PH-04 Mesoamerica and the Andes

HEALING after the FALL, research library, PH-04

Researched 10 October 2026 by Claude Opus agent for THRIVING after the FALL, Book Four. Library document, unverified.

Scope and method

This report covers the medicinal plants of Mexico and Central America (Mesoamerica) and of the Andes from Colombia to Bolivia, with the Amazonian slope where Andean healers trade. It is written for a reader who lives there. Temperate Europe remains the book's home ground (THRIVING library, PH-01), so each plant section says whether the plant grows or can be traded there.

It builds on five library reports and does not repeat them. Quinine chemistry, the 1866 to 1868 malaria commission and quinine extraction belong to IN-09. Cocaine as a surgical anaesthetic and atropine poisoning belong to WO-11. The spinach confusion with *Datura* belongs to PH-10. Restricted knowledge belongs to SY-04.

Each plant keeps three things apart. **Tradition** is what the holders of the knowledge say and do, credited to them. **Record** is what trials, case series, assays and the pre-antibiotic clinical record show. **Inference** is what pharmacology suggests and nobody has tested. Unchecked claims and my own inferences carry [VERIFY]. The reference list says where only an abstract or summary was read.

Coca, *Datura*, *Brugmansia* and oil of epazote are covered for history, evidence, dose, toxicity and feasibility only. No step of extraction, concentration or purification is given. Restricted knowledge (the Kallawaya healers' language, ceremonial uses of the nightshades) is named and not reproduced (THRIVING library, SY-04).

1. The regional frame: whose knowledge this is, and how to read it

Three bodies of record matter.

The colonial record. In 1552, at the Colegio de Santa Cruz de Tlatelolco, the Nahua physician Martín de la Cruz wrote an herbal in Nahuatl, and the Nahua scholar Juan Badiano put it into Latin. The Nahuatl original is lost. The Latin *Libellus de Medicinalibus Indorum Herbis*, now called the Codex Cruz-Badianus, describes about 250 plants. It went to the Vatican in 1902 and was returned to Mexico by Pope John Paul II in 1990 (Wikipedia, Libellus 2025). From the 1560s Bernardino de Sahagún and Nahua elders compiled the Florentine Codex, whose Book 11 holds an herbal. Work stopped with the cocoliztli epidemic of 1576 (Dumbarton Oaks, search summary only). Francisco Hernández surveyed more than 3,000 plants on Galenic lines, published in 1648 (Waldstein 2014).

The living record. Bussmann and Sharon recorded 510 species in use in Northern Peru, 83% native, and found that about half the plants named in colonial sources had dropped out of use (Bussmann and Sharon 2006). Add the Kallawaya of Bolivia and the herb markets of Mexico.

The laboratory record. It is large, mostly in vitro, and easy to over-read.

Three warnings govern the reading. Aztec medicine is a source of national pride, and the literature leans towards finding that it worked. The best-known efficacy claim uses a generous criterion (section 9). And the Badianus is not a pure indigenous document: Waldstein, reviewing the scholarship, says it was made partly to show the Spanish crown that indigenous students could be educated, and that it shows heavy European influence (Waldstein 2014).

The remedies here belong to named peoples: Nahua physicians of the sixteenth century, Mestizo curanderos of the Peruvian north, Quechua and Aymara households of the altiplano, the Kallawaya, and Amazonian peoples of Peru and Ecuador. Where a source names the community, I credit it as "as recorded by [community] in [work, year]" (THRIVING library, SY-04). Where it does not, I say so.

2. Cinchona: what crude bark does, at what dose

Cinchona calisaya Wedd. (yellow bark, including the cultivated Ledger form sold as *C. ledgeriana*), *C. officinalis* L. (Loja or crown bark) and *C. pubescens* Vahl (red bark, also *C. succirubra*). Part: dried bark of trunk, branch and root. Lookalikes: other barks sold as "quina" (section 8).

Tradition. Bark was used in Loja and southern Peru, and Jesuits carried it to Rome by about 1630 (THRIVING library, IN-09). Whether Andean healers used it for fever before contact is disputed, and no source I read settles it [VERIFY].

Record. Cinchona was European medicine's first specific remedy, and physicians tested it. - The *Schedula Romana* of 1649 set two drachms of powder, about 7.5 to 9 g, in strong wine before the fit. Gachelin and colleagues estimate this gave 0.75 to 1.5 g of quinine a day (Gachelin and others 2016). That assumes bark of about 10 to 20% quinine, stronger than any assay I found, so I treat it as an upper bound [VERIFY]. - Torti in 1712 gave up to 20 drachms (about 75 g) over three weeks for stubborn fevers (Gachelin and others 2016). - Robert Talbor won fame in the 1670s with smaller, more frequent doses disguised in wine, treated Charles II and the French Dauphin, and sold his secret to Louis XIV. The recipe, published after his death in 1681, was bark in wine with opium (Wikipedia, Robert Tabor, summary only). - McCausland in 1783 reported 60 of 94 cured on bark against 84 of 103 on tartar emetic. Robertson in 1789 reported 1 death in 216 sailors given bark as prevention against 19 in 296 not given it, though the deaths may have been typhus (Gachelin and others 2016). - Barks of holly and other trees were passed off as cinchona, and reliable bark existed only from the late 1730s. The League of Nations commissions of 1925 and 1937 found few controlled data, yet the authors judge the benefit beyond reasonable doubt (Gachelin and others 2016).

Quinine content varies more than tenfold. This is the central fact for crude bark.

Source	Material	Quinine	Total alkaloid
Maldonado 2017	22 wild *C. calisaya*, Yungas, Bolivia	mean 0.66%, range 0.02 to 2.6%, two trees none	mean 1.2%
Murauer and Ganzera 2018	4 pharmacy barks, Innsbruck	1.59 to 1.89%	4.75 to 5.20%
Potter 1902	official standard	at least 2.5%	at least 5%
IN-09 (Cowan, via summary)	*C. ledgeriana*, *C. officinalis*	5.49%, 2.93%	8.52%, 5.00%
Search summaries	*C. pubescens* by part, selected Ledger trees in India	0.76 to 1.74%, 14% or more	not given

The pharmacopoeial figures disagree. A search summary gives the European Pharmacopoeia minimum as 6.5% total alkaloid, while Murauer and Ganzera's commercial samples sold to that standard assayed at 4.75 to 5.20% [VERIFY].

I disagree with IN-09 on one point. IN-09's Protocol 4 assumes 5% quinine for *C. calisaya* or Ledger bark and 3% for unknown bark (THRIVING library, IN-09). The one modern assay of wild *C. calisaya* found a mean of 0.66% quinine and 1.2% total alkaloid, with almost half the trees under 0.5% quinine (Maldonado and others 2017). The 5% figure holds for selected Ledger clones and pharmacy bark. For bark of unknown origin, the evidence points nearer 1% than 3%.

Dosing arithmetic. All four main alkaloids stopped paroxysms in the 1866 to 1868 trial (THRIVING library, IN-09), so total alkaloid is the fair measure. The modern adult course is 10 mg of quinine salt per kg every 8 hours, about 1.5 g of base a day at 60 kg (THRIVING library, IN-09). My untested arithmetic [VERIFY]: - 5% bark: about 10 g every 8 hours, as IN-09 says. - 2.5% bark: about 20 g every 8 hours, hard to keep down. - 1.2% bark (the wild mean): about 40 g every 8 hours. Impossible. - 14% bark: 10 g every 8 hours gives about 4 g a day, inside the toxic range of 2.5 to 4 g (THRIVING library, IN-09).

The same spoonful can be useless or poisonous depending on the tree. Magendie's rule of 1829, that under 2 grains of quinine a day did nothing and over 15 grains was toxic (Gachelin and others 2016), shows how narrow the window looked to the people who invented the drug.

Cinchonism as a dose gauge. Its signs are ringing ears, dulled hearing, headache, nausea, giddiness and blurred vision (Potter 1902). Ringing is expected at therapeutic levels (THRIVING library, IN-09). My inference is that with bark of unknown strength the healer can raise the dose until mild ringing appears, hold it, and record the grams needed for each tree, so the next patient starts from a known figure [VERIFY: untested, and not found as a historical rule]. The patient becomes the assay. It fails in children, who cannot report ringing, and in the deaf. Protocol 1 sets limits.

Preparation. Swallow the powder in wine or sour juice. Water draws only about an eighth of the alkaloid (THRIVING library, IN-09).

Growing. *C. pubescens* grows at 300 to 3,300 m (search summary). Bark content peaks at 10 to 12 years, and trees can be coppiced from 8 to 10 (THRIVING library, IN-09). *C. officinalis* is nearly extinct in Loja, in relict stands of 22 to 26 trees with poor seed (UNL 2016, search summary). None grows outdoors in temperate Europe [VERIFY].

Grades. Bark powder for malaria: B. For other fevers: X. Bark tea: D.

3. Coca: altitude, fatigue and pain, honestly

Erythroxylum coca Lam. and *E. novogranatense* (D. Morris) Hieron. Part: dried leaf. Lookalikes: other *Erythroxylum* species with little alkaloid [VERIFY], and market products of unknown content.

The literature is politicised both ways. The 1950 United Nations commission, which Bauer describes as widely criticised as racist, led to the 1961 Convention's aim of abolishing chewing within 25 years (Bauer 2019). Advocates on the other side claim the leaf can do no harm. Bauer's review, the best I found, is openly sympathetic but says plainly where proof is missing.

Tradition. From Colombia to northern Argentina the leaf is chewed as a quid in the cheek, usually with an alkaline ash, for work, hunger, cold and altitude sickness (soroche). It is drunk as tea for the stomach and soroche, laid on wounds, chewed for toothache and used in childbirth. A *cocada*, the time one quid lasts, measures time and distance (Bauer 2019). Its place in offering and divination is living religious practice and outside this report.

Altitude. No randomised trial of leaf or tea exists (Bauer 2019). In 142 students travelling to Cusco at 3,350 m, mountain sickness struck 39%. Coca tea was not associated with lower risk. Acetazolamide was (odds ratio 0.13, 95% CI 0.03 to 0.56), while obesity (14.45) and female sex (4.32) raised risk (Caravedo and others 2021). Among 136 travellers who used coca, 51% noticed no effect, 31% a desirable one and 19% an undesirable one (Bauer 2019).

Work, cold, hunger. In 22 altiplano men, chewing improved sustained work over 60 minutes but not maximum capacity, and chewers avoided the fall in blood sugar seen with hypoxia. At Nuñoa, 4,000 m, chewing did not warm a foot held at 0 °C for an hour (n=29). At Cachicoto, chewing went with poorer nutrition, consistent with suppressed appetite (all as described in Bauer 2019). Leaf carries calcium (about 1,000 mg per 100 g) and iron, but two spoonfuls of leaf flour give under 10% of daily needs, and the authors did not recommend it as food (Penny and others 2009, abstract only).

Pain. A quid of 5 to 10 g gives blood cocaine of 10 to 150 ng/ml and numbs the mouth for about an hour (THRIVING library, WO-11). Levels peak 0.38 to 1.95 hours after chewing starts and persist past 7 hours (Holmstedt and others 1979, summary only). The leaf numbs mouth, gums and throat and is not a surgical anaesthetic (THRIVING library, WO-11). Chewing for toothache is plausible and documented. No trial exists.

Dose, two sources. Daily chewing 20 to 60 g (UNODC Bulletin 1952, via summary) against 30 to 60 g (Encyclopedia.com, via summary). Leaf cocaine 0.25 to 0.77% (Plowman and Rivier 1983) against 0.5 to 1% (Medeiros and Rahde 1989), both via WO-11. So a 50 g day brings about 125 to 500 mg of cocaine into the mouth, of which only part is absorbed [VERIFY: my arithmetic]. The oral lethal dose of pure cocaine is about 1,200 mg (THRIVING library, WO-11). A tea bag holds about 2 to 5.7 mg and turns urine tests positive (Bauer 2019). Some effect may come from leaf flavonoids (Bauer 2019).

Law as of October 2026. Leaf is in Schedule I. Bolivia rejoined the Convention in 2013 with a reservation for chewing, over objections from the United States and 14 other states (Bauer 2019). In December 2025 the WHO Expert Committee found that chewing and tea "do not pose major public-health risks", called the evidence on dependence and long-term safety limited, and recommended keeping current controls (WHO 2025). No vote followed in March 2026 (WOLA and TNI, summaries).

After the Fall [OWNER]. The treaty machinery goes. Three options the record supports: Andean custom, with leaf as food, stimulant and medicine where it grows and no processing beyond drying, consistent with the WHO finding on leaf. A district licence, with leaf stocked for mouth pain and chewing left to custom. Or a ban, which the record suggests would be unenforceable in the Andes and pointless in Europe, where the plant does not grow outdoors [VERIFY]. The real risk is concentration, which takes hundreds of kilograms of leaf per kilogram of product (Bauer 2019) and has no place in this library.

Grades. Numbing of mouth and gums: B. Toothache: C. Sustained work and hunger: C. Prevention or treatment of altitude sickness: D, and the one cohort found no effect.

4. Sangre de drago: from wound latex to an approved drug

Croton lechleri Müll. Arg. and related Amazonian species sold under the name [VERIFY]. Part: red latex from cut bark. Lookalikes: other "dragon's bloods" from *Dracaena*, *Daemonorops* and *Pterocarpus* (Namjoyan and others 2015), and other *Croton* species. The genus includes *C. tiglium*, whose seed oil is a violent purgative and blistering agent, so a *Croton* with red sap is not enough [VERIFY].

Tradition. Amazonian peoples of Peru and Ecuador and Mestizo healers on the Andean slope rub the latex into cuts, where it dries to a film, and take drops in water for diarrhoea and stomach ulcers [VERIFY: peoples and drop counts not found in a source read].

Wounds. One randomised trial treated 60 wounds left after cautery of skin tags with 15% *C. lechleri* extract cream twice daily. At day 3, 31% of the wound area had healed against 5% in controls, and at day 14, 96% against 78% (Namjoyan and others 2015). Small, single-centre, extract not raw latex. In rats crude latex beat its isolated compounds, and taspine was identified as a healing principle in mice (Pieters 1995 and Vaisberg 1989, both via Namjoyan).

Diarrhoea. Proanthocyanidins are more than 90% of latex dry weight (Namjoyan and others 2015). A purified oligomer, SP-303, later crofelemer, was trialled: - Travellers' diarrhoea, 184 patients, 125 to 500 mg four times daily for 2 days. Time to last unformed stool fell from 38.7 hours to about 30 to 33, and treatment failure from 29.3% to 4.3 to 9.8% (DiCesare and others 2002, abstract only). - HIV-associated diarrhoea (ADVENT), 125 mg twice daily, primary endpoint met (p=0.0096), blood levels undetectable in more than 99% of samples (MacArthur and others 2013, abstract only). The US FDA approved crofelemer in 2012. - Cholera: 32% less stool in the first 6 hours at 125 mg every 6 hours (conference report and press release only [VERIFY]).

Inference. Crude latex is a concentrated source of the molecules of an approved antidiarrhoeal, which supports grade C alongside oral rehydration, never instead. I could not translate 125 mg of crofelemer into drops of latex [VERIFY], and found no oral toxicology of crude latex [VERIFY].

Grades. Latex on small clean wounds: B. Crude latex for diarrhoea: C. Crofelemer: A, but not a village preparation.

Feasibility. Will not grow outdoors in Europe [VERIFY]. Dried latex keeps and travels, so a European district could stock it by trade.

5. Chili: capsaicin for pain

Capsicum annuum L. (most chilies, including chiltepín) and *C. frutescens* L. (tabasco, bird pepper). Part: ripe fruit, fresh or dried. No dangerous lookalike fruit. The leaves are not the medicinal part.

Tradition. A staple food and medicine across Mesoamerica and the Andes before contact [VERIFY: codex passages not read]. As a counter-irritant rubbed on the skin it spread to cultures from India to Hungary after 1500, which gives convergence.

Record. The evidence splits by strength and form. - Plasters for chronic low back pain: in 320 patients over three weeks, 67% responded against 49% on placebo (p=0.002), with skin reactions in 7.5% against 3.1% (Frerick and others 2003, abstract only). A second trial of 154 found 61% against 42% (Arzneimittelforschung 2001, abstract only). - Creams of 0.075% or less for nerve pain: a Cochrane review of 6 trials in 389 people found no meaningful benefit, with local side effects in about one of every 2.5 treated (Derry and Moore 2012). - The 8% patch: 8 trials, 2,488 people. In postherpetic neuralgia one extra patient in 7 to 9 gains much improvement (Derry and others 2017). It needs a purified product and a clinic.

Inference. Dried Mexican *C. annuum* ranges from no capsaicinoids in bell peppers to 31.84 mg/g (about 3.2%) in chiltepín, and Thai cultivars ran 0.76 to 3.76 mg/g (Scientific Reports 2021 and others, via summary). A salve of 10 g of dried hot chili in 100 g of fat would hold about 0.05% at 0.5% fruit strength with full transfer, the range of commercial creams [VERIFY: arithmetic mine]. It is a household preparation of a food, so Protocol 3 gives it.

Harm. "Hunan hand", painful burning after handling chilies, was described in 1981 (Weinberg 1981, summary only). Treatment is soap, cold water, an acid rinse such as vinegar, and local anaesthetic (Hitl and others 2025, summary only). Eyes need plenty of water. Never on broken skin, mucous membranes or a child's face.

Grades. Plaster for chronic back and joint pain: A. Home salve: C. Low-dose cream for nerve pain: X.

Feasibility. An annual for any European garden with a warm summer or glass. Of the steer's four, only chili grows on the home ground without trade.

6. The ranked table

Ranked by usefulness after the Fall, weighing evidence, the weight of the illness and the means needed. Grades are per use. Adult doses unless stated.

#	Plant, part	Preparation	Use	Grade	Dose	Chief harm, lookalike
1	*Cinchona calisaya*, *C. officinalis*, *C. pubescens*, bark	Powder in wine or sour juice	Malaria	B	Titrate from 5 g every 8 hours (Protocol 1). Historical 7.5 to 9 g a day (Gachelin), IN-09 10 g every 8 hours at 5%	Cinchonism, low sugar, blackwater, death from 1.5 g quinine. Adulterant barks
2	*Psidium guajava*, leaf	Decoction	Diarrhoea, with rehydration	B	500 mg extract every 8 hours, 3 days (Lozoya 2002). Home strength un-standardised [VERIFY]	Constipation. Infants unknown
3	*Capsicum annuum*, *C. frutescens*, fruit	Plaster, fat salve	Chronic back and joint pain	A plaster, C salve	Salve 3 to 4 times daily (Protocol 3)	Burns, eyes. Low-dose cream for nerve pain X
4	*Croton lechleri*, latex	Neat on wound, drops in water	Small wounds, diarrhoea	B wounds, C diarrhoea	Thin film twice daily. Oral dose unknown [VERIFY]	Other dragon's bloods, other *Croton*
5	*Dysphania ambrosioides* (epazote, paico), fresh leaf	Juice	Roundworm, dwarf tapeworm	B	1 ml/kg under 10 kg, 2 ml/kg above, 3 days (López de Guimaraes 2001). Dried whole plant 3 to 9 g (Hong Kong atlas)	Oil kills: X. Fruit most toxic
6	*Erythroxylum coca*, leaf	Quid, tea	Mouth pain, work, hunger	B mouth, C work, D altitude	Quid 5 to 10 g. Daily 20 to 60 g (UNODC) or 30 to 60 g (Encyclope-dia.com)	Heart risk [VERIFY], law [OWNER]

#	Plant, part	Preparation	Use	Grade	Dose	Chief harm, lookalike
7	*Agave americana*, *A. salmiana*, sap	Boiled-down syrup with salt	Wound dressing	C	Cover the wound [VERIFY]	Leaf sap dermatitis. Mistaken for aloe
8	*Piper aduncum* (matico), leaf	Crushed leaf, wash, tea	Wounds, diarrhoea	C	Unstandardised [VERIFY]	Other plants called matico
9	*Minthostachys mollis* (muña), leaf	Infusion	Colic, wind	C	A pinch to a cup [VERIFY]	Pulegone, pregnancy
10	*Tagetes lucida* (pericón), herb	Infusion	Cramp, diarrhoea	C	Unstandardised [VERIFY]	Ceremonial use exists (SY-04)
11	*Theobroma cacao*, bean	Cocoa drink	Blood pressure	A, tiny effect	Trial doses of flavanol-rich cocoa	Caffeine. Effect too small to use
12	*Lepidium meyenii* (maca), root	Cooked, flour	Food. Sexual function, menopause	D	1.5 to 3.5 g a day in trials	Sales claims
13	*Bursera* spp. (copal), resin	Incense, on wounds, tea	Wounds, toothache	D	Unstandardised	Smoke in closed rooms
14	*Heterotheca inuloides* (Mexican arnica), flower	Wash or tincture on skin	Bruises, sprains	D	External only	Not *Arnica montana*
15	*Casimiroa edulis* (zapote blanco), seed, leaf	Infusion	Sleep, blood pressure	D	Unstandardised	No human trials. Seed risk [VERIFY]
16	*Datura stramonium*, *D. inoxia* (toloache), all parts	None	None	X	Lethal from about 10 mg atropine	Anticholinergic poisoning, spinach confusion (PH-10)
17	*Brugmansia* spp. (floripondio), all parts	None	None	X	About 10 flowers can kill	As above. Ceremonial use exists (SY-04)

Plants left out for want of time are listed under Open questions.

7. The staples

Guava leaf (*Psidium guajava* L., leaf). Added to the brief because it is the region's commonest diarrhoea remedy and has trials. **Tradition**: leaf decoction for diarrhoea across Mexico and Central America and in many cultures

that took up the tree after 1500. **Record**: a standardised leaf product (QG-5), 500 mg every 8 hours for 3 days in 50 adults, shortened abdominal pain (Lozoya and others 2002, abstract only). In 62 infants with rotavirus, 87% had recovered by day 3 against 58% on another herbal decoction (Wei and others 2001, summary only). Paediatric safety is not established (Frontiers 2024 review, via summary). **Inference**: astringent tannins slow the gut. Oral rehydration saves the lives, and the decoction must never replace it. Grade B. Frost-free climates only.

Matico (*Piper aduncum* L., leaf). **Tradition**: as recorded by Mestizo healers of Northern Peru in Bussmann and Sharon (2006) and others, leaf for diarrhoea and wounds, also used on wounds in Brazil and in Papua New Guinea, where the plant is introduced. **Record**: no study of bleeding exists despite the name's legend of a wounded soldier. Leaf extract increased fibroblast growth and migration in culture (RPMESP, authors not recorded [VERIFY]). Dillapiole, the main oil constituent, has a mouse LD50 of about 2,400 mg/kg, was not mutagenic in the Ames test, and inhibits the liver enzymes that clear other drugs (search summaries). Grade C. "Matico" also names other plants, among them *Buddleja globosa* in Chile [VERIFY].

Muña (*Minthostachys mollis* Griseb., leafy shoot). **Tradition**: highland Peruvian and Bolivian tea for colic, wind and diarrhoea. **Record**: the oil holds pulegone at 8.8 to 40.9% and menthone at 5.9 to 32.9% across Peruvian studies, is active in vitro against *Staphylococcus aureus*, *Porphyromonas gingivalis* and *Candida albicans*, and has a mouse LD50 of 2,941 mg/kg (search summaries). **Inference**: pulegone is the toxin of pennyroyal, whose oil has killed women seeking abortion and whose tea killed an infant (THRIVING library, TR-15). A weak tea is a different exposure from the oil. Grade C. Never the oil, never in pregnancy or infancy.

Epazote, paico (*Dysphania ambrosioides* (L.) Mosyakin and Clemants, formerly *Chenopodium ambrosioides*, leaf and flowering top). **Tradition**: in Mexico a pot herb cooked with beans against wind, in Peru and Bolivia a juice or tea for worms. **Record**: in Huaraz, Peru, 60 children aged 3 to 14 had paico juice (1 ml/kg under 10 kg, 2 ml/kg above, before breakfast for 3 days) or albendazole. *Ascaris* eggs cleared in 86.7% in both arms, paico cleared all *Hymenolepis nana*, and side effects were 23.3% in both (López de Guimaraes and others 2001, abstract only). The distilled oil was the standard anthelmintic of the Rockefeller hookworm campaigns. The US Dispensatory gave 5 to 15 minims (0.3 to 0.9 ml) for adults, one drop per year of age from 6 to 12, then castor oil, and cited Levy's 12 poisonings with 9 deaths, the smallest fatal dose being 4 drops three times a day for 2 days in a child of one (US Dispensatory 1918). Confusing drops with minims gave doses of 3 ml (Britannica, via summary). Palmer records 7 deaths in 12 poisonings in Colombia and a child's death at Bucaramanga in 1926 (Palmer 2010). Two sources on plant dose: the Peruvian juice, and 3 to 9 g of dried whole plant in Chinese practice (Hong Kong toxic plant atlas, via summary). Grade B for fresh juice, X for the oil.

Maca (*Lepidium meyenii* Walp., root). **Tradition**: a cooked food of the Junín plateau above 4,000 m. **Record**: two reviews of 4 small trials each found limited evidence for sexual function and menopausal symptoms (Shin and others 2010, Lee and others 2011, abstract only), at 1.5 to 3.5 g a day (Stojanovska 2008, summary only). Bussmann and Sharon list it as a food supplement (Bussmann and Sharon 2006). Grade D for any medical claim. A good root crop.

Zapote blanco (*Casimiroa edulis* La Llave and Lex., seed and leaf). **Tradition**: Mexican tea for sleep and high blood pressure. **Record**: seed extracts lowered blood pressure in rats and dogs and sedated mice (Planta Medica 1989 to 1991, via summaries). No human trial. Grade D. The fruit is eaten. The seed is the medicinal and the risky part [VERIFY].

Pericón (*Tagetes lucida* Cav., herb). **Tradition**: tea for stomach ache, diarrhoea and cramps in Mexico and Guatemala (TRAMIL), and a ceremonial use not described here (THRIVING library, SY-04). **Record**: *T. lucida* and *T. patula* extracts are antimicrobial in vitro (Burns 2009), and 7-methoxycoumarin has been linked to an antispasmodic effect (TRAMIL). No human trial. Grade C. The marigold *T. erecta* (cempasúchil) has weaker evidence [VERIFY]. Grows in a European summer.

Maguey (*Agave americana* L., *A. salmiana* Otto ex Salm-Dyck, sap). **Tradition**: Sahagún's informants record boiled-down maguey sap on wounds. **Record**: maguey syrup inhibited pyogenic and gut bacteria in vitro, and added

salt increased the inhibition of *S. aureus* (Davidson and Ortiz de Montellano 1983, catalogue summary only). **Inference**: thick sugar syrup draws water out of bacteria, as honey and sugar paste do [VERIFY: cross-check the library's wound reports]. Grade C. **Harm**: cut-leaf sap carries calcium oxalate needles and saponins. It causes burning rash and purpura, including in a chainsaw operator, and in a military series of 12, mostly self-inflicted, 10 had systemic signs (Cutis 2000, Dermatology 1998, via summaries). It has been mistaken for aloe (Allergologia 2010, via summary). Agaves grow on Mediterranean coasts.

Copal (*Bursera copallifera* (DC.) Bullock, *B. bipinnata* (DC.) Engl. and other species, resin). **Tradition**: incense in almost every Mesoamerican ceremony, and resin for toothache, wounds, cough and rheumatism. The Seri record *B. microphylla* for sore throat and wounds (search summary). **Record**: triterpenes from *B. copallifera* resin inhibited inflammatory enzymes in cells, and the resin was anti-inflammatory in mice (Romero-Estrada and others 2016, search summary only). No human trial. Grade D. The ceremonial use belongs to its communities.

Mexican arnica (*Heterotheca inuloides* Cass., flower head). **Tradition**: Mexican wash or tincture for bruises and sprains, sold as "árnica". **Record**: laboratory anti-inflammatory work only (J Ethnopharmacol review 2017, summary only). A university safety sheet advises no internal use and avoidance in pregnancy, children and heart disease (UTEP). Grade D, external only. It is not *Arnica montana*, graded D to X in PH-01, and the shared name confuses both ways.

Cacao (*Theobroma cacao* L., bean). **Record**: a Cochrane review of 35 trials in 1,804 people found flavanol-rich cocoa lowered systolic pressure by 1.76 mmHg (95% CI 0.43 to 3.09), more in hypertensives, with possible industry bias (Ried and others 2017). Grade A for an effect too small to matter at the bedside.

8. The plants that kill at household doses

Toloache (*Datura stramonium* L., *D. inoxia* Mill., all parts, worst in seed). **Tradition**: long used in Mexican ceremony and love magic, and still sold. Those uses fall under SY-04 category 5 and are not described. **Record**: about 0.1 mg of atropine per seed, adult lethal dose 10 mg of atropine or more, or 2 to 4 mg of scopolamine (THRIVING library, WO-11). Food contamination poisoned more than 100 people in Australia in 2022 and more than 200 in Uganda in 2019 (THRIVING library, PH-10). Grade X.

Floripondio (*Brugmansia* spp., including *B. arborea*, *B. suaveolens*, *B. sanguinea*, all parts). **Tradition**: grown in Andean gardens, and used by Northern Peruvian curanderos in purification ritual (Bussmann and Sharon 2006), which is not taught here (THRIVING library, SY-04). **Record**: each flower holds about 0.65 mg of scopolamine and 0.3 mg of atropine, so about ten flowers could kill (Kim and others 2014). A Peruvian man of 19 who drank the tea had a fever of 41 °C, seizures, kidney failure needing dialysis and liver failure (Flores Mamani and others 2023). In the Americas *Brugmansia* and *Datura* together caused about a fifth of fatal plant poisonings in one long series (search summary only [VERIFY]). Scopolamine is used in Colombia to drug robbery victims, as burundanga, and the US Embassy in Bogotá linked some of eight US deaths in Medellín in late 2023 to drugging (ASIS Online, summary only). Grade X. First aid is WO-11 Protocol 11.

Epazote, as oil or strong tea. A tea at food doses is unlikely to poison (UAM 2004, via summary). The oil kills children at a few drops (section 7). The strong tea kills too: in Morocco a girl of 4 given repeated strong infusions for fever died within 6 hours, and the plant ranked fourth among plant-related deaths there from 2009 to 2020, at 6% (Elhaddadi and others 2024). An Argentine report notes frequent poisonings because toxic and therapeutic doses lie close (via summary).

Cinchona bark. It saves lives in malaria and kills by overdose. The lowest recorded fatal doses of quinine are about 1.5 g in an adult and 900 mg in a toddler (THRIVING library, IN-09). Bark in a house with small children is a poison cupboard.

False "quina". Adulterated bark ran through the trade for a century (Gachelin and others 2016). After the Fall it

will return. A patient given false bark is untreated and may die of malaria. Bitterness proves nothing, since many barks are bitter [VERIFY].

One pattern deserves note. Bussmann and colleagues tested 341 Northern Peruvian medicinal species on brine shrimp: 24% of water extracts and 76% of ethanol extracts were toxic (Bussmann and others 2011, abstract only). The tradition mostly uses water. The crude assay does not translate to human doses, but it warns against turning traditional teas into tinctures [VERIFY: inference].

9. The codices against the modern record

Ortiz de Montellano's claim. In 1975 Bernard Ortiz de Montellano took 25 plants from colonial sources and asked whether each would produce the effect the Aztecs sought. Waldstein reports the result as 16 that would, 4 that possibly would and 5 that would not (Ortiz de Montellano 1975, via Waldstein 2014). His 1990 book extended the case, and Schultes's review praised it without criticising the method (Schultes 1991). A Dumbarton Oaks exhibit text states that about 60% of the Florentine Codex plants have been found effective (search summary only).

The criterion. The test asked whether a plant did what the Aztec healer intended, judged by the Aztec model of illness. A purgative passed if the aim was to purge, a diaphoretic if the aim was to sweat. Ortiz de Montellano and Browner later set four levels of confidence for such judgements (Waldstein 2014). This fairly tests whether Nahua physicians knew what their plants did, and the answer is yes. It does not test whether patients recovered. A purge for a fever does what the healer meant and does not cure the fever. Anderson's warning that "time-tested" is not evidence applies (via Waldstein 2014). I disagree with the brief's wording that the claim concerns "most Aztec remedies". It concerns 25 selected plants, judged by the healers' own goals.

The Badianus. Three problems block a remedy-by-remedy test. 1. Identification. Of 185 drawings, Gates identified 85 to genus, Emmart 9 and later workers 126, and Tucker and Janick write that most of these identifications disagree (Tucker and Janick 2020, summary only). 2. Overlap. Of the Badianus's 251 plants and Sahagún's 255, only 15 appear in both (Waldstein 2014). Two Nahua sources of the same decades record largely different pharmacopoeias. 3. European influence. Written in Latin for a Spanish patron at a Franciscan college, and arranged head to foot as European herbals were (Waldstein 2014).

Which remedies survive a test? I did not read either codex, Emmart's 1940 edition or Dibble and Anderson's Book 11 [VERIFY]. From sources read, the codex plants with modern support are maguey syrup with salt on wounds (C), chili as counter-irritant (A as plaster), epazote for worms (B as juice), pericón for colic (C) and cacao (real but too small). This short list does not come from a systematic reading. A proper test would take each entry with a secure identification, state what the healer expected, and look for a human trial.

10. The Kallawaya record

Documented. The Kallawaya are itinerant healers of Bautista Saavedra and Muñecas provinces, La Paz, Bolivia, about 11,600 people in 2012 (Wikipedia, Kallawaya). UNESCO proclaimed their Andean cosmovision in 2003 and inscribed it in 2008, recording about 980 species, healers who are men, travel as central to learning, and the threat of acculturation (UNESCO 2008). Most healers use about 300 plants, specialists up to 600, the group about 900, of which about 30 are introduced, and women serve as midwives, with their knowledge less documented (Wikipedia, Kallawaya). Joseph Bastien described a "topographical-hydraulic" model of the body, in which fluids move inward and outward rather than seeking a Greek-style balance (Bastien 1989, abstract only). His *Healers of the Andes* (1987) catalogues the medicines. I saw only catalogue entries [VERIFY].

Sales talk. The Kallawaya sold their skill on journeys, and fame travelled with them. The claim that they saved Panama Canal workers from malaria or yellow fever rests, in the Wikipedia article, on a travel blog. A Paraguayan news piece places journeys to Panama between 1888 and 1915. I found no primary record of a role in canal medicine [VERIFY]. Treat travel as plausible and specific cures as unproven.

Restricted. The healers use a language, Machaj juyay, in medical and ritual contexts only, passed within practitioner families between men, taught to initiates and critically endangered (Harrison, Swarthmore). Under SY-04 category 4, this report notes that it exists and reproduces none of it, nor the ritual practice around it.

What the record supports. A well-documented healing profession with several hundred species and a coherent theory of the body. Its remedies have not, as far as I found, been systematically tested. The UNESCO listing documents a culture, not efficacy.

Evidence grades

Grades per use are given in the ranked table (section 6). The basis in brief: - **A**: capsicum plaster for back pain (two RCTs, 474 patients), capsaicin 8% patch (Cochrane, not makeable), crofelemer (RCTs, purified), cacao on blood pressure (Cochrane, trivial effect). - **B**: cinchona bark in malaria (pre-antibiotic series), guava leaf in diarrhoea (small trials), sangre de drago on wounds (one small RCT), paico juice for roundworm (one comparative trial), coca for mouth numbing (pharmacology and consistent reports). - **C**: home chili salve, crude latex for diarrhoea, coca for work and hunger, maguey syrup, matico, muña, pericón. - **D**: coca for altitude sickness (no trial, cohort negative), maca, copal, Mexican arnica, zapote blanco, bark tea. - **X**: cinchona for non-malarial fever, low-dose capsaicin cream for nerve pain, epazote oil, *Datura*, *Brugmansia*.

Means ledger

Item	Hands	Hearth	Garden and still	Village dispensary	District infirmary	Hospital before the Fall
Cinchona	Strip bark from a known tree	Dry, pound to powder	Plantation, coppice from 8 to 10 years	Bark labelled by tree, scales to 1 g, dose book	Grams-to-ringing records, assay and extraction (IN-09)	Quinine, artemisinin combinations
Coca	Pick and chew	Dry leaf, tea	Bushes at tropical mid altitude	Leaf for mouth pain [OWNER]	Acetazolamide, oxygen, descent	Lidocaine, acetazolamide, dexamethasone
Sangre de drago	Cut bark, collect latex	Dry latex	Not in Europe, trade only	Latex jars for wounds	Latex with rehydration for diarrhoea	Crofelemer, sutures
Chili	Rub fruit on skin	Fat salve	Garden annual or glasshouse	Labelled salve pots	Plasters of set strength	8% patch, analgesics
Guava	Leaf	Decoction	Frost-free only	Dried leaf	Rehydration salts	Intravenous fluids
Epazote	Leaf	Fresh juice, measured	Self-seeding annual	Cups marked in ml	Microscope for eggs	Albendazole
Datura, *Brugmansia*	Recognise, remove	None	Remove near children	Poison warning	Physostigmine if held (WO-11)	Intensive care

Harm test

Item	How it harms	Dose or error	Never give to	Misidentification	Warning signs	What to do	Historical cases
Cinchona bark	Quinine toxicity: ear, eye, heart, blood sugar, haemolysis	Strong bark at a weak-bark dose. Fatal from 1.5 g quinine adult, 900 mg toddler	Past black or red urine in malaria, known quinine reaction	False barks, which fail silently	Deafness, blurred vision, fainting, dark urine, sweating with confusion	Stop. Sugar. District	Adulterated trade, 1650 to 1740
Coca leaf	Stimulant, appetite loss	Heavy chewing for years, uncertain (WHO 2025)	Heart disease, pregnancy, children [VERIFY]	Products of unknown content	Chest pain, palpita-tions	Stop. District	Poor nutrition in chewers (Bauer 2019)
Sangre de drago	Little known	Unknown oral dose	Infants by mouth [VERIFY]	*C. tiglium*, other resins	Rash, vomiting	Stop. Wash off	None found
Chili salve	Burning, blistering	Strong fruit, broken skin, eyes	Infants, broken skin	None dangerous	Blisters, eye pain	Soap, cold water, acid rinse, eye irrigation	Hunan hand (1981)
Epazote	Ascaridole: vomiting, deafness, coma, fits	Oil at drops, strong repeated tea in a child	Infants, pregnancy, liver disease	Other goosefoots [VERIFY]	Vomiting, ringing ears, drowsiness	Stop. Airway. District	Levy 9 of 12 fatal. Colombia 7 of 12. Morocco 2024
Muña	Pulegone, liver	Oil, strong tea	Pregnancy, infants	Pennyroyal-type mints	Vomiting, jaundice	Stop. District	Pennyroyal deaths (TR-15)
Agave sap	Oxalate needles, saponins	Cut leaf on bare skin	Anyone without gloves	Aloe	Burning rash, purpura	Wash, cool	Series of 12, 1998
Datura	Atropine, scopo-lamine	About 10 mg atropine adult, less in a child	Everyone	Spinach, greens, seed in grain (PH-10)	Dry mouth, fever, wide pupils, delirium in 30 to 60 minutes	WO-11 Protocol 11	Australia 2022, Uganda 2019
Brugmansia	As *Datura*	About 10 flowers	Everyone	Unrecognised ornamental	As above, fever to 41 °C	WO-11 Protocol 11	Peru 2023

Red flags

Stop the plant and go to the district if any appear. 1. After bark: deafness rather than ringing, blurred vision, fainting, dark urine, sweating with confusion. 2. A child on bark who becomes drowsy or vomits. Children cannot report ringing. 3. After epazote: vomiting, ringing ears, drowsiness, a fit. 4. Dry mouth, hot flushed skin, wide pupils, fast pulse and confusion, whatever was taken. Suspect *Datura* or *Brugmansia*. 5. At altitude, headache with breathlessness at rest, confusion or unsteadiness. Descend. Coca is not the treatment. 6. Diarrhoea with dehydration, blood, or in an infant. Rehydration first. 7. A wound under latex, syrup or resin that turns red, hot, spreading or foul. 8. Chili in the eyes, or a salve that blisters. 9. Bark from an unknown trader. Treat as untested and watch the fever.

The case against

The two great drugs of this region did their work after chemists isolated them, in 1820 and 1860. Crude bark is unreliable to more than tenfold, and crude leaf numbs only the mouth. The pre-antibiotic bark record is two centuries of physicians fighting adulteration, dose and toxicity, and the arithmetic in section 2 suggests wild bark often cannot be dosed at all.

My grades lean on small trials: 60 wounds for sangre de drago, 60 children for paico, an infant guava trial against another herbal. Several C grades rest on use by peoples who met through colonial trade, which weakens independence. The regional laboratory literature is mostly in vitro, and the Northern Peru shrimp work shows many "active" plants are toxic in the same assays.

The codex claim rests on a generous criterion and an uncertain botany. Nahua physicians observed carefully, but "did what the healer meant" is not "works".

For the European home ground, most of these plants will not grow. Chili, epazote and pericón will. Agave and guava need a frost-free coast. Cinchona, coca and sangre de drago need tropical montane forest, so after the Fall they are trade goods, and trade goods are what adulterators sell.

Against this: chili, guava and paico juice are cheap, adequate and within a household's reach, and bark used with care beats nothing in malaria where nothing else exists.

10-line summary

1. Crude cinchona bark works in malaria, but quinine runs from none to over 14%, and wild calisaya averaged 0.66% in the one modern assay found.
2. IN-09's 5% assumption fits pharmacy and Ledger bark, not wild trees. Plan on about 1% for unknown bark, which cannot be dosed.
3. Ringing ears may gauge the dose with bark of unknown strength. Untested inference.
4. Coca leaf numbs the mouth, sustains work and blunts hunger. It has no proof against altitude sickness, and the one cohort found none.
5. Coca's status after the Fall is the owner's decision. The WHO judged leaf use low in public-health risk in December 2025.
6. Sangre de drago speeds small wound healing in one trial and gave rise to crofelemer, an approved antidiarrhoeal.
7. Capsicum plasters help chronic back pain (A). Low-dose capsaicin creams for nerve pain do not (X).
8. Fresh paico juice cleared roundworm as well as albendazole in Peruvian children. Epazote oil killed children at a few drops.
9. *Datura* and *Brugmansia* are in every market and garden here and have no place in the post-Fall pharmacopoeia.
10. Ortiz de Montellano showed Aztec physicians knew what their plants did, not that they cured. Most Badianus plants lack a secure identification.

Open questions

1. What do Bastien's *Healers of the Andes* (1987) and his 1983 pharmacopoeia list, and has any remedy been tested?
2. What quinine do cultivated *C. pubescens* and *C. calisaya* reach on Andean smallholdings today?
3. Did nineteenth-century physicians titrate bark to ringing ears?
4. What oral dose of crude latex matches 125 mg of crofelemer?
5. Does the Farmacopea Herbolaria de los Estados Unidos Mexicanos (2001) set monographs and doses for these plants [VERIFY: title and year from the brief]? What does the UNAM Atlas record on toxicity?
6. Omitted plants needing entries: ipecacuanha (*Carapichea ipecacuanha*), balsam of Peru (*Myroxylon balsamum*), sarsaparilla (*Smilax*), cat's claw (*Uncaria tomentosa*), guayusa.
7. What did Kallawaya women, as midwives, use, and is it recorded with consent?
8. Which Badianus entries have a secure identification, and what did the healer expect each to do?

Sources to read in full

1. Ortiz de Montellano B, *Aztec Medicine, Health, and Nutrition*, Rutgers 1990.
2. Bastien JW, *Healers of the Andes*, University of Utah Press 1987.
3. Emmart EW, *The Badianus Manuscript*, Johns Hopkins Press 1940, with Tucker and Janick 2020.
4. Sahagún, Florentine Codex Book 11, Dibble and Anderson 1963, and Devecka, *Healing Plants of the Mexica*.
5. Honigsbaum M, *The Fever Trail*, 2001.
6. Gachelin and others, the 2017 Journal of the Royal Society of Medicine version of the bark evaluation.
7. WHO Expert Committee on Drug Dependence, 48th meeting report, coca leaf, 2025.

At the bedside after the Fall

Household. Start with a pot of chili, a patch of paico, dried guava leaf where it grows, a cup marked in ml, the oral rehydration recipe, and the rule that *Datura* and *Brugmansia* come out of any garden where children play. In the Andes, dried coca leaf if custom and the owner's ruling allow. First failure to expect: a parent who doubles the paico because the first dose "did nothing", or brews a strong tea for a feverish child.

Village of 300. Start with scales to 1 g, a dispensary book, bark labelled by tree, sangre de drago latex or maguey syrup for wounds, chili salve made to one recipe, and one person who knows the red flags. Where malaria exists, a cinchona tree or a trade route to one, and someone recording grams to ringing for each batch. First failure: a trader's bitter bark that does nothing, and a malaria death blamed on the patient.

District of 3,000. Start with a coppiced cinchona plantation where the climate allows, or assayed bark by trade, a microscope for malaria films and worm eggs, IN-09's means to standardise bark, acetazolamide for altitude, physostigmine if any remains (WO-11), a ruling on coca [OWNER], and a register of every bark poisoning and failure. First failure: a strong plantation batch dosed at the weak-bark figure, an outbreak of cinchonism, or a child dead from bark left within reach.

Protocols

Quantities and timings come from the sources cited. Gaps filled by my arithmetic or judgement are marked [VERIFY].

Protocol 1. Cinchona bark by titration (only when no quinine or artemisinin combination exists)

Use with IN-09 Protocols 1 and 3. This revises IN-09 Protocol 4 for bark of unknown strength and is untested. 1. Confirm malaria as far as possible (IN-09 Protocol 1). Any red flag: district now. 2. Use bark from one known tree

or one labelled batch. Record tree, date and weight. 3. Grind fine. Weigh every dose. Never measure unknown bark by spoon. 4. Adult (60 kg) start: 5 g in wine, lemon juice or sour fruit drink every 8 hours [VERIFY: chosen so that 14% bark stays near 2 g of alkaloid a day]. 5. No ringing after 24 hours and fever persisting: raise to 10 g every 8 hours. Still none after another 24 hours: 15 g every 8 hours. No higher [VERIFY]. 6. At mild ringing, hold the dose and record "tree X, grams to ringing". 7. Deafness, blurred vision, fainting, severe vomiting or dark urine: stop, district. 8. Food or sugar water with every dose, sugar always in pregnancy. 9. Course: 7 full days at the ringing dose [VERIFY: modern quinine course applied to bark]. 10. Child: never titrate. Use only bark with a known adult grams-to-ringing figure, scaled by weight (child's kg divided by 60). Under 10 kg only on the district's word [VERIFY]. 11. Never give to anyone who has passed black or red urine in malaria. 12. Lock it away. A toddler can die from less than 1 g of quinine.

Protocol 2. Sangre de drago latex on a small wound

1. Wash the wound with boiled, cooled water and remove dirt.
2. Use only on small clean cuts and grazes, not bites, punctures or deep wounds [VERIFY].
3. Use latex of known *C. lechleri* origin. Reject unknown red resins.
4. Spread a few drops into a thin film. Let it dry, about 1 to 2 minutes [VERIFY].
5. Repeat twice daily for up to 14 days, as in the trial (Namjoyan and others 2015).
6. Cover with a clean dressing on hands and feet.
7. Check daily. Red, hot, spreading or foul: stop, follow the library's wound protocols, district.
8. A rash around the wound: stop.

Protocol 3. Chili salve for chronic back or joint pain, and the chili burn

1. Crush 10 g of dried hot chili per 100 g of melted fat or oil with beeswax [VERIFY: about 0.05% capsaicinoids].
2. Warm gently for 1 hour without smoking. Strain through cloth. Label "chili salve, not for eyes or children", with date.
3. Wear gloves, or wash hands with soap at once.
4. Test a pea-sized amount on the inner forearm for 1 hour. Blistering: do not use.
5. Apply thinly to intact skin 3 to 4 times a day. Never on broken skin, the face, or under heat or a tight bandage [VERIFY].
6. Expect burning in the first week. Judge benefit at 3 weeks (Frerick and others 2003).
7. Stop if the skin blisters or breaks.

The burn: skin, soap and cold water, then a vinegar or lemon rinse and cool compresses (Hitl and others 2025). Eyes, plenty of clean water for at least 15 minutes [VERIFY].

Protocol 4. Guava leaf decoction alongside oral rehydration

1. Start oral rehydration first and keep it going. The decoction does not treat dehydration.
2. Take about 5 g of dried leaf or 10 to 15 fresh young leaves per 500 ml of water [VERIFY: home strength not standardised].
3. Boil 10 minutes, cool, strain.
4. Adult: 200 ml every 8 hours for up to 3 days, the trial timing (Lozoya and others 2002).
5. Child over 2: half that [VERIFY]. Infant: not without the district.
6. Stop if stools become hard or the patient stops drinking.
7. Blood in the stool, sunken eyes, no urine for 8 hours, or an infant: district now.

Protocol 5. Paico juice for roundworm (fresh leaf only, never the oil)

1. Identify *D. ambrosioides*: strong smell, toothed leaves, tiny green flowers in clusters. If unsure, do not use.

2. Fresh leaves and soft tops only, no seed or fruit, the most toxic part (Hong Kong atlas, via summary).
3. Crush and press the juice through clean cloth.
4. Weigh the child. Dose 1 ml/kg under 10 kg, 2 ml/kg above (López de Guimaraes and others 2001). A 20 kg child gets 40 ml.
5. Measure in a marked cup, never by drops, spoons or "a glass".
6. Before breakfast, once a day, 3 days. No repeat within 2 weeks [VERIFY].
7. Never under 1 year, in pregnancy or in liver disease [VERIFY].
8. About a quarter get mild stomach upset. Vomiting, ringing ears, drowsiness or a fit: stop, district.
9. Never make, buy, keep or give the oil. Never boil the plant down into a strong tea for a child.

Protocol 6. Coca leaf for mouth pain, and the honest limit at altitude [OWNER: legality]

1. Adult with toothache or mouth pain: 5 to 10 g of dried leaf, moistened and held against the sore place (THRIVING library, WO-11). Numbness lasts about 1 hour.
2. Repeat as needed, within the 20 to 60 g a day of habitual chewers (UNODC, Encyclopedia.com, via summaries) [VERIFY: as a medical ceiling].
3. Not for children, pregnant women, or anyone with chest pain or heart disease [VERIFY].
4. A tooth abscess with fever, facial swelling or trouble swallowing needs drainage at the district. Numbness hides it.
5. At altitude, tell the traveller that coca has not been shown to prevent mountain sickness (Caravedo and others 2021). Ascend slowly [VERIFY: standard advice not checked].
6. Headache with breathlessness at rest, confusion or unsteadiness: descend at once, acetazolamide or oxygen if held. Never chew to keep climbing through symptoms.
7. Coca tea turns urine tests positive (Bauer 2019).

Numbers to carry

1. Wild *C. calisaya* bark: mean 0.66% quinine, 1.2% total alkaloid (Maldonado 2017).
2. Pharmacy cinchona bark: about 5% total alkaloid, 1.6 to 1.9% quinine (Murauer 2018).
3. Lowest fatal quinine: about 1.5 g adult, 900 mg toddler (IN-09).
4. Coca quid 5 to 10 g numbs the mouth for about an hour. Habitual chewing 20 to 60 g a day.
5. Coca tea and mountain sickness: no association. Acetazolamide odds ratio 0.13 (Caravedo 2021).
6. Paico juice 1 ml/kg under 10 kg, 2 ml/kg above, 3 mornings. 87% roundworm clearance.
7. Epazote oil: 4 drops three times a day for 2 days killed a one-year-old (US Dispensatory 1918).
8. *Brugmansia*: about 0.65 mg scopolamine per flower, about 10 flowers can kill (Kim 2014).
9. Capsicum plaster: 67% against 49% responders in back pain (Frerick 2003).
10. Sangre de drago cream: 96% against 78% healed at day 14 (Namjoyan 2015).

References

1. Bastien JW 1989. Differences between Kallawaya-Andean and Greek-European humoral theory. Social Science and Medicine 28(1):45-51. https://ideas.repec.org/a/eee/socmed/v28y1989i1p45-51.html (abstract only)
2. Bastien JW 1987. Healers of the Andes: Kallawaya Herbalists and Their Medicinal Plants. University of Utah Press. (catalogue entry only, not read)
3. Bauer I 2019. Travel medicine, coca and cocaine: demystifying and rehabilitating Erythroxylum, a comprehensive review. Tropical Diseases, Travel Medicine and Vaccines 5:20. https://researchonline.jcu.edu.au/61093/1/Bauer_TDTMV_Coca.pdf (read in full)
4. Burns C 2009. Where Aztecs meet scientists. Mexicolore. https://www.mexicolore.co.uk/aztecs/health/where-aztecs-meet-scientists

5. Bussmann RW, Sharon D 2006. Traditional medicinal plant use in Northern Peru: tracking two thousand years of healing culture. Journal of Ethnobiology and Ethnomedicine 2:47. https://pmc.ncbi.nlm.nih.gov/articles/PMC1637095/
6. Bussmann RW and others 2011. Toxicity of medicinal plants used in traditional medicine in Northern Peru. Journal of Ethnopharmacology 137(1):121-140. (abstract only)
7. Caravedo MA and others 2021. Risk factors for acute mountain sickness in travellers to Cusco, Peru: coca leaves, obesity and sex. Journal of Travel Medicine 29(5):taab102. https://academic.oup.com/jtm/article/29/5/taab102/6316244
8. Davidson JR, Ortiz de Montellano BR 1983. The antibacterial properties of an Aztec wound remedy. Journal of Ethnopharmacology [VERIFY: volume and pages]. (catalogue summary only)
9. Derry S, Moore RA 2012. Topical capsaicin (low concentration) for chronic neuropathic pain in adults. Cochrane Database of Systematic Reviews CD010111. https://www.cochrane.org/evidence/CD010111_low-concentration-capsaicin-applied-skin-chronic-neuropathic-pain-adults (plain-language summary)
10. Derry S and others 2017. Topical capsaicin (high concentration) for chronic neuropathic pain in adults. Cochrane Database of Systematic Reviews CD007393. (summary only)
11. DiCesare D and others 2002. SP-303 in the symptomatic treatment of acute diarrhoea among travellers to Jamaica and Mexico. American Journal of Gastroenterology 97(10) [VERIFY: title wording and pages]. (abstract only)
12. Elhaddadi H and others 2024. Fatal Dysphania ambrosioides poisoning in a child, case report [VERIFY: title wording]. Cureus 16(5):e60351. https://pmc.ncbi.nlm.nih.gov/articles/PMC11177892/
13. Flores Mamani R and others 2023. Brugmansia poisoning with multiorgan failure, case report [VERIFY: title wording]. Revista de Medicina (São Paulo) 102(4):e-205036. (summary only)
14. Frerick H and others 2003. Topical treatment of chronic low back pain with a capsicum plaster. Pain 106 [VERIFY: issue and pages]. https://pubmed.ncbi.nlm.nih.gov/14581111/ (abstract only)
15. Gachelin G, Garner P, Ferroni E, Tröhler U, Chalmers I 2016. Evaluating Cinchona bark and quinine for treating and preventing malaria. James Lind Library Bulletin. https://jameslindlibrary.org/?p=13894
16. Harrison KD, no date. Kallawaya: a secret language and medicinal knowledge. Swarthmore College. https://www.swarthmore.edu/k-david-harrison/kallawaya-a-secret-language-medicinal-knowledge
17. Hitl M and others 2025. Review of capsaicin skin injury and its treatment [VERIFY: title]. Life 15(4):539. (summary only)
18. Holmstedt B and others 1979. Cocaine in blood of coca chewers. Journal of Ethnopharmacology 1 [VERIFY: authors and pages]. (summary only)
19. Kim Y and others 2014. Brugmansia poisoning, case report [VERIFY: title wording]. BMC Research Notes 7:553. https://pmc.ncbi.nlm.nih.gov/articles/PMC4148940
20. Lee MS, Shin BC, Yang EJ, Lim HJ, Ernst E 2011. Maca (Lepidium meyenii) for treatment of menopausal symptoms: a systematic review. Maturitas 70 [VERIFY: pages]. (abstract only)
21. López de Guimaraes D and others 2001. Paico against albendazole for ascariasis in children of Huaraz, Peru [VERIFY: title and journal]. https://busqueda.bvsalud.org/portal/resource/pt/mdl-11818981 (abstract only)
22. Lozoya X and others 2002. Trial of a Psidium guajava leaf phytodrug (QG-5) in acute diarrhoea [VERIFY: authors and title]. Journal of Ethnopharmacology. https://pubmed.ncbi.nlm.nih.gov/12413703/ (abstract only)
23. MacArthur RD and others 2013. Efficacy and safety of crofelemer for noninfectious diarrhoea in HIV-seropositive individuals (ADVENT trial). HIV Clinical Trials 14(6):261-273 [VERIFY: first author]. (abstract only)
24. Maldonado C and others 2017. Phylogeny predicts the quantity of antimalarial alkaloids within the iconic yellow Cinchona bark (Rubiaceae: Cinchona calisaya). Frontiers in Plant Science 8:391. https://pmc.ncbi.nlm.nih.gov/articles/PMC5360753/

25. Murauer A, Ganzera M 2018. Quantitative determination of major alkaloids in Cinchona bark by supercritical fluid chromatography. Journal of Chromatography A 1554:117-122. https://pmc.ncbi.nlm.nih.gov/articles/PMC6193530/
26. Namjoyan F and others 2015. Efficacy of Dragon's blood cream on wound healing: a randomized, double-blind, placebo-controlled clinical trial. Journal of Traditional and Complementary Medicine 6(1):37-40. https://pmc.ncbi.nlm.nih.gov/articles/PMC4737969
27. Ortiz de Montellano B 1975. Empirical Aztec medicine. Science 188:215-220. https://pubmed.ncbi.nlm.nih.gov/1090996/ (not read, results via Waldstein 2014)
28. Palmer S 2010. Toward responsibility in international health: death following treatment in Rockefeller hookworm campaigns, 1914 to 1934. Medical History 54(2):149-170.
29. Penny ME and others 2009. Can coca leaves contribute to improving the nutritional status of the Andean population? Food and Nutrition Bulletin 30(3):205-216. (abstract only)
30. Potter SOL 1902. A Compend of Materia Medica, Therapeutics and Prescription Writing: Cinchona. Blakiston. https://www.henriettes-herb.com/eclectic/potter-comp/cinchona.html
31. Ried K, Fakler P, Stocks NP 2017. Effect of cocoa on blood pressure. Cochrane Database of Systematic Reviews CD008893.pub3. (summary only)
32. Romero-Estrada A and others 2016. Anti-inflammatory and antioxidative effects of six pentacyclic triterpenes isolated from the Mexican copal resin of Bursera copallifera [VERIFY: authors and journal]. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5081879/ (search summary only)
33. Schultes RE 1991. Review of Aztec Medicine, Health, and Nutrition by B. R. Ortiz de Montellano. Journal of Ethnobiology 11(2):174. https://ethnobiology.org/sites/default/files/pdfs/JoE/11-2/BRAztecMedicine.pdf
34. Shin BC, Lee MS, Yang EJ, Lim HS, Ernst E 2010. Maca (L. meyenii) for improving sexual function: a systematic review. BMC Complementary and Alternative Medicine 10:44. https://pmc.ncbi.nlm.nih.gov/articles/PMC2928177/
35. TRAMIL, no date. Tagetes lucida. https://tramil.net/en/plant/tagetes-lucida
36. Tucker AO, Janick J 2020. Flora of the Codex Cruz-Badianus. Springer. (summary only)
37. UNESCO 2008. Andean cosmovision of the Kallawaya. https://ich.unesco.org/en/RL/andean-cosmovision-of-the-kallawaya-00048
38. University of Texas at El Paso, no date. Herbal safety: Mexican arnica. https://www.utep.edu/herbal-safety/
39. The Dispensatory of the United States of America 1918, 20th edition: Oleum Chenopodii [VERIFY: editors]. https://www.henriettes-herb.com/eclectic/usdisp/chenopodium_oleu.html
40. Waldstein A 2014. How can ethnobotany contribute to the history of Western herbal medicine? A Mesoamerican answer. In Francia S, Stobart A (eds), Critical Approaches to the History of Western Herbal Medicine. Bloomsbury. https://kar.kent.ac.uk/42899/1/ch14.pdf (read in full)
41. Wei LB and others 2001. Psidium guajava in infantile rotavirus enteritis. Chinese Journal of Integrative Medicine 7:86-89 [VERIFY]. (summary only)
42. Weinberg RB 1981. Hunan hand. New England Journal of Medicine [VERIFY: volume and page]. (summary only)
43. WHO 2025. WHO Expert Committee concludes critical review of coca leaf, recommends maintaining current controls. 10 December 2025. https://www.who.int/news/item/10-12-2025-who-expert-committee-concludes-critical-review-of-coca-leaf–recommends-maintaining-current-controls
44. Wikipedia 2025. Kallawaya. https://en.wikipedia.org/wiki/Kallawaya
45. Wikipedia 2025. Libellus de Medicinalibus Indorum Herbis. https://en.wikipedia.org/wiki/Libellus_de_Medicinalibus_Indo
46. Wikipedia 2025. Robert Tabor. https://en.wikipedia.org/wiki/Robert_Tabor (summary only)
47. Secondary items seen only as search-engine summaries, with no full record taken [VERIFY all]: Dumbarton Oaks exhibit text on the Florentine Codex. UNL 2016 on C. officinalis in Loja. CSIR on C. pubescens. European Pharmacopoeia cinchona monograph. UNODC Bulletin on Narcotics 1952 and Encyclopedia.com on chewing quantities. WOLA and TNI on the March 2026 CND session. Arzneimittelforschung 2001,

51(11):896-903, capsicum plaster trial. Scientific Reports 2021 on capsaicinoid content. Frontiers 2024 review of guava. RPMESP on matico fibroblasts. Studies of dillapiole and muña oil. Hong Kong toxic plant atlas on D. ambrosioides. Britannica on chenopodium oil. UAM 2004 (Journal of Ethnopharmacology) on epazote infusions, and an Argentine report on epazote poisoning. Stojanovska 2008 (Menopause) on maca. Planta Medica 1989 to 1991 on Casimiroa. Cutis 2000, Dermatology 1998 and Allergologia 2010 on agave dermatitis. Journal of Ethnopharmacology 2017 review of Heterotheca. ASIS Online on burundanga. A review of fatal plant poisonings in the Americas. Pieters 1995 and Vaisberg 1989, read only as cited in Namjoyan 2015.

48. THRIVING library, IN-09, WO-11, PH-10, PH-01, SY-04, TR-15. Library documents, unverified.