HerbalGram 142 Winter 2025

Mullein Herb Profile • Why Plant Names Matter • Milk Thistle & Acne
Shatavari & Menopause • Cordyceps Adulteration Bulletin • Experts Endorse BAPP SOP

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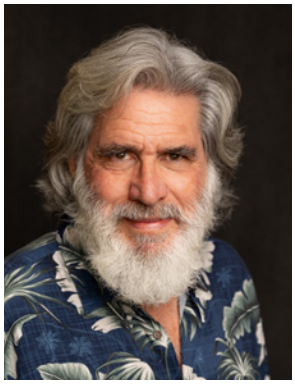

dear *reader*

A significant part of the rich history and lore of medicinal plants is found in the myriad ways people have named them. Plant names can be based on various factors, including their shape, color, texture, location, medicinal uses, and more. The common name "devil's claw," for example, refers to the sharp protrusions from its fruit. Its genus name, *Harpagophytum*, means "grappling hook plant" in Latin. People have used different names to describe the same plant for as long as plants have been named — a source of much confusion throughout history.

Attempts have been made to standardize the names of plants and other organisms for centuries, most notably in the 18th century by Swedish botanist Carl Linnaeus (1707–1778), who established the Latin binomial system of biological nomenclature. More than 200 years later, in the United States, the American Herbal Products Association has codified standardized common names of commercially used herbs in its *Herbs of Commerce* guide, now in its third edition (2023). For decades, ABC has used this reference as its standard, whenever possible, for the common names of medicinal plants.

In this vein, our main feature in this issue focuses on plant nomenclature. Authors Bob Allkin, PhD, and Kristina Patmore from the Royal Botanic Gardens, Kew emphasize the importance of using precise names when communicating about plants and herbal substances. In their 24-page feature, Bob and Kristina advocate for the use of the Latin binomial (genus and species) plus the author(s) who first published the name (i.e., the "authority"). These names are stable and based on type specimens (the specimen on which the name and description of a new species are based), the authors explain, while using common or even pharmacopeial names can lead to ambiguity. The extensive article is roughly 16,000 words and includes 97 references, nine figures, and four tables.

Bob and Kristina suggest a different format than the one we currently use at ABC. Our publications include a plant's Latin binomial and family name, often parenthetically, upon first mention. The late botanist Steven Foster and I adopted this format years ago. It was our opinion that listing the family name with the binomial would provide readers with more information about a plant than a reference to the person who officially named it. The use of botanical authorities — which often involves abbreviations, full names, punctuation, and spacing that can seem almost cryptic at times — is viewed by some as cumbersome, especially by those who are not taxonomists and in commercial or journalistic settings. Nevertheless, although we may not follow Bob and Kristina's recommended convention, we regularly refer to Kew's online databases when questions about nomenclature arise.

Our Herb Profile in this issue is on mullein, the soft, fuzzy-leafed European plant naturalized to North America. (Its genus name, *Verbascum*, possibly derives from the Latin *barba*, meaning "beard," due to its fuzzy foliage.) The leaf and flower of mullein have some interesting folkloric and traditional medicinal uses, many of which mirror modern uses of the plant. Once again, we extend our deep gratitude to Marisa Williams, ND, RH (AHG), and Aaron Jenks, PhD, of Traditional Medicinals for their valuable time and dedication in producing the extensively researched articles for this series.

And, finally, we pay our respects to friends and colleagues who have passed from our world. I met herbalist and author Jeanne Rose in the late 1970s. She was a creative and unique person who lived life on her own terms. Her first book, *Herbs & Things*, was published in 1972, and it was one of the first books written by a contemporary herbalist at the dawn of what the late Paul Lee termed "the Herbal Renaissance." I will always cherish the memories of my annual phone calls to her on her birthday. She was outspoken, sometimes brash, and always knowledgeable and brilliant.

We also honor the life of Alan Dattner, MD, an integrative dermatologist and ABC's "go-to" guy for peer review on articles dealing with the external uses of botanical preparations. Energetic and lively, Alan was one of the few MDs in North America with expertise in botanicals' effects on skin conditions, and he had a deep passion for herbal medicine and natural health.

Our third tribute is to my old friend Paul Ross, an herb industry pioneer and visionary who brought his modern advertising and marketing savvy to a fledgling herbal industry beginning in the mid-1970s, when he created two natural health companies. His final company, Bioforce USA, continues under the leadership of his family. Paul helped to pioneer the importation and marketing of various high-quality herbal products from Europe to the US herb market.

Mission: Provide education using science-based and traditional information to promote responsible use of herbal medicine—serving the public, researchers, educators, healthcare professionals, industry, and media.

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Yarrow *Achillea millefolium*
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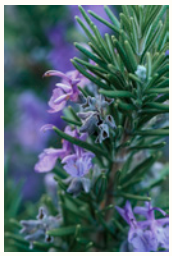

On the Cover
Rosemary *Salvia rosmarinus*
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Mullein

Verbascum thapsus L.

Family: Scrophulariaceae

By Marisa Williams, ND, RH (AHG), and Aaron Jenks, PhD

INTRODUCTION

Verbascum thapsus, or mullein, is a stately plant with yellow flowers and fuzzy leaves and has been used since ancient times for many purposes, medicinal and otherwise. This well-known plant is commonly found growing on roadsides and other disturbed or dry areas, and few, if any, plant species have such a large lexicon of common and local names associated with them.[1] The many names attributed to the plant frequently refer to its memorable morphology, specifically its soft, woolly leaves and towering flower stalk.

A few of these myriad and varied names are white mullein, torches, mullein dock, Our Lady's flannel, Our Lady's candle, velvet dock, blanket herb, velvet plant, woollen, rag paper, candlewick plant, wild ice leaf, clown's lungwort, bullocks lungwort, Aaron's rod, Jupiter's staff, Jacob's staff, Peter's staff, shepherd's staff, shepherd's clubs, beggar's stalk, golden rod, Adam's flannel, beggar's blanket, clot, cuddy's longs, duffle, feltwort, fluffweed, hare's beard, old man's flannel, hag's taper, Quaker rouge, grande moléne, and cowboy toilet paper.[1-4] While some common names are referential of specific uses for the soft leaf texture, others, such as those including "staff" and "rod," are due to the height and rigidity of the flowering stalk. The *American Herbal Products Association's Herbs of Commerce*, 3rd edition, lists the plant's Standardized Common Name (SCN) as "mullein," with Other Common Names (OCN) listed as "Aaron's rod," "common mullein," and "great mullein."[5]

Mullein typically grows as a biennial, forming a basal rosette of leaves the first year and a tall, stout inflorescence in its second year of life that ranges in height from 30 cm to 2 m. The plant is densely stellate-hirsute, covered with small, star-shaped hairs that give it a woolly appearance. The leaves are 5–50 cm long, with basal leaves being oblanceolate and with a short petiole and cauline leaves being lanceolate and decurrent. The inflorescence is a dense raceme that is generally unbranched, and the bracted flowers are typically fused to the stem. The flowers themselves each have a yellow, five-lobed corolla (15–30 mm wide) growing from inside a calyx (7–9 mm long), with five stamens and the stigmas fused and head-like.

Mullein *Verbascum thapsus*
Photo ©2025 Steven Foster

The fruit is an ovoid capsule, which is 7–10 mm long and contains hundreds of tiny seeds.[6,7] The flowers, which are only open for one day, uniquely open in two stages, presumably to enable preferential cross-pollination by bees. First, the pistil emerges with the three lower lobes of the corolla, and, once pollinated by a bee carrying pollen from another flower, the pistil falls off. Second, the pollen-laden stamens emerge with the two upper corolla lobes. If, however, a bee has not brought pollen from another flower, the pistil will not fall off, and the flower will then self-pollinate from its own stamens.[8]

Mullein belongs to the figwort family (Scrophulariaceae) and is one of 466 accepted species of the genus *Verbascum*, which are native to Africa, Asia, and Europe.[9] *Verbascum thapsus* is native to Europe and much of Western and Central Asia, from the Azores (Portugal) to Siberia and the Himalayas. However, it is now naturalized far outside of this native range in parts of South America and much of North America, where it is, at times, considered weedy.[4,6,9] Remarkably little phylogenetic research has been done on the genus. However, *Verbascum* is considered to be monophyletic (derived from a common ancestor) based on molecular and morphological evidence.[10] *Verbascum thapsus* has two accepted subspecies: *V. thapsus* subsp. *thapsus* and *V. thapsus* subsp. *montanum*. The latter is known to be found only in France, Italy, Portugal, and Spain.[6,9]

Across its native range and particularly in Mediterranean Europe, mullein has been used medicinally since antiquity. The leaves and flowers primarily were, and continue to be, the parts used, but the roots and seeds also have uses ascribed to them. Historically, the plant has been considered to have emollient, demulcent, and astringent properties, and, to a lesser extent, sedative and pain relieving properties, with much of that use internally for pulmonary or respiratory system-specific ailments.[1] Its actions are considered to be expectorant, anti-inflammatory, antispasmodic, and vulnerary (wound-healing).[11,12] In addition to its use as a soothing respiratory remedy, an oil specifically made from the flowers is used topically and for ear infections and painful conditions.[1,12] Although *V. thapsus* is the most abundant and commonly used species medicinally, several other *Verbascum* species, including *V. densiflorum* and *V. phlomoides*, are included in various pharmacopeias and may have been used historically.[11,13]

Mullein is typically harvested from cultivated plants in the European Union (EU), particularly Bulgaria, Czechia (the Czech Republic), and Slovakia. Mullein is also commercially cultivated in Egypt[11] and wild harvested in Albania for the international market.[14] In North America, much of the supply of mullein is produced by certified organic farms, either as crops or wild crops, primarily in Oregon but also in Illinois, Washington, and Ontario, Canada.[15] Mullein is not reported in the American Herbal Products Association's (AHPA's) *2011–2017 Tonnage Survey of Select North American Wild-Harvested Plants* as either wild collected or cultivated, indicating that mullein production in North America is likely to be too minimal to be tracked.[16]

HISTORY AND CULTURAL SIGNIFICANCE

Verbascum thapsus was first described by Swedish botanist Carl Linnaeus (1707–1778) in his 1753 work *Species Plantarum*,[17] retaining, as the genus name, the Latin name *verbascum*, which Pliny used for mullein.[18,19] *Verbascum* derives from a corruption of the word *barbascum* or *barbatus*, from the Latin word *barba*, meaning "beard," due to the fuzzy foliage and hairy stamens.[1,8] The epithet *thapsus* is derived from the Greek word Θάψος, or "Thapsos," the Greek name for an ancient settlement in Syracuse, Sicily, Italy. "Thapsos" could also refer to Thapsus, Tunisia, where a plant used to make a yellow dye (*Rhus cotinus* syn. *Cotinus coggygria* [Anacardiaceae] and possibly *V. thapsus*) is reported to have been abundantly gathered.[8,20] Alternately, *thapsus* could be derived from the Greek word *thapsinos*, meaning "yellow,"[19,21] due to either mullein's yellow flowers or a yellow dye that can be made from the plant.[1]

Grieve (1931),[1] citing Prior (1863),[22] states that the word mullein (*moleyn* in Old English and *malen* in Old French) is ultimately derived from the Latin *malandrium* (referring to illnesses like leprosy). Because mullein was commonly used to heal *moleyn* (i.e., pulmonary and other illnesses) in cattle and other livestock, it became known as mullein, and for the same reason, bullock's lungwort,[1,22] meaning "herb for cows' lungs." Alternatively, the word mullein may also be derived from the Latin word *mollis*, meaning "soft," due to the softness of the leaves.[19,23]

Many of the earliest records credit mullein with having supernatural powers and protective properties. A 4th-century text, *Cyranides* (a compilation of Greek writings on magic and medicine), provides instructions for a "necromantic ring of Nemesis," which, among other things, contained mullein, known as *nekua*, or "death-plant." This ring was believed to have many properties, including divination and increasing longevity.[24] In the Middle Ages, mullein was believed to have the power to control demons,[8,24] and across Europe and Asia to India it is traditionally considered to have "the power of driving away evil spirits"[1] and was used as a ward against magic, noxious spirits, and nightmares, either worn as a talisman or planted near a home.[1,24] Another species, *V. sinuatum*, was burned as an incense of protection in Kashmir.[24] According to traditional interpretation, Odysseus (Ulysses) used mullein to protect himself from Circe in Homer's *Odyssey*.[1]

In medieval Europe, mullein was cultivated in monastic gardens, and its medicinal properties were studied. By the 16th century, possibly earlier, it had become widely cultivated in home gardens across Europe due to its reputation as a healing agent.[8] Its use as a medicine was so widespread that even in locations where mullein grew wild, such as Ireland, it was often still cultivated in home gardens because the demand for the plant could not be met by wild harvesting alone.[1]

The Puritans brought mullein seeds to America to grow in their gardens for medicinal use, but by the 1630s, it had escaped their gardens and begun naturalizing the nearby roadsides and fields.[8,19] Mullein was used widely during the

Colonial period, and as settlers moved south and west, they brought mullein with them. Before long, it had naturalized across North America.[8] By 1818, mullein had become so abundant that it was described as a North American native species by American botanist Amos Eaton (1776–1842).[19]

Records of mullein's medicinal use go back at least as far as Greek physician Pedanius Dioscorides (ca. 40–90), who recommended the root to be taken in wine,[25] and, later, English herbalist John Gerard (1545–1612) and others wrote about it in the 16th century and before.[1] However, it appears to have been the English physician and botanist Nicholas Culpeper (1616–1654) who first cataloged mullein's medicinal uses,[25] and the categories of therapeutic use and the plant parts used for each application have changed surprisingly little since then.[1]

Medicinal uses of mullein can be grouped into internal uses (for respiratory, pulmonary, gastrointestinal, neurological, and other issues) or topical uses (as an anti-inflammatory for treatment of conditions from ear infections to hemorrhoids).[1,2,12,26,27] It is important to note that after mullein's introduction to the Western Hemisphere in the early 1600s, mullein was adopted quickly and widely into the healing traditions of Indigenous peoples in North America.[28] Whether medicinal uses were learned from settlers or whether Indigenous peoples learned mullein's therapeutic properties by their own means, their use of mullein typically mirrored that of Europeans.

Mullein leaves are the most commonly used plant part for respiratory and pulmonary complaints, from asthma, coughs, and colds to pulmonary tuberculosis. They are brewed into a hot infusion, sometimes in milk, usually strained before consumption to remove the irritating hairs, and sweetened if desired. At times, the roots were also used, either with the leaves or decocted on their own. At other times, flowers were employed.[1,29] Mullein was used in Northern Europe in the treatment of tuberculosis and was considered to be the best, if not only, way to quell coughs and soothe symptoms of that illness.[1,29] It has been used since ancient times for inflammation of the throat[25] and hoarseness. Reportedly, Hildegard von Bingen (ca. 1098–1179) used mullein for this purpose, taken boiled in wine with fennel (*Foeniculum vulgare*, Apiaceae).[2] Its specificity for the respiratory system and lungs is due to its anti-inflammatory and astringent properties, while it is also demulcent, stimulates fluid production, facilitates expectoration, and, at the same time, soothes painful coughing.[12]

The Cherokee,[30] Creek,[31] Delaware,[32] Iroquois,[33] and others[28,34] used mullein, consumed as a tea or syrup, to treat coughs and croup. In modern Southwestern herbal medicine, *Punchon* (mullein) leaves and flowers are made into a tea for bronchial infections, relaxing the lungs and chest, and sedating respiration.[35] Mullein was also once widely used to treat respiratory diseases in livestock, cattle in particular.[1,2,8,29]

The same antispasmodic, demulcent, and anti-inflammatory actions that facilitate mullein's effectiveness as a respiratory medicine also render it a time-honored treatment for other complaints, in particular those of eliminatory functions and for musculoskeletal and other pain.[1,2] Root decoctions (sometimes including leaves) have been used for stomach aches, intestinal and other cramps,[1,25] and diarrhea and to regulate bowels.[1,36] The root is also diuretic and astringent for the urinary tract, and it has been used to treat prostate inflammation and urethral irritation after "sexual calisthenics."[37] In addition to being used to address musculoskeletal conditions and alleviate associated pain,[1,2] mullein has also been consumed for rheumatism,[38] convulsions, and toothaches,[1] perhaps indicating a broadly soothing, peripheral, mildly analgesic action.

Externally, a decoction of mullein leaves with sage (*Salvia officinalis*, Lamiaceae), marjoram (*Origanum majorana*, Lamiaceae), and chamomile (*Matricaria chamomilla*, Asteraceae) may be applied topically for cramps, a use credited to English herbalist and botanist John Parkinson (1567–1650).[2] A poultice of mullein leaves, with the addition of seeds in some instances, is used to draw out splinters, help backaches, reduce lymphatic swelling, reduce joint pain, and heal broken bones.[1,2,8,25] In the 17th century, a poultice of the leaves was used for horses' hooves injured while shoeing.[2] Many Indigenous peoples of North America used poultices of the leaves to heal cuts, bruises, and other wounds and swellings,[28,34,38] and the Delaware used a heated poultice topically to alleviate pain and swelling of rheumatism.[32] The Cherokee used the leaves topically for swollen glands and for mumps and diphtheria (bacterial infection of the nose and throat) by wrapping the leaves or a poultice of the leaves around the neck.[28,30,31] In the Ozarks, fresh mullein leaves bound around a tobacco (*Nicotiana tabacum*, Solanaceae) poultice were used to "draw the pizen [poison]" out of boils or a "risin'" (a boil or carbuncle),[39] and in rural Appalachia an ointment is made from tallow and mullein.[8]

External uses of mullein for therapeutic effects are many. A topical application of dried mullein has been used to remove warts.[1,25] A "conserve" of the flowers is used for treating ringworm in Europe, and "distilled water of the flowers" is used to treat burns and erysipelas (a bacterial infection of the upper dermis causing a red, raised rash with well-defined borders).[1,36] The Abenaki used mullein roots for teething babies, placed as a necklace on the children.[28,33] A poultice or fomentation of mullein leaves is a traditional treatment for hemorrhoids,[1,39] but Culpeper recommended an oil made from the flowers for that condition.[25]

Mullein flower oil has been used historically for piles (hemorrhoids) or for any swelling or irritation of the mucous membranes,[1,2] and it is probably the mullein preparation most commonly encountered today. Mullein oil can be made by macerating the flowers in olive oil (*Olea europaea*, Oleaceae) in the sun or another warm place for several weeks and then straining. A more concentrated oil can be made by doing a second or even third round of floral maceration.[1,40] Mullein oil is well known for its ability to heal ear infections and injuries. The anti-inflammatory and

antibiotic properties of mullein flowers combined with the emollient properties of the oil not only soothe inflamed ear canals but also loosen impacted ear wax.[12,37] Mullein oil is also indicated for suppurative (relating to the formation or discharge of pus) inflammation of the inner ear.[1]

Mullein is one of a handful of plants that have a long history of being smoked for medicinal purposes. Smoked in a pipe or rolled into a cigarette, mullein is said to soothe and control severe and spasmodic coughing due to asthma or even tuberculosis.[1] "For BRONCHITIS and ASTHMA: the leaves of the mullein plant, dried, and put in a clay pipe and smoked like tobacco"[41] (in Vickery, 1995).[29] This use is mirrored in the Southwestern United States, where mullein is sometimes smoked in combination with *toloache* (*Datura* spp., Solanaceae).[35] The Iroquois smoked the dried leaves for catarrh, asthma, tuberculosis, and hiccups.[36] The leaves were smoked for pleasure in the Ozark Mountains, where the leaves were gathered in July and August and then dried.[8]

The Hopi collected and cured mullein in the same way as tobacco. It was then smoked together with *Lithospermum thurberi* (syn. *Onosmodium thurberi*, Boraginaceae),[42] now commonly called giant trumpets or Thurber's giant-trumpets.[43] A healer would smoke the mixture and blow the smoke in the face of patients with "fits" (possibly epileptic attacks) or who were not in their "right mind."[42] Mullein has a long history of being ignited and the smoke inhaled, but it also has been burned since antiquity to create light.

Not only has the tall flowering stalk of mullein been compared to a candle — "That the whole toppe, with its pleasant yellow floures sheweth like to a wax candle or taper cunningly wrought," according to English botanist Henry Lyte (ca. 1529–1607) in *A Nievve Herball* (1578)[1] — but the plant has been used for millennia as a torch and to make candle wicks. This explains its alternate name "candle-wick plant." The fine, downy hairs on the leaves and stems make very flammable tinder and, before the use of cotton (*Gossypium* spp., Malvaceae), were used to make the wicks of candles, a practice that apparently originated with the Greeks.[1,8,44] Records indicate mullein stalks were dipped in tallow and used as torches by Roman legionaries, who carried these torches as they expanded their empire.[1,2,8] The Romans and others also were reported to have used mullein torches for funeral processions.[1,8]

Beyond uses for illumination, mullein has been employed in other unique and diverse ways. The leaves have been used since ancient times to add warmth and comfort to shoes and as insoles to promote circulation,[1] soothe chafed feet,[8] and relieve pain of plantar fasciitis (a disorder of the plantar

Mullein *Verbascum thapsus*
Photo ©2025 Steven Foster

fascia, or connective tissue, which supports the arch of the foot).[2] A wrapper of the leaves has also been used to preserve food. As stated by Gerard, "Figs do not putrifie at all that are wrapped in the leaves of Mullein."[1] Use of mullein leaves as "cowboy toilet paper"[3] is reported,[37] as is their application as diapers.[2] Girls also have used the hairy leaves of mullein as an irritant to redden their cheeks, giving rise to the local name of "Quaker rouge."[2]

Yellow dyes have been made from mullein flowers.[45] The yellow color from boiling the flowers in water is changed to green with the addition of diluted sulfuric acid and to brown with the addition of alkalis (or base).[1] Roman women used a preparation of the flowers as a hair wash to dye hair golden. Historically, the ashes of the plant were used in soap to return gray hair to its original color.[1]

Seeds of multiple *Verbascum* species, including *V. thapsus*, have been used as fish poison. The seeds were thrown into water and were said to intoxicate fish to make them catchable. This use is reported from Greece and elsewhere in Europe.[1,46] The practice of using mullein seeds to catch fish was introduced to North America from Europe, Germany in particular, in the 17th century and possibly earlier. Immigrants brought mullein seeds with them to use as piscicide so they could feed their families, and the practice of "stinging" fish using mullein was reported from Southern Appalachia at least as recently as the 1970s.[19,46]

In modern herbal medicine, mullein leaves and flowers are considered to be separate botanical medicine entities. The dried leaves of *V. thapsus* "and other species of Verbascum" were officially listed in *The National Formulary*, 4th Edition (1916), as was a fluid extract of the leaves. The flowers of *V. phlomoides* and *V. densiflorum* (syn. *V. thapsiforme*) were also officially listed.[45]

CURRENT AUTHORIZED USES IN COSMETICS, FOODS, AND MEDICINES

Mullein is generally considered to be an old dietary ingredient (ODI),[47] as mullein ingredients and products were marketed in the United States before October 15, 1994, which justifies their use as a component of dietary supplements. For an herbal ingredient to be used in a dietary supplement in the United States, the marketer must submit a notification letter to the US Food and Drug Administration (FDA) within 30 days of marketing the product if a structure-function claim[48] (a non-therapeutic, non-disease-related claim) is made on the package and/or marketing materials. Manufacture of the product must comply with FDA current Good Manufacturing Practices (cGMPs).[49]

As a food additive, as per FDA regulation 21 CFR §172.510, the extracts, oils, or distillates of two species of mullein (*V. phlomoides* or *V. thapsiforme*) flowers are permitted for use as natural flavoring substances and/or as natural substances used in conjunction with flavors, albeit limited to use as a flavor ingredient of alcoholic beverages only.[50] The second listed species in the regulation, *V. thapsiforme*, is considered a synonym of *V. densiflorum*. While the more commonly used mullein species, *V. thapsus*, is not expressly included in the FDA regulation, several *V. thapsus* subspecific taxa have been synonymized with the listed species, *V. phlomoides* and *V. densiflorum* (syn. *V. thapsiforme*). [9] US Environmental Protection Agency (EPA) regulation 40 CFR §180.1, which concerns pesticide chemical residues in food, defines edible mullein flower as "*Verbascum thapsus* L., *Verbascum* spp.," providing evidence of use of this species as a conventional food in the United States.[51]

In Canada, *V. thapsus* (whole plant) is classified as a medicinal ingredient of licensed Natural Health Products (NHPs), which require pre-marketing authorization and issuance of a product license for sale in Canada.[52] More than 175 licensed NHPs, mainly poly-preparations at the time of writing (September 2024), contain *V. thapsus* as a medicinal ingredient.[53] Authorized indications for use for mullein flower mono-preparations, such as fluid extracts or tinctures, include "Traditionally used in Herbal Medicine as an expectorant to help relieve chest complaints, such as catarrhs, coughs and bronchitis."[54] Both "Verbascum Thapsus Herb" and "Verbascum Thapsus Extract" are permitted for use as non-medicinal components of licensed topical-application NHPs as a topical skin-conditioning agent.[55]

In Mexico, the *Farmacopea Herbolaria de los Estados Unidos Mexicanos* (FHEUM) quality standard monograph lists "Gordolobo Europeo Flor" of which *Verbascum thapsus* is one of the accepted species and "consists of dry flora reduced to the corolla and the androecium." Other species, such as *V. densiflorum* and *V. phlomoides*, are also included.[56]

In the EU, the *European Pharmacopoeia* (PhEur) quality standard monograph lists *V. thapsus* as one of the accepted species for mullein flower (Verbasci flos) and defines it as "dried flower, reduced to the corolla and the androecium, of *Verbascum thapsus* L., *V. densiflorum* Bertol. (syn. *V. thapsiforme* Schrad.) or *V. phlomoides* L., or their hybrids, or any mixture amongst the three species and their hybrids."[13] Mullein flower may be used as an active ingredient of registered traditional herbal medicinal products (THMPs). The European Medicines Agency (EMA) EU herbal monograph provides an authorized indication statement for product labeling for mullein: "Traditional herbal medicinal product used to relieve symptoms of sore throat associated with dry cough and cold."[57] For use in cosmetic products in the EU, the defined substance "Hydrolyzed Verbascum Thapsus Flower" (the hydrolysate of the flowers of *Verbascum thapsus* derived by acid, enzyme, or other method of hydrolysis) is authorized for antioxidant and skin-protecting functions. Both "Verbascum thapsus (cut, dried herb)" and "Verbascum Thapsus Leaf Extract" are authorized for use in cosmetic products for skin-conditioning function. "Verbascum Thapsus Extract" (extract of the flowers and leaves) may be used for both skin-conditioning and smoothing functions.[58]

Additionally, mullein leaf (*V. thapsus*, *V. densiflorum* [*V. thapsiforme*], or *V. phlomoides*) is listed in the *British Herbal Pharmacopoeia* as an expectorant.[11]

MODERN RESEARCH

The primary chemical constituents recognized in mullein are phenylethanoid glycosides (e.g., verbascoside, which takes its name from the genus name *Verbascum*), flavonoids, iridoid glycosides (e.g., harpagoside, harpagide, and aucubin, particularly in the leaf), lignan glycosides, sesquiterpenes, polysaccharides, and triterpene saponins.[59-65] In an aqueous mullein leaf extract, six phenylethanoid glycosides were identified by high-performance liquid chromatography with diode array detection (HPLC-DAD), with verbascoside as the predominant compound.[61]

In an in vitro model, an aqueous leaf extract of mullein demonstrated inhibitory effects on inflammation when evaluated for anti-inflammatory and anti-osteoarthritic properties with a positive control of a devil's claw (*Harpagophytum procumbens* Pedaliaceae) extract standardized to 12% harpagoside. The anti-inflammatory model (lipopolysaccharide [LPS]-induced inflammation in mouse macrophage [RAW 264.7] cells) showed a statistically significant reduction of nitric oxide after 24 hours at a 50 µg/mL concentration for mullein leaf extract and a 100 µg/mL concentration for devil's claw extract. After six days of treatment in the model, the mullein and devil's claw extracts at both concentrations (50 and 100 µg/mL) showed significant reduction of nitric oxide levels, indicating anti-inflammatory properties, with mullein leaf extract showing less cytotoxic effects.[61]

The antibacterial activity of mullein was evaluated in an in vitro disk diffusion bioassay model, called the Kirby-Bauer method, which uses an agar plate to determine if bacteria are sensitive to the compounds of interest. Various mullein leaf sources (field grown, commercial, in vitro cultured) and different extraction solvents (water, ethanol, and methanol) were evaluated against six bacterial strains (*Escherichia coli*, *Pseudomonas aeruginosa*, *Klebsiella pneumoniae*, *Streptococcus pyogenes*, *Staphylococcus aureus*, and *Staphylococcus epidermidis*). Additionally, various formats of mullein commercial products were assessed, including tea bags, capsules, alcohol extract made from the leaves, and a mullein flower oil in an olive oil base.

This study included controls of solvents, glycyrrhizic acid, and other saponin standards tested alongside the mullein preparations, which were extracted and filtered. The commercial mullein flower oil inhibited the growth of *K. pneumoniae*, *E. coli*, *P. aeruginosa*, and *S. aureus*. The commercial mullein leaf alcohol extract and mullein tea sample (plant part not listed in study) showed growth inhibition of only one bacterial species: *K. pneumoniae*. The aqueous extract from the commercial leaf material inhibited *K. pneumoniae*, *S. aureus*, *S. epidermidis*, and *E. coli*.[65,66]

Mullein *Verbascum thapsus*
Photo ©2025 Steven Foster

The essential oil of the dried flowering aerial parts of mullein was evaluated by a disk diffusion method for antimicrobial activity. Various essential oil amounts (250, 500, 1,000, 2,000, 4,000, and 8,000 µg/disk) were evaluated, and the antimicrobial activity was found to be dose-dependent for each microbial species: *Bacillus subtilis*, *S. aureus*, *Salmonella typhi*, *P. aeruginosa*, and *Aspergillus niger*. No antimicrobial activity was reported against *E. coli* or *Candida albicans*.[67]

No relevant toxicity and safety information is available for mullein.[68] Mullein flower is recognized as safe within the EU when recommended intake preparations, specified uses, instructions, and dosage levels are followed.[60] A caution for mullein flower exists if there are hypersensitivities to the ingredient.[57]

Even though mullein has an extensive historical and traditional use record, modern clinical studies are sparse. Only two studies[69,70] and a naturopathic practitioner survey[71,72] were identified for this Herb Profile. Both studies evaluated mullein flower extract as an ingredient for topical application, either in a multiple-ingredient combination formula or as a mono-preparation.

In a double-blind pediatric study, a total of 171 children (5–18 years of age) with ear pain and/or symptoms of middle ear infections were randomly provided herbal ear drops or anesthetic ear drops, with or without the antibiotic medication amoxicillin. The herbal ear drops contained vitamin E (tocopherol acetate oil, 2%), olive oil (10%), garlic (*Allium sativum*, Amaryllidaceae, 0.05%) essential oil, and multiple herbal extracts, including extracts of calendula (*Calendula officinalis*, Asteraceae, 28%) flowers, St. John's wort (*Hypericum perforatum*, Hypericaceae, 30%) whole plant, and mullein flower (25%). The treatment sub-groups were Group A: herbal ear drops only (5 drops 3 times per day [TID]), Group B: herbal ear drops with a topical anesthetic (amethocaine and phenazone in glycerin) (5 drops TID), Group C: herbal ear drops (5 drops TID) with amoxicillin (80 mg/kg/d, maximum 500 mg/dose, divided into 3 doses), and Group D: topical anesthetic only (5 drops TID). One physician monitored treatment care, documented symptom changes throughout the study, and educated parents and children on how to use the pain scale tools to help communicate if symptoms had changed during the study. Ear pain was measured with a Pain-O-Meter device and a visual analog scale (VAS) tool for three days. Overall, there were no significant differences related to age, gender, fever, symptoms of middle ear infections, or other related symptoms between the sub-groups. At the end of the study, each sub-group demonstrated improvements in ear pain after three days. The authors reported that sub-groups that were given just herbal ear drops responded better than the sub-group that was given ear drops and amoxicillin. No side effects were reported in the study.[69]

In a randomized, double-blind, placebo-controlled trial, a total of 93 women (18–35 years of age) with an episiotomy wound (i.e., from an incision through the perineum to make the vaginal opening larger during childbirth) after giving their first vaginal birth were evaluated to determine if mullein flower extract could improve the wound healing process. Study participants were divided between the treatment group (n = 46) and placebo group (n = 47). The intervention topical cream was approximately 7.5% mullein flower extract (ethanol extraction) in a Eucerin® (Beiersdorf AG; Hamburg, Germany) cream base in 30-gram containers, while the placebo group received Eucerin without the flower extract. Both were prepared by a pharmacist who provided application guidance. Study participants applied the prescribed creams to the wound area after cleaning the area twice per day for 10 days. Each group was monitored before intervention to obtain a baseline of the wound area and then on day 1, day 3, and day 10 under the supervision of a gynecologist. The wound area was monitored with a scale called REEDA (redness, edema, ecchymosis [bruising], discharge, approximation), which is a tool to monitor and evaluate the healing of the episiotomy wound area at the hospital. On day 1 and day 3, REEDA scores improved in the intervention group compared to the placebo group. However, the improvement was not statistically significant. On day 10, REEDA scores improved significantly in the intervention group compared to placebo. The authors reported no significant differences in side effects between the two groups.[70]

In a modified Delphi study, naturopathic practitioners from the United States, Canada, and Australia were asked a series of questions related to naturopathic treatment of acute respiratory infections in children. Fourteen practitioners participated in the survey and had experience related to providing care in a pediatric-focused practice, treating children with respiratory tract infections, and/or teaching as an active faculty member at an educational institution on naturopathic care management specific to children with respiratory tract infections. In the survey results reported for otitis media (middle ear infection), more than 92% of participants recommended "garlic-mullein ear drops" as a treatment option.[71,72]

ADULTERATION AND SUBSTITUTION

The current quality standard monograph for mullein flower in the PhEur lists *V. thapsus* as one of three accepted species. *Verbascum thapsus* can be distinguished from the other two accepted species by its "smaller funnel-shaped flowers (up to 22 mm in diameter) and narrower corolla lobes."[13] Additionally, there is a high-performance thin-layer chromatography (HPTLC) method in the PhEur for identification of *V. thapsus*.[13] Additional botanical identity methods for mullein flower are included in a quality standard monograph for *V. thapsus* in the FHEUM.[56]

SUSTAINABILITY AND FUTURE OUTLOOK

Mullein is not subject to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) and is not listed in the US Endangered Species Act.[73] This species is assessed as Least Concern according to the International Union for Conservation of Nature (IUCN) Red List categories and criteria.[74]

Natural pests and other biological threats to its cultivation are minimal,[75] and although a range of bees and other insects frequently pollinate it,[76] the plant readily self-pollinates and sets abundant seed, even in the absence of pollinators.[8] Given that mullein readily self-propagates, colonizes quickly, and has naturalized in nearly all temperate climates globally, to the point of sometimes being considered a weed[4] (although it is not considered aggressively invasive),[75] risks to its supply chain due to habitat loss, political unrest, and climate change are minimal. Coupled with its ease of cultivation and short life span (a biennial harvested in its second year), its future outlook appears stable, and it will likely continue to be sufficiently available to meet market needs.

Commercial cultivation in Eastern Europe and North America appears to meet current market demand for mullein.[9,11,15] While organic operations are mostly adequate,[15] wild-collected material could supplement an increase in demand. The FairWild Foundation lists one supplier in Albania that provides mullein leaf and flower as FairWild-certified herbal ingredients.[14] Currently, mullein's market share appears small, and it is most commonly seen as an ear oil prepared from the flowers, but the potential for growth in both sales volume and diversity of available preparations is possible, with additional attention given to its well-documented traditional uses. HG

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Mullein *Verbascum thapsus*
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Nutraland USA and Nature's Answer Adoptions Support ABC's Adopt-an-Herb Program

By ABC Staff

The American Botanical Council (ABC) recently announced the adoptions of reindeer lichen (*Cladonia rangiferina*, Cladoniaceae) by Nutraland USA, Inc. and mullein (*Verbascum thapsus*, Scrophulariaceae) by Nature's Answer through ABC's Adopt-an-Herb botanical research and education program.

These adoptions help support ABC's extensive HerbMedPro database, ensuring that this unique resource remains up to date for researchers, health professionals, industry members, students, consumers, and other members of the herbal and dietary supplement and natural medicine communities. HerbMedPro is a comprehensive, interactive online database that provides access to important scientific and clinical research data on the uses and health effects of more than 275 herbs, spices, medicinal plants, and fungi.

"ABC is deeply grateful to our friends at Nutraland USA and Nature's Answer for their adoptions," said ABC Founder and Executive Director Mark Blumenthal.

Nutraland USA Adopts Reindeer Lichen

Cladonia rangiferina is a cold-hardy lichen species that grows in hot and cold climates in well-drained locations, specifically in boreal forests and alpine tundra. Lichen are not technically plants. They are a composite organism that consists of fungi and either cyanobacteria or green algae (or both).[1] Called reindeer lichen because it is an important food source for reindeer (caribou), it has also long been used by humans as both food and medicine. Reindeer lichen has been used as a thickener in soups and stews and in combination with nuts and fruits in foods for energy support. It has immunoprotective, antimicrobial, and antioxidant properties and has been used traditionally to treat kidney stones and diarrhea. The lichen is a natural source of vitamin D_3.

Reindeer lichen *Cladonia rangiferina*
Photo ©2025 Jerzy Opioła

"As a company dedicated to providing sustainable, verifiable, and responsibly sourced plant-based [and other natural] ingredients, supporting ABC's Adopt-an-Herb program through the adoption of reindeer lichen aligns perfectly with our mission," said Gene Bruno, MS, RH (AHG), Nutraland's chief scientific officer.

"Our mission is to provide ingredients that are good for health and good for the earth," Bruno continued. "By supporting the Adopt-an-Herb program, we're investing in the future of sustainable herbal [and other natural] nutrients and ensuring that researchers, health professionals, and consumers have access to reliable information about reindeer lichen and its potential benefits. Participating in the Adopt-an-Herb program underscores Nutraland's commitment to sustainability, ethical sourcing, and community outreach. By ensuring the responsible wild-crafted harvesting of reindeer lichen for our VegaDelight® products, we're helping to sustain local communities, thereby preserving not just a species but also the livelihoods of those who rely on it."

Bruno added: "By highlighting reindeer lichen in the Adopt-an-Herb program, we can educate consumers about its natural vitamin D_3 content that provides a truly [natural] alternative to synthetically derived D_3. Equally important is the industry connection. We believe that our adoption will help expand the database of information on reindeer lichen and [therefore help] manufacturers to ensure their products are not synthetically spiked or otherwise adulterated."

About Nutraland USA

Nutraland USA considers itself a pioneer in the development and manufacture of functional ingredients for nutraceutical, cosmeceutical, food, and beverage industries. Established in Irvine, California, in 2011, Nutraland USA is dedicated to offering innovative, science-based natural ingredients.

Nature's Answer Adopts Mullein

Commonly called mullein or great mullein, *V. thapsus* is one of many mulleins in the figwort family. It is typically a biennial and is native to Europe, northern Africa, and temperate Asia, but it has naturalized in the Americas and Australia. Mullein has been used medicinally since ancient times. The flowers and leaves are both mildly demulcent, expectorant, and astringent. In the 19th century, Eclectic physicians used mullein for inflammatory diseases of the respiratory and genitourinary tracts and preparations of the flower for earaches. Mullein is still used to treat dry coughs, colds, chills, congestion, and earaches. (See pages 6–16 in this issue for the Herb Profile on mullein.)

"Adopting mullein is important to Nature's Answer, as it plays a significant role in our product lineup, with Mullein Extract being particularly popular among our consumers," said Dean D'Amelio, Nature's Answer's chief marketing officer. "Mullein is an herb that many people have seen, but they may not know the full extent of its benefits. By supporting organizations like ABC, we aim to give back and help further educate the public about this remarkable herb."

"In today's world, while information is abundant, it can be challenging to find reliable sources," said Chris Martir, Nature's Answer's manager of commercial development and innovation. "By educating the public with research-based information about mullein's properties and uses, we aim to increase awareness of how this often-overlooked herb can support health. Additionally, through collaborations with organizations like ABC, we can reach a wider audience and promote the integration of natural products into daily wellness routines. We hope the adoption of mullein will enhance people's understanding of its medicinal benefits by providing access to comprehensive and accurate information."

About Nature's Answer

Since 1972, Nature's Answer, via its parent company Bio-Botanica, was one of the first herb companies in the United States to manufacture and market a wide array of herbal extracts. Company founder Frank D'Amelio Sr. (1940–2021), who was memorialized in *HerbalGram* issue 131 in 2021, was passionate about helping people and teaching them about herbs and natural options. Nature's Answer strives to continue his legacy by creating herbal extracts that empower people to take control of their health. Through this initiative, the company hopes to foster a greater appreciation for plants and encourage people to make informed choices about their well-being.

About Adopt-an-Herb and HerbMedPro

Nutraland USA and Nature's Answer are two of the 79 US and international companies and organizations that have supported ABC's educational efforts to collect, organize, and disseminate reliable traditional and science-based information, including clinical studies, on herbs, medicinal plants, and other botanical- and fungal-based ingredients through the ABC Adopt-an-Herb program. This program encourages companies, organizations, and individuals to "adopt" one or more specific herbs for inclusion and ongoing maintenance in the HerbMedPro database. To date, 92 herbs have been adopted.

Each adopted herb is researched continuously for new scientific articles in the areas of botanical, chemical, pharmacological, toxicological, and clinical studies, ensuring that its HerbMedPro record stays current and robust. Access to the studies is organized conveniently by publication type, with each study condensed to a one-sentence summary with a link to the study's official abstract on PubMed (the US National Library of Medicine's free-access database) or other publicly accessible databases.

HerbMedPro is available to ABC members at the Academic level and higher. Its "sister" site, HerbMed, is available to the public at no cost, with access to 25–30 herb records from the larger HerbMedPro database, along with all the adopted herbs. In keeping with ABC's position as an independent nonprofit research and education organization, herb adopters do not influence the scientific information that is compiled for their respective adopted herbs. HG

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Mullein *Verbascum thapsus*
Photo ©2025 Steven Foster

ADOPT-AN-HERB

HerbMedPro™ PROGRAM

The American Botanical Council's Adopt-an-Herb Program provides a mutually beneficial opportunity to support ABC's nonprofit educational efforts and promote a company's most important herbs.

One of the benefits of supporting the Adopt-an-Herb Program is that it ensures that the most current information on the adopted herb is available through ABC's powerful HerbMedPro™ database.

HerbMedPro provides online access to abstracts of scientific and clinical publications on more than 250 commonly used medicinal herbs. A free version, HerbMed®, is available to the general public and includes access to adopted herbs. HerbMedPro is available as a member benefit to all ABC members at the Academic Membership level and up.

In addition to ensuring that recently published information on an adopted herb is up to date on HerbMedPro, another benefit adopters enjoy is being included among their peers in each issue of ABC's acclaimed quarterly, peer-reviewed scientific journal, *HerbalGram*, on the ABC website, and at scientific, medical, and other educational conferences. Press releases also are issued on new adoptions, bringing attention to the program, the adopted herb, and the adopting company. Each adopted herb is featured on its own page on the ABC website.

Parties interested in taking part in the Adopt-an-Herb Program are invited to contact ABC Development Director Denise Meikel at 512-926-4900, extension 120, or by email at denise@herbalgram.org.

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Asian Ginseng
Panax ginseng

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Fig
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Turmeric
Curcuma longa

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Ganoderma lucidum

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Echinacea spp.

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Sambucus nigra

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Verbascum thapsus

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Valerian
Valeriana officinalis

NEW ADOPTER!
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Sambucus canadensis

Black Chokeberry
Aronia melanocarpa

Stinging Nettle
Urtica dioica

Holy Basil
Ocimum tenuiflorum

Andrographis
Andrographis paniculata

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Herbal Adopters

CONTAINS Zembrin	**Sceletium** *Sceletium tortuosum*
Symphony Natural Health	**Maca** *Lepidium meyenii*
Nature's Way	**Ginkgo** *Ginkgo biloba*
ECOSO DYNAMICS	**Devil's Claw** *Harpagophytum* spp.
RFI From Field to Formula	**Hibiscus** *Hibiscus sabdariffa*
JIAHERB essentials of nature	**Kava** *Piper methysticum*
	Rhodiola *Rhodiola rosea*
ANI America Natural Ingredients	**Nopal/Prickly Pear** *Opuntia ficus-indica*
layn Natural Ingredients	**Sophora Japonica** *Styphnolobium japonicum*
	Monk Fruit *Siraitia grosvenorii*
Natac Science to Market	**Olive** *Olea europaea*
	Grape *Vitis vinifera*
NAHA	**Lavender** *Lavandula angustifolia*
VERDURE SCIENCES®	**Pomegranate** *Punica granatum*
KSM-66®	**Ashwagandha** *Withania somnifera*

PLT Health Solutions Growth Through Innovation	**Indian Frankincense** *Boswellia serrata*
KP Authentic Botanical Extracts	**Senna** *Senna alexandrina*
FOUR ELEMENTS	**Lemon Balm** *Melissa officinalis*
Brassica Protection Products	**Broccoli** *Brassica oleracea* Broccoli Group
Aromatics International	**Peppermint** *Mentha x piperita*
The Actives Factory	**Birch** *Betula* spp.
indena®	**Bilberry** *Vaccinium myrtillus*
eurofins | Botanical Testing	**California Poppy** *Eschscholzia californica*
nexira Innovation Inspired by Nature	**Acacia Gum** *Acacia senegal* (syn. *Senegalia senegal*), *Acacia seyal* (syn. *Vachellia seyal*)
ARTEMIS INTERNATIONAL	**Tart Cherry** *Prunus cerasus*
	Black Currant *Ribes nigrum*
	Purple Corn *Zea mays*
Pharmatoka	**Cranberry** *Vaccinium macrocarpon*
valensa	**Saw Palmetto** *Serenoa repens*
NATUROPATHICA Holistic Health	**Arnica** *Arnica montana*
Gaia Trading Company, Inc.	**Hops** *Humulus lupulus*

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New BAPP Review Paper Reveals Challenges in Determining Adulteration Rates for Popular Botanical Ingredients

By ABC Staff

While reports of adulteration of specific botanicals are published regularly, reliable data about the extent of adulteration in botanical dietary supplements and herbal medicines are lacking. Therefore, the ABC-AHP-NCNPR Botanical Adulterants Prevention Program (BAPP) conducted a systematic review of information on the authenticity of several popular botanicals,[1] and preparations made from them, in US and international markets.

The herbal materials discussed in the report are black cohosh (*Actaea racemosa*, Ranunculaceae) rhizome, echinacea (*Echinacea angustifolia*, *E. pallida*, and *E. purpurea*, Asteraceae) herb and root, elder (*Sambucus nigra*, Viburnaceae) berry,* ginkgo (*Ginkgo biloba*, Ginkgoaceae) leaf, and turmeric (*Curcuma longa*, Zingiberaceae) rhizome.

Botanical Adulterants Prevention Program

* Elder berry, frequently written "elderberry," usually refers to the fruit of European elder, also known as black elder.

Echinacea *Echinacea purpurea*
Photo ©2025 Steven Foster

The BAPP article, titled "Estimating the extent of adulteration of the popular herbs black cohosh, echinacea, elder berry, ginkgo, and turmeric — Its challenges and limitations," was published in the highly regarded peer-reviewed journal *Natural Product Reports*. It was authored by Nilüfer Orhan, PhD, an expert in natural products pharmacology, chemistry, and analysis; Stefan Gafner, PhD, chief science officer of the American Botanical Council (ABC) and director of BAPP; and Mark Blumenthal, founder and executive director of ABC and founder of BAPP.

"Adulteration and fraud are unfortunate facts of commerce," said Blumenthal. "The question is, to what extent do they affect the current market for herbal dietary supplements and related natural plant- and fungus-based ingredients?

"Our paper demonstrates that estimating the extent of adulteration using published data is a challenging and imperfect process, and the results cannot be deemed definitive," he added.

The paper points to the many challenges and limitations in determining the number of adulterated products in a specific market. For example, results from comprehensive testing and analyses of products may not be available, definitions of adulteration may vary from author to author, and laboratory analytical methods used to detect adulteration may not be fit for purpose. Due to the lack of information in many of the reviewed publications, an independent assessment of their accuracy is not possible.

"The numbers obtained for the extent of adulteration of the five botanicals investigated for this systematic review may not be representative for the overall adulteration rate in the global herbal dietary and food supplement industry," said Gafner. "But it is clear that adulteration of botanical ingredients is a problem and impacts a substantial portion of products sold as dietary or food supplements."

The BAPP review included a total of 77 publications and 2,995 samples across the five botanicals. Ginkgo leaf extract samples (n = 533) had the highest estimated adulteration rate of 56.7%, followed by powdered plant materials or extracts of black cohosh root/rhizome (n = 320) with 42.2%, echinacea root/herb (n = 200) with 28.5%, elder berry (n = 695) with 17.1%, and turmeric rhizome (n = 1,247) with 16.5%.

Notably, products sold as licensed or registered herbal medicines, as is the case in many European countries, were all found to be authentic (i.e., not adulterated), contrary to products sold as dietary or food supplements.

Gafner and Blumenthal emphasized that many responsible companies sell authentic and properly produced and labeled botanical ingredients and herbal products, and many of these companies support BAPP's efforts to provide peer-reviewed scientific research to help educate members of the global industry.

Nine botanical experts — including two industry consultants and seven experts from the botanical industry, educational nonprofits, and supplement trade organizations — reviewed the paper before it was submitted to *Natural Product Reports*. It then underwent the journal's formal peer-review process.

The paper comes after BAPP's almost 13 years of research, writing, and editing of extensively peer-reviewed publications on various popular botanical ingredients in US and international markets. BAPP has published data on the adulteration of roughly 30 botanicals thus far. While some adulteration may be accidental, evidence confirms that most cases are intentional — also known as economically motivated adulteration (EMA).

EMA is usually defined as the fraudulent addition of non-authentic substances or the removal or replacement of authentic substances without the purchaser's knowledge for the economic gain of the seller. EMA is not a new problem, as evidenced in BAPP's first publication (in *HerbalGram* issue 92 in 2011), which documents the history of adulteration of herbs, spices, and botanical drugs dating back to Greco-Roman times.[2]

The *Natural Product Reports* article is BAPP's 90th peer-reviewed publication. All BAPP publications are freely accessible on BAPP's homepage on the ABC website (registration required).

About the ABC-AHP-NCNPR Botanical Adulterants Prevention Program

The ABC-American Herbal Pharmacopoeia (AHP)-National Center for Natural Products Research at the University of Mississippi (NCNPR) BAPP is an international consortium of nonprofit professional organizations, analytical laboratories, research centers, industry trade associations, industry members, and other parties with interest in herbs and medicinal plants. BAPP advises industry, researchers, health professionals, government agencies, the media, and the public about the various challenges related to authentication of botanical ingredients and how to avoid purchasing adulterated and fraudulent botanical ingredients in international commerce. To date, BAPP has published more than 90 peer-reviewed documents. More than 200 US and international parties have financially supported or otherwise endorsed BAPP. HG

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BAPP Publishes Bulletin on Cordyceps Adulteration

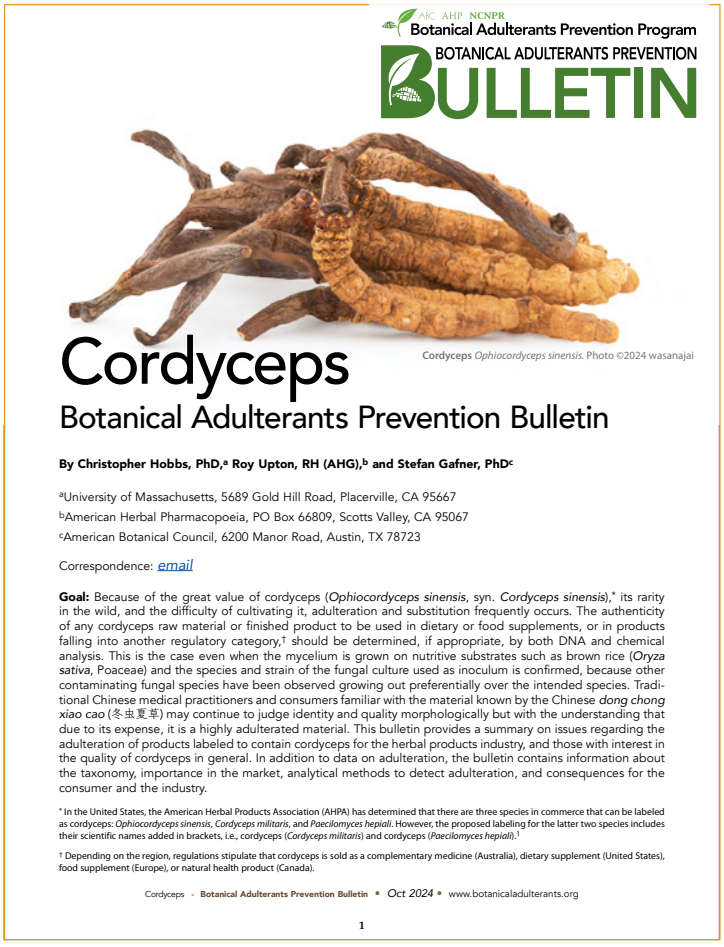
By ABC Staff

In October 2024, the ABC-AHP-NCNPR Botanical Adulterants Prevention Program (BAPP) published a Botanical Adulterants Prevention Bulletin (BAPB) on cordyceps (*Ophiocordyceps sinensis*, Ophiocordycipitaceae), also known as caterpillar fungus. The bulletin details the many ways in which the fruiting body and mycelium of this fungus are mislabeled and/or adulterated.[1] It is the first BAPP document that focuses on a fungal ingredient.

Cordyceps is considered to be one of the most valued ingredients in traditional Chinese medicine (TCM). Harvested from the wild, this parasitic fungus has a club-shaped, spore-releasing fruiting body that emerges from the larva of a ghost moth (*Hepialus* spp.). That is, spores of cordyceps infect the larva, and the fungus then develops via the mycelium that grows inside the larva. This process culminates in the emergence of the fruiting body from the larva's body (typically from the head).

The name "cordyceps" can refer to several different fungal species, but *Ophiocordyceps sinensis* is the primary species that grows in the wild. However, due to the high price of wild cordyceps (up to $50,000/kg), the cordyceps dietary and food supplement market is understandably dominated by lower-cost alternatives, such as commercially raised *Cordyceps militaris* (Cordycipitaceae) or *Paecilomyces hepiali* (Thermoascaceae; reclassified as *Samsoniella hepiali*, Cordycipitaceae, in 2020). According to the third edition of the *American Herbal Products Association's Herbs of Commerce*, both *C. militaris* and *P. hepiali* can be marketed in the United States using the common name "cordyceps."

Cordyceps dietary supplements are marketed to support kidney, immune, and cardiovascular health, enhance athletic performance, and increase endurance. As with many other fungal ingredients, US sales of cordyceps have increased in recent years. Cordyceps supplements are primarily sold in the natural retail channel, where cordyceps was the 26th top-selling "herbal" supplement ingredient in 2023 with $5,225,915 in sales, according to *HerbalGram*'s 2023 Herb Market Report.[2]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BOTANICAL ADULTERANTS PREVENTION
BULLETIN

Cordyceps *Ophiocordyceps sinensis*. Photo ©2024 wasanajai

Cordyceps

Botanical Adulterants Prevention Bulletin

By Christopher Hobbs, PhD,[a] Roy Upton, RH (AHG),[b] and Stefan Gafner, PhD[c]

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Goal: Because of the great value of cordyceps (*Ophiocordyceps sinensis*, syn. *Cordyceps sinensis*),* its rarity in the wild, and the difficulty of cultivating it, adulteration and substitution frequently occurs. The authenticity of any cordyceps raw material or finished product to be used in dietary or food supplements, or in products falling into another regulatory category,† should be determined, if appropriate, by both DNA and chemical analysis. This is the case even when the mycelium is grown on nutritive substrates such as brown rice (*Oryza sativa*, Poaceae) and the species and strain of the fungal culture used as inoculum is confirmed, because other contaminating fungal species have been observed growing out preferentially over the intended species. Traditional Chinese medical practitioners and consumers familiar with the material known by the Chinese *dong chong xiao cao* (冬虫夏草) may continue to judge identity and quality morphologically but with the understanding that due to its expense, it is a highly adulterated material. This bulletin provides a summary on issues regarding the adulteration of products labeled to contain cordyceps for the herbal products industry, and those with interest in the quality of cordyceps in general. In addition to data on adulteration, the bulletin contains information about the taxonomy, importance in the market, analytical methods to detect adulteration, and consequences for the consumer and the industry.

* In the United States, the American Herbal Products Association (AHPA) has determined that there are three species in commerce that can be labeled as cordyceps: *Ophiocordyceps sinensis*, *Cordyceps militaris*, and *Paecilomyces hepiali*. However, the proposed labeling for the latter two species includes their scientific names added in brackets, i.e., cordyceps (*Cordyceps militaris*) and cordyceps (*Paecilomyces hepiali*).[1]

† Depending on the region, regulations stipulate that cordyceps is sold as a complementary medicine (Australia), dietary supplement (United States), food supplement (Europe), or natural health product (Canada).

Cordyceps - Botanical Adulterants Prevention Bulletin • Oct 2024 • www.botanicaladulterants.org

1

Cordyceps was the 26th top-selling "herbal" supplement ingredient in 2023 with $5,225,915 in sales, according to *HerbalGram*'s 2023 Herb Market Report.[2]

Cordyceps adulteration comes in many forms. In Asian countries where wild cordyceps is sold at high prices, sellers have been reported to add pieces of sticks or wires or soak the fungus in concentrated mineral solutions to increase the weight. In some instances, cordyceps look-alikes are made from flour and dyes, which are modeled into a caterpillar shape with sticks glued onto the fraudulent material to imitate the cordyceps fruiting body. In Europe and North America, economically motivated adulterants in cordyceps dietary supplements include different fungal species (e.g., *Tolypocladium inflatum*, Ophiocordycipitaceae), grain-based media that contain little or no cordyceps mycelium, and undeclared excipients or fillers. Only recently, artificial commercial cultivation yielding a product similar to wild cordyceps has been developed.

The BAPP cordyceps bulletin was authored by Christopher Hobbs, PhD, a renowned herbalist, botanist, mycologist, and author; Roy Upton, RH (AHG), president and executive director of the nonprofit American Herbal Pharmacopoeia (AHP); and Stefan Gafner, PhD, chief science officer of the nonprofit American Botanical Council (ABC). It was peer-reviewed by 21 experts from academia, contract analytical laboratories, and the botan-

ical ingredient industries in the United States and internationally. The bulletin includes a review of the literature on cordyceps adulteration, nomenclature and taxonomy, supply chain/network and market importance, and analytical approaches to detect adulterants.

"This [was] a challenging bulletin to write, especially figuring out what is currently offered as 'cordyceps' in various regions around the globe," said Gafner. "For me, the main takeaway for the dietary supplement industry is that better methods to authenticate the various products marketed as cordyceps are needed."

Hobbs, the primary author of the bulletin, is also the author of an award-winning illustrated book on mushrooms,[3] which received the ABC James A. Duke Excellence in Botanical Literature award in 2021. "This was a complex and challenging process from start to finish," he wrote. "Research on the related genera *Cordyceps*, *Ophiocordyceps*, *Samsoniella*, and others, as well as the nature of the traditional Tibetan medicine *yartsa gunbu* (the Tibetan name for the medicine, also known as *dōng chóng xià cǎo*) were and are still undergoing rapid change.

"New research, particularly our ability to identify and characterize DNA sequences from a complex soil microbiome and delineate the genera and species growing on the surface of wild cordyceps, has allowed analytical labs to accurately identify the genera and species in commercial products," Hobbs continued. "This has led the way to the understanding that the most popular commercial 'cordyceps' products sold in China, other Asian countries, the United States, and Europe come from a variety of species with differing chemistries, pharmacological properties, and potential benefits.

"I hope that our publication will help consumers, manufacturers, practitioners, and researchers understand the origins and biology of these fascinating traditional medicines," Hobbs added. He also noted that researchers may find it useful to take this information into consideration when designing and conducting future studies to assess cordyceps' potential efficacy and range of health benefits.

The cordyceps bulletin is the 29th publication in the series of BAPBs. All BAPP publications are freely accessible on BAPP's homepage on the ABC website (registration required). HG

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Cordyceps *Ophiocordyceps sinensis*
Photo ©2025 Steven Foster

Implementation of BAPP Standard Operating Procedure Can Reduce Costs of Good Manufacturing Practices

Industry experts at SupplySide West session confirm BAPP SOP's value proposition and return on investment

By ABC Staff

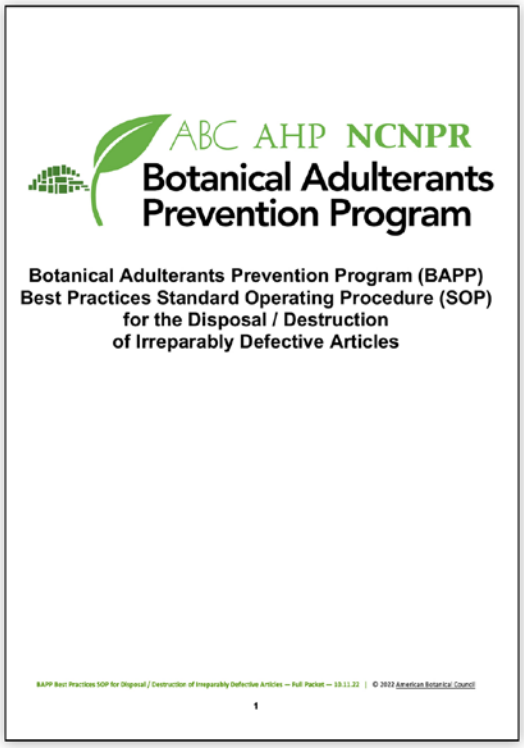
During a presentation at the SupplySide West trade show in Las Vegas, Nevada, in October 2024, representatives from two leading supplement companies discussed ingredient adulteration and their experiences implementing the ABC-AHP-NCNPR Botanical Adulterants Prevention Program's (BAPP's) "Best Practices Standard Operating Procedure (SOP) for the Disposal/Destruction of Irreparably Defective Articles"[1] and reiterated the SOP's value proposition.

The BAPP SOP connects regulatory law with contract law to provide a simple and effective strategy that can be incorporated directly into supply chain agreements. It protects all participating parties and provides a measurable return on investment (ROI) for buyers and sellers.

Taneesha Routier-Rogers, director of regulatory affairs for professional-channel dietary supplement brand Xymogen, and Tom Dubinski, vice president of quality systems for contract manufacturer Arizona Nutritional Supplements (ANS), spoke during the SupplySide Stage presentation, titled "Adulteration in the Food, Supplement, Cosmetic and OTC Drug Supply Chain: Issues, Concerns and an ROI-based Solution."

They were joined by Stefan Gafner, PhD, chief science officer of the American Botanical Council (ABC) and director of BAPP, and Michael D. Levin, founder of consultancy Health Business Strategies LLC and principal author of the BAPP SOP.

Jon Benninger, vice president and market leader of SupplySide, moderated the session. In summer 2024, Informa Markets, the producer of the two annual SupplySide conferences and tradeshows in the United States, suggested that "every company buying or selling ingredients should endorse and implement" the BAPP SOP as a voluntary standard.[2] Informa also added BAPP to its SupplySide Compliance Program, which "provides tools to gain a greater understanding of some of the most common compliance issues within the industry and help support self-regulatory efforts."[3] The 30-minute video of the complete panel discussion is available on YouTube.[4]



Explaining why Xymogen adopted the BAPP SOP, Routier-Rogers said: "We found adulteration [in the marketplace]. Being part of [BAPP] and … the SOP was just a natural progression. It was the next step."

"The SOP aligned with our values," she added. "It aligned with the fact that we want to put out a quality product that not only is good and effective but also does not harm. We want to be part of a community with other suppliers and manufacturers that are doing the same."

When discussing a large unnamed botanical ingredients supplier with a history of inconsistent ingredient quality, Dubinski noted that ANS and the supplier modified existing purchase agreements to include the SOP language. Now, that supplier is one of ANS' "more reputable" and "more trustworthy" suppliers, he said.

For ANS, Dubinski added, "hundreds of thousands of dollars" are being saved in "lab testing, the amount of time to test, getting new samples in, purchasing teams, having

to source new materials, whatever it may be. [The BAPP SOP] made a huge impact."

"The SOP has certainly saved us a lot of time and helped us financially because it provides a clear roadmap for what to do and when," Routier-Rogers said. "While on the front end you have to do a bit of work so that you can make sure that you and your suppliers align and understand that you're on the same page, in the end, it saves so much time and so much effort."

Levin, who also discussed SOP implementation details, noted that purchase order specifications are the heart and soul of the program.

"It is up to the trading partners, the buyers and sellers, to say, 'These are the specs. Your representation to me is that [the ingredient will meet all specs and] is not going to be adulterated. It's going to be fit for use,'" he said. "This is a solution whereby we, all working together, can pull these 'irreparably defective articles' out of the supply chain."

Noting that expert attorney fees for managing a regulatory action can start at tens of thousands of dollars, Levin said: "The SOP is going to reduce [the potential for] adverse effects. It's going to reduce product recalls. Putting this into place is basically reinforcing the rules and helping you do a better job for your customers, protecting your brand, and just doing the right thing."

The BAPP SOP is the subject of a September 2024 article (the first in a series of three) in *SupplySide Supplement Journal*.[5] The article outlines the basic intent of the SOP and how members of the dietary supplement industry and others are employing it.

More information about how to implement the BAPP SOP and endorse and financially support BAPP is available on ABC's website.[6] HG

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35 Years of the European Scientific Cooperative on Phytotherapy: Successful European Integration for Herbal Medicine

Umbrella association of national phytotherapy societies has been working for 35 years to lead the way in harmonizing standards for herbal medicines across Europe

By Liselotte Krenn, PhD,[a,b] Bernat Vanaclocha, MD,[a,c] Evelyn Wolfram, PhD,[a,d] and Simon Mills[a] on behalf of ESCOP

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[b] Division of Pharmacognosy, University of Vienna (Vienna, Austria)
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[d] Natural Products and Phytopharmacy Research Group, Zürich University of Applied Sciences (Switzerland)

The European Scientific Cooperative on Phytotherapy (ESCOP), an international scientific association that represents herbal medicine and phytotherapy societies in Europe, celebrated its 35th anniversary in June 2024. The organization's mission is to "advance the scientific status of herbal medicinal products and to assist with the harmonisation of their regulatory status at the European level."[1]

The success and widespread use of synthetic drugs in the first half of the 20th century led to a significant loss of traditional knowledge and an almost complete lack of regulatory frameworks for medicines of herbal origin. However, in the late 1970s, the "Green movement" in Europe fueled a significant increase in public interest in herbal products as well as calls for a harmonized legal framework. These developments led a small group of visionaries from Germany, the Netherlands, Belgium, France, Switzerland, and the United Kingdom to establish a European umbrella organization of societies in the field of phytotherapy and herbal medicine.

ESCOP was founded in Cologne, Germany, on June 18, 1989. Shortly thereafter, the organization appointed a scientific committee to support its aims and started to develop and publish reference monographs on the therapeutic use of herbal medicines. The first five monographs were published in October 1990 as a scientific consensus across different European countries and in the standard medicine dossier ("SPC") format.* The monographs on anthraquinone- and hydroxyanthracene-containing herbal drugs (e.g., frangula bark [*Frangula alnus*, Rhamnaceae] and senna leaf [*Cassia senna* and *C. angustifolia*, Fabaceae]) subsequently provided the basis for respective official documents of the Committee for Proprietary Medicinal Products (CPMP, now the Committee for Medicinal Products for Human Use) of the European Medicines Agency.

Table 1. Current Members of ESCOP†

Austria	Österreichische Gesellschaft für Phytotherapie (ÖGPhyt) (Austrian Society for Phytotherapy)
Germany	Gesellschaft für Phytotherapie eV (GPT) (Society for Phytotherapy)
Hungary	Hungarian Society of Pharmaceutical Sciences – Medicinal Plant Section
Italy	Società Italiana di Fitochimica e delle Scienze delle Piante Medicinali, Alimentari e da Profumo (SIF) (Italian Society of Phytochemistry and Sciences of Medicinal, Food and Perfume Plants)
Netherlands	Nederlandse Vereniging voor Fytotherapie (NVF) (Dutch Association for Phytotherapy)
Poland	Polish Herbal Committee
Portugal	Sociedade Portuguesa de Fitoquímica e Fitoterapia (SPFito) (Portuguese Society of Phytochemistry and Phytotherapy)
Spain	Sociedad Española de Fitoterapia (SEFIT) (Spanish Society of Phytotherapy)
Switzerland	Schweizerische Medizinische Gesellschaft für Phytotherapie (SMGP) (Swiss Medical Society for Phytotherapy)
Türkiye	Farmakognozi ve Fitoterapi Derneği (Pharmacognosy and Phytotherapy Association)
United Kingdom	British Herbal Medicine Association (BHMA)

† As of June 2024

* The summary of product characteristics ("SPC") describes the properties and conditions of use of a medicine and contains information for health care professionals for the safe and effective use of a medicine.

In the 1990s, the number of member societies in ESCOP increased, as did the number of scientific committee members (Table 1). Monograph elaboration was accelerated by the division of the scientific committee into two working subcommittees (B and E).

In its most significant early achievement, ESCOP successfully secured a major grant from the European Union (EU) BIOMED research program for a project that ran from 1994 to 1996 called "Determining European standards for the safe and effective use of phytomedicines." ESCOP coordinated this program, which involved 21 research partners. The project established safety assessments and other regulatory initiatives and, most significantly, provided enhanced support for European monograph production, with 60 monographs published in six consecutive volumes as loose leaflet binders from 1996 until 1999. ESCOP monographs include therapeutic information as well as a short overview of constituents and the quality criteria in the cited pharmacopoeia.

ESCOP also organized five major international symposia: in Brussels, Belgium (1990), Milan, Italy (1992), The Hague, The Netherlands (1994), Cologne (1996), and London, UK (1998) to promote acceptance, initiate research, and accumulate international scientific and practical knowledge in phytotherapy. Two further symposia followed: in Bonn, Germany, in 2001 and Cologne in 2009 to commemorate the 20th anniversary of ESCOP.

ESCOP's tireless lobbying for scientific phytotherapy under the earlier long-term presidency (1989–2010) of Professor Fritz H. Kemper, MD (1927–2017), including in his role as chief scientific advisor to the president of the European Commission, was indispensable in the improved legal framework for herbal medicinal products in the EU as outlined in the Directives 2001/83/EC and especially 2004/24/EC of the European Parliament and of the Council.[2-3] These efforts resulted in the establishment of a Committee for Herbal Medicinal Products (HMPC) and a simplified registration procedure for traditionally used herbal medicinal products (THMPs).

The almost exponential growth in the literature on medicinal plant research led ESCOP to update its monographs on a regular basis. In 2003, the second, completely revised and expanded edition of 80 ESCOP monographs (*The ESCOP Monographs – The Scientific Foundation for Herbal Medicinal Products*) was published in book format. At that time, ESCOP was the only editor of monographs in the field of phytotherapy that provided such updates. More than 50 delegates in the scientific committee and more than 30 external experts continued their work on the monographs. These were reviewed by a board of supervising editors and finally edited in detail (notably, in former times, by another ESCOP pioneer, Peter Bradley [1937–2021], long-term chair of Subcommittee B).

ESCOP is grateful to those who have contributed their extensive and completely voluntary work to guarantee the high scientific standard of the ESCOP monographs. Based on input received, ESCOP released the supplement to the second edition of ESCOP monographs (*The ESCOP Monographs – The Scientific Foundation for Herbal Medicinal Products; Supplement to the Second Edition*) with 27 new and eight revised monographs in 2009, the 20th anniversary of the organization.

E/S/C/O/P
European Scientific Cooperative on Phytotherapy

In the 2010s, new challenges for ESCOP needed to be addressed. Among these were the rapidly increasing knowledge in the field of phytotherapy and changes in the legal and economic environment for herbal products, as well as significant transformations in publishing. In 2011, ESCOP moved to online publication of new monographs and their revisions as single documents in PDF format. These are available on the ESCOP website (www.escop.com) for purchase and immediate download of the documents in the well-established SPC format.

Since the first online monograph "Cimicifugae rhizoma – Black Cohosh" (*Actaea racemosa*, Ranunculaceae) was released in 2011, more than 80 monographs, either new or revised, have been published online. The most recent are revisions of "Ginseng radix – Ginseng" (*Panax* spp., Araliaceae) and "Passiflorae herba – Passionflower herb" (*Passiflora incarnata*, Passifloraceae) and new monographs on "Epilobii herba – Willow herb" (*Salix* spp., Salicaceae) "Juglandis folium – Walnut leaf" (*Juglans* spp., Juglandaceae) and "Taraxaci radix – Dandelion root" (*Taraxacum officinale*, Asteraceae). The monographs can be downloaded as single copies or in bundles with special offers, and all are also available for read-only via an annual subscription model. ESCOP offers free reading access for member societies and their individual members, as well as discounts on downloads.

The main objectives of the ESCOP monographs are to offer health professionals information that facilitates the prescribing and dispensing of herbal products and to provide educational material for teachers of phytotherapy.

Another online tool is ESCOP's table of Herb-Drug Interactions.[4] Knowledge of such interactions is critical for health care professionals, including medical herbalists, and numerous publications are available on the topic. However, results are sometimes contradictory and often based on preclinical research or extrapolated from theoretical mechanisms only. This online table is based on ESCOP monographs and provides a balanced evaluation of herb-drug interactions, with relevant information about severity and frequency. It is frequently updated and is freely available as a PDF document or searchable list.

In recent years, the representation of phytotherapy in scientific symposia also has changed. To support national and international initiatives with special emphasis on

general medical practice, ESCOP supported the organization of several joint congresses of member associations in Austria, Germany, Switzerland, and the Netherlands. These include congresses on the occasion of the 20th anniversary of the Austrian Society of Phytotherapy (ÖGPhyt) in Vienna ("Phytotherapeutika 2012 – Wissensfortschritte im 21. Jahrhundert"); the 25th anniversary of the Swiss Medical Society for Phytotherapy (SMGP) in Winterthur, Switzerland ("Phytotherapie 2014"); the Phytotherapiekongress 2016 in Bonn; the Phytotherapiekongress 2018 in Vienna; and the Phytotherapiekongress 2022 in Zurich, Switzerland, the latter for the first time in hybrid format (i.e., with online presentations).

The most recent events with ESCOP's participation were the Tetranational Congress on Phytotherapy in Utrecht, the Netherlands, in May 2024, and the workshop "Real-world data to document phytopharmaceuticals in children" during the International Congress on Natural Products Research in Krakow, Poland, in July 2024. ESCOP also collaborated with the Latin American umbrella organization on phytotherapy, the Consejo Iberoamericano de Fitoterapia – Conselho Íbero-americano de Fitoterapia (CIAF), during the first and third Ibero-American Congress of Phytotherapy in Mexico (2006) and Brazil (2012).

Another important part of the knowledge, acceptance, and responsible use of herbal preparations and phytotherapy is the education of health care professionals.[5] Unfortunately, the once-standard teaching of phytotherapy in medical curricula across Europe has decreased or is now completely omitted. To get an initial overview of future physicians' knowledge of the field and to explore requirements for education within and outside current medical curricula, ESCOP cooperated in a survey of European medical students in three regions (Germany; Italy and Spain; Czechia, Hungary, and Slovakia). This first investigation of student attitudes toward and knowledge of phytotherapy in different countries showed that national or international associations might offer relevant education in this field.[6] This outcome suggests an important continued educational role for ESCOP.

Today, the border between herbal medicinal products (HMPs) and food supplements increasingly overlaps, and ESCOP continues to be a science-based advocate for HMPs of proven quality, efficacy, and safety. Regarding consumer protection, ESCOP intends to continue compiling relevant scientific knowledge and to provide it in accessible form. ESCOP also continues initiatives to increase the popularity of phytotherapy and HMPs with younger generations.

With 35 years of experience, ESCOP is well prepared to navigate a future abundant with opportunities and challenges for evidence-based HMPs. ESCOP is also well-positioned to contribute informed scientific expertise, as an increasingly important antidote to the rise of AI-driven knowledge processing. Collaborating with the American Botanical Council (ABC) and other international nonprofit organizations strengthens the shared mission to advance science-based phytomedicine. HG

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JAMA Network Open Paper Exaggerates Liver Injury Risk of Six Herbal Dietary Supplements

Report overlooks evidence of generally safe herb use

By ABC Staff

On August 5, 2024, the peer-reviewed journal *JAMA Network Open* published an article that estimated the percentages of US adults who have used six "potentially hepatotoxic" botanical dietary supplements.[1] The supplements, which have been linked to case reports of hepatotoxicity, include ashwagandha (*Withania somnifera*, Solanaceae), black cohosh (*Actaea racemosa*, Ranunculaceae), garcinia (*Garcinia cambogia* syn. *Garcinia gummi-gutta*, Clusiaceae), green tea (*Camellia sinensis*, Theaceae), red yeast rice (*Oryza sativa*, Poaceae), and turmeric (*Curcuma longa*, Zingiberaceae)/curcumin. Much of the dietary supplement usage information in the paper is based on US government-sponsored National Health and Nutrition Examination Survey (NHANES) data from 2017 to 2020.

Shortly after its publication, the paper was covered by various media outlets that used misleading and even alarmist headlines such as: "Botanicals like turmeric, green tea are harming Americans' livers,"[2] "More than 15 million US adults consume botanicals with liver harming potential: Study,"[3] and "Study estimates millions in US risk liver damage from herbal remedies."[4]

Concern over the safety of botanical ingredients is certainly an important topic. Therefore, the journal article authors' attempt to raise awareness of the liver-toxic potential of botanicals is reasonable. However, the American Botanical Council (ABC) takes issue with several aspects of the study.

Most importantly, ABC emphasizes the fact that the number of case reports for each of the six botanicals is very small compared to the estimated number of people using these supplements. For example, according to a 2023 review[5] cited in the *JAMA Network Open* paper, there were 23 global case reports of liver injury associated with ashwagandha from

Ashwagandha *Withania somnifera*
Photo ©2025 Steven Foster

Black cohosh *Actaea racemosa*.
Photo ©2025 Steven Foster

January 2019 to December 2022. Eight of the reports were from people in the United States, which had an estimated 1.25 million users of ashwagandha in 2020, according to data in the *JAMA Network Open* paper.[1] Additionally, the case reports include not only dietary supplements but also — in the case of ashwagandha — herbal jams, syrups, and powders of unclear composition from unbranded producers selling at local markets in India.[5]

The article also mentions that the percentage of liver injury associated with herbal dietary supplements (HDSs) relative to liver injury caused by all medications (except the over-the-counter (OTC) drug acetaminophen*) increased from 7% in 2004/2005 to 20% in 2013, according to data from the Drug-Induced Liver Injury Network (DILIN). However, the authors do not report that the overall number of HDS-induced liver injury cases during that 10-year period was only 136, including 45 cases linked to bodybuilding products, many of which were found to contain illegal anabolic steroids masquerading as HDSs.[6]

"It is disappointing that the authors provided only the percentage of DILIN-enrolled patients that experienced liver damage due to [HDSs] as compared to all other medications," wrote Richard Kingston, PharmD. Kingston is president of regulatory and scientific affairs and co-founder of SafetyCall International (a leading consumer reporting service on adverse events for dietary supplements, OTC drugs, and household products) and clinical professor in the Department of Experimental and Clinical Pharmacology at the University of Minnesota's College of Pharmacy.

"Although the percentage of cases looks ominous, … consider that the actual total number of patients who experienced liver damage from [HDSs] was 136 over the 10-year period, amounting to about 14 patients per year," Kingston added. "If the 45 bodybuilding products are excluded, that would leave about nine patients per year with potential liver damage secondary to mainstream [HDSs]."

Besides the exaggerated data on hepatotoxicity risk, the article contains several inaccuracies. The authors misstate the number of HDS users. In the abstract, they write that "The overall prevalence of HDS product use was 57.6%," while they later explain that "in total, 731 of 9685 US adults assessed (7.5%) used a botanical-containing HDS product within the [past] 30 days." The 57.6%, in fact, refers to all users of dietary supplements, including non-herbal vitamins, minerals, and fatty acids.[7]

Another important point is the reported number of people in the United States who are exposed to the six botanicals (15 million). This estimate is based on the authors' erroneous use of the number 329,484,123 for US residents aged 18 and older. According to the 2020 Census, this is the total number

* Acetaminophen is an OTC analgesic and antipyretic drug and the most common cause of drug-induced hepatotoxicity. However, it often is excluded from statistical analyses related to dietary supplements and OTC and prescription drugs with hepatotoxic potential.

Garcinia
Garcinia gummi-gutta
Photo ©2025 Steven Foster

of US residents, while the population of residents aged 18 and older is 256,662,010.[8] Hence, the estimate of 15 million is based on misrepresented data and thus should be corrected and re-published. However, this error does not eliminate the fact that HDS use is common in the United States, and hepatotoxic side effects, although rare, can happen in people with sensitivities to certain botanicals and/or other conditions.

Extrapolating the dietary supplement use data for the six botanicals, the authors write that "An estimated 15,584,599 … US adults used at least 1 of the 6 botanical products within the past 30 days, which was similar to the estimated number of patients prescribed potentially hepatotoxic drugs, including simvastatin (14,036,024 …) and nonsteroidal anti-inflammatory drugs (14,793,837 …)."[1] However, the authors did not provide a comparison of the relative hepatotoxicity risk of the botanical ingredients and the prescription or OTC drugs. Without the relative risk, it is difficult to determine the potential harm these ingredients may cause.

Stefan Gafner, PhD, ABC's chief science officer, said: "In my opinion, the main issue is that the paper implies that 15 million US adults are exposed to potentially hepatotoxic botanicals. This sounds like a huge problem, even if the actual risk of liver injury from the six botanicals in question is low. The authors provide some information to support the hepatotoxic potential of botanicals, but these data are provided without proper context and suggest that the risk of liver injury is much greater than it actually is."

The authors also incorrectly contend that the dietary supplement industry is largely "unregulated." Unfortunately, this notion of an unregulated industry is often repeated in medical journals and mainstream media. Dietary supplement products are subject to various federal regulations, including the requirement to be made according to current good manufacturing practices (cGMPs) and to be tested for identity, purity, strength, composition, and absence of contaminants by appropriate analytical methods.[9] The US Food and Drug Administration (FDA) carries out hundreds of inspections of manufacturers each year in an attempt to ensure that regulations are followed, although the agency is inadequately resourced to inspect all facilities as often as might be optimal.

Liver toxicity is a serious health issue, and causative agents should be identified promptly and monitored closely. However, the actual number of liver injury case reports for botanicals is very low.[10] Therefore, suggesting that 15 million US adults may be at risk of liver injury is an exaggeration that may grab media attention but contributes little to a rational discussion of the hepatotoxic potential of botanical ingredients. HG

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Tea *Camellia sinensis*
Photo ©2025 Steven Foster

Topical Milk Thistle Product for Acne Is Effective and Well Tolerated in Adolescents and Young Adults

Reviewed: Bageorgou F, Li L, Beausillon C, Stennevin A, Ortiz-Brugués A, Saurat JH. Tolerability and effectiveness of a dermocosmetic product containing *Silybum marianum* fruit extract in adolescents and young adults with acne-prone skin: An international, phase IV, longitudinal study. *J Cosmet Dermatol*. August 2023;22(8):2259-2267. doi: 10.1111/jocd.15705

By Gavin Van De Walle, MS, RD

Acne is characterized by skin lesions that can be non-inflammatory (e.g., comedones) or inflammatory (e.g., papules, pustules, and nodules). Topical and systemic therapies that contain antibiotics and retinoids are common first-line treatments to alleviate acne. More recently, milk thistle (*Silybum marianum*, Asteraceae) fruit extract has been identified as having potential anti-comedogenic properties, and, when used alone or in combination with anti-acne therapies, has been found to be effective and well-tolerated. This observational, multicenter study evaluated the tolerability and effectiveness of a product containing milk thistle fruit extract for treating acne, maintaining acne-free skin, and as an associated therapy in adolescents and young adults.

This study was conducted from May 2019 to February 2022 in 21 regions around the world. Dermatologists, invited by the study sponsor, recruited people who were 12 to 25 years old and had mild to moderate acne. Participants were divided into three subpopulations: those who were prescribed the study product alone (initial therapy group), those who were prescribed the study product after completing an anti-acne therapy (maintenance therapy group), and those who were prescribed the study product with ongoing topical or systemic anti-acne treatment (associated therapy group).

The study product was a commercially available skincare cream (Cleanance Comedomed™; Pierre Fabre; Lavaur, France), which was to be applied twice daily (morning and evening) on the face for 8–12 weeks. The cream contained 25% milk thistle fruit extract as the active ingredient, along with isopropyl alcohol, polyethylene glycol-6, silica, polyacrylate-13, polyisobutene, polysorbate 20, sorbitan isostearate, water, and glycerin.

Study Details: At a Glance	
Study Design	Observational, phase IV, longitudinal, multicenter study
Duration	8–12 weeks
Participants	Adolescents and young adults (12–25 years old) with mild to moderate acne
Intervention	Cleanance Comedomed™ (Pierre Fabre; Lavaur, France), a topical cream that contains milk thistle fruit extract
Controls	Maintenance therapy (study product with initial anti-acne treatment) and associated therapy (study product with ongoing anti-acne treatment)
Disclosures	The study was funded by Pierre Fabre. The authors reported no conflicts of interest.

Milk thistle *Silybum marianum*
Photo ©2025 Steven Foster

The dermatologists prescribed the study product "according to usual clinical practice" as an initial, associated, or maintenance therapy. It could be prescribed along with a cleanser or combined with a physical treatment modality (e.g., peeling, light, or laser therapy). When prescribed as an associated therapy, participants were instructed to apply the study product first, followed by the conventional treatment 15 minutes later. At the follow-up visit 8–12 weeks after the beginning of the study, the dermatologists evaluated the tolerability and effectiveness of the study product. As part of the follow-up, participants were asked to evaluate the change in their quality of life (QoL) and the perceived cosmetic properties (texture, fragrance, mattifying effect, moisturizing effect, and absorption time) of the product.

A total of 4,230 participants were included in the study. The mean age was 18.5 years, and 64% were females. The mean age of acne onset was 14.2 years. About half of the participants had both non-inflammatory and inflammatory lesions, while the remaining individuals had either non-inflammatory (36%) or inflammatory (13%) lesions. The study product was prescribed as an initial therapy to 47% of participants (n = 1,981), a maintenance therapy to 5% (n = 205), and an associated therapy to 48% (n = 2,044).

The dermatologists evaluated the overall tolerability of the study product as "good" to "very good" for most participants (95% confidence interval [CI]: 94%–95%). The tolerability correlated with initial scores on the global evaluation of acne (GEA) scale, with participants who had less severe acne reporting better tolerability. Tolerability was also associated with the type of therapy, with a higher proportion of people in the maintenance group demonstrating a greater level of tolerability compared with the initial or associated therapy groups.

A higher percentage of the 165 adverse events (AEs) was reported when the study product was used as an initial therapy (n = 84 participants) or associated therapy (n = 77) compared to when it was used as a maintenance therapy (n = 4). However, the type and severity of AEs were not described.

At follow-up, the dermatologists reported an absolute reduction in scores of 0.8 on the GEA scale and a relative reduction of 36% ± 39% ($P < 0.0001$). (The authors defined an absolute reduction as the final value subtracted from the initial value. Relative reduction was defined as the absolute reduction divided by the initial value multiplied by 100.) About 69% of participants experienced improvements in the GEA scale. The mean reduction correlated with the type of use: initial therapy (0.7 ± 0.7), associated therapy (0.9 ± 0.8), and maintenance therapy (0.8 ± 0.8).

The dermatologists rated the global effectiveness of the study product, which was dependent on the initial GEA scale, as "very effective" or "effective" in about 80% (95% CI: 79%–81%) of participants at follow-up. In the maintenance therapy group, the study product was rated as "very effective" or "effective" by 82% of participants, and in the initial and associated therapy groups, the study product was rated as very effective or effective by 80% of participants.

Participants reported a significant improvement in their QoL after 8–12 weeks as assessed by changes in the 5-item Cardiff Acne Disability Index (CADI). Most participants (80%) rated the global effectiveness of the study product as very effective or effective, especially if they had an initial GEA score of 2 (comedones, papules, and a few pustules), and if they were part of the initial or maintenance therapy groups. Participants were satisfied with the study product's cosmetic properties. Overall, 15% of the study population reported discomfort from the study product.

The product was deemed a clinical success in 3,571 of 4,230 participants (84%), with similar rates of effectiveness in the three treatment groups. This study demonstrated that a skincare product containing milk thistle fruit extract was very well tolerated and may be effective for managing acne in adolescents and young adults with mild to moderate acne when applied twice daily for 8–12 weeks. It was equally effective for improving acne severity and QoL among participants who used the study product as an initial, maintenance, or associated therapy.

The authors recognized the absence of a placebo control and compliance monitoring as major limitations. As such, additional high-quality studies are needed to better assess the efficacy and tolerability of the study product. HG

Milk thistle *Silybum marianum*
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V2 I 2024

Standardized Shatavari Root Extract May Improve Menopausal Symptoms throughout Menopause

Reviewed: Gudise VS, Dasari MP, Kuricheti SSK. Efficacy and safety of shatavari root extract for the management of menopausal symptoms: A double-blind, multicenter, randomized controlled trial. *Cureus*. April 8, 2024;16(4):e57879. doi: 10.7759/cureus.57879.

By Samaara Robbins

Menopause is a physiological state that results from a sudden or gradual decrease in estrogen levels and is preceded by perimenopause. Menopausal and perimenopausal symptoms can include hot flashes, vaginal/vulval dryness, disturbed sleep, urogenital infections, anxiety, depression, cognitive dysfunction, and changes in sexual function. Menopause can also increase the risk of osteoporosis, cardiovascular disease, urinary incontinence, and possibly Alzheimer's disease.

Hormone replacement therapy (HRT) often is prescribed to mitigate symptoms, slow bone loss, and reduce bone fracture rates. However, specific types of HRT are associated with increased risks of breast cancer, heart disease, and thromboembolism (obstruction of a blood vessel by a clot). Many women express interest in non-hormonal strategies for managing symptoms. A systematic review published in 2013 found that more than half of participants used integrative medicine and dietary supplements to treat menopausal symptoms.[1]

Study Details: At a Glance	
Study Design	Prospective, randomized, double-blind, placebo-controlled parallel clinical trial
Duration	60 days
Participants	70 women (40–65 years of age) who were experiencing peri- or postmenopausal symptoms
Intervention	Aspurūs™ (Waleria Healthtech Private Limited; Hyderabad, India), a standardized extract of shatavari root
Control	Placebo (microcrystalline cellulose)
Disclosures	The authors declared no conflicts of interest.

Shatavari *Asparagus racemosus*
Photo ©2025 Vengolis

Shatavari (*Asparagus racemosus*, Asparagaceae) root is widely used in Ayurveda for balancing metabolic and hormonal activities. This prospective, randomized, double-blind, placebo-controlled parallel clinical trial aimed to assess the efficacy and safety of shatavari in managing menopausal symptoms and regulating the hypothalamic-pituitary-ovarian (HPO) axis in peri- and postmenopausal participants.

The trial was conducted at two locations in India from August 10, 2023, to October 26, 2023. Participants were eligible if they were peri- or postmenopausal, aged 40 to 65, and were experiencing menopausal symptoms, such as hot flashes, night sweats, anxiety, fatigue, depression, insomnia, and mood swings, as diagnosed by the study investigator. Participants who were pregnant, lactating, or actively trying to conceive, or had undergone a hysterectomy, or were taking HRT or any other herbal treatments to manage symptoms were excluded. Those with a history of serious illness within three months of the trial, history of alcohol or substance abuse, allergy or sensitivity to the study ingredients, or who had participated or planned to participate in another clinical study during or within three months of the trial also were excluded.

A total of 70 participants were randomly assigned to the shatavari group or placebo group (35 in each group). The test product was Aspurūs™ (Waleria Healthtech Private Limited; Hyderabad, India), a commercial shatavari root extract standardized to contain no less than 5% total shatavarins (steroidal saponins). Microcrystalline cellulose was used as the placebo. Participants were instructed to take one 250-mg capsule of the test product or placebo twice daily for 60 days. Participants were seen at baseline, days 30 and 60, and day 30 + 2 ("visit 4") and day 60 + 2 ("visit 5"). Forty participants attended study visits at the Good Life Hospital (Vijayawada, India) and 30 at the Ravi Nursing Home (Guntur, India).

The primary outcome measure was the change in the Utian Quality of Life (UQoL) total score, a validated measure of QoL through and after menopause. Secondary outcomes included individual domain scores of the UQoL, the Depression, Anxiety, and Stress Scale-21 Items (DASS-21) score, total Regensburg Insomnia Scale (RIS) score and subscale scores, and Menopause Symptoms-Treatment Satisfaction Questionnaire (MS-TSQ) results. Adverse events (AEs) also were recorded. Demographic, medical, and medication histories were collected at baseline. Vital parameters, outcome measures, and laboratory tests were completed at baseline, 30, and 60 days, and at visits 4 and 5.

Total UQoL scores improved in both groups from baseline to days 30 and 60 with significant between-group differences at both time points ($P < 0.0001$ for both), with more pronounced improvements in the shatavari group. Significant improvements in occupational, health, emotional, and sexual UQoL scores were observed in the shatavari group vs. baseline ($P < 0.0001$). A significant within-group change in mean scores for all domains of the UQoL also was shown ($P < 0.0001$). The shatavari group reported a better therapeutic response in each of the DASS-21 scores vs. placebo after the study ($P < 0.0001$). A significant within-group improvement in DASS-21 also was observed ($P < 0.0001$).

The total RIS score was significantly better in the treatment group at visit 5 vs. baseline ($P < 0.001$). Significant shatavari within-group improvements from baseline to visit 5 were observed in RIS subscales for poor sleep depth, poor sleep quality, and "hypnotics and poor daytime functioning" ($P < 0.0001$). A significant change was observed in the treatment group for the "fearful focus on insomnia" subscale at visits 4 and 5 ($P = 0.0018$ and $P < 0.0001$, respectively) compared to baseline. Sleep quality, sleep depth, fearful focus on insomnia, and hypnotics and poor daytime functioning also improved significantly in the shatavari group vs. placebo ($P < 0.0001$).

The treatment group saw a significantly better therapeutic response vs. placebo for serum estradiol and progesterone levels after the study ($P = 0.0025$ and $P = 0.0005$, respectively). However, serum estradiol and progesterone values in this group did not significantly change by visit 5 vs. baseline.

The intervention group reported significantly fewer hot flashes and night sweats vs. placebo from baseline to visit 5 ($P < 0.0001$). Anxiety/nervousness/feeling of worry domain was significantly better in the shatavari group vs. placebo at visit 5 ($P < 0.0001$). The shatavari group saw significant reductions in fatigue, urinary incontinence scores, insomnia/sleeplessness/disturbed sleep, mood swings/sudden changes of mood, and loss of libido vs. placebo after the trial ($P < 0.0001$).

Participants in the shatavari group reported better satisfaction with the treatment. Five participants in the shatavari group and four in the placebo group experienced AEs, including dizziness, bloating, and nausea. The AEs were described as mild in the text, but the authors later contradict themselves and state that "none of the adverse events were mild." Two people in the placebo group were lost to follow-up.

The study was limited by the small sample size, variations in symptom severity, and fluctuating estradiol levels. Additionally, the authors did not provide the actual levels of serum estradiol and progesterone in the paper, and inconsistencies in the text make evaluating the information challenging at times. Larger, multicenter studies with diverse populations are needed before generalizing and confirming this trial's results. The authors conclude that a 250-mg dose of Aspurūs taken twice daily is safe and well-tolerated. HG

Reference

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Meta-analysis Shows Brown Algae May Improve Fasting Blood Glucose, HbA1c, and Postprandial Blood Glucose Levels

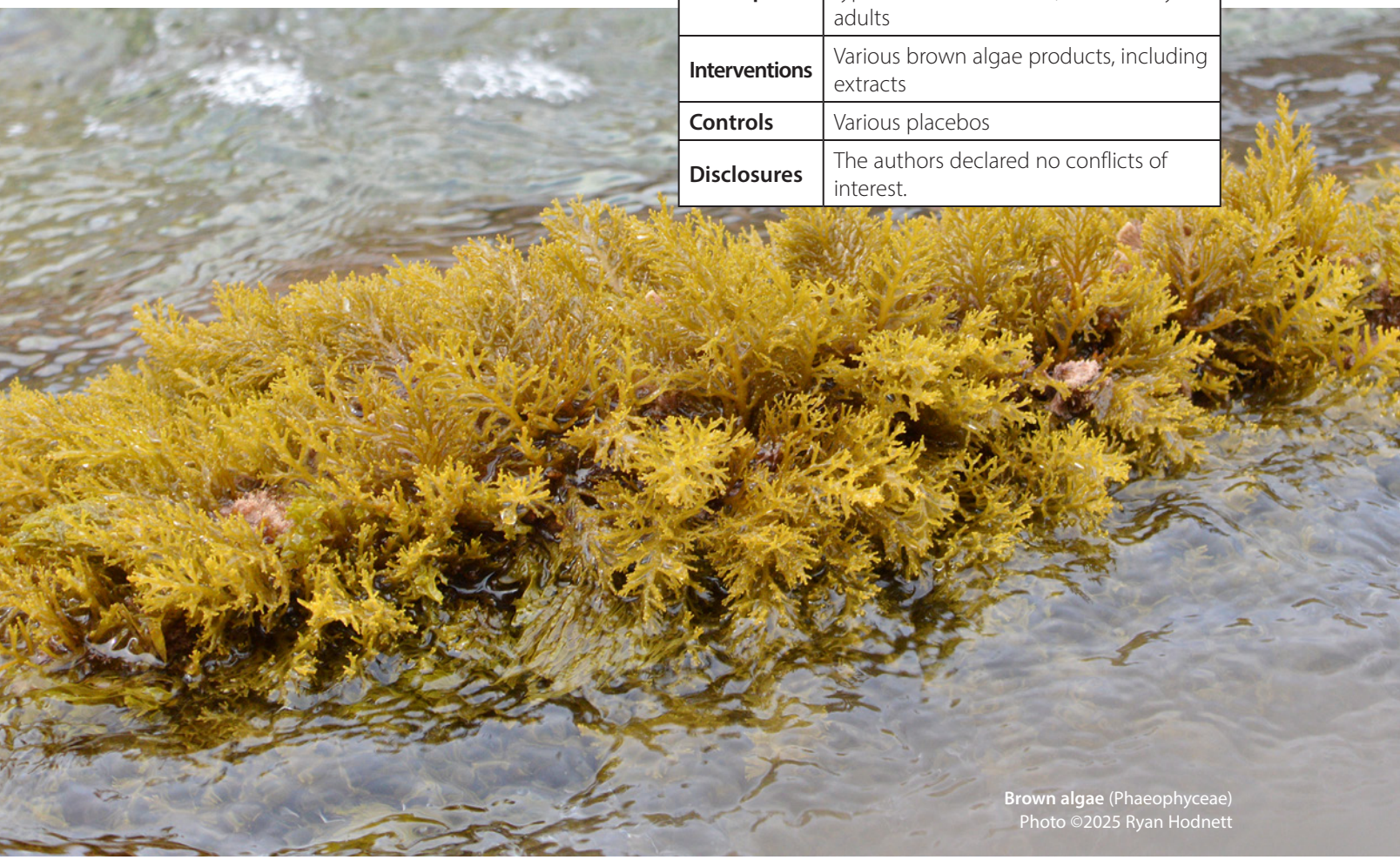
Reviewed: Kim YR, Park MJ, Park SY, Kim JY. Brown seaweed consumption as a promising strategy for blood glucose management: A comprehensive meta-analysis. *Nutrients*. December 2023;15(23):4987. doi: 10.3390/nu15234987.

By Samaara Robbins

Type 2 diabetes mellitus (T2DM) is a chronic condition that is associated with certain lifestyle behaviors such as having a high-calorie diet and being sedentary. People diagnosed with T2DM have a higher risk of cardiovascular and cerebrovascular events. Current pharmaceutical interventions include oral insulin, sulfonylureas, and metformin. These medications can have unwanted side effects, including gastrointestinal disturbances, vitamin deficiencies, weight gain or loss, hypokalemia (low blood potassium), and allergic reactions. Therefore, researchers are investigating alternative therapeutic strategies for the management of blood sugar levels and T2DM.

Seaweed — a loosely defined term that can refer to various species of green algae (Chlorophyta), brown algae (Phaeophyceae), red algae (Rhodophyta), and others — has long been used as a food and medicine, especially in Asia. In vivo and in vitro research has demonstrated that some species of algae have antidiabetic properties, and researchers have investigated commercial algae products in human trials for their potential benefits in regulating

Study Details: At a Glance	
Included Studies	23 randomized controlled clinical trials
Study Durations	Acute (60–120 minutes) to 180 days
Participants	Adults diagnosed with prediabetes or type 2 diabetes mellitus, and healthy adults
Interventions	Various brown algae products, including extracts
Controls	Various placebos
Disclosures	The authors declared no conflicts of interest.



Brown algae (Phaeophyceae)
Photo ©2025 Ryan Hodnett

blood glucose levels. The purpose of this meta-analysis was to assess clinical research findings on the impact of brown algae on blood glucose and glycolipid metabolism.

The authors searched for relevant keywords on various databases, including PubMed, Regional Information Sharing Systems (RISS), Google Scholar, ScienceDirect, and the Cochrane Library. They included randomized controlled trials (RCTs) that evaluated the effects of brown algae or their extracts against a placebo using healthy populations, people diagnosed with prediabetes, or people diagnosed with T2DM.

A total of 15,137 articles were identified initially, and 23 of those articles met all the inclusion criteria and were included in the meta-analysis. Seven studies used a crossover design, and 16 studies used a parallel design. The studies included both women and men (ages not specified), and durations ranged from acute (60–120 minutes) to 180 days.

The studies used various formulation types (e.g., powdered extracts, hot water extracts, etc.), dosages, and species of brown algae. Several studies assessed branded products, such as InSea2® (innoVactiv; Rimouski, Quebec, Canada), Maritech® Synergy (Marinova Pty Ltd; Cambridge, Tasmania, Australia), and Seanol® (Botamedi Inc.; Seoul, Korea). The authors did not describe the placebos.

Twelve RCTs evaluated the effects of brown algae on fasting blood glucose (FBG), and eight assessed fasting blood insulin (FBI). A "noteworthy" but not statistically significant reduction in FBG was observed after brown algae consumption (P = 0.043), with low heterogeneity. Brown algae had no significant impact on FBI.

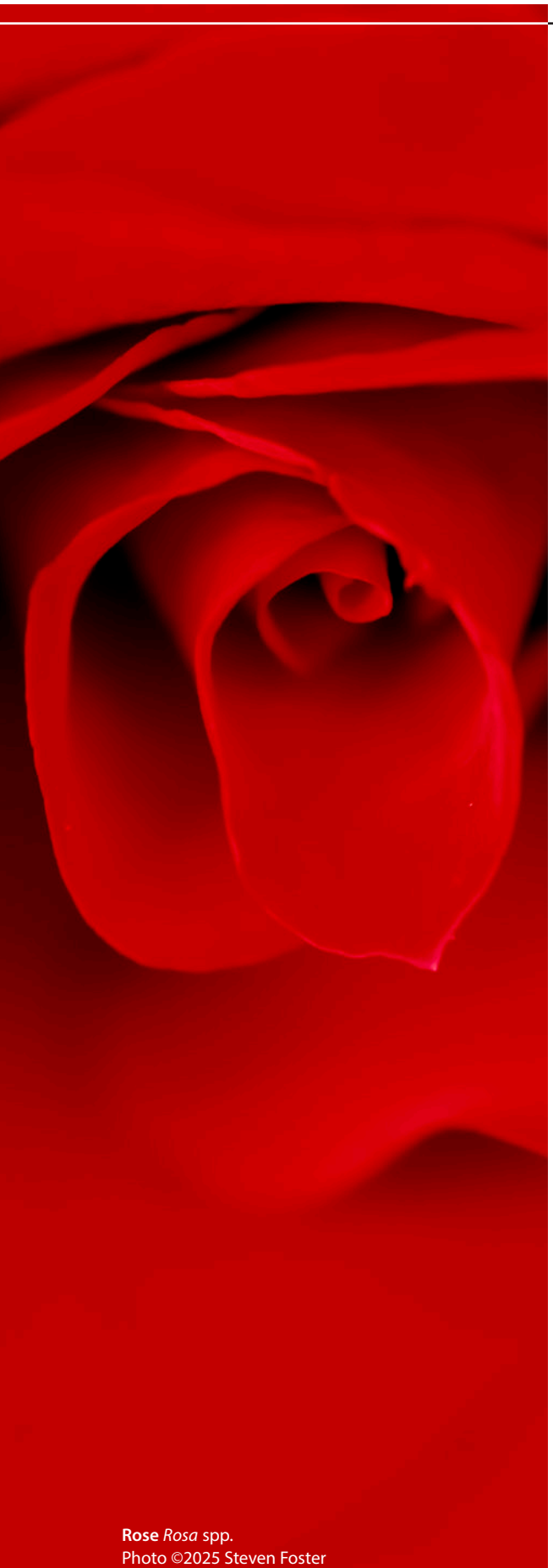
Postprandial blood glucose levels at 60, 90, and 120 minutes were analyzed in eight studies. Significant reductions were observed at all three time points after brown algae supplementation compared to the control groups (P = 0.001, P = 0.0001, and P = 0.011, respectively). A moderate level of heterogeneity was observed for the 60- and 90-minute time points, and a high level of heterogeneity was observed for 120 minutes. Seven studies used the Homeostasis Model Assessment of Insulin Resistance (HOMA-IR), and 10 studies evaluated hemoglobin A1c (HbA1c) levels. Significant reductions in HOMA-IR (indicating an improvement in insulin resistance) and HbA1c were observed in the intervention groups compared to the control groups (P = 0.029 and P = 0.002, respectively).

Subgroup analyses found significant reductions in FBG and HbA1c levels for the brown algae groups in studies that lasted at least 12 weeks (P = 0.044 and P = 0.002, respectively). Dosages of 1,000 mg per day or higher resulted in significant decreases in FBG and postprandial blood glucose levels (P = 0.022 and P = 0.005, respectively).

Results also varied according to the type of brown algae used as the intervention. HbA1c levels substantially decreased in a study in which participants consumed both knotted wrack (*Ascophyllum nodosum*, Fucaceae) and bladder wrack (*Fucus vesiculosus*, Fucaceae) (P = 0.002). Compared to the control groups, reductions in postprandial blood glucose levels at 90 and 120 minutes were more pronounced with supplementation with paddle weed (*Ecklonia cava*, Lessoniaceae; P = 0.029 and P = 0.022, respectively), as well as oarweed (*Laminaria digitata*, Laminariaceae) and wakame (*Undaria pinnatifida*, Alariaceae) (P < 0.0001 and P = 0.025 for both species at 90 and 120 minutes, respectively).

Using the Cochrane Collaboration's Risk of Bias tool, the authors found significant publication bias for studies that assessed FBI (P = 0.007). Seventeen of the RCTs included in the meta-analysis focused on monotherapies. A subgroup analysis showed significant improvements for both monotherapies and complex interventions. Thus, a synergistic effect may be evident. Further studies are needed to investigate the efficacy and synergy of single and complex interventions.

The authors concluded that paddle weed, oarweed, and wakame have a positive effect on postprandial blood glucose levels. Additionally, dosage and duration are significant factors affecting the efficacy of brown algae on FBG and HbA1c. Finally, the mechanism(s) of action and extraction methods require further investigation. HG



Rose *Rosa* spp.
Photo ©2025 Steven Foster

Why Names Matter:

Demystifying the Nomenclature of Plants and Herbal Substances

What's in a name? That which we call a rose by any other name would smell as sweet.

—William Shakespeare's "Romeo and Juliet" (Act II, Scene 2)[1]

By Bob Allkin, PhD, and Kristina Patmore

Plants for Health
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1. Introduction

In Shakespeare's play, Juliet pleads that Romeo is the same person regardless of his name, and *HerbalGram* readers likely need no reminder that a label offers no guarantee of a product's content. This article explains and illustrates why it is important to pay close attention to the names used when communicating about objects, places, and concepts. We encourage readers to clearly differentiate between names (the labels we use) and the objects they refer to (the plants or herbal substances).

Names are necessary to communicate verbally and when searching for information or exchanging data. The validity of research papers, effectiveness of regulations, and credibility of herbal products all rely on using meaningful, unambiguous, and precise plant names. Finding published information about a plant requires knowing the different names that previous authors may have used.

Communicating precisely, unambiguously, and comprehensively about plants or herbal substances is not as straightforward as one might imagine. People often assume, for example, that others will interpret names as they do, but a person's preferred common name for a plant may reflect their birthplace, profession, or cultural background. As with other elements of language, the meaning of names can change and be used inconsistently even within the same language: they may vary from place to place (e.g., "lift" and "elevator") or between generations. Regulators, scientists, pharmacists, and industry members who

do not consider this inconsistency in plant names may fail to communicate safely and effectively.

Scientific botanical nomenclature is designed to avoid such subjectivity and ensure effective communication by providing names that are precise, unambiguous, and, importantly, stable in their meanings. However, it is not always clear how scientific names should be used, and their inappropriate use is a common source of further misunderstanding and confusion.

This article considers different types of plant names in use and their relative merits for research, manufacture, and regulation of herbal products. It also explains what is "scientific" about scientific names, highlights common nomenclatural pitfalls, and offers advice on best practices and available tools.

2. Types of Names

2.1 Common Plant Names

Common names are part of everyday language and often reflect a person's identity or background. For example, a person in southeast England may not use the same common name to describe a particular plant as someone in France, Germany, or other parts of England. Using different common names for the same plant (synonyms) in multiple languages leads to confusion and makes it more difficult to find information published about those plants.

Conversely, the same name may be used by different people to refer to different plants (homonyms). "Bluebell" refers to very different plants in the United Kingdom, Australia, the United States, and South Africa (Figure 1). This ambiguity is potentially dangerous and can lead to false assumptions about which plant should be used. When working in northeastern Brazil with Professor Francisco José de Abreu Matos (1924–2008) and his inspirational "Living Pharmacies" initiative,[2,3,4] nuns in the state of Bahia inadvertently distributed poisonous plants to rural communities for their "medicinal" value. Although well-intentioned, the nuns were misled because the poisonous species was known locally in Bahia by the same name (*agriao*) as that used in the state of Ceará for a medicinal species — *Eclipta prostrata* (L.) L. (Asteraceae[5,a]) — promoted by Matos. Neither use of the name agriao was "wrong," and these cultural differences in usage will persist in different parts of Brazil.

It may come as a surprise that these rural communities in northeastern Brazil use relatively few native Brazilian plants for medicinal purposes. Instead, they mostly use medicinal plants introduced from Europe or Africa by their forebears. Immigrants and enslaved people who settled in this region brought plants and knowledge, which they passed on to their descendants.[6,7,8] Indigenous peoples in the Amazon, by contrast, have a deep, ancestral understanding of how to use native flora.

People who migrate take their language and knowledge with them. British settlers in North America found birds with reddish breasts and came to call them "robins," reusing the name of a bird familiar to them from back home. The European and American robins, however, are quite unrelated. Similarly, plants in the Americas frequently were given names "borrowed" from European or African plants with similar morphologies or medicinal uses. Dutch ethnobotanist Tinde van Andel has published many studies

[a] As noted in this article, botanical family definitions vary. All family names cited in this article follow the current Angiosperm Phylogeny Group (APG) classification (version IV). In some cases, family names are omitted for clarity.[5]

Figure 1. Examples of Synonymy and Homonymy of Common Names

Common names for *Achillea millefolium* L.

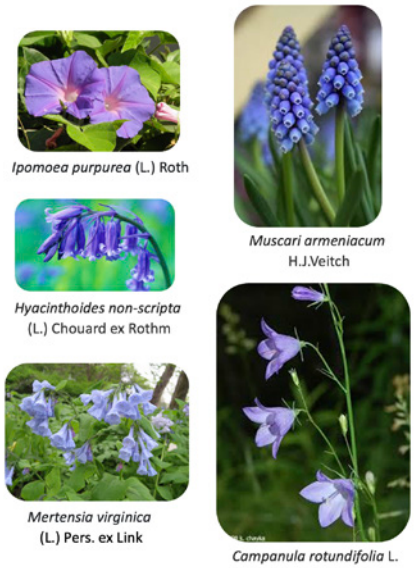
yarrow
nosebleed
woundwort
old man's pepper
蓍草
Y Luo
achillée millefeuille
achillekraut
milfolhada
rölleka
herba militaris
اليارو أخلية
yaru

Synonyms: One plant, many names

An obstacle to finding information

Yarrow *Achillea millefolium*
Photo ©2025 Steven Foster

Species with the common name "bluebell"



Homonyms: One name, many plants

Ambiguity can lead to false conclusions

regarding the Americas, particularly Suriname, that explore how cultural heritage and plant "knowledge" impact plant names.[9,10,11] She cites examples of names given to native American plants (in the colonizers' language) that reflect diverse etymological roots (e.g., pidgin English, Dutch, Portuguese, or multiple African languages). *Possentri* ("poison tree"), for example, is used for a toxic species, *Hura crepitans* L. (Euphorbiaceae). Many plant names used in Suriname have evident African etymological roots, and van Andel found multiple cases in which the name given to a Suriname plant was derived from names used in Africa for African species that share morphological features or uses. The tree *Trema micranthum* (L.) Blume (Cannabaceae), for example, is known as *misobisobi* in Suriname, while a botanically related African species (*Trema orientale* (L.) Blume) is known as *musobisobi* in the original Gabonese language.

How people use plants and the names they give them form part of their cultural heritage. In general, people are attached to the names they grew up with or were taught, but others will have a different view. This rich diversity of names is significant for the supply chains of herbal dietary supplement ingredients sourced from many places. The names familiar to local harvesters, growers, and traders are meaningful to them, but these names may differ from names used by others along the supply chain.

2.2 Names of Herbal Substances

The names of substances derived from plants can also vary. Pharmacopeias offer detailed definitions of herbal substances and assign names (titles) to their monographs and definitions. Trade names are registered in relatively few jurisdictions. However, these pharmacopeial and trade names of plant substances are created by the editors of each publication and follow no formal mechanisms or universal standard. Thus, a single name may be used with different meanings by different people in different publications and contexts. The term "ginseng," for example, appears as part of many different names employed by pharmacopeias and reference papers in various forms (such as "red ginseng," "Indian ginseng," or "blue ginseng"). These names refer to herbal substances and marketed products derived from at least 20 different species, each with a different chemistry. Even the unadorned term "ginseng," on its own, is used in different pharmacopeias to refer to herbal substances derived from at least four different species.[12]

Regulation and pharmacovigilance rely on pharmacopeias for providing precise, detailed descriptions of which plant and which parts of those plants are to be used, how to process that material to prepare a substance, and, potentially, what tests might be used subsequently to authenticate such material. Pharmacopeias aim to achieve precision by using scientific names to specify the plant(s) to be used (Section 2.3). Nonetheless, pharmacopeias can sometimes be surprisingly imprecise as to which plants they are describing (Section 3.4).

The names given to plant substance definitions in pharmacopeias can also take different forms. Some pharmacopeias repurpose plant common names. The *British Pharmacopoeia*, for example, defines "wormwood" as a substance obtained from drying the "basal leaves or slightly leafy, flowering tops" of *Artemisia absinthium* L. (Asteraceae).[13] The name wormwood thus refers simultaneously to the entire plant and to a particular substance derived by processing certain parts of that plant. This is just one of the many sources of ambiguity of names used in pharmacopeias.[14,15]

Elsewhere, a pharmacopeia may create a new name that refers specifically to its definition of an herbal substance. Such a name may exist in any language (e.g., Chinese or English), and no agreed-upon international procedures or standards exist for how this name should be created or registered. Other pharmacopeias established by authorities in different countries or disciplines may use exactly the same term for the definition of a different substance. That name thus becomes ambiguous.

Wormwood *Artemisia absinthium*
Photo ©2025 Steven Foster

Indeed, consecutive editions of a single pharmacopeia will continue to use the same name for a substance, even when the precise definition of that substance changes from one edition to the next.

Other pharmacopeias employ names in Latin (e.g., Stephaniae tetrandrae radix) — also known as pharmaceutical or pharmacopeial names — presumably to increase global accessibility. The use of Latin in itself, however, offers no more guarantee of precision than English or Arabic, and single pharmaceutical names are used in different pharmacopeias to refer to different herbal substances. "Cimicifugae rhizoma" is used in Chinese, Japanese, and European pharmacopeias for substances derived from five different species (Figure 2).[15-18] Thus, the name is ambiguous and imprecise.

Traditional Chinese medicine (TCM) products are increasingly used outside China. In both the Chinese and English editions of the *Chinese Pharmacopoeia*,[17] substances have both a Chinese name and, to facilitate access for non-Chinese speakers, a Pinyin name (a phonetic version of the Chinese name in Roman script). Translation/transliteration of names between languages/scripts is never straightforward, however. In addition, some Pinyin names may be used, unhelpfully, in abbreviated forms. The Pinyin name "fang ji," for example, is cited in many reference sources including the *American Herbal Products Association's Herbs of Commerce*, 3rd edition,[19] which has incorporated the Pinyin names found in the 2015 English edition of *The Pharmacopoeia of the People's Republic of China*. Unfortunately, even single editions of the *Chinese Pharmacopoeia* define two different substances derived from two different plants, which share the Pinyin name "fang ji." These two substances have different purposes and require use of different concentrations of the relevant plant, with "han fang ji" being derived from *Stephania tetrandra* S.Moore, while "guang fang ji" is derived from *Aristolochia fangchi* Y.C.Wu ex L.D.Chow & S.M.Hwang. The term "fang ji," without the appropriate modifier, is thus ambiguous, with serious public safety implications.[20,21] In one well-reported case, this ambiguity led a Belgian weight-loss clinic to mistakenly use a product containing an *Aristolochia* species at toxic doses, which led to 100 people developing end-stage kidney failure.[22] Subsequent studies indicated that this confusion, and misuse of *Aristolochia* species, was far more widespread.[23]

So, while most pharmacopeias do offer precise detailed technical definitions of the substances described, they may nevertheless employ names of significant ambiguity. When using such names, one should cite the pharmacopeia source and edition to avoid being misinterpreted. Nineteen different names are recorded in 23 medicinal references for the traditional Chinese drug derived from *Stephania tetrandra* S.Moore. These include common or pharmacopeial names written in Roman or Chinese scripts or using variants of the Pinyin transliterations of their Chinese names.[12]

2.3 What Makes Scientific Plant Names 'Scientific'?

The binomial system of scientific naming was first introduced by Swedish botanist Carl Linnaeus (1707–1778) in the mid-18th century.[24] By convention, scientific names are written in Latin, a politically neutral language intended to enhance international adoption and be familiar to scholars globally. The language used, however, is irrelevant to its scientific merit. "*Hocus pocus* Allkin" is not a scientific name; nor are the thousands of similar meaningless, misspelled, or made-up "binomials," which superficially look like scientific plant names and appear frequently in the literature.

Today, scientific plant, fungal, and algal names are published, controlled, and interpreted using procedures defined in the 2018 *International Code of Nomenclature for algae, fungi, and plants*.[25] The code is lengthy and somewhat legalistic, although the essentials of how new scientific names are published (created) are straightforward. The code is reviewed every six years via the International Botanical Congress (IBC) and is of use primarily to practicing taxonomists who are directly involved in creating or revising the names and taxonomy of these organisms. The most recent IBC was held in July 2024 in Madrid, Spain, during which 433 specific changes to the code were debated and voted upon.[26]

Approximately 2,000 new plant species are recorded every year,[27,28] requiring new scientific names to be formally published in literature available to the public in print or online. According to the *International Code of Nomenclature*, the name should be unique (cannot already

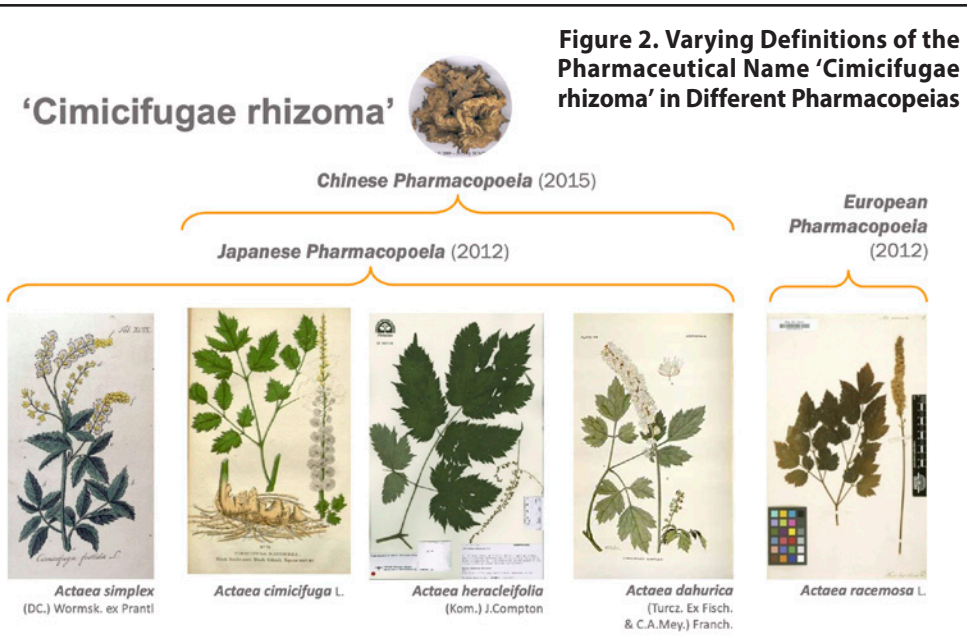


Figure 2. Varying Definitions of the Pharmaceutical Name 'Cimicifugae rhizoma' in Different Pharmacopeias

exist) and must also be accompanied by a diagnosis or description that differentiates the new plant from other similar plants already known to science. Critically, the authors of a new name must also cite details of the physical specimen(s) on which they base their description and must designate at least one as a "type specimen," indicating that the specimen is considered "typical" of the species they describe. Every herbarium collection event (one or more plant samples collected from a single small population of one plant species at one time) is uniquely identified by the name(s) of its collector(s) and, in modern practice, their collection number, along with details including the date and location of collection.[25]

Where such a sample is selected as a "type," it serves as a critical physical reference point that permanently fixes the meaning of the designated scientific name. The type specimen indicates the morphology, chemistry, and DNA of individual plants that can be assigned that name. What flower colors do individuals of this species have? What is their DNA?[b] Such questions can ultimately be resolved only by direct reference to the physical "type" specimen(s). The meaning of the name is not open to debate. Type specimens stored in herbaria in New York, Paris, London, or Nairobi, for example, provide a physical representation of each scientific name. These physical reference points — a standard against which plant material can be compared — enable these names to serve scientific and objective purposes. Unlike common or pharmacopeial names, the meaning of each scientific name is not open to subjective interpretation: their meaning is fixed and will not evolve over time.

Where taxonomists conclude, after analysis, that two or more type specimens, with different published names, in fact represent the same plant, these will be grouped as a single biological entity and a primary "accepted" name selected. Surplus scientific names will be placed into synonymy. Nevertheless, each such name retains its association with the type specimen(s) cited when that name was published (Section 3.3).

2.4 Why Use Scientific Plant Names?

Only scientific names provide a means to refer uniquely, unambiguously, and precisely to plants (or other organisms). Furthermore, the meaning of a scientific name will never change, being defined by the identity of the "type specimen(s)." These characteristics mean that scientific names fulfill the need for an objective means to refer to plants (in regulation or law) and ensure the credibility of published research and reliable and effective communication about a plant. It is worth underlining, however, that while the meaning of each individual scientific name cannot change, the preferred scientific name to be used for a particular plant may well change over time. New evidence (including DNA and chemical information) increasingly becomes available and enhances scientific understanding of the evolutionary relationships among plants (Section 3.3). Which scientific name is considered the most appropriate and meaningful for a particular plant (i.e., which places it in its correct position in the taxonomic hierarchy) is, therefore, under constant review as taxonomic relationships are revised to better reflect evolutionary history and, consequently, their proximity to other plants.

3. Obstacles to Using Scientific Names

Using scientific names appropriately and reliably is not as straightforward as may be imagined. Here we outline the primary obstacles causing confusion and misuse.

3.1 Synonyms

At least 1.4 million scientific names have been published,[29] and yet only approximately 350,000 known plants exist: an average of about four scientific names for every plant.[30] However, because of their greater historical and economic interest, each medicinal plant has on average nine synonyms.[12] Section 3.3 describes how and why synonymy occurs.

The use of multiple scientific names for one plant in the published literature is a significant obstacle to finding relevant clinical trials, chemical analyses, or other information about the uses of a plant. Using a single scientific name to search PubMed[31] or Europe PMC[32,c] rarely retrieves all articles about that plant since articles using alternative scientific names will not be retrieved. The retrieval rate clearly depends on how many synonyms a plant has and the stability of its taxonomy. In a simple case, searching for "*Curcuma longa*" (Zingiberaceae) will retrieve the vast majority of, although not all, relevant articles. However, using a single name to search PubMed for plants with multiple in-use synonyms or recent name changes will retrieve only a small percentage of the relevant articles. For example, searching PubMed using "*Dolomiaea costus*" (Asteraceae) does not retrieve articles that cite only "*Aucklandia costus*," "*Aucklandia lappa*," "*Saussurea costus*," or any of this plant's other synonyms, several of which are used interchangeably in medical literature. One study found that, for a group of medicinal plants, on average, only 20% of the relevant articles were retrieved using single scientific names.[33,34] Guaranteeing the retrieval of all relevant publications would require one to know all possible synonyms and search PubMed using each of those synonyms. This is tedious for plants with 15 synonyms or more. The Medicinal Plant Names Services (MPNS) data portal,[12] described in Section 4.5, enables users to search PubMed or Europe PMC indirectly using all known synonyms simultaneously, thus facilitating comprehensive retrieval regardless of which name the user may prefer.

Synonymy also causes inconsistency and integrity issues in compiled lists or regulations. The Royal Botanic Gardens, Kew (henceforth referred to as "Kew") began collaborating with the US Food and Drug Administration (FDA) in 2012 and validated the list of 2,064 scientific plant names in an FDA database of herbal medicines. Although the quality of these FDA names was far higher

[b] DNA analysis of type specimens is increasingly common, but many type specimens lack such data.

[c] Europe PMC is partnered with PubMed Central (PMC) and hosted by the European Molecular Biology Laboratory's European Bioinformatics Institute (EMBL-EBI), an international interdisciplinary research organization that aims to make the world's public biological data freely available to the scientific community.[32]

than most other regulatory lists available to us, the FDA had, at that time, listed 24 species more than once under different synonyms. Being unaware of the synonymy, it had listed these names as if they were different plants and potentially regulated them in different ways depending on which name was used. Despite the FDA's careful curation, a further 22% of its plant names in 2012 were misspelled or ambiguous. Collaboration with MPNS since then has enabled the FDA's current regulations to address and avoid these nomenclatural pitfalls.

Having many alternative scientific synonyms for each plant also makes it difficult to answer apparently simple questions such as "How many medicinal plants are there?" This question is illustrated and addressed in Section 4.6.

3.2 Scientific Homonyms

The scientific name of a species has three components: the genus name (with an initial capital letter), the specific epithet (i.e., the species taxon name), and the name of the author(s) who published that name. The first two components are italicized and the third is not. "*Vicia faba* L." is a scientific name while "*Vicia faba*" (the binomial) is not complete. Why should this matter? Surprisingly, approximately 4% to 5% of scientific plant names (ca. 64,000 scientific names) have homonyms that occur when two botanists, at different times and places, publish two different scientific names employing the same binomial but referring to different type specimens and species. These two scientific names share the same binomial but are synonyms of different species:

- "*Ocimum album* Roxb." — a recognized synonym of "*Ocimum americanum* L." (Lamiaceae)
- "*Ocimum album* L." — a recognized synonym of "*Ocimum basilicum* L. var. *basilicum*" (Lamiaceae)

Using "*Ocimum album*" (without an author) is ambiguous and might refer to either of the above species. It is rarer for homonyms to be created today since, generally, botanists have better access to published research than in the past, but those older names remain in the literature. It becomes necessary, therefore, to include the author's name to avoid potential ambiguity. Of course, this can be cumbersome, but to ensure certainty and precision, it is best practice to cite the full scientific name (with its author) when that name first occurs in an article. Subsequently, the binomial is sufficient.

In 2002, the European Commission sought to ban the import into Europe of the toxic Japanese plant *Illicium anisatum* L. (Schisandraceae).[35] This plant was being imported due to the very high demand at the time for "star anise" (*Illicium verum* Hook.f.), which had become an important constituent in the production of a vaccine for bird flu.[36,37] The Commission initially banned the import of "*Illicium anisatum*," without including any author. Unknown to the Commission, homonyms existed: one synonym of *Illicium verum* Hook.f. was *Illicium anisatum* Lour. (a homonym of the accepted name of the poisonous plant). By banning the import of "*Illicium anisatum*," without citing an author, the Commission's regulation was ambiguous, failing to specify which homonym was intended. It became open to interpretation whether the Commission was banning the import of an economically important spice. The regulation was hastily replaced to reduce confusion that arose in the trade. Citing a scientific name without including the name of its publishing author(s) risks ambiguity since one may not know if a homonym exists (Figure 3).

3.3 Taxonomic Changes Result in the Use of Different Scientific Names

While the meaning of a single scientific name never changes, the preferred (botanically "accepted") name for a given plant will often change. Gardeners and herbalists alike become aggrieved when plants long known by one name are given a "new" name. These changes are necessary to reflect our growing understanding of how plants relate to one another and their shared evolutionary past.

A global network of systematists with expertise in particular families, genera, or geographical areas works consistently and collaboratively to understand how plants and fungi evolved. Anatomical, chemical, and increasingly DNA evidence is transforming our understanding of evolutionary relationships, leading to constant re-evaluation of the taxonomic hierarchy. This matters enormously for herbal medicine and drug discovery since the proximity of two species will indicate the likelihood of their sharing chemical pathways. Two plants in the same genus are far more likely to have similar chemistries than those in different genera.

Figure 3. Example of Regulatory Ambiguity Caused by Plant Homonyms

Homonyms: An example of regulatory failure

EU Commission Decision 2002/75/EC Feb 2002 (EU 2002) stated:

"The botanical variety of star anise known as Japanese star anise (*Illicium anisatum*, […]) is scientifically recognised as highly poisonous and is therefore not fit for human consumption."

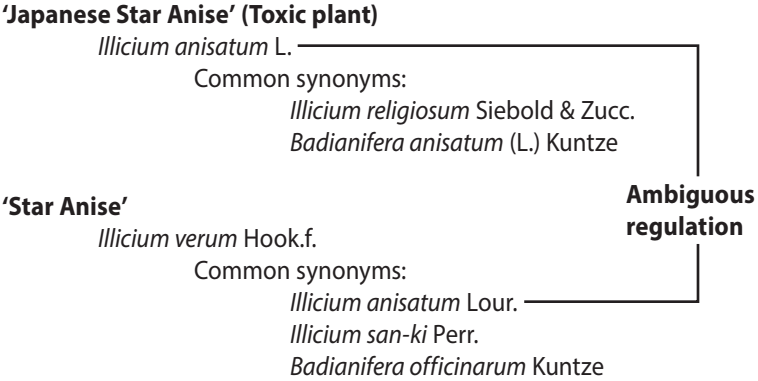
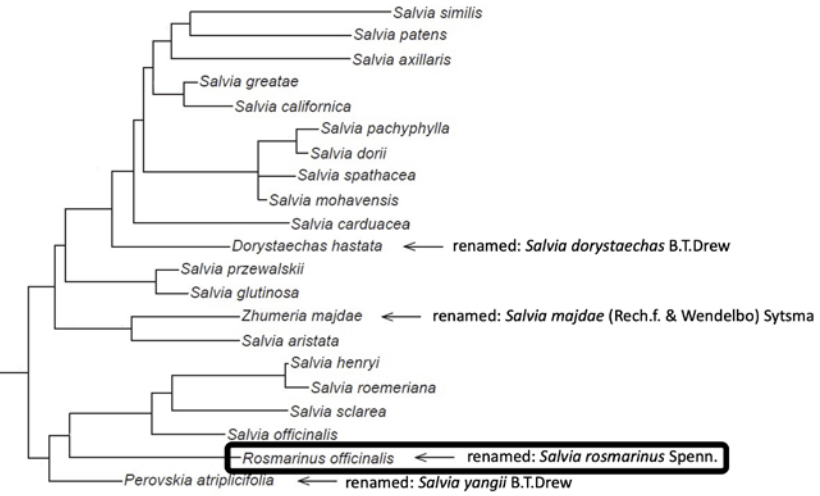


Figure 4. Why 'Rosemary' Came To Be Renamed



A portion of a recent phylogenetic tree by Drew (2017) shows genetic similarity among closely related species in the Lamiaceae (mint) family. Most of these species already belonged to the genus *Salvia*, but four near relatives had previously been placed in other genera. Based on this evidence, Drew reclassified these four species, adopting or publishing names placing them in *Salvia* to reflect their genetic similarity. One consequence was that the accepted name of the culinary herb *Rosmarinus officinalis* L. ("rosemary") became *Salvia rosmarinus* Spenn.[38]

A direct consequence of this taxonomic churn is that the scientific name botanists recommend for a species will change. Approximately 10,000 changes to scientific names are published every year (Table 1).[15,29] These changes result from: (1) a species being moved from one genus to another when molecular evidence indicates it is more closely related to species in the genus into which it is being moved, or (2) individual species definitions changing when a study using new evidence concludes that two plants previously recognized as different species are inseparable, or that a previously described species is, in fact, two or more related species that can be distinguished by their morphology, DNA, or chemistry and given new names. Proposed delimitations of species and genera rely on data from herbarium or laboratory studies. How these data are interpreted can be a matter of opinion.[d] Taxonomists may not all agree with a recent reclassification, and some may wish to continue to use the older name, which can be confusing for non-taxonomists. For non-specialists, however, it is less important to know which name to use than it is to be aware that different people use two or more alternative names for a single plant. Ignoring recently published morphological, chemical, or DNA evidence further risks flawed conclusions as to the chemical similarities between one species and another. Figure 4 illustrates how a recent study reclassified the popular culinary herb "rosemary" to reflect its close genetic resemblance to "sage."[38]

The delimitations of genera and families can change even more over time than the delimitations of individual species, with consequences for the precision of herbal medicine and regulation (Section 3.4).

3.4 Illustrating Why Scientific Names Need to Change

This example demonstrates why these name changes matter. In the 1980s, Kew chemists extracted a novel molecule, "castanospermine," from an Australian tree (*Castanospermum australe* A.Cunn. ex Mudie), in the family Fabaceae.[39] This molecule proved to inhibit the human immunodeficiency virus (HIV).[40,41] To further understand this inhibition and research into the treatment of HIV, the biochemists looked to isolate similar compounds from other plants. Working at Kew, they understood that similar molecules were most likely to be found in closely related species and initially thought to investigate other species of the genus *Castanospermum* A.Cunn ex Mudie. Unfortunately, that genus has only one species.

What were the chemists to do? They sought help from Kew taxonomists familiar with this group of plants and were told that *Castanospermum* was considered to be "congeneric" (two genera that are indistinguishable from one another and should be treated as a single genus) with a South American genus *Alexa* Moq,[42] with all available evidence indicating that these two genera should be merged. With this insight, the biochemists sought and successfully isolated multiple similar molecules from several species of *Alexa*.[43] Having easy access to Kew taxonomists had helped these biochem-

[d] Colloquially within the field of botany, "splitters" are taxonomists whose instinct is to split a group of plants being studied into a larger number of taxa, each of which shows limited internal diversity. In contrast, where there is doubt, so-called "lumpers" believe it is more useful to define fewer taxa showing greater variability within their populations.

Table 1. Causes and Rates of Changes to Scientific Plant Names Published Annually[15]

Reason for Name Change[a]	Approximate Name Changes Published per Year for Plants[b]	Approximate Name Changes Published per Year for Medicinal Plants[c]
Newly described species (new names)	2,200 – 2,700	380
Species moved from one genus into another (new name "combinations")	2,000 – 6,000	300 – 900
Species delimitation (scope) changes • One species split into many, or • Two or more species merged into one	4,000[d]	600

[a] Statistics are for species (binomials alone) and do not include counts for genera, subspecies, or varieties.
[b] Numbers vary from year to year.[29] Molecular studies increasingly drive these taxonomic changes.
[c] Assumes 15% of all vascular plants have a medicinal use (ca. 50,000 species).
[d] Estimates for changing delimitations more difficult to obtain.

ists, but had the taxonomists formally merged these two genera and changed the preferred names of all species to reflect that merge, then scientists globally would be aware of the proximity of these species and the likelihood that they share characteristics.

A scientific name that accurately reflects a plant's taxonomic position allows researchers to anticipate its chemical composition and other traits, which is critical in drug discovery and elsewhere. Effective analysis of adverse reaction records also depends on bringing together records of closely related plants based upon a meaningful (i.e., evolutionarily correct) taxonomic hierarchy.[44]

3.5 Mistaken Identity and Misuse of Names

The scientific literature includes examples of both poor and excellent research. Scientific names are frequently misspelled or misused, making the research papers imprecise, ambiguous, or hard to find. Rivera et al (2014) studied scientific names cited in 308 articles published over two years in the *Journal of Ethnopharmacology* and *Phytomedicine*.[45] They found that 38% of those names were unsatisfactory in one way or another (e.g., misspellings, erroneous author names, etc.).

The authors of a 2010 study[46] reviewed 50 publications on food and nutrition in Africa and assessed how these publications referred to 502 plants. Of the 467 scientific binomials cited, 93% lacked their correct author name, potentially making them ambiguous or misleading (Section 3.2). The authors detected other issues in how these papers employed scientific names and concluded that only 37 of the 502 plants were referred to employing scientific nomenclature that followed "best practice."

When papers do cite sound scientific names, what guarantee does the reader have that the author described or analyzed plant material that was correctly identified? Cases in the literature where scientific names are subsequently shown to have referred to the wrong plant are referred to in the subsequent literature as "misapplied" names to help readers identify these cases and avoid erroneous conclusions. However, misuse of names in this way is poorly documented.

3.6 Imprecision

Imprecision as to which plants are used is also common in the literature, including in pharmacopeias. The substance "acacia," for example, is defined almost identically in the United States, European, and British pharmacopeias (Figure 5). The *British Pharmacopoeia* follows the *European Pharmacopoeia*, and its entry reads: "Air-hardened gummy exudate flowing naturally from or obtained by incision of the trunk or branches of *Acacia senegal* L. Willdenow, other species of African origin and *Acacia seyal* Del."[13]

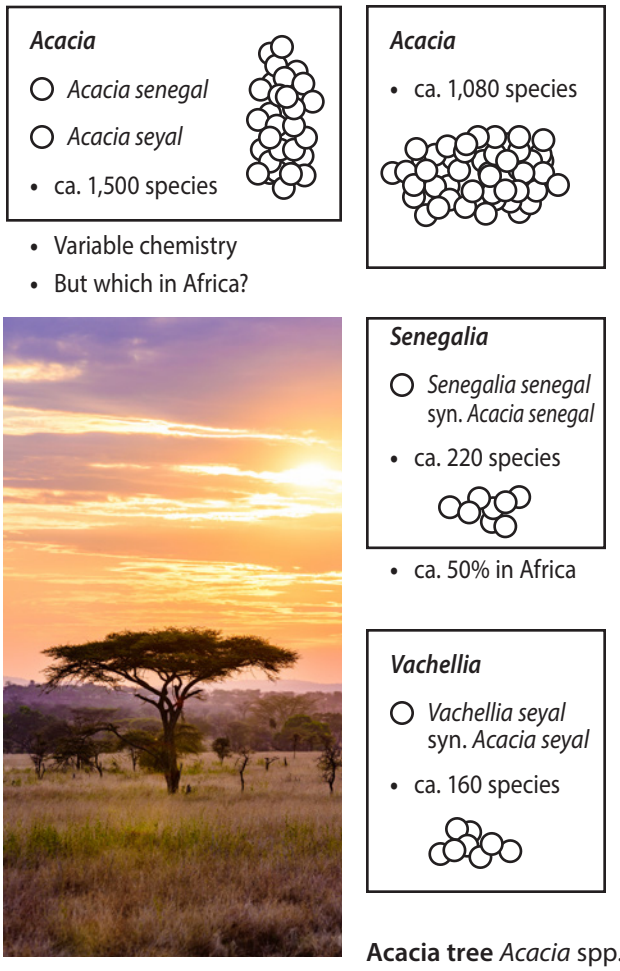
First, the name given to this resinous substance is identical to the name of an entire genus: one source of ambiguity. The description specifically cites two species (with formally published scientific names), but further suggests that an undefined number of other species may also be used. This is problematic in two ways. One issue is the assumption that all species in a genus have identical chemistries. This is evidently not the case. Although species belonging to the same genus are more likely to share chemical pathways, there are risks inherent in assuming that all species will serve identically for a given purpose. This risk grows for larger genera. When the above pharmacopeia entry was published, the genus *Acacia* (Fabaceae) was widely considered to consist of more than 1,500 species, but there existed considerable uncertainty as to which species were native to Africa and differing opinions among botanists as to which

Figure 5. Unintended Imprecision in Pharmacopeias Following Radical Changes in the Taxonomic Delimitation of the Genus *Acacia* between 2002 and 2020

'Acacia'

As specified in the *European Pharmacopoeia* and others:

Definition: Air-hardened, gummy exudate flowing naturally from or obtained by incision of the trunk and branches of *Acacia senegal* L. Willdenow, other species of *Acacia* of African origin and *Acacia seyal* Del.



Acacia tree *Acacia* spp.

species should be included in the genus. This left open to debate which plants were included in the definition of this substance in these pharmacopeias.

A second issue relates to how genus delimitations can and will change over time. Figure 5 illustrates the radical change in the definition (taxonomic delimitation) of the genus *Acacia* since those pharmacopeias were published. Today, *Acacia senegal* is recognized as belonging to another genus, *Senegalia* (with 220 species), and its preferred name is now *Senegalia senegal* (L.) Britton, with *Acacia senegal* L. being retained as a synonym. *Acacia seyal*, meanwhile, now belongs to a third genus, *Vachellia* (with 157 species), and is known as *Vachellia seyal* (Delile) PJH Hurter. *Acacia* is now considered to contain 1,085 species. Given these changes, what can we make of the pharmacopeial definition of this substance? Replacing the names of the cited species with their current accepted names is a straightforward nomenclatural issue, but how might readers interpret "species of *Acacia*" when the species most closely related to *Senegalia senegal* and *Vachellia seyal* do not belong in *Acacia* but in other genera? Avoiding reliance on the names of genera alone for herbal substance definitions in pharmacopeias would reduce such potential confusion.[47]

Such changing delimitations are significant at the genus level and even more dramatic at the family level. The family Liliaceae previously comprised almost 300 different genera. Today, the family contains only 15 genera, with the remainder now belonging to other, sometimes newly created, families.[e] Nearly all botanical institutions globally, including Kew, have adopted the most recent version of the Angiosperm Phylogeny Group classification (version IV),[5] which is under regular review.

3.7 When Are Names in Latin Not Scientific?

As mentioned previously, pharmaceutical (pharmacopeial) names (e.g., Stephaniae tetrandrae radix) are often written in Latin despite not being scientific names. Scientific publications, regulations, and databases also sometimes contain names that look like validly published scientific names, but which, in fact, are misspelled, cite incorrect authority, are incomplete, or simply were never formally published as scientific names (Section 2.3). These names are not useful scientifically and will not be found in the International Plant Names Index (IPNI), which is described in Section 4.2.[29] "Scientific names" whose authors did not follow the essential rules for valid publication have no taxonomic standing, nor do orthographic variants (published misspellings of scientific names), although both find their way into modern literature.

Names in Latin that are not scientific names are sometimes created deliberately when some benefit is anticipated by falsely making names appear to be "scientific." We recently found a name for a "novel food" ("*Cistus incanus* L. Pandalis herb" [Cistaceae]) included in an EU regulation that lists "approved" novel foods.[48] The regulation states that this novel food consists of "dried cut aerial parts of *Cistus incanus* L. Pandalis." But what is this plant? How might one test the authenticity of any product carrying that name?

In 1753, Linnaeus described the species *Cistus incanus* L. (A few subspecies names published subsequently are now all considered to be synonyms of *C. creticus* L.[49]) Modern botanists determined that, like many plant species, *C. incanus* was of hybrid origin. They refer to this plant as *C.* × *incanus* L. — the "×" being the symbol used in hybrid formulas to represent a cross between species. *Cistus* × *incanus* L. continues to be recognized as a distinct botanical entity native to Spain, France, and Morocco and is now naturalized in California.[50]

"Pandalis" is the name of a manufacturer, likely eager to differentiate its product from other "rockrose teas" made from *C.* × *incanus* L. The name has no scientific merit and was not formally published with a registered "type" specimen to indicate any unique characteristics of this plant. Thus, this term does not permit us to draw any conclusions as to the quality of the tea or enable its content to be authenticated. It is not scientific and at best misleading.

It is concerning that such meaningless names, masquerading as "scientific," appear in legislation intended to protect consumers. In this case, a manufacturer appears to have taken advantage of the lack of understanding of botanical nomenclature among regulators to have successfully registered its own branded product with an invented scientific name, offering no guarantee of the botanical material included. The existence of such names adds significantly to the challenges facing regulators, practitioners, trade bodies, and consumers who want to be sure of the plant material included in any product.

3.8 The Need to Authenticate the Identity of Plant Materials

Efforts are being made to improve the quality and reliability of globally traded herbal ingredients and products, including through initiatives such as the ABC-AHP-NCNPR Botanical Adulterants Prevention Program (BAPP), a nonprofit consortium that includes the American Botanical Council (ABC), American Herbal Pharmacopoeia (AHP), and the National Center for Natural Products Research (NCNPR) at the University of Mississippi.[51,52] Action is indeed urgent and vital. Any effort to authenticate plant materials must rely, as an essential first step, on the use of meaningful, precise, and unambiguous names. Without this, authentication becomes meaningless. Botanical reference collections are critical for comparative purposes.

Ensuring that samples of dried plant material are derived from the correct species often requires chemical, genetic, and morphological evidence and analysis. Leon and Lin (2017) published a detailed guide for morphological iden-

[e] Scientific names that are based on the same type specimen are, by definition, synonymous. These names occur, for example, when a species is moved from one genus to another and requires a new name linked to the same type specimen when published. There can be no doubt that these "homotypic synonyms" refer to the same plant — it is a fact. "Heterotypic synonyms," in contrast, relate to different type specimens. These are scientific names published at different times by different authors and are based on different type specimens. If a taxonomist decides, based on the available evidence and inspections of the relevant type specimens, that two previously published scientific names refer to the same biological entity, then they will publish their findings, placing these two names into synonymy (as heterotypic synonyms). Such judgments are subjective and depend on the taxonomist's interpretation of the available morphological, molecular, chemical, and/or other data.

tification of TCM materials, providing necessary information for morphological examination of plant material that supplements the chemical and DNA tests carried out in Kew's laboratories. It is often the case that no definitive conclusion can be drawn from genetic or chemical analyses alone, and indeed either may mislead. Using all available evidence becomes key.[53]

DNA barcoding has enormous potential for the identification of samples. However, DNA barcodes do not resolve the fundamental problem of species recognition since DNA varies among individuals of the same species just as chemical and morphological features vary. Kew's Tree of Life employs modern molecular techniques to track more than 350 different genes for each species studied.[54] Early DNA barcodes tracked only two or three genes each. Though 350 genes remain a tiny fraction of each plant's entire genome, they may serve, like chemistry and morphology, as an invaluable source of information in understanding plant evolution.

3.9 Conflicting Botanical Advice

Botanists have failed to make authoritative taxonomic lists readily accessible or intelligible to non-taxonomists. Section 5.1 offers advice about reliable references. Upton observes that botanical references often offer conflicting views.[55,56] Though differences of opinion do occasionally exist among botanists (especially when they have a different regional focus), by and large, there is a considerable consensus among professional taxonomists as to the current accepted "view" of any plant group based on available evidence (e.g., chemical, DNA, and morphological data).

This overwhelming consensus is largely obscured, however, by a multiplicity of botanical databases and online references compiled at different times for different purposes and with different geographical or taxonomic scopes. Consequently, botanical references can disagree with one another, creating challenges for non-taxonomists seeking guidance.[57]

Cataloging 1.4 million plant scientific names — and researching and classifying taxonomic relationships among 350,000 known plant species (as evidence accumulates and taxonomic opinion evolves) in order to maintain the relationships between these names — requires significant effort, investment, and persistence over time. Such efforts are under-resourced and, consequently, multiple botanical references do not attempt to do this work from scratch but simply copy data from others. Critically, these data "accumulators" often fail to maintain or update these data and thus do not reflect improvements and additions made to the original datasets that they copied. Therefore, over time, the content of well-curated datasets diverges more and more from copies of the content that have been embedded elsewhere. This is by far the most common and significant cause of the differences observed by Upton.[55,56] The Catalogue of Life (www.catalogueoflife.org), for example, relies on datasets supplied by taxonomists globally, including multiple family accounts from Kew, many of which are decades out of date.[58] Other apparently authoritative botanical references are equally constrained by their ability to update their old copies of data from source institutions like Kew.

The Plant List (TPL) illustrates this. It was initially completed in 2010[59] as the world's first attempt to list all plants for Target 1[60,f] of the United Nation's (UN's) Global Strategy for Plant Conservation.[61,62] The data were derived primarily from Kew, with contributions from the Missouri Botanical Garden and the collaborating authors of several species lists previously created for large, important plant families. Bob Allkin, PhD, a co-author of this article, was project manager and oversaw the creation and deployment of the TPL checklist, which needed to be achieved quickly to meet the UN deadline.

The team devised mechanisms for (1) detecting conflicting taxonomic opinions reflected among (and within) the data sources to be merged, and (2) resolving these inconsistencies using algorithms. For the latter, working with taxonomic botanists, the TPL team defined and employed ca. 40 "logical" and "taxonomic" rules to be applied sequentially. A key discovery was that there was no perfect sequence in which to apply these rules. One sequence would lead to one kind of bias, while another sequence would lead to a different bias. The dataset was simply too large and the time too short to ask taxonomic experts to review millions of data records manually, and we opted for "the least-worst" solution, knowing that some decisions would be in error. Each dataset supplied also contained errors, and the team knew of gaps in the coverage of these datasets. Despite these failings, TPL became extremely popular. It was easy to use and offered an apparent solution, retaining its status as the only "complete" list for some years. It became promoted as a standard reference in some editorial guidelines.

Unfortunately, neither Kew nor the Missouri Botanical Garden invested further in TPL, and from 2012, the data remained static: the errors were not resolved, the gaps were not filled, and the data became increasingly outdated and unreliable. Nonetheless, the website remained online and available for use by non-botanists unaware of these limitations until 2023.

3.10 Landraces and Cultivated Variants

The previous sections refer primarily to scientific names given to genera, species, subspecies, and botanical varieties. The *International Code of Nomenclature for algae, fungi, and plants*[25] governs the form and use of these names to describe populations of individual plants that share a common biology and chemistry. How species might best be defined is debatable, however,[63] and for both biological and practical reasons, the criteria used to recognize species vary among different classes of organisms.

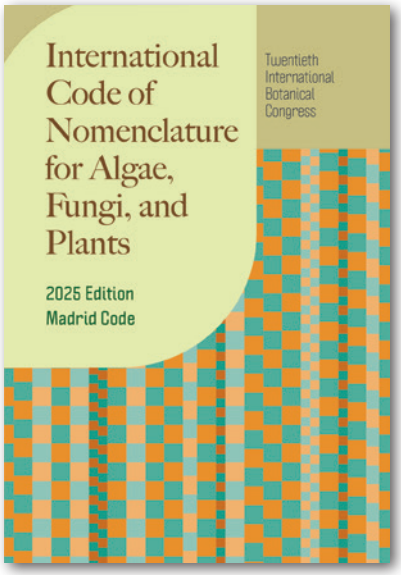
Reliably and consistently labeling subpopulations of plants within these species is less straightforward. Gardeners or chefs, for example, may be surprised to learn that broccoli, cauliflower, cabbage, kale, and brussels sprouts all belong to the same species (*Brassica oleracea* L., Brassicaceae). Over generations, these divergent forms have been selected by humans precisely for those traits that define and separate them today. Biologically, however, these differences are neither significant nor, critically, stable enough to merit

[f] The 2010 Target 1 for the Global Strategy for Plant Conservation was a "widely accessible working list of known plant species, as a step towards a complete world flora."[60]

recognition as separate species. Interbreeding may be possible, and how these plants grow or taste can also depend on their environment. The chemical profile of plant materials (*materia medica*) employed in preparing traditional Chinese medicines can also vary significantly from place to place. TCM practitioners and consumers may search for and pay considerably more for plant materials from specific geographical locations — just as one might select a bottle of wine based on the grape variety used and the type of soil or habitat ("terroir") in which it was grown.

The swollen leaf-bases of "Florence fennel"[64] are used as vegetables, while other fennel forms without swollen leaf-bases ("sweet fennel" and "bitter fennel") contain differing proportions of key constituents and are grown for seed and medicinal use. Such differences are important to growers and users and yet are not particularly stable nor easily linked to clear genetic distinctions. The characteristics of each group vary according to environmental conditions, and individuals of different groups may interbreed. All three forms belong to a single species: *Foeniculum vulgare* Mill. (Apiaceae), and different names are thus required for different cultivars or recognized "selections" (in addition to the scientific name of the species).

The *International Code of Nomenclature for Cultivated Plants* (ICNCP) (2016) establishes standards and procedures for the use of plant names in horticulture, agriculture, and forestry.[65] It plays a similar role to the botanical "Code" but focuses on cultivated varieties and trade names.[66] Because differences exist across continents and domains regarding how such names are controlled and employed, the "Cultivated Code" lists different standard authorities for each plant group. Varieties of commercial agricultural crops are recorded in regional, not global, reference resources,[67,68] which can overlap or contradict one another.



Existing horticultural and agricultural reference resources do not list all varieties. This is particularly the case for less-commercial species or locally recognized landraces (populations of domesticated plants that, over time, have developed characteristics distinct from other populations of that species to adapt to local growing conditions and cultivation practices). Many horticultural growers prefer using commercially beneficial trade names and region-specific name registration schemes. A single core index, equivalent to IPNI (Section 4.2), does not exist for cultivated varieties and selections, nor is such a resource ever likely to be practical.

4. Useful Tools and Solutions

4.1 Kew's Core Taxonomic Resources

Sir Joseph Banks (1743–1820) was the first, unofficial director of the Royal Botanic Gardens, Kew when it was established in London. Sir William Hooker (1785–1865) became director when the gardens opened to the public in 1840, after donation by the Crown. Many visitors to Kew are aware of its living plant collections and greenhouses, which cover 300 acres, but behind the scenes is a vigorous and wide-ranging research program. Kew is a major research organization with more than 580 research scientists (and 100 PhD students) studying multiple aspects of plant and fungal diversity: their systematics, conservation, uses, ecology, anatomy, and chemistry.

Kew's Herbarium, built in 1853, houses more than seven million specimens. Other collections at Kew include the Millennium Seed Bank, Library and Archives, the world's most species-diverse collections of fungi and DNA, as well as an economic botany collection that includes *materia medica* for TCM, Ayurvedic medicine, and other herbal products. These collections serve as critical reference points for effective authentication of herbal substances employing genetic (DNA), chemical, or morphological traits.

Kew's research focuses on plants and fungi of the tropics and sits at the heart of an international network of collaborating systematists sharing their expertise. Over the years, in addition to its physical collections, Kew has accumulated significant digital resources, some of which provide the foundation of scientific plant nomenclature and serve as global references.

4.2 International Plant Names Index (IPNI)

IPNI began in 1882 with a legacy donation from Charles Darwin (1809–1882).[29,69] Today, the database is available online (www.ipni.org) and includes collaboration with Harvard University and the Australian National Herbarium. IPNI catalogs all known published scientific names (ca. 1.4 million) and addresses the nomenclatural questions: "Is this a scientific name?", "Who published it?", "Where?", "When?", and "How is it spelled?" Other than occasional annotations, and in rare cases some "homotypic" synonymy, IPNI offers no information about plants, taxonomy, or synonymy and is of little direct use to most *HerbalGram* readers, although it is the necessary bedrock for botanical science on which the following resources build. IPNI publishes "persistent digital identifiers" for each name, facilitating global exchange of data about plants.

4.3 The World Checklist of Vascular Plants (WCVP)

WCVP, searchable via the Plants of the World Online (POWO) portal (Section 4.4),[70] catalogs all known vascular plants taxonomically (ca. 350,000). It establishes the number of species in each genus and which genera belong to each family (implementing the previously mentioned Angiosperm Phylogeny Group classification[5]). WCVP assigns each plant an accepted (preferred) name and links this to all its synonyms, drawing nomenclatural informa-

tion from IPNI. WCVP also includes each plant's habit and geographical distribution (native or naturalized).

Although compiled and hosted at Kew, WCVP is made possible by a collaborative network of contributors and reviewers from around the globe. Most global online botanical references include copies of parts or most of WCVP (e.g., The Catalogue of Life,[58] World Flora Online,[71] and Global Biodiversity Information Facility[72]), underlining its importance. Sadly, the copies employed by many collaborators were often shared by Kew many years ago and have not been updated to reflect more recent research or subsequent expansion and improvement of WCVP. Each, therefore, offers potentially conflicting taxonomic views (Section 3.9).

Kew's own systems, POWO (Section 4.4) and MPNS (Section 4.5), embed WCVP directly and thus track taxonomic changes and underlying improvements.

4.4 Plants of the World Online (POWO)

Kew's searchable POWO portal[47] (http://powo.science.kew.org) brings together much of the digital content describing plants and their uses currently available to Kew and its collaborators. POWO offers an enriched view containing images, distribution maps, and diverse types of descriptions of plants drawn from multiple sources. It is a growing resource, and new datasets and images are being added continuously. POWO relies on the full WCVP synonymy to bring together publications, archival manuscripts, specimens, and images of a single plant despite these having originally used different scientific names.

4.5 Medicinal Plant Names Services (MPNS)

Kew's MPNS offers a suite of tools and information services, including a searchable portal[12] (www.kew.org/mpns) that is designed to address issues and answer questions facing health regulators, natural product chemists, herbalists, ethnobotanists, and others who need to refer reliably and unambiguously to herbal substances and/or medicinal plants. It allows users to retrieve comprehensive information about medicinal plants and to exchange data records meaningfully. MPNS captures the enormous ambiguity, inconsistency, and confusion in the medical literature regarding the names of plants and substances derived from them and facilitates users in resolving this ambiguity by deploying Kew's authoritative taxonomic references. MPNS enables users to navigate the "plant names jungle," as colleagues at the World Health Organization's (WHO's) Uppsala Monitoring Centre (WHO-UMC) in Sweden like to refer to it.[73]

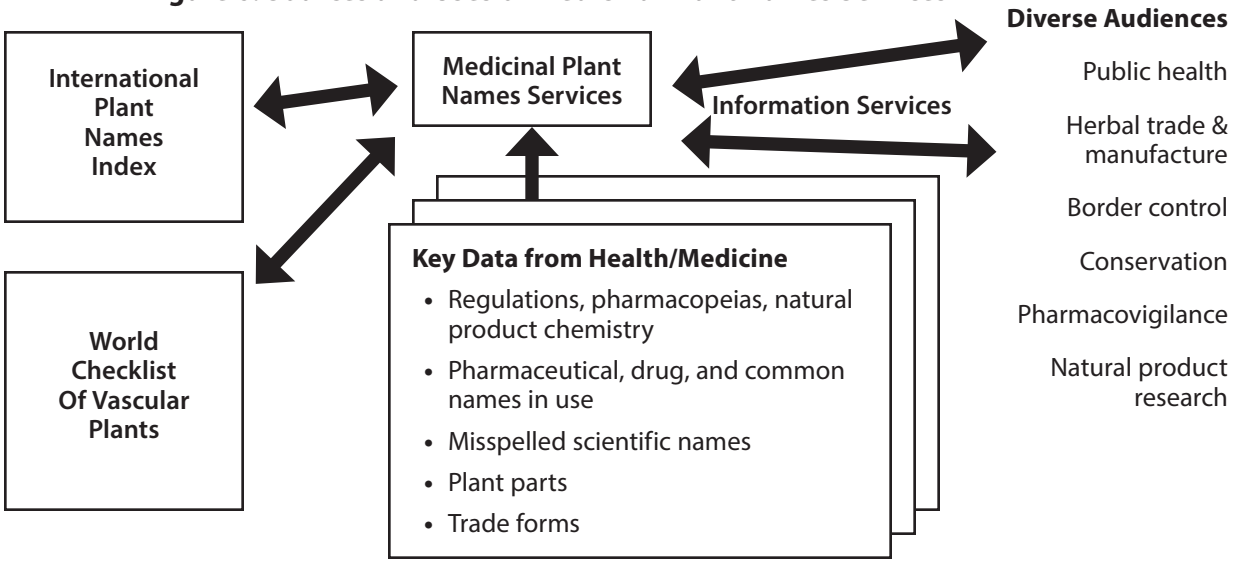
Figure 6 illustrates how MPNS builds on Kew's core taxonomic and nomenclatural references and deploys them specifically for use within the herbal community.

Content of MPNS

Version 13 of MPNS was published in December 2023 and indexes the names, substances, and plant parts cited in 361 medical, regulatory, natural product, and ethnobotanical references.[74] Together, these provide evidence of more than 38,000 different plants (more than 34,500 unique species with the remainder being particular subspecies or varieties of those species) cited as having a medicinal use. Table 2 summarizes the content of Version 13. After its initial publication in 2014, MPNS has grown as Kew has indexed an increasing number of data sources (Figure 7).

MPNS records the common, drug, pharmacopeial, and scientific names (including those that are misspelled) cited in these 361 references and enables users to track how pharmacopeial names (and their definitions of herbal substances) vary among different pharmacopeias or even among editions of one pharmacopeia. Drawing on these 361 resources, MPNS has cataloged more than 600,000 different names in use for these plants, products, or both. It is worth emphasizing that MPNS' primary role is not to tell people which is the "right" name for a given plant (although this is frequently requested). Instead, MPNS aims to record this multiplicity of names and use Kew's current taxonomy as a scientific baseline with which

Figure 6. Sources and Uses of Medicinal Plant Names Services



to map them to one another, while also exposing ambiguity. MPNS also provides support for users in resolving such ambiguity among common, pharmaceutical, and trade names, or among differently spelled or abbreviated variants of scientific names as included in the medical literature and regulations.

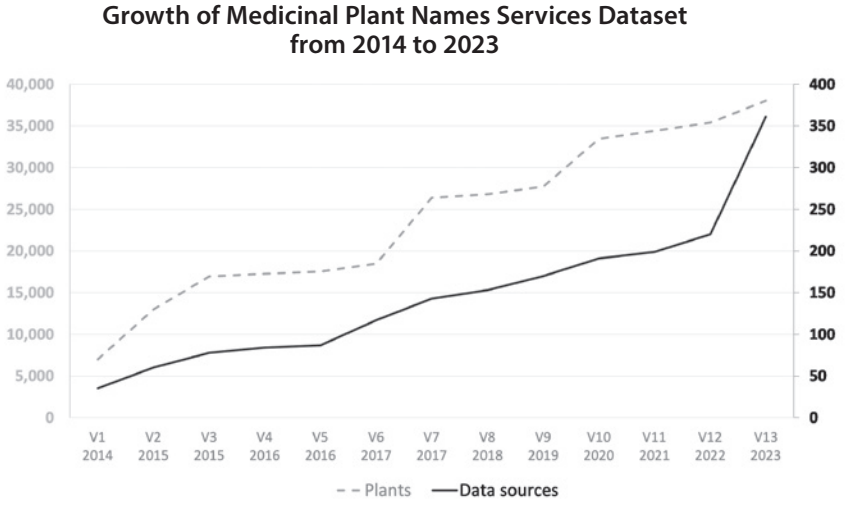
MPNS addresses ambiguity by mapping names to Kew's authoritative plant taxonomy.[70] For each plant, this taxonomy provides MPNS users with up-to-date data about the preferred scientific name, scientific synonyms, taxonomic position, and geographical distribution. MPNS relies on the expertise and judgment of the global community of botanical experts and makes no taxonomic judgments of its own. The taxonomy and botanical nomenclature in MPNS are refreshed annually to reflect enhancements in WCVP[70] and IPNI.[29] Citing the version of MPNS used provides a paper trail, should the taxonomic position of the plant change over time.

Each version of MPNS also includes newly added medicinal plant references.[75] Literature from less documented countries or disciplines is prioritized, and suggestions are welcome regarding gaps in coverage. MPNS also records the plant parts and forms used, and species can be retrieved according to where they are recorded as being used, or whether they are documented as regulated or in trade, for example.

Table 2. Content of MPNS V13 by the Numbers

Content Type	Number Included
Regulatory, research, and herbal references, databases, and other sources indexed by MPNS	361
Unique medicinal species cited in those references	34,715
Unique plants (species, subspecies, and varieties) cited as having medicinal use in those references	38,013
Plant families to which those species belong	389
Unique pharmacopeial names employed by the data sources indexed	3,044
Unique common and other non-scientific names employed by the data sources indexed	252,656
Unique scientific names in use for those species	323,455
Records of names cited in one or more data source	856,097

Figure 7. Growing Evidence for Plants with Medicinal Uses



The search portal

MPNS' portal is freely available and enables users to disambiguate names and navigate between regulatory or research references that refer to a medicinal plant or herbal substance, regardless of which names these publications originally used. One can search names in Arabic, Chinese, or several other scripts, as well as names in other languages in Roman script.

Each search detects and makes visible any ambiguity inherent in the entered name. Searching MPNS V13 for the Pinyin name "Mu Xiang," for example, will report that this name was found in 15 different references to refer to herbal substances derived from 11 different plants. For each plant, MPNS provides users with its accepted scientific name and synonyms, as well as the parts used and non-scientific names recorded in any of the 361 medicinal sources indexed by MPNS, regardless of whether they include the name "Mu Xiang." The species *Dolomiaea costus* (Falc.) Kasana & A.K.Pandey, for example, is cited in 66 different herbal sources, and users may browse the data recorded from all of these sources.

The portal also links to richer information sources (including POWO[47]) and allows users to retrieve records comprehensively from PubMed.[31] By searching for published articles using all known scientific synonyms simultaneously, MPNS will retrieve all available articles relating to that plant, which is not possible using PubMed's own website. Table 3 presents the significant numbers of synonyms used for medicinal plants, which make it challenging to find all relevant records from the literature or online databases.

The network and digital services

MPNS benefits from a global network of partners working in research, regulation, pharmacovigilance, and trade. The MPNS team deploys its data, tools, and expertise

to help other organizations manage, improve, and enrich their own datasets concerning herbal products.

The FDA, the WHO-UMC, and the Medicinal and Aromatic Plant Resources of the World (MAPROW) database[75] are among MPNS' longest-standing collaborators. Other collaborators include medicinal plant and natural products specialists in many countries, including India, Sri Lanka, Indonesia, and Brazil, which are themselves building catalogs of plants used locally.

Table 3. Numbers of Plant and Herb Names in MPNS V13

All Plants	Total Number
Vascular plant species (WCVP)	ca. 350,000
Scientific plant names (IPNI)	ca. 1.4 million
Scientific synonyms per species (WCVP)	ca. 4 names per plant
Medicinal Plants	
Medicinal plants	38,013
Scientific names in use for medicinal plants	323,455
Scientific synonyms for each medicinal plant	ca. 8.5 names per plant

MPNS' validation service ensures the integrity and nomenclatural richness of its partners' databases and enables them to find and link to other relevant resources. Typically, the MPNS team initially checks that the Latin names used are genuine scientific names — meaningful and unique. They then suggest updates to the partner's taxonomy (supplying accepted scientific names and families), check the integrity of the partner's dataset (e.g., did they list plants twice using alternative synonyms?), and enrich their dataset with all known synonyms, families, geography, or any other available data. This partner network thus shares a common taxonomy and terminology and can reliably link and exchange data with one another. In return, MPNS incorporates the plants, substances, and names they record.

MPNS data services offer partners annual data refreshes, keeping their datasets up-to-date and making explicit the nomenclatural and taxonomic changes that have occurred that year to plants of relevance to the recipient.

MPNS training and consultancy services build on the considerable expertise and experience that the team has gained in managing data about medicinal plants and herbal substances.[76] MPNS offers advice and training on best practices in the use of plant names and how to structure databases to handle these data effectively.

Supporting international drug standards

Health regulators struggle to exchange information and data records regarding medicinal products, including pharmaceutical drugs, because they are known by different names in different countries or disciplines. "Acetaminophen," as the drug is known in the United States, is known as "paracetamol" in the United Kingdom, for example. The International Organization for Standardization's (ISO's) Identification of Medicinal Products (IDMP) standard[77,78] was developed by a consortium including the FDA,[79] the Royal Netherlands Standardization Institute, industry figures, and MPNS, among others. IDMP seeks to facilitate information exchange and support more consistent drug regulation. The standard has been adopted and implemented by other major regulators (e.g., the European Medicines Agency[80] and WHO) and pharmaceutical companies.

IDMP also covers herbal substances, which it classes as complex substances.[81] MPNS worked with the FDA and others in developing a data structure suitable for storing the necessary information about these complex substances and offers a data service providing "controlled vocabularies" for plant parts and scientific plant names to address this need within IDMP. These are currently supplied via the FDA through its Global Substance Registration System (GSRS) implementation of IDMP.[82,83]

4.6 How Many Medicinal Plants Are There?

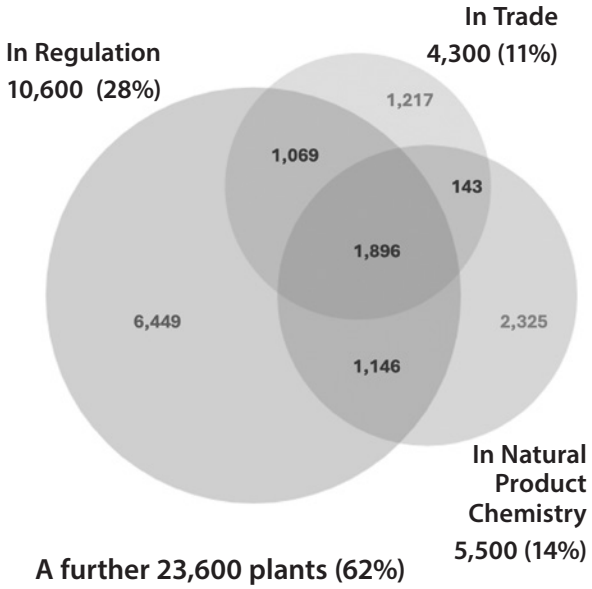
Such an apparently simple question is, in practice, challenging to answer for at least two reasons. First, what do we mean by "medicinal" use? Different publications adopt different definitions. Some include aromatic plants and others do not. Some exclude plants known to be toxic when used in higher concentrations. The primary benefits of some products listed in the *Ayurvedic Pharmacopoeia of India* are viewed by some as being nutritional rather than strictly "medicinal." Rather than attempt to resolve such alternative definitions, MPNS adopts a wide definition including any plant explicitly recorded as being "medicinal" in the literature.

The second challenge relates to how one might count the species in use given that publications use different scientific names for the same plant. Cataloging lists of scientific names is only a first step. One then needs to decide how many plants those names represent, and in this regard, MPNS is extremely well-placed.

From its outset, MPNS benefited from close collaboration with Uwe Schippmann, PhD, and his MAPROW database, regularly used and cited by the International Union for Conservation of Nature (IUCN) Medicinal Plant Specialist Group.[75] This invaluable partnership remains as important today. Before working with Kew, MAPROW had cataloged 27,000 scientific medicinal plant names. Schippmann's challenge was knowing which of those names were current and which were older synonyms of others already in the list. By deduplicating the synonymy present in the MAPROW list, MPNS found it to refer to ca. 17,000 unique species. (An article[84] published in *HerbalGram* issue 111 in 2016 stated that Kew's species list was shorter than the MAPROW list when, at that point, they were, in fact, the same length.)

In 2017, Allkin et al summarized medicinal plant diversity using records accumulated by MPNS of about 28,000 different plants recorded as having medicinal use.[33] That number has grown to 38,000 today and is still growing.[12] This statistic remains lower than the published figures of 50,000 to 70,000 species that Schippmann et al (2006)

Figure 8. What Percentage of Medicinal Plants Are under Formal Regulation?

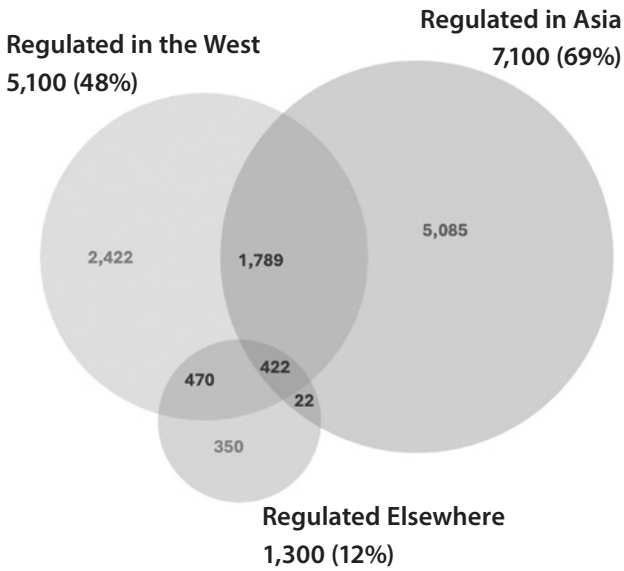


A further 23,600 plants (62%)

NOT reported as being:

- In Trade,
- In Regulation, or
- In Natural Product Chemistry

Figure 9. What Percentage of Regulated Medicinal Plants Are Regulated by Major Western Authorities?



estimated to be the number we might eventually record.[85] As MPNS increasingly indexes new reference sources, we find evidence for the medicinal use of additional species (Figure 7). Currently, MPNS remains the most comprehensive list of medicinal plants available, and the MPNS staff is committed to growing the resource further. Version 14 of MPNS became available in November 2024.

4.7 What Does MPNS Tell Us about the Regulatory Status of Herbs?

A sound, de-synonymized list of plants enables us to answer other important questions. For example, V13 of MPNS shows that of the 38,013 medicinal plants included, only 28% are formally regulated somewhere in the world (Figure 8). Figure 9 breaks this figure down further, illustrating that less than half of these regulated plants are "known" to either the FDA, WHO, or EMA: most of the remaining plants are regulated in parts of Asia.

Figure 8 also summarizes evidence gathered by MPNS as to which plants are recorded as being "in trade" or as having been referred to in the natural product chemistry literature. Most striking, perhaps, is that the evidence gathered by MPNS to date indicates that only 38% of medicinal plants are either regulated, traded, or studied chemically. Of the 38,013 plants, 62% are less well known and are typically reported in the ethnobotanical literature as being used traditionally in one or more communities. This is a measure of the unexplored potential of medicinal plants.

4.8 Using MPNS for Studies of Conservation and Intellectual Property

Using MPNS data, Howes et al (2020) reported that, on average, the extinction risk for medicinal plants is lower than for plants with no reported medicinal use.[86] The odds of a species being listed as "threatened" on IUCN's Red List are five times lower for medicinal species.[87] There are well-documented cases of conservation threats for medicinal plants, particularly through uncontrolled wild harvesting, but this overall assessment speaks both to the care paid by humans in conserving plants of value to them and that "weedy" species (which typically have low mean extinction risks) are disproportionately represented in traditional medicinal floras. Mapping MPNS against the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) species lists and global assessments of red-listed species will permit future versions of MPNS to flag species of conservation concern.

Simmonds et al (2020) explored the diversity of plant species cited in UK patents and sought to compare them with MPNS to point to untapped potential.[88] A striking feature of this analysis was that only 65% of the plant names cited in UK patents could be confidently matched to a known scientific plant name (even when allowing for modest differences in spelling or the presence of homonyms). Of the patents assessed, 35%

Fennel *Foeniculum vulgare*
Photo ©2025 Steven Foster

therefore failed to effectively establish (unambiguously and precisely) which species was referred to.

The Indian government seeks to protect intellectual property (IP) associated with traditional uses of medicinal plants in India. Its Traditional Knowledge Digital Library (TKDL)[89] has achieved wide recognition, including support from the World Intellectual Property Organization, which encourages patent officers to consult TKDL before granting new patent applications. However, TKDL's plant list mostly follows older and conflicting taxonomies and almost entirely lacks synonymy, preventing the government from protecting Indian IP effectively. MPNS is in a position to resolve these challenges and enrich the TKDL list with full synonymy. We are working with Indian partners and talking with the World Intellectual Property Organization to see how this might best be achieved.

5. A Guide to Best Practices

5.1 Best Practices When Using Plant Names in Publications

Those publishing research, pharmacopeias, or regulations, or creating adverse reaction records have a responsibility (and self-interest) to record which plant(s) they refer to precisely and unambiguously. Neither common names nor pharmacopeial names are adequate and will always be open to misinterpretation. Scientific plant names are therefore obligatory since each is objectively defined and static in meaning.

Previous sections point to pitfalls when using scientific names arising from issues inherent in their use and meaning. Table 4 provides guidance regarding how to employ plant names in publications and when searching for published references.[47,45,90-92]

5.2 Useful Publications

Allkin and Patmore (2020)[15] cover the ground included in this article in more detail and focus specifically on issues facing those working in pharmacovigilance. Allkin (2013)[14] and Bennett and Balick (2014)[93] offer insights regarding the significance of plant nomenclature to biomedical research. Rivera et al (2014)[45] demonstrate how poorly scientific nomenclature may be used even in highly respected journals. Dauncey et al (2016)[92] outline common mistakes in using plant names and offer recommendations as to how to avoid them. Roy Upton and colleagues at BAPP and AHP explore diverse aspects of the relevance of botanical nomenclature to the herbal industry.[94,55,56]

No article concerning the naming of medicinal plants and herbal ingredients would be complete without recognition of the *American Herbal Products Association's Herbs of Commerce*, now in its third edition.[19] The first edition, published in 1992, contains around 550 plant species and was adopted by the FDA in 1997 as a standard for common names for products sold in the United States, giving the American Herbal Products Association (AHPA) list resonance for the US market. The second edition,[95] containing approximately 2,000 plant species, was published in 2000 and indexed (i.e., incorporated and mapped to Kew's taxonomic resources) by MPNS. The third edition, published in July 2023, covers more than 2,800 species including more than 300 Ayurvedic and 700 *Pinyin* names. MPNS hopes to index AHPA's third edition in the future.

AHPA's ambition is to "standardize" common names used across the United States. This goal may be possible within the United States but, as outlined above, there can be no certain way of controlling how common names are used (or have been used in the past) in different countries,

Cistus × incanus
Photo ©2025 Steven Foster

Table 4. Best Practices When Using Plant Names in Publications

Use valid, correctly spelled scientific names	Neither common names nor pharmacopeial names alone are adequate. They are open to misinterpretation. Scientific plant names, including citation (ideally using correct abbreviation) of the publishing author(s), are therefore obligatory, being both objectively defined and static in meaning. Use of the full name citing its author(s) is necessary only the first time that name is used within an article. Authors should not assume that scientific names cited in published research articles or in pharmacopeias are necessarily well-formed and meaningful. It is wise to consult a recent taxonomic reference work to avoid repeating past errors. It is particularly important to use full scientific names, without genus abbreviations, in lists or tables that refer to multiple plants. Authors of research papers may further wish to ensure they are using the currently accepted scientific name for that species rather than an older synonym, certainly if there is consensus. If generic placement has changed, using the modern accepted name informs readers as to the taxonomic position of that species and which other species are most closely related. Where consensus may still be lacking regarding the taxonomic arrangement (and preferred scientific name) of a plant, it is important to be aware of evidence in taxonomic publications to suggest which plants share an evolutionary past and are more likely to share chemical pathways.
Cite significant synonyms	In a manuscript, it is not necessary to include all known synonyms, but inclusion of those synonyms that are likely to be familiar to the intended readers will improve the chances of communicating effectively. Inclusion of relevant synonyms is particularly important when recent taxonomic changes have led to alternative naming conventions for a species. One may hold a strong view as to which name is "correct," but it is important to remember that readers may hold alternative views or be consulting taxonomic sources that present a different view. Papers that include long lists or tables citing many plants risk including single plants more than once under alternative synonyms unless the authors are aware of synonymy. MPNS is developing an automated service, for use by authors, journals, and editors, with longer lists of names to check.
Cite the adopted taxonomy*	Since taxonomies are ever changing, when using MPNS (or any other reference), it is necessary to quote the version number or year of publication (e.g. MPNS V13 2024) to be precise as to the reference that is followed. As stated previously, for most purposes, the choice of scientific name one employs for a given plant is less critical than one's awareness that different scientific names are in use and considered synonymous. The choice of accepted scientific name for a given plant (e.g., when publishing an article or regulation) should, in any event, follow a recognized authoritative taxonomic reference. Citing this reference and the date and version employed will enable readers to be certain of the taxonomic delimitation that was followed (e.g., How many and which species are recognized in a genus? Are other subspecies recognized?). Older, incomplete, and infrequently updated taxonomic references will often mislead and should be avoided. For plants not known to have medicinal use, Kew's Plants of the World Online (POWO)[70] provides globally peer-reviewed taxonomic information that is consistent with that used in MPNS. The taxonomy embedded in POWO is updated daily rather than being versioned annually as with MPNS.
Avoid imprecision	Citing the name of a genus or family without specifying exactly which species are referred to can introduce imprecision, since the definitions of genera or families (and how many species are included) change over time (Section 3.3). It is important to cite whichever taxonomic reference was employed to establish the precise delimitation of the genus or family referred to.
Be aware of synonymy when searching the literature	Comprehensively locating research publications or other data referring to a particular species requires one to perform searches using all the plant's scientific synonyms that may have been used in the literature. MPNS' search portal allows users to search external websites such as PubMed using all synonyms simultaneously, thereby ensuring comprehensive retrieval regardless of which scientific synonyms were used in the original publications. Searching any online database using a genus name alone will retrieve any record that cites that genus name. This may include records of both species now belonging to that genus (intended) and species that have been moved to other genera (unintended).
Avoid false conclusions	Pharmaceutical names are used differently among pharmacopeias. Readers of articles employing only pharmaceutical names (e.g., "Cimicifugae rhizoma") will be uncertain, therefore, as to which herbal substance or plant is being described (Figure 2), unless the authors of that article state which pharmacopeia (and edition) they refer to. Readers should be cautious when finding scientific binomials that lack their publishing author(s). Binomials sometimes have been incorrectly re-used to describe more than one species, making it unclear which of those plants the author of the publication intended. MPNS has worked with multiple researchers to help resolve their lists of plant names where this issue, among others, is relatively common.
Ensure the identity of the plant	Citing a valid scientific name is of little value if the plants described were misidentified. This is not the primary topic of this article, but it is important to note that citing voucher specimens (where they are deposited and how the specimens were identified) will add credibility to published research and enable readers to confirm the identity of the plants studied. Such a practice ensures reproducibility of one's research.[45,91-93]

* This is particularly relevant for those seeking to be precise about the exact plant population, biological entity group, or chemistry to which they refer and may not be as critical for those referring more broadly to well-known medicinal plants or natural products.

on different continents, or even in different professions. Common names mean different things to different people, even if they share a common language. Internationally, among countries from which the ingredients for US products may derive, there will continue to be diverse use and interpretation of these names. AHPA faces another challenge in providing up-to-date botanical taxonomy and scientific nomenclature given the rapid rates of change (Table 1). It is in this regard that MPNS hopes to be able to contribute more directly to future editions of AHPA's *Herbs of Commerce*.

6. Summary

In this article, we hope to have conveyed how the use of names has practical consequences and how their inappropriate use and misinterpretation can lead to significant problems, whether that misuse occurs in published scientific research, health regulations, or on product labels.

We have reviewed the classes of names used in herbal medicine, illustrated common pitfalls, and offered guidance on how to avoid them. In particular, we hope to have clarified what scientific names actually are, why they are necessary, and that the meaning of each individual scientific name will remain forever static, regardless of any changes that occur in the choice of scientific name used for a particular species. We hope to have explained why these names must continue to change if taxonomy is to accurately predict which features may be shared by plants, including their metabolic pathways.

6.1 The Next Steps

The authors invite readers to stay up to date with their work by signing up for the MPNS Newsletter,[96] which contains announcements about new content and features as they appear.

MPNS is relevant only if it meets the needs of its users. We encourage readers and users to write regularly and let us know how they would like to see the portal or other services improved and extended (e.g., what data sources are lacking, etc.).

In a potential subsequent article, we look forward to reporting developments such as the addition of images and conservation status to MPNS, as well as its expansion to become Plants for Health,[97] which will explicitly cover dietary and food supplements, other health products, and nutritional and toxicological issues. HG

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***Kristina Patmore** is currently the Digital Resources Manager for Kew's Plants for Health initiative and previously worked to build, curate, and deploy the MPNS database.*

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Basil *Ocimum basilicum*
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Rosemary *Salvia rosmarinus*
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Star anise *Illicium verum*
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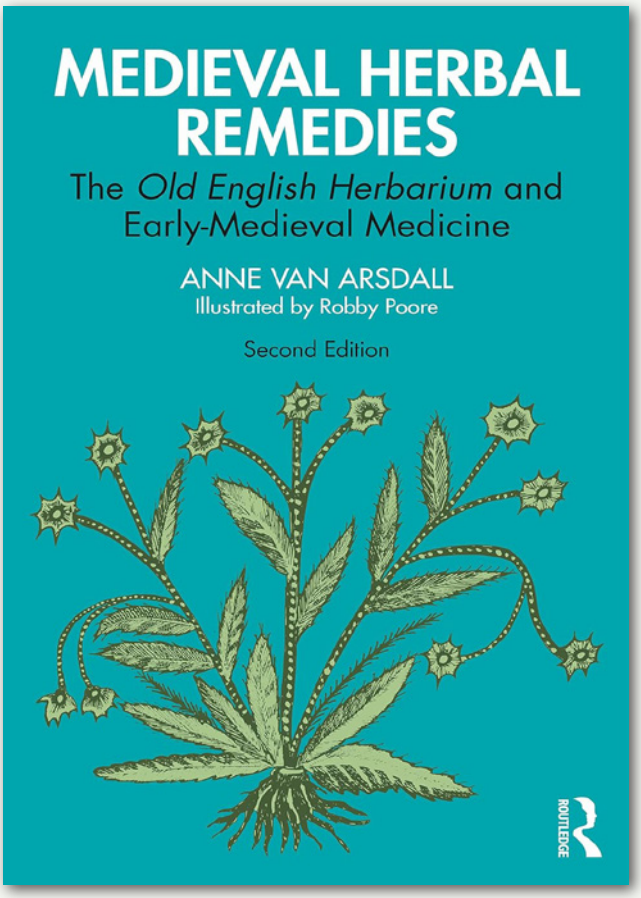

***Medieval Herbal Remedies: The* Old English Herbarium *and Early-Medieval Medicine*, 2nd ed.,** by Anne Van Arsdall. New York, NY: Routledge; 2023. Softcover, 260 pages. ISBN: 978-0-367-75377-1. $48.99.

By David Hoffmann, FNIMH, RH (AHG)

***Medieval Herbal Remedies*, now in its second edition, is an important scholarly text that applies the insights of modern historiography to an often-opaque part of British medical history and related *materia medica*. Recent years have seen a dramatic reinterpretation of culturally accepted history, challenging the orthodox narrative regarding historical events, timespans, or phenomena by reinterpreting the motivations and decisions of the people involved.**

Consider the cultural assumptions bequeathed to paleoanthropologists, who once viewed Neanderthals as cognitively dull and too clumsy to use tools efficiently. However, a plethora of insights from the reassessment of European sites suggests they were imaginative enough to carve artistic objects and clever enough to invent a language. As anthropologist Fred H. Smith, PhD, wrote, rather than culturally bereft scavengers with primitive tools, Neanderthals "were highly intelligent, able to adapt to a wide variety of ecological zones, and capable of developing highly functional tools to help them do so. They were quite accomplished."[1]

It is in this spirit of reinterpretation that author Anne Van Arsdall, PhD, approaches 19th-century philologist* Thomas Oswald Cockayne's (1807–1873) translation of the Old English medical text collection known as *The Old English Herbarium*. Cockayne is best known for his translations of these texts, but his choice of terms to translate the antiquated language he found abounds with cultural assumptions and moral judgments. Medical historians' informing schoolteachers led to generations of English schoolchildren being told that Anglo-Saxon herbalism was "folk medicine at its lowest level."[2]

It is in rectifying this misapprehension that *Medieval Herbal Remedies* shines. Van Arsdall's new translations of medical texts previously translated by Cockayne greatly benefit from her exploration of Cockayne's life and works and her multidisciplinary expertise in the *materia medica* of medieval European medicine and its philological complexities. Cockayne is best known for his edition of translations of Old English medical texts, and this is the focus of *Medieval Herbal Remedies*.

Van Arsdall's updated text is a rich resource that extensively discusses the Latin, Germanic, and Old English philology of the *materia medica* of the day, which is important to historians, but, alas, of only passing interest to clinical phytotherapists. This irreplaceable scholarly material is put in the context of the era in which Cockayne worked. The particulars of his life are not the focus of this review, but Cockayne was a divisive academic figure — seemingly out of a 19th-century soap opera.

The Old English Herbarium includes Cockayne's translation of an important herbal collection titled *The Leechbook of Bald*. The original Old English and medieval Latin text survives in only one manuscript, which is part of the British Library in London. Known by its accession number "Royal MS 12, D xvii," it contains two distinct collections of medical material, beginning with a copy of the *Old English Pharmacopeia* followed immediately by a second, independent collection of cures in Old English. The collection was compiled in the ninth century, possibly as part of the educational reforms of Alfred the Great (ca. 849–899), and the manuscript itself originates from the mid-10th century.

The name of the collection comes from a Latin verse at the end of the second book, which reads *Bald habet hunc librum Cild quem conscribere iussit*, meaning "Bald owns this book, which he ordered Cild to compile." A common misconception is that the title is a reference to the use of leeches, when the word actually comes from *læca*, the Old English word for "physician." Thus, it is a doctor's handbook. (Cockayne's title for the work, *Lacnunga*, an Old English word meaning "remedies," is not in the manuscript.)

For those interested in herbal history, information about medieval herbal formulations is becoming increasingly digitized. Some larger libraries now provide free access to view collections online, as does the Digitized Medieval Manuscripts web app (DMMapp), which links to more than 500 medieval manuscripts.[3] The British Library has also made the complete set of the *Old English Herbarium* available online,[4] along with blogs on medieval medicine.[5]

* Philologists specialize in the study of languages, especially their history and development.

Van Arsdall's translation shows the *Old English Herbarium* covers 201 plants named with modern binomial designation. For example, the entry for wood betony is headed as follows: "Wood Betony (*Stachys officinalis*) betonica, Biscopwyrt [old English]" (page 124). The herb is now classified as *Betonica officinalis* L. (Lamiaceae), with *Stachys officinalis* (L.) Trevis. as a recognized synonym.

This highlights the taxonomic uncertainty facing all who explore medieval herbal literature. The fundamental challenge of untranslatable names adds to the taxonomic trepidation. In the book, there are 49 entries where no direct botanical correlation can be made and, therefore, these entries do not include a binomial. In addition to herbs that are well-known from medieval European medicine, the text includes ashwagandha (*Withania somnifera*, Solanaceae) as *argand* from Unani medicine, the origins of which lie in ancient Greece. "This plant was grown in Greece and the Middle East and is mentioned in many old Unani books to treat aging, stress and improve fertility," according to the book (page 213).

An opportunity was missed in not comparing the Anglo-Saxon herbalism revealed in Cockayne's translations with the writings of Welsh herbalists of the same period. The writings of the Physicians of Myddfai from Myddfai in Carmarthenshire, Wales, contain much that shows the *Lacnunga* and its associated texts to be quite primitive compared to the practice of medicine across the border of Offa's Dyke (an earthwork that roughly follows the border between England and Wales).[6]

There is a very unfortunate weakness resulting from the editorial process. The index is of minimal use. In fact, the entry for the letter "T" only reaches "translation." In a book of this competence, the publisher has let down the author badly. The important insights of this book should be seen in a wider historical context found, for example, in *Medical Texts in Anglo-Saxon Literary Culture* (Boydell & Brewer, 2020).[7]

Despite these minor shortcomings, *Medieval Herbal Remedies* is an irreplaceable text for historians of early British medicine, as well as the development of British intellectual life. However, the book has little immediate relevance to clinical phytotherapy. HG

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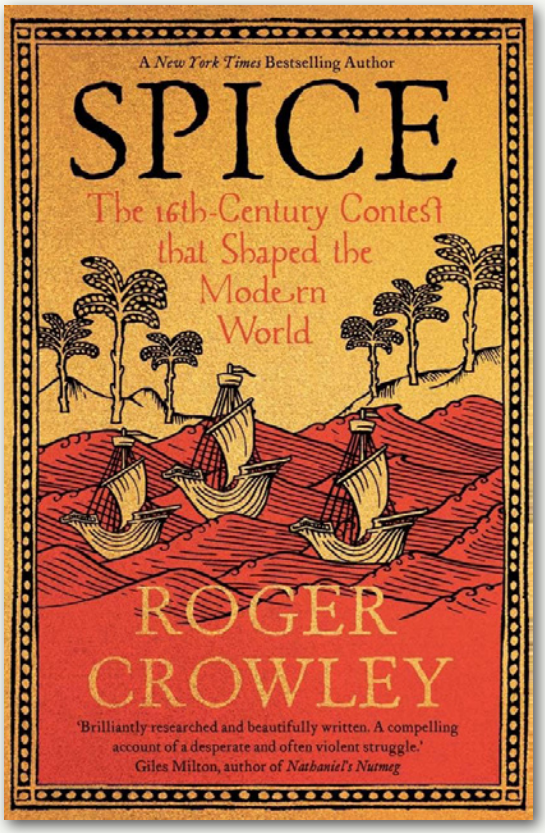

Spice: The 16th-Century Contest That Shaped the Modern World by Roger Crowley. New Haven, CT: Yale University Press; 2024. ISBN: 9780300267471. Hardcover, 320 pages. $25.00.

By Mark J. Plotkin, PhD, LHD

> "The history of spices is the history of trade."
> —*The Economist*, December 17, 1998[1]

One of the most significant and vital eras in the history of ethnobotany coincided with the spice trade during the European Age of Discovery, which began in the 15th century with the Portuguese exploration of Africa and wound down in the late 17th century when cultivation of spices expanded throughout the tropical world. Nonetheless, the trade in spices by Arab, Chinese, and Indian merchants commenced long before European involvement. Botanical bounty like cinnamon (*Cinnamomum* spp., Lauraceae), cloves (*Syzygium aromaticum*, Myrtaceae), nutmeg (*Myristica fragrans*, Myristicaceae), and black pepper (*Piper nigrum*, Piperaceae) were moving from Southeast Asia and India to the Middle East long before the early 1400s when Prince Henry the Navigator (1394–1460) kickstarted Portuguese exploration of tropical regions.

The spice trade changed the world in many fundamental areas, including agriculture, cartography, navigation, religion, spycraft, and even major aspects of capitalism as we know it. As a 1998 article in *The Economist* noted: "If history's modern age has a beginning, [the spice trade] is it…. To support this expansion [into tropical regions, Europe's] merchant classes would invent new forms of commercial credit and the first great corporations, vital parts of capitalism's operating system, and spread their trading networks across the seven seas."[1]

Charles Corn, in his excellent 1999 book *The Scents of Eden: A History of the Spice Trade* (Kodansha America, Inc.), echoed these sentiments: "The Spice Trade was the lifeblood of civilization and brought with it a tide of wealth sweeping through a still largely barbaric Europe. Literally worth their weight in gold, the cloves, nutmeg, mace [derived from nutmeg], cinnamon, ginger [*Zingiber officinale*, Zingiberaceae] and [black] pepper spawned a new age of revolutionary economics based on credit, the rise of a rudimentary banking system, and ultimately free enterprise."[2]

It is difficult to overemphasize the importance of spices and the spice trade in the ancient world. In the words of my late colleague Frederic Rosengarten Jr. (1916–1998), spice grower and historian, in his 1969 classic *The Book of Spices* (Livingston Publishing Company)[3]:

> As we look back across some five thousand years of recorded history, we begin to grasp the pivotal part that spices have played in the development of modern civilization. In an epoch where Europe knew nothing of sugar, tea [*Camellia sinensis*, Theaceae], coffee [*Coffea* spp., Rubiaceae], chocolate [from cacao; *Theobroma cacao*, Malvaceae], potatoes [*Solanum tuberosum*, Solanaceae], citrus fruits [*Citrus* spp., Rutaceae], or tobacco [*Nicotiana* spp., Solanaceae], to say nothing of plumbing or refrigeration, Oriental spices supplied flavor and piquancy for food and drink and fragrant aromas to mask a multitude of unpleasant odors. So useful, indeed indispensable, were spices, both politically and economically, that kings sent expeditions in search of them, merchants risked life and fortune to trade in them, wars were fought over them, whole populations were enslaved, the globe was explored, and such far reaching changes as the Renaissance were brought about by the restless, ruthless competition.

Spices played many roles in the ancient world. As today, they were culinary staples, enhancing flavors in bland and monotonous diets. Unlike today, they were often used to mask the flavor of foods that were past their prime, a necessity in an age without refrigeration. Spices were

Black pepper *Piper nigrum*
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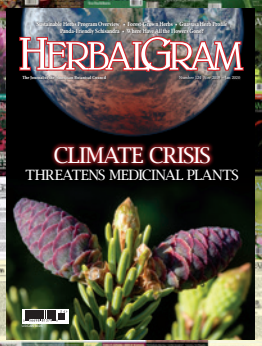

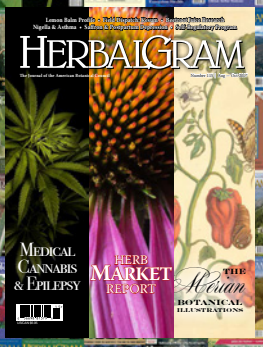

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a mainstay of ancient medicine for a comparable reason: They harbor essential oils and compounds that can inhibit the growth of bacteria and other microorganisms. The importance of the antimicrobial effects of spices — an essential benefit in a world without the antibiotics that are available now — is often downplayed or overlooked in histories of the spice trade.

Their fragrances also were valued for what we would now term aromatherapy. In an epoch where soaps and perfumes were either unavailable or the province of the very wealthy, sweet-smelling spices were in great demand.

Both these properties — antimicrobial and aromatic — were undoubtedly reasons that spices served as key commodities in Egyptian mummification rituals. Ancient Jewish traditions also widely employed plant products. Spices like cinnamon, for example, were used to make anointing oils and burned as incense in the Temple in Jerusalem.

For the Romans, spices ranked among the most highly prized commodities in the Eternal City. The historian and naturalist Pliny the Elder (ca. 23–79 CE) famously criticized the empire's obsession with spices, complaining that Rome wasted enormous sums on frivolous foreign luxuries. His remarks highlighted a larger concern about the drain of wealth to Asia in exchange for spices and other commodities. So much wealth flowed east that gold and silver Roman coins are still occasionally found in India, particularly in the south near the Malabar Coast where black pepper originated.

Spices have loomed large in both history and religion for thousands of years. Muhammad, the founder of Islam, was a spice merchant by profession. In the Book of Genesis, Joseph is sold to Arabian spice traders who were headed to Egypt, foreshadowing the Jews' eventual return to Israel (the Exodus) from the land of the Pharaohs. And the Three Wise Men who visited the infant Jesus were likely Persian spice merchants.

Much of the early trade in spices until the mid-15th century was by the overland route commonly called the Silk Road. Arab merchants served as middlemen, connecting tropical Asian plant products with Middle Eastern and European markets. Venice served as the entrepôt (intermediate place of trade) for these goods coming from the East. Venice's wealth, power, and cultural flowering can be attributed in large part to the substantial profits that the spice trade generated.

But as demand increased while supplies did not, spice prices continued to rise, creating a strong economic incentive for Europeans to obtain direct access to the spice lands. One relatively obvious route was to sail east, thereby circumventing the land routes controlled by the Arabs. Certainly, there already existed maritime trade in spices and other commodities, but this was relatively limited in geographic scope, mostly in the Indian Ocean and the South China Sea. None of these merchants had sailed across either the Atlantic or the Pacific oceans. For western Europeans, a large obstacle blocked access to the Moluccas (the "Spice Islands"): the continent of Africa. For those crowns and explorers willing to entertain the speculation that the world was round, another route to the lands of spice presented itself: sailing west.

The Spaniards led the way when Christopher Columbus (1451–1506) headed west to the Americas in 1492. Six years later, the Portuguese blazed their own oceanic trail in the opposite direction, with Vasco da Gama (ca. 1460–1524) sailing south, rounding the African Cape of Good Hope, and continuing east to India.* The true significance of these two voyages became clearer in 1522, when Ferdinand Magellan's (ca. 1480–1521) crew completed the first circumnavigation of the globe. This harsh and brutal three-year journey resulted in the death of the commander and the demise of most of the ship's sailors: Only 18 of the original 270 who embarked with Magellan in 1519 returned to Spain in 1522, a survival rate of less than 7%.

The rivalry between Spain and Portugal as they raced across the oceans to take control of the global spice trade, especially that of cloves, mace, and nutmeg, forms the basis of Roger Crowley's wonderful new book *Spice: The 16th-Century Contest That Shaped the Modern World*. The book is a sort of narrative synecdoche, detailing a two-century period to tell a broader story of a trade that spanned 2,000 years.

Spice is a rollicking good read. Crowley, a historian and author whose specialty is maritime history, is a gifted storyteller. His detailed account of Magellan's voyage is terrifying enough to make any sailor question whether to leave dry land. He also brings to life not only well-known figures like da Gama and Magellan but also the anticolonial Philippine Chieftain Lapulapu and the extraordinary Juan Sebastián Elcano (ca. 1486–1526), who successfully took command of the expedition when Magellan was killed, only to perish himself when he tempted fate by attempting a second voyage around the globe merely four years after his return to Spain.

What makes this book so intriguing is that it brims with extraordinary characters and stories of arrogance, betrayal, bravery, cannibalism, idealism, and evil. In Crowley's telling, the spice trade is a cautionary tale in which history, exploration, culture, and commerce clash. Indigenous peoples also suffer greatly in the wake of a pattern of colonialist extractivism that endures through today. Quoting *The Economist* once more: "In the war for spices, Portuguese and Spanish explorers killed locals, and each other, with gusto."[4]

What transpired in Magellan's fleet is a microcosm of the intercultural confusion, violence, and treachery that

* When da Gama first disembarked in India, he is said to have proclaimed, "For Christ and Spices!" This must have come as a surprise to the local Christians whose community had been founded by Saint Thomas the Apostle in the year 52 CE — more than 300 years before Christianity became fully rooted in da Gama's home country of Portugal. Da Gama's declaration encapsulates the idealism, ignorance, religious fanaticism, and greed of the European spice seekers.

threads through the book. Born in Portugal, Magellan sailed as a representative of the King of Spain. Some three-quarters of his sailors were Spanish, and another 15% were Portuguese. Neither nationality seemed to have trusted the other, and elements of both seem to have distrusted Magellan. After a mutiny, several sailors were executed while others were marooned on an island and left to die. Rivalries intensified after Magellan was killed in the Philippines in 1521, leading to more dissension and misery as his remaining shipmates sailed on.

The Indigenous peoples, meanwhile, were not helpless bystanders. Magellan was killed in battle after taking sides in a confrontation between local groups. After his death, some of the fleet's surviving leaders were invited to a feast supposedly given in their honor by a different local chief. There, many of the Europeans were massacred by their hosts.

More often, though, when European steel was pitted against local wooden spears and arrows, the outcome was devastating for the Indigenous peoples. Time after time, as Crowley writes, "Trade and conquest went hand in hand."

Crowley opens the book by detailing the early history of the spice trade, emphasizing the aforementioned Silk Road route from Southeast Asia to the Middle East and beyond. He then charts the Portuguese rise to power, of which the Magellan voyage is a dramatic highlight. Holland enters the picture in the guise of the ruthless Dutch East India Company as the two European powers battled over nutmeg and mace from the Moluccas, to the detriment of the Indigenous peoples and forests of this Asian archipelago. Finally, the Spanish Empire appears on the scene, in the form of the Manila galleon trading ships, which established regular maritime connections between Asia (primarily the Philippines) and the Americas (primarily Mexico), and then on to Europe (Spain). Crowley concludes by charting the decline of the spice monopoly as the expanding European presence in Asia, along with competition and cultivation of spices in other tropical colonies, increased supply while reducing demand.

Finally, as an ethnobotanist, I note that Crowley's book features lots of "ethno" but very little botany. This is to be expected: the author is a maritime historian, so it comes as no surprise that this text focuses more on ships' captains, capstans, and crow's nests than on cloves — more mizzen masts than mace. Nonetheless, Crowley's writing is clear and engrossing, and the history is accurate and compelling. I recommend this book without reservation.

Readers who want a more global perspective with a heavier dose of botany, however, would do well to seek out Rosengarten's *The Book of Spices* or Gary Nabhan's *Cumin, Camels, and Caravans: A Spice Odyssey* (University of California Press, 2014), an often-overlooked gem. As a further complement to Crowley's book, which focuses so heavily on the Portuguese role in the spice trade, I also recommend *Nathaniel's Nutmeg: Or, the True and Incredible Adventures of the Spice Trader Who Changed the Course of History* by Giles Milton (Hodder & Stoughton, 1999), which further details the role of the Dutch, who not only replaced the Iberians in the Spice Islands but also unfortunately proved much more brutal. HG

***Mark J. Plotkin, PhD, LHD**, is an ethnobotanist, president of the Amazon Conservation Team (www.amazonteam.org), and host of the popular podcast "Plants of the Gods: Hallucinogens, Healing, Culture and Conservation."*

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Cloves *Syzygium aromaticum*
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Paul Carl Ross 1931–2021

By Connor Yearsley


Paul Ross
Photo courtesy of Abby Ross Sioussat

Paul Ross, an advertising executive and entrepreneur, died peacefully at his home in Millbrook, New York, on December 22, 2021, at age 90.[1] He was the founder and chairman of Bioforce USA, a company that offers distribution solutions for natural brands seeking to enter and grow in the US market. Before that, he founded or co-founded and led other companies in the natural products industry. His friends and family remember his entrepreneurial spirit, creativity, determination, charm, and more.

Ross was born in New York City on January 4, 1931, to George and Diana Ross. He attended Friends Seminary in New York City and, in 1953, graduated with a bachelor's degree in English literature from Oberlin College in Oberlin, Ohio.[1]

Early in his career, Ross was an ad man and worked for prominent New York ad agencies, including the William Esty Company and SSC&B. According to his family, his most famous line — "Manly, yes, but I like it too" — informed the brand positioning for Irish Spring® soap for many years.[1] Irish Spring ads ended with a young woman saying this to highlight the product's appeal for both men and women.

In 1975, Ross left his job as creative director at the William Esty Company and, with original partner Fred Kulow, started his first set of companies, Health from the Sun and Bee Pollen from England. Health from the Sun distributed Sanhelios® products. A natural supplement company based in Germany, Sanhelios is still in the Bioforce USA portfolio.[2]

According to a 1976 article in *The New York Times*, an Englishman whom Ross knew when he worked at SSC&B arranged for Ross to obtain US distribution rights for bee pollen. At the time of the article, Ross' company, Bee Pollen from England, was working through 25 health food distributors and supplying about 1,200 health food stores in the United States, as well as some department stores where the product was featured with cosmetics. Also at the time, Ross was promoting the company in industry trade publications and consumer health publications such as *Let's Live*, *Prevention*, and *Bestways*. Ross was quoted as saying that sales were "soaring," and he planned to expand distribution from specialty stores to more mass merchandise outlets.[3]

In 1985, Ross started ABKIT, a New York-based marketing company that was named for his daughter Abby and wife Kitty (Kathryn). ABKIT distributed the CamoCare® brand, a German line of primarily topical products containing extract and essential oil from German chamomile (*Matricaria chamomilla*, Asteraceae) flowers. In 1994, ABKIT acquired the German company Natureworks and Ross' son-in-law, Pierce Sioussat, joined the company as chief financial officer (CFO).[2]

In 1998, ABKIT was sold. The same year, in a then-new company called Bioforce USA, Ross obtained the US distribution rights for the Bioforce® line of herbal products. These products are produced in Switzerland by what was then called Bioforce AG (and which was renamed A. Vogel AG in 2020). In 2006, Bioforce USA expanded and constructed a new building in Ghent, New York.

In 2012, Sioussat succeeded Ross as CEO of Bioforce USA, which today is an importer and distributor/marketer of various European brands of natural products. Bioforce USA also is now a B Corporation™, a certification that reflects the company's commitment to maintaining high standards of social and environmental performance, accountability, and transparency.[2]

Bioforce USA brands include A. Vogel, which manufactures herbal products including Echinaforce®, the most extensively researched echinacea (*Echinacea purpurea*, Asteraceae) product in the world; Bionorica (Germany), a phytomedicine company that produces Sinupret®, a clinically tested product for sinus support, among other phytomedicines; and Herbatint® (Italy), a certified B Corporation that makes natural hair-coloring products; among other brands.

In their personal life, Ross and his wife Kitty were an outgoing New York couple who, at one time, lived on Park Avenue and enjoyed vacationing in fashionable places such as The Marbella Club in Marbella, Spain, and Montpelier in Nevis in the Caribbean and dining at some of New York's best restaurants. Over the years, they were members of Sleepy Hollow Country Club, The Shenorock Shore Club, and Doubles Club in New York.[1]

After Kitty's death in 2004, Ross moved briefly to Millbrook to spend time with his daughter and be closer to his company, which operated out of Hudson, New York. He then returned to New York City, where for the next 12 years he was a companion of Anne Tracy Bricker, a longtime family friend. When Anne died in 2019, Ross returned to Millbrook, where he remained until his death.[1]

Paul Ross is survived by his daughter Abigail "Abby" Ross Sioussat and son-in-law Pierce Stewart Sioussat of Tannersville, New York; and by his grandson Alton Hale Sioussat of Richmond, Virginia. Ross' family would like to recognize Barbara Marinelli, with whom Ross spent his last two years and whose companionship was a source of joy for Ross.[1] Bioforce USA will continue under the leadership of Ross' family and remains completely family-owned.

Abby Ross Sioussat, who previously was national sales manager for her father's company ABKIT and currently serves as an officer on the board of Bioforce USA, wrote (email, October 3, 2024):

> My father, Paul Ross, was a wonderfully creative and soulful man. He was an entrepreneur in the truest sense of the word. Growing up, I remember many different and fun products he would attempt to build a business around, all the while supporting our family as an ad man in advertising. When he finally had an opportunity to create a successful business in the natural products industry with Bee Pollen from England, he ran with it, and the rest is history. My family and I will be forever grateful for his early insight into the potential of our industry and for the foundation we stand upon today.

Pierce Sioussat, president and CEO of Bioforce USA, wrote (email, September 18, 2024):

> Paul was a true ad man of the '60s and led a never-give-up, never-ending search for the headline or slogan that would make or break a brand. He was unrelenting. He was the entrepreneur who developed the concept that still informs our business strategy today. He applied both his charm and his dogged determination to his business, which created a foundation for the company. Paul and I would travel together, visiting our European manufacturing partners, and even when things weren't going as planned, after hearing from Paul, our partners would come away thanking us for not meeting our budget. That was the essence of Paul's charm.
>
> Paul always believed in endless testing of headlines that would drive consumers to act. Once he found that headline, he had a simple, yet brilliant way to drive consumers into stores to purchase our products. We would take out ads in local market newspapers. It could be a midsize market like Sacramento, where we would advertise in *The Sacramento Bee*, or a market like New York City, where the *New York Post* would be used. We sent our brokers into stores and had our sales team on the phones calling stores and letting them know that if they purchased a certain amount of product, we would tag their store in the ad in their market. We would run double-column ads and beneath the ad include listings of stores' addresses and phone numbers, sometimes as many as 60 stores in a market like New York. These ads drove consumers into the stores, many of whom became new customers for the retailers. We built great relationships with our retailers as a result of this approach.

Heather Wainer, owner, publisher, and vice president of media at *WholeFoods Magazine*, wrote (email, September 19, 2024):

> My dad introduced me to Paul and his daughter Abby when I first started in the business, as my dad wanted me to know other people who worked with their families. When Paul started Bioforce USA, he and I started working closely together to promote the company in *WholeFoods Magazine*. I would always love his calls to pick my brain and just chat and think of new innovative things we could do together to help Bioforce USA grow. Paul was kind enough to include me on a Bioforce trip to Switzerland to see where the company's products were manufactured. The echinacea fields were breathtaking, and the trip was a special time that I cherish. I enjoyed working with Paul and getting to know his family. I miss that.

Mark Blumenthal, the founder and executive director of the American Botanical Council (ABC), wrote (email, October 9, 2024):

> I knew Paul beginning in the 1980s, shortly after his entry into the herb and natural products industry, and maintained a relationship with him until his death. He was a great guy, and I truly enjoyed my friendship with him. I will always remember his brilliance in introducing and marketing unique, high-quality natural products from Europe. He had an eye for the unusual and a mind that knew how to communicate the benefits of many niche natural products he introduced into the United States. Paul was a pioneer in the natural products industry, and I will always be grateful to him for his recognition of the importance of science and research in documenting the quality of natural products, as well as his early support of the science-based initiatives and mission of ABC. HG

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Alan Michael Dattner 1944–2023

By Hannah Bauman


Alan Dattner

Integrative dermatologist Alan Dattner, MD, died on November 29, 2023, in Sarasota, Florida, at age 79, from a heart attack. He pioneered the use of complementary and alternative medicine (CAM) in the practice of dermatology, including the use of herbal and plant-based medicines. Starting in the 1970s, Dattner combined his rigorous scientific training and Western medical background with a holistic care model.

The son of Harold Dattner, a dentist, and Ruth Racusin Dattner, a teacher and real estate agent, Alan was born in New Rochelle, New York, on June 2, 1944. He attended the University of Rochester on a pre-med track, during which he was a preceptee for Lloyd J. Old, MD (1933–2011), a leading researcher in the emerging field of tumor immunology, at a Sloan Kettering laboratory in Rye, New York.

He graduated with a bachelor's degree in chemistry from the University of Rochester in 1965 and earned his MD from New York University's (NYU's) Grossman School of Medicine in 1969. While at NYU, Dattner pursued his interest in immunology under Professor Barry R. Bloom, PhD, and Boyce Bennett, PhD, interned at San Francisco General Hospital, and completed his dermatology residency at the Albert Einstein College of Medicine in New York City. He was a board-certified dermatologist by the American Academy of Dermatology.

Dattner's interest in whole-body medicine and CAM began early, when he read a book that his father owned on the use of hypnotherapy to reduce anxiety. In the late '70s and early '80s, he joined a group of like-minded scientists, physicians, and others, including functional medicine leader Jeffrey Bland, PhD. This group inspired Dattner to apply his formal medical training to the use of dietary supplements. He also frequently attended herbal conferences to continue learning and networking with others in the natural healing community.

Dattner's background in immunology also fueled his study and practice of CAM. In the 1970s, he studied tumor immunology at the US National Institutes of Health, where he elucidated key concepts that linked environmental factors to inflammatory diseases and that helped form the basis of the modern understanding of autoimmune diseases. As the "rules" for diseases changed, he wanted to discover what other rules no longer applied.

Dattner founded his private practice in 1979 in Connecticut and moved it to New York in 2000. He retired in 2019. In addition to his private practice, he worked at Integral Health Services in Putnam, Connecticut, from 1979 to 1982; Harrington Memorial Hospital in Southbridge, Massachusetts, from 1982 to 2000; and as a staff dermatologist at Day Kimball Hospital in Putnam from 1979 to 2000.

Dattner had "a reverence" for herbal medicine as well as his Western training, according to his daughter, Alicia, who worked with her father as his editor, website manager, and marketing director (oral communication, June 3, 2024). "He wanted to combine the highest level of both," she said. He saw each patient as a unique person with a unique set of circumstances and often spent hours taking detailed, in-depth intake information to ensure he understood the patient's exposures, the products they used, and their symptoms, environment, and emotions. Patients who adhered to his protocols often reported that they not only found relief from their primary skin or autoimmune issue but also saw improved overall wellness.

Dattner was a visiting scientist at the US National Cancer Institute's dermatology branch and a founding member of the American Academy of Dermatology's Task Force for Nutrition and Evaluation of Alternative Medicine. He was also a member of numerous professional organizations, including the American Holistic Medical Association, American Society for Dermatologic Surgery, Connecticut Society of Dermatology, Connecticut State Medical Society, Dermatology Foundation, Massachusetts Academy of Dermatology, New England Dermatological Society, New York Academy of Sciences, Quinsigamond Dermatological Society, and Rhode Island Dermatology Society.

Dattner wrote widely about integrative dermatology. He authored or co-authored numerous scientific articles for dermatology journals including *Clinical Dermatology*, *Journal of Cosmetic Dermatology*, and *Journal of Investigative Dermatology*, among others, and chapters in books including *Integrative Medicine*, 3rd ed. (Saunders, 2012); *Integrative Dermatology* (Oxford University Press, 2014); and *Fitzpatrick's Dermatology in General Medicine*, 8th ed. (McGraw Hill, 2012). In 2015, Dattner shared his philosophy on natural healing in his book *Radiant Skin from the Inside Out: The Holistic Dermatologist's Guide to Healing Your Skin Naturally* (Picture Health Press).

"Alan was an energetic, generous, and one-of-a-kind fellow," said Mark Blumenthal, founder and executive director of the American Botanical Council (ABC). "He was one of the few health professionals I've ever met who had such a strong passion for natural therapies in the field of dermatology. I met him at an herb conference in the 1990s, and I was impressed by his energy and his penchant for learning new therapeutic options in his field. This prompted me to invite him to join the ABC Advisory Board, on which he served from 2013 until his untimely passing. As an expert peer reviewer, Alan generously agreed to review various articles for ABC's journal *HerbalGram* and draft HerbClip summaries of clinical studies. And, he was a fun guy. At conferences, he could be seen dancing or drumming — sometimes at the same time!"

In his personal life, Dattner was a deeply spiritual person who loved people and cared about everybody. "Even after retirement, he had a hard time not giving advice," Alicia said. In the words of Henry David Thoreau, he strived to "suck out all the marrow of life" and loved to go to festivals, parties, and other events to connect with people. He enjoyed music: he played the harmonica and was famous for his energetic dance moves. He liked to stay active by sailing, jogging, bicycling, and hiking.

Alan Dattner is survived by his wife Rabbi Shohama Wiener, DMin; his daughter Alicia; stepchildren Janet Wiener, Lauren Wiener, and Brian Wiener; and six grandchildren. HG

Jeanne Rose
1937–2024

By Warren Raysor, Jeanne Rose, and Hannah Bauman

Editor's note: *Jeanne Rose wrote, edited, and approved sections of this article prior to her death.*


Jeanne Rose

Herbalist, aromatherapist, and author Jeanne Rose died in San Francisco, California, on June 15, 2024, from congestive heart failure at age 87.[1]

Jeanne Rose, née Jean Alice Colón, was born on January 9, 1937, to a French-Canadian mother, Aline LaLancette, and a Puerto Rican father, Arnold M. Colón. She grew up in Antioch, California, and graduated from San José State University with a bachelor's degree in zoology in 1960 after spending the summer of 1959 studying at Stanford University's Hopkins Marine Station in Pacific Grove, California. Upon completing her bachelor's degree, she studied marine biology on a full scholarship at the University of Miami's Institute of Marine Science in Key Biscayne, Florida.

She returned to California in 1963 and made a living as "Jeanne the Tailor" in San Francisco, making custom clothing from natural fibers for rock-and-roll stars and other musicians of the era. These included Jorma Kaukonen Jr. of Jefferson Airplane and his brother Peter; Tim Davis of the Steve Miller Band; jazz bassist Ron McClure; Peter Albin of Big Brother and the Holding Company; Barry Melton of Country Joe and the Fish; Felix Cavaliere of the Rascals; and Mickey Hart of the Grateful Dead. Some of her works have been on display in museums, such as in a 2017 exhibition titled "The Summer of Love Experience: Art, Fashion, and Rock & Roll" at the de Young Museum, part of the Fine Arts Museums of San Francisco.

In 1964, after the birth of her daughter Amber, Jeanne took LSD for the first time and "saw the light." She switched to eating organically grown food and became interested in natural and plant medicine. She stepped away from the "rock and roll lifestyle" after a car accident in 1969 and began writing about herbs instead. Her writings helped inspire the public's quest for down-to-earth herbal knowledge with the publication of *Herbs & Things: A Compendium of Practical and Exotic Herbal Lore* (Grosset and Dunlap) in 1972. Her son Bryan was born the next year.

Jeanne authored more than 20 books (including herb course curricula) and hundreds of articles and papers on herbal medicine and aromatherapy. She also maintained a website and blogs,[2-4] which reportedly have reached hundreds of thousands of people. Respected and even feared as a seminar leader, she did not suffer fools lightly. For 30 years, she traveled North America teaching her love of herbs, natural scents, and natural medicine to hundreds of students. When she developed a serious respiratory condition in 1985, she traveled with an oxygen tank to continue her work. She was called an "academic enthusiast" by her friends and a "renegade herbalist" by her peers.

According to Jeanne, she was the first to use the word "hydrosol," previously used in the process of gold production, in 1989 in connection with aromatherapy. She used the term to describe the liquid distillate from the first step of the production of essential oils and defined it as an aromatic, non-alcoholic liquid that contained water-soluble compounds of the plant material and microdrops of the essential oil and had a strong taste, strong scent, and pH of less than 5.5. This term is now used widely in modern essential oil production and aromatherapy practice.

Jeanne loved her work, her house, her library, and her garden. She loved sweet scents, heroic dogs, beautiful silverware, elegant classic cars (especially those from 1956), good gin, vintage champagne, oysters, old paperweights, 500-year-old herbals, pop-up books, stylish shoes, cowboy boots, handmade Christmas tree ornaments, the Girl Scouts, deep baths, copper distillation, antique quilts, linen sheets, featherbeds, football, rodeo, lacrosse, and three-meter board diving. She loved her children, Amber Rose and Bryan Moore, her friends, and all her ex-boyfriends and ex-husbands. She loved to read, to study, and to learn as much as possible about a wide array of subjects. She loved her lemon verbena (*Aloysia citrodora*, Verbenaceae) plant, simple herbs, and tomatoes (*Solanum lycopersicum*, Solanaceae). She loved San Francisco's fine arts scene, graceful buildings, ballet, the Gardens of Golden Gate Park, and the California Academy of Sciences. She was sad when she gave up her season tickets to the San Francisco 49ers football team and the San Francisco Ballet. She left her heart in San Francisco — forever.

Jeanne Rose was a mentor, wise woman, confidant, and one who could take any situation, whether positive or negative, and make it bloom. Once, Jeanne grew mushrooms in her basement from horse manure compost gathered at the police stables in Golden Gate Park. She would drive up with a shovel and fill the back seat of her stylish '56 Mercedes convertible before driving off to get it sterilized at the VA hospital. She just wanted to see how mushrooms grew.

She loved rosemary (*Salvia rosmarinus* syn. *Rosmarinus officinalis*, Lamiaceae), seaweeds, and whatever else happened to occupy her attention on any one day. She donated her library of 1,500 herbal texts to the Lloyd Library and Museum in Cincinnati, Ohio, starting in 1996, and her pop-up books were donated to the Dr. Martin Luther King, Jr. Library at San José State University in 2008. She was the

executive director of the Aromatic Plant Project, past president of the American Herb Association, and president emerita of the National Association for Holistic Aromatherapy.

Jeanne was known for helping women realize their full potential and encouraging them to educate themselves in what they wanted to achieve. She believed in the power of knowledge through disciplined reading and was always saying, "The answers are right there, if only people would read!" She worked tirelessly to teach others about the power of essential oils, hydrosols, and herbs. Her best seminars were held in her own home, "The Home of 10,000 Aromatic Mysteries." Jeanne Rose lived and breathed what she believed — it was not just something she talked about when teaching a class or writing a book. This was evident as soon as one walked into her home because it had become saturated with years of scented living.

Jeanne celebrated the holiday season with grand affairs. For years, she bought 12 bottles of champagne and 12 jars of caviar to celebrate the 12 days of Christmas. Through her, others learned how to appreciate the sacredness of living, the ceremony of life, old books, fine food, red wine, and, of course, the "proper" way to drink a good martini.

Somewhere, she is surrounded by her favorite California poppies (*Eschscholzia californica*, Papaveraceae), reading stacks of her favorite pop-up books, enjoying a martini, and watching the sunrise over the San Francisco skyline. HG

Warren Raysor *is an herbalist and the president, founder, and formulator at ABRA Therapeutics.*

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Friends and Colleagues Remember Jeanne Rose

Mark Blumenthal, the founder and executive director of the American Botanical Council, wrote (email, September 17, 2024):

> I first met Jeanne in San Francisco in the late 1970s during an early meeting of the Herb Trade Association. I had already read her book *Herbs & Things*, so, to me, she showed up as a sort of celebrity. We became good friends over the years, and I called her every year on her birthday, when we would engage in long talks about — what else? — herbs and things. The last time I spoke with her was on her birthday in January 2024, and she told me that her health had been steadily declining for several years. At that time, knowing that I would want to honor her with a tribute in *HerbalGram*, I asked for her biography, which she helpfully provided.

Tony Bravo, a journalist at the *San Francisco Chronicle* and a friend of Jeanne, wrote (email, July 26, 2024):

> Jeanne Rose taught us to feel wonder at nature and celebrate the rituals of life. In her careers as rock 'n' roll fashion designer, author, herbalist, aromatherapy pioneer, and teacher, she brought beauty into the world and insisted we slow down to admire it. I see her wreathed in the afternoon sun, surrounded by Cécile Brünner roses (*Rosa* spp., Rosaceae) in her garden, presenting a vial of essential oils like the Caterpillar to Alice. Jeanne Rose now lives in the smell of lavender (*Lavandula angustifolia*, Lamiaceae), the leaps of ballet dancers, and the first icy cold sip of champagne at a Saturday farmer's market.

Rosemary Gladstar, an herbalist, author, and the so-called "Godmother of Modern Herbalism," wrote (email, August 6, 2024):

> The herbal community has lost another great member of the family. Jeanne Rose was one of the pioneers of the herbal renaissance of the '70s, and she continued to cultivate a lifelong love of "herbs and things" and a commitment to sharing her knowledge with others throughout her life. I knew Jeanne from the early days, right after her iconic book *Herbs & Things* was published. It was one of the first books [on this topic] to come out during the '70s and quickly became popular among everyone hungry for anything herbal. Jeanne always made an impression. While many herbalists of the time were barefoot and dressed in long flowing dresses, Jeanne was often seen wearing high-heeled boots and dressed in designer clothes she made herself. Along with her herbal teas, she enjoyed expensive champagne and a good martini. We called her "the Grande Dame of Herbalism," because, in Jeanne's own words, she was "a down to earth woman and a real Grande Dame."

She was, without a doubt, a colorful character: beautiful, never afraid to speak her mind, and highly opinionated. She was also deeply committed to her herbal work and was always reading, researching and studying, and sharing her knowledge with others through her books and classes. I remember going to her home in the Haight-Ashbury neighborhood, a typical San Franciscan house hemmed in by houses on either side, but her backyard was extraordinary — a botanical wonderland overflowing with plants. Jeanne had created a plant paradise, a botanical sanctuary, in her tiny backyard in the heart of the city. It was memorable, as was Jeanne. Who better to write her own obituary? No one describes Jeanne better than Jeanne herself.

Mindy Green, an herbalist, aromatherapist, and author, wrote (email, June 21, 2024):

Jeanne Rose was a trailblazer and a genuine inspiration. Many of us young Bay Area newbies were eager students of hers and enthusiastically consumed her books. She was deeply involved in the early organizations of American aromatherapy, and I remember fondly attending her aromatherapy salons at her home in the late 1980s.

A fierce advocate for all things botanical and a true herbal elder, she leaves us an enormous heritage with her writings, as well as many trained students who continue her legacy. I want to honor her for the great educator and mentor that she was for so many through her aromatherapy courses, books, classes, and online presence. I like to think that she floated into the Great Mystery on a petal-laced cloud, arriving at a beautifully aromatic paradise.

Kathi Keville, an aromatherapist, herbalist, author, and director of the American Herb Association, wrote (email, August 19, 2024):

I still remember the day in 1972 when I walked into a health food store and first saw the just-released *Herbs & Things*. I owned the only six herb books available at the time — books like *Back to Eden* written decades earlier — plus a couple of wild edible plant books. But this book by Jeanne Rose was different. It was hip, very informative yet informal, and even a little wacky. The best part was that it was part formulary and filled with herb recipes to make all sorts of lotions and potions. Jeanne delighted in aromatics, curious herbs, and plant history. Thanks to her, I added obscure herbs like opopanax (*Commiphora* spp., Burseraceae), mesquite (*Prosopis* spp., Fabaceae), and calamus (*Acorus calamus*, Acoraceae) to my pharmacopeia early in my herb career. I was impressed by the book's extensive bibliography, which led me down the path of botanical book collecting.

I met Jeanne a few years later, and we worked together in the 1980s through the American Aromatherapy Association and in the National Herbalist Association that she founded and was later incorporated into my American Herb Association. A fond memory is walking with Jeanne through the San Francisco Botanical Garden, a favorite haunt for both of us. She would bring her distiller to the gardens and give demos on producing essential oils from their aromatic plants.

Ethnobotany was Jeanne's passion. While Jeanne wrote many entertaining, easy-to-read books, she was a biologist with a lifelong interest in ethnobotany. She shared scientific research in her newsletter and classes and loved chatting about new findings. She collected botanical folklore and studied with Indigenous peoples, but she never forgot her scientific roots.

Jeanne was a legend in the herb and aromatherapy arenas long before she passed. She leaves an herbal legacy in her books, but also in the thousands of people she touched through her writing and wonderful herb, aromatherapy, and perfume classes.

Classifieds

FROM THE FIELD

A rosemary (*Salvia rosmarinus* syn. *Rosmarinus officinalis*, Lamiaceae) harvester in Morocco.

Photo by Chris Kilham

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