

American ginseng plate from Jacob Bigelow's *American Medical Botany*, Vol. 2, published in 1818.



TOWARD AN UNDERSTANDING OF
GINSENG
ADULTERATION:
THE TANGLED WEB OF NAMES,
HISTORY, TRADE, AND PERCEPTION

By Steven Foster

Editor's note: This article is produced under the aegis of the ABC-AHP-NCNPR Botanical Adulterants Program and is the fifth from Steven Foster in his series on herb adulteration. His previous article on the adulteration of black cohosh (*Actaea racemosa*, *Ranunculaceae*) was the cover story of issue 98, published in 2013. This article is the first part of a planned two-part series on the vast subject of adulteration of Asian and American ginseng. In order to adequately explain the methods employed to adulterate ginseng, it is constructive to understand the nomenclature, taxonomy, and trade history of this economically important medicinal plant.

INTRODUCTION

If there is a single word that exemplifies global interest in medicinal plants, it is “ginseng.” The commercial, scientific, and historical importance of ginseng (*Panax* spp., *Araliaceae*) includes at least 2,200 years of written history in traditional Chinese medicine (TCM) and, coupled with the European discovery of American ginseng (*P. quinquefolius*) in 1700, has created an iconic bridge between East and West that helps define both traditional and modern human experience with medicinal plants.

To simplify the discussion, *P. quinquefolius* will be referred to throughout this article as “American ginseng,” the Standardized Common Name established by the second edition of the American Herbal Products Association’s (AHPA’s) *Herbs of Commerce*,¹ a reference text that includes common names and Latin binomials for herbs sold in the United States. (Some Canadian colleagues might scold this writer for not using the more diplomatically correct “North American ginseng.”) To remain consistent with *Herbs of Commerce*, *P. ginseng* will be referred to as “Asian ginseng,” in a general sense, although some prefer to use English common names that reflect the nation of origin (e.g., “Chinese ginseng” or “Korean ginseng”).

The literature on ginseng is voluminous.^{2,3} A PubMed search for the word “ginseng” yields more than 7,200 references to scientific papers, and a Google Scholar search for “Panax” results in 91,000 references (as of July 11, 2016). Almost any general work on medicinal plants, pharmacognosy, or herbal medicine includes ginseng, and hundreds of technical treatises, popular books, and monographs on ginseng have been published in dozens of languages.

Since the 1970s, numerous symposia on all aspects of ginseng — its botany, chemistry, clinical use, conservation, commerce, cultivation, pharmacology, and safety — have been held around the world. (Unfortunately, many important papers presented in symposia proceedings are not cataloged by indexing services, thus making that information more challenging to access.) Various organizations, such as the Korean Ginseng Research Institute, Wisconsin Ginseng Grower’s Association, Ontario Ginseng Grower’s Association, and others, also are dedicated to better understanding the chemistry, pharmacology, production, toxicology, and clinical applications of ginseng root and its extracts.

Intermixed source plants, rampant taxonomic confusion, and unrelated plants mislabeled as “ginseng” have created ever-evolving challenges in authentication. These

issues, combined with the historically high value of ginseng roots, and the perceived value of plants and products offered under the name “ginseng,” have made this botanical particularly tempting to economic adulterers.

This article reviews information related to the potential, perceived, or actual adulteration of material offered as “ginseng,” including historical, commercial, botanical, pharmaceutical, and nomenclatural (in both technical and trade use) information, from 1655 to 1980.

Understanding Ginseng Adulteration

In the broadest sense, ginseng adulteration* falls into the following five categories, which are not necessarily mutually exclusive:

1. **Plant materials not from the genus *Panax* misbranded as “ginseng,”** including species from both inside and outside the *Araliaceae* family, in association with product labeling or marketing. In the herb trade, this extends to plants referred to in TCM as *sheng* or *shen* (e.g., codonopsis or *dang shen* [*Codonopsis pilosula*, *C. tangshen*; *Campanulaceae*], which is sometimes regarded as a “poor man’s ginseng”) or lower-cost ginseng alternatives with perceived similar activity.⁴
2. **Intentional adulteration of one *Panax* species with another,** such as the adulteration of American ginseng with Asian ginseng, or vice versa. This is usually done for economic incentive (i.e., adulterating higher-priced species with lower-priced material), and depends on market conditions and the end-user market country. However, unintentional or accidental adulteration of one species with the other may occur as the result of carelessness or insufficient information in the supply chain. A cultural or national bias may also be a consideration. For example, in South Korea, various forms of Asian ginseng whole root offerings are preferred, and American ginseng is regarded as an adulterant. In fact, sale of American ginseng is not allowed in Korea. In southern China, where various product forms of

*This paper will not discuss potential contamination with agricultural chemicals, such as pesticides, herbicides, and fungicides; soil microbes; heavy metals; or other natural and artificial contaminants.

American ginseng are sought as a “cooling” tonic, lower-priced, domestic Asian ginseng may masquerade as American ginseng, sometimes sold under the trade name “Chinese white.”

- 3. Intentional adulteration of *Panax* species with other plant materials or substances of lesser value** that may have a casual visual resemblance to a *Panax* species, or the use of pharmacologically inert bulking agents, particularly in powders (e.g., the use of sawdust, or the addition of filling agents such as dicalcium phosphate).^{4,5}
- 4. Intentional admixing or substitution of various ginseng plant parts** without declaring all parts on the label. For example, ginseng leaf extracts purportedly are added to ginseng root extracts in an effort to increase the overall level of ginsenosides (panaxosides), the saponin glycosides widely considered the most important active constituents of *Panax* species. However, the ginsenoside profile of ginseng leaf is different than that of ginseng root. Admixing or substituting one part for another may affect product bioactivity, perhaps increasing or otherwise altering efficacy. Nonetheless, a ginseng root product containing ginseng leaf extract should be labeled as containing ginseng leaf extract. The chemistry of various plant parts in the genus *Panax* is also species-dependent.
- 5. Intentional reduction of quality and strength** by selling waste material (e.g., dried marc, or raw material left over from commercial extraction) as “ginseng root,” which is often mixed with varying percentages of the unextracted root, especially for powdered material.⁴

Unadulterated Ambiguity: On the Name ‘Ginseng’

The names associated with “ginseng” vary depending on the context, which is important to keep in mind when discussing the history, trade, discovery, use, science, and nomenclatural complexities of ginseng over the last 300 years.

The late Harvard University botanist Shiu Ying Hu, PhD (1908-2012), explained that the word “ginseng” derives from the Romanization of the sounds of two Chinese characters: *Gin* is the sound for the word “man,” and *seng* is very close in pronunciation, and equivalent in meaning, to “essence.” According to Hu’s interpretation, the name translates to “essence of the earth in the form of a man,” which represents the spiritual phase of nature, or the vital spirit of earth that dwells in the material form of the root.⁶ Often loosely translated as “man-shaped root,” the proper Chinese translation, Hu suggested, is “man essence.”⁷

Panax derives from the Greek *pan* (“all”) and *akos* (“cure”), a reference to the mid-18th century Western understanding of the herb’s medicinal reputation in China. However, as Hu pointed out, ginseng was never employed as a “panacea”; rather, its use is restricted and specific in TCM.⁶

In Chinese medicine (including formalized TCM and regional folk medicine), “seng” refers to fleshy root-

stocks used as tonics. Modifiers can indicate the source plant or various qualities (e.g., “gin seng,” “bitter seng,” “black seng,” “Mingtang seng,” and “prince seng”). Not all *Panax* species are considered sengs, and there are sengs not in the genus *Panax*.^{8,9} Hu used the metaphor, “A horse is a mammal, but not all mammals are horses. Likewise, ginseng is a *Seng* but not all sengs in Chinese medicine are ginseng.” She documented 62 species of “seng-producing” plants in 40 genera from 20 botanical families. Once known as a type of “ginseng,” the woody plant eleuthero (*Eleutherococcus senticosus*, Araliaceae) does not have a fleshy rootstock. Therefore, in a traditional Chinese sense, it is not considered a seng-producing plant.¹⁰

Since the revival of the US herb trade in the 1970s, the term “ginseng” has been applied to various herbal ingredients, often with qualifying adjectives that denote geographic origin or other details. Unsuspecting or under-informed consumers may assume that products deemed “ginseng” have tonic, aphrodisiac, or other properties that are casually associated with *Panax* species.

A 2003 *HerbalGram* article by American Botanical Council (ABC) Advisory Board member Dennis Awang, PhD, a natural products chemist and former Health Canada regulatory scientist, reviewed plants sold in the marketplace under the name “ginseng.” Unless the plant material was American ginseng or Asian ginseng, Awang considered this practice to be an abuse by uninformed herbal vendors, or even unscrupulous vendors seeking to cash in on the reputation of the name. His list enumerated imposters within the Araliaceae family and from six other plant families (Table 1).¹¹

The unique and illustrative cases of canaigre (*Rumex hymenosepalus*, Polygonaceae) — perhaps the most egregious example of outright fraud — and eleuthero are detailed briefly below.

Unadulterated Fraud: ‘Wild Red Desert Ginseng’

The story of canaigre, sold as “wild red desert ginseng” or “wild red American ginseng” in the late 1970s, is one of the best examples of product mislabeling fraud associated with ginseng adulteration. One such product contained a red-colored root that was collected from wild habitats in the southwest United States. However, canaigre — also known as Arizona dock, tanner’s dock, or canaigre dock¹² — is not remotely related to the genus *Panax* or the family Araliaceae. Its chemistry and expected health benefits also are unrelated to ginseng.¹³ Due to its traditional use for tanning leathers, and its very high tannin content, the plant was developed as a commercial tanning agent by businessmen in Texas and Arizona in the late 19th century.¹⁴

The now-defunct Herb Trade Association (HTA; the predecessor of AHPA) investigated the “wild red American ginseng” issue and deemed the mislabeled products fraudulent. The results were published as the “Herb Trade Association Policy Statement No. 1 — Canaigre.” After HTA’s small educational campaign for the natural foods and herb industry, the product quickly disappeared from the market.^{13,15}

Ussurian Thorny Pepperbush: The Best-Disguised Ginseng Imposter

In 1979, Russian researcher A.I. Baranov proposed the name “Ussurian thorny pepperbush” as an English technical name for the genus *Eleutherococcus*. He claimed the name was “guided by the botanical characteristics of the plant, by good taste, and by the spirit of English language,” but Baranov’s suggested name never stuck. The plant would go on to achieve widespread market appeal as “Siberian ginseng,” but, today, it is known as eleuthero (*E. senticosus*, syn. *Acanthopanax senticosus*).¹⁶ The case of eleuthero is perhaps the best example of a plant in the family Araliaceae but not in the genus *Panax* that was sold falsely as “ginseng.”

Bruce Halstead, MD, (1920-2002) claimed to have coined the term “Siberian ginseng” shortly after returning from a trip to Vladivostok, Russia, in December 1967, to meet with pioneering Soviet eleuthero researcher I.I. Brekhman, MD, (1921-1994). “Siberian ginseng” was also used to refer to eleuthero in a popular 1973 book by Richard Lucas, titled *Eleuthero (Siberian ginseng): Health Herb of Russia*.¹⁷ However, “Siberian ginseng” is used in small print on the cover of the book and that name is referred to only once elsewhere in the book. Otherwise, the name “eleuthero” is used throughout the book.

After successful discussions with Soviet officials, Halstead

approached Beverly Hills businessman Milton Brucker about creating a company to import *E. senticosus* extract from the Soviet Union. Together, they formed Medimpex (later changed to Imedex International), and a deal was struck with the Soviet government for an exclusive franchise to distribute the Russian pharmacopeial extract of *E. senticosus* in the United States. The Pharmacological Committee of the USSR Ministry of Health approved the extract as a stimulant in 1962.¹⁸

The US Patent Office issued a trademark to Imedex International for a “dietary food supplement containing extract of ginseng,” with the terms “Siberian,” “ginseng,” “extract,” and “genuine” on the registered mark. It was registered on November 30, 1976 (with the date of first use listed as April 17, 1973), and cancelled less than seven years later, on April 26, 1983.¹⁹

Once Imedex International started selling “Siberian ginseng” in the US market, competitors began importing the herb from China (a relatively new option made possible by President Richard Nixon’s historic 1972 trip to China, which opened the door for trade between the two countries). A state-owned export corporation in Harbin, China, was responsible for the shipment of raw materials and finished products to the United States.

In the mid-1970s, following nearly three decades of Soviet research and product development, the Chinese resurrected an obscure article of the Chinese materia medica known as “eleuthero root.” Parts of its Chinese name (without key modifiers) were used in the descriptions of several



Early European illustration of *Panax ginseng* (from a Chinese work) in Andreas Müller’s 1674 *Hebdomas Observationum de Rebus Sincis*. Source: Bavarian State Library Digital Collections.

Table 1. Awang’s List of ‘Plants Improperly Sold as Ginseng’¹¹

Common Name	Latin Binomial (Family)	Incorrect Name Given to Species
California spikenard	<i>Aralia californica</i> (Araliaceae)	“California ginseng”
Small spikenard	<i>A. nudicaulis</i> (Araliaceae)	“Wild ginseng” (also historically traded as “false sarsaparilla,” “wild sarsaparilla,” or “American sarsaparilla”)
Eleutherococcus gracilistylus	<i>Eleutherococcus gracilistylus</i> , syn. <i>E. nodiflorus</i> and <i>Acanthopanax gracilistylus</i> (Araliaceae)	“Prickly ginseng”
Eleuthero	<i>E. senticosus</i> (Araliaceae)	“Siberian ginseng” or “eleuthero ginseng”
Devil’s club	<i>Oplopanax horridus</i> (Araliaceae)	“Pacific ginseng”
Tongkat ali	<i>Eurycoma longifolia</i> (Simaroubaceae)	“Malaysian ginseng”
Ashwagandha	<i>Withania somnifera</i> (Solanaceae)	“Indian ginseng” or “Ayurvedic ginseng”
Maca	<i>Lepidium meyenii</i> (Brassicaceae)	“Peruvian ginseng”
Gynostemma	<i>Gynostemma pentaphyllum</i> (Cucurbitaceae)	“Southern ginseng” or “blue ginseng”
Suma	<i>Hebanthe eriantha</i> , syn. <i>Pfaffia paniculata</i> (Amaranthaceae)	“Brazilian ginseng”
Canaigre	<i>Rumex hymenosepalus</i> (Polygonaceae)	“Wild red desert ginseng” or “wild red American ginseng”

other items in the materia medica, further confusing the identity of the source plant. Actually containing eleuthero, products entered the US trade as “*wuchaseng*,” “*wujiaseng*,” “*eleuthero ginseng*,” and “*Siberian ginseng*.”²⁰

Imports of eleuthero prompted heated debates among board members of the then-fledgling HTA. At a meeting of the organization’s board in March 1980, some argued to allow eleuthero to be called “*ginseng*” in the US market, while others argued against it. The heart of the debate centered around the obvious physical differences between eleuthero and ginseng plants and the materials of commerce obtained from them. Ginseng roots from *Panax* spp. are harvested after at least four years in the ground, and once dug, the plant no longer exists. Contrastingly, the aboveground woody stalks of *E. senticosus*, a shrub that can grow up to three meters (9.8 feet) in height, was the material found in trade.

In the April 1980 issue of *Natural Foods Merchandiser*, Ken Murdock, former president of Nature’s Way Herbs, noted these differences in a memorable quote that captured the essence of the debate. “*Panax ginseng* is a highly vulnerable plant that can only grow in a restricted habitat. Its roots are what are used for ginseng,” he is quoted as saying. “But with eleuthero, we’re talking about a cotton-picking tree. I don’t think we should be calling something ginseng that you can harvest with a chain saw.”²¹

An Ancient Supply Chain with Specialized Terminology

In the 1985 paper “On the role of botany in Chinese medicinal materials research,” Hu highlights the case of eleuthero as an example of an herb whose common names in Chinese and whose English name in commercial trade (“*Siberian ginseng*”) could lead to confusion and possible product adulteration.²²

Decades earlier, in July 1942, while walking along sand dunes of the Min River in northwestern Sichuan province, Hu encountered thickets of *Periploca calophylla* (family: Apocynaceae or Asclepiadaceae), a shrubby vine with slender paired pods. She asked her guide about the name of the plant, and he told her it was called “*jia pi*” (a pod-bearing species, the bark of which is harvested for medicine). A week later, she and her guide encountered a species of *Eleutherococcus* with dense red spines (*E. gracilistylus*) in a river plain. Her guide told her it was called “*hong mao ci wu jia*.” He harvested a section of the bark, and told her that, among herb traders, the bark is called “*wu jia pi*.”²²

In the 1985 paper, Hu explained that the green-yellow-flowered *P. calophylla* was the source plant of the drug *jia pi* from western China, and the maroon-flowered *P. sepium* was the source plant of *jia pi* from northern China. Local merchants dealing with crude drugs collected from the field know *P. sepium* from northern China as “*bei wu jia pi*” (also known as “*xiang jia pi*”), whereas *P. calophylla* from southern China was labeled “*nan wu jia pi*.” (*Bei* is Mandarin for “north” and *nan* means “south.”)

Hu used the *Eleutherococcus/Periploca* example to highlight the fact that Chinese drug plant collectors give plants different, yet similar, names that refer to distinct morpho-

logical features and/or different plant parts.

Field collectors, wholesale dealers, and herb shop owners are able to distinguish between the two distinct plant materials based on their appearance and smell. There is little confusion of the source plant in this centuries-old supply chain, in which crude drug names, often with modifiers of geographic origin or morphological features, are commonly used. These local Chinese drug names predate Linnaean scientific taxonomy by many centuries²² and could be equally as exacting.

When West Meets East: Lessons in Translation from the Collector to the Consumer

Nomenclatural nuances caused confusion when “*Siberian ginseng*” was imported to the United States from China in the mid-1970s. Different traditional Chinese modifiers attached to “*wu jia pi*” apparently were reduced in communications to “*jia pi*.” Confusion between *ci wu jia* (the root of *E. senticosus*) and the Chinese name of its relative *E. gracilistylus*, also listed as a source of *wu jia pi*, resulted in significant adulteration of North American (and, presumably, global) supplies of *E. senticosus* with *P. sepium* (*bei wu jia pi*).

By the early 1980s, some members of the North American herb trade suspected a possible adulteration problem with eleuthero. The American Herb Association (not to be confused with the HTA or AHPA) began gathering information on alleged adulteration, and published information in its newsletter alerting herbalists to the potential problem of adulteration of eleuthero with *P. sepium*.²³

In 1986, Subhuti Dharmananda, PhD, a member of the ABC Advisory Board, published an article in his periodical *Update on Herbs* in which he described the confusion about the Chinese names and sources of *P. sepium* and *E. senticosus*. He also suggested that *E. sessiliflorus* (syn. *Acanthopanax sessiliflorus*) was being supplied as “*eleuthero ginseng*” from Korean sources. (In recent years, *E. sessiliflorus* has also been offered widely as “*E. senticosus*” in the horticultural trade, furthering confusion.) In the same issue, an article by researchers at the Heilongjiang Institute of Chinese Materia Medica presented old and new perspectives of eleuthero (as “*ci wu jia*”). They detailed its ancient history and explained how it had fallen into obscurity in recent centuries in China only to be revived by Chinese research in the 1970s, which was sparked by market interest following Soviet research.²⁴

Despite modern references placing *E. senticosus* in the genus *Eleutherococcus*,²⁵⁻²⁷ many researchers still use the obsolete genus name *Acanthopanax* and refer to it as *Acanthopanax senticosus*. A PubMed search for “*Eleutherococcus*” and “*senticosus*” yielded 81 references (as of July 11, 2016), whereas a search for “*Acanthopanax*” and “*senticosus*” retrieved 130 references.

The ‘Hairy Baby’ Case: Adulteration Leads to Safety Issues

In the early 1990s, the confusion surrounding *Panax* species and eleuthero emerged from the obscurity of herbal newsletters into mainstream media. The *Journal of the American Medical Association (JAMA)*, in an issue

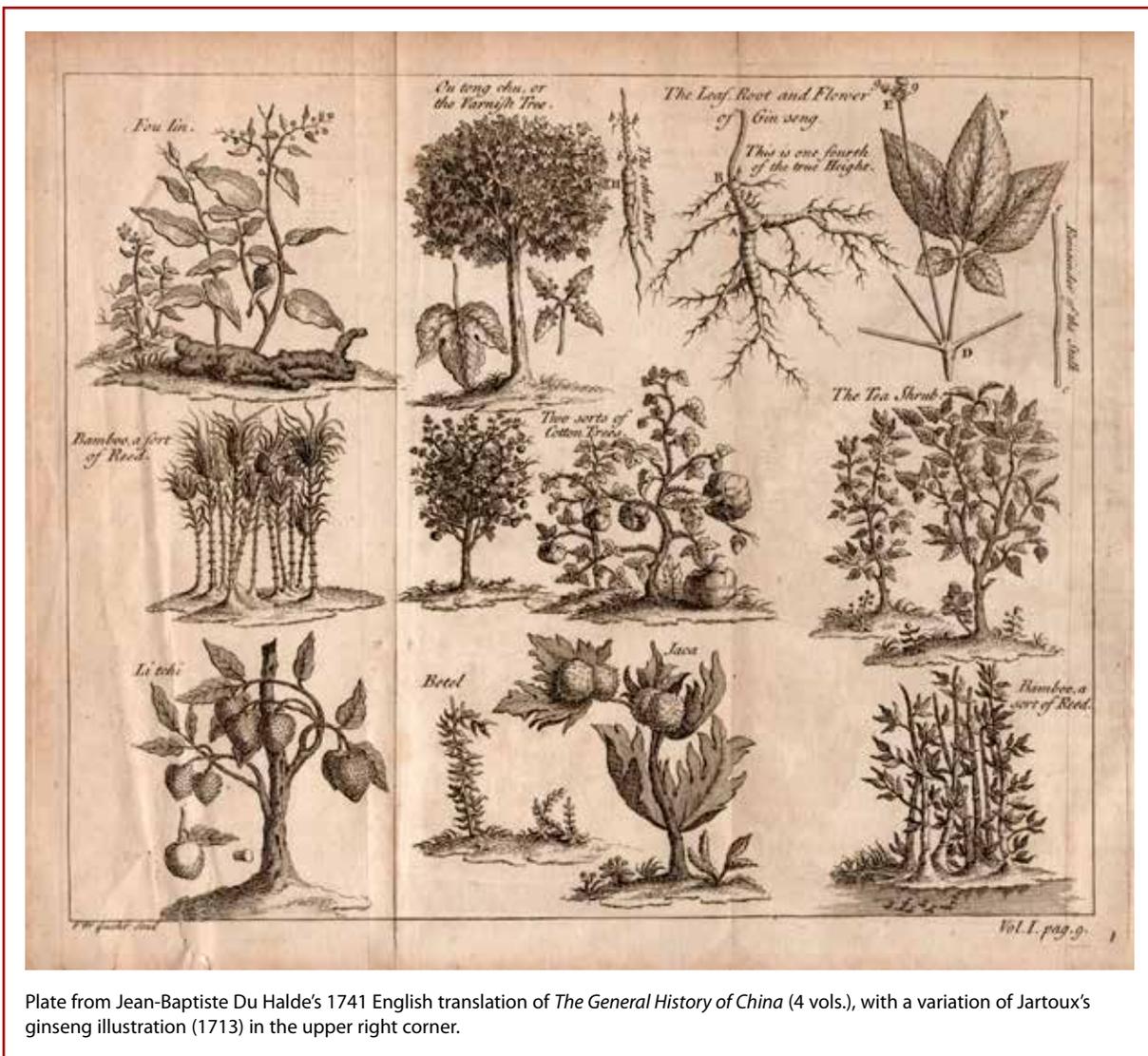


Plate from Jean-Baptiste Du Halde's 1741 English translation of *The General History of China* (4 vols.), with a variation of Jartoux's ginseng illustration (1713) in the upper right corner.

dated December 12, 1990, published a letter to the editor describing a case of adulteration of eleuthero with *Periploca sepium*.²⁸ Gideon Koren, MD, a pediatrician, clinical pharmacologist, and toxicologist, and colleagues in Toronto, Ontario, reported on a case of neonatal androgenization associated with maternal “ginseng” use — the so-called “hairy baby” case. The isolated incident was attributed to the mother’s use of “pure Siberian ginseng.” The authors erroneously cited information about *Panax ginseng* in their discussion of “Siberian ginseng,” leading to even more confusion and misreporting.

Follow-up research by Awang (then head of the Natural Products Section of Health and Welfare Canada’s Bureau of Drug Research) pointed out the errors in the report by Koren and colleagues. His lab obtained samples of the same lot from the manufacturer and compared the product to authenticated raw eleuthero material and herbarium specimens obtained from the Institute of Chinese Materia Medica at the Academy of Traditional Chinese Medicine in Beijing.

Awang’s lab confirmed that the product did not in fact contain eleuthero, but instead contained *P. sepium*.^{29,30}

In conjunction with Awang’s lab, Donald P. Waller, PhD, and colleagues at the College of Pharmacy at the University of Illinois at Chicago (UIC) performed pharmacological tests with the implicated plant material (*P. sepium*). They observed no androgenic activity and concluded that “the effects observed were specific to humans and possibly related to an undetermined peculiarity of the subject patient.”³¹

Another Adverse Reaction Report

In 1996, the *Canadian Medical Association Journal* featured a case report by Shelagh McRae, MD, describing “elevated serum digoxin levels in a [74-year-old] patient taking digoxin and Siberian ginseng.” The patient reportedly experienced no toxic effects. The physician ruled out common causes of high serum digoxin. Digoxin levels remained high even after digoxin therapy was discontinued. The patient revealed he was taking a “Siberian ginseng” product. After stopping use of the product, serum digoxin levels returned to normal, and treatment with digoxin resumed. Several months later, the patient started taking “Siberian ginseng” once

again, and serum digoxin levels rose. Use of “Siberian ginseng” was stopped, and serum digoxin levels returned to normal. McRae concluded that “Siberian ginseng contains eleutherosides, which are chemically related to cardiac glycosides such as digoxin.”³²

In a follow-up letter to the journal’s editor, Awang suggested that this was another probable case of botanical misidentification and chemical inaccuracies. Contrary to McRae’s report, Awang noted that eleutherosides from *E. senticosus* are not related to cardiac glycosides such as digoxin. *Periploca sepium*, however, does contain compounds related to cardiac glycosides. A regional forensic laboratory assayed the offending “Siberian ginseng” capsules for digoxin and digitoxin. Neither was found, and the package was discarded. Unfortunately, no further analyses were conducted, and the identity of the plant material remains unknown.³³ McRae’s paper also sullied the good name of authentic ginseng products from the genus *Panax*.

Confusion Persists in the Scientific Literature

The 1996 case report by McRae is still cited without reference to Awang’s caveats regarding nomenclatural confusion. For example, various studies by Amitava Dasgupta, PhD, and colleagues from the Department of Pathology and Laboratory Medicine at the University of Texas Health Science Center’s McGovern Medical School in Houston continue to cite, uncritically, the McRae study. This adds to the rampant, dizzying confusion about the use of the word “ginseng.” One of their publications, for example, was titled “Effect of Brazilian, Indian, Siberian, Asian, and North American ginseng on serum digoxin measurement.”³⁴ Inexplicably, some of the products used in the studies by Dasgupta’s research group did not contain the word “ginseng” in labeling. Incredibly, too, there was no apparent effort to authenticate the identity of these “ginseng” products, which were purchased from retail outlets in Houston, primarily in the city’s Chinatown area.

The studies by Dasgupta’s research group were designed to evaluate interferences of “ginsengs” in various commercial clinical assays used to determine digoxin levels in the serum of patients. Here, the researchers simply added the “ginseng” products to human serum samples in vitro, rather than analyze serum samples from humans who had consumed the products. The decision not to include human subjects, they explain, is due to the “reported toxicity of Asian ginseng and unknown toxicity of recently available Indian ginseng,”³⁵ although no reference is provided for the alleged toxicity.

Another paper that famously confuses the name “ginseng” was written by neuropsychiatrist Ronald K. Siegel, MD (then at the Neuropsychiatric Institute at the University of California, Los Angeles), and published in the April 13, 1979 issue of *JAMA*. Despite being debunked, this “clinical note” continues to be cited ad nauseam in the scientific literature. In his uncontrolled study of 133 “ginseng” users, 14 individuals (10%) self-reported what Siegel deemed “Ginseng Abuse Syndrome” (GAS; described as hypertension with nervousness, sleep-

lessness, skin eruptions, and morning diarrhea). All were self-reported consumers of caffeinated beverages, which may also account for these symptoms. Although the “ginseng” was not identified or analyzed, it was presumed to be either Asian ginseng or American ginseng. Siegel also suggested that the products may have contained canaigre and/or eleuthero.^{36,37}

The late Norman R. Farnsworth, PhD, a professor and research pharmacognosist at UIC’s College of Pharmacy and co-founding member of ABC’s Board of Trustees, concluded that there is “no basis in fact for attributing these side effects to *Panax* or *Eleutherococcus*.” Further, he states that “clearly this type of a report does nothing to establish the efficacy, safety, or real or potential side effects of a plant that has been used for more than 3,000 years by millions of people and for which adverse effects have been either minimal or nonexistent, based on reports in the literature.”³⁸

‘Ginseng’ Codified in Federal Law

As noted above, confusion about the use of the word “ginseng” in case reports in medical literature wrongly associates Asian and American ginsengs with various adverse effects. In the absence of analysis of the actual substance(s) ingested, toxicological conclusions cannot be drawn clearly.

Use of the word “ginseng” on product labeling was legally clarified in the United States with the passage of the Farm Security and Rural Investment Act of 2002, signed into law on May 13, 2002, by President George W. Bush. US Senator Russell Feingold of Wisconsin introduced the provision (presumably with counsel and advice from the Ginseng Board of Wisconsin), which effectively reserves the use of the term “ginseng” for any herb or herbal ingredient *only* from the genus *Panax*, in regard to labeling and advertising. In a later amendment, that legal definition extended to the Food, Drug, and Cosmetic Act.³⁹ The second edition of *Herbs of Commerce* was codified as the source of common names to be used on dietary supplement product labels,⁴⁰ establishing the name “Asian ginseng” for *P. ginseng*, “American ginseng” for *P. quinquefolius*, and “eleuthero” for *E. senticosus*.

Confounded Taxonomy

Understanding the pre-1970s botanical nomenclature of *Panax* is useful in searching for clues to ginseng adulteration and adulterants. From 1854 onward, *Panax ginseng* has been referred to by a variety of scientific names, including *Aralia quinquefolia*, *A. quinquefolia* var. *ginseng*, *A. quinquefolius* var. *ginseng*, *P. quinquefolius* var. *ginseng*, and, erroneously, as *P. quinquefolius* (American ginseng).

The genus name *Panax* originates in Carl Linnaeus’s 1735 *Systema Naturae*, which serves as the first published foundation of his sexual taxonomic system for botanicals.⁴¹ Despite not having seen the plant’s flowers, Linnaeus preferred the genus name *Panax* over French botanist Sébastien Vaillant’s (1669-1722) earlier genus name, *Araliastrum*, which was published in 1718 and broadly circumscribed several genera in the family

Araliaceae (which includes many flowering species).⁴² Linnaeus also used the genus name *Panax* in his 1749 *Materia Medica*.⁴³

In *Species Plantarum* (1753),⁴⁴ codified as the starting point of modern botanical taxonomy, Linnaeus provides the taxonomic underpinnings of the modern concepts of the two North American species "*P. quinquefolium*" and "*P. trifolium*." Like other 18th century European authors describing and classifying ginseng, Linnaeus treated *P. ginseng* as the same species as American ginseng.

Like Linnaeus and Vaillant, the Swiss botanist Augustin Pyramus de Candolle (1778-1841) broadly circumscribed various genera in the family Araliaceae. In 1830, he included 28 species in his broad generic concept of *Panax*, yet only two of those species are included in the modern concept of the genus.⁴⁵

A lack of understanding of variation within the genus coupled with the plasticity of leaf and root morphology led 19th century botanical writers to attempt various taxonomic shifts of *Panax* into *Aralia*, further compounding confusion created by Linnaeus's initial ambiguity in circumscribing the morphology of *Panax*. Among them were the French botanists Joseph Decaisne (1807-1882) and Jules Émile Planchon (1823-1888).⁴⁶ The eminent American botanist Asa Gray (1810-1888), in the first edition of *Manual of the Botany of the Northern States* (1848), treated American ginseng as *P. quinquefolium* (following Linnaeus).⁴⁷ However, in the 1859 edition, Gray refers to American ginseng as *A. quinquefolia* and observes scarcity due to over-collection, describing it as "becoming rare." In another 1859 work, Gray treats Japanese ginseng (*P. japonicus*) as synonymous with American ginseng, cited as "*Aralia (Ginseng) quinquefolia*."⁴⁸ Other botanists followed Gray's authoritative lead. In 1870, Alphonso Wood attempted to make clarity out of the chaos, but instead added to the confusion: he assigns "True Ginseng" the binomial *Ginseng quinquefolium*.⁴⁹

I.H. Burkill (1870-1965), noted for his East Asian and Southeast Asian botanical collections, further confounded the taxonomy of Asian species in a 1902 publication by

creating seven varieties under "*Aralia quinquefolia*" (American ginseng) and refers to Asian ginseng as "*A. quinquefolia* var. *ginseng*."⁵⁰

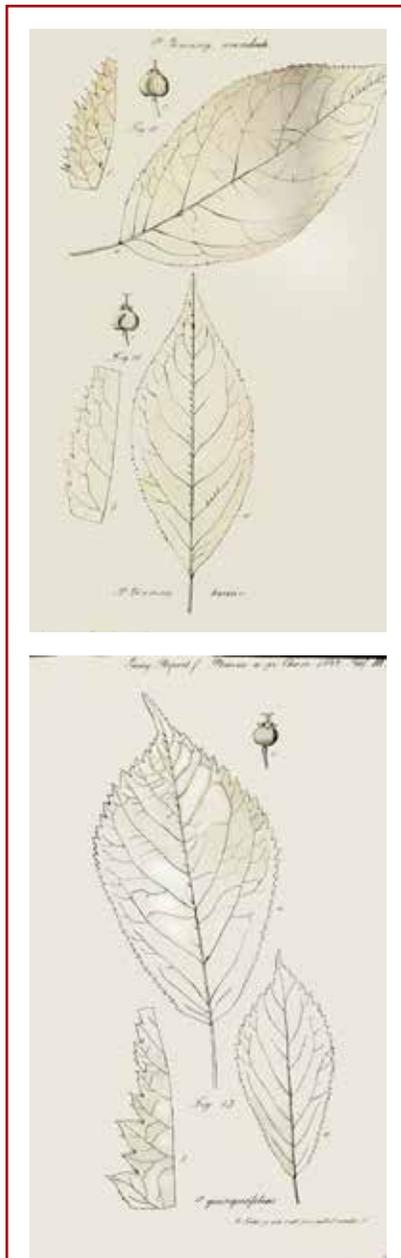
Well into the 20th century, medicinal plant literature continued to follow trends of confusing and sometimes erroneous taxonomic variants. A standard and often-cited work, the 19th edition of *King's American Dispensatory* (1905) by Harvey Wickes Felter and John Uri Lloyd uses "*Aralia quinquefolia*" as the primary name for American ginseng. Asian ginseng is referred to as "*Aralia Ginseng*, A. Meyer" and "*Panax Ginseng*, Nees," both with erroneous botanical authorities.⁵¹

In an 1868 paper, Berthold Carl Seemann (1825-1871) stated, "*Panax* has been one of the great lumber-rooms of our science, and none of the modern botanists have assigned it to intelligible limits."⁵² His clear definition of the genus within prescribed limits is today's accepted description for the genus *Panax*. Although morphological delineation of the genus has remained relatively stable since the early 20th century, at the species level and below, the taxonomy of *Panax* still remains controversial and confusing.

Why *Panax ginseng* Is the Correct Name for Asian Ginseng

Carl Anton von Meyer's 1842 binomial *Panax ginseng* is the correct botanical name for Asian ginseng (encompassing *P. ginseng* from the geographical areas of Russia, Korea, and China).

What appears to be the first validly published scientific name for Asian ginseng — the 1833 binomial *Panax schinseng* T. Nees, (written as "*Panax schin-seng*") — is, in fact, invalid. Theodor F.L. Nees von Esenbeck (1787-1837) described *P. schin-seng* in his rare *Plantae officinales oder Sammlung officineller Pflanzen* supplement volume (1833), which also contained a hand-colored plate of the plant.⁵³ Nees, a pharmacist, was the younger brother of Christian Gottfried Daniel Nees von Esenbeck (1776-1858), who authored nearly as many Latin binomials as Linnaeus. The younger brother is sometimes confused with the older brother in botanical literature and citations.



Top: Leaf serration details of *Panax ginseng*. Bottom: Leaf serration details of *Panax quinquefolium*. Adapted from C.A. Meyer's 1842 paper that established the scientific name *Panax ginseng*. Source: Library of Braunschweig University of Technology.

Well into the 20th century, *P. schin-seng* was accepted by many botanists, including H.L. Li,⁵⁴ T. Nakai,⁵⁵ and H. Hara,⁵⁶ among others. Nakai, in *Flora Koreana* (1909), first preferred *P. ginseng* as a binomial.⁵⁷ However, in *Araliaceae Imperii Japonici* (1924), Nakai argued that *P. schin-seng* should have priority over Meyer's binomial, since Nees's 1833 description of *P. schin-seng* and unmistakable colored plate predated Meyer's 1842 description of *P. ginseng* by a decade.

Although Nees's binomial predates today's widely accepted scientific name *Panax ginseng* C.A. Meyer by nine years, his *P. schin-seng* was eventually deemed illegitimate and superfluous in favor of Meyer's binomial *P. ginseng* C.A. Meyer.⁵⁸ Meyer's lengthy 1842 paper was republished as abridged extracts in at least two 1843 publications, and these condensed versions from 1843 are frequently and erroneously cited as the original publication date of Meyer's binomial *P. ginseng*.^{59,60}

Meyer himself refers to Nees's previous description and illustration(s) of the species in a footnote in his 1842 paper, which is not included in the 1843 abridgments. To quote Meyer: "The botanists may pardon me for not having accepted the name suggested by Nees von Esenbeck; in part because the name ginseng has been in use in Europe for one-and-a-half centuries, and then my *P. Ginseng* is substantially different from *P. Schinseng* Nees."⁵⁸

Since Nees's circumscription (i.e., his overall definition of the genus *Panax*) included a species that had already been validly published, under the rules of the *International Code of Botanical Nomenclature*, his *Panax* species concepts were technically invalid when published in 1833.^{61,62}

Further cementing Meyer's Asian ginseng binomial in botanical history, A.I. Baranov proposed Meyer's 1842 illustration as a lectotype** to represent the missing original type specimen collected by P.J. Kirilov (1801-1864), who deposited it in the Komarov Botanical Institute in St. Petersburg, which eventually misplaced the specimen.⁶³ In 1862, E. Regel included a reprint of the original illustration of Meyer's 1842 drawing of the apparently lost original European herbarium specimen of *P. ginseng*, but only added to confusion by reclassifying Asian ginseng as a variety of American ginseng: *P. quinquefolium* L. var. *ginseng* Rgl. et Maack.⁶⁴

Evolving Understanding of the Genus and Species Concepts in *Panax*

In 1996, Wen and Zimmer delineated 12 species of *Panax* — two in North America and 10 in Asia, with a center of diversity in the eastern Himalayas and western, central, and southeastern China.⁶⁵ Revising her taxonomic treatment, Wen added *Panax vietnamensis* as a distinct species in 2001. At the same time, she relegated two binomials she created in 1996, *P. omeiensis* and *P. sinensis*, to synonyms of *P. vietnamensis*, reducing the overall number of *Panax* species to 11 (nine Asiatic and

two North American).⁶⁶

Sharm and Pandit published a more recent taxonomic treatment focusing on the *Panax* species complex from the Indian state of Sikkim in the Himalayas in 2009. In 2011, they published a paper describing a new species, *P. sokpayensis*, represented by only a few hundred specimens at 1,700-2,300 meters in elevation. This rare species is named after the nearby Sikkim village Sopakha, the local vernacular name of the Yeti ("Abominable Snowman").^{67,68} This newly-discovered species brings the evolving count of *Panax* species to 12.

Modification of the taxonomy of *Panax* has continued since Linnaeus first described the genus in modern scientific terms. Variation in morphological characteristics within the genus presents challenges when attempting to define entities at or below the species level. The habit, type, and morphology of the rhizome, leaflets, bracts, and fruits have all been used to delimit species within the genus. Continuing research on *Panax* genetics may help clarify the taxonomy.

Little Difference in the Morphology of American and Asian Ginsengs

Many authors have failed to find morphological differences between American ginseng and Asian ginseng. As pointed out by Sharma and Pandit,^{67,68} previous papers by S.A. Graham,⁶¹ J. Wen and E. Zimmer,⁶⁵ and J. Wen⁶⁶ note no definitive distinguishing morphological characteristics that separate American ginseng and Asian ginseng, except for differences in the pattern of leaf serration. In 1859, Asa Gray observed, "The early missionaries were correct in their identification of the Ginseng of America with that of Tartary; and the Himalayan plant may be safely added to the species."⁴⁸

The respected economic botanist James A. Duke, PhD, a founding member of ABC's Board of Trustees, observed the two species side by side and found little to distinguish between them. Duke wrote, "I myself am not sure how to distinguish occidental ginseng (*Panax quinquefolium* L.) from oriental ginseng (*Panax ginseng* L.)."⁶⁹ He suggests differences in teeth along margins of seedlings as a possible distinguishing factor, as do other authors,⁷⁰ including C.A. Meyer in a finely detailed graphic of differences in leaf margin serration.⁵⁸

Beginnings of Ginseng Transoceanic Trade, Adulteration, and Authentication

The earliest European trade with China began during the Eastern Han dynasty (25-220 CE), though the first appearance of ginseng in European trade is attributed to the Moorish trader Ibn Hazm of Cordoba, who brought ginseng to Spain sometime around 850 CE.⁷¹ The Venetian trader Marco Polo is said to have brought ginseng from the Far East in 1294.⁷² In the early modern era, the earliest European account of ginseng originates with the Portuguese Jesuit Alvaro de Semedo (1585-1658; also spelled Semmedo), whose tome on the history of China

**A lectotype (i.e., in this case, an illustration of the original plant material chosen to represent the scientific name "*Panax ginseng*") can be designated if the original publication did not include such a "type specimen," or if that type specimen was lost.

was published in Portuguese in 1642, with an English edition issued in 1655, which was translated from the 1643 Italian edition. “The sixth and last Province is *Leaotum* [Liaoning] the Northern bound of that Kingdome, it is famous for a root which it produceth of so high esteem, that at my departure from thence it was sold for twice the weight in silver,” Semedo wrote. “It is so excellent as a medicine, that if those which are in health doe take it, it augments their strength and vigour, and it if be given to a sick person it doth marvelously comfort and warme him: it is called *Ginsem*.”⁷³

Within a few years after the formation of the British East India Company in 1600 and the Dutch East India Company in 1602, specimens of Asian ginseng began to trickle into European ports. Shortly after the inception of the Royal Philosophical Society of London in 1662, members became interested in the medicinal and monetary value of ginseng after reading translations of Semedo’s comments. From 1666 until 1788, the Society’s inquisitive and receptive attitude to further knowledge of the plant was followed by a more discriminating interest

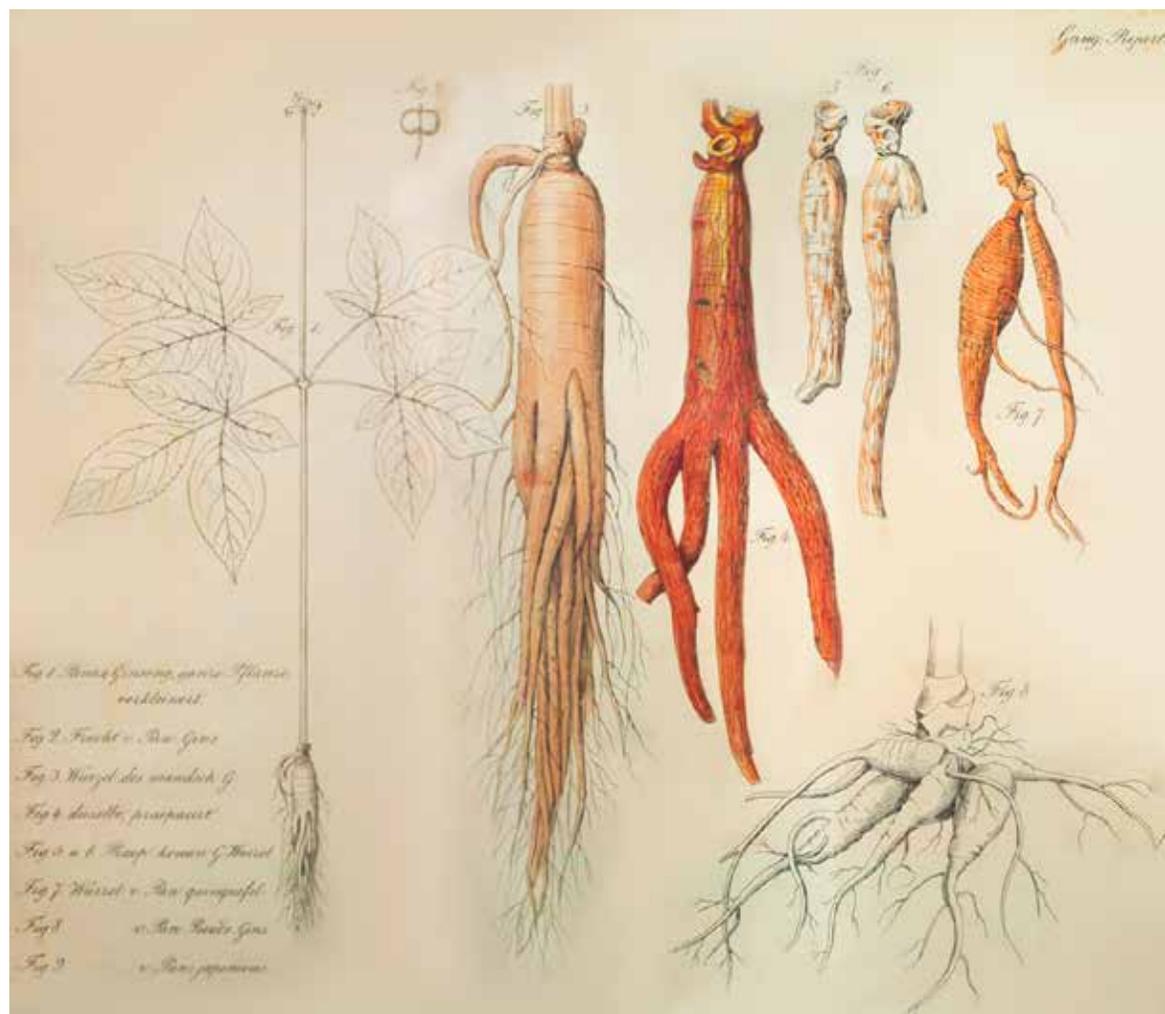
in the plant’s cultivation, use, and trade.⁷⁴

Melchisedech Thevenot’s French edition of Semedo’s *Relations of Divers Curious Voyages* was briefly reviewed in the inaugural volume of the *Transactions of the Royal Society* (1666). Among the highlighted items is the statement: “That they prise highly the Root *Ginseng*, as an extraordinary Restorative and Cordiall, recovering frequently with it agonizing persons; one pound of it being paid with 3 pounds of silver.”⁷⁵

Great hope was placed in the new drug from China for its potential in commerce and in medicine. *Some Observations Made upon the Root called Nean, or Ninsing* by John Pechey (1680) quotes one of the Royal Society’s founders, Sir Robert Boyle (1627-1691), the Anglo-Irish scientist known as the Father of Modern Chemistry: “Mr. Boyle once told me, he thought it was a Medicine sent from Heaven to save the Lives of Thousands of Men, Women and Children.”⁷⁶

The breakthrough that catapulted ginseng from obscurity to fame in Europe was Pierre Jartoux’s *Description of a Tartarian Plant, Call’d Gin-Seng; with an Account of Its*

Color plate showing different root products from various *Panax* species. Adapted from C.A. Meyer’s 1842 paper that established the scientific name *Panax ginseng*. Source: Library of Braunschweig University of Technology.



Virtues. Jartoux (1669-1720), a Jesuit mathematician and cartographer working in China in the early 18th century, assisted two Jesuit colleagues, Joachim Bouvet and Jean-Baptiste Regis, in developing a map of the Chinese empire, which “procur’d us the Opportunity of seeing the famous Plant, call’d Gin-seng, so highly valu’d in *China* and as little known in *Europe*.”⁷⁷

In 1708, Jartoux traveled to Manchuria for the first time, then again in July of 1709, when he observed a harvest of wild Asian ginseng. He described the harvest in a letter addressed to the Jesuit General of the Missions of India and China dated April 12, 1711, and first published in French in 1713.⁷⁸ Jartoux was the first European to provide a detailed account of the ginseng harvest from firsthand observations. He would also be the first to witness the rapid decline of wild Asian ginseng.

Published in 1981, Van Jay Symons’s comprehensive study of the imperial ginseng monopoly during the Qing dynasty⁷⁹ provides a backdrop for the ginseng trade that Jartoux observed. As the Manchus consolidated power and wrested all control of China from the ruling Ming dynasty, they established an imperial court monopoly of the ginseng trade by 1648. The Imperial Household controlled the gathering, transportation, and sale of ginseng root, which became their second leading source of income. Bannermen (military-social units known as “Banners”) were charged with meeting court monopoly quotas for ginseng root.

By the early 18th century, the root was becoming scarcer and the area in which it could be found was shrinking. More than 300 years earlier, at the beginning of the Ming dynasty (1368-1644), ginseng had a broader natural range. However, overharvest and habitat loss due to an expansion of farming in the mountains of eastern Shanxi province and Hebei province shrunk that range, limiting ginseng’s natural occurrence to far northeastern China.

By 1709, high court-issued quotas and an inability to stop illegal collection led to a breakdown of the bannermen system established in the previous 50 years. As the supply of root was diminishing and illegal competition was increasing, overharvesting of the declining wild populations became inevitable. Still, in 1709, the government monopoly sought 160,000 ounces (10,000 pounds) of wild ginseng. The Emperor reserved 1,600 ounces (100 pounds) of the highest quality root. The Imperial Household received 14,400 ounces (900 pounds), and the government sold the rest.⁷⁹

By the mid-18th century, ginseng supply and demand was dictated by a variety of factors, such as overharvest, the vagaries of exotic export markets, and national and cultural differences. The prices, quantities, management, mismanagement, and dictates of the Chinese imperial ginseng monopoly also impacted Chinese demand for ginseng.

On the Korean Peninsula, cultivation of Asian ginseng began as early as 1,000 years ago. During the Seonjo era (1552-1608), habitat destruction and overharvest decimated wild ginseng populations, leading to widespread cultivation in mountain forest gardens.⁸⁰

Meanwhile, in Japan, ginseng arrived as a medicine by 737 CE, and became an article of trade, barter, and/or gift-giving from Korea. Attempts to cultivate ginseng in Japan began nearly 1,000 years later in 1607. The Japanese believed in the value of the drug and demand exceeded supply. Tokugawa Ieyasu (1543-1616), the first shogun of the Tokugawa shogunate, or Edo period (1603-1868), ordered exploration of ginseng cultivation, which took more than a century to develop. By the 1670s, the country’s treasury of gold and silver bullion was being depleted at an alarming rate to pay for imports, particularly ginseng. Imports of Korean ginseng reached as much as 3 metric tons (6,614 pounds) per year, leading the shogunate to limit ginseng trade by 1686. The eighth shogun, Yoshimune, ordered cultivation trials in the feudal domain of Aizu in Fukushima Prefecture in 1716 — the same year that Joseph Francois Lafitau (1681-1746), a Jesuit missionary at the Caughnawaga settlement near Montréal, found American ginseng. Shogunate-sponsored clandestine efforts resulted in seeds being smuggled out of China and Korea in 1725 and 1728, respectively. In 1728, Wada Chojun published the first Japanese guide to ginseng. In 1767, the shogunate appointed seven merchants to control ginseng cultivation and trade, but by 1790, cultivation and trade of ginseng was open to any farmer or merchant.⁸¹

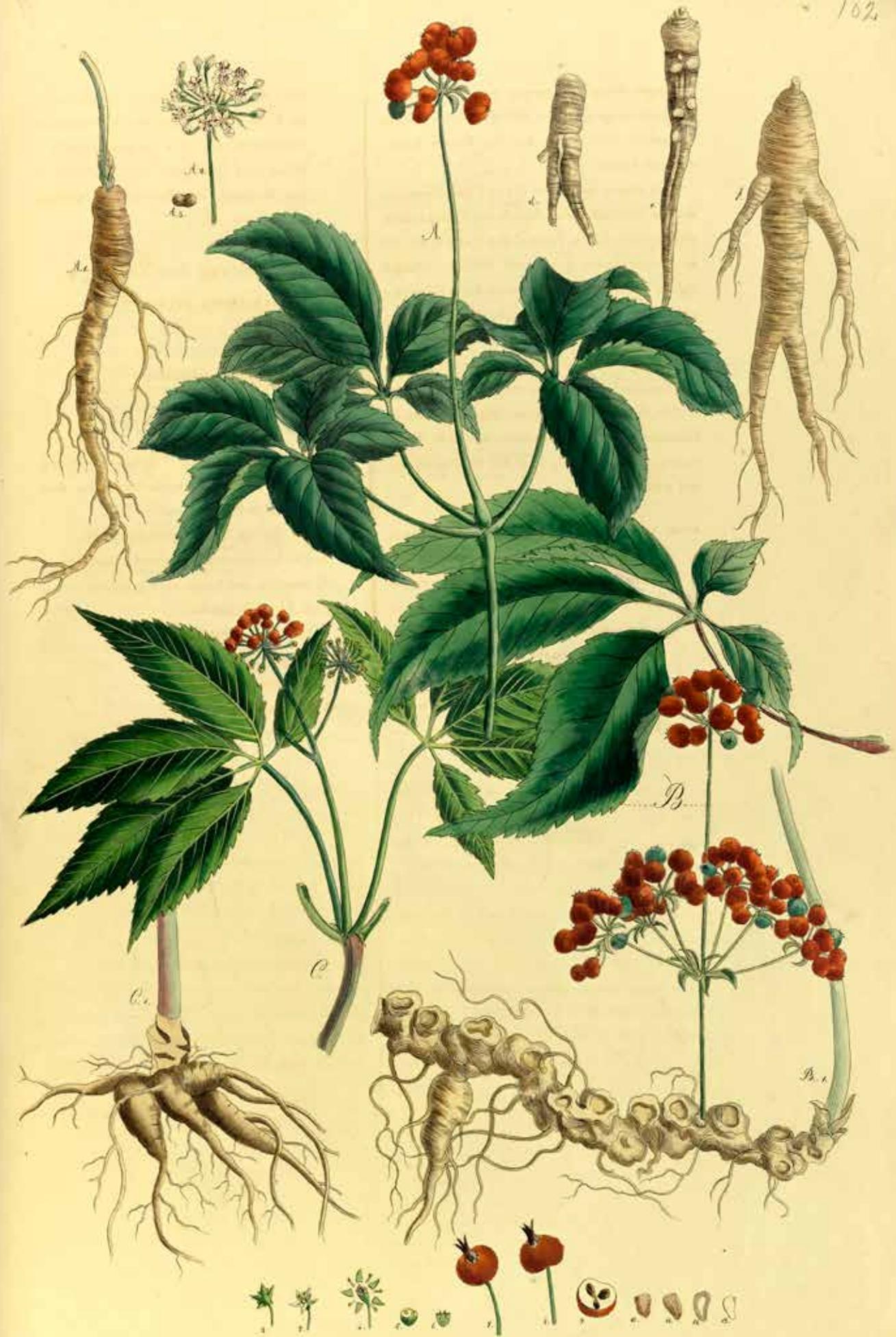
By the late 18th century, Yoshimune’s ginseng cultivation experiment had succeeded, and Japan became a net exporter of ginseng. By 1765, Japanese ginseng gained popularity and acceptance in China because, like China’s ginseng, the ginseng from Japan was a warming tonic, unlike the cooling “French” ginseng from Canada. (One year earlier, in 1764, Nagasaki customs officers seized and publically burned 600 pounds of “Cantonese ginseng” — American ginseng imported from Canton, which they considered to be an imposter of Asian ginseng. In essence, national and cultural biases branded Cantonese ginseng an adulterant, and it was dispatched accordingly.) In China, the demand for Japanese-grown *P. ginseng* surpassed that of American ginseng. By then it was viewed as a valuable antidote to opium addiction. As Harvard University’s Shigehisa Kuriyama, PhD, stated, “Local habitats still mattered in the reconfiguration of the geography of ginseng.”^{80,81}

Early Recognition of Ginseng Adulteration in the West

Jartoux’s 1709 observations coincided with what was to become the last vestiges of mass harvest of wild *P. ginseng* for the Imperial Household. If logic dictates that a limited supply leads to conservation problems, then a reduction in supply followed by a spike in prices provides the perfect recipe to stimulate economic adulteration — Jartoux’s description of the Chinese ginseng harvest foretold trouble ahead.

By the 1740s, wild roots were mixed with illicitly cultivated roots, which

Right page: Aimé Henry’s hand-colored plate of “*Panax schin-seng*” in Theodor F.L. Nees von Esenbeck’s rare supplement volume of *Plantae officinales oder Sammlung officineller Pflanzen*, published in 1833. Courtesy of Missouri Botanical Garden.



Panax Schin-seng nob.

were considered an adulterant. This was an inevitable consequence of declining wild root supplies and growing lawlessness in Manchuria. A long-held code of honor allowed a digger to erect a small fence around immature wild ginseng plants to claim them for future harvest. As law and order disintegrated, this tradition was no longer honored, so less valuable, immature roots were also harvested.

By the beginning of the 19th century, cultivated ginseng mixed with wild roots was becoming more commonplace. In 1810, an imperial edict criticized the quality of tribute-grade ginseng received at the court, some of which was cultivated and illegally weighted with lead added to the interior of the root.⁷⁹

Several authors have reported the practice of spiking individual roots with lead to increase weight. In 1751, John Hill (1716–1775), the first superintendent of the Royal Botanic Gardens, Kew, observed: “With us it has been sold at a much higher price than there [China]; and such cheats have been the Chinese, who sold it, that, when cut, every root of it has often been found loaded with a long piece of lead, carefully let into it, which has given it three times its real weight.”⁸²

In 1905, H.A. Hare, C. Caspari, and H.H. Rusby described the same practice in *The National Standard Dispensatory*: “Adulteration, however, is largely practiced, chiefly by the Chinese, by introducing heavy bodies to increase its weights. They are frequently known to bore out the interior through a minute opening and to plug it with lead, afterward closing and concealing the orifice. In addition, roots of ginseng used previously for making an extract are not uncommonly dried and fraudulently sold for good roots.”⁸³

At the start of the 20th century, most of the Asian ginseng root harvested in Manchuria was cultivated, processed in Korea, and then returned to Chinese markets. In 1901, Sir Alexander Hosie, who served as the British Consul General at Tianjin and lived in China for more than 40 years, related that considerable quantities of ginseng from Manchuria were taken to Korea for processing as red ginseng. So-called “Korean ginseng” exported from Manchuria in the early 20th century was, in fact, Chinese-grown ginseng processed in Korea.

Hosie also described a clever deception intended to increase the visual age of the root if it was too young for

market. “During the steaming process a thread is wound round the head,” he wrote. “The steaming causes the root to swell, with the exception of the parts bound by the thread, and when the root contracts in drying the artificial wrinkles remain.”⁸⁴

By the early 20th century, the Chinese were also re-exporting American ginseng root as “clarified Chinese ginseng” back to the North American market. Adulteration in the form of offering ginseng as something it was not had become a subtle yet pervasive practice in the ginseng market.⁸⁴

I.H. Burkill also warned of adulteration problems in 1902: “Adulteration is not uncommon. Rootstocks of *Centaurea*, *Adenophora*, *Angelica*, *Platycodon*, *Rehmannia*, etc., are used in the East, *Campanula glauca* being said to be common in Japanese Ginseng. *Sium Ninsi* [*Sium ninsi*, Apiaceae] was formerly confused with Ginseng, perhaps, because it was offered as a substitute.”⁵⁰

Sium ninsi, also known as ninzin, nindsin, ninzing, nin sing and radix ninsi, among others, was confused with various species of *Panax*, including *P. ginseng* and *P. japonicus*. The confusion began with the 1712 publication of Engelbert Kaempfer’s *Amoenitatum Exoticarum*, a text that is noted for medical observations on acupuncture, information about tea production, and the first Western descriptions and illustrations of several important plants, including ginkgo (*Ginkgo biloba*, Ginkgoaceae). Apparently, Kaempfer (1651–1716), traveling in Asia from 1683–1695, believed that *S. ninsi* was synonymous with the source plant of ginseng. He spent the last two years of his journey in Nagasaki,

Japan, as a physician for the Dutch East India Company. “Ninzing” is Kaempfer’s phonetic transliteration of the sound of the Japanese name for ginseng, just as “ginkgo” was Kaempfer’s pronunciation of the Japanese name for *Ginkgo biloba*.⁸⁵

In researching their 1907 book on the *materia medica* of Chinese medicinal plants used in Vietnam — *Matiere Médicale et Pharmacopée Sino-Annamites*⁸⁶ — French pharmacists Émile Perrot and Paul Hurrier published a separate pharmacognostic analysis of plant materials, which their research revealed were adulterants of or substitutes for Asian ginseng. More than any other plant, they found that ginseng was subject to many and varied falsifications due to its rarity, price, and that



American ginseng root with the 1985 *Pharmacopoeia of the People's Republic of China* as background.
Photo ©2016 Steven Foster

Asian peoples considered it not only an aphrodisiac *par excellence*, but a universal panacea. They observed that, depending on quality, ginseng root sometimes reached a price of a thousand times its weight in silver. The roots were sold between 2,000-5,000 francs apiece. The average price for cultivated root material was 500 francs per kilogram. In short, they explained, the falsification of the root was very lucrative business.⁸⁷

In 1906, Hurrier and Perrot indicated that it was almost impossible to find true ginseng from Manchuria in the European market, and that it was very rare to find unadulterated Korean ginseng. In addition, they suggested that after the whole root was macerated or decocted in water, it was dried again, then sold to consumers. In particular, ginseng root was adulterated by adding roots of members of the families Araliaceae, Umbelliferae (Apiaceae or parsley), and Campanulaceae (bellflower). Their original paper provides classical

pharmacognostic details, such as cross-section microscopic illustrations of the adulterants' roots with detailed descriptions for proper identification. A list of the adulterants noted by Hurrier and Perrot is included in Table 2.⁸⁷

Physician to the Russian Legation in Beijing, Emil Bretschneider (1833-1901) chronicled European botanical explorations to China and translated key passages of Chinese texts on medicinal plants. He recorded *Adenophora* and *Platycodon* as frequent adulterants, noting, too, that the wild ginseng from Manchuria was considered the highest quality, with Korean ginseng the next most desirable. Bretschneider, like Chinese authors of the Ming dynasty, reiterated that the highest quality ginseng in ancient times came from Hua Shan (Mount Hua) in the Qin Mountains of southeastern Shaanxi province (near the border of present Shaanxi), but it is long extinct in that region.⁸⁸

Table 2. Ginseng Adulterants Noted by Hurrier and Perrot in 1906⁸⁷

Nomenclature in Original	Current Nomenclature and Synonymy
<i>Adenophora verticillata</i> Fisch. (Campanulaceae)	<i>Adenophora triphylla</i> (Thunb.) A. DC. [Taiwan endemic]
<i>Angelica polyclada</i> Franch. (Apiaceae)	<i>Angelica pubescens</i> Maxim. Synonyms: <i>A. polyclada</i> Franch.; <i>A. myriostachys</i> Koidz.; <i>A. schishiudo</i> Koidz.
<i>Campanula glauca</i> Thunb. (Campanulaceae)	<i>Platycodon grandiflorus</i> (Jacq.) A. DC. Synonyms: <i>Campanula grandiflora</i> Jacq.; <i>C. glauca</i> Thunb.; <i>Platycodon autumnalis</i> Decne.; <i>P. chinensis</i> Lindl. & Paxton; <i>P. glaucus</i> (Thunb.) Nak.; <i>P. sinensis</i> Lemaire
<i>Campanumoea pilosula</i> Franch. (Campanulaceae)	<i>Codonopsis pilosula</i> (Franch.) Nannf.
<i>Gynura pinnatifida</i> (Lour.) DC. (Asteraceae)	<i>Gynura japonica</i> (Thunb.) Juel Synonyms: <i>Senecio japonicus</i> Thunb.; <i>Cacalia pinnatifida</i> Lour.; <i>C. segetum</i> Lour.; <i>Gynura aurita</i> C. Winkler; <i>G. flava</i> Hayata; <i>G. japonica</i> var. <i>flava</i> (Hayata) Kitamura; <i>G. pinnatifida</i> (Lour.) Candolle; <i>G. segetum</i> (Lour.) Merrill; <i>G. vaniotii</i> H. Léveillé; <i>Kleina japonica</i> (Thunb.) Lessing
<i>Panax sessiliflorum</i> Rupr. & Maxim. (Araliaceae)	<i>Eleutherococcus sessiliflorus</i> (Rupr. & Maxim.) S.Y. Hu Synonyms: <i>E. sessiliflorus</i> var. <i>parviceps</i> (Rehder) S.Y. Hu; <i>Acanthopanax sessiliflorus</i> (Rupr. & Maxim.) Seem.; <i>A. sessiliflorus</i> var. <i>parviceps</i> Rehder
<i>Phyteuma japonicum</i> Miq. (Campanulaceae)	<i>Asyneuma japonicum</i> (Miq.) Briq. Synonym: <i>Campanula japonica</i> (Miq.) Vatke
<i>Platycodon grandiflorum</i> (Jacq.) A. DC. (Campanulaceae)	<i>Platycodon grandiflorus</i> (Jacq.) A. DC.
<i>Rehmannia chinensis</i> Libosch. ex Fisch. & C.A. Mey. (Plantaginaceae)	<i>Rehmannia glutinosa</i> (Gaertn.) DC. Synonym: <i>Digitalis glutinosa</i> Gaertn.
<i>Sophora angustifolia</i> Sieb. & Zucc. (Fabaceae)	Sometimes treated as a variety of, conspecific with, or synonymous with <i>Sophora flavescens</i> Ait.

American Ginseng Adds Further Complications

A need to differentiate between Asian ginseng and American ginseng arose sometime before 1720, as American ginseng began to be exported from Canada to China. In his 1713 publication describing the ginseng harvest in China, Jartoux proposed: "All of which makes me believe, that if it is to be found in any other country in the World, it may be particularly in *Canada*, where the Forests and Mountains, according to the relation of those that have lived there, very much resemble these here."⁷⁷

Jartoux's description of Asian ginseng reached Lafitau at the Caughnawaga settlement near Montréal. Within months of learning of Jartoux's speculation in a 1718 publication, Lafitau claimed to have discovered American ginseng in Canada about three years earlier, in 1715 (as *Aureliana canadensis*).^{89,90} Lafitau is best remembered as an ethnographer who advanced the theory of the Asiatic origin of indigenous peoples of North America, and he used his discovery of American ginseng to support that theory. Aside from his single paper on American ginseng (yet to be translated to English), he is largely overlooked in botanical history.

According to Jacques Rousseau (1905-1970), a professor at the Centre d'Études Nordiques at the Université Laval in Québec, Lafitau was not the first European to

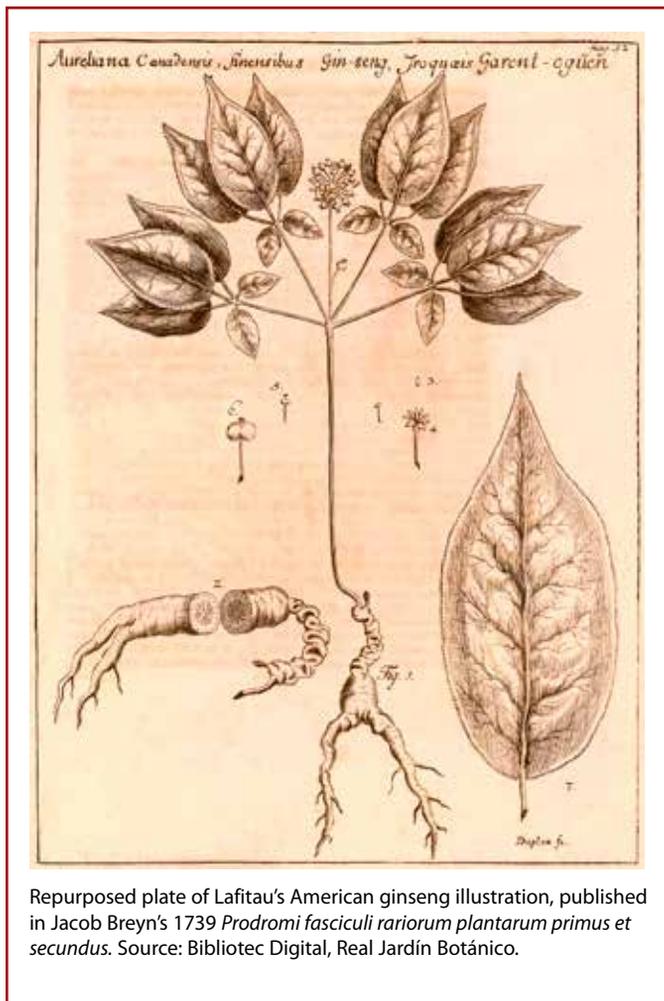
collect and describe American ginseng from Canada. Instead, Lafitau was the first to promote his discovery.

Also in 1718, Vaillant described American ginseng with a pre-Linnaean Latin phrase — *Araliastrum Quinquefolii folio majus* — and attributed a specimen collected in 1700 to physician and naturalist Michel Sarrazin (1659-1734), thus crediting him with the European discovery of American ginseng. Sarrazin, for whom Linnaeus named the insectivorous genus *Sarracenia*, was one of the earliest botanical collectors in Canada, but he left no significant publications.

Sarrazin was a student of the French botanist Joseph Pitton de Tournefort (1656-1708) and served as physician at the Court of Québec. In 1705, he dispatched a shipment of Canadian plant specimens to Tournefort at the Jardin Royal des Plantes in Paris. Vaillant, who had been employed at the garden since 1702, worked on Sarrazin's list of specimens; the list survives as two manuscript copies of his *Catalogue des Plantes du Canada*, one of which is in Vaillant's own hand, from 1708. As Jacques Rousseau explained, "I have seen the original plants and without any doubt Sarrazin was the discoverer of the plant in Canada, but Father Lafitau had the great merit of having recognized the close affinity between the Asiatic and Canadian species."⁹¹

According to botanist and physician Jacob M. Bigelow, MD, (1787-1879) descriptions of American ginseng from both Sarrazin and Lafitau were published in 1718; together, the descriptions left no doubt about the similarities between American ginseng and Asian ginseng. But, like many of his contemporaries, Bigelow had little understanding of why ginseng was so highly valued. He reiterated the comments of most medical authorities of his day who believed its medicinal value was overrated, as evidenced by the fact "that a whole root may be eaten without inconvenience. ... As far as Ginseng has been tried medicinally in this country, and in Europe, its virtues do not appear, by any means, to justify the high estimation of it by the Chinese."⁹²

Soon after Lafitau's 1718 publication, the French began collecting American ginseng root for export, primarily employing Mohawk tribal members to dig the root to the exclusion of other work. English settlers in New York also engaged in the same traffic in hopes of fetching high export prices. Linnaean student Pehr (sometimes spelled "Peter") Kalm noted that, in 1748, the price was five to six livres a pound (a livre was the French monetary unit prior to introduction of the franc in 1795). By comparison, the average salary of a tradesman was 60-100 livres per year. Eighteenth century re-exports of American ginseng to China via France proved profitable, but in a short time the market was flooded, and the Chinese deemed American ginseng inferior to its Chinese counterpart, depreciating the value. By 1818, according to Bigelow, there was little export of American ginseng.⁹²



Repurposed plate of Lafitau's American ginseng illustration, published in Jacob Breyn's 1739 *Prodromi fasciculi rariorum plantarum primus et secundus*. Source: Bibliotec Digital, Real Jardín Botánico.

Expanding and Bursting Bubbles of Trade

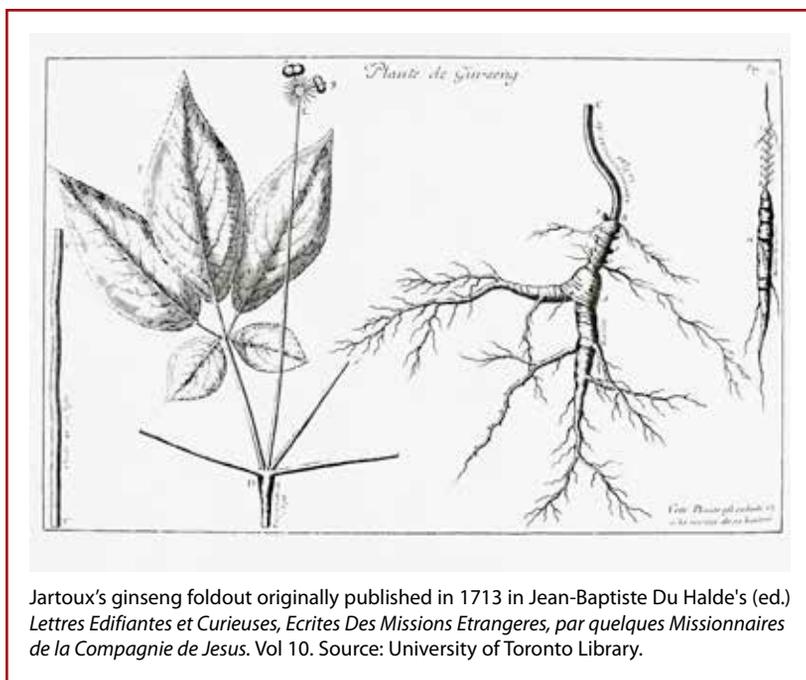
The slowdown of trade described by Bigelow in 1818 was just one trough in a wave of contraction and expansion of the 300-year-old ginseng trade between North America and Asia. Quality, price, availability, and adulteration have all contributed to the fluctuations. American ginseng is a trade good with a remarkably long history between North America and China. M.D. Block calls ginseng “the prototypical trade fantasy commodity.” During the 18th century, there were two bubble cycles: one during the 1750s and another in the 1780s and 1790s.⁹³

English-American merchants did not begin selling Native American-harvested ginseng until the 1750s. Seeing an opportunity for export through New York, Sir William Johnson (1715-1774), an Irish-Anglo 1st Baronet, was appointed as New York’s agent to the Iroquois in 1743. He resigned the commission in 1751, but was reinstated as Indian commissioner three years later, in 1754. Most trade goods gathered by the Mohawks were sent north to the French in Canada. Up until this time, the root was primarily harvested in New France, shipped to France, then used as a barter item in trade between the French and Chinese.

In 1751, aided by Johnson’s standing among the Iroquois and Mohawks, the British East India Company began manipulating the market, paying the equivalent of 33 francs per pound of ginseng, nearly three times the Québec market price of 12 francs. By 1752, English competition and simple greed overcame common sense, and traders began buying May-harvested roots that were spongy, soft, and highly wrinkled when oven-dried, creating an inferior product with little appeal to Asian buyers. Anglo-Europeans abandoned other crops to harvest ginseng. In the fall of 1752, the value of exports rose to 500,000 francs, but the resource was exhausted by 1754, when only a fraction, worth 33,000 francs, was exported.^{92,94,95}

According to Block, after US independence, American ginseng became almost exclusively a Euro-American frontier settler product, rather than a Native American-harvested item. Like other wild-harvested “fantasy” commodities for export to China, an overharvest flooded the Chinese market and depleted the natural resource.

Famously, the *Empress of China* became the first American-flagged ship to trade with the Chinese. Loaded by Robert Morris and his associates with a cargo of 30 tons of choice New England and Appalachian American ginseng in 242 casks, the ship departed on February 22, 1784 — George Washington’s 52nd birthday — with a



13-gun salute representing the 13 states, just five weeks after the Confederation Congress ratified the Treaty of Paris. When the *Empress of China* returned 14 months later, one of the investors in the ginseng trade made a profit of \$55,000. The fortunes of other famous Americans, such as Daniel Boone (1734-1820), rose and fell with the American ginseng trade. In 1788, after recruiting Native Americans to harvest ginseng on the Western frontier, Boone lost a cargo of 12-15 tons of ginseng when a boat headed to market overturned on the Ohio River.⁹⁴⁻⁹⁶

Quality and adulteration problems persisted. Johann David Schoepf (1752-1800), chief surgeon to the Ansbach troops in service of English King George III during the American Revolution, authored one of the first works devoted to American medicinal plants: *Materia medica Americana potissimum regni vegetabilis* (1787).⁹⁷ One year later, a German edition of another of his books, *Travels in the Confederation* (1783-1784), was published. In 1784, Schoepf met a man taking 500 pounds of ginseng root packed on two horses to Philadelphia. Schoepf commented: “Industrious people who went out for the purpose have gathered as much as 60 pounds in one day. Three pounds of the freshly gathered make only one pound of the well dried. ... The physicians in America make no use of this root; and it is an article of trade only in China, where the price is not so high as it was, on account of the great adulteration. All manner of similar roots were mix in.”⁹⁸

American Ginseng Trade Fluctuations in the 19th and 20th Centuries

Wild ginseng harvest followed westward migration. Economic instability from 1857-1859 set the stage for a “ginseng rush” in the Minnesota Territory. From 1859 to 1862, thousands of people rushed to Minnesota forests to harvest ginseng for export. Nearly half of the Ameri-

can ginseng exported in 1860, 1861, and 1862 (395,909 pounds, 347,577 pounds, and 630,714 pounds, respectively) came from Minnesota, the eastern half of which became a state in 1858. One digger extracted as much as 20 to 50 pounds of roots per day. In 1865, the State of Minnesota passed “The Ginseng Law” to regulate harvest. By 1894, wild ginseng was nearly extinct in the state. Once again, a high price and ready market had depleted the resource, bursting another bubble in the American ginseng export trade.

Between 1860 and 1883, the United States exported an average of 417,500 pounds of ginseng each year.^{99,100} In the 36-year period from 1858 to 1893 in the United States, more than 18.6 million pounds of American ginseng, almost all of it wild-harvested, was exported to China. By the early 20th century, pressure on wild populations resulted in the development of various laws in the US and Canada; wild harvest was restricted in Minnesota in 1865, followed by Virginia in 1875-1876, and Ontario in 1891. Early attempts at cultivating American ginseng in the 1870s produced little success. Finally, in the 1890s, there was considerable success with ginseng cultivation in New York, North Carolina, Kentucky, Pennsylvania, and elsewhere. The US Department of Agriculture began publishing handbooks on how to grow ginseng.¹⁰¹

By 1902, there were as many as 1,000 ginseng growers in the US, but that declined to 303 producers in 1929, and further declined during the Great Depression to only 112 growers in 1939. In the 1960s, American ginseng production became concentrated in Wisconsin, which created a six-fold increase in cultivated production from the 1960s to the mid-1980s.¹⁰² However, since then, Wisconsin ginseng production has declined; there were 1,468 growers in 1995, but only 190 producers by 2006. Between 1995 and 2006, acreage declined by 50%, and the quantity sold decreased by as much as 95%. In recent years, American exports have also declined, given the serious competition from Australian, Canadian, and, in particular, Chinese producers. In 2012, The US exported 347,737 pounds of cultivated ginseng, and 45,351 pounds of wild-harvested ginseng.¹⁰³

Clashing Perceptions of Value

Since the first European encounter with ginseng in the modern era, the medicinal value of ginseng in any form has been met with skepticism. From the first edition of *The American Dispensatory* published in 1806 to the ninth edition published in 1831, John Redman Coxe, MD, (1773-1864) speculates about conflicting perceptions of ginseng's worth: “The Chinese, probably on account of [ginseng's] scarcity, have a very extraordinary opinion of the virtues of the root, so that it sells for many times its weight of silver. The Americans, on the contrary, disregard it, because it is found plentifully in their woods.”¹⁰⁴

John Sims, MD, discussed American ginseng's value in an 1811 issue of *Curtis's Botanical Magazine*: “The sensible qualities of this root do not promise any particular efficacy, according to European ideas, and this prejudice may perhaps occasion us to under-value it. For although it can hardly be doubted but that its virtues are highly over-

rated by the Chinese, yet it does not seem credible that any absolutely inert remedy could for ages, and in distant countries, maintain so high a reputation.”¹⁰⁵

Monetary value aside, the disagreement about ginseng's medicinal value was well-summarized by Christison and Griffith in 1848. “[I]t can scarcely be possible that an article so long in use, and so highly prized, can be wholly worthless, and yet there is every reason to believe that its beneficial effects should be attributed rather to the effects of imagination, than to any extraordinary power in the root,” they wrote.

Pokeroot (*Phytolacca americana*, Phytolaccaceae) is sometimes noted as an adulterant of ginseng, both in Asian and North American markets. Christison and Griffith provided evidence that, instead of being economically motivated, adulteration of ginseng with pokeroot may be a case of mistaken identity, noting that pokeroot in the fresh state has the rather distinctive fragrance of ginseng root.¹⁰⁶

Quality of exported root was a problem, as described by physician, philanthropist, and plantsman John Fothergill, MD (1712-1780): “[L]eave me to say, that some considerable parcels of the root have been sent to China, and disposed of to great advantage: that this advantage would still have been greater, had those who gather the root, collected it at a proper season; and cured it in the Chinese manner,” he wrote.

Fothergill, one of the most respected English physicians of his time, reflected on the herb's value in relation to other drugs. “Upon the whole thou it does not seem entitled to even a moderate share of those virtues that are romantically ascribed to it by the Chinese, yet it is very well worth the attention of the faculty, and promises fair to be a more useful and efficacious medicine, than many now kept in the shops, as the *Sarsa China* [sarsaparilla; *Smilax aristolochiifolia*, Smilacaceae], and some others.”¹⁰⁷

American ginseng itself was sometimes considered as an adulterant of costlier drugs imported from the Americas. In 1880, Bentley and Trimen reported that American ginseng root was commonly found as an adulterant of Seneca snakeroot (*Polygala senega*, Polygalaceae). “It does not appear to be intentionally adulterated, but from carelessness in collection some other roots or rhizomes in small proportion may be frequently found mixed with it. American Ginseng root ... is that most commonly found, and is readily distinguished by its greater size, more or less fusiform shape, and by the absence of any projecting line,” they wrote.¹⁰⁸

By 1900, American ginseng imported by China seemed to be readily recognized as a distinct product that did not confuse ginseng traders. As S. Well Williams observed: “Ginseng is found wild in the forests of Manchuria, where it is collected by detachments of soldiers detailed for this purpose; these regions are regarded as imperial preserves, and the medicine is held as a governmental monopoly. The importation of the American root does not interfere to a very serious degree with the imperial sales, as the Chinese are fully convinced that their own plant is far superior.”¹⁰⁹

In 1905, Hare, Caspari, and Rusby complained that American ginseng's "medicinal value is almost *nil*, yet its great and growing commercial importance calls for a somewhat extended account."⁸³ According to them, the root should only be collected in the fall, and is more highly priced when of a fine light color. They continued:

The best root is said to be that collected by the Sioux Indian women, who impart this white appearance by rotating it with water in a partly filled barrel, through which rods are run in a longitudinal direction. In no other way, it is said, can the surface be so thoroughly and safely cleansed. ... Since the chief value of Ginseng depends upon its favor with the Chinese, and this in turn depends almost wholly upon fanciful considerations, its commercial value is determined in a high degree by its appearance ... with their large size, and light color, their plumpness and firm consistent, their unbroken and natural form. ... A Chinese trader, examining a lot of Ginseng, will eagerly ... seek an opportunity for abstracting from a bale one or more select roots which may represent, in the Chinese market, a money value several times greater than that of the entire remainder of the lot.⁸³

'Differentiating Appearance to Determine Quality'

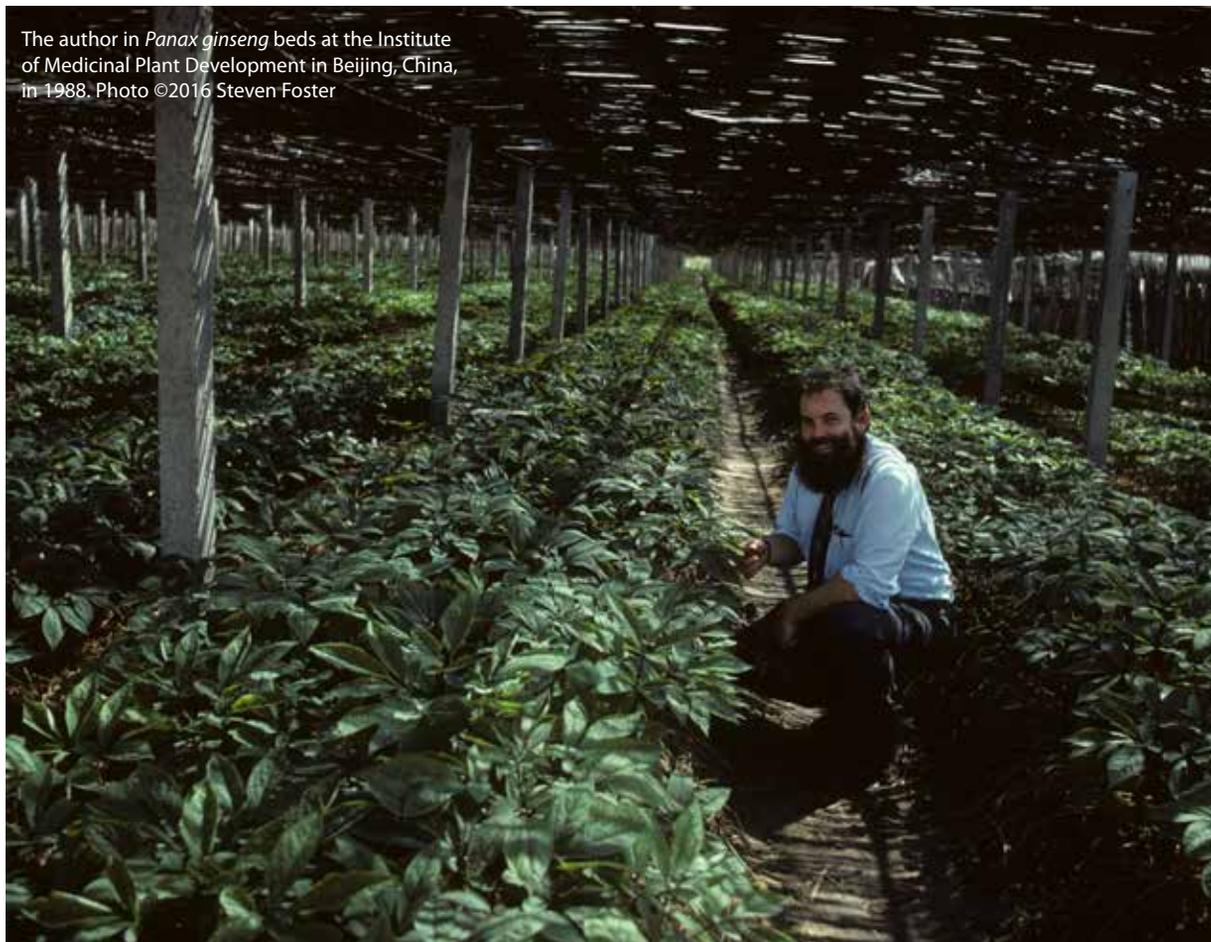
Historically, form and appearance are very important factors in relation to quality, and they can help discourage economic adulteration. In a review of the recent book *Chinese Medicinal Identification: An Illustrated Approach* by Zhongzhen Zhao and Hubiao Chen, ABC Advisory Board member Roy Upton emphasized that evaluation of botanical ingredients using physical and organoleptic characteristics (taste, smell, appearance, etc.) is often overshadowed by reliance on chemical and molecular identification methods.¹¹⁰

Zhao and Chen outline "experience-based" authentication and macroscopic differentiation of herbal ingredients as essential skills for the traditional herbal pharmacist and others in the supply chain. In TCM, this knowledge is known as *bian zhuang lun zhi* or "differentiating appearance to determine quality." Chemical analysis sometimes challenges long-held beliefs of authenticity and quality. In the case of ginseng, it was traditionally thought that large main roots were of superior quality, but chemical analysis shows that the thin fibrous roots have a higher content of ginsenosides[†] (the active and marker compounds characteristic of plants in the genus *Panax*).¹¹¹

Writing about the visual factors that distinguish cultivated *P. ginseng* (*yuan shen*) with wild *P. ginseng*, Zhao

[†] Ginsenosides also are found in *Gynostemma pentaphyllum* (Cucurbitaceae), a plant not related to *Panax* species.

The author in *Panax ginseng* beds at the Institute of Medicinal Plant Development in Beijing, China, in 1988. Photo ©2016 Steven Foster



and Chen note that special terminology is used. “Iron wire striations” refer to dark-colored circular striations at the upper part of the primary root of wild ginseng. So-called “pearl dots,” or “pearl bumps,” are small protrusions from the rootlets of wild ginseng. These unique morphological features of wild ginseng root are used to distinguish it from cultivated root. Sun-dried cultivated root is essentially a different product that sells at a much lower price compared to wild root.

Until the 1970s, traditional pharmacognosy tools, such as plant and root morphology and histological (i.e., relating to the study of microscopic structures of plant and animal tissues) characteristics, were used to authenticate ginseng products and species. In addition, thin-layer chromatography (TLC) and high-performance thin-layer chromatography (HPTLC) methods have been developed for *Panax* species. TLC was developed in 1961 and HPTLC, which includes software-controlled automated steps, was developed in the 1980s. Because of relatively minor chemical differences between American ginseng and Asian ginseng, distinguishing between the two requires expertise and experience. Introduced in the 1970s, the application of high-performance liquid chromatography (HPLC) to ginseng research offered a new tool for authentication. In the 1990s, the use of DNA authentication methods further enhanced the evolution of authentication of ginseng source plants and their adulterants.

Discussion

Ginseng adulteration can be as subtle as the medicinal effects attributed to the root by early European writers. Cultural preferences and socioeconomic factors can impact the market for ginseng in both the country of origin and the destination country. For example, in the early 1990s, when Hong Kong was the center of the ginseng trade, cultivated American ginseng from the US and Canada (primarily from Wisconsin, Ontario, and British Columbia) sold for 5-10 the price of cultivated Asian ginseng. Therefore, Asian ginseng roots became an adulterant of higher-priced American ginseng.

In addition, as Yip et al. has noted, consumers in Korea or China may prefer Asian ginseng from their own countries. In Korea, American ginseng is considered an adulterant of Korean ginseng and is not allowed in the market.

The two plants cannot be used interchangeably in practice. TCM classifies American ginseng as “cool” and recommends it for “yin-deficient” conditions. American ginseng consumption is greater in southern China as a cooling tonic, whereas Asian ginseng is considered “hot” and is used for “yang-deficient” conditions. Adulteration of one species with the other could produce unexpected clinical outcomes in TCM practice.¹¹² Each of these nuances points to an acute need for proper authentication. HG

Steven Foster is an author, photographer, and herbalist, and he serves on the Board of Trustees of the American Botanical Council. His most recent book is the third edition

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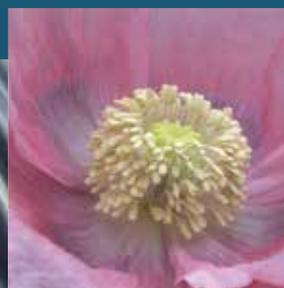
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