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The Contribution of Javanese Pharmacognosy to Suriname’s Traditional Medicinal Pharmacopeia: Part 1

Dennis R.A. Mans, Priscilla Frieperson, Meryll Djoaroen and Jennifer Pawirodihardjo

Abstract

The Republic of Suriname (South America) is among the culturally, ethnically, and religiously most diverse countries in the world. Suriname’s population of about 600,000 consists of peoples from all continents including the Javanese who arrived in the country between 1890 and 1939 as indentured laborers to work on sugar cane plantations. After expiration of their five-year contract, some Javanese returned to Indonesia while others migrated to The Netherlands (the former colonial master of both Suriname and Indonesia), but many settled in Suriname. Today, the Javanese community of about 80,000 has been integrated well in Suriname but has preserved many of their traditions and rituals. This holds true for their language, religion, cultural expressions, and forms of entertainment. The Javanese have also maintained their traditional medical practices that are based on *Jamu*. *Jamu* has its origin in the Mataram Kingdom era in ancient Java, some 1300 years ago, and is mostly based on a variety of plant species. The many *jamu* products are called *jamus*. The first part of this chapter presents a brief background of Suriname, addresses the history of the Surinamese Javanese as well as some of the religious and cultural expressions of this group, focuses on *jamu*, and comprehensively deals with four medicinal plants that are commonly used by the Javanese. The second part of this chapter continues with an equally extensive narrative of six more such plants and concludes with a few remarks on the contribution of Javanese *jamus* to Suriname’s traditional medicinal pharmacopeia.

Keywords: Suriname, Javanese, ethnopharmacology, medicinal plants, ethnobotanical uses, phytochemistry, pharmacology

1. Introduction

The Republic of Suriname is a small independent country in South America that is renowned for its ethnic, cultural, and religious diversity [1]. The Javanese are currently the fourth most numerous ethnic group in Suriname, after the Hindustanis, the Creoles, and the Maroons [1]. The Javanese are the descendants of indentured laborers from particularly the Indonesian island of Java who were attracted by the Dutch colonizers from the former Dutch East Indies - modern-day Indonesia - at the
end of the 19th century to work on the sugar cane plantations in Suriname following the abolition of slavery in the year 1863 [2, 3]. They had signed contracts for five years, and although some returned to their home country and others relocated to The Netherlands [2, 3], most remained in Suriname and settled in the district of Commewijne (Figure 1) where the first groups of Javanese had been put to work [2, 3].

Today, only five generations later, the Javanese have integrated well in Suriname, actively participating in all sections of the society including politics, arts, entertainment, and sports. For instance, Iding and Willy Soemita and Paul Somohardjo were prominent Surinamese Javanese politicians. Iding Soemita was born in West Java and came as an indentured laborer to Suriname, and founded the political party Kerukunan Tulodo Pranatan Inggil (KTPI) in 1949, giving Surinamese Javanese for the first time a political voice. Iding Soemita’s son Willy succeeded his father as chairman of the KTPI in 1972 and served several times as a minister until 1996. As a more outspoken and assertive alternative to the KTPI, Paul Somohardjo founded the Javanese party Pendawa Lima in 1977 that was superseded in 1998 by the Pertjajah Luhur. Somohardjo became the first-ever Javanese Speaker of the National Assembly in 2005 and also served several terms as a minister.

The Surinamese-Javanese writer Karin Amatmoekrim studied Modern Literature at the University of Amsterdam, graduated with a thesis on ‘The ethnicity in literature in Suriname’, and won the 2009-Black Magic Woman Literature Prize for her novel ‘Titus’. The Surinamese-Javanese singers Ragmad Amatstam, Oesje Soekatma, and Eddy Assan are among the greatest and most beloved musicians Suriname has brought forth. Specializing in pop-Jawa songs, they reached a broad audience in both Suriname and The Netherlands. Notable Surinamese-Javanese sports heroes are Andy Atmodimedjo, Virgil Soeroredjo, and Mitchel Wongsodikromo. Andy Atmodimedjo was an impressive professional football player and became the successful manager of several clubs in Suriname’s highest soccer league as well as the head coach of the country’s senior and under-21 national soccer teams. And Virgil

Figure 1. Location of Suriname with respect to its neighboring countries French Guyana, Brazil, and Guyana, as well as its poisoning in South America (insert) (modified from: https://goo.gl/images/F77jg5).
Soeroredjo and Mitchel Wongsodikromo were among the world’s top badminton players who excelled on various national, Caribbean, Central American, and South American competitions.

Nevertheless, the Javanese have preserved their own identity, speaking their own language and adhering to their own specific religious and cultural customs. This also holds true for their traditional medical customs which are based on *Jamu*, the centuries-old traditional form of medicine from Indonesia that mainly involves the use of plants with medicinal properties. The first part of this chapter gives some background on Suriname; then addresses some of the religious and cultural expressions of Surinamese Javanese; focuses on *Jamu*, and concludes with an extensive account of the traditional, phytochemical, and pharmacological aspects of four medicinal plants that are mainly used by Surinamese Javanese. The second part of the chapter continues with a comprehensive narrative about six additional popular ‘Javanese’ medicinal plants and concludes with the contribution of the Javanese pharmacognostic knowledge to Suriname’s traditional medicinal pharmacopeia.

2. Background on Suriname

2.1 Geography, population, and economy

The Republic of Suriname is located in the north-eastern part of South America, bordering the Atlantic Ocean to the north, French Guiana to the east, Guyana to the west, and Brazil to the south (Figure 1). It is the smallest sovereign country in South America with a land area of about 165,000 km$^2$ that can be distinguished into a relatively narrow northern coastal region and a large, sparsely inhabited hinterland that is mainly covered by savanna grassland and pristine Amazon rain forest [4]. Suriname’s capital and largest city is Paramaribo that is located in the coastal area near the mouth of the Suriname River (Figure 1) and harbors, together with the other cities in the coastal area, approximately 80% of the population [1]. The hinterland encompasses more than three-quarters of the country’s surface and [4] and is home to the remaining 20% of Suriname’s inhabitants [1].

The population is among the ethnically most varied in the world, comprising Amerindians, the original inhabitants; Maroons, the immediate descendants of enslaved Africans shipped from western Africa between the 17th and 19th centuries; mixed people descending from enslaved Africans and mostly Europeans called Creoles; the descendants from indentured laborers attracted from China and India in addition to Java (Indonesia) between the second half of the 19th century and the first half of the 20th century; and immigrants from various European, South American, and Caribbean countries [1]. According to the 2012 census, the largest groups are represented by the Hindustanis, Maroons, Creoles, and Javanese, making up roughly 27, 22, 17, and 16%, respectively, of the total Surinamese population [1].

Suriname is situated on the Guiana Shield, a Precambrian geological formation estimated to be 1.7 billion years old and one of the regions with the largest expanse of undisturbed tropical rain forest in the world, with an extraordinary high animal and plant biodiversity [4]. The high mineral density of Suriname’s soil contributes to its ranking as the 17th richest country in the world in terms of natural resources and development potential [5]. Suriname’s most important economic means of support are crude oil drilling, gold mining, agriculture, fisheries, forestry, and ecotourism [5]. These activities contributed substantially to the gross domestic product in 2019 of USD 3,697 billion and the gross per capita income in that year of USD 5,420 [6]. This positions Suriname on the World Bank’s list of upper-middle income economies [6].
2.2 Brief history

Although many history textbooks discuss Suriname starting from 1492 (the year Christopher Columbus ‘discovered’ South America’s ‘Wild Coast’), archeological finds in Suriname’s deep south-west have demonstrated the presence of human beings in Suriname as far back as 5,000 years ago [7]. The artifacts have been ascribed to nomadic Amazon tribes who then lived in that region and who may represent the ancestors of the present-day Indigenous tribes who still populate Suriname’s hinterland. One of these nomadic tribes are the Arawaks, who are generally believed to be Suriname’s original inhabitants [8], but there are no written documents to support this assumption.

Dozens of years after Columbus, the first Europeans arrived in Suriname in the early 1600s. They were Spanish, English, French and Dutch fortune hunters who were in search of El Dorado, a mythical city of immense wealth somewhere at the ‘Wild Coast’ ruled by a chieftain covered with gold dust [9]. The area was first colonized in 1630 by British settlers led by Captain John Marshall [10], and they called the occupied region ‘Surinam’ after the Surinen indigenous people they had encountered. Their attempt to set up tobacco plantations failed and they abandoned the colony by 1645 [10].

A second English operation undertaken in 1651 was more successful when permanent sugar cane plantations were established in the colony that had been named Willoughbyland in honor of their patron Lord Francis Willoughby, the then governor of Barbados [10]. Initially, cheap labor to work on the plantations was mainly provided by captured Indigenous tribespeople from the hinterland. However, because of the increasing need for laborers, the British started importing enslaved Africans in 1663 from Dutch centers for slave trading in western Africa [10]. In the resulting conflict, the Dutch invaded and captured Willoughbyland in 1667 [10]. This eventually led to settlements in which Suriname was assigned to The Netherlands in exchange for New Amsterdam in North America [11]. The Dutch renamed Willoughbyland Dutch Guiana, while the English renamed New Amsterdam New York after the Duke of York [11].

From 1683 onwards, the Dutch ruled over their newly acquired colony in South America, elevating the plantation economy to unprecedented heights by producing cocoa, coffee, cotton, sugar, and indigo [12]. The Dutch also dominated the trans-Atlantic slave trade for a long time, transporting a total of approximately 300,000 Africans to Suriname [12]. However, treatment of the enslaved Africans was notoriously brutal, and many escaped to Suriname’s hinterland [13]. These Maroons preserved much of their cultural concepts and established a new and unique culture that was highly successful and exists until today [13].

Slavery was officially abolished in 1863, but the enslaved Africans who had remained on the plantations were obliged to conduct ill-paid work over the next ten years. As soon as they became truly free, the majority abandoned the plantations and settled in Paramaribo [14]. To make up for the shortage of workers on the plantations after 1873, indentured laborers were brought in, first from India then from the then Dutch East Indies [2]. In addition, between 1850 and 1860, small numbers of (mostly male) laborers had been brought in from China and the Middle East [15]. From the mid-20th century onwards, various immigrants from South American and Caribbean countries immigrated to Suriname [5]. These developments are the reason that Suriname has become one of the ethnically and culturally most diverse countries in the world notwithstanding its relatively small population. It also explains the large variety of traditional forms of medicine practised in the country.
3. Surinamese Javanese

3.1 The first arrivals

The first group of 94 Javanese indentured laborers was from the countryside of the city of Surakarta in Java (also known as Solo) and left on May 21, 1890, for Suriname on the steamship Prins Willem II [16]. This was an initiative of the Netherlands Trading Society (Nederlandsche Handel-Maatschappij, abbreviated NHM), one of the primary ancestors of ABN AMRO Bank NV, the third-largest bank in The Netherlands. The Prins Willem II arrived 70 days later, on August 9, 1890, in Suriname [16]. Lately, this date has been proclaimed a national holiday in commemoration of the Javanese immigration. The new arrivals were set to work on the sugar cane plantations at Mariënburg (district Commewijne) which were then owned by the NHM.

The NHM initiative was considered successful, and by 1894 the Dutch colonial government took over the task of recruiting Javanese hands starting with signing up 584 additional Javanese in that year [16]. The workers (and their families) arrived in small groups and in two stages, i.e., first from the Dutch East Indies to The Netherlands and from there to Paramaribo [16] (Figure 2). They came from the then overpopulated villages in central and western Java, Batavia, Surabaya, and Semarang, and awaited their departure in depots in Batavia, Semarang, and Tandjong Priok, where they were inspected and registered and signed their contract [16]. The transport of Javanese indentured laborers continued until 13 December 1939, when it was discontinued by the outbreak of World War II [16].

Figure 2.
Arrival of one of first groups of Javanese indentured laborers in Suriname (from: https://images.app.goo.gl/cuQWxqXpBvwnbkgR6).
In total, 32,956 Javanese arrived in Suriname. Most of them were recruited to work on the plantations, but a group was also specifically recruited to work at the Colonial Railways, while another group was assigned to the Suriname Bauxite Company in Moengo during World War I [16]. Only 20 to 25% of the Javanese migrants returned to their home country before World War II [2, 3]. In 1954, an additional 1,200 Javanese, encouraged by Iding Soemita's rival Salikin Hardjo, returned to Indonesia to start an agricultural co-operative in Tongar in western Sumatra [2, 3]. And in the 1970s, 20,000 to 25,000 Surinamese Javanese went to The Netherlands for fear of social-economic insecurity in an independent Suriname that was due in 1975 [2, 3]. However, the great majority of Javanese immigrants settled permanently in Suriname,

Nevertheless, many Javanese identified and still identify with their country of origin, even though very few have ever visited Java or maintain family connections there. This strong adherence to their origin is partly due to the major socio-economic disadvantages they had to face in an often hostile environment [16, 17]. In addition, the firm commitment of many Javanese to their own customs and traditions is for an important part directly attributable to Dutch colonial policies to control the immigrants [16, 17]. This was done through the so-called 'Indianisation' project implemented in the 1930s and involved, among others the creation of small Indonesian-styled Javanese farm villages - desas - in the countryside, each headed by its own village head (the lurah) and religious and civic leaders [16, 17]. Obviously, this secluded lifestyle strengthened the group identity and helped them to maintain the rich culture they had brought with them from Java [16, 17]. Indeed, some of the desas were situated in locations that are still mainly populated by Javanese such as Tamanredjo, Kampong Baru, Sidoredjo, and Kuwarasan as well as Lelydorp, Domburg, and Meerdorp.

3.2 Javanese culture

The social, economic, linguistic, cultural, and religious challenges the Javanese indentured laborers had to cope with, obviously contributed to the consolidation of the group cohesion and the preservation of their customs and traditions. For instance, the Surinamese Javanese still speak their own language in addition to Dutch, the official language of government, business, media, and education, as well as Surinamese or Sranan Tongo, the widely used English- and Portuguese-based lingua franca [18]. The language spoken by this group is Surinamese-Javanese that is derived from the original Javanese language called Basa Jawa spoken in the central and eastern parts of Java [19]. However, after more than a century, Surinamese-Javanese has become influenced by Dutch and Sranan Tongo and has developed differently from Basa Jawa [19].

Most Javanese are Muslim, and one of the central values in their philosophy about life is rukun that involves a commitment to harmony and togetherness, not only among people but also between the human world and that of the gods and the spirits. The importance of rukun manifests in Javanese everyday-life in, for instance, the pursuit of good relations with others, an attitude of modesty, courtesy, politeness, formality, and avoiding conflicts whenever possible. Rukun is also expressed in several ceremonies and rituals for maintaining good relations with the gods and the spiritual world [20]. This is mainly done by making sacrifices and holding ritual sacrificial meals or slametans. A slametan is headed by a religious leader called kaum who asks God to bless the various dishes spread out on the table, each with a specific ritual meaning based on the purpose of the slametan [20].

Unique cultural expressions from the Javanese are the gamelan music, the wayang shadow puppet show, and the ludruk theater. Gamelan (Figure 3) is the...
traditional ensemble music of Javanese and is predominantly performed by dif-
ferent percussion instruments such as metallophones and xylophones played by
mallets, chimes, and hand-played drums called kendhang to register the beat, as
well as melodic instruments like bamboo flutes, strings, and vocalists called sindhen
if female or gerong if male [21]. The earliest known records of gamelan were found
in the reliefs of the Borobudur Temple located near Central Java, the world’s largest
Buddhist temple, dating it back as far as the 9th century [21]. Gamelan is commonly
played in many religious rituals, traditional ceremonies, and informal events,
including, among others, wajang puppet shows and ludruk theater [21].

Wajang is an ancient form of storytelling by theater play that dates back to
medieval times [22]. The form most practiced is called wajang kulit that depicts
dramatic mythological stories as well as local adaptations of cultural legends using
flat leather shadow puppets [22]. A wajang is played out by the dalang, the pup-
peteer who sits behind the screen and sings and narrates the dialogs of the different
characters of the story [22]. The dalang is highly respected for his knowledge and
art, and as a spiritual person capable of bringing to life the spiritual stories in the
religious epics [22]. Ludruk theater is the old Javanese tradition of storytelling
presented by a group of actors (or comedians) on a stage, through slow, graceful,
and expressive dances [23]. Ludruk presumably dates as far back as the 13th century
[23]. It tells stories about everyday life, mostly that of the underprivileged, and is
particularly appreciated by a working-class audience [23].

Other characteristic Javanese cultural expressions are djarang kepang and pentjak
silat. Djarang kepang (Figure 4) is a spectacular cultural religious tradition where
young males dance on hobby horses and suddenly become entranced, behaving
like horses and eating grass [24]. It is generally performed in a cordoned-off area,
with the audience separated from the dancers [24]. The origin of djarang kepang is
uncertain, but it may be based on the wars fought between native Javanese and the
colonial Dutch Empire in the dying days of the Sultanate of Mataram at the end of
the 19th century and during the Diponegoro War from 1825 to 1830 [24]. Pentjak
silat is the indigenous ritual martial art of Indonesia intended for self defense [25].
It is believed to be founded as early as the 6th century and has extensively been
practised during the epoch of the powerful kingdom of Sri Vijaja on Sumatra in
the 11th century [25]. Pentjak silat is based on the movements and stances of tigers,
eagles, snakes, crocodiles, monkeys, scorpions, and dragons [25]. As a result, some of the stances and styles have been named after animals, such as *harimau* (tiger) and *garuda putih* (white eagle) [25].

3.3 Jamu

The Surinamese Javanese have also maintained their traditional medical customs which are mainly based on medicinal plants and, as mentioned above, are referred to as *Jamu* [20]. *Jamu* is widely practiced in Indonesia and probably has its origin in the Mataram Kingdom era in ancient Java, some 1300 years ago [26, 27]. *Jamu* products called *jamus* are in Indonesia traditionally available from (particularly female) peddlers and street-side vendors, entrepreneurs who operate on a made-to-order basis out of their home, as well as medium-sized and large firms that produce and retail pre-made *jamus* in dried form, sachet packaging, and as tablets, capsules, and liquid drinks [26, 27]. The many different *Jamu* brands are united in the Indonesian Herbal and Traditional Medicine Association locally known as *Gabungan Pengusaha Jamu* that had sales worth USD 74 million in 2014 [26, 27].

There are *jamus* against almost every ailment, ranging from remedies for treating sick children and managing post-childbirth conditions to a large variety of beauty products and remedies for sexual problems [28]. The medicine book from Mataram from the 18th century even has 3,000 entries of *jamu* recipes [28]. An example is *jamu kunirasem* that contains as main ingredients the rhizome from the turmeric *Curcuma longa* L. (Zingiberaceae) called *kunjir* or *kunir* in Javanese,
and parts from the tamarind *Tamarindus indica* L. (Caesalpiniaceae) called *asem* in Javanese [28]. Another example is *jamu beraskentjur* that has as basic ingredients rice (*beras* in Javanese) and the rhizome from the sand ginger *Kaempferia galanga* L. (Zingiberaceae) called *kentjur* in Javanese [28]. However, depending on the desired benefits, various other ingredients are added, such as ginger rhizome, cardamom seeds, cinnamon, pomegranate, lemon, and/or nutmeg [28]. To improve the (sometimes bitter or sour) taste, natural sweeteners such as brown sugar, granulated sugar, rock sugar or honey may be added [28].

*Jamu* is practiced in both Indonesia and Suriname by highly respected medicinal practitioners known as *dukuns* [20, 26, 29]. The *dukun* is very influential and holds extensive knowledge about the preparation of the large variety of sometimes rather complicated *jamus* [20, 26]. An example is the very popular *jama galian* consisting of different parts of eight plants that is widely used in Suriname as a general health-promoting tonic [20, 26, 29]. The *dukun* also plays an important role during, for instance, *njuwuk*, a ritual to bring a person at ease by praying over and blowing three times over a glass of water that then must be drunk by the client [20, 26, 29]. *Njuwuk* is often performed prior to examinations, circumcisions, or giving birth [20, 26].

### 4. Plants used in Javanese pharmacognosy

Hereunder, four medicinal plants that are traditionally mainly used by Surinamese Javanese, have in detail been assessed for their phytochemical contents and pharmacological activities in order to provide a scientific rationale for their ethnopharmacological applications. The plants have been selected on the basis of the number of times they have been dealt with in a number of comprehensive publications describing the use of medicinal plants in the country [30–38]. In part 2 of this chapter, six additional plants are equally extensive addressed. All the plants and their main traditional use by Surinamese Javanese are given in Table 1.

#### 4.1 Acanthaceae - *Strobilanthes crispa* Blume

The black face general *S. crispa*, known as *ketji beling* in Suriname (Figure 5), is native to the region between Madagascar and Indonesia but is now found in many countries throughout south-eastern Asia. It is a woody spreading shrub that carries yellow-colored flowers, attains a height of 50 centimeters to 1 meter, and can be found on riverbanks and abandoned fields. The leaf is eaten as a vegetable but has for centuries been used medicinally in Indonesian and Malaysian folk medicine. More recently, some products prepared from *S. crispa* leaf have entered the health-food market as nutraceuticals in the form of sachets containing the raw crude powder for preparing a tea, as an additive in coffee, or as capsules for oral intake. *S. crispa* has probably been introduced in Suriname from Java in 1956 [32], and mainly the leaf is used as an ingredient of popular *jama* for lowering elevated blood sugar levels [34]. In Suriname, it is also used as a diuretic, against kidney stones and renal colics, and to lower elevated blood sugar levels in diabetes mellitus [34], either separately or in combination with, for instance, the leaves from the cat’s whiskers *Orthosiphon grandiflorus* Bold. (Lamiaceae) [34].

Some of these traditional uses are supported by experimental data and pharmacological studies. The use of the leaf as a mild diuretic [39] can be attributed to the many cystoliths of calcium carbonate in this part of the plant [40], which make an infusion slightly alkaline. Support for the anti-urolithiatic properties of *S. crispa* and its efficacy against renal colics came from the inhibitory activity
| Family         | Species (vernacular names in English; Surinamese-Javanese) | Part(s) used       | Traditional indications                                      | References |
|---------------|-----------------------------------------------------------|--------------------|-------------------------------------------------------------|------------|
| Acanthaceae   | *Strobilanthes crispa* Blume (black face general; ketji beling) | Leaf               | Disorders of the urinary system; diabetes mellitus          | [34]       |
| Araceae       | *Acorus calamus* L. (sweet flag; dlingo)                  | Rhizome            | Gastrointestinal disorders, intestinal parasites, common cold, convulsions and seizures in children, evil eye and evil spirits | [33, 34, 38] |
| Areaceae      | *Cocos nucifera* L. (coconut; klapa)                      | Coconut oil, coconut meat, coconut water, husk fibers | Respiratory problems, pimples, shingles due to herpes, diabetes mellitus, hypertension, gastrointestinal disorders, skin and hair care, skin lesions, burns, sprains, sore muscles, evil eye and luck | [32–36] |
| Asclepiadaceae| *Calotropis gigantea* (L.) Aiton (crown flower; bidari, widuri) | Latex, stem        | Bleeding, skin lesions, burns, toothache, tonsillitis, colds, heart conditions | [36, 38] |
| Asteraceae    | *Ageratum conyzoides* L. 1753 not Hieron. 1895 nor Sieber ex Steud. 1840 (goatweed; wedusan) | Whole plant leaf, root | Symptoms of flu, gastrointestinal problems, gynecological disorders, gonorrhea, itching, skin lesions | [32, 35, 37, 38] |
| Caesalpiniaceae| *Tamarindus indica* L. (tamarind; asem)                    | Leaf, fruit pulp   | Health-promoting *jamus*, fever, gynecological conditions, itching, skin lesions | [30, 34, 38] |
| Fabaceae      | *Sesbania grandiflora* (L.) Poiret (vegetable hummingbird; turi) | Leaf, bark         | Abdominal disorders, throat and oral infections             | [38]       |
| Portulacaceae | *Portulaca oleracea* L. (green purslane; kroket)          | Whole plant leaf   | Skin lesions, sprains, swellings, stiff joints, pain, bronchitis, conjunctivitis, anemia | [31, 35, 38] |
| Zingiberaceae | *Curcuma longa* L. (turmeric; kunjit)                     | Rhizome            | Health-promoting *jamus*, gynecological disorders, gastrointestinal diseases, fever, inflamed gums, conjunctivitis, skin lesions, pinworm infection | [34, 38] |
| Zingiberaceae | *Zingiber officinale* Roscoe (ginger; djahe)               | Rhizome            | Health-promoting *jamus*, overweight, respiratory diseases, gastrointestinal disorders, gynecological problems, bruises, rheumatic joints, sore muscles | [34, 38] |

Table 1. Plants commonly used in Javanese traditional medicine addressed in this chapter, parts preferentially used, and traditional indications in the Surinamese-Javanese community.
of methanolic and ethyl acetate leaf extracts against the aggregation of calcium oxalate crystals and their stimulatory effects on the dissolution of the crystals [41]. The results from a clinical trial with a polyherbal formulation containing *S. crispa* suggested that it was safe and effective in the treatment of urolithiasis [42]. It has been suggested that the phenolic compounds in the leaf are responsible for the anti-urolithiatic activity of the plant, as these compounds have been found to inhibit the growth of calcium oxalate crystals *in vitro* [43].

The use of *S. crispa* against diabetes mellitus is supported by the antihyperglycemic activities of hot water extracts of fermented and/or unfermented leaf tea in normal and streptozotocin-induced diabetic laboratory rats [44]. Both fermented and unfermented *S. crispa* tea improved lipid profile in the animals [44]. Comparable results were obtained with *S. crispa* juice in diabetic and normal rats [45]. Interestingly, the fresh juice from *S. crispa* leaf stimulated the healing of incision wounds on the back of normal and streptozotocin-induced hyperglycemic rats [46]. These observations are in accordance with the stimulatory effects of a topically applied ethanol extract of *S. crispa* leaf on excision wounds in the posterior neck area rats [47].

4.2 Acoraceae - *Acorus calamus* L. 1753

*The sweet flag* *A. calamus*, also called *dlingu* in Surinamese-Javanese (*Figure 6*), is a species of flowering plant that is widely spread from the Caucasus through western Asia and Siberia to China, India and south-eastern Asia, as well as North America, where it can be found in swampy and marshy habitats. It is a stemless herbaceous perennial that grows about 2 meters tall and is characterized by clusters of leaves arising from a spreading rhizome. The plant has diploid forms (mainly in parts of northern Asia and much of North America), triploid forms (mainly in Europe and south-western Asia to the Himalayas), and tetraploid forms (mainly in central Asia, through India, Japan and tropical Asia) [48]. Each of these forms has a distinct chemistry, particularly with respect to the composition up of the essential oil in leaf and rhizome [49].

*A. calamus* has been known since the ancient Egyptians who appreciated the sweet, cinnamon-like scent of the essential oil and incorporated extracts from
these parts of the plant into perfumes and aromatic vinegars [50]. In Suriname, *A. calamus* is only used by the Javanese [34] who incorporate the dried rhizome as a spice in a herbal paste called *bumbus* [34]. The dried rhizome is also prepared into a tea for treating abdominal cramps, stomach problems, and dysentery [38]; as an ingredient of a number of *jamus* [34] such as *jamu sawanang* that is given to children as a deworming treatment and against pinworms; the macerated rhizome mixed with aniseed is placed on the forehead of children with the common cold; as an ingredient of an ointment for treating convulsions and seizures in children; and the grated rhizome is rubbed behind the ears and on the forehead of children to ward off the evil eye and provide protection from evil spirits [34, 38].

Phytochemical studies of *A. calamus* have shown the presence of a wide variety of chemical constituents in the rhizome and other parts of the plant, including a volatile oil that consists of the phenylpropanoids $\alpha$-asarone and $\beta$-asarone as well as saponins, lectins, sesquiterpenoids, lignans, and steroids [49]. $\beta$-Asarone is responsible for the characteristic odor and flavor of *A. calamus* rhizome and leaf [49] and is present in varying amounts in the essential oils from the diploid, triploid, and tetraploid forms the plant. The oil from the tetraploid form consists for 90 to 95% of $\beta$-asarone, that of the triploid form has only relatively small amounts of $\beta$-asarone, while the diploid form is devoid of this compound [49]. $\beta$-Asarone is potentially carcinogenic and hepatotoxic [51] and can cause hallucinations, as well as severe and prolonged nausea and vomiting [52]. For these reasons, *A. calamus*-derived products such as the rhizome oil have been banned in the USA and their concentrations as flavorings in, for instance, bitters, have been limited to 115 $\mu$g per day [53].

Nevertheless, a great number of pharmacological studies provided support for various Surinamese-Javanese traditional applications of *A. calamus*. The traditional use of the dried rhizome for gastrointestinal conditions [38] is supported by the inhibitory effects of an ethanolic rhizome extract on gastric secretion in rats and the protective effect of this preparation on the animals’ gastroduodenal mucosa against damage caused by pyloric ligation, indomethacin, reserpine, cysteamine administration, and cytodestructive agents such as ethanol [54]. A 50%-ethanol extract
of the rhizome also showed antispasmodic activity in an isolated guinea pig ileum assay in mice [55], while a crude rhizome extract inhibited spontaneous and high K⁺-induced contractions in an isolated rabbit jejunum preparation, accomplishing spasmytic activity that might be mediated through calcium channel blockade [56]. Furthermore, a methanolic rhizome extract the considerably reduced induction time of castor oil-induced diarrhea and total weight of the feces in mice [57].

The incorporation of *A. calamus* rhizome in, among others, *jamu sawanang* in order to remove intestinal worms and pinworms [34] is justified by the inhibitory effects of extracts of the essential oil against the large roundworm *Ascaris lumbricoides* [58], the causative agent of ascariasis that causes abdominal swelling, abdominal pain, and diarrhea, as well as poor weight gain, malnutrition, and learning problems in children [59]. Notably, administration of the dried rhizome powder to 147 children aged between 5 and 11 years with round worm infestation produced complete cures in 83% of cases [60]. *A. calamus* essential oil also displayed nematocidal activity against the root-knot nematode *Meloidogyne incognita* [61] that arouses large, usually irregular galls on roots of trees [62].

Support for an anticonvulsant activity from *A. calamus* came from the protective effect of the essential oil on convulsions produced by electroshocks in laboratory rats and mice [63], the reduction in the severity of maximum electric shock-induced seizure in rats by aqueous and alcohol extracts from the rhizome [64], and the significant increase in the pentylentetrazole-induced seizure latency caused by these extracts [64]. These calming effects of *A. calamus* preparations may also account, at least partially, for their use to ward off the evil eye and protect against evil spirits [34, 38].

**4.3 Arecaceae - Cocos nucifera L.**

The coconut tree *C. nucifera*, known as *klapa* in Surinamese-Javanese (Figure 7), presumably originates from Indonesia, Malaysia, the Philippines, as well as the many islands between the Indian and the Pacific Ocean. It has subsequently been brought to India, Africa, and the Americas, and is now found in most tropical regions throughout the world. The plant is an evergreen arborescent monocotyledonous tree that can range in height from 2 meters up to 30 meters. *C. nucifera* is grown for decoration but also for the many culinary, non-culinary, and medicinal uses of virtually every part of the plant. Indeed, coconut oil; coconut milk; coconut water; preparations from the dried coconut meat, husk fiber, leaf, inflorescence, stem, and root; leaves and roots of young plants are widely used in many traditional medical systems throughout the world.

In Suriname, small amounts of coconut oil are included in in preparations to fight colds, flu, fever, bronchitis, and asthma [32, 34]. Coconut meat is eaten against pimples, or applied on shingles due to herpes zoster infection after it has been macerated by chewing [34]. A tea from the husk fibers is drunk to manage the symptoms of diabetes mellitus and hypertension [38]. Diarrhea and dysentery are treated by drinking coconut water or an infusion of cocos meat with allspice and clove [35]. Coconut water would also stop vomiting and fever [36]. Externally, coconut oil is used for skin and hair care, skin wounds, insect bites, burns, sprains, sore muscles, to massage the abdomen of pregnant women, to promote the health of newborn babies [34], and to protect newborn babies against the evil eye and to command luck in their life [33].

Phytochemical studies showed the presence of many phytochemicals and bioactive compounds in various parts of *C. nucifera* including, among others, flavonoids and other phenolic compounds having antioxidant properties, condensed tannins with potential antihelminthic activity, macronutrients such as lauric acid that may
be involved in the antiprotozoal, antifungal, antibacterial, and antiviral properties of the plant, and micronutrients such as manganese, copper, iron, and selenium [65]. The presence of these compounds in the plant could support some of its traditional applications and could help explain some of its pharmacological activities dealt with hereunder.

The use of *C. nucifera* preparations against infections of the respiratory tract in Suriname [32, 34] may be attributed to their antibacterial, antifungal, and antiviral properties. Support for the former activity particularly came from the inhibitory effects of preparations from the dried and macerated husk fibers against common oral pathogens like cariogenic bacteria, periodontal pathogens, and candidal organisms albeit the less than that of the disinfectant and antiseptic chlorhexidine [66]; cultures of a broad range of both Gram-positive and Gram-negative pathogenic bacteria [67, 68] including methicillin-resistant *Staphylococcus aureus* [69]. Other studies also found antimicrobial activities of preparations from the endocarp [70] and the mesocarp [71]. The antibacterial activities may be associated with phenolic compounds, terpenoids, phytosterols, and unsaturated fatty alcohols [67, 71], and their mechanism of action may involve perturbation of the bacterial cytoplasmic membrane [68].

Indications for antimycotic activity of *C. nucifera* were provided by the *in vitro* activity of an alcoholic extract of the shell against a wide diversity of fungal species [72]; that of the virgin oil from the coconut pulp and a teas from the husk fiber against *Candida albicans* [69, 73]; and that of coconut oil - either incorporated into a Viscogel tissue conditioner or not - against *Candida albicans* [74], a frequent cause of oral candidiasis and denture stomatitis. The antifungal activity has mainly been attributed to the presence of phenolic compounds in these preparations [72]. That *C. nucifera* may also exert antiviral activity is indicated by the inhibitory activity of a crude catechin-rich husk fiber extract against acyclovir-resistant herpes simplex virus type 1 [67] and the efficacy of coconut oil against a variety of viruses with lipid capsules such as visna virus, cytomegalovirus, and Epstein–Barr virus [75]. It has been suggested that the medium chain saturated fatty acids from coconut oil destroy and break the membranes and interfere with viral maturation [75]. Importantly, the apparent antiviral activity of *C. nucifera* may also account for the application of finely chewed coconut meat on shingles caused by herpes zoster infection [34].
The use of coconut meat against impurities in the face [34] and that of coconut oil for skin and hair care, skin lesions, sprains, and sore muscles [34] may mainly have its rationale in the analgesic and antiinflammatory properties of these parts of the plant. Support for an analgesic effect is provided by the inhibitory effects of orally administered husk fiber extracts as well as two aqueous subfractions derived therefrom on acetic acid-induced writhing, heat-induced tail flicking, and formalin-induced paw licking in mice [69, 76]. Comparable results were obtained with an ethanolic root extract that, in addition, potentiated the sleeping time of mice induced by pentobarbital sodium, diazepam, and meprobamate, potentiated analgesia induced by morphine and pethidine in the animals, and protected them from convulsions caused by pentylentetrazole [77]. The latter action may also tentatively explain the putative protective effects of coconut oil in newborns against symptoms ascribed to the evil eye [33]. Administration of the opioid antagonist naloxone counteracted the antinociceptive effects of the C. nucifera preparations, indicating that they might act on opioid receptors [76]. Indications for antiinflammatory activity of the extracts were provided by their inhibitory effects on carrageenan carrageenan-, histamine-, and serotonin-induced paw edema and on cell migration, extravasation of protein, and TNF-α production following subcutaneous injection of air in rats [69, 76].

The usefulness of C. nucifera against diabetes mellitus [38] is supported by the decrease in fasting blood glucose and insulin levels as well as the restoration of all other biomarker as well as enzymes in streptozotocin- and alloxan-induced diabetic rats treated with a purified coconut kernel protein isolated from dried coconut kernel [78], a hydro-methanol or methanol extract of the immature inflorescence [79], or lyophilized mature coconut water [80]. The hypoglycemic effect of coconut water was comparable to that caused by glibenclamide [79, 80], and the antidiabetic activity of the purified coconut kernel protein has been attributed to the beneficial effects on pancreatic β cell regeneration of the relatively high levels of arginine in the protein [78]. And the traditional use in Suriname of a tea from the husk fibers to manage hypertension [38] is supported by the vasorelaxant activity of an ethanolic extract of the endocarp on isolated rat aortic rings and the blood pressure-lowering effect of the extract in deoxycorticosterone acetate salt-induced hypertensive rats [81]. This effect has been attributed to the direct activation of the nitric oxide/guanylate cyclase pathway as well as stimulation of muscarinic receptors and/or the cyclooxygenase (COX) pathway [81] and might be attributed to phenolic compounds in the extract [81].

4.4 Apocynaceae - Calotropis gigantea (L.) Dryand

The crown flower C. gigantea (Figure 8) called bidari or widuri in Surinamese-Javanese, is a fast-growing, evergreen, flowering shrub that can reach a height of 2 meters and that is native to Indonesia, India, southern China, and Malaysia. The vernacular name 'crown flower' is derived from the shape of the flower that consists of five pointed petals and a small crown-like structure rising from the center that holds the stamen. C. gigantea has extensively been cultivated in eastern Asian countries as an ornamental, for the fiber obtained from its stems, and for its medicinal uses, but easily naturalizes and is often found as a weed in uncultivated urban areas. It is an important religious plant in Hinduism where it is sacred to the God Shiva, and is used in various traditional medical systems throughout the world. C. gigantea has presumably been introduced in Suriname by Hindustani indentured laborers but its medicinal properties have also been recognized by other ethnic groups in the country including the Javanese. The milky latex is used to stop bleeding, and for treating minor wounds, boils, scabies, itches, bruises, cuts, sores,
and burns [38]. The latex is also rubbed against the gums to ease toothache or put on a piece of gauze that is placed in a cavity to stop caries [38]. The dried stem is burned, placed in the nostrils, and the released vapors are inhaled for treating inflamed tonsils [36]. And preparations from the leaf are taken orally for severe chest colds and heart conditions [38].

Phytochemical studies showed a variety of bioactive compounds in various parts of the plant which may account for some of its pharmacological activities [82], providing support for some of the traditional uses. For instance, the milky latex and the leaf contain, among others, cardiac glycosides such as calotropin, gigantin and uscharin that exerted a digitalis-like action on the heart [83], possibly accounting for the traditional use of leaf preparations against heart conditions [38]. Another group of glycosides in the plant exhibited, along with certain flavonoids, phenolic compounds, and triterpenoids, antimicrobial and antioxidant properties [84] that may help explain the traditional use of the latex against a variety of skin lesions [38].

Further evidence to support the use of the plant to stop bleeding and treat various types of wounds [38] is provided by the apparent wound healing stimulating effects of the plant. For instance, the use of the latex led to a smaller wound area, faster epithelization, increased granuloma breaking strength, and improved wound contraction in excision and incision wounds in Wistar rats [85, 86]. And an ethanol extract of *C. gigantea* root bark formulated as an ointment base for topical application, also stimulated the healing of incision, excision, and dead space wounds in albino rats, as judged by the increased percentage of wound contraction, the decreased degree of fibrosis, and the increased breaking strength [86].

The use of *C. gigantea* latex against toothache, caries, and chest colds [38], and that of the dried and burned stem against inflamed tonsils [36] is supported by the substantial inhibitory effects of aqueous and/or ethanolic extracts of the sap of the plant on the growth of various pathogenic bacteria as well as yeast species [87, 88]. Aqueous, methanol, ethanol, and petroleum ether extracts of the leaves of the plant also exerted broad antimicrobial activity against cultured bacterial strains [88], clinical isolates of *Candida* species [89], and the plant-pathogenic...
fungus *Fusarium mangiferae* that can cause serious damage to mango cultivations [90]. Additionally, a methanol extract from the root bark and its petroleum ether, chloroform, and ethyl acetate fractions, as well as crude aqueous, ethanolic, and acetone extract also displayed broad *in vitro* antibacterial activity [89, 91].

Possibly contributing to the above-mentioned therapeutic efficacies of *C. gigantea* are the anti-inflammatory, antioxidant, analgesic, and antipyretic activities reported in various laboratory models. An ethanol extract of the leaf inhibited carrageenan-induced paw edema in Wistar albino rats to a greater extent than ibuprofen [92]; a hydroalcoholic leaf extract displayed notable DPPH radical-scavenging activity, reducing power activity, and nitric oxide scavenging activity [93]; an orally administered ethanolic extract of the flower produced a substantial decrease in the frequency of writhing and paw licking in laboratory rodents [94, 95]; and intraperitoneal administration of a water:ethanol extract of the root led to a reduction of the fever and normalization of the body temperature in yeast- and typhoid vaccine-induced pyrexia in Albino Swiss rats and rabbits [96].

5. Concluding remarks

The Javanese have been in Suriname for over a century. They have been brought to that country as poor and unaccustomed indentured laborers but have become successful individuals who have integrated well into the Surinamese community, actively participating in all its sections. Indeed, the Javanese are full-fledged citizens of the country and an integral part of the vibrant color palette represented by its unique cultural, religious, and ethnic diversity. This is reflected by the presence of the small, often family-owned Javanese restaurants called *warungs* in the smallest of towns, where widely appreciated savory dishes such as *bami goreng* (fried noodles), *nasi goreng* (fried rice), *pityel* (mixed blanched vegetables with a peanut sauce dressing), *teloh* (fried cassava), *pejeh* (prawn crackers), and *saoto* soup (chicken broth, meat, and vegetables) can be enjoyed, and can be washed down with refreshing beverages such as the lemongrass-, corn starch-, and coconut milk-based *dawet*.

Nevertheless, the Javanese have maintained most of their cultural traditions. This particularly holds true for their ancient form of medicine that is based on centuries-old *Jamu*. *Jamu* has added a unique element to the array of traditional forms of medicine throughout the Caribbean and Latin America, most of which are based on practices from the Indigenous American peoples as well as those from Africa, China, India, and various European countries. The influence of *Jamu* is already noticeable. The use of an infusion of the cat’s whiskers or *kumis kutjing* *Orthosiphon aristatus* (Blume) Miq. (Lamiaceae) for treating kidney stones and renal colics is no longer limited to Indonesia and Suriname but has expanded into many other parts of the world. It is foreseeable that many more *Jamu* recipes will one day contribute to Suriname’s traditional medicinal pharmacopeia as well as to the development of novel mainstream drugs for treating human diseases.
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