



Khiam (*Cotylelobium lanceolatum*) as a bittering and preservative wood in Nipa (*Nypa fruticans*) sugar and alcohol production in Southern Thailand

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Notes on Ethnobotany

Abstract

Background: Although **khiam** (*Cotylelobium lanceolatum*) is locally recognized as a preservative in palm sap processing, its deliberate use as a bittering material has received little attention. This note documents its dual role in nipa sugar making and community alcohol production in Pak Phanang, southern Thailand.

Methods: Ethnobotanical fieldwork was conducted in 2025 in nipa-producing communities of the Pak Phanang River Basin. Data were gathered through semi-structured interviews with local sugar producers and distillers (n = 6) and through direct observation of tapping, boiling, fermentation, and distillation practices.

Results: Producers used small amounts of khiam during nipa sugar processing to help maintain sap quality and to impart a slight bitter-astringent note that contributes to a balanced “three-taste” profile. In alcohol production, substantially larger amounts were added during fermentation to prevent souring and to produce a stronger, bitter taste with a more pronounced character. Producers deliberately adjusted the quantity of khiam according to the intended product, showing a clear empirical understanding of dose-dependent effects on both fermentation outcome and flavor.

Conclusions: This study highlights a previously undocumented or little-documented dimension of **khiam** use: its deliberate management as a bittering and fermentation-modifying material, not merely a preservative.

Keywords: Ethnobotany; Asteraceae, Indigenous communities; Human diseases, Herbal medicine

Background

Nipa palm (*Nypa fruticans* Wurmb) sugar production is an important livelihood in coastal southern Thailand. A major challenge in this system is the rapid fermentation of freshly collected sap, driven by microbial activity soon after tapping. To reduce spoilage during collection and early processing, producers in different parts of Southeast Asia have long used plant-derived materials. In addition to **khiam** (*Cotylelobium lanceolatum* Craib) in southern Thailand, examples include **payorm** wood (*Shorea roxburghii* G.Don) in Thailand and gum-lac tree bark (*Schleichera oleosa* (Lour.) Oken) or cashew leaves (*Anacardium occidentale* L.) in East Java, Indonesia (Naknean *et al.* 2010; Saidi *et al.* 2018). These practices show that palm

sap processing is not only a technical activity, but also one shaped by local ecological knowledge and plant-based management of fermentation.

Most previous studies of palm sap processing have focused on preservation, microbial spoilage, and processing techniques, with comparatively little attention to intentional flavor modification. In Pak Phanang, southern Thailand, however, local producers explicitly associate **khiam** not only with delaying spoilage, but also with creating a desirable bitter taste. This suggests that *khiam* is valued not merely as a preservative additive, but as a material that combines technological and sensory functions. Seen in this light, its use can be situated within a broader cross-cultural tradition of plant-derived bittering agents employed in food and beverage production.

In many such traditions, bitterness is added primarily to define product style or sensory identity, as in hops (*Humulus lupulus* L.) in beer, where iso- α -acids are the principal bitter compounds (Caballero *et al.* 2012), wormwood (*Artemisia absinthium* L.) in absinthe and related aromatized beverages (Panesar *et al.* 2011), gentian (*Gentiana lutea* L.) in bitter liqueurs (Mustafa *et al.* 2016), quassia (*Picrasma excelsa* (Sw.) Planch.) as a natural bittering agent and food additive (Sugimoto *et al.* 2003), and quinine in tonic beverages (Rudnicki *et al.* 2021). These examples, however, are not functionally equivalent. Some are used mainly to impart bitterness, whereas others also influence preservation, fermentation, or overall product stability. This distinction is especially important in the case of *khiam*, which appears to unite sensory bitterness with functions relevant to sap stabilization and alcohol production.

This ethnobotanical note documents the dual role of **khiam** in nipa palm sugar making and community alcohol production in Pak Phanang, Nakhon Si Thammarat province, southern Thailand. In particular, it highlights bitterness not as an incidental by-product, but as a deliberately managed and culturally valued attribute of processing.

Materials and Methods

Study area

Fieldwork was conducted in 2025 in Khanap Nak Subdistrict, Pak Phanang district, Nakhon Si Thammarat province, in southern Thailand (approximate center: 8°13'27" N, 100°15'52" E). The area forms part of the Pak Phanang basin, a tidally influenced lowland wetland and estuarine system that supports extensive stands of nipa palm.

Data collecting

Ethnobotanical data were collected through semi-structured interviews with local southern Thai sugar producers and distillers (n = 6), complemented with direct observation of daily production practices. Information on processing stages, quantities of *khiam* used, vessel capacity, and local interpretations of function were recorded. Weight estimates of wood were based on the producers' experience.



Figure 1. Nipa palm (*Nypa fruticans*) stand in Khanap Nak subdistrict, Pak Phanang district, Nakhon Si Thammarat province, southern Thailand, where fieldwork on nipa-based production and processing was conducted.



Figure 2. Morphology of the nipa palm (*Nypa fruticans*) in the study area: (a) clump with developing infructescence; (b) immature infructescence which is the stage associated with sap production; and (c) mature fruit.

Results

Nypa Palm production

Nipa production in the study area relied largely on naturally established stands, with management focused on maintaining existing palms without applying fertilizer. Palms began yielding after approximately 6-7 years and could remain productive for many years although their maximal production age remains unknown. The selection of suitable palms was important, since not all individuals produced sap in desirable quantity or quality. Some palms were recognized specifically for sap production, whereas others were valued mainly for leaves or shoots.

Sap harvesting involved a skilled and sequential process. The **stalk of the immature infructescence** was first beaten or massaged repeatedly, usually about 50 strokes per day over several days, then left to rest before being sliced for sap collection. Cutting was done in the early morning, around dawn, because sap which was collected after evening cutting was more likely to become sour. A single infructescence yielded 2-3 L of sap. After collection, the sap was boiled for 20-25 minutes to produce nipa sugar. During harvesting, pieces of **khiam** wood were placed in the collecting container to delay spoilage and to help maintain sap quality (Figure 3).

Nypa fruticans was a multipurpose palm. Immature fruits were used as food, leaves were used for household materials, and mature fruits were used for dyeing. Nipa sugar production in the area depended on long-inherited local knowledge that combined palm selection, skilled tapping, and plant-based preservation practices.



Figure 3. Sap collection from nipa palm (*Nypa fruticans*) during sugar production: (a) a collection bottle was prepared with pieces of **khiam** wood (*Cotylelobium lanceolatum*), placed at the beginning of tapping; and (b) bottle containing freshly collected nipa sap.

Use in Traditional Alcohol Production

Khiam is used more intensively in alcohol fermentation than in sugar production (Figure 4), which serves both technological and sensory purposes. About one handful of **khiam** in batches was added for community distillation, while larger-scale preparation involved approximately 1.5 kg per 60-L fermentation tank or about 2 kg in a 200-L vessel containing roughly 50 kg of palm sugar and 150 L of water. At these levels, **khiam** was no longer a minor additive but a major component of the fermentation system.

An important role of **khiam** was to prevent the ferment from turning sour. In local explanation, omitting **khiam** could cause the liquid to become vinegar rather than alcohol, while adequate addition helps maintain the ferment in a condition suitable for distillation. Producers therefore associate **khiam** not only with preservation, but with guiding the process toward successful alcohol production.

Khiam was also used deliberately to shape flavor. One producer noted that excessive addition makes the liquor bitter, whereas another explained that for sugar intended for household use only a small amount should be added, because too much bitterness would be undesirable in sweets. By contrast, material prepared for sale to community distillers could contain considerably more **khiam**, because a stronger bitter note is acceptable, and even desirable, in alcohol production.

In the distillery setting, **khiam** was not added only once and left passively in the tank. Rather, fermentation proceeded in stages: the first batch of wood was used for about 3-4 days until foam was produced, then it was removed and replaced with a new batch, after which fermentation continued for another 10-15 days before distillation. One producer explicitly described this first stage as drawing out the taste of the wood, suggesting that bitterness and woody character were intentionally extracted before full alcohol development.

Taken together, these accounts point to a clear empirical understanding of dose-dependent effects. Small amounts of **khiam** would be used when the goal was mainly preservation with minimal flavor change, whereas much larger amounts were employed when producers wanted a more robust ferment, resistance to souring, and a distinctly bitter, characterful liquor. In this sense, bitterness was not an accidental by-product, but part of the desired sensory identity of the final alcohol.

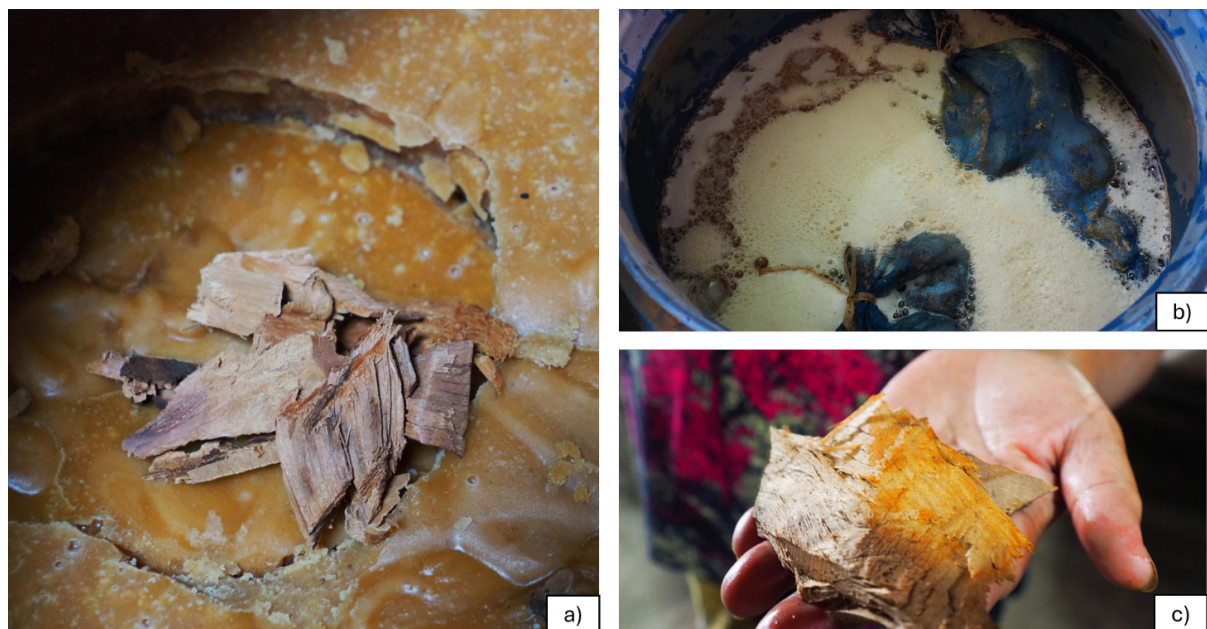


Figure 4 Use of **khiam** wood (*Cotylelobium lanceolatum*) being prepared for alcohol production: (a) additional pieces of khiam added to nipa palm jaggery prior to fermentation; (b) khiam enclosed in blue mesh bags and added to the fermenting mixture; and (c) a piece of khiam wood used in the process.

Use in Nipa Sugar Production

During the initial boiling of fresh nipa sap (approximately 800-1000 ml per container), producers added 1-2 small pieces of Khiam wood, weighing an estimated 10-20 g. The wood was removed before further reduction, and no additional **khiam** was added at later stages.

While **khiam** helped stabilize the sap, it was also used to impart a **subtle bitterness and astringency** to the finished sugar. The resulting product was described as having a balanced “สามรส” (three tastes): sweet, salty, and slightly bitter. This indicates that bitterness was not incidental but intentionally incorporated at low intensity to complement the natural flavor profile of nipa sugar.

Discussion

Khiam was used in Pak Phanang not simply as a preservative, but as a deliberately managed processing material whose quantity varied according to the intended product. In nipa sugar production, producers used only small amounts to help maintain sap quality while contributing a slight bitter-astringent note. In alcohol production, much larger amounts were added during fermentation to prevent souring and to produce a stronger, more characterful bitterness. These observations indicate that bitterness was not an incidental consequence of preservation, but an intentionally regulated sensory property. In this respect, khiam differs from classic beverage bitterants such as hops, quinine, gentian, wormwood, and quassia, which are primarily recognized for defining flavor profile, and appears closer to plant additives that combine bitterness with technological effects on fermentation or preservation. A particularly relevant comparison is *Sacoglottis gabonensis* (Baill.) Urb. bark used in West African palm wine, which has been reported not only to impart bitterness, but also to reduce foaming, prolong shelf life, and alter fermentation products and beverage quality (Maduka and Okoye, 2002; Nwaiwu *et al.* 2016). The dual role observed here is also consistent with Thai studies showing antimicrobial or spoilage-delaying effects of khiam wood in palm sap systems, supporting our interpretation that it is a functional bitter wood rather than merely a flavor additive (Chanthachum and Beuchat, 1997; Naknean *et al.* 2010; Hebban *et al.* 2018; Balange and Benjakul, 2009).

Conclusion

The use of *Cotylelobium lanceolatum* in southern Thailand illustrates a sophisticated ethnobotanical practice in which a single plant material serves both preservative and sensory functions. While its role in delaying spoilage is recognized, its deliberate use as a **bittering agent** in both sugar and alcohol production represent a novel contribution to regional ethnobotany. Future research should focus on the phytochemical characterization of Khiam wood and controlled studies on its effects on taste and microbial dynamics, contributing to a deeper understanding of plant-based flavor modulation in traditional food systems.

Declarations

List of abbreviations: Not applicable

Ethics approval and consent to participate: The development of the study followed the ethical and legal guidelines for the development of research on traditional knowledge. The participation was subject to the acceptance of the Free and Informed Consent Form.

Consent for publication: Not applicable

Availability of data and materials: Not applicable

Competing interests: Not applicable

Funding: Not applicable

Author contributions: S.P. & P.P. collected the data and developed the conceptual framework of the study. P.P. wrote the manuscript. H.B. commented on the manuscript and edited the text.

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