Plants of Semillas Sagradas:

An Ethnomedicinal Garden in Costa Rica

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Rafael Ocampo, BSc. and Michael J. Balick, Ph.D

Foreword by Peter H. Raven, Ph.D

Edited by Ruth Goldstein and Katherine Herrera

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For the Children


Catharanthus roseus

Medical Disclaimer

This book is not intended as a treatise on herbal medicine. It describes a living garden, Semillas Sagradas at Finca Luna Nueva in Costa Rica, where medicinal herbs from both the New World and Old World tropics have been collected and propagated. From this predicate, authors Rafael Ocampo and Michael J. Balick have researched and reported upon the uses of these herbs in various traditional medicine systems. Their report on the uses presented in this book is not an endorsement of the therapeutic value or safety of these herbs and is not an exhaustive description of the published literature.

This book is therefore not intended in any way as a guide for consumer self-medication and people should consult with a healthcare practitioner before taking any medicinal herbs. Moreover, this book is not intended as a full summary of all available information for healthcare practitioners about these medicinal herbs. Neither the authors nor the publishers accept any liability or responsibility for the accuracy of the information reported or the consequences of the use or misuse of the information in this book. Nothing should be construed to represent an attempt to diagnose, prescribe or administer in any manner to any physical ailment or conditions. In matters of your health care, we recommend that you consult a qualified health practitioner and not attempt to self-treat based on information in this book.

Table of Contents


Emerald Glass Frog

Foreword

Biodiversity is the source of sustainability for our planet, essential for sustaining human life and environmental health. The greatest threat to biodiversity is habitat destruction, now proceeding rapidly all over the world, particularly in the world's tropical forests. It may be that half of all species will become extinct by the end of this century, victims of climate change, crowding out by invasive plants and animals, and reduction in numbers through selective hunting and gathering. Stuart Pimm and I have estimated that, by the middle of this century, there may be an extinction rate of 50,000 per million species each decade, a frightening number. However, while we offered that gloomy scenario in 2000, I personally am optimistic that we humans will not—cannot—let this happen. We are paying more attention to biodiversity for a variety of different reasons. Although we have discovered and described a relatively small fraction of the species that inhabit this earth with us, we do know well that we depend fully upon them for our survival. Through the process of photosynthesis, plants, algae, and some bacteria capture a small proportion of the energy from the sun that bombards our planet and convert it into chemical bonds, thus making possible life on earth. Biodiversity is the source of our food, much of our medicine, our construction materials, and many other commodities vital to life. Globally, the best way to capture the carbon dioxide being released in the atmosphere is to preserve and expand wilderness habitats, including planting new forests. People are starting to see the crucial importance of biodiversity, and understand that we are in a race against time to preserve as much of it as possible.

I am particularly pleased that New Chapter, Inc., a company whose environmental and social values I admire immensely, has chosen to create the world's first seed sanctuary for local plants used in traditional medical systems at Finca Luna Nueva, their organic farm in Costa Rica. In addition, as part of their business model, New Chapter has made a substantial commitment to rainforest conservation and habitat preservation, helping to save forest corridors that connect important protected areas. They believe, as I do, that the world would be greatly impoverished without biodiversity and wilderness habitats, and that we must continue our conservation work and remain optimistic about its chances for success, despite the global changes happening around us.

Foreword, continued

This book, and the garden it describes, appropriately named Semillas Sagradas (sacred seeds), is a most valuable resource. In this garden, the genetic diversity of important Costa Rican medicinal plants, along with species from elsewhere in the Neotropics, is displayed, studied, and preserved. For two-thirds of the world's people, billions of us, plants are the primary source of medicine; and many of the drugs we use in the industrialized world likewise came originally from plants or other living sources. Thus, the task of preserving medicinal plants and plant lore through Semillas Sagradas is an important priority; I hope the garden presented here will inspire the formation of many more such gardens protecting medicinal plant diversity and the knowledge associated with it throughout the world.

Rafael Ocampo and Michael J. Balick, the authors of this book, have dedicated their lives to the study of plants, particularly medicinal plants, and the ways in which traditional cultures employ them. They have partnered with New Chapter to develop the Semillas Sagradas garden, and publish this initial guide to a selection of the species found therein as an inspiration for others. We at the Missouri Botanical Garden have established smaller, similar gardens elsewhere in Latin America and as part of our exhibits in St. Louis, which we hope you will visit and enjoy. I greatly appreciate the contribution to understanding healing plants that the authors and editors of this book have made, and to New Chapter for its ongoing commitment to the planet and our health.

– Peter H. Raven, Ph.D.
President, Missouri Botanical Garden

Looking west from Luna Nueva to the Children's Eternal Rainforest

Steven Farrell and Tom Newmark examining tuber of Dracontium gigas

Preface

One hundred and fifty years ago, *The Origin of Species* revealed the gifts of Mother Nature working through the biological history of our planet. Darwin's masterpiece celebrated the play and display of evolution, and finally humankind could appreciate the exquisite diversity of Nature as the consequence of clever responses to the struggle for existence.

The struggle for existence has gotten a lot tougher. Scientists now understand that we are in the midst of a mass extinction – an end game for biodiversity – and that human misconduct is responsible for the frightening rate of disappearance of our sister species. Our destructive behaviors are well chronicled: aggressive agricultural practices, habitat destruction, global climate change, and pollution all hammer away at biodiversity. Modern society is collectively at fault, which leads us to ponder how we as individuals can do anything to preserve what remains of our ecosystem.

On the one hand, the problems are thousands of years in the creation, and the destructive forces seem too powerful to resist. What can one person do to make a difference? We have an idea, but it requires small steps and a love of plants. If plant species in your ecosystem are disappearing, perhaps you can create a preservation garden that will protect some of the endangered genetic treasures. By creating such a garden – a sanctuary for the seeds that support life – we can create a living seed bank for the future. That impulse led to the creation of Semillas Sagradas, the Sacred Seeds Sanctuary.

But that is just a part of the story. Traditional societies have long lived in reliance on the healing power of medicinal herbs. Throughout the world, the guardians of traditional healing have passed this knowledge from generation to generation – from grandmother to mother to daughter, from shaman to apprentice – but the knowledge is disappearing. As ethnobotanist Wade Davis has noted, every two weeks a native language is lost as the last lonely speaker of that mother tongue falls silent.

The Sacred Seeds Sanctuary is dedicated to preserving both medicinal plant species and cultural memory. Think of the garden as a living encyclopedia of ethnobotany, growing larger every day when grandmothers come and tell us how they, in their village, work with these healing botanicals.

Preface, continued

The first Sacred Seeds Sanctuary is based at Finca Luna Nueva in the volcanic rainforest of northern Costa Rica. Finca Luna Nueva was established in 1994 by Paul Schulick, the visionary founder of New Chapter, a certified organic manufacturer of vitamins and herbal supplements. He wanted to secure a source of certified organic ginger, and fortune smiled on him when he joined with Steven Farrell in finding this piece of paradise and establishing a world model of Biodynamic® farming. With the support of local artisans, farmers, Mother Nature, and some cooperative oxen and water buffalo, Finca Luna Nueva is now a center of research and education.

We are especially honored that leaders of the scientific community such as Michael Balick, Jim Duke, and Rafael Ocampo have guided us in creating the Sacred Seeds Sanctuary at Finca Luna Nueva. This sanctuary will help preserve biodiversity for our seasonal rainforest ecosystem, but the greater preservation mission requires the creation of such sanctuaries in as many diverse ecosystems as possible. We have a special love for this seasonal rainforest, but we know that some people deeply resonate with deserts, high plains, prairies, cloud forests, and tundra. Wherever your love of Nature flows, protect that biodiversity. We urge you to create a Sacred Seeds Sanctuary in your habitat – either on your own or working with community groups, religious groups, or schools. We are grateful to our friends Rafael Ocampo and Michael Balick for writing this book, as we believe it will be a "how to" manual for Sacred Seeds Sanctuaries in Central America and across the world.

We confront a biodiversity crisis, and the challenges are daunting. Start small, start with what you love and treasure, and maybe, together, we can help protect life on Earth for generations to come.

¡Pura vida!

–Steven Farrell
President, Finca Luna Nueva

–Thomas M. Newmark
CEO, New Chapter

Steven Farrell and Tom Newmark

Rafael Ocampo and Michael Balick examining seeds in Semillas Sagradas

Introduction

Since the beginning of time, humans have depended on seeds for survival. Seeds of many different plant species provided essentials such as foods, fibers, medicines, and combustible oils. At some point in time, people, most likely in many different places, noticed that seeds dropping from the plants they were using had sprouted, quickly multiplying the plant populations.

The development and spread of agriculture is thought to have begun over 10,000 years ago, when people began to intentionally collect and plant seeds of species important to them. Agricultural practices developed independently in many parts of the world—the Middle East, China, Southeast Asia, Africa, the Pacific and the Americas. Human society quickly learned how vital seeds were to feeding, fueling, and healing their rapidly evolving world. In fact, agriculture made it possible for human civilization to develop, and people to move to new regions, build settlements, feed, clothe, house, and heal growing populations, store and barter or sell their surpluses. This newfound treasure based on seeds and agriculture, allowed people to travel outside of their settlements – to begin to explore planet Earth and appreciate the magnitude of its diversity and beauty.

It was the recognition of the essentiality of crop seeds that led people to create the first seed banks—these precious propagules were originally stored in earthen pots in cool areas underground or in caves protected from the elements. Great advances in seed storage technology have been made since those early days, with large international projects now underway to protect the Earth's plant diversity–sometimes in deep freezers at -20° Celsius. At the same time as the world scientific community, using its latest technological tools, takes on the massive challenge of preserving seeds as a hedge against calamity, it is now clear that small farmers around the world are essential to seed and genetic preservation—by maintaining crop diversity through cultivation and use, and protection of nature habitats, including agricultural ecosystems. Speak to any small farmer in Costa Rica and they will share with you stories of their favorite bean or squash variety, often pointing out how some of their plants differ from their neighbors.

Steeped in this spirit and purpose was the creation of Semillas Sagradas—the Sacred Seed Santuary of Finca Luna Nueva. As Tom Newmark and Steven Farrell have pointed out in their introduction, Finca Luna Nueva, and New Chapter, are devoted to preserving the diversity of plants so important in traditional healing and the field of botanical medicine.

Introduction, continued

This volume contains information on a very small number of the more than 250 plant species currently growing in Semillas Sagradas. The senior author selected these species as representative of the range of plants he, Steven Farrell, and the staff of Finca Luna Nueva began to grow in the garden. Rafael Ocampo developed the early edition of what has become this manuscript based on decades of experience, personal research, and bibliographic research.

This book is not intended as a complete guide to Semillas Sagradas, but rather an illustration of the richness of information that exists about the many species under protection and study there. How fascinating to find that a species of plant is used for the same healing purpose in various parts of the world. One can only imagine the trial and error experimentation that led to those simultaneous discoveries—or did people disperse seeds and plants, along with knowledge of their healing properties, on their journeys? The answer, most likely, is that both scenarios occurred. We know that some plants are employed for the same medicinal uses by cultures that have never been in contact, while we have evidence of other species being dispersed to far off places by botanically and medicinally-inclined travelers and explorers.

Semillas Sagradas is a contribution to preserving and teaching traditional wisdom involving healing herbs. It honors the reverence that ancient cultures had for their seeds and plants, such as the sacred lotus, according them the highest status possible through religious symbolism, myth, and legend. As mentioned, the information presented in an earlier version of this manuscript was originally compiled by the senior author. The co-author and editors expanded that version, updated nomenclature and synonyms, added local names through conversations with the San Isidro de las Peñas Blancas community, and collected additional references on uses, chemistry, and pharmacology.

We hope that the readers of this book will find inspiration in its pages, and enjoy learning about the wisdom of nature as much as we, the authors and editors have. Perhaps some of you will find a way to create your own Semillas Sagradas, in Costa Rica or wherever you make your home, contributing both to the preservation of plant diversity and the knowledge of traditional medicines around the world.

–Rafael Ocampo, BSc.

–Michael J. Balick, Ph.D.

Black pepper

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Photos

Photos on cover:
top: *Aristolochia grandiflora*
left to right: *Dorstenia contrajerva, Asclepias curassavica, Eryngium foetidum, Quassia amara*
Photos on page 3:
left to right: *Gliricidia sepium, Malachra alceifolia, Dracontium gigas*
Photos on page 17:
left to right: *Passion flower, Turmeric, Pichichio fruit*
Photo on back cover: *Hymenocallis littoralis*
Photos courtesy of Sean Davis
Nest 5
Examining tuber of *Dracontium gigas* 10
Steven Farrell and Tom Newmark 11
Grounds at Finca Luna Nueva 16
Fresh Jaguar prints 89
Photos courtesy of Emily Hart
Cooked chaya 37
Cut at stem to show milky latex 47
Hand holding leaf 55
Jatropha curcas 58
Jatropha gossypiifolia 63
Sara Newmark working with the four chemotypes of this species in the garden 67
Psychotria ipecacuanha 78
Hand holding *Psychotria ipecacuanha* 79
Wood and bark of *Quassia amara* 82
Photos courtesy of Rachel Crandell
Howler monkey, Toucan, Green iguana, Morpho butterfly 90
Coral snake, Hummingbird 91
Photo courtesy of Melissa Castellanos
Rufous eyed stream frog 90
Photo courtesy of Dr. Robbin Moran
. *Phlebodium decumanum* 74
Other photos courtesy:
Michael J. Balick, Steven Farrell, Ruth Goldstein, Thomas M. Newmark and Rafael Ocampo

View of Arenal from Semillas Sagradas (Sacred Seeds) Sanctuary

Where We Are

The grounds at Finca Luna Nueva

Finca Luna Nueva Lodge

We warmly invite you to visit Semillas Sagradas and Finca Luna Nueva Lodge.

For information, please visit **www.fincalunanuevalodge.com** or call **011.506.2468.4006.**

Transportation and Directions

Private and public transportation are available from the airports in San Jose and Liberia, but if you wish to drive the directions are as follows:

By Car from San Jose

From San Jose head north to San Ramon via the Pan American highway. In San Ramon, exit Pan American highway (right turn), go straight until the last stop sign, and then turn left. Take an immediate right turn at traffic light. Follow road for about 3 km staying to the left. Go uphill over a speed bump. There will be a small school on right and then another speed bump. Make a left at the "Y" intersection. This is the road to Fortuna. Follow this road north for about an hour when you will arrive at a single lane suspension bridge over the Peñas Blancas river.

About two kilometers after the bridge watch for a church and cemetery on left. 150 meters past the cemetery turn left onto a rock road. Go 2.3 km west into the jungle. Keep bearing to the right when you come to intersections. When you see a large tin building go 100 m and make the right into the driveway through our beautiful gates. Continue driving into the farm to the large two story house.

If lost ask for Finca Luna Nueva or finca de Steven, or call 011.506.2468.4006. This drive should take approximately 2.25 hours.

From the Beaches in Guanacaste and Liberia Airport

If you are driving from the Liberia International airport or from any of the main beach resorts in the Guanacaste Region, we recommend driving west to Liberia, continuing on to Cañas and Tilarán, and driving the scenic road bordering the Arenal Lake. The drive from the beaches should take between 3 to 4 hours, depending on the point of departure.

From Liberia head east onto the Interamerican Highway, the road to Cañas, Puntarenas and San José. Drive past the town of Bagaces, reaching the city of Cañas. Turn north into town, departing from the Interamerican Highway. Follow signs to Tilarán in the mountains north of town. Tilarán is about 20 minutes from Cañas. When you arrive you must make a hairpin to the left at the top of the hill where a brand new gas station is on your left. If you feel uncertain, ask for the way to Arenal (lake and volcano). Within 10 minutes you will reach a fork on the road. Stay on the left, following signs to Fortuna and Arenal Volcano.

Stay on the scenic road that takes you around Lake Arenal. Drive for about 90 minutes, passing the town of Nuevo Arenal and the dam that forms the lake. At this point, you will depart from the Lake and continue east toward the volcano and the town of La Fortuna. Stay on this road for approximately 20 minutes, until you arrive in Fortuna. You will reach a point of the road where you can not continue going straight and must turn right. Follow the road to the right, crossing a bridge after one block and leaving town. Signs will say route to Chachagua, La Tigra and San Ramon.

After approximately 20 minutes you will reach Chachagua. You will know Chachagua since there is a road bump on a curve of the road. You may want to ask several people to be sure.

Passing Chachagua keep looking for a store called CocoLoco. This will be on your left hand side. Once you have passed CocoLoco, you will cross a small bridge. After this bridge you will see a rock road on your right. Leave the paved road and take the rock road to your right. Keep going for approximately 2.5 kilometers and you will see the gates of Luna on your right.

"A great resource book that presents the wisdom of the ages, the care of the indigenous users and the lasting wonders of nature's healing abilities. What this book and the Sacred Seeds Sanctuary at Luna Nueva achieve is to give a powerful reassurance to our collective health and to us all a great feeling that nature can show us many lessons and can make us value and hopefully harness its gifts.

Not so long ago many home medicinal gardens were a source of comfort to families and friends and were useful for common ailments. They are more so now especially that biodiversity has greater potential than ever for both human and environmental health."

–Panfilo Tabora, Jr., Ph.D., Professor, EARTH University in Costa Rica

The Plants of Semillas Sagradas

Aristolochia gigantea Mart. & Zucc.

Synonyms
Aristolochia clypeata Linden & André, *Aristolochia silvicola* Standl, *Howardia gigantea* (Mart. & Zucc.) Klotzsch

Family
Aristolochiaceae

Common Names
jockokicha (**Bribri Indians, Costa Rica**), tirrokicha (**Cabecar Indians, Costa Rica**), oreja de elefante, bejuco de estrella, canastilla (**Costa Rica**).

Description
Liana, leaves dark green and glabrous, 10–15 cm broad, 12–16 cm long. Flowers cauliflorous, purple and yellow-orange. Fruits large, glaucous, 8 cm long, 2.5–3.0 cm wide. Seeds numerous, flat, 5 mm wide, 7 mm long, very thin and papery.

History and Traditional Use
The genus *Aristolochia* is one of the plants of greatest cultural significance to indigenous groups in the Americas in that its traditional use is linked to the concept known as the Doctrine of Signatures, based on the theory that "like cures like". In this case, as the shape of the leaf resembles a snake's head it is considered useful by Bribri Indians in treating snakebites. In referring to the Doctrine of Signatures, González Torres (1980) notes that, "Since the time of the Conquest it is considered as an antidote for the bites of snakes and spiders, and for scorpion stings".

These traditional medical uses for Aristolochia have spread throughout Central America. For example, the largest indigenous groups in **Costa Rica**, the Bribri and Cabecar, use tirrokicha (*Aristolochia gigantea*) to treat snakebites (Ocampo 1984), while in **Honduras** the root of the guaco (*Aristolochia anguicida* Jack.) is boiled and the liquid consumed for snakebites, diarrhea, and stomachache (House et al. 1995). Duke (1968) reports on the use of the root of flor de culebra (*Aristolochia arborescens* L.) as a snakebite remedy in **Panama**; in **Belize** *Aristolochia trilobata* L., commonly known as contribo, is widely used for gastritis, amoebas, colitis, and high blood pressure, as well as for other conditions (Arvigo and Balick 1998); and in **Honduras** it is used for colic. Morton (1981) notes that the root of *Aristolochia grandiflora* Swartz is used throughout **Central America** in treating snakebites and scorpion stings.

Pharmacology and Biological Activity
A study by Otero et al. (2000) shows that *Aristolochia gigantea* is able to moderately neutralize the hemorrhagic effects of the venom from the fer-de-lance snake (*Bothrops atrox*). All parts of Aristolochia gigantea are poisonous, and the Spanish agency controlling medicines (Agencia Española de Medicamentos y Productos Sanitarios 2001) has been sending out warnings relating to the genus *Aristolochia* since the early 1990s, based on episodes – in many cases irreversible – of renal alterations. These include the development of urothelial carcinomas and fibrosing interstitial nephritis in people who used preparations containing extracts of Aristolochia. In some cases, such as a formula prescribed for weight loss, the products contained mixtures of other plants. The agency showed that consuming more than 200 g of plant matter increases the risk of urothelial carcinoma (Agencia Española de Medicamentos y Productos Sanitarios 2001). Aristolochic acid is a known tumor promotor and has been linked to cases of renal carcinoma in humans as well as kidney, bladder, stomach, and lung cancer in rodents. Furthermore, in

rabbits, pharmacokinetics and nephrotoxicity studies of aristolochic acid demonstrated that escalating doses (0.5, 1.0, and 2.0 mg/kg) caused renal lesions (Chen et al. 2007). For this reason, the sale, supply, and import of all species or the galenical derivatives of the genus *Aristolochia* is prohibited in Spain, and the United States Food and Drug Administration has also released numerous advisories concerning this genus.

Toxicity

Despite the wide range of traditional medicinal uses of many *Aristolochia* species in the tropics, there are restrictions on its sale in Europe and the United States based on evidence of its toxicity due to the presence of aristolochic acid (Barnes, Anderson, and Phillipson 2002; Heinrich et al. 2004). A recent study by Zhou et al. (2007) showing that toxic metabolites are generated by cytochrome P450s liver proteins during drug-herb interactions – such as with aristolochic acids – helps explain the toxicity of the increased use of *Aristolochia* species.

Conservation Status and Trade

In the American tropics the genus *Aristolochia* is mainly used in traditional medicine and information on its trade is scarce. Morton (1981) refers to sales of the Santa Maria liana (*Aristolochia adoratissima* L.) in Venezuelan markets; and Degen, Basualdo, and Soria (2004) refer to the commercialization of A. triangularis in Paraguay.

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Arrabidaea chica (Humb. & Bonpl.) B. Verl.

Synonyms
Adenocalymma portoricensis A. Stahl., *Arrabidaea acutifolia* A. DC., *Arrabidaea cuprea* (Cham.) Bornm., *Arrabidaea larensis* Pittier, *Arrabidaea rosea* DC., *Bignonia chica* Humb. & Bonpl., *Bignonia cuprea* Cham., *Bignonia erubescens* S. Moore, *Bignonia triphylla* Willd. Ex DC., *Lundia chica* (Humb. & Bonpl.) Seem., *Temnocydia carajura* Mart. ex DC., *Vasconcellia acutifolia* C. Mart. ex DC.

Family
Bignoniaceae

Common Names
stka, dkokli (**Bribri Indians, Costa Rica**), fierrillo, bejuco fierro, parrua colorada (**Costa Rica**); witts (**Nicaragua**); chica, digó, chisná, bejuco nimi, magueb (**Panama**); carajirú, carajurú, cipó cruz (**Brazil**); chica, piranga, bija, caballito, curi, cudio (**Colombia**); nea–curi, ma-kuri, koo-ri, taii (**Ecuador**); puca panga, barqui, yonina (**Peru**); barqui (**Venezuela**).

Description
Liana, growing to 20 m tall, 6 cm in diameter, stems round, with pale grey bark. The nodes are slightly flattened and broad with strong tendrils. Leaves are bi- or trifoliate; leaflets oval or elliptical, 7–9 cm long and 3–5 cm wide, acuminate, rounded to obtuse at the base, smooth and shiny. The inflorescence is a terminal or axillary panicle. In its wild form this liana grows on forest trees, recognizable by the whitish color of its stem and its pink aromatic flowers.

History and Traditional Use
The liana *Arrabidaea chica*, commonly known in Costa Rica as fierrillo, is native to the American tropics, and found in tropical and sub-tropical climate zones. As a liana it requires the support of large tree trunks to reach upper canopies in search of light in order to flower and produce seeds (Groome 1998).

The production of utensils in native communities is of vital importance and people living in tropical forests use the fierrillo liana in basket making, choosing high quality lianas with a diameter greater than 5 cm for their crafts (Palma and Chaves 2000). The leaves of fierrillo have natural dyes and are widely used among indigenous tribes of the Americas, and it is only in the American tropics that the leaves are cooked in water to extract red colorant for dying natural fibers. This dye has been used since time immemorial, although it was in the 1990s that artefacts of American origin in Spain's Museo de Madrid were found to contain the red colorant from fierrillo. The fact that this plant is protected by American indigenous peoples when forests are cut down and when slash-and-burn techniques are used to prepare for crop cultivation is an indication of fierrillo's importance. It is also used for medicinal purposes, especially in South America.

In **Costa Rica**, Ocampo and Valverde (1987) note its leaves are used for their emollient, astringent and disinfectant properties, and are highly effective against dermatoses. The transfrontier Guaymi indigenous populations in the south of Costa Rica and northern **Panama** use a decoction of pieces of liana to treat menstrual problems (Estrella 1994). In **Honduras** the sap is used as an eye wash in the treatment of infections (Lentz 1993), while in **Nicaragua** Coe and Anderson (1996) refer to the use of an aqueous decoction for diarrhea and anemia, and as a tonic.

In **Peru** the leaves are used to control skin infections, for herpes, anemia, as an anti-inflammatory and for problems of the blood. (Duke and Vasquez 1994; Brack 1999) In the Manaus and Belém regions of the **Brazilian** Amazonia, the fresh leaves are sold in herb markets as an anti-inflammatory, and also in Belém as a tonic and an anti-inflammatory in capsule form; Gentry (1992) mentions the dried leaves being used for rheumatism and as a tonic. Brazil's phytotherapy industry is also using the leaves for the development of natural products with anti-inflammatory properties.

Pharmacology and Biological Activity

Studies carried out suggest that various 3–deoxyanthocyanidins present in the leaves of *Arrabidaea chica*, as well as other constituents such as the red pigments carajurin and carajurone, could contribute to the plant's anti-inflammatory activity. This involves the inhibitory effect of anthocyanidins on DNA binding of NF–ϰB (a transcription factor that is a central mediator of the human immune response and regulates the transcription of genes encoding various inflammatory cytokines, chemokines, adhesion molecules and inflammatory enzymes such as iNOS, COX–2, 5–LOX and cytosolic phospholipase A2). However, other unknown compounds in the leaf of A. chica should also inhibit NF–ϰB (Devia et al. 2002; Zorn et al. 2001).

Toxicity

When tested in a brine shrimp assay, this species did not appear to be particularly toxic (Quignard et al. 2003).

Conservation Status and Trade

There are no written references to the conservation status of *A. chica*, although information does exist on raw material being extracted in South America to supply the international market. The disappearance of tropical rainforest is threatening its status, and attempts at its domestication are known only in Costa Rica. An illegal trade in its leaves exists but is not reflected in statistics of the countries in which wild harvesting takes place (Ocampo, Martínez, and Cáceres 2007).

In Brazil bundles of fresh branches are known to be sold in the Ver-o-Peso market in Belém in the state of Pará, and capsules are sold in Manaus, Amazonas state. A phytotherapeutic product, in the form of a gel with anti-inflammatory properties, has also become available (Paes et al. 2005).

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Asclepias curassavica L.

Synonyms
Asclepias aurantiaca Salisb., *Asclepias bicolor* Moench, *Asclepias cubensis* Wenderoth, *Asclepias curassavica* var. *concolor* Krug & Urb., *Asclepias margaritacea* Hoffmannsegg ex Schult. In Roem. & Schult., *Asclepias nivea* var. *curassavica* (L.) Kuntze

Family
Asclepiadaceae

Common Names
viborana (**Costa Rica**); chilillo venenoso, chililllo, quiebramuelas, venenillo, pinatawuan (totonaco) (**Mexico**); viborana, cantil, cochinita, hierba de culebra, seda (**Guatemala**); viborán, señorita (**Honduras**); vivorana, vivorán, señorita, burladora, revienta, venenillo (**Nicaragua**); flor de la calentura (**Cuba**); oficial-de-sala (**Brazil**); red milkweed (**English**).

Description
Herbaceous annual reaching a height of 1 m with sticky white latex in its stems. Leaves opposite, entire, and without stipules; leaf blade lanceolate or oblong-lanceolate and glabrous, 5–15 cm long, 1–3 cm broad. Small flowers, less than 1.3 cm long occur in groups of 7–10; calyx with marked segments, bright corona with five oblong petals, purple-red oval-oblong lobes and erect, fructiferous pedicels. Seeds flattened and ovate, surrounded by 2.5 cm of silky coating, in a 7.5–10 cm long erect pod.

History and Traditional Use
This herbaceous plant is widely distributed throughout the Americas and has many traditional uses. In **Mexico** the latex from the plant is used to treat "evil eye" (mal de ojo) and other culture-bound syndromes (Martinez et al. 2001). It is also a wild herb with ornamental qualities due to its red flowers with a yellow corona that attracts butterflies. The seeds are covered in a silky mass when fruit capsules open.

In **Costa Rica** Nuñez (1975) and Pittier (1978) refer to the secretion that exudes from the stem and the leaves being used for toothache and note that it causes bad teeth to disintegrate. It is also known to kill worms and eliminate warts. Used internally it is said to serve as an emetic, a diaphoretic, and emeto–cathartic and as a depurative. In **Nicaragua**, reference is made to its use in treating a series of illnesses, including constipation, body aches, sinusitis, earache, parasitic worms, snakebites, rheumatism, headache, as a laxative, to heal wounds, for intestinal infections, to treat fever, gonorrhea, syphilis, asthma, nervous conditions, and hemorrhaging. The leaves, the root, the stem and the latex are used both internally and externally (Floripe 2000). House et al. (1995) refer to the plant's use in **Honduras** where the roots and leaves are boiled for constipation, aching body, sinusitis, earache, parasitic worms, snakebites, rheumatism, and headache.

In **Guatemala** the infusion or extract of the plant is taken orally in the treatment of headaches, constipation, fever, intestinal infections, gonorrhea, leucorrhea, parasites, and cancer. A decoction of the root and the stalk is also used in the treatment of asthma and venereal diseases, while the juice of the leaves is used for dysentery, gonorrhea, bleeding and parasites. The powdered root is used in the treatment of chronic ulcers; the latex is used to treat malaria, and the stem for asthma and nerves. Powdered dry leaves or the juice of fresh leaves are used on warts, calluses, in the treatment of poisonous bites, wounds, cancers, and skin diseases. The whole plant, in powder or balsamic form or as an enema, is used to treat abdominal tumors; the flowers are used as a poultice for headaches, and the vapor from leaves is inhaled for the treatment of sinusitis. The root is said to have pain relieving, astringent, emetic, and fever-reducing properties, and is also used to reduce bleeding,

as a laxative, a tonic, and against parasites; and the latex is also an anti-parasitic (anthelmintic) (Cáceres 1996).

According to Roig (1974) the root is used to provoke vomiting and as a laxative in **Cuba**, while in **Colombia** García-Barriga (1975) notes that the dried root in powder form is used to induce vomiting and for skin diseases of venereal origin; the extract of leaves and flowers also causes vomiting, while the latex is also used as an anthelmintic. In Peru, reference is made to the concoction of the leaves causing vomiting, to the milky sap being applied externally to cure abscesses, and the latex being used for the elimination of internal parasitic worms (Brack 1999).

In **Mexico**, the plant has a wide range of uses among the populations of the Sierra Norte de Puebla, as well as in Xcotepec and Jalapan where it is rubbed on wounds made by worms. It is also used on newborn infants when spots appear on the head, by washing the affected area with a decoction of the boiled plant. In Cuetzalán, the latex is used to break up molars with cavities by putting a drop directly on the tooth; and in Pantepec it is used to treat hemorrhoids. A medium-sized branch is cut, wrapped in a cloth or a handkerchief and men put in their back trouser pocket while women place it under their skirt at hip level. In Tuzamapan it is used as a disinfectant for spots, the latex being prepared with washed fat as a cream for local application. For some forms of dermatitis an infusion is prepared with two plants in a liter of water and the affected area washed until an improvement is noted. In Pahuatlán an infusion is prepared and taken orally for skin spots and snakebites (Martínez et al. 2001).

Pharmacology and Biological Activity

In vitro studies show that the latex has antifungal activity against *Candida albicans* (Giordani, Moulin-Traffort, and Regli 1991). According to Verpoorte and Dihal (1987) the ethanolic extract is active against the bacteria *Bacillus subtilis*, while the ethanolic extract of the dried fruit is active against *Staphylococcus aureus* (George and Pandalaf 1949); and Cáceres (1991) reports on a decoction of the leaves having a moderate effect against *Microsporum canis*. Cytotoxicity studies *in vitro* show that the aerial parts and root extracts contain cardenolides and related compounds that inhibit four cancer cell lines (human lung carcinoma A549, human breast carcinomas MCF–7 and MDA–MB–231, and hepatoma HepG2) (Roy et al. 2005). Martínez (1992) reports on the syrup of the juice being effective against parasitic worms.

Toxicity

The family Asclepiadaceae contains toxic alkaloids known as cardenolides. The consumption of fresh flowers of *A. curassavica* causes vomiting (Morton 1981). This species has been used to poison fish, and Grainge and Ahmed (1988) refer to its use in the control of insects, and various reports refer to this species' toxicity (Barnes, Anderson, and Phillipson 2002). In Brazil it is noted that its ingestion causes abdominal pain, nausea and vomiting, an alteration of the heartbeat, and can cause serious irritation of the eyes and edema of the cornea (Simões et al. 2000).

Conservation Status and Trade

This is a weedy plant that grows on abandoned agricultural land, grasslands, along the edges of roads, and in the wild. It is considered to be highly adaptable due to its presence in disturbed areas, and is therefore not considered to be under threat in its natural environment. Morton (1981) noted its sale in herb markets in Central America, without specifying volumes or prices. No references have been found on its conservation status.

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Bauhinia guianensis
Aublet

Synonyms
Bauhinia chrysophylla Vogel, *Bauhinia excisa* (Griseb.) Hemsl., *Bauhinia guianensis* var. *splendens* (Kunth) Amshoff, *Bauhinia manca* Standl., *Bauhinia obovata* S.F. Blake, *Bauhinia outimouta* Aubl., *Bauhinia platycalyx* Benth., *Bauhinia sericella* Standl., *Bauhinia splendens* Kunth, *Bauhinia splendens* var. *latifolia* Benth., *Bauhinia sprucei* var. *acuminata* Benth., *Bauhinia thompsonii* I.M. Johnst., *Schnella bicomata* Pittier, *Schnella excisa* Griseb., *Schnella obovata* (S.F. Blake) Britton & Rose, *Schnella splendens* (Kunth) Benth.

Family
Fabaceae

Common Names
sibökaparumo (**Bribri Indians, Costa Rica**), dumowa (**Cabecar Indians, Costa Rica**), escalera de mono (**Costa Rica**); escalera de mono, escalera de mico (**Honduras**); escalera de mico (**Nicaragua**); escalera de motelo, mororó-cipó, escada de jabuti, cipó-escada (**Brazil**); manan shahuen tapite (**Shipibo-Conibo Indians, Peru**), escalera de motelo, escalera de mono (**Peru**); monkey ladder (**English**).

Description
A climbing liana that often resembles a ladder, reaching 30–40 m in length but highly variable in size, with characteristically broad (up to 15 cm) flattened and undulating stems, with cavities at regular intervals and spines. Large bilobate, heart-shaped leaves reach 12 cm in length and 10 cm in width, although leaf size on the same liana can vary considerably. Flowers five-petalled, white, perfumed, growing in groups. Fruit is a brown pod, up to 8 cm long.

History and Traditional Use
The monkey ladder is a woody liana that clings to the trunks of supporting trees allowing it to reach the upper forest canopy. It is well known to indigenous groups inhabiting tropical forests for its form, use and beauty. Its common name, monkey ladder, refers to its use by monkeys as a ladder so that they too can reach the highest canopies. It is precisely in the forest canopy that the plant develops its leaves, flowers and pod-shaped fruits. The Bribri Indians in Talamanca, **Costa Rica** have a beautiful legend that refers to this strange double, wavy climbing plant as the belt of their god Sibö (Ginzbarg 1977; Hazlett 1986; García 1994; Ocampo and Villalobos 1997).

It addition to its biological usefulness, the genus *Bauhinia* plays an important role in traditional medicine among inhabitants of tropical forests and particularly their indigenous communities, being mainly used to treat kidney diseases. The genus is widely used in the tropics, and Arvigo and Balick (1998) refer to *B. herrerae* (Britt. & Rose) Standl. & Steyerm. being used as an astringent and in the treatment of diarrhea in **Belize**; while, according to Brack (1999), in **Peru** an infusion of the bark of *B. glabra* Jaquin is used for pulmonary problems, and the cooked stem is used to treat kidney problems. In **Trinidad**, the concoction of boiled stalk and root of *B. excisa* Hemsl. is taken as a treatment for venereal and urinary diseases (Morton 1981). In **Costa Rica** it is used to combat weakness and kidney infections (Nuñez 1975) while Querol (1996) mentions its use in **Nicaragua** to treat anemia, kidney infections and menstrual problems, the stem being used together with zarzaparrilla (*Smilax* spp.) and cuculmeca (*Smilax* spp.). In **Honduras** House et al. (1995) note that the grated stem is cooked in water and applied to the body as a bath for stomachache, diarrhea, arthritis, and rheumatism. In **Brazil** the stem bark is used to treat renal troubles, respiratory syndrome (asthma), and diarrhea, and an infusion of the root is used to treat amoebas (Viana et al. 1999; Carvalho 2004). The vine's sinuous form also makes it attractive for use in Christmas decorations.

Pharmacology and Biological Activity

Raw extracts of the stem bark in dichloromethane and ethyl acetate were assayed to evaluate anti-inflammatory activity, using an edema from the leg of a mouse for the trial. The 100 mg/kg dose of methyl extract considerably reduced the carrageenin-induced edema when this was compared with the control group (Carvalho 2004). The ethanolic stem bark (50 mg/kg) showed excellent in vivo antimalarial activity (84%) in mice against the *Plasmodium vinckei* strain (Muñoz et al. 2000).

Toxicity

No information was found relating to the toxicity of this species.

Conservation Status and Trade

Stem pieces of *Bauhinia guianensis* can to be found in some local markets selling medicinal plants in Honduras and Costa Rica, but there are few studies on the conservation status of the species in the Americas. Díaz (2000) inventoried a one-hectare area of forest in Costa Rica containing this species to determine ecological parameters and its conservation status. Preliminary results show a scarce adult population, although no density parameters exist for the species that would allow its conservation status to be determined and comparisons made to other tropical forests. The two most serious threats current from human populations today include trade for use as Christmas decorations, and species loss due to deforestation. Secondary forests are also of importance to the species as regeneration is promoted by increased sunlight. In Brazil *B. forficata* Link., a species in this genus that has a tree structure, is included among the 221 medicinal plants of importance for conservation and management (EMBRAPA 2002).

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Borojoa patinoi Cuatrec.

Family
Rubiaceae

Common Names
borojó pichí (**Embera-Katio Indians, Colombia**), borojó (**Colombia**).

Description
A shrub/tree growing to 7–25 m in height, branching from the base; branchlets smooth and glabrous. Bark with nodes spaced to 6 cm apart, the pedicel scars are usually prominent. Leaves, terminal, opposite, elliptic-lanceolate, tough, smooth, with prominent veins on the underside, 36 cm long, up to 17 cm wide. Male and female flowers with creamy-white corolla; pale green calyx; numerous terminal male flowers, with bracts subtending a solitary female flower. Edible, apple-like fruits take more than one year to ripen and are sessile, rotund, 7–8 cm in diameter. Seeds subovoid, 6–7 mm long, and 7–12 mm wide, embedded in a pulp.

History and Traditional Use
Hernández and León (1992) refer to phytogenetic resources of the New World and probable areas of expansion at the time of its discovery, and among many others, two species of *Borojoa* are noted: *Borojoa patinoi*, known to the Embera-Katío population of **Colombia** as borojó pichí, and *B. sorbilis*, known as puruí grande, originating in Brazil. According to these authors, borojó has been known since ancient times.

Borojoa is a genus of approximately ten species (Burger and Taylor 1993). Its ethnopharmacological origins lie with the native populations of the tropical rainforest in **Colombia's** Pacific Chocó Department, and as a result of which this small tree is a medicinal plant of considerable importance in the region. In 1950 Dr. Victor Manuel Patiño published the discovery of the species after finding it in Chocó and took it to Dr. José Cuatrecasas, a taxonomic botanist at the University of Colombia, who named it *Borojoa patinoi* after Dr. Patiño. However, Cuatrecasas discovered that not only was it a new species but also a new genus.

The pulp of this species is of a chocolate color, acid and dense (30° Brix, consisting mainly of fructose and glucose, and with a high protein content). The indigenous populations of the Darien Province in **Panama** use borojó as a food and a medicine. Being a natural source of energy it helps them walk long distances through forests and up mountains without food and in high temperatures, pushing their limits of endurance. Indigenous groups usually leave the ripe fruits in a pot of water, the resulting juice providing them with an excellent source of energy. The energy provided by borojó is unlike that of caffeine in coffee or that found in the Brazilian liana guaraná. The fruit neither has any known side effects nor causes dependency and contains high levels of protein and certain minerals (García-Barriga 1975).

Duke (1981) refers to the fruit's use in making *chicha* (fermented juice) in **Panama**, while in **Colombia** García-Barriga (1975) notes its use as an aphrodisiac and as a cure for kidney diseases, as well as the fruit being used in embalming bodies.

Pharmacology and Biological Activity

No pharmacological research on this species has been identified, although research has been carried out on the related species, *Borojoa sorbilis* Cuatrec. which, according to Cernasov et al. (1997), demonstrates very good *in vitro* antierythemal (against abnormal redness of the skin due to local congestion) and anti-inflammatory properties.

Toxicity

No information on the toxicity of this species has been identified.

Conservation Status and Trade

No references to its conservation status exist. However, studies of the genetic variation of wild material are a prerequisite and a priority in determining its conservation status. The fruit is sold in large quantities in markets in Cali, Colombia.

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Bursera simaruba (L.) Sarg.

Synonyms
Bursera bonairensis Boldingh, *Bursera gummifera* L., *Bursera gummifera* var. *pubescens* Engl., *Bursera integerrima* (Tul.) Triana & Planch., *Bursera ovalifolia* (Schltdl.) Engl., *Bursera subpubescens* (Rose) Engl., *Burseria gummifera* (L.) L., *Elaphrium ovalifolium* Schltdl., *Elaphrium simaruba* (L.) Rose, *Elaphrium subpubescens* Rose, *Pistacia simaruba* L., *Tapirira macrophylla* Lundell

Family
Burseraceae

Common Names
kal no (**Bribri Indians, Costa Rica**), indio desnudo, jiñocuabe, indio pelado (**Costa Rica**); chaca, tusum, chacal (**Nahua, Mexico**); gumbolimbo (**Belize**); palo jiote, jiote, chino, chinacahuiti (**Guatemala**); jiote, jinicuabo (**Honduras**); jiote (**El Salvador**); jinocuabo, indio desnudo (**Nicaragua**); almácigo colorado (**Cuba**); carate, caratero, almácigo, indio desnudo, cholo pelao (**Panama**); indio desnudo, palo mulato, indio en cuero, almácigo, caratero (**Colombia**); indio desnudo (**Venezuela**); birch bark (**English**).

Description
Deciduous tree growing to 20 m tall and 1 m in diameter with a golden resinous sap. Smooth, shiny reddish-brown bark that flakes off in thin sheets to reveal a greenish photosynthetic trunk. Leaves pinnately compound, alternate, glabrous or sometimes pubescent, each with 5–13 leaflets, ovate-lanceolate and firm in texture, up to 14 cm long. Inflorescence axillary. Flowers with 4 or 5 petals, greenish-yellow and 2–5 cm long. Fruit oblong, triangular, 5–10 mm long, a drupe often split into three valves; white woody seeds surrounded by fleshy pulp.

History and Traditional Use
This is a tree from tropical America, known for its brown bark that turns red upon maturity, and peels off in papery flakes (Stevens 1983). Fernández de Oviedo reported on its use in pre-Columbian times, and Pichardo (1973 quoted by Gupta 1995) cites the reference in Christopher Columbus' diary to the *almácigo*, a common name given to trees of the family Burseraceae: "It is said that an Indian indicated through sign language that the *almácigo* was good when one had stomachache." It is possible that this reference to almácigo was made to *Bursera simarouba* or else it was confused with one of two other species – *Pistacia lentiscus* or *Pistacia atlantica* – of the same family used medicinally in Spain (Gupta 1995). Almácigo (*Bursera simaruba*) and other useful species were frequently carried, mainly to Andalucian Spanish ports, by Christopher Columbus on his first and subsequent trans-Atlantic voyages. Details of the arrival of many of these plants will probably never be known due to the excessive jealousy of the Spanish Crown and the control of ships' cargoes (Hernández and León 1992).

The resin of *B. simaruba* is used as incense in religious rites. The inner bark also exudes a transparent resin known as archipin gum used in gluing glass and porcelain objects (Orellana 1997). Recent interest focuses on research carried out in space on the plant's potential for the control of Chagas' disease. This has involved the participation of NASA researchers and Franklin Chang-Díaz, the retired Costa Rican-born astronaut, and support from Costa Rica's EARTH University.

Regarding the plant's use in **Costa Rica,** several vertical strips are cut from the bark and boiled in water to release the resin which is used to reduce inflammation by bathing the affected area. Indigenous populations use the bark to treat snakebites, to treat internal infections, to purify the blood, to stop bleeding, for weight loss, and diarrhea. An infusion is drunk to treat *papalomoyo*, the common name for the disfiguring parasitic disease leishmaniasis. It is also a diuretic, is effective for kidney problems, and also reduces fever and serves as an expectorant and, in high doses, as a laxative. The resin from the bark is also known to cure ulcers, venereal diseases, and mechanically extract splinters (Ginzbarg 1977; Hazlett 1983; Palmer, Sánchez, and Mayorga 1992; Ocampo, Villalobos, and Cifuentes 1997; Segleau 2001).

Grijalva (1992) refers to use of the boiled bark together with honey from the wild jicote honeybee of the *Trigona* and *Melipona* sp. to fortify the blood of postpartum women in **Nicaragua**; while House et al. (1995) refer to use of the bark in **Honduras** for anemia and malaria. In **El Salvador** De

Mena (1994) reports that the leaves, resin, and the bark are used to treat diarrhea, headache, heal wounds and sores, and relieve flatulence. For wounds, the resin is placed directly on the area affected, while the bark is boiled in water and consumed to treat diarrhea. In **Guatemala** the bark is used for stomach cramps, skin lesions, kidney pains, and urinary problems (Orellana 1997). In the Darien Province of **Panama**, Duke (1985) cites a tea made from the leaves being used to treat venereal diseases and obesity.

In **Colombia** the resin obtained from the trunk after soaking in hot water is used to extract splinters and treat snakebites. The leaves are used as a poultice and placed on the skin to avoid gangrene or prevent it spreading. A concoction of the branches is used in Colombia's Tolima Department for slimming and "keeping in shape". A daily dose of one or two cups of the extract is said to be a good remedy for the liver and the thyroid (García-Barriga 1975). In **Venezuela** the leaves are used as a poultice to treat ulcers, while an infusion of the flowers is used to treat diarrhea, and of the bark and the wood to calm fevers (Serra 2000). In Puebla, **Mexico** this species is used to treat fevers, measles, kidney pains, headaches, and as a laxative. In the case of kidney pains, an infusion is made with 20 g of bark in one liter of water and is repeatedly taken orally. In Cuetzalán, the crushed leaves are applied as a poultice to the soles of the feet to reduce fever (Martinez et al. 2001).

Pharmacology and Biological Activity

The ethanolic (95%) extract of the aerial parts show *in vitro* stimulant activity in smooth muscle (rabbit duodenum) as well as spasmolitic and vasodilatory activities. The ethanolic (95%) extract of the stems has a fungicidal effect against *Neurospora crassa*, and a similar extract of the dried bark shows molluscicidal activity in concentrations of 50 ppm; the aqueous extract of the aerial parts also shows a spasmolitic effect. The leaves and stalks have a relaxant effect on smooth muscle, and show spasmolitic and vasodilatory activity. A triterpene present in the tree has shown some anti-tumor activity in Walker Carcinoma 256 in rats. The aqueous extract shows acute toxicity in rats (minimum toxic dosis of 0.5 ml/animal). (Gupta 1995) Other studies show that the bark extract induces moderate diuretic activity in rats compared with the reference drug (hydrochlorothiazide). The infusion (750 mg/kg and 1,000 mg/kg) does not show anti-inflammatory activity in rats compared with the control (phenylbutazone); however, the hydroalcoholic extract of the leaves shows spasmolytic activity in guinea pigs, vasodilatory activity in rats, and is a smooth muscle stimulant in mice (Cáceres 1996).

Toxicity

The ethanolic and aqueous extracts of the bark and leaves (500 mg/kg) are toxic to fish of the genus *Mollinesia* (Planter quoted by Cáceres 1996). Cytotoxic activity has been reported in dried fruits in concentrations of 3.75 μg/ml (Gupta 1995). The chloroform extracts of resin show strong cytotoxic activity in *Artemia salina* (CL50: 33 μg/ml) (Cáceres 1996). Developmental toxicity, namely sperm agglutinating activity on human and boar sperm, is observed using the aqueous extracts of the stems and leaves of two related species, *Bursera fagaroides* (H.B. & K.) Engl. and *Bursera schlechtendalii* (Engl.). Activity is more potent in the stem extract, and the study indicates that proteins present in the extracts are responsible for the aggregation of the sperm heads (Serrano and García-Suarez 2001).

Conservation Status and Trade

This species, abundant in the American tropics, is a tree typical of dry forest, with wide adaptability to different climates and water régimes, growing taller in humid conditions (Stevens 1991). It is widely used in the countryside, and is employed to make local fencing as, when a fencepost from this species is put into the ground it quickly forms roots and grows as a tree. The bark is found in markets selling medicinal herbs in Costa Rica and Nicaragua. There is no indication it is endangered, except due to local burning and clearing of land for agriculture, which destroys local populations of this species along with others.

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Cecropia obtusifolia
Bertol

Synonyms
Ambaiba costaricensis Kuntze, *Ambaiba hemsleyana* Kuntze, *Ambaiba mexicana* (Hemsl.) Kuntze, *Cecropia alvarezii* Cuatrec., *Cecropia amphichlora* Standl. & L.O. Williams, *Cecropia burriada* Cuatrec., *Cecropia commutata* Schott ex Miq., *Cecropia dabeibana* Cuatrec., *Cecropia levyana* V.A. Richt., *Cecropia maxonii* Pittier, *Cecropia mexicana* Hemsl., *Cecropia mexicana* var. *macrostachya* Donn. Sm., *Cecropia obtusifolia* subsp. *burriada* (cuatrec.) C.C. Berg & P. Franco, *Cecropia panamensis* Hemsl., *Cecropia radlkoferiana* A.G. Richt.

Family
Cecropiaceae

Common Names
guarumo (**Costa Rica**); azcatcuahuit (**Nahua Indians, Mexico**), guarumo morado, hormigo, palo de hormigas (**Mexico**); trumpet tree (**Belize**); guarumo o guarumbo (**Guatemala**); guarumo, chancarro (**El Salvador**); guarumo negro (**Honduras, Nicaragua**); cetico (**Peru**).

Description
This rapidly growing tree can reach up to 25 m. The trunk is hollow between the nodes, and has prop roots, and the open crown of the tree has only a few branches which often host biting ants. Leaves have long petioles, are deeply palmate, with 10–13 pelate lobes; numerous secondary nerves with a rough surface are on the upper side. Tiny flowers are massed together in clusters, the male flower from 12–15 cm long, the female ones, in groups of 2–6, to 40 cm long. Small, elongated fruits contain small seeds packed densely in fingerlike clusters.

History and Traditional Use
In America, the genus *Cecropia* has been recognized since ancient times for its presence in disturbed areas, and is typical of regenerating forest, or in gap openings in primary forest. Native communites throughout its range use it for medicinal purposes, as food, as firewood, for domestic implements, and for construction. It can also be pulped for paper, as in the case of cetico (*C. membranaceae* Trecul) in Peru. The traditional name in Nahua, azcatcuahuit – meaning *palo de hormigas* or stick of ants – is typical among the Cecropia species in tropical forests. By providing a home in its hollow stems for ants of the genus Azteca – easily recognizable by their characteristic smell – these species are of considerable biological importance. The trees provide a habitat for various species of mealybugs that provide the ants with sugars, vitamins and amino acids, and the ripe fruits are eaten for their fig-like taste and are particularly favored as a food for birds such as toucans. Leaves with added salt are used as forage for cattle.

An infusion of its leaves is taken in **Costa Rica**, and an infusion made from one leaf in a liter of water is also used to cleanse the uterus. The leaves of guarumo and pineapple are boiled in water and consumed to help with weight loss. This plant is also used for treating high blood pressure, diabetes, and as a sedative, and is recommended for the prostate. A small leaf in an infusion can be taken for kidney infections. It has been used to treat pneumonia, internal infections, and as a gargle for sore throat. The leaves are boiled and inflammations are bathed with the infusion, or applied to the head in the case of fever (Nuñez 1975; Segleau 2001).

In **El Salvador** the leaves are boiled and used to calm nerves and treat stomachache, arthritis, rheumatism, and for the kidneys, as well as for coughs and as an expectorant (De Mena 1994). Other *Cecropia* species have medicinal and other uses. In some parts of **Nicaragua** the leaves of the guarumo rojo (*Cecropia peltata* L.) are used to wrap cheese, while in other parts they are used to make

an extract to treat asthma, rheumatism and skin diseases (Grijalva 1992). In **Belize** where *C. peltata* is commonly known as the trumpet tree, an infusion of the leaves is used for high blood pressure, diabetes, and as a diuretic (Arvigo and Balick 1998). Cáceres (1996) mentions the use of both *C. obtusifolia* and *C. peltata* in **Guatemala** where the two species are referred to by the common name of guarumo, despite scientific studies having established differences between them. A syrup, with the name cecropina, is prepared from the leaves of *C. peltata* and is an extremely effective remedy for asthma of bronchial as well as cardiac origin (Correa and Bernal 1995).

According to Martínez et al. (2001) it is used in Puebla, **Mexico** to treat diabetes. An infusion is prepared with four leaves or a 10–20 cm length of bark, and it is taken throughout the day. A similar practice, using only the bark, is common in the treatment of high blood pressure. Morton (1981) also reports that one leaf boiled in a liter of water is used to treat obesity, diabetes and asthma in Mexico. In **Guatemala** Orellana (1997) refers to the use of the leaf and the bark for asthma, "heart pain", diabetes, and to ease the flow of urine.

Pharmacology and Biological Activity

The aqueous and ethanolic extracts of *Cecropia obtusifolia* are active against the bacteria *Escherichia coli* and *Staphylococcus aureus*; a tincture of the leaves is active against *Streptococcus pneumoniae* but not against *Streptococcus pyogenes* (Cáceres et al. 1991). According to Jiu (1996), the alcoholic leaf and petiole extract of *C. obtusifolia* shows anti-atherogenic activity (against the formation of atheromatous deposits, especially on arterial walls) and depression of the central nervous system, but does not demonstrate appetite inhibiting, diuretic, hypotensory or anti-inflammatory activities. The aqueous extract of the leaves administered to patients with type 2 diabetes has a significant hypoglycemic effect with no adverse side effects (Revilla-Monsalve et al. 2007).

Toxicity

The aqueous and ethanolic extracts of the leaves and bark of *Cecropia obtusifolia* and *C. peltata* in a 500 ppm dose were notably toxic to fish of the *Mollinesia* genus within 24 hours. The infusion of the bark, at a dosage of 1–5 g/kg, did not cause acute toxicity in mice (Cáceres 1996).

Conservation Status and Trade

The leaves are sold in local markets in Guatemala, Mexico, and Costa Rica (Morton 1981). They are usually harvested from specimens that have dried and fallen to the ground, and being a common, weedy species, there is no concern for its endangerment.

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Cissampelos pareira L.

Synonyms
Cissampelos acuminata Benth., *Cissampelos argentea* Kunth, *Cissampelos auriculata* Miers, *Cissampelos australis* Saint-Hilaire, *Cissampelos benthamiana* Miers, *Cissampelos boivinni* Baill., *Cissampelos bojeriana* Miers, *Cissampelos caapeba* L., *Cissampelos caapeba* Roxb., *Cissampelos canescens* Miq., *Cissampelos cordata* Ruiz ex J.F. Macbr., *Cissampelos haenkeana* C. Presl, *Cissampelos owariensis* Beauvais ex DC.

Family
Menispermaceae

Common Names
bejuco azul, venadero, oreja de ratón (**Costa Rica**); huaco redondo (**Mexico**); alcotán, curarina de monte, hierba de la víbora (**Guatemala**); alcotán (**Honduras**); alcotán, picamano, curarina del monte (**El Salvador**); alcotán, picamano, terciopelo, redondilla (**Nicaragua**); bejuco de ratón (**Dominican Republic**); pat chwal (**Haiti**); bejuco de cerca, batatilla (**Colombia**); barbasco (**Peru**); oreja de tigre (**Venezuela**).

Description
A twisting, woody liana with large, brown, branching, and bitter-tasting roots, and a narrow, hairy stem. Leaves are alternate, long-stemmed and heart- or kidney-shaped, up to 30 cm long, 3–12 cm wide, with a silky pubescence on both sides. Male flowers are small, yellow, in narrow branched axillary spikes, and female flowers are green, in smaller and simpler groups. The fruit is nearly round, 4–5 cm long, red or orange, and velvety.

History and Traditional Use
The family Menispermaceae gets its name from the crescent shape of its seeds and fruits. In the case of *Cissampelos andromorphia* DC, a species from Central and South America, the whole plant is used by the Krijona and Makuna tribes in **Colombia**, together with other plants in the preparation of *curare; C. pareira* is also used in a similar manner. Curare is a poison prepared from various plants by indigenous populations in South America, including those inhabiting the Colombian forests mainly within the Amazon, Orinoco and Putumayo river basins. It is a preparation that results from boiling together various plant species of the following genera: *Chondrodendron, Cissampelos, Strychnos, Lonchocarpus, Annona, Sciaddotenia, Spigelia, Ormosia,* and *Abuta*. However, the inclusion of other genera depends on individual indigenous groups. It is the shaman of the tribe who carefully monitors and collects the raw materials necessary for the preparation of curare and prepares the potion by boiling it for several hours until it reaches a certain color and consistency, taking various samples and indicating when it is ready. The dancing and the music that frequently accompany the preparation come to a sudden halt when the potion is ready, and the preparer then hands out the curare among those present. Prepared in this way, it is a smooth, dark brown mass that is stored in gourds or taparos, tubes of bamboo, as well as in clay containers. The curare is applied to the tip of the blowdart which is then put into the blowpipe and fired at the bird or monkey which drops dead immediately. There are no details available on the plants or the quantities used by indigenous peoples as its preparation is a carefully kept secret (García-Barriga 1975).

In **Costa Rica** an infusion of the root has been used as a diuretic, and is effective in urinary and venereal diseases, as an emmenagogue, to reduce fever, and as an expectorant (Nuñez 1975). In **Nicaragua** Grijalva (1992) refers to it being used locally as an antidote for perforating bites, and in **El Salvador** the root is crushed and boiled in water to treat diarrhea, stomachache, and cold fevers (De Mena 1994).

In **Guatemala** the decoction made from the root is taken orally for snakebites and bites of other poisonous animals, to treat diabetes, jaundice, rheumatism, gonorrhoea, and to assist during births, and in preventing miscarriages. It is also used to treat tachycardia, as well as gastrointestinal and respiratory infections, as well as being used topically for skin diseases. The infusion is used to treat renal infections and the tincture is used for fever and malaria. It is also said to have anti-emitic, antiseptic, aperitive, digestive, diuretic, expectorant, febrifugal, emmenagogic, tonifying, sudorific, and anti-parasitic properties (Cáceres 1996). Orellana (1997) refers to its use to treat stomachache, menstrual pains, rheumatic pains and migraine, using the root, leaves and flowers. In **Honduras**, House (1995) mentions the root's use in treating stomachache, diarrhea, and indigestion. An infusion of the root and stalk is able to dissolve kidney stones. While the liquid from macerated leaves is taken for fertility in Puebla, **Mexico** (Martínez et al. 2001), a decoction of the leaves is used for stomachache in the **Dominican Republic** (Germosén-Robineau 2005). In **Peru** the seeds are used for snakebites, and the root is used to reduce fever and as an expectorant (Duke and Vasquez 1994).

In **Colombia**, García-Barriga (1975) refers to use of the root and the aerial parts in an infusion to dispel fever, as an emmenagogue and a diuretic. In **Venezuela** Correa and Bernal (1983) note the root's use for bladder and kidney stones, as well as against snake venom.

Pharmacology and Biological Activity

According to Germosén-Robineau (2005) the aqueous extract (30 mg/l) significantly reduces experimentally produced contractions in the isolated ileum of rats; and the aqueous-alcoholic extract promotes antibacterial activity against *Escherichia coli* and *Staphylococus aureus*. The whole plant is shown to be inactive in cytotoxicity tests (Chapuis et al. 1988 quoted by Gupta 1995). An ethnopharmacological study carried out among Guaymí Indians in Panama provided evidence of antimalarial activity of the aqueous and chloroformic extracts of the plant against *Plasmodium gallinaceum* (Joly et al. 1987). Pharmacological studies show that a decoction of the root has a moderate diuretic effect in rats (Cáceres, Girón, and Martínez 1987); and subsequent antibacterial studies carried out by Cáceres (1990) show that a tincture of the leaves, bark and roots is inactive against enterobacteria and *S. aureus*. Amresh, Singh, and Rao (2007) report on a 50% ethanolic extract of the roots at dose levels of 100–400 mg/kg having a significant protective effect against pain from arthritis in mice.

Toxicity

The total alkaloidal extract of the root given intravenously (1 mg/kg) to male rats, showed a curare-type effect involving muscular weakness progressing to flaccid paralysis (Boissier 1965 quoted by Germosén-Robineau 2005). The methanolic leaf extract administered orally to female mice exhibited antifertility activity by altering the principal hormones involved in the estrous cycle regulation (LH, FSH, prolactin, and estradiol), as well as significantly reducing the number of litters; the oral LD50 was 7.3 g/kg (Ganguly et al. 2007).

Conservation Status and Trade

This plant is a wild liana of great abundance in disturbed areas and is currently little used. No references have been found on its conservation status or trade.

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Cnidoscolus chayamansa McVaugh

Synonym
Cnidoscolus aconitifolius (Mill.) I.M. Johnst.

Family
Euphorbiaceae

Common names
chayamansa, chicasquil (**Central America**); chay (**Maya Indians, Guatemala**), chaya (**Guatemala**); chaya, chaya mansa (**Mexico**); tree spinach (**English**).

Description
A succulent shrub growing up to 2 m high. Leaves are round with five lobes, more broad than long, with abundant latex. Flowers white, small, less than 10 mm long, blooming frequently, with male and female flowers found together at the end of long stems and having a faintly unpleasant scent. Fruits pods are rounded and approximately 2.5 cm in width.

History and Traditional Use
This plant is an important food as well as a medicinal plant in the American tropics (National Academy of Sciences 1975; Morera, 1981). There are two species, *Cnidoscolus chayamansa* and *C. aconitifolium*, which are both edible and very similar in appearance. The former can be eaten raw, while the second needs to be cooked due to the presence of glycocides that are inactivated on cooking. *Cnidoscolus acontifolium* present in Costa Rica is popularly known as chicasquil, a name of Nahuatl origin that could be derived from *zicatl* (ant) and *quilitl* (young shoot), in reference to the irritating hairs on the young parts of small branches. The young leaves are eaten cooked and are highly nutritious (Hernández and León 1992). The chayamansa (*C. chayamansa*) is a recent introduction that is more palatable and nutritious, having been brought from Mexico in the 1980s by Costa Rica's Ministry of Agriculture and Livestock. The chaya (*C. chayamansa*) is cultivated in the Yucatan and Peten in Guatemala (Hernández and Leon 1992). In Costa Rica greater genetic variety of the genus Cnidoscolus is to be found in the Quitirrisí area of Puriscal and in Santa Cruz, Guanacaste. It is important to note that five types of chaya have been chronicled, two domesticated varieties and three wild ones. Of the first two, one has narrower leaves and is known by Mayan Indians in Mexico as *kekenshay* or *chaykeken*, and this seems to be the favorite not just because it is has fewer thorns but also because it cooks better and is tastier. The wild varieties, known as *tzintzinchay*, have more thorns and longer leaves (López 1988). The protein content of this plant exceeds that found in such common vegetables as spinach and alfalfa.

In Yucatán, **Mexico**, this species is used medicinally to treat a wide variety of conditions through the stabilization of blood pressure, to reduce weight, increase available calcium, improve blood circulation, aid digestion, reduce eye irritations and the inflammation of veins and hemorrhoids , treat constipation, help in the expulsion of urine and breast milk, and to lower levels of cholesterol and uric acid. It is also used to prevent coughing, and as a decongestant and to disinfect lungs, to prevent amemia, improve memory and brain function, relieve arthritis, treat diabetes, and cure infections of the teeth, gums, and the tongue as well as skin diseases. It helps in the growth and development of bones and muscles in children, and increases energy levels of women during menstruation (Díaz-Bolio 1974).

Pharmacology and Biological Activity

The raw leaf extracts in *Cnidoscolus chayamansa* and the related species, *C. aconitifolius*, have been shown to have strong antioxidant activity due to the high concentrations of total phenolic content (Kuti and Konuru 2004).

Toxicity

Wild varieties can be harmful if eaten raw, due to their spines and their sap.

Conservation Status and Trade

There is no information available on the plant's conservation status. However, being commonly cultivated, it is assumed the species is not under threat. The plant has been promoted by national and international organizations as a dietary complement due to the high level of calcium in its leaves. It is sold on the international market in pickled form.

Cooked chaya

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Chaptalia nutans (L.) Pol.

Synonyms
Cacalia spatulata Sessé & Moc., *Chaptalia diversifolia* Greene, *Chaptalia erosa* Greene, *Chaptalia majuscula* Greene, *Chaptalia subcordata* Greene, *Leria lyrata* Cass., *Leria nutans* (L.) DC., *Thyrsanthema nutans* (L.) Kuntze, *Tussilago lyrata* Pers., *Tussilago nutans* L., *Tussilago vaccina* Vell.

Family
Asteraceae

Common Names
wuara-dowóo (**Guaymí Indians, Costa Rica**), arnica, árnica de montaña (**Costa Rica**); agacha cabeza, globillo (**Mexico**); arnica de monte, hierba de fuego, valeriana de monte (**Honduras**); lechuguilla (**Colombia**); bretonica (**Ecuador**).

Description
A perennial herb, 20–25 cm high, growing in the form of a rosette. Leaves sessile, approximately 20 cm long, oblong-lanceolate-spatulate with the large terminal lobe taking up the major part of the leaf, underside whitish. Inflorescence 15–60 cm long, slightly pendulant when young, flower, with reddish petals. Root fascicled and white.

History and Traditional Use
In Costa Rica *Chaptalia nutans* is commonly known as arnica and is recommended for bruises, sprained and torn muscles and tendons (Gupta 1995) using the same doses as for the arnica (*Arnica montana L.*) of European origin, with which it has probably been confused in the past due to its similar appearance. Conforming to the Doctrine of Signatures discussed under *Aristolochia gigantea*, it is interesting to note that the long and creamy-white, worm-like roots of *C. nutans* are used by Guaymi Indians in **Costa Rica** and **Panama**, to control intestinal worms (Ocampo and Duro 1992). Other uses in Costa Rica include the treatment of muscular pains, bruises and sprains, the plant being boiled and the affected areas bathed with towels soaked in the resulting warm liquid. The leaf and the root are used to treat ulcers (Morton 1981; Gupta 1995). In **Brazil** the leaf extract is used externally to heal wounds (Alice et al. 1991).

In **Honduras** the liquid from boiled leaves and the root is used to soothe bruises. The boiled root is used for the nerves and blood and is also is used as a mouthwash to relieve toothache (House et al. 1995). In **Colombia** the leaves dried in the open air are important with the underside of the leaf being placed on wounds to rapidly stop hemorrhaging. The leaf is also boiled and a cup of the resulting liquid is consumed before retiring to facilitate sleep (García-Barriga 1975).

Pharmacology and Biological Activity
The daily intragastric application of an ethanolic extract (95%) at 100 mg/kg for four days in mice showed no antimalarial activity against *Plasmodium berghei* (Brandao, Botelho, and Krettli 1985). The compound, 7–O–β–D–glucopyranosyl–nutanocoumarinethanolic, isolated from the ethanolic extract of the root, inhibits the bacteria *Bacillus subtilis* and *Staphylococcus aureus* at concentrations of 62.5 g/ml and 125 g/ml, respectively (Truiti et al. 2003). A methanolic extract of aerial parts also shows antibacterial activity against *Bacillus subtilis* (Souza et al. 2004), while Badilla, Mora, and Poveda (1999) report on the aqueous extract (500 mg/kg) showing an anti-inflammatory activity comparable with that of indomethacin in rats.

Toxicity
No toxicological data was reported for this species.

Conservation Status and Trade
This is a wild species spontaneously colonizing disturbed sites, and is said to be moderately abundant in Mexico, although its sale in local markets is unknown.

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Dorstenia contrajerva L.

Synonyms
Dorstenia alexiteria L., *Dorstenia contrajerva* subsp. *tenuiloba* S.F. Blake, *Dorstenia contrajerva* subsp. *houstonni* (L.) Bureau, *Dorstenia contrajerva* subsp. *maculata* (Lem.) Bureau, *Dorstenia contrajerva* subsp. *tenuiloba* (S.F. Blake) Standl. & Steyerm., *Dorstenia houstonni* L., *Dortsenia maculata* Lem., *Dorstenia palmata* Willd. ex Schult., *Dorstenia quadrangularis* Stokes, *Dorstenia quadrangularis* var. *integrifolia* Stokes, *Dorstenia quadrangularis* var. *pinnatifida* Stokes, *Dorstenia quadrangularis* var. *sinuata* Stokes

Family
Moraceae

Common Names
contrahierba, contrayerba (**Costa Rica**); tozpatli (**Nahua, Mexico**), contrahierba, crestilla, mano de león, cresta de gallo (**Mexico**); contrahierba (**Honduras**); contrayerba (**El Salvador**); contra hierba, contrahierba, moukape (**Nicaragua**); taropé, higuerilla, contrahierba (**Argentina**); contrahierba (**Peru**); contra yerba (**Venezuela**).

Description
A succulent herb with a short or non-existent stem, 20–40 cm high, with an aromatic rhizome. Leaves variously shaped: oval, ovoid or almost round, commonly deeply pinnatified, complete or slightly lobed. The unusual and characteristic inflorescence is in the form of a flattened receptacle, the upper surface of which is densely covered with minute flowers, and the inflorescence is a syconium. Fruits generally round and ca. 0.25–1 cm in diameter.

History and Traditional Use
Dorstenia contrajerva is one of many medicinal plants that were traded and taken to Europe, and Hernández and León (1992) refer to it being taken to Europe by Columbus. The genus *Dorstenia* is made up of more than 50 species distributed throughout the tropics, and many of these are present in America and Africa. It is an unusual genus within the family Moraceae due to its herbaceous form, establishing itself in the undergrowth, and drawing attention with its disc-shaped inflorescence with small flowers in the receptacle. The herb loses its leaves in regions with extended dry periods, but these re-sprout vigorously once rains start again. Other species of *Dorstenia* are used for their medicinal properties. In **Brazil**, *D. brasiliensis* Lam, known as cayapiá verdadeiro, or taropé, is used for occasional fevers and chronic diarrhea (Gupta 1995). Other species are given the name contrahierba, such as in **Honduras** (House et al. 1995) and **Nicaragua** (Grijalva 1992), where *D. drakena* L. and *D. contrajerva* have similar uses.

In **Costa Rica** the inflorescence is boiled and used to make the umbilical cord fall off newborn babies. The boiled root is considered effective in curing diarrhea, and an infusion used to lower fever; and it also has a reputation as being very useful in curing persistent diarrhea as well as serving as an emmenagogue (Pittier 1978; Ocampo, Villalobos, and Cifuentes 1997).

In **Honduras** the boiled root is used to treat diarrhea, dysentery, and stomachache; the slightly roasted, toasted and ground root is used for parasites and worms; and the crushed root is also mixed with water to treat snakebites (House et al. 1995). In **Nicaragua** the boiled rhizomes of the plant are used to prevent diarrhea, and the minced raw rhizomes are used to treat diarrhea, sickness, upset stomach, indigestion, and worms (Grijalva 1992). Williams (1981) refers to its rhizome being used historically to give flavor to tobacco cigarettes in **Guatemala** and **El Salvador,** while Morton (1981) indicates that the traditional use of the boiled root for stomachache and to prevent vomiting continues in El

Salvador. In Puebla, **Mexico**, the latex is used to heal wounds and the inflorescenses given to children when teething to relieve itching gums (Martínez et al. 2001). In the Amazonian region of **Peru** it is used as a tonic, against gangrene, and as an antidote for bee and wasp stings (Brack 1999); in the subtropical province of Misiones in **Argentina**, the whole plant is used to treat snakebite (Amat 1998); and SECAB (1983) refers to its use as a sudorific and against dysentery in **Venezuela**.

Pharmacology and Biological Activity

The peptide (a building block of protein) contrajervin isolated from this plant inhibits the cytopathic effects of HIV–1 (RF) infection in a human T–lymphoblastoid cell line (CEM-SS) (Bokesch et al. 2004). The methanol extract from the whole plant shows potent leishmanicidal activity against *Leishmania mexicana* promastigotes (Peraza-Sánchez et al. 2007), while the ethanolic and aqueous extracts of the leaves and roots show no inhibitory activity in bacterial cultures of *Escherechia coli* and *Staphyloccus aureus* (De Mena 1994).

Toxicity

No information on the toxicity of this species has been identified.

Conservation Status and Trade

It is only in Brazil that reference is made to the conservation status of the genus, identifying the species known as carapía (*Dorstenia asaroides* Hook) as being of importance for conservation and managment, though no mention is made of its conservation status (Vieira et al. 2002). Domestic consumption is common in Mexico.

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Dracontium gigas (Seem.) Engl.

Synonym
Godwinia gigas Seem.

Family
Araceae

Common Names
chebekeke (**Cabecar Indians, Costa Rica**), alamokol (**Bribri Indians, Costa Rica**), hombrón, culebra, terciopelo, tkabe-kli (**Costa Rica**); fer de lance (**English/French**).

Description
Herb growing to 4 m in height. Leaves solitary or 1 per tuber, petiole to 3.4 m long and 9.5 cm in diameter; adult leaf extending horizontally from 1.5–2.5 m. Inflorescence solitary, deep purple to almost black, with peduncle 30–120 cm long, with brown spathe 58–78 cm long and 13–15 cm wide, and green spadix up to 50 cm in length with a characteristic aroma.

History and Traditional Use
Snakebites are a permanent threat to populations living in tropical forests and Holm-Nielsen, Kuist, and Aguavil (1983) note that 11% of the useful plants of the Awa-Cuaiquer ethnic group in Ecuador are employed to treat snakebites. These plants include members of the families Piperaceae, Gesneriaceae, Melastomataceae and Araceae. *Dracontium gigas*, or hombrón, as it is known in Costa Rica, conforms to the aforementioned Doctrine of Signatures, based on the form and color of the stem, the leaf petiole having a greenish dappled color reminiscent of the body of a snake. As a result, various species are used to treat snakebites, particularly in Costa Rica. The genus *Dracontium* includes 13 species (Gentry 1993), and both Pittier (1978) and Morton (1981) refer to the use of D. *pittieri* by indigenous groups in the country's Pacific region. However, in the Caribbean region *D. gigas* and *D. costaricense* are used by the Bribri and Cabecar Indians living in the humid forests for the same purpose. The similarity of the species and the scarce attention paid to the genus' taxonomy has given rise to confusing bibliographic references regarding its use as an antidote for snakebites, and there are repeated mentions in Costa Rica of the use of *D. pittieri* when in fact exploitation is of more than two species.

In **Costa Rica** indigenous groups also use this plant for boils and as an anti-inflammatory; the cooked tuber is used to treat swellings from snakebites by bathing the affected area with the warm solution while the boiled leaves are used as an anti-inflammatory. To get rid of boils, the tuber is cut and left to dry for 30 minutes and the resulting sap is placed on the infected area. The plant is also used to eliminate worms from animal wounds (Ocampo, Villalobos and Cifuentes 1997; Nuñez 1975; Pittier 1978; Ginzbarg 1977).

In **Colombia** Duke (1981) reports on chupadera (*Dracontium* sp.) being used for snakebite. In **Peru** reference is made to *D. loretense* Krause, known as jergón sacha, of which the corm is grated and applied as a poultice to the snakebite. The leaves of *D. longipes* Engler are similarly used with a small amount of water, being applied three times a day (Nalvarte, Jong, and Dominguez 1999; Brack 1999).

Pharmacology and Biological Activity
The rhizome extract (2000 µg/kg) of the related species, *Dracontium croatii*, had 100% neutralizing ability in mice against the defibrinating effect of *Bothrops asper* venom (Núñez et al. 2004).

Toxicity

Although the species, as with other plants in this family, may contain calcium oxylate crystals in its leaves and tubers that are injurious to humans, no toxicological information specific to this species has been identified.

Conservation Status and Trade

Drancontium species are traditionally used by indigenous communities and therefore managed and protected. The most serious conservation problem is in Peru where *D. loretense* is extracted from wild populations and traded on the international market, possibly endangering the species in its natural environment. Data exist on the sale of jergón sacha corms being collected from the wild and sold on the international market, and specifically in 1996 when almost one ton was reportedly exported, although the end user and market were not identified (Nalvarte, Jong, and Domínguez 1999). In Brazil reference is made to *D. arifolia* Lam, D. *cayapia Vell.*, and *D. elata* Hook, as being endangered (Vieira et al. 2002).

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Eryngium foetidum L.

Synonym
Eryngium antihystericum Rottb., *Eryngium foetidum* f. *comosum* Urb., *Eryngium foetidum* f. *nudum* H. Wolff., *Eryngium molleri* Gand.

Family
Apiaceae

Common Names
culantro coyote, culantro (**Costa Rica**); coriander (**Belize**); culantro de monte, culantro de pata, culantro de pozo (**Honduras**); acapate, culantro silvestre (**El Salvador**); cilantro ancho (**Dominican Republic**); cilantro (**Colombia**); culantrillo (**Ecuador**); culantro chuncho, sacha culantro (**Peru**); culantro de monte (**Venezuela**); wild coriander (**English**).

Description
Annual herb growing to 60 cm tall, aromatic, erect, growing in a basal rosette. Leaves, lanceolate or oblong-lanceolate, with toothed edges up to 30 cm long. Cylindrical inflorescence, with small white or green terminal flowers; fruits greenish. Roots white.

History and Traditional Use
Culantro coyote, as it is known in Costa Rica, is an herb native to tropical American forests, but also is found in open fields, as large populations of plants. It has been traditionally used as a spice due to the highly volatile essential oils in the fresh leaves, and is therefore best used as a food and medicine when fresh. In tropical regions it is used as a substitute for European coriander (*Coriandrum sativum* L.) known as cilantro in the United States. It is currently cultivated in Costa Rica for export to the US market as a spice and is also widely used in the tropics for its medicinal properties.

In **Costa Rica** an infusion of the boiled leaves is taken three times daily to reduce cholesterol (Ocampo, Villalobos, and Cifuentes 1997). The Afro-Caribbean population use the leaves cooked in water which is administered orally to help control gastritis and anemia. It is also mixed with the herb *Kalanchoe pinnata* to treat heart conditions. An infusion of the root and leaves is also used to calm the nerves (Nuñez 1975).

In **Honduras** a decoction is used to treat diarrhea; the leaves are also crushed and inserted as earplugs for earache, while the boiled root is given to treat obesity, a decoction of the root is taken for stomachache, and a poultice of the leaves is applied for headache (House 1995). In **El Salvador**, De Mena (1994) reports that the boiled leaves are commonly used for fevers that result in erruptions of the skin. According to Arvigo and Balick (1998), in **Belize** the leaves are used to make an infusion to treat indigestion, and sickness and diarrhea in children. In **Venezuela** Naranjo, Gil, and Naranjo (2001) report on the use of the root as a diuretic, as well as for flatulence, to promote or re-establish menstruation and help in the expulsion of gastro-intestinal parasites. In **Peru** the cooked leaves are used to counter diarrhea and, with the addition of lemon, the liquid is taken to stop vomiting; when the whole plant is boiled, it is used to treat bronchitis (Duke and Vasquez 1994; Brack 1999). Germosén-Robineau (2005) refers to traditional use in the Caribbean to treat chest pains, palpitations and tiredness with a decoction of the leaves; fever, with a decoction or an infusion of the whole plant; and flatulence and influenza, with a decoction or infusion of the leaves; all of these preparations being taken orally.

Pharmacology and Biological Activity
Compounds in the hexane extract of the leaves show significant topical anti-inflammatory activity in mice (García et al. 1999).

Toxicity

Toxicological studies of a plant extract in mice show that the LD50 injected intravenously is above 50 mg/kg, and orally, 1,000 mg (Germosén-Robineau 2005).

Conservation Status and Trade

There are no reports available on the conservation status of this species. It is an herb sold in Central American markets, and is cultivated as a spice in Costa Rica's Caribbean region for export to the US. Its presence as a weedy species in the wild and its cultivation would indicate that there is no immediate threat to the species.

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Euphorbia lancifolia Schltdl.

Family
Euphorbiaceae

Common Names
hierba lechera (**Costa Rica**); tiriciaxihuit or jeguite para la tiricia (**Nahua Indians, Mexico**), hierba de la tristeza (**Mexico**); ixbut, hierba lechera, besmut, sapillo (**Guatemala**).

Description
An annual herb ranging from 50–70 cm in height, fleshy, with round stalks. Leaves alternate, very short erect petioles, rombo-lanceolate, 5–9 cm long, acute or acuminate, green and smooth on the upper surface, pale on the underside, and marked with a whitish 'v' shape. The plant produces copious white latex from its leaves and stems.

History and Traditional Use
Traditionally, this plant has been used by the indigenous populations in Mesoamerica as a galactogene (to stimulate milk production) in humans and cattle (Morton 1981). This is consistent with the Doctrine of Signatures (discussed under *Aristolochia*) as the plant, and indeed the entire family, is characterized by an abundant white latex (milk) that flows freely when the plant is cut. Its traditional use has spread through the Central American region as far south as Colombia where it is used to induce milk production in cattle.

In the 1940s tests were carried out by the University of Costa Rica's Faculty of Chemistry to determine the mechanism involved in the plant's ability to induce women to produce more milk to feed their babies. However, these tests, which used an extract of the ixbut herb administered orally, were inconclusive. However, according to Ocampo and Maffioli (1987) the boiled leaves are nonetheless used to increase the production of breast milk feeding mothers in **Costa Rica**. In **Guatemala** an infusion or a decoction of leaves is also used to stimulate the production of breast milk, to help to reduce impotence, for puerperal fever (also known as childbed fever), body pains, and gastric colic; a decoction of the whole plant is used topically for ulcers and body pain. The plant is also reputed to have properties as an antiseptic and a stimulating tonic (Cáceres 1996).

Martínez et al. (2001) report on an infusion of the leaves, flowers and fruits being taken orally and applied topically three times a day for gastric ulcers in **Mexico**, while shock is treated with an infusion of the leaves in which the person is bathed for nine consecutive afternoons.

Pharmacology and Biological Activity
Clinical studies demonstrate that the administration of the sap extract from the leaves stimulates milk production in humans. A study carried out among 86 post-partum women shows a 62.8% increase in milk production with no change in its quality. In subsequent studies among 1,800 women with breast feeding problems, 50% said they were unable to breast feed without *Euphorbia lancifolia,* 35% showed a notable increase in milk production, and 15% showed no benefit. Clinical tests with prolactin suggest that this hormone does not appear to intervene in the process. Other tests did not result in conclusive results, although they did show that it does not stimulate milk production in women who are not lactating (Rosengarten 1982).

Toxicity

No toxicological data has been reported for this species.

Conservation Status and Trade

In Mexico it is noted to be an abundant wild herb; in Guatemala it is gathered from the wild and is cultivated. This herb is usually easy to propagate with cuttings. In Costa Rica it is cultivated and easily reproduced in cold climates as well as in humid tropical zones (Ocampo 1986; Martínez et al. 2001). No references are available on the species' conservation status.

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Fevillea cordifolia L.

Synonyms
Fevillea cordifolia var. *hederacea* (Poir.) Cogn., *Fevillea cordifolia* var. *typica* Stehlé, M. Stehlé & Quentin, *Fevillea hederacea* Poir., *Fevillea javilla* Kunth, *Fevillea karstenii* Cogn., *Fevillea punctata* (L.) Poir., *Fevillea scandens* L., *Fevillea triloba* Sessé & Moc., *Fevillea trilobata* Reichard, *Fevillea uncipetala* Kuhlm., *Nhandiroba cordifolia* (L.) Kuntze, *Nhandiroba karstenii* (Cogn.) Kuntze, *Nhandiroba scandens* (L.) Desc., *Siolmatra mexiae* Standl., *Trichosanthes punctata* (L.) L.

Family
Cucurbitaceae

Common Names
cabalonga, chichimora, contraveneno, dunawó (**Costa Rica**); chichimora, guacalitos, cabalonga (**Honduras**); buto, chichimora, pepita amarga, calabaza de castilla, secua, mukula (**Nicaragua**); atamuyo (**Ecuador**); maní del monte, habilla, cabalonga (**Peru**).

Description
Climbing vine growing to 20 m with axillary tendrils. Stems smooth, often reddish, robust, hairless with narrow branches. Leaves alternate, cordiform, 6–15 cm long by 4–12 cm wide, tendril with two branches near the point. Flowers dioecious with five yellow or orange petals, in clusters. Fruits spherical, green, globose, 7–12 cm wide.

History and Traditional Use
This medicinal plant is a wild liana common to tropical forests. Being a forest liana it takes advantage of tree trunks to grow and establish itself in the forest canopy. It is thus difficult to see the round, green gourd-like fruits that grow on the branches of the leafy tropical stems. It is normal to find the fruits broken open on the ground as they are a source of food for forest rodents. Indigenous peoples of Costa Rica have known and used these fruits since ancient times. A fat with a buttery consistency in the seeds, known as *aceite secua*, has been suggested for use in candle making. In the 1980s ethnobotanist James Duke promoted research into the oil as a fuel for the internal combustion engine in Costa Rica.

In **Costa Rica** indigenous groups use the seeds for a variety of different ailments, such as parasites, stomachache, and to treat fever. The grated seeds are placed in cold water and drunk for stomachache. Farmers are known to use the seeds to treat septicemia in pigs and horses and internal parasites in cows (Ocampo, Villalobos, and Cifuentes 1997; Pittier 1978).

The seed is also used in **Honduras** to treat a variety of ailments, including stomachache, diarrhea and as a laxative, by grating a teaspoon of the seed and adding it to a cup of warm water (Nelson 1986; House et al. 1995). In **Nicaragua** the seeds are also used to treat a variety of similar ailments including stomachache, constipation, diarrhea, colic, to induce birth, as a tonic, and as an antidote for snakebites and poisonous plants (Coe and Anderson 1997). Similarly, in **Peru** the grated seeds are likewise used in ethnoveterinary practices as a strong laxative in cattle (Duke and Vasquez 1994; Brack 1999).

Pharmacology and Biological Activity
There is no information on the pharmacological or biological activity of this species.

Toxicity
No toxicity data has been reported on this species.

Conservation Status and Trade

Although no information on conservation status has been identified, research is required due to potential commercial interests, and specifically those in dry seeds being sold on regional markets.

Sprouted seed

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Gliricidia sepium
(Jacq.) Kunth ex Walp.

Synonyms
Galedupa pungam Blanco, *Gliricidia lambii* Fernald, *Gliricidia maculata* (Kunth) Walp., *Gliricidia maculata* var. *multijuga* Micheli ex Donn. Sm., *Gliricidia sepium* (Jacq.) Kunth ex Griseb., *Gliricidia sepium* f. *maculata* (Kunth) Urb., *Gliricidia sepium* Kunth ex Steud., *Lonchocarpus maculatus* (Kunth) DC., *Lonchocarpus sepium* (Jacq.) DC., *Millettia luzonensis* A. Gray, *Robinia hispida* L., *Robinia maculata* Kunth, *Robinia sepium* Jacq., *Robinia variegata* Schltdl.

Family
Fabaceae

Common Names
madera negra, madero negro, madre de cacao (**Costa Rica**); cuacuite, cocuite, San José, cuacuitle (**Mexico**); madrecacao, kante, madriado, matasarna, sacyab (**Guatemala**); madriado, madrecacao, cacaonance, cacahunance (**Honduras**); madrecacao, cacahuenance, palo de hierro (**El Salvador**); madero negro, madreado, madre de cacao, yuaguaguyt (**Nicaragua**); piñon amoroso (**Cuba**); balo, bala, madera negra (**Panama**); mata ratón (**Colombia**).

Description
Deciduous tree growing to 15 m in height with gray bark. Leaves alternate, compound, with 5–19 ovate-elliptical leaflets, 2–7 cm long by 1–3 cm wide. Flowers closely grouped along the branches, pink, lilac or white, 2 cm long, fragrant. Fruits flat and oblong, to 15 cm long by 2 cm wide containing up to 10 brown seeds.

History and Traditional Use
This tree has been used since pre-Columbian times for its multiple benefits throughout Central America, Mexico and the Caribbean. Today, it is valued as an edible species, to provide fuel and living fences, for domestic tools, and construction materials (Morton 1981; Martínez et al. 2001).

In **Costa Rica** it is used as cattle fodder and in agroforestry systems; leaves have a protein content of up to 28%, the tree supplies the soil with nitrogen, and the plant also has insecticidal and repellent properties being commonly used to kill fleas. The bark has rodenticidal properties, and the wood is strong and termite resistant. The common name is madre de cacao (mother of cocoa), and according to Pittier (1978) in **Nicaragua** and Costa Rica it is considered highly effective in controlling the rodent *taltuza* (*Orthogeomys heterodus*) and, for which reason, has been established as a shade tree in cocoa *(Theobroma cacao*) plantations, its toxic roots helping to control this rodent. The sap from the leaves is effectively used to treat fungal infections of the feet, flea infestations and possibly *Streptococcus* bacteria. The flower can be chewed to prevent pyorrhea, and baths of boiled leaves are used for skin infections (Segleau 2001).

In **Belize** Arvigo and Balick (1998) report on boiled bark water being used for bathing tired, burning, or irritated eyes. A 8 cm x 2.5 cm piece of madre de cacao bark is boiled in a cup of water for 10 minutes, then strained through a cloth twice, and cooled before applying to the eyes. The seeds and bark are also pulverized and mixed with ground corn to kill rats, while mashed fresh leaves are applied as a poultice to wounds, skin ulcers, boils, and diaper rash.

House et al. (1995) refer to a variety of uses in **Honduras**. The leaves, flowers, bark and stalks are boiled to bathe rashes, spots and itching; the leaves are boiled and rubbed on areas affected by arthritis; and minced and fried leaves are used as a poultice to reduce fever.

In **Nicaragua** Grijalva (1992) refers to the use of leaves in the treatment of diarrhea, dysentery and amoebas; and according to Gupta et al. (1979) the leaves are used in **Panama** in a decoction, and the juice is used for scabies, fungal infections, urticaria and other skin diseases.

De Mena (1994) reports on the bark being macerated in water and applied for one day on inflamed areas to act as an anti-inflammatory in **El Salvador**; while García Barriga (1974) mentions that the leaves are used as an insecticide and as an emmenagogue, and a decoction of the these is also used to bathe diseases of the skin in **Colombia.**

According to Gupta (1995) the leaves are used in **Mexico** as an antihistamine, an antipyretic agent, a diuretic, and to ease labor; and in **Guatemala** Cáceres (1996) indicates that the boiled leaves and the bark are used to treat gastrointestinal, respiratory and skin diseases, as well as for malaria and mumps, while the boiled root is used to relieve sore throat, kidney diseases, jaundice and edema.

Pharmacology and Biological Activity

The ethanolic extracts of the aerial parts of the plant given orally to rats, with a dosage of 0.375 mg/kg, show anti-inflammatory activity; also, the bark extract shows inhibitory activity on the liberation of histamine, explaining the anti-inflammatory activity (Cáceres 1996). *In vitro* studies of anti-microbial activity show that the alcoholic maceration of leaves and bark does not inhibit the growth of pathogenic entero-bacteria or *Candida albicans* (Cáceres et al. 1991a). The decoction of leaves is an active fungicidal against *Microsporum canis* and *Trichopyton mentagrophytes*, with a minimum inhibitory concentration of 100–200 mg (Cáceres et al. 1991b). The alcoholic maceration of the leaves is active against *Neisseria gonorrhea*, with an inhibitory spectrum of 80% of pathogenic strains (Cáceres et al. 1995). Other studies show that the alcoholic extract of the bark has diuretic, antimicrobial, anti-inflammatory and endocrinal activity (Gupta 1995). Insecticidal activity has been demonstrated against aphids, coccidia, *Culex* species, *Diacrisis virginica*, flies, *Eliothis armigera, Hydrellia philippia, Nymphula depunctalis,* and *Spodoptera eridania* (Grainge and Ahmed 1988). A 200 µg dose of methanolic bark extract exhibited antimicrobial effects against *Staphylococcus epidermis, Staphylococcus aureus, Pseudomonas aeruginosa, Vibrio cholerae,* and *Bacillus pumillus* (Pérez et al. 2001). Ethanolic extracts of the branches and leaves are active against the *Staphylococcus aureus* bacterium (Rojas et al. 2006).

Toxicity

Aqueous extracts of the bark and leaves produce significant changes in mice behavior. They decrease motor activity, and sound and touch response, with hypothermia, back tonus, parpebral ptosis, catalepsy, and decreased righting reflex. These signs of toxicity indicate that this species has significant depressant effects on the central nervous system (CNS) of mice (Morales et al. 2001).

Conservation Status and Trade

This species is commonly found in Central America forming living fences, and in Mexico it is considered to be quite abundant. The plant is sold as fence posts, and leaves are sold in local markets.

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Hamelia patens Jacq.

Synonyms
Duhamelia odorata Willd. ex Roem. & Schult., *Duhamelia patens* (Jacq.) Pers., *Duhamelia sphaerocarpa* (Ruiz & Pav.) Pers., *Hamelia brachystemon* Wernham, *Hamelia brittoniana* Wernham, *Hamelia coccinea* Sw., *Hamelia corymbosa* Sessé & Moc., *Hamelia erecta* Jacq., *Hamelia intermedia* Urb. & Ekman, *Hamelia lanuginosa* M. Martens & Galeotti, *Hamelia latifolia* Rchb. ex DC., *Hamelia nodosa* M. Martens & Galeotti, *Hamelia pedicellata* Wernham, *Hamelia sphaerocarpa* Ruiz & Pav., *Hamelia suaveolens* Kunth, *Hamelia tubiflora* Wernham, *Hamelia viridiflora* Wernham.

Family
Rubiaceae

Common Names
zorrillo colorado, zorrillo real, red head, coralillo, clavillo (**Costa Rica**); chichipin, achiotillo colorado, chichipinse (**Guatemala**); red head, sanalo-todo, klaush-pím (**Kekchí Maya, Belize**); chichipinse, mazamorra, achotillo, coloradillo, sarnilla (**Honduras**); pinta machete, coralillo de hoja ancha (**Nicaragua**); chichipince (**El Salvador**); uvero (**Panama**); baletilla, trompetilla, imegchichi (**Nahua, Mexico**); buzunuco (**Dominican Republic**); benzeynuca, puca ungí sacha (**Quechua, Peru**); firebush, polly red head (**English**).

Description
Shrub or small tree reaching a height of 5 m. Leaves opposite or whorled, lanceolate-oblong to spherical-ovate, 5–21 cm long. Inflorescence with multiple orange to deep-red tubular flowers, calyx 2.5–3 mm long, corolla 1.5–2 cm long. Fruits oblong, 1 cm long, purple to black when mature, growing in clusters.

History and Traditional Use
Europeans who settled in South America learned much about the local herbal traditions, modifying concepts and, incorporating their own plants brought from Europe, established the basis for a mixed polyherbal medicinal tradition during the Colonial period (Lozoya 1990). This tradition has been further enriched with the contribution of other cultural practices and the broadening of the modalities of herbal medicine.

The wealth of ethnobotanical information on this species in **Mexico** focuses on this plant being commonly used to stop bleeding or to promote the healing of wounds. This plant continues to be used for these purposes today (Martinez et al. 2001).

In **Costa Rica** Segleau (2001) reports on the leaves being macerated in alcohol and, with the addition of three drops of kerosene, being used externally as a poultice to heal wounds. A decoction of the entire plant is used in a bath for skin diseases and migraine. In **Nicaragua** the leaves are used to treat itchiness and dysentery (Grijalva 1992), while in **Guatemala** Cáceres (1996) reports on the leaves being used to treat menstrual disorders. The boiled root is used to expel kidney stones and to treat diabetes and rheumatism. It is also said to have properties as an antiseptic, astringent, to promote healing, to reduce inflammation, as an emmenogogue, emollient, stomachic and vulnerary.

In **Honduras** House et al. (1995) note that small farmers use the water from boiled leaves to kill sucking lice (order Anoplura) on horses; and the tender shoots, leaves and roots are boiled to bathe the skin for infections, irritations, itching and rashes.

In **Panama** an infusion of the stem bark is used for snakebites and as a postpartum aid to relieve pain (Joly et al. 1987), and in **El Salvador** De Mena (1994) reports on leaves and stems in a concoction being widely used to treat wounds. In **Mexico** it is used for a variety of illnesses. The leaves are macerated to extract the sap necessary to cover the wound, or, in case of bleeding and ulcers, a poultice is made to cover the wounded area (Martínez et al. 2001).

In South America the **Quechua** people also know of the plant's medicinal attributes, using its heated leaves as a poultice to relieve pain, and ripe fruits are also used as a food. In **Peru** Brack (1999) reports on a mixture derived from the leaves being used to expell intestinal worms the aerial parts used as an anti-inflammatory and an anti-rheumatic.

Pharmacology and Biological Activity

The analgesic activity of the ethanolic extract has been evaluated in mice using the hot-plate test. A dosage of 570 mg/kg of *Hamelia patens* applied intraperitoneally has a significant analgesic effect after being administered. With a dosage of 5,700 mg/kg, the analgesic effect was observed 60, 90, 120 and 140 minutes after being administered. The preliminary screening shows that the ethanolic extract, with a dosage of 770 mg/kg (half of LD50) given intraperitoneally in rats, causes an evident depression of the central nervous system, a drastic reduction of motor activity, anesthesia, passivity, paralysis of the back legs, mydriasis and a drop in rectal temperature (Esposito-Avella and Gupta 1986). However, anti-fertility screening in rats utilizing the 80% ethanolic extract of the leaf shows no activity (Weniger 1983 quoted in Gupta 1995). López Abraham (1979) reports on the plant showing cytostatic activity. Clinical studies in El Salvador report improvements in the healing of wounds with the use of a soap prepared from this plant (Tobkes 1987); while studies in Brazil confirm that the plant is not toxic (Correa 1969). Studies by Gomez-Beloz (2003) show that an ethanolic extract of the whole plant of *Hamelia patens*, administered in an ointment base, promoted wound healing in mice and significantly increased the breaking strength of wounds. Anti-microbial activity has been reported in a variety of gram-positive and gram-negative microorganisms (Gupta 1995). The methanolic leaf extract demonstrated to have a weak relaxant effect on rat myometrium may be due to the alkaloids present in the leaf (Reyes-Chilpas et al. 2004).

Toxicity

The LD50 of the ethanolic extract applied intraperitoneally in rats is 1,540 mg/kg. The subacute toxicity (daily intraperitoneal administration over 10 days) provides the following results: with one third of the lethal dose, no mortality for 10 days; with half the lethal dose, 30% mortality; with three-fourths of the lethal dose, 50% mortalily (Germosén-Robineau 2005).

Conservation Status and Trade

This shrub is abundant in secondary forests in the American tropics and is considered highly abundant in Mexico, and in El Salvador the plant is widely available on local markets. It is also cultivated in other tropical regions around the world. The CITES' list of medicinal plants does not include this species in any of its categories.

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Hymenocallis littoralis (Jacq.) Salisb.

Synonyms
Hymenocallis panamensis Lindl., *Pancratium americanum* Mill., *Pancratium littorale* Jacq.

Family
Amaryllidaceae

Common Names
bisna, lirio, niñarle (**Costa Rica**); spider lily (**English**).

Description
Bulbous plant with ovoid bulb 5–8 cm long. Leaves straplike, 60–80 cm long, 2.5 cm wide, forming a rosette. Flowers white, arising from a 30–60 cm long scape, numerous, with tubular perianth 15–20 cm long and a wide, funnel-shaped corona, 2–2.5 cm deep by 3–3.5 cm in diameter, with fine filaments, each approximately 4.5–5.5 cm long.

History and Traditional Use
The family Amaryllidaceae comprises herbaceous, bulbous plants, many of which are found throughout the tropical Americas and other regions around the world and are traditionally used for their medicinal properties. This particular species grows in humid, sandy sites, and has beautiful white flowers. Morton (1981) refers to various species of *Hymenocallis* such as *H. arenicola, H. caribaea, H. tubiflora,* being used in the Caribbean as an emetic with no reference made to H. littoralis for the same purpose. In **El Salvador** the crushed bulbs of *Hymenocallis americana* are used as a poultice for varicose veins, sores and swellings (De Mena 1994). In **Peru** *Hymenocallis amancaes* (R.&P.) Nich is used as an ornamental as well as in cosmetics, the bulbs being crushed in oil and applied to the face to remove freckles and blemishes. It is used medicinally as an emollient and the boiled bulbs are used to treat contusions and torn muscles. It is also used as an ornamental and is the symbol of the capital city of Lima, although is considered to be in danger of extinction in the wild (Brack 1999). In **Africa** various related genera, such as *Agapanthus africanus, Clivia miniata, Crinum macowanii, Gethyllis* sp., and *Scadoxus puniceus*, are used medicinally (Van Wyk, Van Oudtshoorn, and Gericke 1997). Hartwell (1982) refers to six species of *Hymenocallis* found in Venezuela and the West Indies being used for tumors.

In **Costa Rica** the Bribri Indians located on the Caribbean seabord of the Talamanca region, use the bulb of *H. littoralis* as an emetic and for controlling intestinal worms by grating the bulb and drinking the juice; a concoction of the bulb is also used against intestinal worms.

Pharmacology and Biological Activity
Fungicidal, and in some cases anti-viral activity, have been reported when high concentrations of more polar extracts are used (Chaumont, Sheemaeker, and Rousseau 1978). Isolated compounds have been found to inhibit cancer cell growth in murine P388 lymphocytic leukemia and other human cell lines (Pettit et al. 2006); and specific alkaloids in this plant show inhibitory activity of HIV reverse transcriptase and potent *in vitro* cytotoxicity (Lin et al. 1995).

Toxicity
Contains lycorine, a toxic crystalline alkaloid, and related phenanthridine alkaloide (Nelson, Shih, and Balick 2007).

Conservation Status and Trade

There is no information on its conservation status apart from the Brack (1999) reference above. However, it is abundant along the edges of beaches on Costa Rica's Caribbean coastline and is commonly cultivated elsewhere in Central America and the Caribbean.

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Hyptis verticillata Jacq.

Synonyms
Hyptis axillaris Fernald, *Hyptis parviflora* M. Martens & Galeotti, *Hyptis pringlei* Fernald, *Mesosphaerum verticillatum* (Jacq.) Kuntze

Family
Lamiaceae

Common Names
John Charles, canilla negra, juanilama mocha, pie de paloma (**Costa Rica**); huele a fierro, escoba de negro, epazotillo, vara negra, tzantzin (**Nahua, Mexico**); John Charles, shkot-k wai (**Kekchí Maya, Belize**); matadolor, lengua de vaca, hoja de dolor, palo de dolor (**Honduras**); verbena, verbena de río (**El Salvador**); hierba del dolor, trébol de monte, yerba pedorra (**Nicaragua**).

Description
An upright shrub 1–2 m tall with a woody, well-branched stem. Leaves opposite, 2–13 cm long, somewhat lanceolate to elliptical-lanceolate, sharply serrated or subentire. Flowers small, in panicles, corolla greenish-white or purple, 2 mm long, aromatic. Fruit 1.3–2 mm long, reticulate.

History and Traditional Use
The genus *Hyptis* is abundant in the Americas and various species, such as chan (*Hyptis suaveolens* (L.) Poit), are important medicinal plants in the tropics. The seeds, used as an emollient, are crushed in water and consumed as a juice. *Hyptis verticillata* is a medicinal plant widely used in Mesoamerica since ancient times, known in Nahuatl as *chian* and *chia*. It is a wild plant common to the Neotropics and forms large colonies in pastures and along pathways. The plant is considered by local people as having "hot" properties. (In traditional therapy plants, animals, and minerals are assigned "cold" and "hot" properties that constitute a compensation mechanism for the organism of the sick person. Such properties, known as a plant's humoral qualities, are often related to analogies in appearance to some aspects of the illness being treated or to the cure). *Hyptis verticillata* is also used in treating culturally specific, traditional illnesses found in the region such as *mal de ojo* (evil eye) and *mal aire* (bad wind), that manifest in a known set of symptoms that must be addressed with explicit cures. In addition to this tradition within native populations in the region, the plant is also used by Afro-Caribbean populations both in Belize and **Costa Rica** who call it John Charles. In Costa Rica the leaves and inflorescences are used as an infusion to treat gastrointestinal colics (Pittier 1978) and Afro-Costa Ricans use a concoction to treat colds.

In **Honduras** the leaves, freshly crushed in water, are used for stomachache and indigestion. Boiled leaves are employed to relieve backache, for colic and general aches and pains, by heating the leaves and rubbing them on aching areas. A poultice of hot leaves is also used to relieve toothache. In cases of arthritis, the affected areas are bathed in a liquid of boiled leaves, the minced fresh leaves are applied as a poultice for herpes, and headaches are treated by bathing the head with the liquid from boiled shoots. The macerated shoots are also prepared as part of a syrup, and are used to treat coughs, influenza, colic and fever. For this latter condition, the leaves are cooked and baths taken daily. Fresh, crushed leaves are also tied to wounds to stop bleeding (House et al. 1995).

In **Nicaragua** the fresh leaves are used externally as an aphrodisiac, and a decoction of the root is used for abdominal pains and as to stimulate gastric and liver functions (Grijalva 1992; Dennis 1988). In **El Salvador** the leaves, stem and roots are cooked for fevers, as a diaphoretic as well as to calm the nerves and for coughs (De Mena 1994). In **Belize** the branches are used to treat asthma, coughs, colds, and fever, and the boiled root is used in cases of gastric acidity (Arvigo and Balick 1998). In Cuetzalán, **Mexico**, Martinez et al. (2001) indicate its use in treating catarrh, colds and watery discharges. A small tamal made with the leaves is heated and placed on the affected area. It is also used to treat bad wind (*mal aire*) in children, a culturally specific condition perceived to result from the spirit of a dead person, wandering souls, or evil air or wind from the rainforest or from water.

Pharmacology and Biological Activity

The minced plant is placed in chickens' nests to repel fleas (Morton 1981). The methanolic extract (20 g/ml) is active against *Pseudomonas aeruginosa* and shows weak antibacterial activity against *Bacillus subtilis, Escherichia coli, Staphylococcus aureus,* and *Candida albicans* (Rojas et al. 1992). The aqueous extracts of leaves and stems shows cytotoxic activity against the leukemia P1534 cell line (Gupta 1995), and rosmarinic acid found in the aerial parts extracts shows significant capillary stabilizing effects (Kuhnt et al. 1995).

Toxicity

The aqueous extract of this plant shows toxicity toward some human cell lines, suggesting that it may be of toxicological relevance in cases of internal application (Kuhnt et al. 1995).

Conservation Status and Trade

This species is a wild, weedy shrub widely distributed throughout the American tropics. In Mexico it is considered to be fairly abundant, and its consumption is usually domestic. There are no references to its conservation status on CITES' lists.

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Jatropha curcas L.

Synonyms
Castiglionia lobata Ruiz & Pav., *Curcas purgans* Medic., *Jatropha moluccana* Wall.

Family
Euphorbiaceae

Common Names
piñón, coquito, coquillo, tempate (**Costa Rica**); piñón, pitana, cahuax, axti (**Nahua, Mexico**); physic nut (Belize); piñon, coquito, piñoncillo, sakilté (**Guatemala**); piñon, yupur (**Honduras**); tempate, coquito, piñón, tártago (**El Salvador**); tempate, piñon (**Nicaragua**); coquillo (**Panama**); piñón, piñon botija (**Dominican Republic**); medsiyen (**Haiti**); jaquillo, piñon de purga, purga (**Colombia**); yita ti rebetive (**Yurucaré Indians, Bolivia**), piñon (**Bolivia**); piñon, piñol, piñoncitos, piñon blanco (**Peru**); purging nut (**English**).

Description
Small tree growing to 6 m in height, with spreading branches and milky white or yellow latex in stems. Leaves deciduous, 6–40 cm long by 6–35 cm wide, alternate, or in dense terminal groupings, ovate and heart-shaped at the base. Flowers yellowish, bell-shaped, 6 mm wide. Fruits green, capsules oval and smooth, 2.5–4 cm long, turning black when dry.

History and Traditional Use
Jatropha curcas L., known as cahuax and axti in Nahuatl, is a shrub native to the dry regions of the American tropics used for its medicinal properties, for fuel and as a food. In Mexico seeds are roasted or when they are mature and black they are put in the sun to dry, ground and added to beans, or pipián, a vegetable of the family Cucurbitaceae. Recent chemical studies have identified the presence of curcin and phorbol, toxic substances known as toxalbumins, derivatives of 12–deoxy–16–hydroxy phorbol. These are present in the seed and the latex, but lose their toxicity when the seeds are roasted (Van Wyk, Van Oudtshoorn, and Gericke 1997). This is an excellent example of how native populations have learned to safely exploit potentially dangerous plants. In Bolivia *J. curcas* is known as yita ti rebetive by the Yuracaré Indians in Bolivia who use it for treating cuts and wounds, as in other parts of the tropics (Thomas and Vandebroek 2006). In Central America there is evidence of the piñon having been used in the past as a fuel to illuminate homes, due to the presence of fatty oleic, linoleic, arachidic, myristic, palmitic, and stearic acids, and interest is currently being shown in the production of biofuels from this plant (Gupta 1995; Duke 1983).

In **Costa Rica** the extract and the lactic secretion of the leaves and stems have been used topically to treat hemorrhoids, ulcers, herpes and other skin infections. The leaves are applied as a poultice to alleviate inflammation of the spleen and erysipelas, and as a galactogogue. The fresh seeds are used in small doses for their emetic and purgative properties, although their indiscriminate use can result in symptoms of poisoning (Núñez 1975; Pittier 1978).

While Arvigo and Balick (1998) refer to its use in **Belize** for mouth wounds, gum or throat problems, urine retention, back pain and arthritis, a much wider range of uses is reported in **Guatemala**. A decoction of the leaves is used topically with compresses to treat fever and catarrh; it is taken orally for the treatment of gastrointestinal infections, cataracts, venereal diseases, toothache, eczema, erysipelas, gonorrhoea, gout, leprosy, neuralgia, malaria, paralysis, sunburn, and

rheumatism. The fresh leaves are used in the treatment of wounds, swellings, burns, ulcers and jaundice. The latex of the stem and leaves is slightly rubefacient and antiseptic, and is used topically to treat gingivitis, wounds, fractures, hemorrhoids, herpes, sores, insect bites, burns, ulcers and warts; as well as for gargles and as a mouthwash to treat mouth infections and swollen tongue, toothache, and leprosy. The oil from the seed is used to treat fractures, gout, burns, and toothache. A decoction of the bark is used to treat colic and to stimulate the appetite. The leaves and the bark are said to have cathartic properties, to reduce swelling, as an anti-inflammatory, stomachache, narcotic, galactogogue, for tooth problems, and to heal wounds; the seeds are said to possess cathartic-emetic properties; and the latex has healing, anti-inflammatory, hemostatic, and wart-healing properties (Morton 1981; Cáceres 1996).

In **Honduras** House et al. (1995) report on its use for wounds in the mouth, spots, bruises, to stop bleeding, to clean wounds, and as a purgative. The latex is applied directly to wounds and the liquid from boiled bark is used to bathe spots on the skin. In **El Salvador** it is known to have various therapeutic uses; the latex is used for rashes in the mouth and against hemorrhoids; the leaves are used to heal wounds acting as a hemostatic and are a powerful purgative (De Mena 1994). In **Nicaragua** it is used to treat mouth infections, blisters and spots on the lips (Ministerio de Salud 1987), and is also used as a mouthwash (a teaspoon of latex in two ounces of water) and on the lips. In **Panama** it is used to treat infected wounds, ulcers and indigestion. Several leaves are boiled and the resulting decoction is used to wash infected wounds. The plant is used as a laxative and the latex is a hemostatic used to cure hemorrhoids and burns. A poultice or decoction of the leaves is used for external ulcers, and internally for jaundice (Duke 1983; Gupta 1995).

In **Mexico** the latex is traditionally used to treat excoriations around the mouth (Martínez et al. 2001) while in the **Dominican Republic** the plant is used to treat *buccal candidiasis*, applying the sap (latex) topically (Germosén-Robineau 2005). In **Peru** the latex is mixed with water for stomach ulcers, the leaves are employed as a poultice for healing wounds, and the latex is also applied in the treatment of hemorrhoids and burns (Brack 1999). In **Bolivia** the seeds are peeled, roasted and mixed with food to eliminate stomach parasites. The resin and leaves are applied as a poultice to be changed three times a day to heal wounds. The dried and minced leaves are likewise applied as a poultice to wounds, and are also used for other purposes (Thomas and Vandebroek 2006).

Pharmacology and Biological Activity

While, according to Cáceres et al. (1990) *in vitro* studies of anti-bacterial activity show that the alcoholic maceration of the leaves has no effect on five diarrhea-causing entero-bacteria, Cáceres (1996) subsequently reported that the ethanolic extract of the roots and leaves does show activity against *Staphylococcus aureus, Streptococcus pyogenes,* and *Streptococcus viridans*, but not against *Streptococcus pneumonidae, Corynebacterium diphtheridae, Cryptococccus neoformans, Histoplasma capsulatum, Trichosporon cutaneum, Trichophyton rubrum, Microsporum nanum,* and *Madurella mycetomy.* Chloroformic and ethanolic extracts of the leaves and stems have been shown to be active against the P388 lymphocytic leukemia cell line with a 12.5 mg/kg dose (Hufford and Oguntimein 1978). Cáceres (1996) also shows the ethanolic extract potentiates the action of barbiturates and shows diuretic activity, and Gupta (1995) reports the methanolic extract of the root showing anticonvulsive activity against metrozole-induced convulsions. A clinical test using the latex of the plant among 30 patients with warts on upper extremities showed a total cure (100%) in all patients, being an improvement on the treatment of choice, liquid nitrogen. The activity of latex appears to select warty tissue, and it is suggested that it acts by chelation of the infected tissue (Germosén-Robineau 2005). The anti-inflammatory activity of the root extract has been demonstrated in mice and rats by Adesina (1982). It has been determined that the plant's latex shows pro-coagulant and anti-coagulant activity, depending on the dilution level. Pure latex reduces the coagulation time of human blood, while diluted preparations prolong the time taken to coagulate, and in the case of highly diluted preparations there is no coagulation whatsoever. It is thus advisable to apply pure resin when healing wounds (Thomas and Vandebroek 2006). Finally, according to Grainge and Ahmed (1988) the leaves and roots show activity against phytopathogens such as Aulacophora foveicollis, *Lipaphis erysimi,* termites, mosquitoes, the housefly, and snails.

Toxicity

The aqueous extract of the fresh seed solution administered intraperitoneally (5 mg/kg) to mice, caused death in three days. The toxic effects of the seed are attributed to curcine and the resin-sterolic complex (Germosén-Robineau 2005). Pure (100%) latex was instilled in the lower conjunctival sac of nine rabbits, using the Draize occular irritancy test. No microscopic lesions were found either in the cornea or the iris; slight conjunctival inflammation appeared between 1–4 hours in four rabbits, but disappeared within 24 hours (Germosén-Robineau 2005). Oral administration of different extracts were given to pregnant rats for varying periods of time and a pregnancy-terminating effect (arbortifacient effect) was observed, especially using the fruit extract (Goonasekera et al. 1995).

Conservation Status and Trade

This is a small tree easily reproduced from seed and cuttings used for living fences, and thus common in the region. In Mexico it is considered to be quite abundant while it is frequently found forming such fences in the north Pacific and central regions of Costa Rica, but is not commonly found in the wild. Fruit production in the humid tropics is rare. There are no germplasm banks, and its conservation status is undetermined. Current interest in the commercialization of this species is related to the production of oil from its seeds, which is used as a biofuel in Mexico.

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Semillas Sagradas in Action

Ruth Goldstein teaching a group of local students in the Sacred Seeds Sanctuary

Rafael Ocampo and Ruth Goldstein discuss plant preparations

Doctors James Duke and Michael Balick

Jatropha gossypiifolia L.

Family
Euphorbiaceae

Common Names
frailecillo, casaba marble (**Costa Rica**); hierba de fraile, frailecillo, sube y baja (**Honduras**); hierba del fraile (**El Salvador**); purga del fraile, frailecillo, quelite de fraile (**Nicaragua**); tuatúa, frailecillo, san juan del cobre (**Cuba**); piñón (**Bolivia**); piao roxo (**Brazil**); frailecillo, frailejón, purga de fraile, jaquillo, higuerilla, túa-túa (**Colombia**); piñon, piñón negro, piñon rojo, piñon colorado (**Peru**); frailecillo, tua-tuá (**Venezuela**); black physic nut (**English**).

Description
Annual shrub with branched stalk, 6–10 m high. Leaves with 3–5 blades or lobules, pubescent, glabrous beneath or smooth; obovate. Inflorescence monoecious, male flowers in the upper part of apex, 5-lobed corolla calyx, 5 free petals; corolla double the length of the calyx, dark purple; feminine flowers in the low subdivisions of the apex. Fruit an ovoid or subglobose capsule approximately 1 cm in diameter, seeds oval-elongate, yellowish, with brown marks 1.3 cm long by 5 mm wide.

History and Traditional Use
As a whole, the family Euphorbiaceae contains toxic compounds in the tissues, particularly in the sap. The genus *Jatropha* includes an important group of species used for medicinal purposes, although organs such as the seed have oils that can be toxic in high doses. In Honduras and Costa Rica the plant known as rhubarb (*Jatropha podagrica* Hook) that is used as a purgative, is not the real rhubarb (*Rheum officinale* Baill.) which is also used for its laxative effect and as a flavorsome food. The frailecillo, as it is known in Costa Rica, is a plant widely exploited traditionally in Latin America and the Caribbean, with references to its use dating back to the eighteen hundreds (Morton 1981). Two varieties are found in Costa Rica: one with green leaves and another with brown leaves. In Brazil, batata de tiú (*Jatropha elliptica* (Pohl) Müll.), of which the root is used, is native to the Cerrado-Pantanal geographic region where it is endangered by the uncontrolled harvest of wild populations.

In **Costa Rica** it is taken as an infusion, its leaves being used as a depurative of the blood in the case of venereal disease and to treat gastrointestinal ulcers and colic; the leaves and seeds also have purgative and emetic properties. The bark also serves as a depurative (Nuñez 1975; Ocampo and Maffioli 1987). In **Nicaragua** a decoction of the leaves is used for kidney problems, anemia, and colic (Grijalva 1992). In **Honduras** the leaves, bark and the whole plant are used for diverse illnesses such as rheumatism and swellings, for which boiled leaves are used as a poultice; the leaves are boiled with cinnamon bark to stop vomiting (House et al. 1995). In **El Salvador** 6-8 leaves are boiled in water and a cup of the infusion is taken twice daily as a purgative, diuretic, and against colic (De Mena 1994).

In **Cuba** a decoction is made from boiled leaves and taken orally for digestive and respiratory problems, kidney diseases and for diabetes, and it is also used to treat arthritis (Roig 1984). In the **Dominican Republic** a decoction of leaf buds mixed with other plants is taken orally to treat diarrhea, the leaf being used to treat anorexia and heal wounds (Gupta 1995). In **Bolivia** the roasted seeds are crushed and mixed with food to eliminate internal parasites, and as a purgative. Three to four seeds are recommended for adults, being careful with the dosage due to toxicity of the seed (Thomas and Vandebroek 2006). In **Peru** the seeds are used as a laxative, the crushed leaves are applied as a poultice for headache as well as for abcesses, and the latex is applied topically to treat skin fungus (Brack 1999).

Pharmacology and Biological Activity

The extract exhibited hypoglycemic activity *in vitro* and *in vivo* in rats treated with dexametasone (a sugar) (Llanes et al. 1988, quoted by Gupta 1995). Ethanolic root extracts (95%) have shown anti-tumoral activity in the tumor mice cell lines P388 leukemia, 180 sarcoma (S180), WM 256 Walker's carcinoma, and Lewis' pulmonary adenocarcinoma, attributable to jatrophone; the ethanolic root extracts also show *in vitro* cyctotoxic activity (Kupchan et al. 1970, quoted by Gupta 1995). The stems show antimicrobial activity against *Escherichia coli* (Chopra et al. 1986, quoted by Gupta, 1995). The whole plant demonstrates its effect as a molluscicide against *Bulinus globules*, with Adewunmi and Marques (1980) showing the molluscicide activity of methanolic extracts of the fruit and root.

The ethanolic extract of the leaves shows activity as a central nervous system depressant when administered intraperitoneally with slight anti-convulsive action in mice with Metrazol-induced convulsions. The ethanolic extract of the root administered intraperitoneally has an antagonizing effect on strychnine-induced convulsions in mice, while the extract of the leaves is inactive (Adesina 1982).

An aqueous extract (15 µg/ml) of the leaf is active against *Plasmodium falciparum* (Gbeassor et al. 1989). Decoctions of the whole plant have a stimulatory effect *in vitro* on uterine muscle (Poblador 1989, quoted by Gupta 1995).

Toxicity

Contact with the plant can result in severe allergic reactions and the sap can cause dermatitis (Duke 1988). The oil of the seed applied locally *in vivo* results in irritation (Adolf et al. 1984, quoted by Gupta 1995). The in vitro median lethal dose (LD50) of an ethanolic extract using *Artemia salina* as an experimental model was 1.0 mg/ml (Poblador 1989, quoted by Gupta 1995).

Conservation Status and Trade

Distribution of *Jatropha gossypiifolia* is by seed and spontaneously colonizes wasteland and forms colonies along roadsides. There are no references to its conservation status, but its broad distribution and abundance in dry and humid regions suggests that it is not endangered. The plant is not commercialized in the tropics.

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Justicia pectoralis
Jacq.

Synonyms
Dianthera pectoralis (Jacq.) J.F. Gmel., *Dianthera pectoralis* (Jacq.) Murray, *Ecbolium pectorale* (Jacq.) Kuntze, *Psacadocalymma pectorale* (Jacq.) Bremek., *Rhytiglossa pectoralis* (Jacq.) Nees, *Stethoma pectoralis* (Jacq.) Raf.

Family
Acanthaceae

Common Names
tilo, tilo criollo, fresh cut, cerebril (**Costa Rica**); santa marta (**Honduras**); té criollo, tila, tilo, carpintero (**Cuba**); zeb chapantyè (**Dominica and Martinique**); carpintera (**Dominican Republic**); chapantye (**Haiti**); azul, cuya-cuya, patco (**Peru**); curía, curía blanca, curía morada, yerba del carpintero (**Venezuela**); fresh cut (**English**).

Description
A perennial herb, growing to 40–70 cm. Leaves opposite, entire, with short petioles, lanceolate, 3–10 cm long by 1–2 cm wide. Terminal inflorescence attaining a length of 25 cm with numerous small, 8–12 mm long, tubular white, lilac or pink-colored flowers. Fruit a mallet-shaped capsule, 7–8 mm long with spherical seeds 1.5 mm in diameter.

History and Traditional Use
There is a tree known as tilo (*Tilia europeae* L.) that is widely used to treat nervous illnesses throughout the world. In America, a native herb, *Justicia pectoralis*, with the same common name and usage, is obtained from tropical forests and used as a substitute for the European tilo. Its recorded use dates back to the nineteenth century, being cited in *El Médico Botánico Criollo*. Roig (1989) refers to *Justicia pectoralis* being used in Cuba as a substitute when its supply became scarce during the Second World War. In Costa Rica's Caribbean region, Afro-Costa Ricans have been using the fresh cut plant for many years to treat nervous conditions. According to Morton (1981) this plant is also widely used in Jamaica, Martinique, Guadeloupe and throughout the West Indies. The same common name is given to *Justicia comata* (L.) Lam. by Afro-Costa Ricans, which is morphologically very similar to *J. pectoralis*.

Morton (1981) also refers to *Stenophylla*, a variety of *Jatropha pectoralis* used by indigenous groups in traditional ceremonies along the Orinoco and Río Negro rivers of the Brazilian Amazonia, together with another hallucinogenic plant, *Virola elongata* (Benth.) Warb. of the Myristicaceae family. Although the *Stenophylla* variety is also found in Costa Rica, where it is characterized by growth in the form of a rosette, it is not used traditionally. The distinctive smell given off by the dried leaves is due to the presence of chemicals known as coumarins.

In **El Salvador** the plant *Justicia carthaginensis* Jacq., known as shock plant (*hierba del susto*), is used in the treatment of shock, anxiety, and stress.

In **Costa Rica** a decoction of shoots of Justicia pectoralis is taken orally as a tranquilizer. The boiled leaves are recommended for bronchial catarrh (Ocampo and Maffioli 1987). According to Roig (1989) its most common use in **Cuba** is as a sedative to calm the nerves, although it is also used as a pectoral to treat chest congestion, colds, and coughing.

In **Venezuela** Gupta (1995) refers to its use as an astringent, a pectoral, a sedative, and to stop bleeding of the urinary tract and the womb. For external treatment, a poultice can be made from the leaves to heal wounds. A decoction of the root is said to promote menstruation; infusions are used for diseases of the liver, for gout and rheumatism; and the tender stems and flowers are used to treat influenza and colds.

In **Honduras** the boiled leaf, stem and flower are used to treat stomachache, coughs and fevers (House et al. 1995), while in **Peru** the plant is used medicinally as a febrifuge with the leaves used to prepare a bath and wash the patient (Brack 1999).

Pharmacology and Biological Activity

The cumarin compound extracted from the plant shows activity as an anti-inflammatory, a sedative, a spasmolytic, a smooth-muscle relaxant, and a hypotensor; it is also chronotropic and assists healing. The γ-aminobutyric acid that is isolated from the leaf of the plant is considered to be a strong neurotransmitter due to its capacity to alter neuronal discharge, and depress activity of the central nervous system. The sedative or tranquilizing effect of 120–240 ml of a 40 g/l decoction of fresh aerial parts of the plant administered orally, and the infusion (25% of the above dose) of dry aerial parts, have been demonstrated in clinical trials (Germosén-Robineau 1996).

Toxicity

This plant is known to contain hepatotoxic coumarins, although there are no reports of toxicity that can be attributed to the presence of these particular substances. Reference is also made to a study that involved a decoction of 2,889 kg of fresh aerial parts to 7,850 l of distilled water that was lyophilized and administered orally (5 g/kg/day/5 days) to Swiss mice of both sexes that caused no deaths or noticeable signs of toxicity (Germosén-Robineau 2005).

Conservation Status and Trade

This is a native plant common in tropical forest understory throughout the Americas, growing in sites with moderate shade (Ocampo and Valverde 2000). There are no references to its conservation status. It is easily reproduced through cuttings, and is cultivated in Costa Rica and sold at local markets as well as to industry for the production of tisanes.

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Lippia alba
(Mill.) N.E. Br. ex Britt. & Wils.

Synonyms
Lantana alba Mill., *Lantana geminata* (H.B.K.) Spreng. *Lantana lippioides* Hooker & Arm., *Lippia asperifolia* A. Richard, *Lippia citrata* Chamisso, *Lippia geminata* HBK, *Lippia geminata* var. *microphylla* Griseb., *Lippia havanensis* Turczaninow, *Lippia panamensis* Turczaninow, *Verbena odorata* (Persoon) Steudel, *Zapania lantanoides* Lamarck, *Zapania odorata* Persoon

Family
Verbenaceae

Common Names
juanilama, mastrante, cap mint (**Costa Rica**); salvia real, hierba del negro, mirto, hierba buena, salvia betónica (**Mexico**); salvia sija, salvia santa (**Guatemala**); juanilama, salvia santa, orégano de monte (**Honduras**); juanislama, rondana, salvia santa, orégano de monte (**Nicaragua**); mastranto, orozul (**Panama**); quita dolor, menta americana, poleo, salvia americana, toronjil americano, toronjil isleño (**Cuba**); brisée, lamerik (**Martinique**); tushiri (**Yuracaré Indians, Bolivia**), toronjil (**Bolivia**); alecrin do campo, falsa melissa, erva-cidreira, cidreira capin, salva limao (**Brazil**); pronto alivio, cidrón llanero, orégano de cerro, quita dolor (**Colombia**); yantría (**Ecuador**); cidra, cidraero, pampa orégano, hierbaluisa, salvia (**Peru**); Santa María, toronjil, malojillo extranjero, poleo (**Venezuela**); licorice verbena (**English**).

Description
An aromatic, perennial shrub reaching 2 m in height, with woody stems and long, curving branches. Leaves opposite, 2–8 cm long, finely dentate on the margins and with a rough texture. Flowers solitary, one to each axil, pale lilac or white in color with a purple corolla. Fruits small, dark violet, partially inserted within the calyx.

History and Traditional Use
When considering the chemical composition of a specific medicinal plant in the tropical regions one usually expects there to be a degree of chemical homogeneity among plant populations across the species. However, in the case of juanilama (*Lippia alba*) there are important variations in the characteristics of its essential oil throughout its geographic distribution. This species has specific chemotypes (chemical varieties) within the same geographic region which are also influenced by climatic variation – such as temperature, luminosity, and relative humidity – and the altitude at which the plant is found, as well as the structure, composition, pH, humidity, etc. of the soil. For example, the composition of oil of the myrcenone chemotype in Guatemala, Argentina, and Costa Rica varies with differences noted between oil from Guatemala's northern subtropics, the southern subtropics in Argentina, and Costa Rica's dry tropical regions. There is a higher percentage of myrcenone in the Guatemalan and Argentinian oils (37.8–58.2% and 34.2–47.1% respectively) than in the Costa Rican oil (12.9%) (Morton 1981; Fischer et al. 2004; Ricciardi et al. 1999; Cicció and Ocampo 2004).

In a study carried out by Nagao et al. (2004) in Pentecoste in the state of Ceará, Brazil, seasonal differences were found in oil production, with more being produced in the dry rather than the wet periods. Comparative studies were also carried out on the harvesting schedule, with a higher percentage of citral and limonene oils being observed when harvesting took place at 3:00 p.m. In **Costa Rica** an infusion of the leaves and inflorescences has been used as a gastrointestinal sedative. It is also used as an anti-spasmodic for hepatic colic and as a sudorific, expectorant, and emmenagogue. The alcoholic extract of the plant is used in combating the common cold (Nuñez 1975; Ocampo and Maffioli 1987; Ocampo, Martínez, and Cáceres 2007).

In **Panama** Gupta (1995) reported an infusion of *Lippia alba* leaves being used for digestive disorders and as an anti-spasmodic for hepatic colic. A tea made from this plant is used to treat coughs and for colds. In **Nicaragua** the plant is used to treat a variety of ailments, including cough, fever, stomachache, pains in the chest, arthritis, hepatic colic, insomnia, and skin infections (Floripe 2000).

In **Guatemala** Cáceres (1996) cited cooked leaves and flowers being used to treat liver, gastrointestinal and respiratory problems, insomnia, venereal diseases, diseases of the skin and mucous membranes, vaginal discharge, hangover, arthritis, muscular pains and toothache, hypertension, and during birth. The crushed leaves are also inhaled to promote sleepiness, and the alcoholic extract is used in frictions for colds and congestion of the respiratory tract. Antiseptic, astringent, emmenagogic, spasmolytic, stomach-related, expectorant, febrifugal, pectoral, and sudorific properties are also attributed to the plant.

According to House et al. (1995), the plant is used in **Honduras** as a remedy for colds and congestion of the respiratory tract, for coughs, and to reduce fever; and García-Barriga (1975) mentions its use in **Colombia** as a sedative, for diabetes, as a diaphoretic, an emmenagogue, for digestive problems, and as a spasmolytic. While the leaves crushed in alcohol are used for earache in **Mexico** (Martínez et al. 2001), in **Bolivia** the boiled leaves are used for diarrhea, stomachache, and vomiting (Thomas and Vandebroek 2006).

In **Peru** an infusion of the leaves is used for gastric relief of vomiting and against colic, for diarrhea, flatulence, menstrual pains, infections of the respiratory and urinary tracts, influenza, and coughs (Brack 1999). In **Brazil** Gilbert, Pinto, and Ferreira (2005) mention the leaves being used for their soothing properties, as a digestive and for colic; while according to Germosén-Robineau (2005) in **Martinique**, the fresh leaves are used to make a decoction that is taken orally to treat influenza.

Pharmacology and Biological Activity

The cytotoxic activity of 50% ethanolic extracts administered intravenously in dogs has been established by Gupta (1995); and according to Cáceres et al. (1987) the essential oil of the leaves shows activity against *Trichophyton mentagrophytes*, *Candida albicans,* and *Neurospora crassa*, and a tincture of the leaves has shown antimicrobial activity against *Staphylococcus aureus*. *In vitro* antibacterial studies indicate that an alcoholic maceration of the leaves shows activity against *Staphylococcus aureus, Streptococcus pneumoniae, Streptococcus pyogenes* and *Salmonella typhi* (Cáceres, Samayoa, and Aguilar 1990). Some of the analgesic activity commonly attributed to this plant is perhaps a result of the essential oils present. The useful effect noted in digestive disorders might also be due to the essential oils' moderate irritant effect within the stomach and the buccal cavity causing a warm sensation and salivation, which is why it is used as a carminative, for digestive discomfort and for colic (Gupta 1995). The high camphor content of the essential oil in this genus and the fact that it has been used as an expectorant could be the basis of its popular use in the treatment of respiratory problems (Martindale 1982, quoted by Gupta 1995). Gupta (1995) also indicates that an aqueous infusion of the leaves has no sedative or hypnotic effect in mice, but that the plant's astringent and antiseptic activity justifies effective post-partum use. According to Grainge and Ahmed (1988) leaves have shown activity against phytopathogenic fungi and insects that attack stored grains.

Sara Newmark working with the four chemotypes of this species in the garden

Toxicity

No mortality is noted in mice treated with doses above 67 g/kg of an infusion of leaves and flowers (Cáceres 1996). Similarly, Germosén-Robineau (2005) reports on the lyophilized aqueous extract obtained from a decoction of fresh leaves, and administered orally (5 g/kg/day for 5 days) to 10 NGP mice (5 males and 5 females), causing no deaths or signs of toxicity in the evaluated parameters during the experiment; and alcoholic extract (50%) of the leaf administered intraperitoneally in mice resulting in a LD50 >1 g/kg.

Conservation Status and Trade

This plant is cultivated for trade within the region (Ocampo and Valverde 2000).

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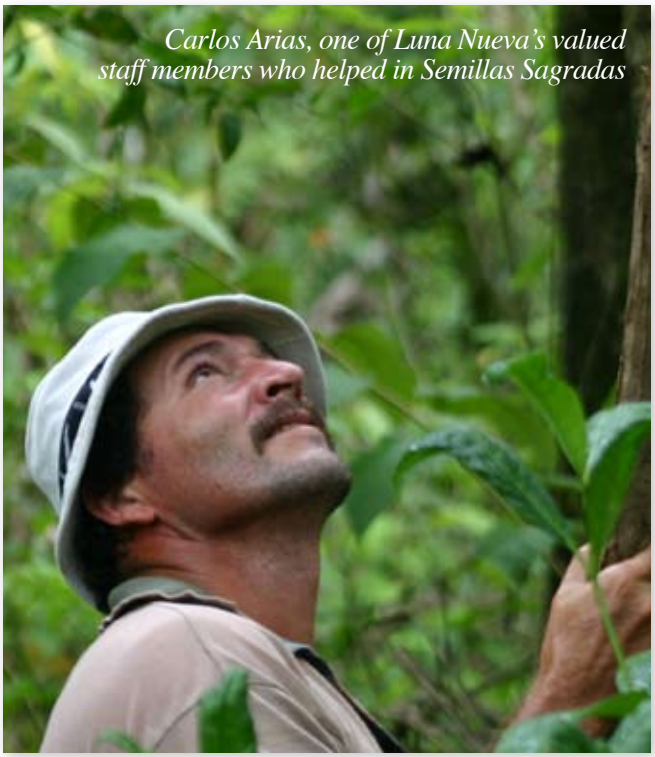
Helping to Build Semillas Sagradas

Steven Farrell teaching about the roots of the Sarsaparilla



Carlos Arias, one of Luna Nueva's valued staff members who helped in Semillas Sagradas

Valued staff members who helped in Semillas Sagradas: Jose Luis Muñoz, Lindor Vega, Luis Arias, Leonardo Montero, Juan Carlos Muñoz

Ruth Goldstein and Rafael Ocampo

Lippia graveolens H.B. & K.

Synonyms
Goniostachyum graveolens (Kunth) Small, *Lantana origanoides* M. Mart. & Galeotti, *Lippia berlandieri* Schauer

Family
Verbenaceae

Common Names
orégano, wild marjoram (**Costa Rica**); oro vegetal, orégano mexicano, salvia real (**Mexico**); orégano castillo (**Belize**); orégano de monte, mejorana (**Guatemala**); orégano, oreganillo, orégano finito (**Honduras**); orégano (**El Salvador**); orégano menudo, oreganito (**Nicaragua**); oregano (**English**).

Description
A shrub growing to 2 m, with short, hairy branches. Leaves opposite, 1.5–4 cm long by 0.5–3.5 cm wide with dentate edges. Flowers white and fragrant. Leaves have an aromatic smell due to the presence of essential oils.

History and Traditional Use
Oregano is the name used when referring to a variety of aromatic spices with essential oils, found primarily in their leaves. There is thus considerable confusion with the common name oregano and the broad variety of species it represents. True oregano (*Origanum vulgare* L.) is a European species, the name originating from the classical Greek *origanon* possibly from the Greek *oros* "mountain", and *ganos* "beauty, brightness, ornament and delight", referring to the bright color of its inflorescences, and *vulgare* due to its common ocurrence, and the Latin *origanum*. This species was introduced into the Americas and grew satisfactorily in cold and temperate climates, but did not survive naturally in tropical regions. Several species native to the Americas, with essential oils in their leaves that contain similar chemicals to the true oregano, have thus been given the same name. *Lippia graveolens*, found in dry regions of Mexico and Central America, is the most important and widely used. *Lippia micromera* Schauer found in the West Indies, Venezuela, and Guayana, is traded as a spice in the Dominican Republic. This demonstrates the rich biological diversity and uses to which the plant is put in the tropics, and how plants with similar secondary metabolites are put to similar uses (Pahlow 1979; Morton 1981; Cáceres 1996; Ocampo, Martínez, and Cáceres 2007).

According to Nuñez (1975), Ocampo and Maffioli (1987), and Segleau (2001) it is used in **Costa Rica** to treat gas, to calm the nerves, relieve insomnia and menstrual pains, and to cleanse the womb after childbirth. It is also effective against asthma and other bronchial problems such as coughs. Germosén-Robineau's (2005) survey refers to the leaves being used as an expectorant for bronchitis.

Morton (1981) and Gupta (1995) report that in **Mexico** the whole plant is used as a decoction as an emmenagogue and expectorant, while a decoction of the leaves is used to induce menstruation, as an anti-tussive and as a condiment.

In **El Salvador** it is used for swellings and for stomachache, the leaves being boiled with salt and applied locally for spasms and to reduce swelling; and water from a decoction of the leaves being taken orally for stomachache (De Mena 1994).

According to Floripe (2000) a spoonful of the leaves boiled in milk is used to treat asthma and bronchitis in **Nicaragua**; an infusion of the leaves is also used for swellings and stomachache, while the leaves, macerated in alcohol, are applied externally to treat rheumatism. House et al. (1995) report on the plant being used for respiratory problems such as asthma, bronchitis, catarrh, cough and whooping cough in **Honduras**; and Arvigo and Balick (1998) note that the plant is highly respected for its medicinal uses in **Belize**, where it is also used as a tea for respiratory infections and to induce menstruation. Finally, Cáceres (1996) indicates its use as an antiseptic, carminative, expectorant, pectoral and sudorific in **Guatemala**.

Pharmacology and Biological Activity

The ethanolic and aqueous extracts of the whole plant have no inhibitory activity towards *Staphylococcus aureus* and *Escherichia coli* (Gupta 1995). The tincture and the infusion of the leaf (2 mg/ml) show activity against the growth of *Escherichia coli*, *Enterobacter aerogenes, Pseudomonas aeruginosa, Staphylococus aureus, Salmonella typhi, Shigella flexneri, Streptococus pneumoniae,* and *S. Pyogenes* (Mendoza 1995, quoted by Cáceres 1996). The decoction (30 mg/ml) demonstrates anti-protozoal activity against *Giardia intestinales,* while a 10% tincture of the dry leaf *in vitro* (1 mg/ml) shows activity against *Plasmodium falciparum* and *Leishmania mexicana* but not against *L. brasilensis* (Germosén-Robineau 2005).

Toxicity

Germosén-Robineau (2005) report that the lyophilized aqueous extract (decoction) of fresh leaves and stems was administered orally in a single dose of 5g/kg/day/5 days, to ten Swiss mice (5 male and 5 female). Observation of the animals continued for seven days after terminating administration, and indicated there was no mortality or sign of acute toxicity within the evaluated parameters.

Conservation Status and Trade

While the leaves of *L. graveolens* have been commercialized in Central America by the ton as a spice, there is less trade as an herbal drug, although tinctures are to be found at herb markets (Ocampo and Valverde 2000; Ocampo, Martínez, and Cáceres 2007).

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Malachra alceifolia Jacq.

Synonyms
Malachra alceifolia var. *conglomerata* (Turcz.) Hochr., *Malachra alceifolia* var. *rotundifolia* (Schrank) Gürke, *Malachra conglomerata* Turcz., *Malachra fascinata* Jacq., *Malachra hispida* Sessé & Moc., *Malachra rotundifolia* Schrank, *Urena capitata* var. *alceifolia* (Jacq.) M. Gómez

Family
Malvaceae

Common Names
malva (**Costa Rica**); malva mulata (**Cuba**); malva, kwala tumat (**Cuna indians, Panama**), borraja (**Panama**); borraja, malva montera (**Colombia**); malva (**Ecuador**); malva, maraba (**Shipibo-Conibo Indians, Peru**); malva (**Venezuela**).

Description
Shrub 1–3 m in height, with branched stems. Leaves three-lobed, 4–8 cm long by 3–5.8 cm wide, with dentate margins. Flowers yellow, surrounded by bracts, petals 1.5 cm long. Seeds brown, 2.5 mm long.

History and Traditional Use
A plant of impressive appearance, commonly known as malva, this wild species forms colonies in warm humid tropical habitats with plenty of light. It is a highly attractive plant due to its abundant yellow flowers. In cold tropical regions other medicinal plants belonging to the family Malvaceae are also known as *malva*. Plants referred to as malva are generally known for the mucilage found in the tissue of the majority of the species within this family (Trease and Evans 1988). Europeans introduced various species of malva, such as *M. silvestris* L. and *M. parviflora* L., to the Americas and which now have a range from Mexico to Chile. These are the most widely distributed species in the temperate tropics traditionally used for medicinal purposes, the leaves of which are crushed in water and used to "refresh" the stomach. *Malva silvestris* is the most important species in this genus on the world market and is cultivated for its red flowers in subtropical regions.

García-Barriga (1975) reports on a decoction of the whole plant being used as an emollient in compresses for bruises and contusions in **Colombia**, as well as to reduce swelling by bathing sores, wounds and some skin infections, and as a gargle to reduce the swelling of tonsils.

In **Costa Rica** Segleau (2001) reports on the leaves being macerated in water and used as an emollient and to refresh the stomach. According to Brack (1999) its leaves are also widely used in **Peru** to prepare an emollient, and to refresh; the juice of the leaves is also used to treat headache and stomachache, while a decoction of the leaves and bark is used as a vaginal douche for seven nights.

Morton (1981) reports on the leaves being used to treat fever, dysentery, and as an emollient in **Venezuela**, while Duke and Vasquez (1994) record an infusion of the leaves being used to treat fever in **Panama**.

Pharmacology and Biological Activity

No studies have been carried out on this species.

Toxicity

No toxicity data has been reported for this species.

Conservation Status and Trade

This is an abundant plant, commonly found on wastelands. It is not commercialized and therefore probably not endangered.

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Doña Juanita, at far right with friend in Semillas Sagradas

Phlebodium decumanum
(Willd.) J. Sm.

Synonyms
Phlebodium aureum (L.) John Smith, *Polypodium aureolatum* H&B, *Polypodium aureum* L., *Polypodium decumanum* Willd., *Polypodium leucotomos* Poir., *Polypodium multiseriale* Stolze

Family
Polypodiaceae

Common Names
calaguala, helecho azul (**Costa Rica**); bear paw fern, calawalla, tallawalla (**Belize**); calahuala (**Guatemala**); calaguala (**Honduras**); calaguala (**Nicaragua**); samambaia (**Brazil**); calaguala (**Colombia**); calaguala (**Panama**); calaguala, huayhuashi shupa (**Peru**).

Description
Epiphytic fern with fronds up to 1.5 m long, with pinnae extending to approximately 75 cm of the total length of the leaf, with brown sori on underside; petiole 10–40 cm long. Stem thick and scaly, covered with orange-colored, translucent scales. Roots are lateral, growing on the stems of trees.

History and Traditional Use
The native peoples of the American tropics use the common name calaguala when referring to various species of ferns belonging to the genus *Polypodium* that they use for medicinal purposes. In Colombia reference is made to the medicinal use of *P. decumanum* and *P. lanceolatum,* while in Peru, reference is made to *P. angustifolium, P. aureum,* and *P. decumanum*.

In Honduras other species such as *Polypodium triseriales, P. fraxinifolium,* and *P. leucotomos*, as well as *P. decumanum* described by Willd in 1810 in Honduras and Guatemala, are known for their medicinal use (Gupta 1995). Morton (1981) refers to *P. atenuatum* in Panama, and to native populations on Chile's Easter Island who use and refer to *P. scolopendria* as matu á pu á.

Although calaguala was the subject of research by the United States National Cancer Institute, and the pharmaceutical company Merck to determine its activity against tumors, both produced negative results (Morton 1981). The plant was, however, the first native, traditionally used Central American tropical species to be the object of systematic scientific research and international commercialization.

In **Costa Rica** Segleau (2001) refers to its use in treating problems of the prostate gland, while in **Guatemala** Cáceres (1996) mentions the rhizome being used in an infusion and being boiled to treat diarrhea and stomachache. According to Brack (1999), in **Peru** the rhizome is applied as a poultice in the treatment of mumps, and is boiled to treat whooping cough. An infusion of the rhizome is used to treat discomfort of the kidneys and urinary infections; and an infusion of the leaves is also used for influenza and the juice of the plant for ulcers of the skin.

In **Colombia** García-Barriga (1975) refers to the use of an aqueous extract of the fronds for secondary accidents of syphilis, while in **Honduras** the rhizome is used in the treatment of a wide range of gastrointestinal problems such as stomachache, constipation, gastritis, and diarrhea; for respiratory illnesses such as asthma, cough, whooping cough; and for the the treatment of arthritis, gout and renal infections (House et al. 1995; Gupta 1995).

In **Nicaragua** Floripe (2000) mentions the rhizome's use for the blood, liver problems, cancer, aching bones, rheumatism and arthritis, gastritis, skin problems, stomachache, backache, and parasites. According to Arvigo and Balick (1998) pieces of the rhizome are cooked to treat stomach ulcers and chronic indigestion in **Belize** where local herbalists recommend its use to lower blood pressure. Taylor (1998) also mentions its use in **Brazil** as a sudorific, an anti-rheumatic, a tonic, and as an expectorant.

Pharmacology and Biological Activity

Extracts have shown to have strong immuno-regulatory activity (Bernd et al. 1995; Rayward et al. 1993; Sempere et al. 1997; Punzon, Alcaide, and Fresno 2003), and may be used for the treatment of immune-response related symptoms such as inflammation (Sempere et al. 1997; González et al. 2000), arthritis (Navarro-Blasco and Sempere 1998), psoriasis (Corrales, Lainez, and Pacheco 1974; Mercadal and Maessci 1981; Capella Pérez and Castells 1981; Del Pino Gamboa, Sambricio Guiu, and Colomo Gomez 1982; Alvarez 1983; Jiménez 1987), vitiligo (Mohammad 1989), atopic dermititis (Jiménez et al. 1987; López and Vargas 1988), herpes zoster (Vargas and Jiménez 1986), recurrent aphthous stomatitis (Bagan et al. 1989), Alzheimer's disease (Alvarez et al. 1997), anti-tumoral effects (Horvath et al. 1967; Manna et al. 2003), and for the treatment of immuno-suppressed patients with, for example, AIDS and cancer (Cáceres 2007).

Toxicity

The lethal dose (LD50) of the extract administered intraperitoneally in rats is 2,800 mg/kg, mice is 3,900 mg/kg, while in rabbits it is 3,700 mg/kg.

Conservation Status and Trade

The calaguala is a native species benefiting from a variety of conservation initiatives in different regions. It is only in Honduras that widespread organic production can be found in the absence of harvesting from wild populations, thus contributing to environmental conservation. In other regions it is not clear from where the raw material is obtained. It is a species that requires evaluation by international bodies to determine its level of vulnerability (Rivera et al. 2000).

Important research has been carried out for the last 20 years to include calaguala as a phyto-therapeutic remedy on regional and international markets. Both the fronds as well as the rhizome can be used for medicinal purposes, which need to have good physical and chemical properties for the preparation of phyto-pharmaceutic products. The fronds are used when they reach maximum development and maturity; this is when they become dark green in color, the sori are visible on the underside, and the spores have been liberated. The plants give off a characteristic smell when the fresh rhizome is actively growing.

Extracts have been commercialized in different pharmaceutical presentations in Guatemala and Honduras since 1990. These include syrups, capsules, granules, tinctures and pure extracts. Other commercialized products include Difur (European Union and Central America), Rapuani (Switzerland), Leucostat (Australia and New Zealand), and EPL (Caribbean). In Europe it is sold under the trade name Exply as a food supplement for patients with cancer and high performance sportspersons. It is promoted via Internet under the brand names of Kalawalla and Immuno–C.

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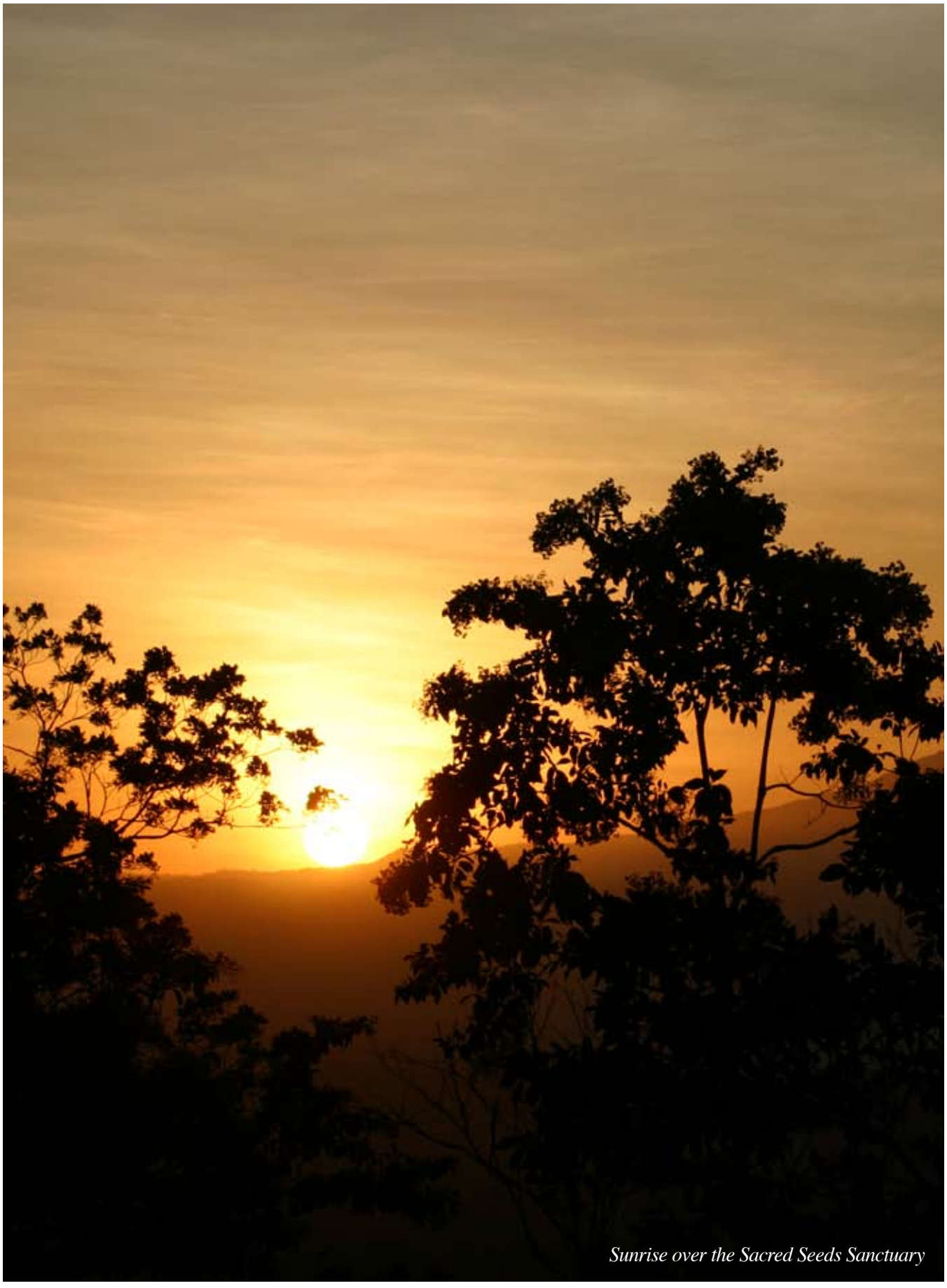

Sunrise over the Sacred Seeds Sanctuary

Psychotria ipecacuanha (Brot.) Stokes

Synonyms
Calicocca ipecacuanha Brot, *Cephaelis ipecacuanha* (Brot.) A. Rich., *Evea ipecacuanha* (Brot.) Standl., *Uragoga ipecacuanha* (Brot.) Baill.

Family
Rubiaceae

Common Names
raicilla, ipecacuana (**Costa Rica**); raicilla (**Nicaragua**); raicilla (**Panama**); poaia, ipecacuanha preta, ipecacuanha anelada, raíz preta, poaia do mato, ipeca do rio, ipeca de mato grosso (**Brazil**); raicilla (**Colombia**); ipecac (**English**).

Description
Small herbaceous plant 20–30 cm tall, with a thin, twisted, and slightly woody stem. Leaves opposite, oval-lanceolate. Flower small, white in a terminal inflorescence. Small oval fruit with blackish berries.

History and Traditional Use
Known in Costa Rica, Nicaragua, Panama, and Colombia as *raicilla*, and as *ipecacuana* on the international market, *Psychotria ipecacuanha* (Brotero) Stokes, these countries pioneered rational exploitation of this medicinal plant. The extract of the root of ipecacuana is used as an amoebicide, an emetic, and as an expectorant. Its main components are isoquinolic alkaloids, of which emetine is the most important for the pharmaceutical industry (Trease and Evans 1988). In Europe the use of ipecacuana as a plant-based drug dates back to 1762. In the 1940s it became one of the pharmaceutical industry's most important drugs in the United States and Europe (Sievers and Higbee 1949; Morton 1981).

Since pre-Columbian times, ipecacuana was one of many plants used by indigenous populations in the American humid tropics. When Spaniards learned of the virtues of its root, it was taken back to Spain from where its use spread throughout Europe. The plant from Brazil was first mentioned by Purchas, the well-known traveler, in 1625. According to Fischer (1973), it was introduced into European medicine in 1686 when King Louis XIV of France bought the secret remedy from a charlatan called Hervetius who successfully used the remedy to treat diarrhea and dysentery, and discovered that the ipecacuana was the main ingredient. It was not until 1817 that Pelletier and Magendie discovered emetine, the main alkaloid (Trease and Evans 1988).

Ipecacuana has been and continues to be an irreplaceable drug. It is also to be noted that the synthetic drug does not have the same medicinal properties as that extracted directly from the plant, especially when this plant-based drug is derived from plantations (León 1968; Castro 2000). García-Barriga (1975) refers to its cultivation as a result of depletion of wild populations. Morton (1981) reports on its origins in tropical forests between Bolivia and Brazil and notes its cultivation in Nicaragua, Costa Rica, and Panama. It is currently cultivated in Nicaragua and Costa Rica (Ocampo 2004).

The rhizomes and roots of this species are used in syrup form as an expectorant in **Costa Rica**, in powdered form as a diaphoretic, and in higher doses, also in syrup form, as an emetic. Nuñez (1975) mentions its effectiveness in treating amoebic dysentery, alveolar pyorrhea, and other amoebal infections, as well as the slight effect cefaline, one of the plant's alkaloids, has as an antitussive and expectorant when taken as a syrup.

Gupta (1995) notes that in **Brazil** it is said to be effective against diarrhea, as an expectorant and an amoebicide, that it is also used in treating bronchitis and amoebic dysentery, and for its antitussive and sudorific properties. In **Colombia** the root of ipecacuana is used in small doses as a repulsive to stimulate intestinal movements, and in higher doses to provoke vomiting (García-Barriga 1975).

Pharmacology and Biological Activity

Gupta (1995) indicates that the latex/sap is used to make a syrup to treat accidental poisoning in children, but that the fluid extract of ipecacuana should not be used to induce vomiting. Emetine hydrochloride is the medicine of choice for hepatic amoebiasis (Wyk and Wink 2004), and Trease and Evans (1988) report on the compound being extensively used in the treatment of amoebic diseases and alveolar pyorrhea. Morton (1981) also reports on it having an expectorant effect and its use in various cough medicines. Emetine is a protein synthesis inhibitor, and in doses over 1 g administered over a long period, it can cause myositis at the injection site, diarrhea, sickness, hypotension, dyspnea, palpitations, hematuria, circulatory collapse, and present neuromuscular symptoms (Gupta 1995). According to Morton (1981) it can also cause itching and inflammation of the skin. The aqueous extract of the root has shown strong anti-viral activity against type 2 herpes, A2 influenza, type 2 poliomyelitis, and vaccinia (small pox virus) (May and Willuhn 1978, quoted by Gupta 1995). It is a plant that is widely used in homeopathy and by the pharmaceutical industry (Trease and Evans 1988).

Toxicity

Ipecacuana powder is a respiratory irritant, and repeated exposures can cause rhinitis (a type of sinus allergy) and asthma (Gupta 1995).

Conservation Status and Trade

Populations of this species in Colombia and Costa Rica had already disappeared by the 1970s and were replaced by cultivated plots (García-Barriga 1975). Despite its economic and historic importance, there are no studies to shed light on its conservation status (Ocampo 2004).

Costa Rica and Nicaragua are the only countries that have cultivated ipecacuana under forest cover since the 1950s. It was previously harvested from the wild causing conflict with indigenous populations who also used the plant. The plant has now disappeared from the wild, and various attempts to substitute the naturally occurring medicinal components with synthetic preparations have been unsuccessful due to the quality of cultivated material. Both Costa Rica and Nicaragua are currently producers of raw material for the international market due to the quality of their rootstock. In 2006 the European industry was eagerly seeking new sources of the raw material from producer countries as supply had fallen as low prices paid in earlier years had discouraged farmers who grew this crop.

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Quassia amara L.

Synonyms
Quassia alatifolia Stokes, *Quassia officinalis* Rich.

Family
Simaroubaceae

Common Names
kini, quiniclu (**Bribri Indians, Costa Rica**), kinina (**Cabecar Indians, Costa Rica**), hombre grande, big man (**Costa Rica**); cuasia (**Mexico**); hombre grande, palo grande (**Guatemala**); cuasia, hombre grande, limoncillo, tru (**Honduras**); hombre grande, chile de río, chirrión de río (**Nicaragua**); guabito amargo, crucete, hombre grande (**Panama**); cuasia, bitter-ash (**West Indies**); cuasia amarga (**Bolivia**); pau quassia, quina, falsa quina, murubá, murupa (**Brazil**); cuasia, creceto morado, contra-cruceto (**Colombia**); quashie-bitters, quassia-bitters (**Guyana**); amargo, cuasia, simaba (**Peru**); surinam quassia (**English**).

Description
A shrub or treelet growing to 6 m, with a stem reaching 10 cm in diameter. Leaves pinnately compound, 5–11 cm long by 4–7 cm wide, obovate to oblong, dark green on upper surface, slightly pale on the underside. Flowers in thin panicles, red with pink base, petals 2.5–4.5 cm long. Fruits black, 1.5 cm oblong, each with one seed.

History and Traditional Use
During the eighteenth century a Surinamese man called Quassi acquired fame in treating fevers with a secret treatment using this plant, the medicinal reputation of which spread throughout Europe after Rolander took it to Sweden in 1756. Linnaeus later identified this plant as *Quassia amara*, in reference to Quassi and its bitter taste. Calolus M. Blom published its first description in 1763 (Busbey 1939; Carson 1848), referring to it as *Lignum quassiae*, and it became highly popular as a febrifuge, a tonic, and to treat dysentery.

Quassia amara is a traditionally used medicinal plant, known for its bitter properties and its qualities as a tonic by indigenous populations in South America (Standley and Steyermark 1946). Pittier (1978) noted it as being "very scarce in dry forests in Costa Rica's Pacific region, and one of the main remedies used by Indian communities. They break the trunk into 30–60 cm pieces, one of which which they take with them on their travels, and occasionally manage to sell in markets in the interior, being used for fevers, and an infusion of the grated pieces being taken as an aperitif."

Historically, the wood of *Quassia amara* has been confused with another bitter species, *Picrasma excelsa* (Swartz.) Planchon, commonly referred to as Jamaican quassia, quássia-das-Antillas, quássia-nova, and lenho-de-san martín, is widely used as a medicinal plant in Jamaica and other Caribbean islands (Trease and Evans 1988).

The most widely used common name for *Quassia amara* in Latin America is cuasia, followed by hombre grande (big man), the latter not in fact corresponding to any particular characteristic of the species. The internationally used common name is Surinam quassia. The vernacular names used by indigenous groups in Costa Rica – quiniclu, kini, and kinina – have a common denominator in that they all refer to the bitter taste of its tissue and to quinine (*Cinchona* sp.) that is also bitter.

According to Taylor (1998) the common names of quassia amarga and quassia amer have been used to refer to *Simarouba amara* and *S. glauca*, of the family Simaroubaceae, which has amoebicidal properties. In **Argentina** *Q. amara* has also been confused with other species of bitter wood, and specifically the family *Simaroubaceae* (*Picrasma crenata*) present in the humid subtropical region of Misiones.

According to Oliveira, Akisue, and Akisue (2005) the name Quássia-do-Brasil refers to the species *Picrasma crenata* (Vell.) Engl., that has a variety of other common names, including quássia amarga, pau-tenente, pau-amarelo, and pau-quassia. Two species exist in Brazil: *Q. amara*, known as false quinine, which grows wild in the humid Amazonian region of Belén and Pará, and *Picrasma crenata*, also known as *Aeschrion crenata* Vell and commonly known as Pau-amarelo, which grows wild in Mata Atlântica.

Morton (1981) refers to the use of *Picramnia antidesma* Swartz, a small shrub common to forest undergrowth, and known as hombre grande and cascara amarga in Central America, the Caribbean, and Mexico.

Plants characterized by the presence of bitters in their tissues are important natural resources in traditional remedies, but have given rise to considerable confusion when establishing their botanical identity. However, it is clear that although there is no confusion in the traditional use of *Q. amara* for medicinal purposes in the tropics, misunderstandings have arisen in literature due to confusing local names and the lack of access to botanical specimens (Ocampo 1995).

An infusion of the macerated wood is used as a bitter tonic in **Costa Rica** to stimulate the appetite and to treat diarrhea. It is considered to be effective in treating fever, and liver and kidney stones, as well as in treating weakness of the digestive system (Ocampo and Maffioli 1987; Ocampo and Díaz 2006).

In **Panama** an infusion of the wood is used as a febrifuge, for the liver and for snake bites (Duke 1984), and in **Brazil** it is used to combat dysentery, dyspepsia, intestinal gases, vesicular colic, malaria and as a febrifuge (Morton 1981; Gupta 1995). In **Peru** an infusion of the bark is used as a febrifuge and to treat hepatitis, and it is also macerated in water or alcohol, used as a tonic (Brack 1999); and in **Colombia** as a bitter for dyspepsia, anorexia, and malaria (García-Barriga 1975).

In **Honduras** the boiled bark is used for stomachache, diabetes, urinary problems, diarrhea, and migraine, and to fortify the blood (House et al. 1995), and in **Nicaragua** the root is used for snakebites. For this a 20 cm piece of root is crushed, water is added, and then the liquid strained and drunk; and for malaria, two ounces of the bark are cut, boiled in water and drunk three times daily (Morales and Uriarte 1996; Querol et al. 1996).

Barnes, Anderson, and Phillipson (2002), refer to its being used as a gastric stimulant and as having anthelminthic properties. It has been traditionally used for anorexia, dyspepsia, and nematode infestations (taken orally or rectally). A dose between 0.3 and 0.6 g of dry wood in an infusion is recommended three times a day.

Pharmacology and Biological Activity

The aqueous extract of *Quassia amara* wood used to evaluate intestinal movement in mice (doses of 500 and 1,000 mg/kg), results in an increase in intestinal motility when compared with the control group, only in the case of the highest dose (García, Gonzales, and Pazos 1997). Another study shows that doses of both 500 mg/kg and 1,000 mg/kg, result in increased intestinal movement (Badilla et al. 1998).

The same authors find that the aqueous extract, independently of the dosage, shows important activity in protecting against gastric lesions caused by indomethacin, ethanol, and stress, independently of the dosage. Teixeira et al. (1999) refer to a personal communication with S.C. Oliveira who carried out an *in vitro* study with aqueous solutions obtained from the lyophilized leaves of *Q. amara* that showed activity against types of erythrocitic Plasmodium falciparum in concentrations of 0.05mg/ml and 0.125 mg/ml. Barnes, Anderson, and Phillipson (2002) refer to quassinoids present in *Q. amara* wood being 50 times more bitter than quinine.

Toxicity

Research on the acute toxicity of *Quassia amara* wood was carried out in Costa Rica on NGP-UCR albino mice. Two tests involved oral administration and intraperitoneal injection. The first test showed no mortality or evident signs of toxicity after 48 hours of observation. The results of the second test with a dose of 500 mg/kg showed signs of piloerection, a reduction in motor activity, and a partial loss of righting reflex. All test subjects recuperated 24 hours after the extract had been administered. Similar signs were apparent with the 1,000 mg/kg dose, but all animals died within 24 hours after being administered the raw aqueous extract (García, Gonzales, and Pazos 1997).

Another bioassay carried out on the lethality of Artemia salina containing an ethanolic extract of the chloroformic (alkaloidal) fraction of *Q. amara* wood, shows a high level of toxicity (Furlan 1994). Cáceres (2007) refers to a study carried out by Njar et al. (1995) on reproductive toxicity; using the methanolic extract of the bark administered orally to rats at doses of 100, 1,000, and 2,000 mg/kg over eight weeks, significantly reduces testicle weight, epidydimo, seminal vesicle and sperm count, and increases the size of the pituitary gland. No changes were noted in sperm motility or morphology. The levels of serum testosterone, lutenizing hormone (LH), and follicle stimulant hormone (FSH) were significantly reduced. The levels of testosterone do not vary within the groups that had been administered with the extract plus LH and quassin plus LH, compared with the control group. No relationship was shown between dose-dependence and the administered doses. All the effects disappear eight weeks after suspension of treatment. No lethal effects were found on Leydig cells *in vivo* and *in vitro* (Njar et al. 1995). The chloroformic extract in doses of 12.5, 25, 50, and 100% were administered to rats once a day for 15 days. No behavioral or body weight changes were noted in the animals during treatment with any of the dilutions. Testicular weight and the epidydimo were reduced through dose-dependent treatment. The sperm parameters of the epidydimo presented evidence of toxicity related to the dose in that there was a significant decrease in sperm count, motility, and the viability and morphology of the sperm (Parveen et al. 2002).

Conservation Status and Trade

Although there are no studies on the conservation status of wild populations in the region, Ribero et al. (2001) refer to its endangerment in Brazil. The twentieth century saw a marked reduction in wild populations as a result of trade, and in 1998 it was observed that raw material entering Germany from the Americas was no longer *Q. amara* wood. Its substitution with other bitter raw materials of the Simaroubaceae family is a clear indicator that the species is under threat and, according to Ocampo and Díaz (2006), justifies the development of agroecological cultivation models in Costa Rica.

The wood and bark of *Q. amara* are sold on local markets for medicinal use and as tinctures through herb stores in the tropics (Ocampo 1997), and the wood and dry bark have been commercialized in large volumes on the international market as chips for pest control (Ocampo and Díaz 2006). For example, in 2006 a small trader from Germany requested three tons of the dried wood from Costa Rica (Ocampo 2006).

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Senna reticulata
(Willd.) H.S. Irwin & Barneby

Synonyms
Cassia reticulata Bentham, *Cassia reticulata* Willd., *Cassia annunciata* E.H.L. Klause., *Cassia dumetorum* Bertero ex De Candolle., *Chamaesenna reticulata* Pittier

Family
Fabaceae

Common Names
saragundí, wild senna (**Costa Rica**); barajo (**Honduras**); barajo negro, zambrán de río, barajo, zambrano, barajillo (**El Salvador**); serocontil, sorocontil (**Nicaragua**); curalotodo, inanabiske v etnía Cuna (**Panama**); retama, sapechihua (**Peru**).

Description
Shrub or treelet reaching a height of 6–8 m, pubescent twigs. Leaves large, pinnately compound with 8–12 pairs of leaflets, the largest ones reaching 13 cm in length are aromatic and close at night. Inflorescence up to 30 cm long or more with abundant yellow flowers. Fruit is a flat pod up to 15 cm in length with numerous seeds.

History and Traditional Use
Saragundí (*Senna reticulata*), as it is known in Costa Rica, is a small native tree traditionally used in the tropics and little known to science. A morphologically similar but smaller species known as barajo (*Senna alata* L. Roxb.) has been the subject of greater research. While the genus *Senna* is pharmacologically important, it is *Cassia senna* that is chemically characterized by derivatives of hydroxyanthracenes with laxative effects (Barnes, Anderson, and Phillipson 1996; Correa and Bernal 1990).

An infusion of the leaves is used in **Costa Rica** as an antipyretic, and the middle vein of the leaf is recognized as a laxative. An alcoholic maceration of the leaves is used for arthritis and rheumatism. The liquid from boiled leaves is used for bathing, and to cure skin diseases. An alcoholic maceration of this species together with the leaves of *juanilama (Lippia alba)* is also used for rheumatism and arthritis (Nuñez 1975; Ginzbarg 1977; Ocampo and Maffioli 1987; Gupta 1995).

In **Panama** the dried root is used by Guaymi Indians to cause vomiting (Joly et al. 1987), while in **Honduras** House et al. (1995) indicate that it is taken as a purgative and as an emmenagogue. In **Peru** Brack (1999) reports on the boiled leaves being used for constipation, scabies, ringworm of the scalp (tiña), and externally as an anti-mycotic. An infusion of the flowers is used to protect the liver, as a diuretic, a laxative, and to treat hypertension. The resin of the pod is used externally for warts.

According to Grijalva (1982) in **Nicaragua** a decoction of seven leaves and three buds is taken for the kidneys, the liver, for rheumatism, indigestion and lack of energy; and leaves are applied locally to bathe herpes and scabies while the seeds serve as a vermifuge. In **El Salvador** De Mena (1994) reports on a cup of the liquid from boiled leaves being taken three times a day in the case of kidney problems.

Pharmacology and Biological Activity
The ethanolic extract (95%) of the leaves and stalk was shown to be inactive against *Klebsiella pneumoniae, Salmonella gallinarum, Staphylococcus aureus* and *Mycobacterium smegmatis*. Furthermore, the aqueous and ethanolic extracts of the whole plant were active against **Stephylococcus aureus** (Mitscher et al. 1972).

Toxicity
No toxicity data is available.

Conservation Status and Trade

There are no studies on the conservation status of the species in the tropics. Being found in wet areas that do not compete with agriculture, wild populations forming colonies still exist. The plant is rarely traded on local and regional markets. In Costa Rica the leaves are used for the production of a liniment.

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Uncaria tomentosa
(Willd. ex Roem. & Shult.) DC.

Synonyms
Nauclea aculeata Kunth, *Nauclea tomentosa* Willd. ex Roem. & Schult., *Ourouparia tomentosa* (Willd. ex Roem. & Schult.) K. Schum., *Uncaria surinamensis* Miq., *Uncaria tomentosa* var. *dioica* Bremek.

Family
Rubiaceae

Common Names
rangallo, bejuco de agua (**Costa Rica**); uña de guara (**Honduras**); rangaya (**Panama**); unha de gato (**Brazil**); bejuco de agua, tua juncara, uña de gato (**Colombia**); uña de gato (**Ecuador**); samento and unganangui (**Ashaninka Indians, Peru**), pao tati mosha (**Shipibo–Conibo Indians, Peru**), uña de gato, uña de gavilán, garra gavilán, garabato amarillo, garabato colorado, (**Peru**); uña de gavilán (**Venezuela**); cat's claw (**English**).

Description
Climbing vine reaching 30 m in the rainforest canopy, with a stem diameter up to 30 cm. Branches have strong, sharp woody thorns, curved downwards like cat's claws, reaching 2 cm in length and 0.4–0.6 cm wide. Leaves ovate or elliptical, 9–17 cm long by 4.3–9.0 cm wide. Terminal or axilliary inflorescence reaching 9 cm length. Flowers sessile, yellowish in color.

History and Traditional Use
According to Barnes et al. (2002) the root, bark of the root and stem, and the leaves of *Uncaria tomentosa* are employed for traditional medicine. In Peru the plant is used to treat inflammation in organs and/or organ systems such as arthritis, dermal inflammations, genitourinary tracts, asthma, gastric ulcers, and diabetes (Obregón 1995). Gupta (1995) refers to its use in treating malignant tumors, rheumatism, arthritis, diabetes, and cirrhosis. Two spoonfuls of the plant are boiled in 1.5 l of water for 30 minutes; the liquid is strained and cooled, and half a glass is drunk three times a day before meals.

The Shipibo-Conibo indigenous population in Yarinacocha, of the Ucayali department in **Peru,** refer to *Uncaria tomentosa* as *pao tati mosha, paoti* meaning curved, and *mosha* meaning thorn. Reference is made to a variety of uses such as venereal diseases, gastric and intestinal ulcers, kidney problems, and snakebites for which the juice of the fresh vine or the liquid from boiled bark is drunk. In the case of snakebites, the fresh bark is also grated and applied as a poultice. The abundant, slightly bitter juice (water) of the vine can be drunk to quench the thirst, also has medicinal properties. (Arévalo 1994)

According to Schultes and Raffauf (1990) in **Guayana** the juice from the boiled bark is used in the treatment of dysentery, and EMBRAPA (2002) reports the bark being commonly used in **Brazil** against diarrhea, cystitis, gastritis, diabetes, and viruses.

Pharmacology and Biological Activity

Among the isolated compounds pentacyclic oxindolic alkaloids were shown to have immuno-stimulatory and inhibitory effects on the growth of leukemia cells (Carvalho 2004), and according to Wagner, Kreutzkamp, and Jurcic (1985) the isolated alkaloids cause a considerable increase in phagocytosis. The aqueous or ethanolic extracts also show cytostatic action, as well as having contraceptive and anti-inflammatory capacities (Keplinger 1982). The anti-inflammatory activity in free extracts of the tannins (Aquino et al. 1991) and the anti-viral activity (Aquino et al. 1989) have confirmed these results. This plant decreases inflammation in osteoporosis and the mechanism appears to involve the ability of the plant extract to inhibit the protein called tumor necrosis factor-alpha (TNF–α), as well as acting as an antioxidant (Hardin 2007).

Toxicity

There is no reported cytotoxic effect on bacterial cells in the following concentrations: 10, 20, 30, 40, 50, 75, and 100 mg/ml (Carvalho 2004).

Conservation Status and Trade

The boom for cat's claw on national and international markets has given rise to massive harvesting from wild populations with devastating effects, especially in Peru. Although conservation strategies have resulted, no studies exist to determine its conservation status.

Information is available on trade in Colombia, but no reference is made to volumes and prices (Rivera, Buitrón and Rodríguez 2000). In Brazil Silva et al. (2001) refer to internal trade and export, but make no reference to volumes or prices.

Peruvian statistics on production and trade collected by the National Institute for Natural Resources (INRENA), indicate that cat's claw started acquiring commercial value on national and international markets in 1992 when various marketing channels emerged. In 1995 INRENA issued 400 permits for the commercialization of the plant, and it was in that same year that the volume traded reached 726,684 kg – of which 89% was bark – exported to 24 countries and resulted in a sudden increase in the extraction. However, this was followed by a slump in international demand, due to market saturation and excessive reserves at the main collection points (Nalvarte and Jong 2004).

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The Creatures of Semillas Sagradas

On his first visit to the New World tropics, Darwin was struck by the exuberant diversity of life and asked "what explains the riot?" At Semillas Sagradas, we say "welcome to our riot!" Our garden offers sanctuary not only to medicinal plants but to myriad sister species. At every turn you may be surprised by the sights or sounds of toucans, howler monkeys, hummingbirds, parrots, sloths, lizards, basilisks, morpho butterflies, leaf cutter ants, Azteca ants, anteaters, termites, poison dart frogs, and yes, even snakes. This is, after all, a working tropical ecosystem, and each creature has a role to play in maintaining equilibrium.

The garden lies within Finca Luna Nueva, a 220 acre certified organic spice farm at approximately 1000' elevation and 10° N latitude on the Caribbean slope of Costa Rica's central mountain range. Just 13 miles southeast of the Arenal Volcano, the farm neighbors El Bosque Eterno de los Niños (the "BEN"), known also as the Children's Eternal Rainforest. This 54,000 acre private reserve connects the seasonal rainforest at Finca Luna Nueva with the premontane and cloud forest life zones within the BEN. Rainforest creatures often migrate up and down the slopes of mountains, as food goes in and out of season at differing elevations. The farm and garden thus form part of a wildlife migration zone supporting "the riot" of life in the tropical rainforest.

On the following pages are images of a few of the creatures found within Semillas Sagradas. Volumes have been written about each species, but a few stories will illustrate the many delights of this ecosystem. We often see a solitary sloth in Semillas Sagradas, but we were especially pleased recently to spot a mother and child. The mother sloth will nurse her baby for up to two years, and she will then force weaning by abandoning the toddler (who would otherwise never quit nursing.) This might sound like tough love, but the mother sloth eases the transition by gifting her feeding territory to the baby. Male sloths of this region, such as the one eating cecropia leaves at page 32, have a characteristic orange slash mark on their backs. Sloths are grey/green, the green coming from the algae that grows in their fur. Controlling the algae growth are pyralid moths endemic to sloths – living their adult lives feasting on algae in the fur! Sharing sloth fur with pyralid moths are at least three genera of beetles, and as many as 900 individual beetles have been found living on one sloth.

Sloths are herbivores, and they are often seen chewing young cecropia leaves. Many other herbivores would like to feast on these tender morsels, so the tree has evolved a defensive strategy: recruiting fierce ants to live in its stems and chase away herbivores. These ants, often called Azteca ants (after the legendary warriors of the Aztec people), make their home in the tree's hollow stems and eat glycogen stored in the tree's Müllerian bodies. Müllerian bodies exist only in the genus *Cecropia* and seem to have only one evolutionary purpose: attracting ants by offering food! This is an example of interspecies collaboration, but perhaps the greatest spectacle of collaboration is seen in a related ant species, the leaf cutter ant. These social insects live in a complex society and are responsible for recycling up to 10% of forest plant biomass every year. Let's put human beings in perspective: the New World tropics thrived in balance for millions of years before humans first visited. If humans were removed from the neotropics, the ecosystems would continue in balance (or some might say rejoice in relief); in contrast, if leaf cutter ants were removed, entirely new systems of equilibrium would need to evolve. Not only are humans dispensable, but we aren't even the biggest species in terms of biomass on the planet. There are now approximately 6.6 billion people and an estimated 10 million billion ants. In their recent book *The Superorganism*, Bert Hölldobler and E.O. Wilson do the math and propose that "ants and people have (again, very roughly) the same biomass." Keep your eyes open for leaf cutters and other ants: they run the place!

Finally, as you walk through Semillas Sagradas, please keep in mind that "there be jaguars."
One photo is worth a thousand words . . .

–Thomas M. Newmark and Steven Farrell

The Creatures of Semillas Sagradas


Trigonum bee in a Poro flower


Green Tree Snake


Fresh jaguar print


Male three-toed sloth


Mother and baby three-toed sloths


Emerald Basilisk (Jesus Christ Lizard)


Red and Blue ("Blue jean") poison dart frog

The Creatures of Semillas Sagradas


Leaf mantis


Toucan


Howler monkey


Green iguana


Rufous eyed stream frog


The most important creatures of the forest - leaf cutter ants!


Morpho butterfly

The Creatures and Fruits of Semillas Sagradas


Anteater


Coral snake


Star fruit


Noni fruit


Hummingbird


Surinam cherries (pitangas)

Doña Juanita, medicine woman of the Kekoldi Indians, shares her herbal wisdom

About the Authors

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Rafael Ocampo is one of Central America's best known specialists in medicinal plants. He received his degree from the University of Costa Rica, and was appointed a researcher and curator at the National Herbarium of Costa Rica, where he specialized in the collection of plants and ethnobotanical studies of indigenous peoples in the region. He then returned to the University as a researcher, investigating medicinal and other useful plants. At CATIE (Centro Agronómico Tropical de Investigación y Enseñanza) he served as a specialist in the study of medicinal plants for nearly a decade and today he is a technical advisor to many projects involving ornamental and medicinal plants. He has published numerous scientific papers, reports and books on healing plants that are used by people in forests, fields and pharmacies.

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Michael J. Balick is an ethnobotanist and plant scientist working on a number of projects around the world that involve the study of the relationship between plants, people and culture, with a focus on traditional medical systems. He received his undergraduate degree in horticulture and plant science at the University of Delaware and his graduate degrees in tropical biology at Harvard University. He has worked at The New York Botanical Garden for nearly three decades, and currently is Vice President and Director of the Institute of Economic Botany at that institution. He is involved in the search for new therapies from plants, and in bringing evidenced based modalities from ethnomedical systems into clinical practice. He has written or edited 18 books on plants and over 160 popular and scientific papers. In the 1970's he lived in Costa Rica and helped develop the Wilson Botanical Garden in San Vito de Coto Brus.

Index

A

B

C

D

E

F

G

H

I

J

K

L

M

N

O

P

Q

R

S

T

U

V

W

Y

Z