litsea cubeba*. In some local preparations, coconut slices, milk and raw egg are also added to increase the nutritional value and produce a richer, creamier beverage.

For example, **Bandrek Hanjuang** (Fig 4B) is a commercially marketed powdered formulation of **bandrek** that has become one of the signature souvenirs of Bandung, West Java. The product contains *Zingiber officinale*, *Syzygium aromaticum*, *Piper retrofractum*, palm sugar, white sugar, and creamer. Its commercial production demonstrates how traditional herbal beverages have been successfully adapted into convenient, ready-to-prepare products while maintaining their cultural identity. Furthermore, standardized processing, regulatory approval, and established distribution networks have enabled **bandrek** to be marketed safely and widely, contributing to the preservation and broader appreciation of this traditional Sundanese beverage.



Figure 4. Traditional **bandrek** beverage. A. The common appearance of **bandrek** in everyday consumption (photo by Agnes E, 2021), B. The commercially packaged **bandrek** in powdered form (photo by Borma Dago, 2026).

Phytochemical Profile of *Piper retrofractum* Fruit and Pharmacology of Piperine

The chemical composition of *P. retrofractum* fruit is dominated by amide-type alkaloids that underlie its pungent flavor and biological activity. Piperine, the most abundant compound, serves as a chemical marker for this species and is largely responsible for the fruit's sharp taste and reported pharmacological effects (Amad *et al.*, 2017; Tang *et al.*, 2019). In addition to piperine, the fruit contains a series of closely related retrofractamides (A-C) (Kubo *et al.*, 2013 & Muharini *et al.*, 2017), which share a similar amide backbone but differ in chain length and degree of unsaturation. Along with other alkamides such as pellitorine (Muharini *et al.*, 2015), guineensine (Muharini *et al.*, 2015 & Tang *et al.*, 2019), sylvatine (Amad *et al.*, 2017), and piperlonguminine (Kubo *et al.*, 2013; Amad *et al.*, 2017; Tang *et al.*, 2019), they form the core group of secondary metabolites in *P. retrofractum*. Although present in lower amounts than piperine, these amides significantly contribute to the overall chemical and bioactive profile of the fruit.

The fruit also contains long-chain polyunsaturated alkamides, mainly N-isobutyl dienamides and trienamide (Kubo *et al.*, 2013 & Tang *et al.*, 2019). These compounds are typical of the genus *Piper* and are usually detected in moderate to low concentrations. Their highly unsaturated structures are often linked to antimicrobial and insecticidal activity. Another important, though less abundant, group consists of piperidine-containing alkaloids, such as piperchabamides (B, C, and H) (Kubo *et al.*, 2013; Muharini *et al.*, 2017; Tang *et al.*, 2019), chabamide (Muharini *et al.*, 2015), nigramides (F and R) (Muharini *et al.*, 2015), pipernonaline (Kubo *et al.*, 2013; Muharini *et al.*, 2017; Tang *et al.*, 2019), and piperundecaline (Kubo *et al.*, 2013; Muharini *et al.*, 2017). These compounds add structural diversity to the amide alkaloid pool and are considered characteristic minor constituents of *P. retrofractum* fruit. Highly polar compounds such as amide glucosides (retrofractosides A-D) (Tang *et al.*, 2019) and phenylpropanoid glycosides (retrofractosides E-F) (Tang *et al.*, 2019) occur only in trace amounts. These glycosides are not major contributors to pungency but reflect metabolic modification of amide and phenylpropanoid structures within the fruit.

Phytochemical screening showed the presence of quinones, sterols, glycosides, and alkaloids in both n-hexane and ethyl acetate extracts. Tannins were also detected in the ethyl acetate and methanol extracts, while the methanol extract additionally contained sterols, glycosides, flavones, tannins, and alkaloids. Notably, the methanol extract exhibited the highest total phenolic content compared to the other solvent extracts (Salleh & Ahmad, 2020). Other than organic compounds present, the fruit was found to contain essential minerals, including calcium, copper, iron, magnesium, phosphorus, potassium, sodium, and zinc, present at varying levels (Salleh & Ahmad, 2020).

Piperine is used in traditional therapies of Chinese as well as in Indian medicine. Piperine can be used widely in pain management, chills, rheumatism arthritis, influenza, and fever (Zachariah & Parthasarathy, 2008; Tiwari *et al.*, 2020). Piperine is reported to be used for the enhancement of blood circulation, salivation, and stimulation of appetite (Pruthi, 1993). Piperine has a multifaceted biological profile that includes pain management (Correa *et al.*, 2010; Tiwari *et al.*, 2020), hypotension, vascular cell modulation (Hlavačková *et al.*, 2011; Tiwari *et al.*, 2020), and anti-cancer activity (Pradeep & Kuttan, 2002). It also acts on many enzyme systems (including p-glycoproteins) (Meghwal & Goswami, 2013; Zarai *et al.*,

2013, Tiwari *et al.*, 2020). Piperine has shown various biological activities, such as antimicrobial, insecticidal (Su, 1977; Miyakado *et al.*, 1979; Tavares *et al.*, 2011, Tiwari *et al.*, 2020), anti-amoebic (Ghoshal *et al.*, 1996, Tiwari *et al.*, 2020), anti-ulcer (Mehmood & Gilani, 2010, Tiwari *et al.*, 2020), antidepressant (Lee *et al.*, 2005, Tiwari *et al.*, 2020), anti-inflammation and anti-arthritis (Mujumdar *et al.*, 1990; Bang *et al.*, 2009, Tiwari *et al.*, 2020), and anti-allergic agent (Aswar *et al.*, 2015; Kim *et al.*, 2017, Tiwari *et al.*, 2020). All constituents showed in Appendix 1.

Conclusion

The widespread use of *P. retrofractum* in traditional foods and beverages among both the Javanese and Sundanese communities reflect its long-standing cultural significance and suggests that it has been utilized since ancient times, as evidenced by the existence of distinct local names and culinary traditions associated with the species. In Javanese culture, *P. retrofractum* is an essential ingredient in **cabe puyang**, while in Sundanese tradition it is incorporated into **bandrek**; both beverages are traditionally consumed to promote warmth and maintain bodily comfort. In addition to its medicinal and beverage applications, *P. retrofractum* also functions as a culinary spice in **sambal gepleng**, a traditional condiment served during the **wiwitan** harvest-opening ceremony in the Yogyakarta region. These diverse applications highlight the species' multifaceted role in Javanese and Sundanese ethnobotanical knowledge, encompassing medicinal, culinary, and ceremonial functions.

Declarations

List of abbreviations: *P.* - *Piper*, *Z.* - *Zingiber*

Ethics approval and consent to participate: All secondary sources referenced in this article were obtained from open-access libraries.

Consent for publication: Not applicable

Availability of data and materials: Not applicable

Competing interests: Not applicable

Funding: Not applicable

Author contributions: TF: methodology, conceptualization, data curation, writing original draft, review, and editing. FO: data curation, methodology, writing, review, editing.

Acknowledgements

We would like to thank all the native Javanese and Sundanese natives who kindly agreed to be interviewed and provided information for this research.

Literature cited

- Afrianto W, Tamnge F, Hasanah L. 2020. Review: A relation between ethnobotany and bioprospecting of edible flower Butterfly Pea (*Clitoria ternatea*) in Indonesia. *Asian Journal of Ethnobiology* 3: 51-61. doi: 10.13057/asianjethnobiol/y030202.
- Agnes E. 2021. Bandrek. <https://cookpad.com/id/resep/14805338> (Accessed 09/08/2026).
- Amad S, Yuenyongsawad A, Wattanapiromsakul C. 2017. Investigation of antitubercular and cytotoxic activities of fruit extract and isolated compounds from *Piper retrofractum* Vahl. *Walailak Journal of Science and Technology* 14: 731-739.
- Ariyanto J, Sugiyarto, Solichatun, Marliyana SD. 2025. Ethnobotany of Plants for Cleansing and Fragrancing in Jamasan Keris Used by Surakarta Community, Central Java, Indonesia. *Journal of Tropical Biodiversity and Biotechnology* 10: 1-8. doi: 10.22146/jtbb.14050
- Asmarayani R. 2018. Phylogenetic relationships in Malesian-Pacific *Piper* (Piperaceae) and their implications for systematics. *Taxon* 67: 693-724. doi: 10.12705/674.2
- Aswar U, Shintre S, Chepurwar S, Aswar M. 2015. Antiallergic effect of piperine on ovalbumin-induced allergic rhinitis in mice. *Pharmaceutical Biology* 53:1358-1366. doi: 10.3109/13880209.2014.982299
- Bang JS, Choi HM, Sur BJ, Lim SJ, Kim JY, Yang HI, Yoo MC, Hahm DH, Kim KS. 2009. Anti-inflammatory and antiarthritic effects of piperine in human interleukin-1 β -stimulated fibroblast-like synoviocytes and rat arthritis models. *Arthritis Research & Therapy* 11. doi: 10.1186/ar2662
- Bhuiyan NI, Chowdhury JU, Begum J. 2009. Chemical investigation of the leaf and rhizome essential oils of *Zingiber zerumbet* (L.) Smith from Bangladesh. *Bangladesh Journal of Pharmacology*. 4: 9-12.

- Borma Dago. 2026. Bandrek Handjuang. bormadago.com/shop/product/1824/hanjuang-bandrek-sak-isi-5-25gr?srltid=AfmBOopnb2ipEI3-zZgtCpLbcm8dy0e59eYSqmc6a7BTKT_ZqX5m6PJblq8. (Accessed 09/08/2026).
- Burkill HI. 1966. Dictionary of the Economic Products of the Malay Peninsula. Ministry of Agriculture and Coop., Kuala Lumpur.
- Chani T, Olugbara OO, Mutanga B. 2023. The Problem of Data Extraction in Social Media: A Theoretical Framework. *Journal of Information Systems and Informatics* 5:1363-1384. doi: 10.51519/journalisi.v5i4.585
- Chaveerach A, Mookamul P, Runglawan S, Tanee T. 2008. Ethnobotany of the Genus *Piper* (Piperaceae) in Thailand. *Ethnobotany Research and Applications* 4: 223-232. doi: 10.17348/era.4.0.223-231.
- Correa EA, Högestätt ED, Sterner O, Echeverri F, Zygmunt PM. 2010. In vitro TRPV1 activity of piperine-derived amides. *Bioorganic & Medicinal Chemistry* 18:3299-3306. doi: 10.1016/j.bmc.2010.03.013
- Darwis R. 2020. Sei Gastronomi Tradisional Sunda: Khazanah Kuliner Kabuyutan Galuh Klasik. Bandung UPI Pers [Bahasa].
- Faramayuda, F., Arifin, S. Z., Syam, A. K., & Elfahmi, E. 2021. Cabe Jawa (*Piper retrofractum* Vahl.): Penggunaan Tradisional, Fitokimia dan Aktivitas Farmakologi *Piper retrofractum* Vahl: Traditional Uses, Phytochemical and Pharmacological Activities. *Perspektif* 20:26-34. doi: 10.21082/psp.v20n1.2021.26-34 [Bahasa].
- Fongod A, Ngoh M, Veranso-Libalah MC. 2014. Ethnobotany, indigenous knowledge and unconscious preservation of the environment: An evaluation of indigenous knowledge in South and Southwest Regions of Cameroon. *International Journal of Biodiversity and Conservation* 6:85-99. doi: 10.5897/IJBC2013.0637.
- Ghoshal S, Prasad BNK, Lakshmi V. 1996. Antiamoebic activity of *Piper longum* fruits against *Entamoeba histolytica* in vitro and in vivo. *Journal of Ethnopharmacology* 50:167-170. doi: 10.1016/0378-8741(96)01382-7
- Hakim L. 2015. Rempah Dan Herba Kebun-Pekarangan Rumah Masyarakat: Keragaman, Sumber Fitofarmaka dan Wisata Kesehatan-kebugaran. Diandra, Yogyakarta, Indonesia [Bahasa].
- Hariana A. 2008. Tumbuhan obat dan khasiatnya. Penebar Swadaya, Jakarta, Indonesia [Bahasa].
- Haryudin W, Rostiana O. 2009. Karakteristik Morfologi Tanaman Cabe Jawa (*Piper retrofractum*. Vahl) Di Beberapa Sentra Produksi. *Buletin Penelitian Tanaman Rempah dan Obat* 20:1-10 [Bahasa].
- Haryudin W, Rostiana O. 2011. Stabilitas Karakter Morfologi 10 Aksesori Cabe Jawa (*Piper retrofractum* Vahl.) Di Kebun Percobaan Cikampek. *Buletin Penelitian Tanaman Rempah dan Obat* 22:13-22 [Bahasa].
- Hasan Z, Suryani, Mulia K, Setiyono A, Silip JJ. 2016. Antiproliferation activities of Indonesian java chili, *Piper retrofractum* Vahl., against breast cancer cells (MCF-7). *Der Pharmacia Lettre* 8:141-147.
- Hawa LC, Ubaidillah U, Mardiyani SA, Laily AN, Yosika NIW, Afifah FN. 2021. Drying kinetics of cabya (*Piper retrofractum* Vahl) fruit as affected by hot water blanching under indirect forced convection solar dryer. *Solar Energy* 214:588-598. doi: 10.1016/j.solener.2020.12.004.
- Heringa R. 1997. Dewi Sri in Village Garb: Fertility, Myth, and Ritual in Northeast Java. *Asian Folklore Studies* 56:355-377. doi: 10.2307/1178731
- Hlavačková L, Janegová A, Uličná O, Janega P, Černá A, Babál P. 2011. Spice up the hypertension diet: Curcumin and piperine prevent remodeling of the aorta in experimental L-NAME-induced hypertension. *Nutrition & Metabolism* 8. doi: 10.1186/1743-7075-8-72
- Kim J, Lee KP, Lee DW, Lim K. 2017. Piperine enhances carbohydrate and fat metabolism in skeletal muscle during acute exercise in mice. *Nutrition & Metabolism* 14. doi: 10.1186/s12986-017-0194-2
- Kindscher K, Martin L, Corbett S, Lafond D. 2018. Nutritional Properties of Native Plants and Traditional Foods from the Central United States. *Ethnobiology Letters* 9: 214-227. doi: 10.14237/eb1.9.2.2018.1219.
- Kompas. 2019. <https://travel.kompas.com/read/2019/06/12/220900727/mengenai-cabya-nenek-moyang-cabai-dinusantara> (Accessed 30/09/2025).
- Kubo M, Ishii R, Ishino Y, Harada K, Matsui N, Akagi M, Kato E, Hosoda S, Fukuyama Y. 2013. Evaluation of constituents of *Piper retrofractum* fruits on neurotrophic activity. *Journal of Natural Products* 76: 769-773.
- Lamy E. 2024. Ethnobotany: Preserving Plants Cultural Significance for Sustainable Medicine and Conservation. *Medicinal & Aromatic Plants* 13:498. doi: 10.35248/2167-0412.24.13.498
- Lee IW, Kim KD. 2024. Using Traditional Ecological Knowledge to Research the Plants of Jeju Coastal Sand Dunes, Republic of Korea. *Journal of Coastal Research* 113:956-960.

- Lee SA, Hong SS, Han XH, Hwang JS, Oh GJ, Lee KS, Lee MK, Hwang BY, Ro JS. 2005. Piperine from the fruits of *Piper longum* with inhibitory effect on monoamine oxidase and antidepressant-like activity. *Chemical & Pharmaceutical Bulletin* 53:832-835. doi: 10.1248/cpb.53.832
- Lim TK. 2012. *Edible Medicinal and Non-Medicinal Plants Volume 1, Fruits*. Springer Dordrecht Heidelberg London, U.K. doi: 10.1007/978-90-481-8661-7
- Listyani B. 2020. Membangun Karakter dan Menanamkan Budi Pekerti Bagi Petani pada Tradisi Wiwitan di Desa Gilangharjo, Pandak, Bantul. *Criksetra: Jurnal Pendidikan Sejarah*. 9: 59-71. doi: 10.36706/jc.v9i1.10210. [Bahasa].
- Mbok Wiryo. 2025. Sambal gepeng. <https://vm.tiktok.com/ZS44K8P5R/> (Accessed 21/03/2026).
- Meghwal M, Goswami TK. 2013. *Piper nigrum* and piperine: An update. *Phytotherapy Research* 27:1121-1130. doi: 10.1002/ptr.4972
- Mehmood MH, Gilani AH. 2010. Pharmacological basis for the medicinal use of black pepper and piperine in gastrointestinal disorders. *Journal of Medicinal Food* 13:1086-1096. doi: 10.1089/jmf.2010.1065
- Miyakado M, Nakayama I, Yoshioka H, Nakatani N. 1979. The Piperaceae amides I: Structure of pipericide, a new insecticidal amide from *Piper nigrum* L. *Agricultural and Biological Chemistry* 43:1609-1611. doi: 10.1080/00021369.1979.10863675
- Muharini R, Liu Z, Lin W, Proksch P. 2015. New amides from the fruits of *Piper retrofractum*. *Tetrahedron Letters*. 56: 2521-2525.
- Mujumdar AM, Dhuley JN, Deshmukh VK, Raman PH, Naik SR. 1990. Anti-inflammatory activity of piperine. *Japanese Journal of Medical Science and Biology* 43:95-100.
- Multigading Subdistric. Bantul Distric. Special Region of Yogyakarta. 2022. <https://murtigading.bantulkab.go.id/first/artikel/5530-Mengenal-Sambel-Gepeng--Menu-Spesial-Wiwitan-Dusun-Sanggrahan> (Accessed 09/10/2025).
- Octarya SN, Sulistyaningsih YC, Kermanee P. 2020. Anatomy and Fruit Development of Javanese Long Pepper (*Piper retrofractum* Vahl.). Thesis. Bogor: IPB University.
- Ohme J, Araujo T, Boeschoten L, Freelon D, Ram N, Reeves BB, Robinson TN. 2023. Digital Trace Data Collection for Social Media Effects Research: APIs, Data Donation, and (Screen) Tracking. *Communication Methods and Measures* 18: 124-141. doi: 10.1080/19312458.202.2181319
- Ohno S, Nemoto A, Miyazato S, Higashikayama H, Miyagi N, Yamashiro S, Tamaki, M. 2016. Geographic distribution of Javanese long pepper (*Piper retrofractum* Vahl) and characteristics of its habitat in Okinawa Prefecture, southwestern Japan, with preliminary notes on damages and disorders of the plant caused by arthropod pests and other unknown factors. *Research for Tropical Agriculture* 9:1-11. doi://doi: 10.11248/nettai.9.1.
- POWO. 2025. "Plants of the World Online. Facilitated by the Royal Botanic Gardens, Kew. Published on the Internet; <https://powo.science.kew.org>.
- Pradeep CR, Kuttan G. 2002. Effect of piperine on the inhibition of lung metastasis induced by B16F-10 melanoma cells in mice. *Clinical & Experimental Metastasis* 19: 703-708. doi: 10.1023/A:1021398601388
- Pretorius K. 2024. A Simple and Systematic Approach to Qualitative Data Extraction From Social Media for Novice Health Care Researchers: Tutorial. *JMIR Formative Research* 8:1-9. doi: 10.2196/54407.
- Pruthi JS. 1993. Major spices of India: Crop management and post-harvest technology. Indian Council of Agricultural Research. <https://www.cabdirect.org/cabdirect/abstract/20043186295> (Accessed 12 /11/2025).
- Rozci F, Diana L, Maritsya Z, Annisa L, Silitonga R J. 2022. Pemanfaatan Produk Olahan Cabai Jawa Sebagai Peluang Usaha Bagi Masyarakat Rw 14 Wilayah Sukorejo. *KARYA: Jurnal Pengabdian Kepada Masyarakat* 2:15-22 [Bahasa].
- Rukachaisirikul T, Prabpai S, Champung P, Suksamrarn A. Chabamide, a novel piperine dimer from stems of *Piper chaba*. *Planta Med*. 2002 Sep;68(9):853-5. doi: 10.1055/s-2002-34410. PMID: 12357406.
- Ryan JC. 2011. Cultural botany: Toward a model of transdisciplinary, embodied, and poetic research into plants. *Nature and Culture* 6: 123-148. doi: 10.3167/nc.2011.060202.
- Salehi B, Zakaria ZA, Gyawali R, Ibrahim SA, Rajkovic J, Shinwari ZK, Khan T, Sharifi-Rad J, Ozleyen A, Turkdonmez E, Valussi M, Tumer TB, Monzote Fidalgo L, Martorell M, Setzer WN. 2019. *Piper* Species: A Comprehensive Review on Their Phytochemistry, Biological Activities and Applications. *Molecules* 24:1364. doi: 10.3390/molecules24071364
- Salim L, Badiah S, Ramadan HR. 2024. Nilai Sosial Dan Keagamaan Pada Tradisi Wiwitan Di Desa Wonodadi Utara Kecamatan Gadingrejo. *Socio Religia* 5: 38-46 <http://dx.doi: 10.24042/sr.v5i1.22275> [Bahasa]

- Salleh WMNHW, Farediah A. 2020. Phytopharmacological investigations of *Piper retrofractum* Vahl. - a review. *Agriculturae Conspectus Scientificus* 85: 193-202.
- Sampurno. 2003. Kebijakan pengembangan jamu/obat tradisional/obat herbal Indonesia. Jakarta. Makalah pada Seminar dan Pameran Nasional POKJANAS TOI, 25-26 Maret 2003 [Bahasa].
- Sathotho SF. 2023. Wiwitan Sebagai Pergelaran Budaya Dalam Tinjauan Ekofeminisme. *Dance and Theatre Review*. 6: 73-81. 10.24821/dtr.v6i2.11062 [Bahasa].
- Sharifi-Rad M, Varoni EM, Salehi B, Sharifi-Rad J, Matthews KR, Ayatollahi SA, Kobarfard F, Ibrahim SA, Mnayer D, Zakaria ZA, Sharifi-Rad M, Yousaf Z, Iriti M, Basile A, Rigano D. 2017. Plants of the Genus *Zingiber* as a Source of Bioactive Phytochemicals: From Tradition to Pharmacy. *Molecules* 22:2145. doi: 10.3390/molecules22122145.
- Sholehah DN, Ulya M. 2023. Javanese long pepper (*Piper retrofractum* Vahl.): botanical, cultivation, post-harvest and utilization review. *Journal of Science in Agrotechnology* 1:76-88. doi: 10.21107/jsa.v1i2.15.
- Silalahi M, Nisyawati, Walujo EB, Supriatna J, Mangunwardoyo W. 2015. The local knowledge of medicinal plants trader and diversity of medicinal plants in the Kabanjahe traditional market, North Sumatra, Indonesia. *Journal of Ethnopharmacology* 175: 432-443. doi: 10.1016/j.jep.2015.09.009.
- Silalahi M. 2021. Utilization and Bioactivity of Java Long Pepper (*Piper retrofractum* Vahl) for Education Purposes. *Proceedings of the 2nd Annual Conference on blended learning, educational technology and Innovation (ACBLETI 2020)*. Series: Advances in Social Science, Education and Humanities Research. doi: 10.2991/assehr.k.210615.052
- Su HCF. 1977. Insecticidal properties of black pepper to rice weevils and cowpea weevils. *Journal of Economic Entomology* 70:18-21. doi: 10.1093/jee/70.1.18
- Suharmiati, Handayani L. 1998. Bahan Baku, Khasiat dan Cara Pengolahan Jamu Gendong: Studi Kasus di Kotamadya Surabaya, 1998. Pusat Penelitian dan Pengembangan Pelayanan kesehatan. Departemen Kesehatan RI [Bahasa].
- Sulaiman MR, Tengku Mohamad TA, Shaik Mossadeq WM, Moin S, Yusof M, Mokhtar AF, Zakaria ZA, Israf DA, Lajis N. 2010. Antinociceptive activity of the essential oil of *Zingiber zerumbet*. *Planta Medica* 76:107-12. doi: 10.1055/s-0029-1185950.
- Sumantri M., Djamaludin A., Patoni A., Koerdi RHM., Koesman MO., Adisastra ES. 1985. Kamus Sunda-Indonesia . Jakarta: Pusat Pembinaan dan Pengembangan Bahasa Departemen Pendidikan dan Kebudayaan. [Bahasa]
- Sutraningsih NKA, Sukenti K, Aryanti E, Sukiman S. 2019. Ethnobotanical study on Daksina constituent plants on Lombok Island, West Nusa Tenggara, Indonesia. *Asian Journal of Ethnobiology*. doi: 10.13057/asianjethnobiol/y020202.
- Tamara V. 2021. Makna Filosofi Tradisi Wiwitan di Desa Begeg Kecamatan Gayam Kabupaten Bojonegoro (Dalam Prespektif Charles Sanders Pierce). Undergraduate thesis. Walisongo State Islamic University [Bahasa].
- Tang R, Zhang YQ, Hu DB, Yang XF, Yang J, San MM, Oo TN, Kong Y, Wang YH. 2019. New amides and phenylpropanoid glucosides from the fruits of *Piper retrofractum*. *Natural Products and Bioprospecting* 9:231-241.
- Tavares WS, Cruz I, Petacci F, Freitas SS, Serratil JE, Zanon JC. 2011. Insecticidal activity of piperine: Toxicity to eggs of *Spodoptera frugiperda* and *Diatraea saccharalis* and phytotoxicity on vegetables. *Journal of Medicinal Plants Research* 5: 5301-5306.
- Tempo. 2021. <https://www.tempo.co/gaya-hidup/jauh-sebelum-portugis-membawa-cabai-sambal-sudah-jadi-tradisi-dinusantara--512832> (Accessed 30/09/2025).
- Tiwari A, Mahadik KR, Gabhe SY. 2020. Piperine: A comprehensive review of methods of isolation, purification, and biological properties. *Medicine in Drug Discovery* 7. doi: 10.1016/j.medidd.2020.100027.
- Torres-Pelayo VR, Fernandez MS, Carmona-Hernandez O, Molina-Torres J, J. Lozada-Garcia JA. 2016. A Phytochemical and Ethnopharmacological Review of the Genus *Piper*: as a Potent Bio-Insecticide. *Research & Reviews: Research Journal of Biology* 4:45-51
- Turgarini D. 2024. <https://berita.upi.edu/bandrek-versus-ronde-jahe/> (Accessed 13/06/2026)
- Wang J, Fan R, Zhong Y, Luo H, Hao C. 2022. Effects of Cabya (*Piper retrofractum* Vahl.) Fruit Developmental Stage on VOCs. *Foods*. 11:2528 doi: 10.3390/foods11162528.
- Wulandari RA, Azrianingsih R. 2014. Etnobotani Jamu Gendong Berdasarkan Persepsi Produsen Jamu Gendong di Desa Karangrejo, Kecamatan Kromengan, Kabupaten Malang. *Biotropika: Journal of Tropical Biology* 2:198-202. [Bahasa]
- Wutthithamavet W. 1997. Thai Traditional Medicine, Odean Store Press, Bangkok, Thailand.
- Zachariah TJ, Parthasarathy VA. 2008. Black pepper. In *Chemistry of spices*. CABI, Oxfordshire, U.K. (pp. 21-40). doi:10.1079/9781845934057.0021.

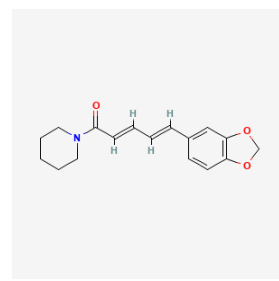
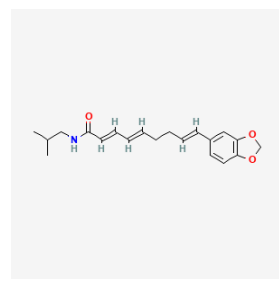
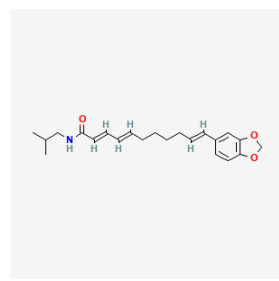
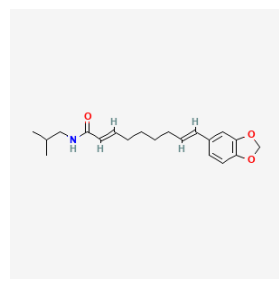
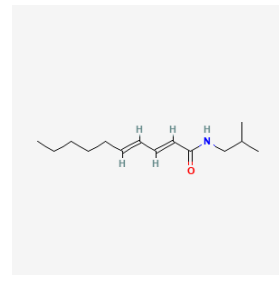
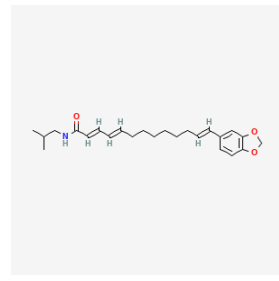
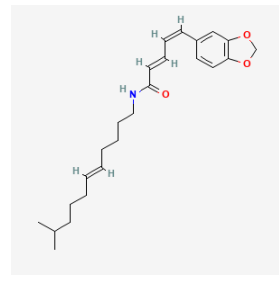
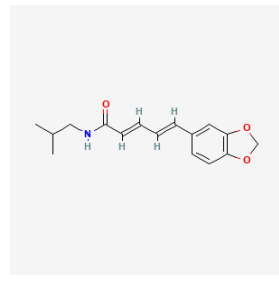
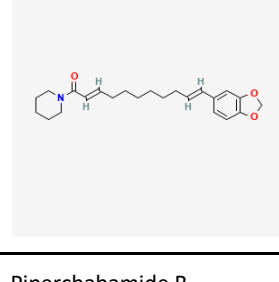
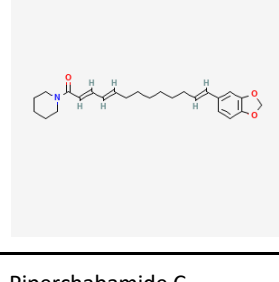
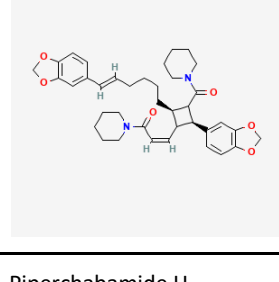
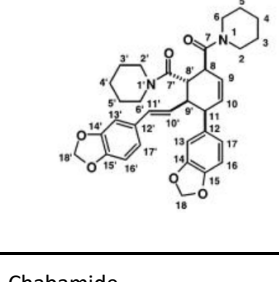
Zakaria ZA, Mohamad AS, Chear CT, Wong YY, Israf DA, Sulaiman MR. 2010. Antiinflammatory and antinociceptive activities of *Zingiber zerumbet* methanol extract in experimental model systems. Medical Principles and Practice 19:287-294. doi: 10.1159/000312715.

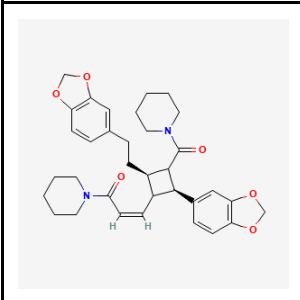
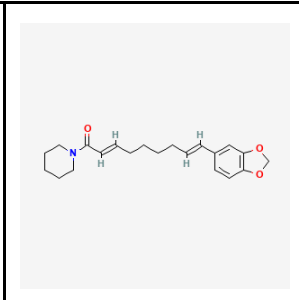
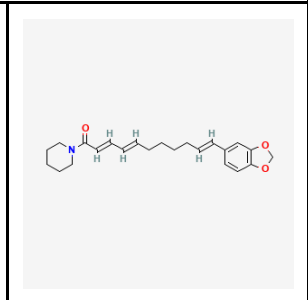
Zakaria ZA, Mohamad AS, Ahmad MS, Mokhtar AF, Israf DA, Lajis NH, Sulaiman MR. 2010. Preliminary analysis of the anti-inflammatory activity of essential oils of *Zingiber zerumbet*. Biological Research for Nursing 13:425-32. doi: 10.1177/1099800410386590.

Zarai Z, Boujelbene E, Ben Salem N, Gargouri Y, Sayari A. 2013. Antioxidant and antimicrobial activities of various solvent extracts, piperine, and piperic acid from *Piper nigrum*. LWT - Food Science and Technology 50: 634-641. doi: 10.1016/j.lwt.2012.07.036

Appendix 1. The chemical constituents of *P. retrofractum*

1. *Piperine* (obtained from <https://pubchem.ncbi.nlm.nih.gov/compound/638024>)
2. *Retrofractamide A* (obtained from <https://pubchem.ncbi.nlm.nih.gov/compound/11012859>)
3. *Retrofractamide B* or *Pipercide* (obtained from <https://pubchem.ncbi.nlm.nih.gov/compound/5372162>)
4. *Retrofractamide C* (obtained from <https://pubchem.ncbi.nlm.nih.gov/compound/25255091>)
5. *Pellitorine* (obtained from <https://pubchem.ncbi.nlm.nih.gov/compound/5318516>)
6. *Guineensine* (obtained from <https://pubchem.ncbi.nlm.nih.gov/compound/6442405>)
7. *Sylvatine* (obtained from <https://pubchem.ncbi.nlm.nih.gov/compound/131750975>)
8. *Piperlonguminine* (obtained from <https://pubchem.ncbi.nlm.nih.gov/compound/5320621>)
10. *Piperchabamide B* (obtained from <https://pubchem.ncbi.nlm.nih.gov/compound/44453655>)
11. *Piperchabamide C* (obtained from <https://pubchem.ncbi.nlm.nih.gov/compound/500817832>)
12. *Piperchabamide H* (obtained from <https://pubchem.ncbi.nlm.nih.gov/compound/46228146>)
13. *Chabamide* (Rukachaisirikul, 2002)
14. *Nigramide F* or *Piperchabamide G* (obtained from <https://pubchem.ncbi.nlm.nih.gov/compound/46228145>)
15. *Pipernonaline* (obtained from <https://pubchem.ncbi.nlm.nih.gov/compound/9974595>)
16. *Piperundecaline* (obtained from <https://pubchem.ncbi.nlm.nih.gov/compound/44453654>)

			
Piperine	Retrofractamide A	Retrofractamide B (Pipercide)	Retrofractamide C
			
Pellitorine	Guineensine	Sylvatine	Piperlonguminine
			
Piperchabamide B	Piperchabamide C	Piperchabamide H	Chabamide

		
Nigramide F (Piperchabamide G)	Pipernonaline	Piperundecaline